



**Is Politics Stifling One of the Most Promising Avenues
of Research?
An Interview with Stephen Hall**

*Stephen Hall, Author
Morton Kondracke, Interviewer
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KONDRACKE: I am happy to be here again, and I am happy especially to be interviewing Stephen Hall, who is the author of this book, *Merchants of Immortality: Chasing the Dream of Human Life Extension*, which I heartily recommend to everyone who is concerned with aging research. I can't think of a book that more fully portrays what goes on in aging research, both the good and the bad, the politics, the science, the personalities, the corporate wars—it covers it all. It is a magnificently readable book. It's accessible to any lay reader, and I am sure that all the experts in the field have been eating it up, looking through the index looking for their names, as well!

But it is magnificently written, and it's a deeply moral book, as well. It points in the direction of saving lives, and it argues for the freedom on the part of scientists to do it—without being didactic, without being lecturely. I cannot praise this book highly enough.

This is Stephen's—how many books have you written?

HALL: Fourth.

KONDRACKE: Fourth. The previous ones were?

HALL: *Invisible Frontiers* kind of chronicled how biotechnology got started. *Mapping the Next Millennium* was kind of a post-modern atlas of new discoveries and how they can be mapped. And the one preceding this was called, *A Commotion in the Blood*, which is about immunology and cancer.

KONDRACKE: He has written for the *New York Times Magazine* and numerous other publications.

I should say that this event today is almost on the second anniversary of President Bush's August 9, 2001, decision on stem cell research, which restricts federal funding of stem cell research, embryonic stem cell research, to those lines that existed at the time. We will get to that shortly.

But first, let me just sort of run through the book with you.

HALL: OK.

KONDRACKE: One of the first personalities that we meet in this book is Leonard Hayflick, whose idea is the Hayflick limit. Explain who Leonard Hayflick is, and what the Hayflick limit is.

HALL: Leonard Hayflick was a scientist who was then working at the Wistar Institute in Philadelphia. This was in the early 1960s. The Wistar Institute was very heavily involved in vaccine preparation in those days, and he was assigned this task to try to grow cell lines that vaccine viruses could be grown in to create safe vaccines.

In the course of doing this, he grew a cell line that was derived from fetal material that had been sent to him from Sweden. He plated these cells out and he watched them grow for about eight or nine months, and then, all of a sudden, they stopped growing. And he thought, like most cell biologists in those days, that he had done something wrong—either he hadn't fed them well, or he hadn't tended them well—he had done something to mistreat his cells and they didn't continue to grow. At that point everyone thought that cells were immortal, that they would just keep going on and replicating forever.

So like a good scientist, he did two things: he repeated his experiments and they still stopped growing; and then he'd listen to his data, even though it contradicted what the general dogma suggested at the time.

What ultimately came out of that was the discovery that cells, when they are grown in a petri dish and culture, reach a limit called the Hayflick limit, after which they stop replicating. They don't instantly die, but they kind of enter a stage known as cell senescence, and that ultimately leads to cell death.

But this notion that cells were not immortal, but that they could continue to grow to a certain point and then hit a wall and then just stop, had enormous repercussions for aging research, precisely because if cells were mortal, then understanding the mechanism that caused that mortality might suggest ways of getting toward aging as a biological phenomenon and what medicine might do to treat it.

KONDRACKE: So after all the various kinds of research that has been done, has the Hayflick limit been overcome? Have researchers discovered how to keep cells alive beyond their natural limit?

HALL: I was going to say, in the dish, they have. But it took about almost thirty years for them to do so.

The Hayflick limit ultimately led to a field of research in senescence called telomere biology. It has to do with the ends of chromosomes, as many of your listeners probably know. These telomeres grow shorter with each cell division of a cell's life. At a certain point they simply become a little disaggregated, and the metaphor that is often used, and I think it's a good one, is that they are kind of like the plastic cap on the end of your shoe laces: that becomes removed, and then the end gets a little bit frazzled, and then all of a sudden the thread falls apart.

Well, if the thread is your genetic material and it's falling apart, you are in trouble, the cell is in trouble, and possibly the organism is in trouble. What happened was, researchers discovered that there is an enzyme called telomerase, which in rare instances actually adds a little bit of the telomere back on and preserves the integrity of the end. And then when some cells were treated with telomeres, they actually went through the Hayflick limit and continued to replicate with the addition of this enzyme.

KONDRACKE: Telomeres are one of the subjects of this book, and we will get into that in a second.

But all of this research has led people to talk about fountain of youth genes and immortality enzymes, etc., and telomeres would be the immortality enzyme. But Hayflick is against talk about immortality, right?

HALL: Hayflick was a skeptic, you could say. His belief is that there is really no genetic way that one could extend life span easily on the basis of the information he has seen up to this point.

It's interesting. I think he represents an earlier generation, and I don't think is quite as enamored of the use of model organisms, for example, to make genetic discoveries that have application to human beings. So I think he's at least skeptical that anything could be done in this particular area.

KONDRACKE: What about with telomeres?

HALL: With telomeres, or with the genes, actually, that extend the life span even of simple organisms. He's become a rather vocal skeptic about this. I think it is an important voice to pay attention to because he's got a great store of knowledge about aging.

On the other hand, I think this field has kind of evolved in a molecular direction in some interesting ways that bear watching, and may ultimately suggest that maybe that's not entirely true.

KONDRACKE: OK. So if I correctly understand the areas of research that are active in aging research, telomeres would be one. Stem cell therapy would be another, which is another major focus of your book. Genetic therapies would be another and calorie deprivation is, as you say, the best. If you are going to want to extend the life of an organism, depriving them of enough food seems to be the most dependable, but you don't spend a lot of time talking about that.

HALL: I don't talk a lot about caloric restriction, and it is not necessarily the best—it's the only one that's been repeatedly established in experiments. If you limit the amount of caloric intake, the amount of food that these model organisms ingest, they very predictably and reproducibly live longer.

You can get back to this later, but it actually kind of curls back into some of the more recent research in a very interesting way.

To take a slightly longer view, what I am talking about in the book are kind of two different general areas of research. I think of regenerative medicine, which would include stem cells, as a kind of continuation or part of the continuum of medical progress that has been made over the last century—part of antibiotics, part of vaccination—it's all part of extending life through medical intervention. It doesn't necessarily extend life span, which

is what possibly some of these immortalizing enzymes, or, I think, more likely, some of these genetic interventions might have.

But they are two different fields, and they are kind of converging at the same time, and they are also drawing out.

It has been a very impressive century, as I am sure, again, everybody is aware—the extension of average human life expectancy from one hundred years ago was slightly less than fifty years and now is very close to eighty. That’s an incredible achievement over the span of a single century.

Much of it has to do with socioeconomic factors and people living better and eating better, but a lot of it has to do with medical intervention. I know some demographers believe that there is no reason to believe that that trend will not continue in the foreseeable future, and I think it is things like stem cells, if that technology becomes refined, that will be contributing to that.

KONDRACKE: Right. So there’s a range of potential life expectancies within the next fifty years. Hayflick is saying that if we cured—I believe he’s the one who says this—that if we cured Alzheimer’s, Parkinson’s, cancer, diabetes, all the rest of that, that we add only fifteen years to the average life span, and people would be living, on average, close to one hundred then.

HALL: That’s right—about ninety-five to one hundred, which would be significant.

KONDRACKE: Right. But there are some people who will go up to 150?

HALL: Those of you who read the paper this morning saw someone who went up to 5,000 years by the end of the current century, which I think is a somewhat exaggerated claim!

But yes, you do hear these numbers thrown around. I think there are a couple issues I’d like to address that this brings up.

One is, people talk about how much longer you are going to live, but you don’t hear the companion piece to that, which is how well are you going to live when you are living longer.

KONRACKE: Right.

HALL: But if the quality of life is not similarly maintained while life is being extended—and many of the elderly people who have attended some of these talks that I have given in the past couple of months are the first to point this out; they basically say, “What’s the bargain?”

If you are going to be living longer and you are not going to be having the quality of life that you would like to optimally have with that extra time, it almost becomes a kind of purgatory of extended suffering and incapacity and a burden on families and loved ones.

I think people need to think a little bit more broadly about this than simply how many more years they are going to live.

KONDRACKE: Right. Now, this is an aside, which I don't remember being covered in your book—but on this point, women are now living about eighty years.

HALL: Yes.

KONDRACKE: So if they go to eighty-six, or ninety, or something like that, on average, are they living healthier lives in those added years or not?

HALL: In some respects, yes. You mentioned Parkinson's and Alzheimer's and cancer. While we are making inroads, we still have not grabbed the brass ring in any of those cases. If you could physically extend life to an average life span of, let's say, 120, in which people had typical physical vigor, and if you haven't solved the problem of Alzheimer's, you are merely creating a larger population for that disease to prey upon.

So it's not simply a matter of extending life, but it's simultaneously addressing some of these other issues. Because if you don't do that, you're not going to be able to bring everybody along with the quality of life that you would like to have.

KONDRACKE: Right. Then they've got to figure out what they are going to do with all those added years. Society is going to have to figure out how to either give them something useful to do, or how can we all afford to pay Social Security? That's another subject for another time.

HALL: OK.

KONDRACKE: Besides Leonard Hayflick, another graphic character, or maybe the most graphic character in this book, the ultimate merchant of immortality, is Michael West—who we had on a debate with Charles Krauthammer about stem cell research, and it's as close as one of these exchanges has come to blows, actually! I sort of had to part them, because they really got into it.

But tell us about Michael West and what kind of a character he is and what being a merchant of immortality is all about.

HALL: Well, Michael West grew up in the Midwest. He actually studied psychology in college. He went back to Michigan, where he was from, to run the family business, which was a motor leasing business, when his father became ill.

The business was sold; he inherited a substantial amount of money—the amount of which he has never revealed—that clearly provided him with the funds to kind of underwrite this kind of mythological and philosophical quest about the meaning of life, which he then engaged in for about ten years.

During that period he was an actual card-carrying, I guess you could say, creationist. He believed the Biblical version of creation, which gets into the whole Adam and Eve story and the expulsion from the Garden of Eden, and why humans were going to be denied immortality because of their sins of knowledge.

With this background, he went out to these creation institutes on the West Coast and hung out with those people and picketed abortion clinics as part of that ethos.

Then he kind of convinced himself that the Biblical version of creation was incorrect and that archeology contradicted it too strongly, and he decided to become a scientist.

So from this very strong creationist background, you have a guy flipping all the way over into a philosophical infatuation, I think, with science. He attended Baylor University, he got a Ph.D. in biology, and as he was getting his Ph.D., and starting to go to medical school, the telomere story was beginning to break. He's always had this infatuation and obsession, I think it's fair to say, with aging, trying to do something to arrest the process of aging, and looking at a biological means to do so.

He, therefore, became involved in the foundation of the first company that was devoted to this area of research, which is called Geron, and was founded in the early 1990s. It was largely, although not exclusively, founded on telomere biology. There was a meeting for venture capitalists in November of 1991, I believe it was—they routinely have these things where various entrepreneurs come in, and they pitch a biotech idea and people either give a thumbs up or thumbs down!

But Mike West gave a talk about this and said that the science was approaching the point where it was actually worth thinking about commercialization. Venture capitalists were writing checks in the breakout room after this presentation.

It captured the moment perfectly. People were ready to hear this. It intersected with the interests of venture capitalists to get into an interesting area of biotechnology. It intersected sociologically with the culture that's with the baby boomers as they grow older, and is very focused on this issue confronting the mortality of their parents, and ultimately their own.

It was one of those moments where everything kind of coalesced, and this company was formed rather rapidly.

They went on to do a lot of work in telomere biology. Interestingly, it looks now like the most promising application of telomere biology may be as a potential cancer therapy, because cancer cells use telomeres.

Let me back up just a second. There really are several classes of immortal cells. We talked about no cells being immortal, but there are a couple of exceptions to the Hayflick limit, one of which are stem cells, which we will talk about in a little bit. The other are cancer cells. Cancer cells override this limit on replication and that's what a tumor is essentially is—a bunch of cells that have overridden the governor of cell replication and are replicating without cease. They use telomeres to do that. So the notion is that you might be able to inhibit telomeres in cancer cells, and that it might be a cancer therapy. So that research has kind of steered off in that direction.

I should mention that the first generation of scientists who participated in the telomere work at Geron, some of them have gone on to another company—a number of companies, actually, but one of them is called Sierra Sciences. They have become involved in the notion of trying to transiently, or for a short period of time, activate the human telomeres gene in a way that it might rejuvenate the cells and rejuvenate the telomeres in one's body and then, just as quickly, shut it off so that it doesn't trip it into a kind of cancer scenario. Now, ideally, they would like to do that in the shape of a pill, and they are doing experiments on that. I think it is very early for that, and one can conjecture that there would be certain problems with doing a kind of systemic treatment with something like that. Nonetheless, that's one avenue that is being pursued at the current time.

KONDRACKE: OK. And Michael West, then, gets into stem cells in a big way, and he is an agent provocateur of all kinds of political turmoil connected with largely his—I think you would say—exaggeration? Is that a fair expression of the way or hyping of the possibilities at every stage, making himself—

HALL: I think it is fair to say, and certainly Mike West is not the only one guilty of this. There is a kind of phase shift, as scientists would say, where scientists are working in an academic lab and then they become affiliated with the company. The phase shift involves a kind of, I wouldn't say surrender of caution, but the language in which their pronouncements are couched suddenly—the normal caveats are shed.

KONDRACKE: They want money. They want capital, right?

HALL: There are all sorts of different pressures on a public corporation or any kind of commercial enterprise that are not necessarily always present in an academic lab. They have their issues, too.

Nonetheless, there is an interest in keeping a company in the public eye, to making it sound to investors that things are moving along in terms of product development, that the promise of these products is imminent, and it's always surprising to me (a) how far out onto a limb people are willing to go, and (b) how many other people are willing to believe it when they do go out on a limb!

KONDRACKE: And journalists are only too happy to join in the fun because they can get their story on the front page.

HALL: Exactly. And we are the go-betweens. I can guarantee you that when Geron started referring to telomeres as the immortalizing enzyme, stories that might have been on the inside of the paper started appearing on the front page of the paper, because the word “immortalizing” gave it a whole different resonance in the general society.

KONDRACKE: OK. Let’s go to stem cells, which is the most politically and morally controversial aspect of this kind of research.

Now, there are two fundamental kinds of stem cells that we are dealing with: adult stem cells and embryonic stem cells.

It’s fair to say that the Bush administration has a bias toward adult stem cells, and the Catholic church and other right-to-life movements believe that adult stem cells, drawn from bone marrow, blood, umbilical fluid, fat, you name it, can be somehow tweaked into doing everything that embryonic stem cells can do.

Now in the book, you cite a number of examples where adult stem cells really have done some fairly phenomenal things—although the scientific community says, “No, no, no, no. Embryonic stem cells are the way to go. They are the big thing. We are going to save lives with embryonic stem cells.” They tend to push adult stem cells to the side. But what’s your judgment based on all the interviewing that you have done about the potential for adult stem cells?

HALL: I think that the potential for adult stem cells, and I think it is pretty clear in the book, could be quite significant. Part of the reason for that is we actually have had a great deal of medical experience with adult stem cells for decades.

We didn’t think of them as adult stem cells when we started doing bone marrow transplants, but that’s what bone marrow transplants were when they were first done in the early 1960s. The reason those transplants took is that stem cells from the donor replenished the blood and immunological cells of the recipient.

So there is actually a lot of experience with the use in that setting, and there are a couple of other settings where I think adult stem cells could be quite useful.

One area is in cardiac tissue, for example, with heart attack victims, where if you could get adult stem cells to that location and you got them to behave properly and tractably, you could replenish some of the damaged tissue that occurs during a heart attack. There are likely to be some tests on this. There has already been some work done in Europe on this concept, and there is likely to be some in this country. I know one company was thinking of trying to get a study started as early as this year.

The reservation about going whole hog into adult stem cells stems comes from a couple of things. A couple of years ago there was a suggestion you could take blood stem cells, for example, and you could convert them into brain cells, or neurons. That work has

looked a little bit more problematic on further revisitation over the past couple of years. So there is uncertainty about that, I think, would be the fair way to put it.

So the versatility of adult stem cells, I think, is still an open issue, and really needs to be addressed.

The interest in embryonic stem cells, and the reason there was so much debate about it, and so much to-do about it, is because these are blank slate cells which have the capacity to go in any direction. If you learn how to nudge them in the proper direction, you could address, literally, over two hundred different cell type scenarios, or dysfunctions, with embryonic stem cells—if that power is harnessed.

I don't think that same versatility is offered by adult stem cells. The danger in putting all our eggs, as it were, in the adult stem cell basket, would be the following: we work five or ten years, which is a legitimate timeframe, to do just adult stem cell work, and at the end of that ten years, when we haven't done the embryonic work, discover that these things didn't work the way we were hoping they would work in a certain clinical situation. Then what do you do but to go back to the people who have Parkinson's, Alzheimer's, and diabetes, and say, "Well, we thought adult cells were better, but we were wrong."

KONDRACKE: How much money is being invested in adult stem cells, as opposed to embryonic stem cells?

HALL: There is some money—you know, it's interesting. I think the big money is not being invested. The big money is essentially from pharmaceutical companies, which are, I think, basically sitting on the sideline. They are watching this very carefully.

But I don't think they feel that this is close enough, right now, to jump into with both feet, partly because the science hasn't been worked out. I think it's going to take a little bit longer than a lot of people suspect, especially with the embryonic stem cells.

The whole other issue is FDA or regulatory approval of these therapies as medicines. These will be living cells which, at least initially, have this protein power to change, and that's going to put enormous pressure on any kind of company or research to be able to prove that the cells they are putting in are exactly the cells they say they are—that they are not contaminated cultures that have cells that are in different stages of development that might be going off in different directions. I think that is a very significant hurdle, which it's probably premature to talk about a lot because we are not there yet. I think that's going to be a big issue.

KONDRACKE: Well, since President Bush limited the amount of research that can be done with embryonic stem cells, is the National Institutes of Health spending a lot of money on adult stem cell research, and if so, how much?

HALL: You know, I don't know the exact figure. I know they are spending a lot on it. They have tried to spend a lot on the embryonic stem cells as well.

But the issue, from the scientists that I have spoken with, is that with the limitations of the cell lines that are available, and we can talk about that a little bit more, it constricts the number of cell lines you can investigate. It's funny, I talked to Leonard Hayflick—one of the things I did is I talked to a number of the people involved in this story about what they were doing on the night of the president's announcement. Hayflick was very vocal in finding this policy inexplicable, and I am sort of softening his language. I invite everyone to read the book to get the actual, more graphic, language! But as someone who has been in cell biology for forty years, he knows especially well that each one of these cell lines is almost like a child in the sense that it has different characteristics, it has different traits—it is easier to grow, it's easier to raise, it's easier to do this or work in certain areas, it's not so good for other things. Ideally, you would like as many as possible, as soon as possible, in order to find the ones that seem to lend themselves best to the basic research that really needs to go on now. I think the fact that they weren't available has slowed things up.

I think the fact that the NIH, to a certain extent, was a party to this whole issue about the number of stem cells that were actually available, and then weren't. We can talk about that a little bit, as well.

I detected a certain degree of wariness on the part of people that I would consider to be very good stem cell researchers about the NIH's role in this, and whether politics were not influencing the way these things were being handled.

KONDRACKE: I want to get into that, but I am just trying to understand. If the Bush administration and the conservatives are serious about adult stem cell research, is the money following it? Is there private money in adult stem cell research so that whatever the potential of that line of research is can be fulfilled and we will have a good idea of how far that can go?

HALL: To answer the general question, yes, they have supported that research. It's interesting, though, in terms of the private money involved in the companies pursuing this. This is basically my feeling, and venture capitalists have told me the same thing, controversy chases money away. Even though adult stem cells are different from embryonic stem cells, they are stem cells. People know that stem cells are controversial and that they are always in the news, and people are arguing about it, and there is a constant debate about it.

I think that has scared some money away. I note this at the end of my book. You know, a lot of the development of both embryonic and adult stem cells, in terms of the private sector development, most of those companies are kind of struggling. They don't have a lot of cash on hand. They are not well capitalized. The money has stayed away.

The NIH has been funding the embryonic stem cell research for the cell lines that are existing, but again, researchers have actually been going and creating privatized situations. Stanford set up a stem cell institute. Some of the private foundations are funding researchers overseas.

There is a wariness about the NIH's intentions here, and I think that's affecting things a little bit, psychologically, if not literally the amount of dollars in play. I think people are a little bit wary and want to see where this is going to unfold.

One researcher told me, and this typifies the problem, he said: "I can't start a program in embryonic stem cell research now. I know it is going to take five years to unfold, and then three or four years down the line to find that politically the rug is pulled out from under me, and I won't get any post-graduates or graduate students to work on it, either."

KONDRACKE: Well, as everybody probably knows, and for the sake of those who don't, what President Bush announced on August 9, 2001, was that federal funds would go for research involving stem cell lines that had already been derived from "leftover embryos" in in vitro fertilization clinics; that is, the embryos had already been destroyed. The stem cells had been taken out from them, and the lines had been developed. He claimed at the time that there were sixty-four such lines—sixty lines, I believe he said, and then the government said, "It's actually sixty-four."

HALL: Right.

KONDRACKE: And people have been chasing around trying to find these sixty-four lines ever since, and there are in fact how many lines?

HALL: I think it's now up to twelve. The history of this is actually very interesting. I actually think it has not been talked about too much in terms of how it affected the relationship between the scientific community and the NIH in this area.

The president made the announcement and said that there were more than sixty cell lines available. From what I'm told, that language in the speech was never vetted by the NIH. They never had an opportunity to suggest that that may have overstated the case.

I was also told that the people at the NIH were flabbergasted when they heard the president mention that number, because their understanding that there were sixty-some cell lines, but they were in various states of development, and the state of development in a cell line is basically you can't call it a cell line unless it's established or not.

There was an immediate reaction from the scientific community because they knew there had only been about a half a dozen cell lines published in the literature that had been established as bona fide real stem cell lines.

There was, as you recall, I'm sure, a huge outcry about this, over how many cell lines there really were. And the press started tracking down every one of them.

What I found really interesting about this, and I actually did an op-ed piece for the *Times* a couple of months ago, is that the parallels to the weapons of mass destruction argument in the Iraq war are kind of haunting, because the people in the White House knew that not all these things were cell lines, from what I'm told. They had a very good scientific understanding of what was being discussed, but somehow the president was allowed to say that there were more than sixty lines.

Now, you could say that the exchange of information had been mistaken and so on. And they could have then said, "We misunderstood" or, "We really maybe perhaps overstated the case." But they didn't do that. Under heavy pressure and continuous pressure over the course of the next month, they didn't say, "We misunderstood it." They kept insisting, "The cell lines are robust. They are viable. They are ready to go." They continually made that argument for a month up, until there was a Senate hearing on September 5, which was about a month after the president's announcement, and under some very intense and relentless questioning by several senators, Tommy Thompson admitted that maybe there were only two or three dozen cell lines that were actually ready to go.

So only under the most forceful kind of skepticism did they even relent from the original argument. What was really interesting is that then a week later September 11 happened. From where I sat, I felt like this whole policy was beginning to unravel because there was a momentum—and you know this as a reporter, too—there is a certain momentum to stories when everybody starts jumping on it and all the stories tend to reinforce each other that there are not these cell lines. I felt like that was happening to the Bush policy in that it was really being severely challenged.

Then September 11 happened and, of course, it instantly dropped from everybody's radar screen, and I think it gave the Administration a buffer on this particular issue.

You have to remember too, this was the first major policy decision that the Bush Administration made. I mean, it was the first one that was the focus of really intense public debate, part of which was because of the protracted decision-making process that took so long. Everybody was talking about it and it just assumed it's own kind of weather, almost.

KONDRACK: And then I think September 11 kind of interrupted that momentum. What happened after that?

HALL: Well, then the NIH finally listed all these available cell lines in November 2001. The total at that time was seventy-one, so it actually had grown larger.

Now, I was in touch with researchers who were trying to track these down, and these were good stem cell researchers, and they felt they needed to do their due diligence in trying to contact all the sources of these cells.

They spent days and weeks, if not months, contacting every single person on the NIH registry and they found that only one or two cell lines were available. The key word is

“available,” because it wasn’t just that they existed, but that they would be available without strings attached in terms of the intellectual property.

Most of them never existed, and the notion that people are wasting their time on government grants tracking down cell lines that did not exist—I think that this where some of the wariness about the NIH grows into this. People at the NIH knew that these cell lines were not available, and they knew that they were not complete cell lines. And I think they knew that for well over a year.

KONDRACKE: So do you think that the president lied?

HALL: I think this is very complicated stuff, and I think it’s easy to misspeak, and I probably have about fifteen times in the first half hour here myself. However, with that intense scrutiny, and with that intense challenge, I think that that information could have been corrected sooner. I think there were some political reasons.

I think the long-term political goal was to keep embryonic stem cell research going at a slow pace and hope that the adult stem cell story would go faster and that you could say, “Here, see, this will work. We don’t need the embryonic cells.”

KONDRACKE: Good. Now, we’ve got another level of controversy involving stem cells, which is cloning.

HALL: Right.

KONDRACKE: Therapeutic cloning. There is a bill that passed the House of Representatives that bans all cloning, both cloning of human beings and also cloning of embryos for research purposes. What do you understand the political situation in the Senate is? Will this bill ever pass? or do you think it’s going to get stuck?

HALL: I actually thought it was going to come up in the spring after the House passed it in February, I think. Then it went to the Senate. The sense I was getting in the early spring was that it would come up maybe in late May or early June in the Senate. The fact that it didn’t leaves me to suspect that the votes were not there to pass it, because they didn’t want to have a discussion about something they weren’t going to be able to get through. So what happens in the fall? It’s not clear.

I will say this: as the House vote was driven in part by the announcement at the very end of last year by the Raelians that they had cloned a human being, these legislative events have been very much been driven by these public disclosures that kind of come out of the blue. That’s why the privatization of this research, as it were, has been a real wild card in the whole public discussion of this.

To revisit that Raelian claim, there were an enormous amount of bioethical resources and journalistic resources and legislative resources expended on what has turned out to be, obviously, a non-event. I think in some instances the public debate on this has been

whipped around needlessly by some of these claims that really haven't turned out to be true.

I would argue that the likelihood of being able to clone a human being for reproductive purposes, if not absolutely impossible, looks to be much more difficult than I think people suspect.

KONDRACKE: If you can do it with sheep, why can't you do this in humans?

HALL: The story in primates and probably in humans, if people have actually been trying to do it in humans, is that the process is slightly different. It's more difficult. The primate researchers are the ones who are saying because of several technical issues, this may not even be possible.

In fact, I think *Science* ran a piece by Gerry Schatten's group in Pittsburgh about this not too long ago. I know of some people who have been involved in mouse cloning have also raised the same questions.

Even in the case of animals, Dolly was one in 277 tries, and, in fact, may have suffered some developmental damage because of the process as well. So I am not even sure that you can do this. But, to say that you can't even do research on it because they don't want people to refine the techniques that might be applied to reproductive cloning, I think goes to an extreme.

KONDRACKE: Now, one of your arguments is that even though cloning is not illegal, and even though use of left over in vitro cells for embryonic research can go on in the private sector.

HALL: Right.

KONDRACKE: One of your arguments is that, in fact, the government restrictions have driven research out of the universities and more into the private sector, where there is less discipline, where there is less publication, more proprietary control over the fruits of the research and so on.

You contrast that with Britain, where there is something called the Human Fertilization and Embryology Authority. Now what does that do, and if we had one, how would it be better in the United States?

HALL: This actually grew out of the work in IBF in the late 1970s. The first test-tube baby actually just celebrated her twenty-fifth anniversary—or birthday.

The notion was, they wanted to keep track of these technologies. They wanted to monitor it. They wanted to know exactly how many embryos were being created. They wanted to know the success rate of the transfer procedures. And to this day they know exactly how

many embryos have been created in England. They know where they are. They know what their status is. They know who's donated them for research purposes or whatever.

In other words, they have a very firm grasp on what has happened. Then with each incremental development of technology, there is an application to the authority, as in the case of Ian Wilmut, who cloned Dolly, who is interested now in getting into human therapeutic cloning. And that has to be applied for through that authority. So they basically keep track of, oversee, and regulate that whole area of research. It grew out of reproductive medicine, but it has extended into these new technologies.

At a similar moment in our sort of medical history—there was a great deal of discussion in Washington through the mid- and late-1970s about federal support for embryo research, fetal tissue research. A lot of people think this is a purely a Republican reaction against it, but actually it happened in the Carter administration first. What was then the HEW secretary refused to approve the notion of NIH funding this research and, for various logistical ledger domains that I talk about in the book, it never came up again until the early 1990s.

It was largely driven by this age-old right-to-life argument, which has inflected so much of the discussion, but was also driven by the medical research policy in this country, certainly in terms of reproductive medicine, and now into some of these regenerative medicine technologies, as well.

KONDRACKE: Right. You argue that all such research should go forward. Is that is your basic position? that at least embryonic stem cell research should be allowed to proceed? I take it you would like to have a regulatory regime, something like Britain's, to oversee it, as opposed to it just going willy-nilly as it might in the private sector?

HALL: You know, I think the NIH could probably handle that task. There certainly wouldn't be a lot of people in over their shoulder, given everything that has preceded it. I think the NIH could conceivably do that. I think there is sentiment for having a more formal regulatory structure for both reproductive medicine and stem cell research, and it is unclear how that is going to play out in the next couple of years. But there seems to be a movement in that direction.

I just think the NIH would be much better—not only as a kind of scientific arbiter, but there is also a lot of moral persuasion behind the NIH because they always get the best people in the field to oversee a field, and do the peer review, and that sort of thing. And they have clearly have been sensitized in this whole area. I think that way it would free up the federal money, and it also, I think, would actually make the research more rigorous.

KONDRACKE: Right. If I have one criticism of your book, it is that I don't think that you gave adequate attention to Leon Kass. You certainly mention him, and you say that he's profoundly reactionary, although you do say that he is also morally serious.

But the kind of objections that are raised to cloning, it seems to me, might have been answered more extensively than they were. I'll give you one specific that I don't think you mentioned at all, and that is the slippery slope argument.

HALL: Um-hmm.

KONDRACKE: In Britain they limit the growth of embryos to fourteen days, right?

HALL: Right.

KONDRACKE: So after that they can't be developed any more. Independent of the argument that we are going to clone babies and some crazy person is going to clone himself or something like that, what is to prevent someone from allowing a fertilized embryo to grow, not to fourteen days but to fourteen weeks, so that we can harvest its little heart for tissue or something like that? That is the kind of brave new world scenario that, if science is sort of left to go its own way unrestricted and so on, conceivably that could happen? That is something that people are afraid of.

HALL: Right.

KONDRACKE: What is the answer to that?

HALL: I think that's a legitimate fear, and I think that could be handled legislatively, if you want to put a fourteen day limit on development. That seems like a reasonable line to draw.

I think you can build in limitations and put limits on what you can do. I think you can attach penalties to it, for example, in the corporate setting, that would be essentially equivalent to a company-ending event, if they were to violate that limit. I think there are ways to handle it, short of having an overall ban on all the forms of research.

The slippery slope arguments I'm always wary of, and I do talk about this a little bit in the book. It is kind of timid and reactive to not do something because something else might happen.

I think you are much wiser to build a safeguard around what you know might happen, and then, if the circumstances change in a year or two because the research suggests different circumstances, then you can address it again. But to put a blanket ban on certain activities because they might lead to something may be being too cautious. If the Wright brothers thought that there might be a plane crash, and thought, "We better not develop this technology"—this is a gross and perhaps unfair example, but any time you are developing a new technology there are things that might go wrong.

I think the wiser course is to identify that which might go wrong and segregate it from that which is likely to benefit society, and use whatever tools are necessary, be they

legislative of scientific community or public to shift it in the direction of benefit, and not in the direction that we don't want it to go.

KONDRACKE: So, at the present state of things, how do you think the United States is going to lose out on this research because of the restrictions that the government has imposed? and is it going to go off shore? Is it going to proceed at a less robust pace than it could in this country? What do you think the bottom line is here?

HALL: I think it is proceeding in a less robust pace than it could be in this country. I mentioned the example of the professor who said he didn't want to start a project that might be intercepted at some point.

One of the things I hear from some stem cell researchers, whose work I respect, is that they can't get young people to work in these areas because it's politically too risky.

I think probably your audience understands, but a lot of people in the public don't understand, that the vast amount of cutting-edge research is not done by the lab head whose name is on the end of the paper, but it's done by the people who are working in the labs eighteen and twenty hours a day, who are solving the incremental daily problems that need to be solved for any experiment to work.

Those are the people who do the bulk of the scientific innovation in this country. If they are scared away from this field because of the political uncertainty that is attached to it, we are really losing this incredible resource that we have, and have enjoyed for such a long period of time. They will go to other places, such as Sweden, Israel, China, Singapore, and England, where there are fewer restrictions on this avenue of research and people are going full throttle.

KONDRACKE: Right. OK. Let's do a little audience participation here. These are questions that have either been e-mailed in or are from the audience here: "With the private sector increasingly becoming the owners of genomic research, do you think that in the future scientific breakthroughs could be economically rationed to the highest bidder?"

HALL: Well, in a sense, they already are if you consider the drug industry and the price people pay for pharmaceuticals, and the prices that are set in this country, for example, versus the price for the same medicine in Canada or in Europe.

So we are the highest bidder. We already are the highest bidder. Part of it is built into our health care system and delivery of it. That will only continue, and believe me, there will be a premium on any of these medications if they are shown to be effective.

KONDRACKE: "Do you think that scientists are in tune with the real-world implications of their research—its effects on public policy, population, culture and human interaction?"

HALL: I do. I think scientists are much more aware of the public ramifications of their work than the public is aware of the political ramifications of some of the things that they suggest in the scientific community.

You can't function in many of these areas without having institutional review boards, and there is a lot of inter-community scientific interaction on all sorts of levels. I think people are very sensitive, particularly on issues where there has been a big public debate, as in stem cells. They are very sensitized to these issues.

I don't think the public realizes what a blanket ban on scientific research means, not only for the specifics of the scientific research, but it has some ominous intellectual and historical parallels to things that we haven't talked about in centuries, like Galileo and the Vatican church.

I mean, restricting human curiosity, although it will probably not figure high on anyone's list of daily priorities, is really a critical issue that underlies the whole structure and monument of American biomedical research for the last fifty years.

KONDRACKE: One of the things I find curious about this debate is that some of the people who are arguing against cloning, for example, the neoconservatives—Bill Crystal of the *Weekly Standard*, Charles Krauthammer, and I guess even Leon Kass is a bit a traditionalist—who believe that dying at the right time is a good thing. Basically.

HALL: Exactly.

KONDRACKE: But under ordinary circumstances, these are people, the neoconservatives, who believe in free inquiry, capitalism, all this kind of stuff. So what is it about their position? What was the intellectual background of their objections?

HALL: You know, it's an excellent question, because it actually is so contrary to everything else in the philosophy.

KONDRACKE: And they are not right-to-lifers. I mean, they are not particularly religious people.

HALL: Not particularly. But there is a social agenda, a family agenda, and a moral agenda, and there's some real interest in kind of telling people what's right and wrong. I think this informs a large part of their interest in this area. And I think technology does frighten people, and one can concoct frightening scenarios out of some of these technologies. There is no question about it.

I think the proper response is to not abandon the technology, but to control it in a socially acceptable and correct way.

KONDRACKE: OK. As a journalist, what do you see as the media's role in covering the issue of "immortality"? and how does the coverage drive public opinion on controversial topics such as stem cells?

HALL: You know, as I mentioned in the book, toward the end, the—when I started out talking with the title, *Merchants of Immortality*, I was thinking primarily of the privatization and the commercial interest in developing these technologies.

As I worked my way through it and saw what other people are doing, and what I was doing, and some of the public arguments, I realized that the merchandizing of the idea of immortality extends to those of us in the media. We are guilty of taking a kind of slender idea, a possibility, and kind of giving it more credence by mentioning it all the time. And I see it in work that I have done, so there is certainly that in play.

You mentioned Leon Kass. I think this whole notion of finitude, and complaining or arguing against immortality is using immortality to merchandise his ideology, which is not just for finitude and not immortality, but as I quote in the book, he has some anti-scientific sentiments that are really surprising in this day and age. They go beyond concern and wariness, but they actually suggest that science, because it does search for truth and searches for the correct answer to things, is a kind of socially destabilizing force.

KONDRACKE: We're just about done. I have one more question. What is the number one barrier to "immortality"? Politics, lack of knowledge, lack of funding?

HALL: I would say actually, the number one barrier might be natural. I don't think we are designed to live forever. I think we can extend life a little bit, but even doing that is going to take an awful lot of work in the laboratory.

KONDRACKE: Well, thank you. Steve Hall, thank you so much for being with us. This is the book, *Merchants of Immortality*. I highly recommend it and thank you all for being with us. Thank you.

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