NIH DIRECTOR FRANCIS COLLINS CALLS FOR INCREASED FEDERAL SPENDING IN VITAL HEALTH RESEARCH

Francis S. Collins, M.D., Ph.D.
Director, National Institutes of Health

July 29, 2014

Excerpts from Dr. Collins' Remarks

You ride a Harley? You know, the government owns an awful lot of me, but they haven't been able to own that part yet. Once in a while, you've just got to get out of that sort of bureaucratic zone and, you know, crank it up. [Laughter.] A Harley is a great way to do that. And I wear a helmet and I'm very careful.

As head of the Human Genome Project, which in 2003 sequenced human DNA, what was the economic value of that effort? Battelle recently estimated the economic spinoffs at about a trillion dollars of economic growth, based on the original federal government investment of $3.8 billion.

Have you had your genome mapped? I've had my genome mapped....My lab works on diabetes. I know a lot about that disease as a physician, as a scientist. I don't want that disease. I looked at myself five years ago and said you're doing all the wrong things if you don't want this disease. You're not exercising, you've gained some weight, your diet is terrible. You better use this as a wake-up call. And it was a wake-up call and it got results, because I decided I'm going to have to change my diet. I hired a personal trainer who still comes to my house twice a week at 5:30 in the morning. I lost 30 pounds and I've kept it off for those five years. I'm in better shape than I was when I was 35.

What is the biggest health problem facing the United States today? It's hard to pick just one thing. But certainly obesity has emerged as a major threat to all the gains we have made when you talk about longevity and how it's continued to go up. About one year out of every six years we seem to be gaining in lifespan. And I should have said a lot of that is because of NIH. Look at heart disease. We have seen deaths from heart attack drop by 60 percent in the last 40 years....

Strokes, now deaths from stokes have fallen by 70 percent in the last 40 years. That's all NIH research. Figure out what are the risk factors, what are the ways that we could intervene, running the clinical trials to show whether they work. All of that making a profound difference in terms of the average person's likelihood of living a long and healthy life.

Do you have a view on smoking cigarettes? Oh, do I! [Laughter.] You know, you can't look at that evidence without wondering how it is that anybody in an educated society could be smoking cigarettes when you consider what that does in terms of shortening lifespan, with all the risks that we know about for cancer, but maybe don't think about as much for heart disease, but that's also huge.

What about electronic cigarettes? You know, electronic cigarettes have come along very quickly. We don't know nearly enough about what exactly the consequences are. The hope is, of course, for those who are fans of this that this is better than a cigarette that has all those tars and other carcinogens that are going into your lungs. But it still has nicotine and we know nicotine is one of the reasons why people who smoke get heart disease. So to have an idea that

somehow electronic cigarettes are benign flies in the face of what we already know about biology.

What is the status of research under the current NIH budget? We should be going so much faster. We could have much sooner than we otherwise would a universal vaccine for influenza, so you wouldn't have to take that yearly shot and we wouldn't have to worry about pandemics in the future. We could have cancer that was more precisely diagnosed and treated sooner than we are getting right now. We could have answers to autism quicker than we currently have. Everything's going about half the pace that it could.

And the consequences of that, for losses in terms of human health advances, losses to our economy, and damage to our generation of young scientists, is so hard to look at day after day when we could be doing so much better. Why can't we turn this around? Why can't this be a real national priority? Why is medical research part of the discretionary budget, which therefore has to be hammered and chipped away at in order to try to do something about our fiscal mess? It makes no sense. [Applause.]

What is NIH doing on Alzheimer's disease? I'm sure you're not alone in this room considering the terrible toll that this disease is taking as people are getting into years that should be full of promise and joy and having those instead cut down by the onset of this disease, which costs our country right now over $200 billion a year, affects roughly 5 million people in this country and uncounted others in other countries. This is a huge challenge.

What we know about Alzheimer's disease is growing practically daily, but we don't know enough. We know that there are genetic risk factors, particularly one called ApoE4. But research, based on the Human Genome Project, has now taught us about a dozen or more other areas of the genome that play a role in risk, and those are pointing us to some ideas about really what are the pathways that go wrong here to cause this disease.

What we have learned is that the ability to develop treatments for this disease is really challenging. Virtually every pharmaceutical trial that has been attempted on Alzheimer's disease has failed. But virtually all of those have been focused on individuals who already had fairly advanced disease. And one of the lessons I think we're learning from that is we really need to start early.

What NIH is doing, and now in partnership with the drug industry and a really remarkable new partnership called the Accelerating Medicines Partnership, which involves 10 pharmaceutical companies and NIH, is to try to figure out how can we work together to identify the kinds of clinical trials that are going to be most revealing, where you identify people who either have no symptoms at all, but are at very high risk, or maybe are just starting to show the earliest symptoms, because that's where you have the best chance of showing benefit.

And we now have three trials on patients who have no symptoms. And you might wonder, how would you know? Well, one is that you have this genetic risk factor called ApoE4 in a double dose. Another is that you're in a family where this disease is being inherited in a vertical dominantly inherited pattern. And there are such families where your risk can be predicted as high as 100 percent if you're in that line.

And another is people who by scanning their brains already have amyloid deposited in the brain. Amyloid is the protein which builds up in large quantities and seems to be a major player in the disease. But there are people walking around whose cognition seems completely normal, but they already have amyloid in their brains in their 40s and 50s. Those are very high-risk people. Suppose we started treating them now? Could we actually stop the process or even begin to see it go away? So pharmaceutical companies have two categories of drugs, monoclonal

antibodies as well as inhibitors of the process that makes amyloid. But there are other ideas coming along.

I'm pretty excited about this. It certainly seems to me if there was a moment where the science is coming together with a really pressing public health need, Alzheimer's is it. But we could be going faster. I mean, we're coming back to that 16 percent success rate. We're about there with Alzheimer's disease, too. Most of our really exciting ideas are really stretched. Half of our great science is left on the table.

David Rubenstein: Good evening, ladies and gentlemen, good evening to members of The Economic Club of Washington and to our guests. Welcome to this dinner event here in the Grand Ballroom of the Fairmont Washington, D.C., Georgetown. I am David Rubenstein, President of the Economic Club.

So, everybody thought we forgot evening events, right? We haven't had one in a while and we thought everybody had nothing to do on a July evening but to come here, and so we very much appreciate your giving up your evening. But I think you're going to find it very, very worthwhile and you're going to learn everything that you need to know about health, how to be healthy, how to live long.

Our speaker's parents both lived to be 98 years old, each one, so he's going to tell us tonight how you can live to be 98, among other things. So you're going to learn everything about health this evening.

This is the first event of our 28th season. And our featured guest is Dr. Francis Collins, who is the Director of the National Institutes of Health. NIH is an organization of the federal government, and is its principal research arm for health care-related research in the United States. NIH has about a $30 billion annual budget. It has 27 separate institutes and centers based in Bethesda with 75 buildings over 300 acres. Some of you no doubt have been there. And it funds enormous amounts of research, as we'll hear later. Dr. Collins was telling me earlier that roughly 400,000 researchers a year get benefits from the research grants that the NIH gives out.

Dr. Collins came to that position as the nominee of President Obama, and assumed the position in 2009. And surely he will serve as of August for five years in that position. He is the 16th director of the NIH.

He is a person who was well-known before he came to NIH for his role in running the Human Genome Project, which was a division, in effect, of NIH, and he ran that for about 15 years and famously discovered and mapped the human genome in a very important scientific breakthrough that occurred during the Clinton Administration. And he was subsequently given the Presidential Medal of Freedom and, among other many awards, he's been given the National Medal of Science and so forth.

So he came to that position from the University of Michigan Medical School where he taught and was a leading geneticist and researcher. He has a very interesting background before that. He grew up in the Shenandoah Valley. His parents home-schooled him to the sixth grade.

He lived on a farm, milked cows, and did everything else you do on a farm. [Laughter.] No indoor plumbing.

And then he managed to get a scholarship to the University of Virginia and graduated in 1970. Then went to Yale to get a Ph.D. in physical chemistry in 1974 and decided to change his life and go to medical school, and he did that. He went to the University of North Carolina and then got very interested in genetics and medical research.

He is obviously an accomplished scientist, but he's also well-known for his views on religion. And he's written a number of books relating to the fact that you can be a committed Christian and born-again Christian and also believe in the kinds of things that he believes in the scientific world. And we'll get to that in a moment. He did create a foundation that he worked at for a while and helped lead, BioLogos Foundation, that tries to bring together people in the religious world and scientific world.

And, not that all those things aren't enough, he is also a person who relaxes by playing the guitar. He's an accomplished musician. And he likes to ride Harleys. [Laughter.]

Well, let's start. Is it safe for the head of NIH to be driving a Harley? I mean, is that very safe? [Laughter.] The country has invested a lot in you. And is it safe to be driving, you know, driving these motorcycles?

FRANCIS COLLINS: Well, maybe not entirely. But you know, the government owns an awful lot of me, but they haven't been able to own that part yet.

And you know, once in a while, you've just got to get out of that sort of bureaucratic zone and, you know, crank it up. [Laughter.] A Harley is a great way to do that. And I wear a helmet and I'm very careful, and so far I've only had one sort of not-so-great event, which happened to be on my honeymoon, but everybody survived. [Laughter.]

MR. RUBENSTEIN: A lot of people have not-so-great events on their honeymoon – [laughter] – but this was related to your –

DR. COLLINS: Yeah, let's be very clear about that. [Laughter.] This was an experience on two wheels, not in another location.

MR. RUBENSTEIN: OK. All right, OK. [Laughter.] And by the way, when we were having dinner I noticed you were eating the red meat. Is that healthy for you?

DR. COLLINS: It was what was put in front of me. And you know what? It was pretty good. You know, red meat probably if you're somebody with high cholesterol you need to watch out how much of it. But a bit of this? You know, I get a little upset about people who are demonizing 90 percent of the available foodstuffs that we have in front of us. You've got to be thoughtful. I noticed you ate the vegetarian.

MR. RUBENSTEIN: I did.

DR. COLLINS: I should have done that. It would have been healthier, but I think I'll be OK. [Laughter.]

MR. RUBENSTEIN: But what about – I noticed you didn't eat the dessert. Was the dessert OK? People – can they eat the dessert?

DR. COLLINS: Well, you dragged me up here before we got to it. [Laughter.]

MR. RUBENSTEIN: All right, we'll get back to it later. Well, OK. So let's talk about the Human Genome Project. You know, in the history of science, obviously, it's an extraordinary development to map all the genes in the human genome. How many genes are there in the human genome?

DR. COLLINS: A startlingly short list. You know, when we started this effort to read out all of the DNA instruction book, which is what the genome is, the estimates about how many genes there were going to be ranged from maybe 70,000 up to 200,000. There was a sweepstakes, people actually made bets, and everybody was wrong because it turned out there's only 20,000 genes in the human genome. And that is surprising when you consider what we've learned about other species. I can tell you that even the vegetables on your plate have more genes than you and I do.

MR. RUBENSTEIN: Does a mouse have more than 20,000?

DR. COLLINS: A mouse is about the same as us.

MR. RUBENSTEIN: A dog?

DR. COLLINS: A dog about the same. Take mammals, we're all in that sort of general zone of 20,000. But you go to rice or wheat or corn, oh, my gosh, they're just making a whole lot more genes out of their genome than we are.

MR. RUBENSTEIN: All right. So let's talk about why this was significant. There was the Human Genome Project, it was headed originally by Dr. Watson who was one of the co-discoverers of DNA.

DR. COLLINS: Indeed.

MR. RUBENSTEIN: And then you replaced him.

DR. COLLINS: Yes.

MR. RUBENSTEIN: And then you were in a race with Craig Venter who was in the private sector. And you famously went to the White House and the President of the United States, President Clinton, said it's a tie. But was it really a tie? [Laughter.]

DR. COLLINS: Well, this was an interesting chapter in the whole experience because the public project, which I had the privilege of leading, had been laboring away already for about eight years when it looked like we were actually going to succeed. The technology, which we had spent a lot of time developing and testing, was beginning to mature to that point.

And then there was this idea by Dr. Venter, maybe this could be a commercial opportunity. But the real difference between Venter's approach and the public effort was not the technology. We were using the same machines. The real question was, is this a database that ought to be in the public domain for everybody to be able to learn from it, or should it actually be a commercial commodity where you'd have to pay to get access?

I believe that latter model would have been an unfortunate one and ultimately, because it was a very close race and we were giving all of our data away, obviously what Dr. Venter had was at least as good as what we had.

MR. RUBENSTEIN: OK.

DR. COLLINS: And so we had a and he a plus a bit of b. Fine, we called it a tie. And at that point basically the idea of having a commercial business model for this kind of data was eliminated. And that basically has now become the norm. This kind of project where every scientist in the world who has a good idea ought to be able to see it for free, that's become the norm, that should have been the norm all along.

MR. RUBENSTEIN: But what is the real benefit we've gotten from the billions of dollars expended by the taxpayers to figure out what the human genome is? Tell me what benefit I'm getting right now by knowing what my human genome is.

DR. COLLINS: [Chuckles.] Well, right, in several ways. Well, first of all, just in terms of economic benefit, Battelle recently did an analysis of what the economic spinoffs were of the success of the Human Genome Project. It adds up now to about $1 trillion of economic growth based upon the original investment of about $3.8 billion that the federal government paid. Do the math; so that's an almost unimaginable high level. Even if you throw in inflation, it's about 178 to one in terms of the ROI. That's the economics.

But what about the health? If you have cancer today, I hope you will have your cancer analyzed to see exactly which genes in that tumor have been misspelled and which are driving that cancer to grow when it shouldn't be. And then you'll have a chance therefore for your treatment to be selected on the basis of that information. That's a direct consequence of the genome project.

MR. RUBENSTEIN: OK. So have you had your genome mapped?

DR. COLLINS: I've had my genome analyzed, not by reading out all 3 billion letters of the instruction book, which now is becoming more and more possible, but the costs are still in the sort of several thousand dollars headed down to a thousand, but I had my genome analyzed, as many people, maybe some in this room have done, by looking at a million or so places in the

genome where we know there are common differences between people that are associated with risk. So I had that done five years ago. I was writing a book about personalized medicine. I thought it wouldn't be very legitimate to do that without checking out my own DNA.

MR. RUBENSTEIN: What did you find?

DR. COLLINS: Interesting. You know, I didn't want to do this to just one company because I wanted to see if the information is reliable. At that point there were three companies that offered this. So I sent my DNA to all of them, and I will admit I used an assumed name because I kind of figured if they thought this was Francis Collins they might try a little harder to get the answer right. [Laughter.] And interestingly –

MR. RUBENSTEIN: So what name did you use? Craig Venter? Or did you – [laughter] –

DR. COLLINS: I'll never tell. It's a secret. Interestingly, David, all three of those companies, when it came to the laboratory part of this, the reading out the DNA, they got the same answer. They're really good at that. They can look at a particular position and say, is that an A, C, G, or a T? Those are the four letters in DNA. And they get it right every time.

The problem was, how do you interpret it? When you looked at their readouts in terms of what they said about my risk of disease, that was not so consistent. Prostate cancer, some said higher risk than normal, some said lower, some said the same. But all of them said my risk of diabetes was significantly elevated over the average person. That got my attention.

MR. RUBENSTEIN: So what did you do?

DR. COLLINS: Well, my lab works on diabetes. I know a lot about that disease as a physician, as a scientist. I don't want that disease. I looked at myself five years ago and said you're doing all the wrong things if you don't want this disease. You're not exercising, you've gained some weight, your diet is terrible. You better use this as a wake-up call. And it was a wake-up call and it got results, because I decided I'm going to have to change my diet. I hired a personal trainer who still comes to my house twice a week at 5:30 in the morning. I lost 30 pounds and I've kept it off for those five years. I'm in better shape than I was when I was 35.

And I don't mean to say this is sort of generalizable finding that everybody who has their DNA tested will have a result of this sort. This is n equals one science, or sometimes called an anecdote. But for me, it was a useful opportunity to get information that became life changing.

MR. RUBENSTEIN: Well, some people have their DNA analyzed. Let's suppose it's a woman and she has the gene for predisposition to breast cancer, and then has a double mastectomy. Is that an unusual thing to do? You recommend that kind of thing if you have a predisposition?

DR. COLLINS: Well, if you have a mutation in one of these genes called BRCA1 or BRCA2 – and Angelina Jolie, I think, really brought this to the attention of a lot of people by being very public about this, and good for her that she did. And she presented the information with really wonderful accuracy about the facts. The facts are if you have a mutation in one of those genes

and you're a woman, your risk of getting breast cancer is in the neighborhood of 70 to 80 percent. Your risk of getting ovarian cancer is about 50 percent.

And those are really bad outcomes for which there are interventions. Draconian to be sure, they're surgical, but they are in fact potentially lifesaving.

MR. RUBENSTEIN: So would you recommend that everybody here, everybody listening get their DNA examined and analyzed?

DR. COLLINS: I wouldn't right now say that that's a necessary part of your medical care. You know, the most important genetic test that we have available is rarely used in the way that it should be and it doesn't cost you anything, it's you family medical history. Women who have a BRCA1 mutation, for instance, generally have a family history of breast and ovarian cancer. That tips you off and that makes you think, boy, maybe I should be tested for that. If you have a history of heart disease, if you have a history of cancer of some particular sort or diabetes, really the first thing we should be doing is getting that information into a standard sort of medical pedigree and having a conversation with your health care provider about how that might influence your own decisions about tests you might have, about lifestyle changes you might want to make, making your prevention strategy individualized instead of one-size-fits-all. Family history is a great way to start.

MR. RUBENSTEIN: So your parents both lived to 98. They were married 74 years?

DR. COLLINS: Seventy-six years.

MR. RUBENSTEIN: Seventy-six years, OK. So and they never had a dispute, right? They got along well? [Laughter.]

DR. COLLINS: No, can't quite validate that comment.

MR. RUBENSTEIN: But 98 apiece. So I mean, did their parents live to be in their 90s? I mean, you must have incredible genes.

DR. COLLINS: My great-grandfather was practicing law at the age of 100 and finally died at 105. So yeah, this –

MR. RUBENSTEIN: Wow.

DR. COLLINS: There is nice longevity. So maybe the advice I could give you if you want to live a long time, pick your parents really carefully. [Laughter.] It'll help.

MR. RUBENSTEIN: So while we're on the subject, should I be taking a baby aspirin?

DR. COLLINS: You know, David, I want to be careful that I'm not giving medical advice to a roomful of gullible people – [laughter] – so let me say what the United States Preventive Services Task Force says.

MR. RUBENSTEIN: Which is?

DR. COLLINS: USPSTF, so that's a group of really expert people who look at the entire literature of rigorously designed studies to say what actually is proven to work, where is the evidence and where isn't it. They would say that if you're a male – I won't ask you your age – between 45 and 70 you should be taking a baby aspirin a day to prevent heart attack. If you're a woman between 55 and 70 you should be taking baby aspirin a day to prevent strokes, interestingly.

MR. RUBENSTEIN: Well, I'm not at that age yet so I'm not really – [laughter] – so one a day you'd recommend. You recommend one baby aspirin.

DR. COLLINS: The USPSTF recommends.

MR. RUBENSTEIN: OK. What about statins, what do you think about that? Should I take a statin?

DR. COLLINS: And here again, the evidence would say that if you have any evidence of cardiovascular disease or high cholesterol, a statin is associated with a better outcome and is very worth doing. There are some side effects; they're generally manageable.

For everybody in the room to be taking statins without those risk factors of documented heart disease or high cholesterol, we're still looking at that. Should we put it in the water supply? Well, we don't quite have the evidence to support that yet. I'm not taking a statin.

MR. RUBENSTEIN: You don't. You take a baby aspirin?

DR. COLLINS: I actually don't.

MR. RUBENSTEIN: You don't? Oh.

DR. COLLINS: Shocking.

MR. RUBENSTEIN: Well, if my parents lived to 98, I might not take it either, but OK.

DR. COLLINS: Well, there you go. [Laughter.] So actually you're making a great point, because we do these recommendations and they tend to be kind of generic, one-size-fits-all. We're all different people. My dream, and it's starting to come true, is that all of these recommendations would become personalized. They'd be based on your situation by a combination of family history, what your lifestyle, your exposures are, what your DNA says, what certain blood tests say about your chemistry. And then you could really individualize the recommendation in a way that's right for you. I don't think my risk probably justifies the small chance that that baby aspirin might give me a GI bleed.

MR. RUBENSTEIN: So some more free medical advice while I have you on this subject. [Laughter.]

DR. COLLINS: It's going so well. Why not? Yeah.

MR. RUBENSTEIN: So tell me, some people say a person my age should get an annual physical, and other people say it's a waste of money and time, it's just a gimmick. What do you think?

DR. COLLINS: Again, there's not a whole lot of evidence that, for an otherwise healthy person with no current complaints, an annual physical does that much to improve your likelihood of living a long time.

MR. RUBENSTEIN: Oh, geez. All right. I'm going to cancel my appointment then. [Laughter.] Geez, OK. All right.

DR. COLLINS: I'm going to hear from your doctor, I'm sure. [Laughter.]

MR. RUBENSTEIN: OK. But seriously, there have been proposals recently that women should not get mammograms, I think, under the age of , is it 40?

DR. COLLINS: Under the age of 50.

MR. RUBENSTEIN: Fifty.
DR. COLLINS: There's a big controversy in the 40s.

MR. RUBENSTEIN: And you have a view on that?

DR. COLLINS: The USPSTF – [laughter] – has a view and they have recently recommended that women between 50 and 70 have biannual, not every year, but every two years a mammogram, that between 40 and 50 you have a conversation with your doctor and try to decide what's right for you.

And again, I would say I'm a little worried that those are still rather generic recommendations. A woman who has a history in her family of breast cancer probably should take a different view than somebody who has no history at all.

MR. RUBENSTEIN: So if you go back, let's say, 100,000 years ago, the average person lived to about 20 or so, on average. Now we live on average, let's say, in Western society maybe in the high 70s, early 80s. What do you think is the principal reason for longevity over the last 100,000 years? Is it better eating? Sanitation? What would you say is the principal reason?

DR. COLLINS: Oh, it's all of those things. I mean, even if you go back 100 years in this country, the survival 100 years ago was sort of 48, 49. Huge advances that have happened. So why has that happened? Well, certainly, better public health has been a big factor in that. Better diet, better access to nutrition.

But a lot of it has been medical advances that have helped us understand how to manage prevention and treatment. Infectious diseases, which used to kill a large proportion of our population, including many children who never got to be 4 or 5 years old, now look where we are. Most of those, vaccines have prevented or antibiotics have treated, although we're having a problem now with our antibiotics beginning to run out of their potential for treating a lot of diseases.

It makes, I think, a lot of us somewhat crazy when you look at the current circumstance where lots of people are now skeptical about vaccines. They didn't live through that period where all those kids were dying and we are at risk maybe of seeing some of that come back again with an anti-vaccine attitude that has emerged in many places, including amongst people who have college educations, one of the remarkable, sort of odd aspects of American culture.

MR. RUBENSTEIN: Well, there was a controversy about some vaccines perhaps causing autism in children. Do you have on whether that's –

DR. COLLINS: I do. So that has been intensively looked at by at least a dozen studies and there is not one shred of evidence for a connection between vaccines and autism, and yet that continues to be perpetuated as a possible model, which causes many parents legitimately who have heard about this to wonder whether they should have their children vaccinated. And by not doing so place them at risk of all manner of terrible diseases that we thought were pretty much controlled.

MR. RUBENSTEIN: So what do you think is the biggest health problem facing the United States today? Is it obesity? Is it – what would you say?

DR. COLLINS: It's hard to pick just one thing. But certainly obesity has emerged as a major threat to all the gains we have made when you talk about longevity and how it's continued to go up. About one year out of every six years we seem to be gaining in lifespan. And I should have said a lot of that is because of NIH. Look at heart disease. We have seen deaths from heart attack drop by 60 percent in the last 40 years.

MR. RUBENSTEIN: Do you think it's because of diet or you think it's because of....

\DR. COLLINS: It's understanding what the risk factors were and treating hypertension, treating high cholesterol, and figuring out how to manage heart attacks in a way that actually causes most people to survive them and live many years beyond that, all of the things we've learned about you manage a coronary artery that's got a block. Put that all together.

Strokes, now deaths from stokes have fallen by 70 percent in the last 40 years. That's all NIH research. Figure out what are the risk factors, what are the ways that we could intervene, running the clinical trials to show whether they work. All of that making a profound difference in terms of the average person's likelihood of living a long and healthy life.

MR. RUBENSTEIN: Do you have a view on smoking cigarettes?

DR. COLLINS: Oh, do I! [Laughter.] You know, you can't look at that evidence without wondering how it is that anybody in an educated society could be smoking cigarettes when you consider what that does in terms of shortening lifespan, with all the risks that we know about for cancer, but maybe don't think about as much for heart disease, but that's also huge.

MR. RUBENSTEIN: What about electronic cigarettes?

DR. COLLINS: You know, electronic cigarettes have come along very quickly. We don't know nearly enough about what exactly the consequences are. The hope is, of course, for those who are fans of this that this is better than a cigarette that has all those tars and other carcinogens that are going into your lungs. But it still has nicotine and we know nicotine is one of the reasons why people who smoke get heart disease. So to have an idea that somehow electronic cigarettes are benign flies in the face of what we already know about biology.

MR. RUBENSTEIN: What about cigars, you have a view on cigars?

DR. COLLINS: I do have a view there, too, and it's clear cigars are associated with an increased risk of oral cancers of tongue and lip and throat and larynx and some of those are pretty horrible outcomes. You're still getting exposure locally, even if you don't inhale because you wouldn't want to, cigar smoke, you're still getting that exposure in your mouth and your upper pharynx.

MR. RUBENSTEIN: All right. So let's talk about the NIH for a moment since you're the head of the NIH.

DR. COLLINS: OK. [Laughter.]

MR. RUBENSTEIN: So you have a budget of $30 billion. That seems like a lot of money. So why do you say that you don't have enough money?

DR. COLLINS: Why am I complaining? Well, OK, it is a lot of money and it's a wonderful testimony to the taxpayers and the Congress and many Administrations over the years that that has been an investment that this government has seen to make. And the yield on that has been phenomenal. You know, many economists would say that more than 50 percent of the American economy growth since World War II has been based on science and technology investments, and certainly in the 21st century the highest return there, the most vigorous investments we're making are in the biological, the life sciences. So there you go. It's a good thing to do. But why is $30 billion not the right answer?

MR. RUBENSTEIN: In real terms, how is that?

DR. COLLINS: In real terms, the problem is NIH went through this wonderful experience between 1998 and 2003 where the budget was doubled. And that was a bipartisan agreement that people decided to roll up their sleeves and make happen. Nita Lowey, who is here, is nodding because she was part of that wonderful five-year experience where people stood

shoulder-to-shoulder and said this is so important for human health, for the economy, we just have to do it.

But then 2003 happened and we reached the end of that doubling. And since then we have steadily lost purchasing power for biomedical research over the course of those now 11 years. So we're down now about 25 percent below where we were in the ability to support research in 2003, even as science has presented us with incredibly exciting opportunities.

MR. RUBENSTEIN: Well, so let's say seven, eight, nine years ago, if somebody submitted a research grant to NIH, they had a 30 percent chance of getting money?

DR. COLLINS: That's about right.

MR. RUBENSTEIN: Today, what's their chance of getting money?

DR. COLLINS: Sixteen percent. And imagine yourself as a young scientist just trying to get your lab started and you've got a great idea, you're in a great institution that wants to support you, you send your grant to NIH, you've only got one chance in six that anything is coming back except no. And those young scientists, that's my greatest concern, David, that's the thing that wakes me up at night. We are at risk right now of losing a significant fraction of that new generation of talent, which is our future, because they are so frustrated.

MR. RUBENSTEIN: What's happening to them? They're going out of research or they're going to other countries to get money? Or what are they doing?

DR. COLLINS: All of the above. Some are leaving research to do other things. A recent poll said roughly one in five young scientists has now seriously considered going to another country because other countries, as we are going like this, many of them are going like that. They read the American playbook from 20 years ago. They saw what our investments in research did to our economy, to the vibrancy of the American experience, and they're trying to replicate that.

Look at China. China is increasing its support for biomedical R&D by 20 to 30 percent per year, even as we are going down and we go dramatically with things like the sequester which took away $1.5 billion in one fell swoop. Singapore, South Korea, Brazil, Europe, all of those going up in their support, because they see what it can do, while we are basically walking off the stage.

MR. RUBENSTEIN: Can you give us a couple of examples of some great research that the NIH has done that led to something useful for people?

DR. COLLINS: [Chuckles.] Something useful? OK. How about HIV/AIDS? Do you all remember 1989, 1990 when distinguished people were predicting that as many as one in six Americans were going to get infected pretty soon and that there was no treatment and people's survival after being diagnosed was measured in months, and there was nothing you could do? And how did that get changed? That was a big, enormous, organized effort – again, Nita Lowey could tell you a story about this in terms of how all the academic researchers, supported by the

NIH, working with the private sector, with pharmaceutical industry – John Castellani could tell you a lot about that – got together and said this is a public health emergency, we're going to solve this. And a lot of people thought it was going to be unsolvable because it's a diabolical virus.

And yet, it worked. And now if you're diagnosed with HIV/AIDS at age 21, what's your lifespan prediction? About age 70, almost the same as if you didn't have the diagnosis, as long as you have access to those antiretrovirals. That's one of the things we've done lately.

I could go on. I mean, in cancer, we're seeing cancer survival rates improving each year, deaths dropping by 1 percent per year, year after year after year. By the way, each 1 percent decrease in cancer is estimated by economists to save our country $500 billion. That $30 billion doesn't sound so big when you think about that.

Look at diabetes. We have learned how to prevent people from going from a pre-diabetic state into full-blown diabetes, and that's now being implemented across the country in programs co-sponsored by NIH, CDC, and the YMCA with the chance, therefore, of greatly reducing the hundreds of billions of dollars that we spend on that disease.

MR. RUBENSTEIN: Obviously, you have done some wonderful things, but sometimes you give grants to people who do research that seems a little strange, and you get Members of Congress or public people saying, what are you doing with those crazy grants? Do you ever re-look at some of the grants when you hear from a Member of Congress? Or do you ever just defend them to the hilt? Or what do you do?

DR. COLLINS: We look closely. Again, the way grants come to us, they are basically then sent to one of our 27 institutes and centers for consideration. Some of the grants that people say look silly are the ones that are basic science, there's not an obvious connection to a disease, but it's critical that we support that kind of basic science effort, because ultimately 20 years from now those are probably the discoveries that are going to lead us down a path that we really want to know for Alzheimer's disease or mental illness or who knows.

So we have to have as part of our portfolio grants that are not disease focused, that are basically trying to figure out how does life work, because that's really important to discover.

But some of those, if they're on a model organism, for instance, a grant about roundworms, it would be easy if one didn't understand this whole tapestry of effort to make fun of those. And people sometimes do.

MR. RUBENSTEIN: Well, at one time you had a great where you gave money to study the freezing of mice sperm. Now, what was that about? [Laughter.] I mean, that was, I gather –

DR. COLLINS: That's a great example. So don't you all want to know why you'd want to freeze mouse sperm? Well, let me tell you. [Laughter.] Mice are our most heavily used animal model for disease. It's an incredibly powerful system and we can manipulate the mouse genome now to

basically create any kind of disease you'd like to by basically going in and stitching in a piece of DNA or taking one out for that particular part of the mouse genome.

But if you had to maintain all of those mouse models all of the time it would cost you a fortune to keep them in cages. You've got to feed them, you've got to change their bedding. It would be much better once you got something you think is interesting, but you're not going to use it right now, you might want to use it two years from now, freeze down the sperm and then you can recreate that mouse at a very low cost two years from now and save yourself all this money. It was a great grant.

MR. RUBENSTEIN: What about smallpox? You were discovered to have had some smallpox in your labs. What was that doing there?

DR. COLLINS: Oh, man, what was that doing there is a good question. [Laughter.] I was in Shanghai leading a meeting and I got this phone call and I thought this has got to be a spoof, this couldn't have happened. But in an FDA research lab on the NIH campus, a group of scientists were cleaning out a walk-in refrigerator which had not been apparently paid attention to in quite some time because the FDA was vacating that building and turning it back to NIH. And they found this cardboard box and nobody could quite remember what that box was doing there, but they decided they should look into it. And they opened it up and they found six glass, sealed vials that said variola.

Now, fortunately, those scientists knew what that was, I'm not sure a lot of scientists these days would, and recognized, oh, my gosh, that is the Latin name for smallpox. We did all the right things, called the FBI, called the CDC who oversees select agents, as they're called, who sent a team up, got the vials removed, carried off to Atlanta to the CDC's lab. And sure enough, those vials, despite the fact that they were labeled February 1954, still had the ability to grow smallpox virus. And they had been sitting there in that cold room apparently put together as some sort of kit that was being used for virologists as sort of a set of standards at a time when smallpox research was done on the bench top and nobody had actually realized that box was there.

MR. RUBENSTEIN: So you don't have any, like, bubonic plague hanging around there either, isn't that right? [Laughter.]

DR. COLLINS: Well, we're sweeping the entire place.

MR. RUBENSTEIN: OK, all right. [Laughter.]

DR. COLLINS: And by October 1st we will know in every nook, cranny, every, you know, windowsill what is there that we didn't know about.

MR. RUBENSTEIN: So you mentioned Alzheimer's, and that's, obviously, a disease that's gotten a lot of attention in recent years.

DR. COLLINS: And appropriately.

MR. RUBENSTEIN: So Alzheimer's is one form of dementia, right? There's several different forms. But what is it that you have done and what progress do you think can be made in the foreseeable future, certainly in my lifetime? This is my greatest focus.

DR. COLLINS: And I'm sure you're not alone in this room considering the terrible toll that this disease is taking as people are getting into years that should be full of promise and joy and having those instead cut down by the onset of this disease which costs our country right now over $200 billion a year, affects roughly 5 million people in this country and uncounted others in other countries. This is a huge challenge.

What we know about Alzheimer's disease is growing practically daily, but we don't know enough. We know that there are genetic risk factors, particularly one called ApoE4. But research, based on the Human Genome Project, has now taught us about a dozen or more other areas of the genome that play a role in risk, and those are pointing us to some ideas about really what are the pathways that go wrong here to cause this disease.

What we have learned is that the ability to develop treatments for this disease is really challenging. Virtually every pharmaceutical trial that has been attempted on Alzheimer's disease has failed. But virtually all of those have been focused on individuals who already had fairly advanced disease. And one of the lessons I think we're learning from that is we really need to start early.

What NIH is doing, and now in partnership with the drug industry and a really remarkable new partnership called the Accelerating Medicines Partnership, which involves 10 pharmaceutical companies and NIH, is to try to figure out how can we work together to identify the kinds of clinical trials that are going to be most revealing, where you identify people who either have no symptoms at all, but are at very high risk, or maybe are just starting to show the earliest symptoms, because that's where you have the best chance of showing benefit.

And we now have three trials on patients who have no symptoms. And you might wonder, how would you know? Well, one is that you have this genetic risk factor called ApoE4 in a double dose. Another is that you're in a family where this disease is being inherited in a vertical dominantly inherited pattern. And there are such families where your risk can be predicted as high as 100 percent if you're in that line.

And another is people who by scanning their brains already have amyloid deposited in the brain. Amyloid is the protein which builds up in large quantities and seems to be a major player in the disease. But there are people walking around whose cognition seems completely normal, but they already have amyloid in their brains in their 40s and 50s. Those are very high-risk people. Suppose we started treating them now? Could we actually stop the process or even begin to see it go away? So pharmaceutical companies have two categories of drugs, monoclonal antibodies as well as inhibitors of the process that makes amyloid. But there are other ideas coming along.

I'm pretty excited about this. It certainly seems to me if there was a moment where the science is coming together with a really pressing public health need, Alzheimer's is it. But we could be going faster. I mean, we're coming back to that 16 percent success rate. We're about there with Alzheimer's disease, too. Most of our really exciting ideas are really stretched. Half of our great science is left on the table.

MR. RUBENSTEIN: So on obesity, I read that one-third of adult Americans are obese. That seems awfully high.

DR. COLLINS: It's true. And about one-sixth of kids, one out of six.

MR. RUBENSTEIN: So I don't know what the definition of obese is. I hope it's like not more than five pounds overweight.

DR. COLLINS: It's a BMI [Body Mass Index] over 30.

MR. RUBENSTEIN: OK. So what do you think is the reason for that? Is it lack of exercise, too many low-fat foods? Diet sodas? What do you think? Why are people getting so fat?

DR. COLLINS: It's all of the above. It clearly is access to cheap, high-calorie food. It is a reduced opportunity for exercise or a reduced decision to take exercise. And all that relates in certain ways to the built environment and to ways in which there's less reason for people to be walking around during the day and more reason to sit in one place. And this certainly applies to kids with video games and other things keeping them from running around outdoors.

Certainly there's a lot of the food industry that has to be sort of looked at carefully to say, what are we doing here as far as what's put in front of people and particularly put in front of kids on Saturday morning television.

And it is, I think, also a kind of wake-up call for all of us to think about. Is this the kind of nation that we want? It's one thing to blame the food industry or the built environment or the way in which our diets have evolved. It's another to say, hey, we're all in this. We have to figure out together how to take some responsibility to change it.

The good news is – and it's just starting to look as if maybe we have leveled off in this inexorable rise in obesity, and maybe even in kids now – we're starting to see a decrease. Too early to say for sure if that's real, but maybe the word's starting to get out and some of the interventions are starting to work.

And you've got to give a lot of credit to people like Michelle Obama, with the Let's Move effort, to try to draw attention to children and how crucial it is that we change the path we've been on.

MR. RUBENSTEIN: The longevity of Americans has gone up historically for a hundred years or so – except now, because of obesity, it's going down a little bit. Is that –

DR. COLLINS: It's going down in some places, in some groups of people. I think overall, as a nation, we haven't yet seen that downturn. But if you look particularly in some parts of the country where the obesity epidemic's the worst, yeah, we've started to see that loss of –

MR. RUBENSTEIN: So what do you think; I was talking about my own exercise theory, which is – I call it exercise by osmosis. You walk past the gym equipment many times, and it kind of rubs off on you. [Laughter.] Do you have any view on whether that works, or – not so much?

DR. COLLINS: You have to walk a lot of times, you know. [Laughter.]

MR. RUBENSTEIN: Right. But you ride a bike to work, right?

DR. COLLINS: I ride a bicycle to work. I wear a Fitbit. How many people in the room have a Fitbit? I'm not trying to sell this, but this little gadget, which is basically an accelerometer, allows you to find out on a given day how many steps have you taken, how many flights of steps you have walked up –

MR. RUBENSTEIN: Well, how many have you taken?

DR. COLLINS: Oh, dear. It's not been a good day. Fifty-seven hundred and forty-two steps. But I'm not done yet. I've got to walk –

MR. RUBENSTEIN: I do that in a week. So that's a week, that's pretty good. [Laughter.] All right. So you grew up on a farm.

DR. COLLINS: Yeah.

MR. RUBENSTEIN: And your parents were, you would say, hippies or something like that?

DR. COLLINS: Yeah, kind of. My dad was a folk song collector, a drama professor; my mother was a playwright. Yeah.

MR. RUBENSTEIN: And so you were home schooled. And so did you know what home schooling was, or you just didn't know there was schools? [Laughter.]

DR. COLLINS: Well, it was a little before the advent of a big home-schooling movement. So in my situation, my mother determined that the schools in our agricultural county in the Shenandoah Valley were not up to her standards. And she was one of the first women to get a graduate degree from Yale, and she thought she could do better.

MR. RUBENSTEIN: So you didn't say to her, you're not teaching me what I could learn, or you were happy with it, or you didn't know?

DR. COLLINS: I knew nothing else. And basically, she had no lesson plans. There was no curriculum. The idea was, let's wake up in the morning and say, what's interesting today? – and then let's go after it. And so if it turned out that what was interesting was history, we would do

history for maybe two or three days in a row. My brother, who's just a year and a half older than I – so she would teach us together.

And then that got boring, so then, OK, well, let's do math, because we'd come up with an idea about mathematics. I was fixated on the number nine for an entire two weeks. And by the way, the number nine is really cool, if you think about it. [Laughter.]

And then we'd do language. My mother, being somebody who's a playwright, was into language, into words. She would say, OK, here's a word. Tell me, is it derived from Greek, Latin, or Old French? And you'd have to think about it and then make a guess and go to the unabridged dictionary and see if you were right.

MR. RUBENSTEIN: But when you got up in the morning, your job was to go milk the cow?

DR. COLLINS: Well, after milking the cow, yeah. Right. We had other duties to do, which were fairly strenuous. This was not sort of a lovely pastoral life that some people imagine. It was a lot of hard work.

MR. RUBENSTEIN: But you haven't bought a farm since you've been an adult, right? You're not going back to the farming world, or –

DR. COLLINS: Not in my current role. That would be pretty hard to manage to fit that in, with the 100-hour weeks that NIH is requiring of me.

MR. RUBENSTEIN: So when you were growing up, your parents were involved in music a bit, and Bob Dylan came to your house. And you met him, as a young man?

DR. COLLINS: [Laughs.] He was very sullen. [Laughter.] So yeah, my dad, because he was involved in folk music, knew a lot of people in that era. And this was sort of the late '50s, before the folk music scare, and everybody knew about it. [Laughter.]

So a reasonably well-known folk singer from Charlottesville, who liked to try to find other young talent and introduce them around, showed up at our farm house one day, bringing along this not-quite-18-year-old, scraggly-looking kid from Minnesota, who stayed for a couple of days and whose birthday was therefore carried out in our living room. The kid's name was Zimmerman. Well, I guess he changed it a little later. That was Bob Dylan.

I saw Bob a year or so ago, and reminded him of this. And he purported not to remember it at all, so – [Laughter.]

MR. RUBENSTEIN: So you go to the University of Virginia, you go to graduate school, you get a Ph.D., and then you say to your parents, guess what? I actually need another degree. I'm going to go to medical school. What did they say?

DR. COLLINS: Said the bill is up to you, fella. They were surprised. I had been so focused on chemistry and physics as what I wanted to spend my life on, ever since high school. I had a

gifted chemistry teacher who got me interested in science. Because you can imagine, growing up in this hippie family, science might not have been the first place to go. It was that 10th-grade chemistry teacher. And I got this vision; that's what I wanted to do.

So I focused on chemistry through the rest of high school, through college, and straight on to this graduate degree. And somewhere, a couple years into that Ph.D., I realized that I'd totally ignored biology, because I thought it was messy and didn't have any principles.

And I'd been wrong. It was actually incredibly interesting. And not knowing what else to do to pursue that, I decided to go to medical school. Why the University of North Carolina thought that was a good reason to admit me is still a good question, but they did. And yes, my parents were astonished, but at that point, I think they kind of figured I was old enough to make my own way and they would be supportive.

That's what they always did. My mom, her teaching taught me to love learning, and she wanted me to pursue that and love learning, whatever it was that was calling to me. If it was medicine, go for it.

MR. RUBENSTEIN: And you parents were not taking you to church every Sunday, is that right?

DR. COLLINS: Oh, no. Not at all.

MR. RUBENSTEIN: They were not big believers in Christianity, or any religion?

DR. COLLINS: They were not denigrating of religion, but they didn't find it particularly relevant for them.

MR. RUBENSTEIN: And so now, later in life you became very involved in religion. I guess you would call yourself a born-again Christian. Is that fair or not?

DR. COLLINS: That would be fair.

MR. RUBENSTEIN: OK. So let me ask you this. The Bible says that God created the heaven and the Earth in six days and rested on the seventh. But scientists would say the Earth took, like, 5 billion years to come together. And how do reconcile those things?

DR. COLLINS: I don't have any trouble with that at all. I think somehow we, in reading Genesis One and Two, have to read it the way those who read it when it was first made available would have done.

There's a wonderful book by John Walton, who teaches Old Testament at Wheaton College – not exactly a liberal institution – called "The Lost World of Genesis One," really going through, in terms of the language of Genesis One and Two, to the Hebrews. What would those individuals have interpreted from this? – concluding that no matter what science says, the one

thing we should not do is to read this literally, because it was clearly not intended or read that way by its audience.

So if we could step back from the relatively recent insistence on the part of some of my wonderful evangelical Christian brothers and sisters that the real litmus test for a Christian is to be a Young Earther, who believes in six literal days, and if we could simply say, that's really not what the text is all about, then without a whole lot of trouble, you can come to a lovely synthesis of what science teaches us about origins and what faith teaches us about origins.

MR. RUBENSTEIN: So when President Obama nominated you to be the head of NIH, some people said, how can this man have this position? He believes in God and Christianity and a whole bunch of other things. Were you surprised by that reaction from the scientific community – parts of the scientific community?

DR. COLLINS: Not entirely, because I had been already talking about my own sense that it would be good for us to have this conversation and to recognize that the debate between science and faith is not well served by the only voices that are being heard being those on the extreme ends of the spectrum, which is pretty much a lot of what conversation was going on.

On the one hand, the sort of new atheists represented by people like Dawkins, who were using evolution as a club over the head of believers to say, you guys should just give it up, because clearly evolution disproves God – which is a leap that really he should not have made on an intellectual ground.

On the other hand, we had fundamentalists, maybe represented particularly by answers in Genesis and a well-intentioned, but I think very literal, reading of Genesis which basically says all of science is a lie and it's a conspiracy.

Most Americans – most people in the rest of the world – don't really buy into those extremes. There needs to be some kind of thoughtful way to look at a way to bring this together, which I think is not difficult to do and which 40 percent of scientists have already done, but they don't talk about it.

MR. RUBENSTEIN: So then you have no problem with the theory of evolution being consistent with the Bible, right?

DR. COLLINS: None at all. I know the theory of evolution is about as well established as the theory of gravity. The evidence for it, particularly coming out of genomics, is incontrovertible.

But if God decided to use the mechanism of evolution to create all of the amazing complexity and majesty of our creation that you see around us on Earth, who are we to say that that was a dumb way to do it? [Laughter.]

MR. RUBENSTEIN: So if somebody wanted to get to heaven, what would you say would be the best way to get to heaven? Any good hints or something? [Laughter.]

DR. COLLINS: Well, I felt uncomfortable giving medical advice, and now you're really going there. [Laughter.]

MR. RUBENSTEIN: All right. Well –

DR. COLLINS: I don't know if there's a USPSTF equivalent for this question about the future life –

MR. RUBENSTEIN: So you have obviously had a big impact at NIH. And today your main message, I guess, would be that NIH does a great job and could use more funding. Is that a fair statement?

DR. COLLINS: Absolutely. I mean, I love this amazingly paradoxical life, David. Every day, standing at the helm of this remarkable institution called NIH, I find out about something amazing that some scientist has done, somewhere out there in this country – some of them that we support even outside the country, although most of it's within the U.S. Every day.

I write a blog; I'm sure you're all reading it every Tuesday and every Thursday. I'm tweeting all the time about this and that. That would be #NIHdirector. [Laughter.] And it's just this proliferation of enormously exciting science. And that's the good part.

And then, in the same daily experience, is this frustration that we could be doing so much better. We should be going so much faster. We could have much sooner than we otherwise would a universal vaccine for influenza, so you wouldn't have to take that yearly shot and we wouldn't have to worry about pandemics in the future. We could have cancer that was more precisely diagnosed and treated sooner than we are getting right now. We could have answers to autism quicker than we currently have. Everything's going about half the pace that it could.

And the consequences of that, for losses in terms of human health advances, losses to our economy, and damage to our generation of young scientists, is so hard to look at day after day when we could be doing so much better. Why can't we turn this around? Why can't this be a real national priority? Why is medical research part of the discretionary budget, which therefore has to be hammered and chipped away at in order to try to do something about our fiscal mess? It makes no sense. [Applause.]

MR. RUBENSTEIN: When you tell that to Members of Congress, what do they say?

DR. COLLINS: Well, one of them's here. [Chuckles.] Nita gets it.

MR. RUBENSTEIN: They agree with you, but then they –

DR. COLLINS: You know, I've met – I haven't ? done a recent count – with more than 300 Members of Congress, one-on-one, in the course of the last three years.

MR. RUBENSTEIN: Is that part of your penance – [laughter] – 300 Members, one-on-one! Wow!

DR. COLLINS: But you know, David, it always goes well, because the case is so compelling. I mean, it's not because I'm a compelling presenter of it; the case speaks for itself. If you really want to look at a place where government investment makes huge sense, and where we are basically losing out because of our failure to support it in the level that it could, here you have it.

And whether it's that you're worried about cancer in your own family or whether it's the Alzheimer's disaster that looms for us as our population gets older, this should be a priority. Everybody gets that.

So I get to the end of those meetings, and everybody says, you know, you're right. We really ought to turn this around. But – and then the but is, but those people in the other party, they are basically making it impossible for us in this party to do the right thing. And both of them say that about each other.

It is so frustrating that we have, in this town, this kind of gridlock with all of this unfortunate hammering of innocent bystanders – which, in this case, is the medical research community – to the detriment of our own country. [Applause.]

MR. RUBENSTEIN: Well, you're obviously doing a great job for the country. If you stay the full term till the end of President Obama's term, which presumably – Director's terms, you only stay till the end of a President's term – what would you consider doing afterwards? Would you consider a higher calling like private equity, or not quite – [laughter] – or what would you like to do next?

DR. COLLINS: I'm sure it would be higher in salary, but I'm not sure about the other meaning.

MR. RUBENSTEIN: You don't think private equity will get you to heaven more quickly – [laughter].

DR. COLLINS: It might be a path toward somewhere, but – [Laughter.]

MR. RUBENSTEIN: What would you like your legacy to be?

DR. COLLINS: You know, David, I have a really hard time thinking about what's next. I feel like I've had such a privilege to have the opportunities, the doors that have opened, to lead the Human Genome Project and to see it succeed, to stand at the helm of NIH and watch it move forward scientifically in such an exhilarating way. How do you follow that up? Where do you go with that? Maybe back to this foundation that focuses on science and faith, something I care deeply about and which I have had to step away from in order to be a Presidential appointee.

MR. RUBENSTEIN: When do you think the people in Sweden will give you the Nobel Prize?

DR. COLLINS: I don't think that's going to happen. The Genome Project – I had the privilege of being what you might call the field general of an enterprise, but it involved 2,500 scientists, all of whom decided to basically put their egos in the corner, put their shoulders to the wheel to

make this happen. I don't see any way the Nobel model fits that achievement, even though the achievement itself, I think, in a thousand years will be seen as one of the big advances in science and human history. It just won't, I think, be recognized in that way.

MR. RUBENSTEIN: Well, if you win a Nobel or not, thank you very much for what you've done for humanity and for our country. Thank you. [Applause.]

FRANCIS S. COLLINS, M.D., PH.D.

Francis S. Collins, M.D., Ph.D. , is the Director of the National Institutes of Health (NIH). In that role he oversees the work of the largest supporter of biomedical research in the world, spanning the spectrum from basic to clinical research.

Dr. Collins is a physician-geneticist noted for his landmark discoveries of disease genes and his leadership of the international Human Genome Project, which culminated in April 2003 with the completion of a finished sequence of the human DNA instruction book. He served as director of the National Human Genome Research Institute at the NIH from 1993-2008.

Before coming to the NIH, Dr. Collins was a Howard Hughes Medical Institute investigator at the University of Michigan. He is an elected member of the Institute of Medicine and the National Academy of Sciences, was awarded the Presidential Medal of Freedom in November 2007, and received the National Medal of Science in 2009.