[LR219]

SENATOR ASHFORD: Good morning, everyone. I think we're going to get started because it's five after 9:00 and my colleagues are going to be coming in, I believe most everyone will be here. Senator Pedersen is not going to be here today, but I believe everyone else will be here. So as we move along we will have the other senators come in. Jonathan Bradford, some of you know, is the Committee Clerk for the Judiciary Committee, he is over on the computer. And Stacey Trout is the Committee Legal Counsel. Amanda McGill is here, Senator McGill, and of course, Senator Schimek. Why don't we get started? I'm going to read the resolution into the record, because I think it's important for everyone here in the room to hear it. Most of you, or many of you, I'm sure, have read it, but we are looking at...the committee has had, over the last several months, many questions about the issue of research. We of course had a hearing on this matter during the legislative session. It was informative but I think the--at least, speaking for myself, and I believe I'm speaking for the other members of the committee--that this of course is a very, very difficult issue. It's a complicated issue. And we realize also, so that everyone understands this, it's an issue that takes months and months and years and years and there are experts here today that have spent their whole professional lifetimes thinking about researching, what influence, impact it has on the citizens of our state. And so we know, we understand that three or four hours cannot do this issue total justice. But we felt, the committee felt, I felt that it was important to hear more. And I understand that those who support embryonic stem cell research generally will be...will have some experts that will be talking about the issue. And those who have reservations about this type of research will also have experts. And the idea is to give each group an hour to speak about the issue. And they can take whatever time in that hour they wish. There may or probably will be some questions. We will try not to include those questions in the hour. But we want to keep things moving along and get finished some time today, hopefully. (Laughter) Senator McDonald is here from the 41st District. Welcome, Senator. Let me read the resolution. It's LR219. And I normally wouldn't do this, but I think just so we get the context of what we're talking about, I'm

going to go ahead and read it. It was introduced by the Judiciary Committee...oh, I see Senator Christensen is here too, excuse me, Senator Christensen. And Senator Hansen, okay. I saw him earlier. This resolution was introduced by the Judiciary Committee, myself as Chair, Senator Lathrop, Senator McDonald, Senator Pedersen, Senator Pirsch, Senator Christensen, and Senator Pat Engel. I don't believe Senator Engel is here today, but Senator Engel has had an interest in this issue as well. And the purpose of this study...I'm going to read the words of the resolution. The purpose of this study is: study the history of stem cell research, human reproductive cloning, and human therapeutic cloning, including the available sources of human stem cells, and the methods and techniques used to obtain both embryonic and nonembryonic stem cells; (2) to research the terminology utilized to describe the various techniques and technologies involved in stem cell research, human reproductive cloning, and human therapeutic cloning so that a common understanding can be established; (3) to identify and analyze the arguments for and against stem cell research, human reproductive cloning, and human therapeutic cloning, including the techniques utilized to obtain stem cells for research and the use of tax dollars to fund such research; and (4) to review past and present legislation involving stem cell research, human reproductive cloning, and human therapeutic cloning and efforts to study the ethical issues involved in stem cell research, human reproductive cloning, and human therapeutic cloning at both the state and national levels. Now, therefore, be it resolved by the members by the members of the One Hundredth Legislature that the Judiciary Committee of the Legislature shall be designated to conduct an interim study to carry out the purposes of this resolution. And that the committee shall upon the conclusion of its study make a report of its findings, together with its recommendations, to the Legislative Council of the Legislature." This is an important process and these Legislative Resolutions are very, very important, especially when we're dealing with issues that are...have been as intensely debated as this one has in the past and is currently being debated and will in the future. We intend--and I know this committee has studied this issue over the summer--we intend to look forward to a full hearing and an informational hearing so that at some point between now and the end of the...this interim and going into next session

we can issue an informed report to our colleagues in the Legislature. Senator Steve Lathrop is here. Welcome, Senator Lathrop. Now when I initially...when we discussed how we would conduct this hearing, the idea was to, as I suggested, was to have an hour for both...each group to produce their experts. And that's the...what I would like to do. I chatted with Senator Maxwell here, former Senator Maxwell, and he indicated he didn't have any particular...didn't care either way who went first. So I think I'm going to ask Chip, if your group would come forward and give their testimony first. Then those who have generally supportive opinions about embryonic stem cell research can then come forward. And then the public will have an opportunity to discuss the issue for about an hour. And we're going to give everyone an hour, or give everyone five minutes to talk about what they have heard these experts talk about, or anything else they want to talk about on this issue. We are not limiting this discussion only to the idea or the concept of cloning, so to say. And I know that's not necessarily the right word to use. We would like to hear, as a committee, discussion about embryonic stem cell research, about stem cell research generally adult, other...as I've suggested in reading the resolution. We're really looking to put this all into context so we can better understand the issue. Then after the public has an opportunity to chime in, we may or may not break for lunch. I don't know where we will be in the process. Then both groups will have some additional time, half hour or so each, to discuss what they've heard, and if they wish to rebut some of the discussion, so...that has gone on. Again, we appreciate everyone being here. This is a difficult issue. I know people...those of you who are here care deeply about it. We respect that on this committee. And we look forward to a good conversation. With that, Chip, do you have a group that would like to proceed, or would you like to introduce [LR219]

CHIP MAXWELL: Mr. Chairman, I'm going to stay out of the way and let the experts handle it. (Laughter) [LR219]

SENATOR ASHFORD: Okay. Who do we have that would like to come up and talk? And would you just state your name and...for the record and where you live? [LR219]

MAUREEN CONDIC: Yes, and my name is Dr. Maureen Condic. I am an associate professor of neurobiology and anatomy at the University of Utah School of Medicine. And it is going to take me, unfortunately, gentlemen, just a couple minutes to set up. [LR219]

SENATOR ASHFORD: Okay, do we have someone... [LR219]

MAUREEN CONDIC: Someone who can help me out here? [LR219]

SENATOR ASHFORD: And Senator Pirsch has joined us, welcome. [LR219]

MAUREEN CONDIC: Okay. I apologize to those of you who are going to have to crane your necks to see my presentation. [LR219]

SENATOR ASHFORD: I wonder if we can move it just out just a little bit. Is it okay for everyone? [LR219]

MAUREEN CONDIC: All right. So, as I said my name is Dr. Maureen Condic. I'm going to be speaking to you today about the topic of embryonic stem cells and human cloning. And I would like to start my talk with a disclaimer. So I'm a stem cell biologist and I'm a human embryologist. But I think it's important for you on this committee to know that I have neither a financial or a scientific interest in the outcome of this debate, on the national level or on the state level. I don't work in Nebraska and on the federal level I work on animal stem cells, which are fully funded and unrestricted. So I believe that enables me to provide you with both expert testimony and also neutral testimony, because I am disinterested in the outcome of this discussion. So today the outline of what I would like to talk to you about is...I'd like to start with a brief discussion of what are stem cells, move on to the problems with the use of embryonic stem cells in medical therapies for humans, problems with human cloning, and end with a very brief

discussion of alternative sources of stem cells that do not involve embryos. So what is a stem cell? I think this is a question that a lot of people find very confusing. And actually, stem cells are pretty simple to understand. So any cell that divides to replace itself and also generate and a different cell that will become something new is a stem cell. So in this little diagram that yellow cell, when it divides it produces two cells. The curving back arrow indicates that it will produce one daughter cell that has all the properties of the original stem cell. And it will also produce a more restricted cell. So because at every division a stem cell replaces itself, it allows there to be a population of cells with the same properties that persist over a long period of time and generate continuously new tissue. So stem cells exist at every stage of development, from early embryos all the way up through adults. They can produce a wide range of cell types or they can be limited to produce only certain types of derivatives. So since we are going to be talking about embryonic stem cells I'm going to do a very brief review of development. So these are pictures of mouse embryos, but I can assure you that human embryos look almost identical to this. Human development starts...let's see if I can maybe just use my pointer, here we go...here at the one-cell stage. And this cell is known as a zygote or a one-celled embryo. And although it's a single cell, it's extremely misleading to call this just a human cell. This is a very unique cell. It's unique because it possesses internal to itself a full program to proceed through development to generate all of the tissues of the mature body and to organize those tissues into a rational body plan. No other cell is like this in any way. So a zygote is not just a cell or even a special cell. A zygote is a one-celled human embryo, a human organism, a human being at the earliest stage of development. And we know that by watching what it does. So here by the two-celled stage this...these two cells are already specializing. They're already making decisions about what they're going to become, what they're going to contribute to the developing body, by the eight-cell stage, the morula stage, these cells have already become different from each other. They are molecularly different. They express different genes. And they've gotten there by virtue of the communication that has happened at earlier stages. So certainly by the eight-cell stage and some evidence suggests as early as the four-cell stage there are clear specializations among the cells that have come about by

the cells communicating to each other earlier in development. In humans by about three to five days the embryo has already generated structures, tissues that are distinct from each other and contain different cell types. So we create...the embryo creates a structure called the blastula, which is a hollow ball of cells, or a blastocyst, sometimes people will refer to it. And this tissue, this structure has two different kinds of cells. The outer cells on the rim there are called trophoblasts, and they'll go on to make placenta and membranes. And this small cluster of cells on the inside is called, creatively, the inner cell mass. And those cells have become restricted in development. They are already specialized. They will not produce everything in the embryo, but they will produce all of the tissues of the postnatal body. So all the cells that you have in your body right now originally derived from that little cluster of cells, the inner cell mass. So stem cells are present in early development and at very early stages at the morula stage. These cells go on to produce all the tissues of the body. So they produce the tissues that will persist after birth, and they produce the embryonic organs that are specific to prenatal life, so the placenta and the embryonic membranes. And because of that, because they do everything, these very early cells are called totipotent cells. "Toti" just means all and potency is power, so they have the power to do everything. If we wait just a few days and we get...we consider what the cells of the inner cell mass will do, they are now restricted. So there has been a progression in development. And they will only make or largely make the cells of the postnatal body. So because of that, because they are no longer totipotent but they still make many things, these cells at this later stage are called pluripotent. So how do we make a stem cell line? Well, we make a stem cell line by starting with a one-celled embryo, a zygote, allowing it to proceed through development, through this early stage where the cells will make everything, allowing development to proceed to the point where we make structures and where restrictions are already occurring in the developmental potency of these cells. So now the cells of the inner cell mass are no longer totipotent, they are only pluripotent. And if we provided this blastocyst-stage embryo with an appropriate environment, that of a womb, it would go on to make a fetus and ultimately a mature body. But if we want to make a stem cell line, instead we isolate the cells of the inner cell mass from this

embryo and maintain them in culture where they continue to divide and they continue to have the properties that they would have had in the embryo. And of course the controversy about this procedure is that in doing this we destroy the embryo and prevent any proceeding through the normal trajectory of development. So I'd like to offer you a second disclaimer at this point. Many people would like to characterize me as an anti-stem-cell biologist in some way. And nothing could be further from the truth. I personally believe that embryonic stem cells are scientifically fabulously interesting cells. I think their study will yield important and unexpected advances in our understanding of basic biology. However, I also firmly believe that everything we want to learn from the study of embryonic stem cells can be learned easier, better, faster, and cheaper with greater scientific power from the study of animal cells. This is why people do research into animals, not just because they're trying to avoid controversy, but because animals are a better scientific system in every conceivable way. If a mouse is a Maserati a human cell line is a Model T, and we just don't have the power, the tools, the resources in a human cell line that we do in an animal cell line or in an animal model, a whole animal model. So why then do we want to study human embryonic stem cells? Human embryonic stem cells are only necessary if embryonic stem cells in a general sense are found to be useful for treating human medical conditions. If they're useful for human medical treatments then the relatively small differences that exist between a mouse stem cell and a human stem cell will become important. And we'll need to figure out those small differences to apply these cells to medical treatments. So I think because of this the central question in the whole stem cell debate is the question of whether and to what extent embryonic stem cells are likely to be useful. And that's why we're going to spend a fair amount of time talking about problems with the therapeutic use of stem cells. So what are the problems? There are serious, long-standing scientific problems with the use of embryonic stem cells for medical therapies that will take many years and enormous amounts of money to resolve if they can be resolved at all. And these problems are not simply technical problems, but they're problems that are linked to the intrinsic biology of these cells. So what do I mean? The first problem is linked to the feature we've already discussed, the pluripotency of these cells. So in embryos the

entire job of an embryonic stem cell is to divide very rapidly and to make multiple cell types. And if this all starts sounding a little bit like a tumor to you, then you are thinking in the right direction, because embryonic stem cells continue to do exactly this job when they are transplanted into adult tissues. They multiply very rapidly. They form tumors known as teratomas. These tumors contain multiple cell types: teeth, hair, bone, eyes, muscle, nerve, and they're often fatal because of their rapid growth. So the first problem with the medical use of embryonic stem cells is that they make lethal tumors with high frequency. I'm going to use Parkinson's as a model, as a way of illustrating my point several times, because Parkinson's is both a horrible disease and also a disease that is frequently put forward as a possible target for stem cell therapies. So in this animal study of Parkinson's the important thing to note here is that 25 percent of the animals, this red part of the graph, died of fatal teratomas following transplantation of embryonic stem cells at eight weeks. And what this tells us, this study and many thousands of studies exactly like this, tell us that transplantation of even a very small number of embryonic stem cells carries a very significant risk of tumor formation. So could we get around this? And of course the answer is...that's often given is, well, no one in their right mind would think to transplant embryonic stem cells into a patient, because it's absolutely clear and completely agreed upon that that would be horribly unsafe. But we can fix this by differentiating these cells, if we mature them into a more mature state, then we'll get around this tumor-forming problem. We're simply going to take embryonic stem cells, we're going to turn them into adult or more adult-like cells and then transplant them. But the problem with that is even differentiated embryonic stem cells still make tumors. More than two dozen studies over the last five years have shown this, I think beyond any reasonable scientific doubt, that so-called differentiation of embryonic stem cells does not fix the tumor-forming problem. And I'll give you one example. In this study the authors were trying to fix a form of blindness that is due to the death or degeneration of neural cells in the eye. So this is again an animal study, this is an animal eye. Light would come in from this direction. This would be the lens that would focus the light. And these at the back of the eye is where the neurons that detect that information live and send it to the brain. So in this study embryonic stem cells were

differentiated into neural progenitor cells or precursor cells, and injected to see if they could restore the cells that were dying. And when you did that, they don't restore vision, they make tumors. So very large tumors, very rapidly growing tumors are formed in the eye, and in this study, at eight weeks, a mere eight weeks following transplantation, tumors were detected in 50 percent of the eyes. So differentiation does not fix the problem. But that's not the only problem with embryonic stem cells. Multiple studies have shown that embryonic stem cells are genetically unstable and they convert into cancer cells. So this is not an isolated result. Several papers from the most prominent stem cell laboratories in the world, published in some of the most prominent scientific journals of the world: Science, Nature Biotechnology, Nature Genetics, have shown that there is genetic and epigenetic instability in stem cell lines. Papers that have illuminating titles like: recurrent gain of chromosomes 17q and 12 in cultured human embryonic stem cells. So what does this mean when we try to translate it into normal language? Instability means that embryonic stem cells not only form teratomas, which are benign, albeit generally fatal tumors, but they also accumulate genetic mutations that convert them into cancer cells. And secondarily what this means is that until we find a way of controlling the tumor- and cancer-forming potential of embryonic stem cells, these cells are simply not safe for the use in human patients. Now I'd like to remind you that President Nixon declared a war on cancer in 1971. And since then, worldwide, hundreds of billions of dollars have been spent and thousands of careers have been consumed trying to solve the problem of tumor formation and cancer conversion. We have made progress in this area, but we still have cancer. Cancer is not an easy problem to fix. And the hubris of embryonic stem cell researchers who will tell you, oh, let's throw a few hundred thousand, a hundred million dollars or so at this problem and we're going to solve it is really something to think about. I'm not saying that we should not continue with research. What I am saying is that this is not a short-term fix. This is a long-term commitment to a very, very arduous task. And enormous barriers stand between us and using these cells safely in patients. The fourth problem with embryonic stem cells is linked to the first three problems. All of these problems result from the fact that embryonic stem cells are immature and they behave in mature tissues the way they

behave in the embryo. So they could all theoretically fixed if we, as scientists, could find a way of controlling these cells and differentiating them appropriately. But thus far we have not been able to generate stable, differentiated adult cells from embryonic stem cells. So what do I mean by that? In theory this is a very simple idea. We start with a dish of pluripotent stem cells and we throw factors on them in the laboratory that cause them to turn into mature cells. And I can tell you many thousands of papers and my own experience with stem cells confirm that it's relatively easy to generate cells in the laboratory that have some of the properties of normal adult cell types. I can even take embryonic stem cells, turn them into cells that look something like heart cells. They will beat in a dish, they will express some of the proteins that heart cells normally express. The question is: are they really heart cells? So how would we know? What we know from organ transplant is that when we take normal tissue, truly normal tissue from a donor, from a human being, and we put into a patient, that tissue will survive for many years and it will continue to function when transplanted. So that's...so the recipient, the patient, their own body is telling you that this is normal tissue. It's functioning in my body like it should. The question is: do cells derived from embryonic stem cells function normally when they're transplanted into animals. And the absolutely unambiguous and uncontested answer is no, they do not. So here again is a study of Parkinson's in a monkey model. This group was interested in trying to replace the class of neurons that's affected by Parkinson's disease, dopaminergic neurons. They generated cells in the laboratory that had many of the properties of dopaminergic neurons and transplanted them into the brains of monkeys. And what they found was that at 14 weeks post-transplantation, 97 to 99.5 percent of all the cells transplanted were simply dead. And this is by far the single most common result we see with embryonic stem cells is that the cells do not survive. And this is telling us that these embryonic-stem-cell-derived, so-called neurons do not survive and as far as the animal is concerned they are not normal cells. So despite nearly a quarter century of research, more than a quarter of century of research on embryonic stem cells it has proven to be very, very difficult to differentiate these cells into cells that survive following transplantation and function normally. And this is not surprising. The reason that it's

difficult is embryology is complicated. And there are multiple factors including physical factors, stretch, electrical fields, extracellular factors, things that we don't really understand very well that are required to produce a normal, mature cell type from an embryonic stem cells. It is not going to be a simple matter of throwing chemicals on them in a dish. And this has been shown many, many times, over and over. The last problem with embryonic stem cells is that they are foreign tissue that will be rejected by the immune system, and fixing this problem is very challenging. So why do I say it's challenging is because we have had a lot of experience with organ transplant and immune rejection. The first successful organ transplant was in 1905, over 100 years ago, with corneas. And the reason that this was successful is because corneas don't receive blood supply. It's the outer surface of your eye, and because of that they're not rejected by the immune system. There was a lag of nearly 50 years before the next successful organ transplant in 1954. And then in the late 1960s with the advent of immune-suppressive drugs we had a lot of success with organ transplant that has continued to this day. But this is in some sense a devil's bargain. Immune suppression is a very horrible thing to do to patients. It gives them the chemical equivalent of AIDS and they are subjected to much higher rates of cancer, much higher rates of fatality due to small infections. It's a very hard thing to live with and a very tough choice to make. So we have been dealing for more than 50 years with the question of immune rejection. And we have still not solved this problem in a way that is really a cure for this problem. And the problem affects stem cell therapies even more so than organ transplant. Stem cells of any source, if they are rejected by the body, create a much more significant problem than foreign organs. So if I transplant a kidney into you, and your body chooses to reject it, it's unfortunate, I don't want to do this, but I can go in and take the kidney back out again. And put you back on dialysis and you will live. But if I transplant stem cells into you, those stem cells will disperse throughout your tissues. They'll disperse throughout your whole body. And if your body chooses to reject them, it will mount an immune response against everything in you, you will die of multiple organ failure. And there is no technology that exists today that can remove those cells once they've been put in. So the issue of immune matching is huge. It's very, very important to think about

in any stem cell therapy: adult stem cells, embryonic stem cells, stem cells from any source. So how could we address this problem with embryonic stem cells or any stem cells? One idea is to take the same model that has been used for organ transplant: to have a registry or an organ bank or a stem cell bank that could provide a good immune match for patients. But there are problems with thinking about embryonic stem cell banks and immune rejection. First, the relatively small numbers of spare embryos available from fertility clinics do not represent the genetic diversity of the American public. So we would need to produce embryos and we would need to focus especially on minorities in order to...and then destroy them...in order to generate stem cell banks. Embryonic stem cell banks would have to be very, very large, enormous, on the orders of hundreds of millions of lines, in order to treat patients of all races. And the expense of this, many people...would simply be prohibitive. Further, the genetic instability of embryonic stem cells that we've already discussed would significantly complicate the problem of assuring safety in such a very large stem cell bank. So every time those stem cells were used we would have to have a very rigorous test to confirm that they have not converted to cancer cells. And testing those cell lines would become, again, prohibitively expensive. So is there another way to address this immune problem? And that of course brings us to the second proposed way, which is human cloning. So what is human cloning? In human cloning we start with a mature egg cell and we remove the nucleus of this cell. So we're left with the cytoplasmic components of the egg but no DNA. Then we take a body cell, somatic just means body, a body cell from the patient and we fuse those two things together. And if all goes well we end up with a single cell. Now I want to emphasize that cloning ends here. When I clone in my lab I have a protocol, kind of a recipe for how you do cloning. It stops right there. You've made a clone. And what have you made? You've made a one-celled embryo. Now many people will argue, oh no, no. You've just made a human cell, you've made a stem cell. That's all you've done. You haven't made an embryo, because there is no sperm and egg. But technology often provides us ways of getting to the same endpoint through a different means. Yes, the old-fashioned of making a zygote was the old-fashioned way, and it involved sperm and egg, but technology has now provided us another way to make a

zygote. And we make that zygote through the process of cloning. Now why do I say that? If this were a mere human cell all it would do is act like cells do, which means it would divide and make more of itself. That is what cells do. But this cell, the zygote, behaves like a human organism. It behaves like a human being at the one-cell stage of development. Why do I say that? Because what do we do with this cloned cell? We allow it mature in the laboratory, and when it matures it does exactly what a zygote does. It produces totipotent cells, those cells begin to express, they communicate with each other, they express molecular difference. Those molecular differences result in the formation of tissues and restrictions in developmental fates. So we've gone from totipotency now to pluripotency of the inner cell mass. And this is precisely why we want to produce this cloned embryo, because it will go through the normal process of embryonic development to the point where we now have a difference in the cells of the inner cell mass from the original cell that we produced. This cell is totipotent, these cells are pluripotent. And so we take those pluripotent cells, we put them in culture, and if all goes well, we produce an embryonic stem cell line. So cloning absolutely does not produce a cell. It produces an organism. It produces an embryo, a human being at the one-cell stage of development. And this process of generating a cloned stem cell line with solve the immune problem because it provides a patient-matched embryonic stem cells line. So these cells in culture now have exactly the same nuclear DNA, the same genetic information that the patient had. And the patient would recognize them as being their own cells. So there would be no immune rejection. And this is why people want to have the ability to clone, because it opens up the possibility of making a patient-specific repair kit. But there are problems with human cloning. The first and most significant problem is that cloning primates has proven to be extremely difficult. No one has successfully cloned a human embryo. And this has to do with the fragility of human eggs. We are not as robust. Our eggs are not as robust as the eggs of many mammalian species. And it's just difficult to clone humans. This does not mean it will prove impossible. I have it on good authority that a paper will be coming out in Nature this month showing cloning of a monkey embryo. So if we can clone monkeys it is possible that in the future we will be able to clone human beings as well though it is

likely to prove inefficient and difficult to do it, but possible. However, much more significantly, all cloned animals are abnormal. And the extent of this abnormality is very difficult or impossible to detect. So what do I mean by this? Let's consider reproductive cloning, like the kind of cloning that generated Dolly the sheep. So if we start with a thousand clones, we make a thousand somatic cell nuclear transfers to generate a thousand one-celled cloned embryos, and then we let them mature in the laboratory. By the time they get to that blastula stage, which is about the time that you would transfer them to the uterus, only 200 of them on average will be normal-looking. Which means that the other 800 will have either died or will be developing so abnormally that they're not really worth the effort and expense of transferring them to a receptive uterus. So we transfer those 200 and we end up with one live birth. So this is a very typical kind of cloning efficiency. Cloning efficiency varies between even less than this, one in a thousand, maybe one or two percent in the animals that are the easiest to clone. But human beings are likely to be on the low end, because as I've said, we are proving difficult to clone. So what this tells us is that the other 999 clones that were produced were so abnormal they couldn't make it through normal development. What about this one? What about the survivor? Is this a normal animal? And the answer, of course, is no. A large-scale screen of gene expression in cloned mice showed that hundreds of genes are abnormally expressed in the survivors. These are not normal animals. Dolly the sheep herself was not normal. She had to be euthanized at half the normal age of a sheep, because of multiple medical problems. So the ones that survive, survive because they're normal enough, but they're still not normal. And unfortunately, it is simply not known whether these kinds of abnormalities will prevent cloned ESLs from generating normal tissue. Tissue that can actually be useful for therapeutic purposes. The third problem with cloning is that obtaining human eggs for therapeutic cloning entails a very significant medical risk to women. And this is a subject near and dear to my heart that unfortunately is almost always completely ignored in a discussion of stem cell research. So it is quite likely that research on the maturation of eggs in the laboratory will eventually provide an alternative source of human eggs. But at the present time and for the foreseeable future, eggs for research and eggs for any

potential therapies must be donated by women. And this has led to what the New York Times chooses to call the vexing egg donor problem, which is that despite a $100,000 advertising campaign by prestigious Harvard stem cell biologists, no egg donors have stepped up to the plate, not a single one. So why is that? Well egg donation is painful, time-consuming, and medically risking. Ovarian hyperstimulation syndrome, or OHHS affects between five and ten percent of all egg donors. And the complications of OHHS, if we can call them complications, include hospitalization, sterility, and death. So in light of these kinds of risks, it's not terribly surprising that women are not stepping up to the plate to donate eggs. And it raises the very serious question: couldn't we actually use cloned human embryos without entailing a significant risk to women? And to illustrate this I would like to use again the example of Parkinson's. What would be the cost to women in the United States of using therapeutic cloning to treat Parkinson's Disease? So the Parkinson's Disease Foundation estimates that there are a million Parkinson's patients in this country right now. And I will have to go a little bit...it's complicated, we'll have to go through best-case, worst-case, because there is always a range of how things could work out. So how many cloned embryos would we need to generate a million stem-cell lines? So the efficiency of generating stem cell lines from embryos is between six and eighteen percent, so in the best case we would need about six million embryos, and the worst case 17 million. How many eggs would we need? Well cloning efficiency to get embryos up to the blastula stage is a little bit better than to bring them up to live birth, but it still varies between one and ten percent. So we would need somewhere between 60 million and 1.7 billion eggs to generate those stem cell lines. Number of cycles: so how many rounds of stimulating the ovaries to get eggs from a donor would we need? Experience with IVF tells us that you get about five to ten eggs per cycle. That means something like six million to 350 million cycles would be required. How many women would be involved? Well the last census tells us that women of reproductive age in this country, which is all women between the ages of 15 and 44 is a total of 62 million women. So in the best case that means one out of every ten women donates, in the worst case, every single woman in this country in that age range donates five to six times. How many cases of OHHS are we going to see? Three

hundred thousand to 35 million cases. How many hospitalizations? Sixty thousand to 3.5 million. How many deaths? Somewhere between 120 and 7,000. Now these are the numbers, Senators, that I think you need to take home to your constituency, half of whom are women. And I find these numbers extremely disturbing, because, frankly, I'm not going to step up to the plate, and I'm not going to let my daughter step up to the plate either. So where are we going to get these eggs? We're going to export our egg problem to the third world, to desperately poor people who are willing to take these kinds of risks for $100 a hit. And if that doesn't disturb you, I think it should. So in summary, embryonic stem cells an cloning will not help patients any time soon. Embryonic stem cells form fatal tumors in adult tissue. Differentiation of these cells--they still form tumors. embryonic stem cells are genetically unstable and they convert to cancer cells. embryonic stem cells have not yet produced normal adult cell types. And embryonic stem cells will be rejected and their derivatives will be rejected by the immune system. The proposed fixes for this problem are problematic. We would need to produce and destroy enormous numbers of embryos to make embryonic stem cells banks that are not biased against racial minorities. Cloning human embryos has not yet proven possible. And cloned embryos will be abnormal. Human egg (inaudible), either for embryonic stem cells banks or for cloning entails a very significant medical risk to women. So are we just dead in the water here? If embryonic stem cells do not offer the best and brightest hope for medical treatments, if these long-standing, serious, intractable problems cannot be solved, are we just going to have to give up the hope of stem cell cures? I would argue not, though some would argue yes. So Dr. Thomas Rosenquist, University of Nebraska Medical Center's vice chancellor for research said in a recent article, "In the hard reality world of scientific research it is now obvious that embryonic stem cells offer unique qualities." And the major unique quality, Dr. Rosenquist identifies in this article is the very property of stem cells that we have been discussing as the source of all of the problems, the pluripotency of stem cells. So I would have to remind Dr. Rosenquist that the unique qualities of embryonic stem cells also include tumor formation and cancer conversion. And I would also like to remind him that in the hard reality world of medicine, the hard reality world of patients who are

suffering from diseases, stem cells from nonembryonic sources offer many advantages. And their potency, pluripotency, multipotency, or otherwise, is still very much in debate. So what do we now about nonembryonic or so-called adult stem cells? So let me remind you that a stem cell is just any cell that does this: it divides, it reproduces itself, and it makes one daughter that is going to be different. So there are stem cells throughout our bodies. We lose skin cells everyday. We have to have a stem cell population in our skin to replace those cells throughout our entire life. So stem cells have been isolated from multiple mature tissues: bone marrow; umbilical cord and umbilical cord blood; placenta; amniotic fluid; and multiple mature tissues including skin; muscle; and my favorite, fat. We're never going to run out of a source of that (laugh) in this country. Also there have been recent scientific results of even more promising alternatives to embryonic stem cells. There are recent scientific findings that suggest we can directly convert adult cells into an embryonic stem cells-like state. Now these findings are very new. There are still some significant problems with applying those converted cells to therapies, and in addition, all the problems we've just discussed. But there are multiple alternatives. So what do we know about these so-called adult stem cells? Whether they're pluripotent or not is now hotly debated. I would say the scientific jury is out but I would argue that as a scientist that it's probably quite unlikely that these adult cells will prove to be the equivalents of embryonic stem cells. So if people tell you, oh, they're just exactly the same--probably not. But is this really an issue? The vast majority of patients do not come to the hospital needing a full-body replacement, needing a cell that can make every single tissue in their bodies. They come to the hospital needing a specific medical treatment. And so even if adult stem cells prove to be more limited, this limitation may not prove to be a medical limitation. They may make them perhaps a little less scientifically interesting, but medically they may make them just as interesting, just as useful. On the positive side it's quite clear that these cells are safe for use in patients, they don't make tumors, they are genetically stable, and they can be immune-matched to patients of all races, particularly stem cells derived from these birth-associated tissues: umbilical cord, placenta, and amniotic fluid. We have about four million births in this country every year. Births are genetically neutral: all

races, all colors, all genetic makeups produce babies. And this provides a really wonderful opportunity for making good immune matches to patients. Moreover tissues like bone marrow, you can take the stem cells from the patient themselves. So you can essentially get a cloned stem cell line, a perfectly normal cell, from the patient, with no problems of immune rejection. And lastly, patients are currently benefitting from adult stem cell therapies in very significant ways. And adult stem cells represent no significant moral or ethical issues. So what are the current benefits to patients? As of this Tuesday, right before I left for Nebraska, there were 1,460 ongoing clinical trials with adult stem cells being funded by the NIH, including 13 here in the state of Nebraska. Moreover, more than 70 medical conditions have shown improvement with adult stem cell treatments, either in animal models or in humans. These are not cures, these are not miracles. These are benefits, improvements in conditions that currently are not treatable by other means. In human studies some of these conditions are: multiple forms of cancer, heart disease, multiple sclerosis. Many medical conditions are showing some benefit from adult stem cell therapies. So at this point I'm often asked: well, why not both? Given how little we currently we know and given the slim possibility that embryonic stem cells may relieve human suffering at some point in the distant future, that we're going to solve the problems that I've presented to you, why not continue research on both adult and embryonic human stem cells? Well, I would remind you about the better, easier, faster, and cheaper concern, because as a scientist I would argue animal models offer the strongest scientific tools for discovering cures. They do. They are the Maseratis. They are the fast-moving, powerful cars. And yet, despite 25 years of research we have still not cured a mouse. So even using the best tools available we are not making tremendous progress towards stem cell cures. If you believe sincerely that there is promise in this field of research, embryonic stem cells may someday relieve human suffering, then focusing on human embryonic stem cells is giving up the Maserati and getting back into that Model T. It's only going to make the research go slower and be more expensive. But I'll give you another reason, and that reason is responsible concern for patients. The serious intractable problems--tumors, cancer, immune rejection--that I've described to you today, stand between the current

state of embryonic stem cells research and any potential therapies that could be developed from these cells. You here in the state Legislature are fully aware that money does not grow on trees. And research funding is a zero-sum game. Many people will argue that, oh, well, funding embryonic stem cells research does not take money away from other areas, but that's only in an unlimited playing field. In the real, hard-facts world of limited NIH funding for research, it's a zero-sum game. Money that goes to embryonic stem cells research is money that will not go to more promising areas. And therefore, if we really do care about patients, we have an obligation to focus medical research funding, limited medical research funding on the most promising therapies. Final disclaimer: it may not be evident to you, but I'm really not a coldhearted person who is trying to deny hope to patients and to their families based on some abstract moral argument. In fact, I hope you can all appreciate that I have not made a single moral argument in this talk. I've made two ethical arguments: that stem cell therapy should not be biased against minorities, and that stem cell therapy should not entail significant medical risk to women. Now I would hope that those two ethical arguments are arguments that everyone in this room can stand behind. Moreover I sincerely believe that science offers great hope to patients, and that we have an obligation to give patients the best possible hope for cures. And I know this is something that everyone in this room shares, people on both sides of this issue want to give patients the best possible hope for cures. However, offering patients a false hope, a hope based on a misleading and incomplete picture of embryonic stem cells science and human cloning is not compassionate. In fact, there is another name for that, and that would be called lying. So in conclusion, this controversy is not over embryonic stem cells research, is not just about morality, whether the rights of the embryo or the rights of patients are more important. It is also and importantly about spending money wisely. It is also and importantly about not endangering women. It is also about providing therapies to all Americans in an equitable manner, without racial discrimination. And lastly, it's about providing the best cures to patients as quickly as possible. Thank you for your time and I'm happy to take questions or to pass this on to the next speaker in our panel. [LR219]

SENATOR ASHFORD: Thank you, Dr. Condic, for that analysis. And I appreciate it. Before we go on, I noticed Senator Wightman is here. Senator, welcome. And Senator John Nelson from Omaha is here. I don't know if anybody else is...we draw quite a crowd in the Judiciary Committee. (Laughter) I appreciate your comments. Any questions of Dr. Condic? Yes. Senator Schimek. [LR219]

SENATOR SCHIMEK: And Mr. Chairman, I'm not sure how many questions you want... [LR219]

SENATOR ASHFORD: Well... [LR219]

SENATOR SCHIMEK: But I'll try to condense what I have to ask. [LR219]

SENATOR ASHFORD: Okay. I was hoping maybe at 10:00 we could move on to the next testifier, so... [LR219]

SENATOR SCHIMEK: Okay. Well, first of all, Dr. Condic, thank you for being here. We appreciate your testimony. I got some information prior to coming here that indicated that embryonic stem cells research has been going on since 1998 and that adult stem cell research, since 1960, some time. And that doesn't jive with what you just said about the research going on for 25 years. [LR219]

CONDIC: This is an often-repeated piece of propaganda that I find very offensive. Embryonic stem cells were first isolated in 1981. We have had animal embryonic stem cells, the Maserati of stem cells, with every conceivable tool, every conceivable advantage, much superior to human stem cells, which were in fact, isolated in 1998. We have had the best conceivable tools for studying embryonic stem cells for more than 25 years. Adult stem cells are derived from bone marrow, among other places, and so the 1960s kind of statement is again misleading and misrepresentative of the true state of the research. Yes, since the 1960s we have been successfully doing bone marrow

transplant, but nobody understood that...when we knew in theory that that was about stem cells, that when we put bone marrow into people we were transplanting stem cells to people. [LR219]

SENATOR SCHIMEK: Well, if I might...you've made your point. But I guess what I was really getting to is the amount of research that has gone on with adult stem cells as compared to the amount of research regarding embryonic stem cells and I guess that some of your conclusions, I think, might be predicated...or might be influenced by the very fact that there hasn't been as much research going on with the embryonic stem cells. [LR219]

CONDIC: I just disagree with that, with that assessment of the state of affairs. If we consider all of the so-called research on adult stem cells, since the 1960s, the vast majority of it, probably 95 percent, until the last five years, have been about how do we transplant bone marrow more efficiently, how do we get it with less problems, how do we do better at immune matching, how do we treat leukemia once we've done bone marrow transplants. So yes, a lot of research has been done using adult stem cells, but that has not been research on the properties of adult stem cells. [LR219]

SENATOR SCHIMEK: Well, I guess the point I am trying to make in response to what you said is that if you examine the facts of the amount of research that is going on in the states, and there are numerous sources for this, but this happens to be from the National Conference of State Governments, there are very few states that do allow embryonic stem cell research. So I guess my question is: how can you have some of these conclusions when there hasn't been very much research? [LR219]

CONDIC: Again, because I just disagree with the conclusion. Embryonic stem cell research is fully funded and completely unrestricted in every single state in this country, so long as its done in animals. And animals are the Maseratis of stem cell research. They give us more power, more tools, more ability to understand than adult stem cells,

than human stem cells, than possibly do... [LR219]

SENATOR SCHIMEK: Then that gets me to my last question. In most cases when research is done on animals, doesn't' eventually it has to take place on humans? [LR219]

CONDIC: The way development of medical cures works, in this country, is we do the heavy-lifting with animals. We cover the vast distance with animals, because animals are better, faster, easier, cheaper, and more powerful. That's...and when we get to a promising cure, when we get close to a cure, the small differences that exist between animals and humans become very important. And then we move into an animal model. Imagine it this way: if there was a road race... [LR219]

SENATOR SCHIMEK: And then we move into a human model. [LR219]

MAUREEN CONDIC: Into, I'm sorry, a human model...if there was a road race between New York and Nebraska and there were two contestants: they were going to start in the same place, they were both going to end up in Lincoln, but they weren't going to get there by the same route. One driver gets to drive a Maserati and he gets to drive on I-80 all the way to Omaha. And when he gets to Omaha he has to get out of the Maserati and get into the Model T and drive on country roads in the Model T as far as Lincoln, that last 60 miles. Okay, but the other driver has to start in New York, with the model T, and he has to drive on the back country roads the whole way. Who is going to get to Lincoln faster? [LR219]

SENATOR SCHIMEK: I'm not sure that's an appropriate analogy, (laughter) but anyway, thank you for your response. [LR219]

SENATOR ASHFORD: It's an interesting one, you know, to think about the issue, but... [LR219]

MAUREEN CONDIC: All right, we should maybe move on to the next speaker. [LR219]

SENATOR SCHIMEK: Thank you. [LR219]

SENATOR ASHFORD: Well, that's all right, that's my job. (Laughter) I have very few jobs, Doctor, in this process, but wait just a second. We're not through with you. [LR219]

MAUREEN CONDIC: I'm not going to take any more questions. (Laugh) [LR219]

SENATOR ASHFORD: We're not through with you yet, but...and Chip, we're going to have time to...we'll spread the time out. Senator Lathrop, do you have any questions, I'm sorry. [LR219]

SENATOR LATHROP: Well, I guess I do. [LR219]

MAUREEN CONDIC: I'm happy to address them. [LR219]

SENATOR LATHROP: And thanks for giving me the opportunity. Doctor, we had a hearing when we took up a bill on cloning last time. And I want to try to give you my understanding of what I learned at that hearing, being a lawyer and not a medical person. And that was that if we were to...the problem with cloning really is the problem that's going to follow some use. I mean, research is going to have to give us something that we can do therapeutically with the stem cell research. It's going to have to advance to the point where it has some application before cloning is a concern. Is that fair, or is that...and if that's the case, is that a problem that we're getting ahead of ourselves on? [LR219]

CONDIC: I think that is a reasonable interpretation. I mean, the only need for human cloning other than just the purely scientific curiosity interest--can we clone ourselves,

wouldn't that be fun--would be if we were close to a medical application. If we got to the point where we really were seriously considering putting stem cells into patients and we faced this very difficult problem of immune rejection and faced the problem of an equitable way of getting to everyone, then cloning would come into play at that point. [LR219]

SENATOR LATHROP: Thank you. And I have another...that was helpful, I'm glad that you came here from Utah to confirm that for me, plus reaffirm what I thought I heard last fall, or last winter. You have testified here today, I was looking at your CV, I've deposed an awful lot of medical people, it's an impressive CV. My next question though, maybe is to test where you're coming from a little bit. And that is: you work on embryos, you study embryos, that is your life's pursuit. If we had some application, if it started to show some promise, would you be on board with it, or do you really have a moral problem with the whole idea of using human embryos? [LR219]

CONDIC: I think first, I am here as a scientist, and I am here to testify about the scientific information and the state of the science. And you know, my own personal views are not scientific, they're personal and really almost irrelevant to my expertise as a scientist. Nonetheless, I think on a practical level, we face a very divisive situation in this country, if we were going to try to push destructive...embryo-destructive research and embryo-destructive therapies on people who have very profound objections to it, and objections that are long-standing and not going to go away. So if the medical research in animals advanced to the point where we had reasonable therapeutic potential for these cells, then I would say, what are alternatives? Are there other sources of cells that have the same properties as embryonic stem cells that would not involve the destruction of embryos? And there are...and I have been very involved in the national debate and discussion over alternative sources of embryo-like stem cells that do not involve destruction of embryos. And I think there are really good opportunities for...and ones that would really back a consensus in this country, for obtaining stem cells with embryo-like properties, but without the destruction of embryos. The most

promising of which is the one that I mentioned, the direct conversion of adult cells into cells that have identical properties to embryonic stem cells, or indistinguishable at least, properties, from embryonic stem cells, which would not involve the generation of an embryo and the subsequent destruction of the embryo. And I would say, science may be able to figure its way out of this problem without social and moral controversy. Now if scientists are given, instead of encouragement to you know, create and destroy embryos, but instead given encouragement to be creative, and come up with alternatives, I think that's very, very possible. And there are clear and solid proposals on the table to do that. [LR219]

SENATOR LATHROP: One more question before I let you get away, and that is maybe to let you...if there is a theme to what you have testified to today, that is, we can do this research on mice, on animals, lab animals's embryos, and we can...and that will bring us faster to a place where we might have some application in human beings. [LR219]

CONDIC: Yes. [LR219]

SENATOR LATHROP: Would that be a fair statement? [LR219]

MAUREEN CONDIC: And that there are significant long-standing, intractable scientific problems that may prevent us from ever getting to that point. Yet if we're going to get there, we're going to get there faster with animal models. [LR219]

SENATOR LATHROP: Is there something...I want to give you an opportunity, because I hope to hear from the University or the folks that come that speak in the next hour, about what...what's the imperative, or in your case, is there an argument at all for using human embryos at this point in the research of stem cell research? [LR219]

CONDIC: Personally, if I'm trying to get to Lincoln, I'm going to pick the Maserati. [LR219]

SENATOR LATHROP: And your point is there's...if we use your road race, we start from New York, are you telling us that they're doing it the hard way, trying to do this research with humans? Or is there a fair argument that there is something unique about human embryos, besides the difficulty in creating them, that makes them a preferable material or a preferable... [LR219]

CONDIC: There are clearly differences between animals and humans. I mean, that's absolutely unambiguous. And yet, the whole basis of science, the whole reason that medical research works, is because we can work on things like fruit flies and soil worms, and learn things about the basic mechanisms of biology and development, about the molecular pathways and the genetic interactions that control what happens. And there is a continuity to biology. Every scientist believes this. No one can tell you otherwise, because this is why science works. This is why people do research on animals, is because we do ultimately learn things not just about mice, when we study mice. We learn things about biology. We learn things about how animals work, how cells work, how molecules and genes work, how proteins and nucleic acids work. I mean, that's how we learn. So yes, you know, there will be differences between mice and humans, and those differences, when we get to the point of actually treating humans will become important. But every single drug and medical treatment that is developed in this country is developed on a single model. We study it in animals, we learn the basic properties, we understand the basic biology, we get to the point where we're close to a cure, where it looks really promising, and then we start tinkering with that last 60 miles between Omaha and Lincoln, because that's where...it only really matters there. No, we can get the rough outline, we can get the big picture, we can get into the state using animal tools. And we get there faster, easier, better, and cheaper. And then, at the end, you know, when we're close, when there really is promise, then we study humans. Because that's where it becomes relevant. [LR219]

SENATOR LATHROP: Thank you. I appreciate you answers and the fact that you came

here. [LR219]

MAUREEN CONDIC: I'm honored to be here, and hopefully have been able to provide information that was useful. [LR219]

SENATOR ASHFORD: Any other questions? Let me just, if I could, just follow up on a couple of things. And I, too, am very impressed with your accomplishments and it is an honor to have you here. It seems to me that there really aren't two sides, that there are lots of sides, because there are numbers of people out there that really are confused or don't understand or have certain moral and ethical standards that they apply to all these sorts of things. And you obviously have one. And I agree with you that that is your right, and that the science you're talking about is not related to that. But at some point you have to make a judgment. I mean, do we go into the issue of using human embryos for research or not? I mean, and that's a decision you don't have to make now, because you have plenty of things to go...you have lots of material to work on, and you don't feel fettered by that. And I respect that. And I think that's an honest answer and a good one. But my sense in talking to my constituents, and women, men, blacks, whites, whatever it is, is there is a great deal of confusion. There also is a desire to find cures. And people...the suffering is real. And you believe that. [LR219]

MAUREEN CONDIC: Oh, absolutely, I think we all do. [LR219]

SENATOR ASHFORD: And I know you do. So I don't think we're...I don't think there are sides in the sense that there's one group that would say, well, let's have a little suffering, it's okay, because we don't want to destroy an embryo. I don't think that's really the issue, but there are people out there that...and especially those that have these particular diseases or family members that have these diseases...let me just understand a couple of things. The...right now federal funding is available for a limited number of these lines. Is that accurate? [LR219]

MAUREEN CONDIC: Yes. [LR219]

SENATOR ASHFORD: And when we talk about a line of stem cells, embryonic stem cells, can you just say again, quickly if you can, what a line is, again? [LR219]

CONDIC: If you remember the slide that I showed there, the little cartoon where we take the embryonic stem cells, or we make the embryos, we allow them to go to the blastula stage, and then we take the stem cells out. So from a specific embryo of a single...of a genetic makeup of that individual, we isolate cells. And those cells continue to divide in culture, and when they do that, they are a stem cell line. So they are a continuously-maintained population of cells in culture that is derived from a single individual. [LR219]

SENATOR ASHFORD: Are they finite? Do those cells stop dividing in this process? Or do they...can they be caused to continue to divide? [LR219]

CONDIC: They are...many people will assert that they are so-called immortal. So they will continue to divide for certainly very long times in culture, whether or not they divide indefinitely in culture and never change their properties and retain all the abilities of an embryonic stem cells is a very tough thing to prove. But they certainly will continue to replicate for a very long time. [LR219]

SENATOR ASHFORD: Are they pluripotent at that point? Do they remain in a pluripotent state during this whole time that they're in this culture? [LR219]

CONDIC: Yes, if you culture them under conditions that maintain them in the state where they continue to divide, then they remain pluripotent. It's actually a little challenging. Embryonic stem cells like to change into things and it's a little bit tough even to create a culture situation where they stay as a pluripotent stem cell and they don't start turning into neurons and, you know, other brain cells and heart cells in the

culture dish. But it can be done. [LR219]

SENATOR ASHFORD: This is very simplistic. But do you order up one of these? How do you... [LR219]

CONDIC: (Laugh) You actually do, you call up the NIH and they have them in a freezer and they send them to you. [LR219]

SENATOR ASHFORD: Okay. And do they send you the...what do they send you? [LR219]

CONDIC: They send you a little plastic tube that's at a very cold temperature. The cells are sort of in hibernation, suspended animation. And you take them to the laboratory and thaw them out under special conditions so that they survive, and then they grow in the laboratory. [LR219]

SENATOR ASHFORD: Are there additional lines being created today outside of that process? [LR219]

CONDIC: The creation and research on human embryonic stem cells lines is completely unrestricted legally. The only restriction is the funding restriction: so federal funds cannot be used to generate new embryonic stem cell lines or to do research on them. [LR219]

SENATOR ASHFORD: Are you aware that there are...there are efforts to, well, not efforts, it's done all the time, and it's...then going back to the...just so I fully understand this...and this is what we get comments on a lot, is this embryo that is destroyed, in effect its nucleus is destroyed and there is a cell, a cell is inserted into the nucleus. Is that correct? Is that how somatic nuclear cell transfer generally works without... [LR219]

MAUREEN CONDIC: Very close, we start with an egg cell. So not with an embryo. [LR219]

SENATOR ASHFORD: An egg, and it's not an embryo, it's an egg cell that comes from the woman. [LR219]

MAUREEN CONDIC: Yes, from the woman donors. [LR219]

SENATOR ASHFORD: And it's not an embryo, it hasn't been fertilized. And it is injected with this cell. [LR219]

MAUREEN CONDIC: Either you inject, or more commonly will people fuse those two cells together, so it's a... [LR219]

SENATOR ASHFORD: Okay. So the outside of them come together. [LR219]

MAUREEN CONDIC: ...little gentler, you just take the remains of the oocyte and you take the little somatic cells which are much smaller. You put them together and give them a chemical that makes their membranes kind of mushy, and then they just pop together. [LR219]

SENATOR ASHFORD: Those eggs are...and I know you've been asked this, but those eggs come from, in many cases from the process of in vitro fertilization, is that correct? [LR219]

MAUREEN CONDIC: Yes. [LR219]

SENATOR ASHFORD: And these eggs are leftover from that process or...that's a bad word, probably, what are they? Where do they come from, these eggs? [LR219]

MAUREEN CONDIC: Most of the stem cell lines that are currently in existence have come from couples who were seeking assisted reproductive technologies, fertility clinics who donated the leftover eggs from that procedure to researchers who could then subsequently use them, or more commonly, people who donated leftover embryos. So, as I said, human cloning has not been accomplished. No one has been able to do the process of taking the nucleus out of the egg and fusing a human cell. So it's all theoretical at this point. [LR219]

SENATOR ASHFORD: Right. But the eggs themselves, though, to get into this chain of research profess, start from the woman's body and they come out? [LR219]

MAUREEN CONDIC: Right. Well, unless you're in Korea, in which case you strong-arm your female technicians in your laboratory to undergo ovarian stimulation and produce eggs for your research. (Laugh) [LR219]

SENATOR ASHFORD: And I don't think anybody...I mean, maybe people want...in Korea, they may want to do that, (laughter) but I was trying...in the normal course today of they...if they don't go into the research line, so to say, they can go...they're frozen. [LR219]

MAUREEN CONDIC: The eggs? Typically...so freezing eggs is technically quite difficult. There has been some advance in this field in recent years. But it's an emotionally complicated topic. People who go to fertility clinics, women who undergo this painful an inconvenient and time-consuming process of producing eggs, they're doing it in order to have a baby. So the whole focus of assisted reproductive technology is to maximize the possibility of having a baby. So because eggs are difficult to freeze, and when you thaw them out, there is some questions about how normal they are going to be. Many women will not elect to do that. They'll say, no, I don't want to freeze my eggs, because if I want to come back and use them, I want to make sure that they're good. And so they will elect rather to have the eggs fertilized, to produce embryos. And then just for the

mysteries of biology, it's actually easier to freeze an embryo at the blastula stage than it is to freeze an egg. So we have better success thawing out embryos and having them remain viable and produce a pregnancy than we have with freezing an egg, taking that egg out, fertilizing it... [LR219]

SENATOR ASHFORD: But theoretically the frozen egg is a source of--theoretically--is a source of embryonic stem cells? If you go through the somatic... [LR219]

MAUREEN CONDIC: If you then subsequently fertilized it or you went through somatic cell nuclear transfer, yes. [LR219]

SENATOR ASHFORD: And then one last question on the timing here: when the egg...when the cell comes from the body of the donor, it can come from...these are, I mean, these are just really rudimentary questions, they're not trick questions in the least. They come from the bodies of the donor, and they come from anywhere, or? [LR219]

MAUREEN CONDIC: People are doing in animals a lot of research to determine if there are tissues that are better for cloning. And there is some suggestion that some tissues do work better for producing clones. But they could come from multiple tissues in the body. And they would not involve significant harm to patients to get these cells. [LR219]

SENATOR ASHFORD: Okay. And it's injected and then it's stimulated somehow for it to produce additional cells from that initial cell. [LR219]

MAUREEN CONDIC: It's stimulated to mimic the normal events that occur due to sperm entry into the egg. So there's a sequence of events that naturally occurs when sperm and egg get together that so-called activates the egg. And allows that zygote to now enter into the program of human development. So you're not simply stimulating the cell to divide, you're stimulating it to start the process of embryonic development. [LR219]

SENATOR ASHFORD: Okay. And I...and I understand that, or I understand it very well (laughter) but I'll give you that...I'll give you that point. And I think maybe I speak for a lot of these people that really are trying to understand this. So anyway, this starts and the cells divide naturally, as they would in a woman's body if there was a fertilization process. [LR219]

MAUREEN CONDIC: Yes. [LR219]

SENATOR ASHFORD: And how do they divide...how quickly do they divide? And do they divide in geometric or how do they divide, double, do they double, double, double, how does it work? [LR219]

MAUREEN CONDIC: Well, human...the early rounds of cell division in human embryo genesis are not exactly synchronous. So it's not like synchronized swimming where you would develop two cells and then bang, those two cells divide, and then...so they divide...the single zygote will divide to produce two cells and typically one of the cells of those two initial daughters will divide a little bit in advance of the other one. So you'll have a brief period where there will be three cells, and then the lagging cell will divide and now you'll have four cells. And then that process will continue. And it's not entirely regular, how they divide, because the cells are talking to each other. And in fact, there is a lot of evidence to suggest that the cell that divides first is doing so because of an interaction between those two cells that ultimately changes the developmental outcome. So the leading cell will go on to make different things than the cell that is lagging in development. [LR219]

SENATOR ASHFORD: And I guess my last question then is: when are these cells available for research? [LR219]

MAUREEN CONDIC: When do we take them in order to make... [LR219]

SENATOR ASHFORD: When could you take them? When can they be...what's the time frame? [LR219]

MAUREEN CONDIC: So once you have produced either a clone or fertilized an egg, generally speaking, people want to wait until somewhere between three to five days post the beginning of development, to take the stem cells, because we're trying to wait for the natural developmental processes to occur. So we're...we don't really want a totipotent cell. And the reason for that is complex. First, we don't generally do placental therapies on patients, right? We don't need a cell that can produce placental tissue, because we don't use it for therapies in mature, postnatal human beings. So we want to get beyond the stage where the cells normally make placenta. And in order to do that we have to wait for development to proceed to the point... [LR219]

SENATOR ASHFORD: Right, and that's the time frame I'm looking for is that... [LR219]

MAUREEN CONDIC: Right. So three to five days. [LR219]

SENATOR ASHFORD: Okay. That's fine. I think that's...yes, Senator McGill. [LR219]

SENATOR McGILL: Thank you doctor for being here, you provided some interesting information that I didn't know about. And I think made some good cases about where funding should be focused, perhaps. But were here in part because there are people who actually want to ban some of these types of research. Do you think that is a good idea for scientific discovery to, you know, if you get down the line with an animal and then just have the door shut to human research at this point? I mean, I know that it's still far down the road, but... [LR219]

CONDIC: I think the question that really needs to be asked here is: regardless of your personal or ethical position on this, is there an ethical position out there that is

arguable? And do we really want to enter into a line of research that will continuously offend and oppose a strong ethical position of many people in this state and many people throughout the country? If there are alternatives, do we need to do human cloning? "Do we?" is the question. So I think two important things: one, how likely is it that cloning will actually contribute to medicine? And I hope I've presented information here to suggest that it isn't terribly likely. Possible, of course, everything is possible. But likely and possible are two different things. The other issue is: is it the only way? Is it the only way that we can get to the potential benefits? If we are able to take a skin cell from an adult and by putting four different genes into that cell, convert it into an embryonic stem cell directly, no embryos involved, no destruction of embryos, no cloning, no abnormalities, no genetic instability, none of that stuff--all of those problems are avoided. If we can do that, and I think it looks quite likely that we will be able to do that--we can do it in animals right now--why do we need cloning? The problem is: if you open the door, an easy door, an obvious door, and though to go through that door requires inciting the passions of a huge number of people, creating an ongoing fight, creating an ongoing moral controversy, is opening that door a smart idea? You know, I would say, just pragmatically, no. Alternatively, if there are other alternatives and we can open those doors, we can direct research in a direction that is noncontroversial... [LR219]

SENATOR McGILL: And I agree that that is probably a good way to go, is to focus our funding on something that isn't as controversial, but, I mean, you've been saying that, you know, take the good car for this far, knowing that you can take this other car if the time comes. And... [LR219]

CONDIC: I think if we get to the point in an animal model where there is strong evidence that embryonic stem cells will be therapeutically useful to humans, I think at that point there are lots of alternatives for getting human cells with the properties of embryonic stem cells that do not involve the destruction of embryos. And that do not involve human cloning. So no, I don't think we're really closing doors, to say: we're simply not going to

go this way. [LR219]

SENATOR McGILL: Okay. Thank you. [LR219]

SENATOR ASHFORD: Let me just ask one more question, because this is very interesting testimony, and I...the...and I understand your point. But if you...if we...is it an issue of banning something? I mean as a scientist, as a researcher, banning, having some political body come in and ban what you're doing is probably not something that you would like very much if it's something that you believe in and you think it's going to result in...and I...you would rather do your research without a lot of politics, I would think. Or do you like politics? (Laughter) [LR219]

CONDIC: I think...politics, I love politics, we all do, right? That's why we're here. No, I think in some ways this is kind of a red herring issue, the issue of intellectual freedom and banning. You know, we're banned from things all the time. [LR219]

SENATOR ASHFORD: No, I understand that. I... [LR219]

MAUREEN CONDIC: I can't take a two-year-old and grind their brains up, no matter how interesting it might be to me. You know, it's not allowed. Why? Because it is unethical. So the question is: we as society, not we as individuals, not me as a scientist, but all of you, all of us, have to make an ethical choice here about whether or not we promote research on human embryos or not whether or not we're going to support that, whether we're going to allow it. And... [LR219]

SENATOR ASHFORD: Even allow it...I mean... [LR219]

CONDIC : The notion banning is a really important notion. What do we ban? We ban things we don't think are ethical. [LR219]

SENATOR ASHFORD: Right, but if you have a...and I agree that this issue brings in...I'm not arguing with you, I'm just trying to understand. If that there are...it does incite a great deal of passion, and I...that's why it's here. And I respect that. But if there is, to Senator McGill's point and Senator Schimek's point, if there is a chance, like polio vaccine or whatever it is, if there is a chance that we're going to find a cure for or help find a cure, or aid in finding a cure for Parkinson's disease or diabetes or whatever, I certainly can't sit here and say we can't use embryonic stem cells research. But I buy your argument that there are other ways to do it. I think you make a good point. Is it an issue of banning? Or is it a question of prioritizing? Or is it a question of maybe the funding isn't there...isn't available until someone somewhere finds some way to use these cells in a very productive way? I mean, I think that's what we're all struggling with. So, with that, thank you very much, Doctor. [LR219]

MAUREEN CONDIC: Thank you for having me. [LR219]

SENATOR ASHFORD: Yeah, very good testimony...I'm sorry. [LR219]

SENATOR LATHROP: I do have one more question, and just now in response to you're just given us. And I'm going to try to make this simple. You gave us an explanation. And my read on your testimony was essentially: this isn't the route to go, the Maseratis in the animals, the animals are going to bring us to point B faster than if we continue down this road of doing research on human cells. Then you said this is an ethical decision you have to make. Is it an ethical decision because we are assuming that the human cells have some--I'll call it a soul--bringing this into the religious...and that seems to be an area of belief that many people have: at the moment that it becomes this one cell with all the potential, it has a soul. Is that what makes this an ethical question? Or is your argument that this is an ethical issue about resources? And you get 30 seconds to answer. (Laughter) [LR219]

SENATOR ASHFORD: Or you can submit a paper, doctor, if you wish. [LR219]

SENATOR LATHROP: I mean, I'm just looking for... [LR219]

CONDIC: Look, I think many people try to turn this into a debate that is black and white. There are on the one hand people who believe that embryos have souls. And there on the other hand are people who believe that patients have rights and should be treated. And I think that's simplistic and inappropriate. The reality is this debate is happening on multiple levels. It's happening on the level of money and pragmatic considerations, of where do we get our biggest research medical bang for our buck? That's a hugely important issue. It's happening on the level of protecting women, you know, from exploitation. It's happening on the level of just pragmatic considerations: we do really want to enter into an acrimonious, long-standing, public moral debate, ethical debate? Do we want to have protestors standing outside the statehouse of Nebraska, you know, every day, every year, for the next twenty years? Do we really want that? [LR219]

SENATOR ASHFORD: But that's been going on on the issue...we deal with though the death penalty, abortion, those issues are...that's part of our democratic process. [LR219]

MAUREEN CONDIC: But if there is a way to avoid this, if there's a way to give both sides what they want, why not take it? Why not take it? Why not take alternatives that give everybody what...if there is a compromise that can be brooked, if science can think it's way out of this problem, I can't see any reason not to take it. [LR219]

SENATOR ASHFORD: Okay. Senator Schimek. [LR219]

SENATOR SCHIMEK: Yes, Mr. Chairman, I just want to follow up on what Senator Lathrop said. And we're keeping you an awful long time. And I just had a conversation with Senator Pirsch, I said, should we...should we have a pool here on how long this hearing is going to last? And he suggested maybe until 9:00 tonight. I hope that's not

true. (Laughter) But your arguments in the first place were not about the ethical considerations. It was more the scientific considerations. And so, you lost me a little bit when you then began to switch over to the ethical considerations. And I believe that everybody should have their right to their own ethical consideration, but I guess what I want to say to you and you can respond or not: there are just as many ethical arguments on the other side of the issue. And no matter what we do, or what decision we make, there will be people who will be unhappy. If we ban, totally ban, we're likely to have those folks outside the state Capitol for another twenty years too. So I don't know that that's a real good concern. [LR219]

MAUREEN CONDIC: Senator, I agree with you. You know, I would prefer to focus on the scientific issues, because that's my area of expertise. I have switched over, as you say, to the ethical issues, only in response to direct questioning on the behalf of Senators who have pushed me to do so. [LR219]

SENATOR ASHFORD: Well, they have just asked you questions. I don't know if they... [LR219]

MAUREEN CONDIC: And the only position I have taken on the ethical issues is: scientists are very clever and there are lots of ways around...there are lots of ways to get to the same endpoint. And many of them involve considerably less controversy. Many of them give the people who want to have embryonic stem cells research fully available to them, pretty much exactly what they want. And give the people who don't want to see embryo-destructive research pretty much exactly what they want. The only reason people are up in arms about cloning is because they believe it's the only possible way we can make patient-specific embryonic stem cells. If the public can be educated to say, no, no, no, there are other ways of doing this, we can do this through routes that do not involve the generation and destruction of embryos, but will give you that same thing: a patient-specific embryonic stem cell, exactly what you want, everything you want, 100 percent, no compromise. If we can do that, then everybody is

happy. We do have a win-win situation. We do not have--well, we will still have ignorant people out there. But you, you know, you've got the Flat Earth Society too. People who are going to persist in intractable ignorance, there's nothing we can do about them. And they will be with us always. But if we can give the people who want cloning everything they want, if science can resolve this without controversy, who would object to this? [LR219]

SENATOR SCHIMEK: I suspect that there will be people who come after you who will make the opposite argument, but thank you very much for your response. [LR219]

SENATOR ASHFORD: Thanks, Doctor. Senator Pirsch, are you...Senator McDonald, anybody? Well, Doctor, thank you. [LR219]

MAUREEN CONDIC: No, thank you. [LR219]

SENATOR ASHFORD: Yes. Chip, how...you have two other...do you have two Safraneks here, Dr. Safranek and Dr. Safranek? Or do you...well, what I was thinking is, and if we could maybe, you know, ten minutes each, if that would suffice and hopefully the questions will not go over too much. Okay. Doctor. [LR219]

JOHN SAFRANEK: (Exhibit 2) I am Dr. John Safranek, I am a practicing physician here in the state of Nebraska. And I'm here representing the Nebraska Coalition for Ethical Research. I'm going to change the direction of our discussion so that we focus on another essential aspect of the discussion, and that's the ethical. The ethical is distinct from religious, because the ethical issue is going to be about our basic ideas of right and wrong. Religion is about are beliefs about God and what God tells us to do. This is not going to be religious. This is going to be ethical, again, our common sense notions of right and wrong. Let's note the principles on which both sides of this debate agree. First that UNMC should conduct only ethical experiences. Both the UNMC officials... [LR219]

(RECORDER MALFUNCTION--SOME TESTIMONY LOST)

JOHN SAFRANEK: ...human life I don't think we have any dispute with them on this point either. The focus of our disagreement is the status of the human being created through cloning. UNMC agrees that only ethical experiments should be performed and that cloning is not unethical because it does not destroy a human life. That is there claim. We maintain that cloning is unethical because it destroys a human life. So this debate reduces to the question: is the cloned individual a human being? I'm not going to bring in any technical science. Instead I'm going to rely on our common sense, something that we Nebraskans are known for. Let me offer this profound concept: if an animal looks like a duck, walks like a duck, and quacks like a duck, it's a duck. Okay? This truth that is so popular...such a popular saying, points out that we know what a thing is by its characteristics. Something that looks and acts like a duck is a duck. We define things by the characteristics that they posses. But there's a funny thing about definitions. People sometimes propose definitions that strike us as inappropriate. Coach Bill Callahan said recently that he was an excellent coach. After last Saturday, I can give 76 reasons why his definition is wrong. In short, a definition fails when it does not describe something properly, when it doesn't fit the facts as we know them. I want to remind you that it is the definition of a human being that is the nub of this debate, because, again, both sides agree that there should be nothing unethical done at the university. I claim that the University of Nebraska Medical Center is using a fault definition of a human being, because their definition does not accurately reflect the facts as we know them. What they have done is chosen a definition that is frozen in time and neglects scientific advancements. Remember the definitions describe the characteristics of things. If it looks like a duck, walks like a duck, and quacks like a duck, it's a duck. Dr. Turpen is here today...appeared before the committee last year. He denied cloning can create human life or a human embryo. He started his rationale to the committee last year: human beings engage in sexual reproduction, cloning is asexual reproduction, and therefore the product of cloning is not a human life or embryo. Dr. Turpen's error is that

he defines things in such a way they cannot account for the facts as we know them. His definition is frozen in time and ends up being obsolete by scientific advances. Let me give three examples. First, the definition of insulin from the time it was discovered as a hormone was that it is a hormone made by the pancreas that controls blood sugar levels. And that definition was valid until scientists discovered how to make it artificially. Is this product that they make, which we call insulin, insulin? Well, there's a reason that we call it insulin, because it has all the characteristics of insulin, even though it's made differently than it has been previously. Science has rendered the old definition obsolete. And to insist that the substance that we call insulin is not insulin, is to defy the common usage and understanding. Consider a second example: for centuries a calf was understood to be the product of an act of sexual intercourse between a bull and a cow in which the bull's sperm interacted with the cow's egg. That's the only way cows came to be. But in the last 50 years, when scientists learned how to artificially inseminate cattle, that definition no longer was valid. Should we say that the calf is not a calf, because after all, the definition requires an act of sexual intercourse between a bull and a cow? Try telling common-sensical farmers that they can't sell as a calf this animal that looks, walks, and moos like a calf, because it doesn't fit the traditional definition. I say we must change our understanding and definition of a calf, because science has rendered the definition obsolete. Now let's reconsider Dr. Turpen's definition, which hangs UMNC's justification for cloning. And I'm going to focus on cloning, we can talk about stem cell research later if we like. His argument is: human beings reproduce themselves sexually, cloning isn't sexual reproduction, so cloning doesn't produce a human embryo or life. So what defines the human being is how it was generated, not the characteristics that it possesses, according to Dr. Turpen's definition. Apparently we should define the duck not by its characteristics but by how it was produced. Well, the error of Dr. Turpen's definition, and the Medical Center's justification for cloning is that the definition has been rendered obsolete. Consider the third example: sheep. Sheep, like humans, reproduce sexually. According to Dr. Turpen's description, you can only get a sheep embryo or a living sheep if they produce sexually. Just one problem with that definition: we've all seen pictures of Dolly the sheep, who was made by cloning. But

by Dr. Turpen's definition, Dolly the sheep couldn't have been a sheep, because she wasn't made the way sheep have naturally been made, the way they've been made for centuries. So I ask this question and it will be the easiest question that you're going to face today: was Dolly the sheep a sheep? She walked, talked, and baaed like a sheep. She had the genes of a sheep, even though some of them were defective, much as some human beings have defective genes. She gave birth to six lambs. I would say, as most of the world did, that Dolly was a sheep. And if you think she was a sheep, then she was a sheep her whole life, whether five years after cloning or one day after cloning. Sheep cloning produce sheep, even if sheep are normally produced through sexual intercourse. Human cloning is the same as sheep cloning. Just because you don't reproduce human beings the old-fashioned way, doesn't mean you don't have a human being or human embryo. Scientific technology has rendered Dr. Turpen's definition of a human being obsolete, just as it rendered the long-standing definition of insulin and calf reproduction obsolete. We have no reason to deny that the result of human cloning is a new human life, just as no one can deny that the result of Dolly's cloning was a sheep. If you think that Dolly the sheep was a sheep, than UNMC's ethical justification for cloning human beings is undermined, because it all depends on their definition of a human being. I want to switch gears for a minute. I mentioned that the Medical Center representatives would agree that they should not do unethical research under any circumstances. And it seems that they would be committing the unethical practice of destroying human beings by cloning. But we will also hear other justifications for this practice of cloning, among them: that we can alleviate much suffering by allowing it, that outlawing this research would harm the academic reputation of UNMC, or that UNMC won't be able to attract researchers. Let me address by example why none of these arguments justify cloning. In the mid-1900s the United States Public Health Service was attempting to stop a terrible disease, syphilis. Syphilis infected 100,000 people each year, 15,000 of those infected were dying each year, more than AIDS has killed in any year. So they decided to infect 400 poor sharecroppers at the Tuskegee Institute with syphilis and study the effects of the disease in hopes of understanding and curing it. They never told the victims what they

had done and they never treated them for the 40 years that the experiment continued, even though they could have. 128 of these poor souls died, 40 of their wives contracted the disease, 19 children were born with it. Would curing this disease and alleviating the suffering for 100,000 victims have justified the experiment? Would enhancing the research status of the Tuskegee Institute justify it? Would attracting great researchers to the institution justify it? One Tuskegee doctor praised the experiment in advance, saying the educational advantages offered our interns and nurses, as well as the added standing it will give the hospital are crucial. Neither alleviating the suffering of thousands nor enhancing the standing of an institution justifies any unethical practice, especially those of destroying the lives of some humans. If there is even a doubt about whether the cloned individual is a human life, a human being, and I think we have shown much more than a doubt about this, then you cannot allow it. If a hunter is not sure if there is a human being in the moving bush, he should not shoot, because the doubt must always go to the possibility of human life. I want to note, this argument is not about religion. In fact, you will note, religion has played no part in my discussion. This is an ethical argument grounded on the wrongness of killing human beings. One does not have to be religious to appreciate the unethical nature of killing human beings. Now some of you Senators may have qualms about imposing your ethics. And a lot of people probably hope this issue would go away. Let me be very clear here: there is no middle ground here on the issue. If you bury this issue in committee or in the whole Legislature you will be imposing an ethical view. How? Well, you will be permitting the destruction of innocent human life by allowing this practice to continue. It's analogous to deciding not to outlaw the hunter's act of shooting into the moving bush. By doing nothing, you are letting the hunter potentially get away with manslaughter. To remain neutral about shooting into the bush is to allow it. Similarly, to allow human cloning to continue is to allow it. There is no middle ground. Thank you. [LR219]

SENATOR ASHFORD: Thanks Doctor Safranek. Any questions of Dr. Safranek? Thanks, Doctor. Dr. Safranek. [LR219]

LOUIS SAFRANEK: (Exhibit 3) Senator, before I launch into my discussion, I want to just mention three things which I think were misunderstood in your conversation with Dr. Condic here. You brought up the issue about the eggs that are used in somatic cell nuclear transfer, and I think Dr. Condic thought you were talking about embryos. The eggs that would be used for stem cell nuclear transfer are not leftover eggs. They're not leftover eggs, they're eggs that have to be derived for this purpose. They're not ones that are sitting out there in a fertility clinic, anyway. Those are embryos, not cells, not eggs that would be used for stem cell nuclear transfer. There is a misunderstanding there, you can clarify that further even with Dr. Condic if you wish. [LR219]

SENATOR ASHFORD: Thanks, Dr. Safranek. (Laugh) [LR219]

LOUIS SAFRANEK: Okay. [LR219]

SENATOR ASHFORD: No, I'm not sure I understood what you just said. But... [LR219]

LOUIS SAFRANEK: You were asking her where the eggs came from for cloning, I think. But I think she interpreted you as asking about where the eggs were...that were used for deriving stem cell lines. There are embryos frozen away from in vitro fertilization that will not be placed in a woman. These "excess embryos" have been used to derive stem cell lines. [LR219]

SENATOR ASHFORD: Right, I understand. [LR219]

LOUIS SAFRANEK: You were asking about eggs used for cloning or stem cell nuclear transfer, as we say. Those eggs are not sitting out there frozen away, leftover. [LR219]

SENATOR ASHFORD: No, I understand there's a difference between an egg and an embryo. And...but, I think I understood what the doctor was saying. [LR219]

LOUIS SAFRANEK: These are eggs that would have to be derived...in fact, Doctor presented a slide to the effect that millions of eggs would have to be generated from women stepping forward to undergo these ovarian stimulation procedures, in order to generate the eggs that would be used for stem cell nuclear transfer. These are not eggs that are coming up randomly as a result of attempts at in vitro fertilization. [LR219]

SENATOR ASHFORD Okay. Well, that's fine. I'll clear that up with Dr. Condic later. Thanks, thanks Doctor. Safranek. [LR219]

LOUIS SAFRANEK: Okay. Folks, embryo destruction is already banned under federal law. It's already banned. You worry about banning it--it's already banned. It's protected. [LR219]

SENATOR ASHFORD: I wasn't worried, Dr. Safranek. I think I was asking Dr. Condic her views on those issues. [LR219]

LOUIS SAFRANEK: It's already protected by both civil and criminal penalties, fine and imprisonment. The law is already in place to protect embryos, but only if you're a bald eagle embryo. You can read the Bald Eagle Protection Act for yourself. It protects bald eagle eggs, alive or dead, even the nests of the eggs, with fines of up to $5,000 or one year imprisonment or both, double that for subsequent acts and each separate act of separate violation. Killing embryos if you're a bald eagle is already banned. We wouldn't be the first state to impose bans or regulations on this. Canada, other countries, as well as other states have already imposed bans on human cloning for therapeutic or research purposes. In an addition, other countries already protect and regulate the use of embryos generated by in vitro fertilization. Germany and Austria...pardon me, German and Australian laws forbid screening of embryos for sex or genetic characteristics. And Germany allows any manipulation of embryos only if such testing would actually improve the ultimate survival of that particular individual. Other countries demand that in vitro fertilization be performed in such a way that all embryos will be

implanted and no embryos will be leftover. There will be no excess embryos. So this is not an area where we would be breaking new ground. Bans and regulations of this type are already in place in this country and around the world. This decision to regulate cloning or use of in vitro embryos has nothing to do with a woman's right to abort her child. What we're talking about here is something entirely different. We're talking about the actual creation of embryos, which in this case are meant to be destroyed. In prior testimony, representatives of university have agreed that cloning that cloning with intent to produce a live human being should be prohibited. Yet by defending so-called therapeutic cloning, their advocation...the creation of embryonic humans that therefore must be destroyed. To allow the creation of these cloned embryonic humans explicitly for destruction, creates a subjective definition of human life that will be left to scientists or bureaucrats to negotiate. We have not been served by prior attempts to exclude designated human beings from the protection of the law. We know them: Standing Bear, Dred Scott, Carrie Buck, Tuskegee, Srebenica, Birkenau. Each name recalls a boundary built to exclude humans from the circle of humankind. What but temporary and narrow interests were served by any of these attempts? Weren't we each and all of us better off when these boundaries were erased and the net of humankind thrown as widely as possible? We'll be better off without the artificial boundaries set across human development. What we really need are boundaries here that tell us what we can do and what we cannot do. We have attempted to provide such boundaries. We have no objection whatsoever to research and treatment using stem cells from any of the many sources that have already been discussed earlier today. We've even championed this work. Research and treatments that rely on the creation and destruction of cloned embryos, though, we feel is wrong. Those championing the destruction of cloned or in vitro embryos for embryonic stem cells fail to provide us with an ethic that tells us what is not justifiable, except to this extent: cloning to produce a live birth is wrong. Why should it be wrong? Who would they punish if a couple were to produce a live child by cloning? Let's ask for guidance here. Is it wrong to clone an embryo and implant it if the goal is to sacrifice the fetus before it can be born in order to harvest its organs or cells? Why would that be wrong? Is it wrong to abort...is it wrong to implant a cloned embryo

into the uterus with the intent of sacrificing the fetus for its stem cells or kidneys or both? Why? Is it wrong to sacrifice a human prior to its live birth ever for the sake of its organs or tissues? Why is it wrong? On what day of development does it become wrong? We ask. You would do well to ask those who are on the other side of this issue to spell out boundaries that tell us what is right and what is wrong. The proponents of therapeutic human cloning argue that the possibility of cures for other humans justifies the sacrifice of these embryonic humans. This argument is a subversion of traditional medical ethics. As I learned in my earliest clinical education, my goal as a physician is to cure sometimes, to care always. Today we'll hear from folks in this room with Parkinson's disease, diabetes, multiple sclerosis. And this afternoon, when I leave here and go back to my rounds, I'll be taking care of folks with diabetes, folks who are paralyzed, and patients who are right now dying of cancer or of AIDS. Patients come to us for cures that too often we cannot provide. And no stem cell research will slay the horseman of death. But we don't abandon the incurable patient. We support them and encourage them, attempt the impossible to temper their course. This traditional ethic of care even in the absence of cure is not something that we health professionals do by virtue of our speciality training. We extend it out of respect for a humanity which is inherent in the patient. A humanity in which we ourselves share. This humanity is wedded to the physical human body of our patients. And in fact, this humanity, and this respect for the humanity extends even to the patients body in death. Even when the body of my deceased patient could be harvested for useful organs or tissues that could save the life of another patient, I don't demand this. We do not demand it. This is how it should be. In this traditional scheme, care given out of respect for the patient's humanity, trumps the opportunity to cure. Those who favor embryo-destructive research or therapeutic human cloning ask us to rearrange our priorities. Ignore the humanity of these embryos, they urge. Don't care about them. Consider the possibilities for cure. But in the end, stem cells notwithstanding, we will all still die. None of us will endure. But cure sometimes, care always is an ethic that should endure. Thank you. [LR219]

SENATOR ASHFORD: Any questions of Dr. Safranek? Just to vouch for that, my

brother was up at the ICU at Bergen over the last week and you were there. And I can vouch for your caring, because I watched you up there with all your patients. Not with my brother necessarily, he was too grouchy, but you guys did a good job for him, and he's getting better. [LR219]

LOUIS SAFRANEK: Well, thank you. [LR219]

SENATOR ASHFORD: Thank you for your work. Okay. Thanks, Doctor. Anyone else? All right. It's five of 11:00, why don't we take about five minutes, seven minutes, and then we'll go on with some more testifiers? Thanks. [LR219]

SENATOR ASHFORD: Good morning. Here we are again, doctors. Why don't we get started? And what I'd like to do here is, let's go to about five or ten after 12:00 and then break for an hour or so. That's sort of the time line that I'd like to follow for now. And then depending upon whether there is question involved, we'll see whether after lunch we need to have more of your testimony or discussion, or whether we can go into the public discussion. We'll just wait and see how that goes. But I plan on breaking a little after 12:00 for lunch. So, great, who would like to go first? Doctor. [LR219]

JIM TURPEN: (Exhibit 4) My name is Jim Turpen, I'm a professor and vice chairman in the Department of Genetics, Cell Biology, and Anatomy at UNMC. Thank you for the opportunity to be here again. I did testify before this group in March, as you've heard. And I appreciate the opportunity to revisit some of these issues. I would like to point out that you all have been given this folder and the testimony of the three of us here. You will find in the right side of that folder so you can follow along at your leisure as we go through this testimony. I'm going to start out, and I guess part of what I'm going to do will end up being a review, because I want to go through some of the fundamental aspects of early human development. But I want to go through them with a point of view of trying to tie the science into some of the ethics, because it is a unique aspect of what we're talking about here is that when we look at early human development we can't

separate those two. We cannot separate the science from what it really means to be a human and the ethical considerations that are related to that. So once again I will start out with asking, what is a human embryo? And I will present the following definitions for you, because I think these definitions are very important. The NIH, National Institutes of Health has issued guidelines that say: in humans the developing organism from the time of fertilization until the end of the eighth week of gestation when it is called a fetus. The International Society for Stem Cell Research, the primary professional organization that is involved in this area, has defined a human embryo as: the product of a fertilized egg from the zygote until the fetal stages. Sister Renee Mirkes in testimony before the Nebraska Bioethics Commission said that: the human embryo comes into existence at the completion of the process of fertilization. It's an individuated organism of human genomic material. And the National Academy of Science has said that a blastocyst is a preimplantation embryo that develops five days after fertilization of an egg by a sperm. So why is fertilization such an important event? Why is fertilization an event that is highlighted when we look at all of these definitions of the human embryo? Fertilization, first of all, is the process that results in the union of the egg and the sperm. It is the process that results in the activation of development and it is the process that results in the conception of a genetically unique individual. And that conception of the genetically unique individual is at the heart of our discussion. It is that conception of the unique individual that makes every one of us in this room different. It is the conception of the unique individual that makes every one of us in this room special. And it is that moment of conception that really defines who we are as a human being. The first cell is then known as a zygote. The zygote is a totipotent stem cell that originates from fertilization. And a totipotent stem cell is a cell that can give rise to all cell types that are found in the embryo and the fetus, including the embryonic components of the trophoblast and the placenta, the components that are require to support development to birth. That zygote divides. The next cell is known as the two-cell stage, and the two-cell stage gives rise to two totipotent stem cells. We known that each of these cells is totipotent because this is one of the points in time when we can have twinning and the generation of two additional or two different individual. We then come to the four-cell stage, the second

division of the zygote that gives rise to four cells and recently we have had the birth of identical quadruplets, which indicates that each cell of the four-cell stage is also a totipotent stem cell. As was pointed out earlier, we then undergo a process of asynchronous cell division, eventually reaching the morula stage. The morula consists of 12 to 32 cells, and the important part about the morula stage is by then totipotency is lost. We are beginning to see differentiation of the cells at this stage. Some of those cells are now known as pluripotential stem cells, and other cells have become limited and can only develop along the lines of the placenta. Pluripotential stem cells are stem cells that become all of the cell types that are found in an implanted embryo, fetus, or an adult, but not the embryonic components of the trophoblast and the placenta. Those cells in the morula are not morphologically distinguishable. They all look the same. So in order to really identify which cells are pluripotent and which cells have been limited to the trophoblast stage, we must look at the blastocyst stage. The blastocyst stage occurs around five to seven days post fertilization. It's an early embryonic stage that consists of approximately 150 cells. The inner cell layer or the inner cell mass is where we find the pluripotential stem cell population and the outer layer is called the trophoblast, which is going to give rise to the placenta. These stages are referred to as preimplantation embryos. Without the trophoblast there is no possibility of the inner cell mass developing further into a human embryo, because the placenta is essential. As the National Academy of Science/Institute of Medication indicated: a blastocyst is a preimplantation embryo that develops five days after fertilization of an egg by a sperm. By seven days the role of the trophoblast comes into play. The trophoblast then is responsible for attaching the blastocyst to the wall of the uterus, for eroding that blastocyst into the wall of the uterus, and for establishing the connection between the uterus and the developing blastocyst. That is where we start to get the development of a placenta. Without the trophoblast, implantation cannot occur. If implantation does occur, normal development results from fertilization and within the wall of the uterus the blastocyst then undergoes several additional stages, eventually resulting in the formation of the embryo and the fetus and at birth, the neonate. Now that is the normal process of development. If we look at embryonic stem cells first, we see that that normal

process is mimicked, that that normal process takes place and what we're looking at initially is the normal process that is taking place outside of the uterus, in a process called in vitro fertilization. Embryonic stem cells are cells that are derived from the inner cell mass of the developing blastocyst. The largest potential source of blastocysts used for embryonic stem cell researches are the blastocysts that are left over from in vitro fertilization clinics. In this process the pluripotential cells of the inner cell mass are removed, placed in a culture dish with a nutrient-rich liquid, the cells develop into a population of cells that are now referred to as embryonic stem cells. Embryonic stem cells can be induced to undergo continuous cell division resulting in the formation of an embryonic stem cell line. Through continued research we will learn how to direct these stem cells to develop into specific tissues that can be used in regenerative medicine. Recent advances have said that we can get these cells to develop into insulin-producing cells, and it is also possible to get some of these human embryonic stem cell lines to differentiate into neurons. The NIH guidelines specifically state that stem cell lines may be derived from human embryos created for the purpose of fertility treatments. And the NIH guidelines also specifically state that pluripotential stem cell lines are not embryos. The next step in this process, the next thing we want to is this whole idea of somatic cell nuclear transfer. Somatic cell nuclear transfer is a process that uses the cytoplasm of an unfertilized egg to reprogram or "de-differentiate" the nucleus of a body cell. Once this body cell has been reprogrammed by inserting into the cytoplasm of an unfertilized egg, the resulting zygote-like cell will develop into a stage resembling the blastocyst. Pluripotential stem cells can be removed from the inner-cell-mass-like features and placed in culture. These pluripotential stem cells can be induced to undergo continuous cell division resulting in the formation of an embryonic stem cell line. These differentiated cells are genetically identical to the donor of the body cell. They are not genetically unique. They are not the creation of a new human individual. They are identical to the donor of the body cell. These identical cells can then be used for the development of patient-specific regenerative medicine procedures. In this process the cytoplasm of an unfertilized, enucleated egg is used, but: no sperm is used; no egg nucleus is involved; no fertilization takes place; no conception occurs; no genetically

unique individual is created; no embryo is produced; no implantation into the uterus takes place; and no pregnancy ensues. The intent of this procedure is to produce a stem cell line from the donor of the nucleus. This cell line can then be used either for therapy or for research purposes. And I think it is important to point out the benefits of using these cell lines for research purposes because it gives us the opportunity to study diseases for which we really have no animal model, diseases that are unique and specific to humans. Francis S. Collins is one of the leading scientists of this generation. He is currently the director of the Human Genome Project. On November 5, 2007, President George Bush presented Dr. Collins with the Presidential Medal of Freedom, our nation's highest civilian awards. In one of his recent books,The Language of God, Dr. Collins explores the scientific, ethical, and religious issues associated with SCNT and embryonic stem cell research. While Dr. Collins opposes reproductive cloning, please listen to what he says about therapeutic cloning, and I quote Dr. Collin, "It is intensely regrettable that the product of somatic cell nuclear transfer has been equated both in terminology and in moral argument with the generation of stem cells from a human embryo derived from the union of sperm and egg. This equivalency, arrived at very early in the public debate, and now adhered to almost slavishly by most participants, ignores the profound difference between the way in which these two entities are generated." As Dr. Collins and numerous other scientists point out, nearly everyone would agree that a donor skin cell has no moral value. Millions of these cells are shed every day and millions more are routinely taken in the form of biopsies. Likewise, unfertilized eggs alone have no potential of becoming living organisms. Millions of these eggs are discarded every day during the normal reproductive cycle. Removing the nucleus from an unfertilized egg and subsequently putting these two entities together in the laboratory creates a cell that does not form in nature, a cell that has great potential but a cell that falls short of the moral status of the union of an egg and a sperm. Thank you. [LR219]

SENATOR ASHFORD: Thanks, Dr. Turpen. Do we have any questions of Dr. Turpen? Yes. Senator Lathrop. [LR219]

SENATOR LATHROP: I'm wondering if we want to ask these now or wait till afterwards, but as long as I'm given the opportunity: you were here in the winter when we took up the LB701, I believe was the LB...700, forgive me, and I understood you to say that the cloning--after your explanation and your presentation--was that the cloning wasn't something that was being done or contemplated, and in fact, wouldn't come along really in the natural course of things until there was a therapeutic use from the stem cell research. Did I understand that correctly? [LR219]

JIM TURPEN: I said that we're not doing that now at the Medical Center, and I think what I was trying to say is that it is a long way or a lot of technical difficulties that need to be worked at. At this point nobody has produced a human embryonic stem cell line through this process of somatic cell nuclear transfer. So I think we're looking at a very long term development of this. [LR219]

SENATOR LATHROP: Is any of that research being undertaken at the med center at present? [LR219]

JIM TURPEN: Somatic cell nuclear transfer? [LR219]

SENATOR LATHROP: Yes, sir. [LR219]

JIM TURPEN: No. [LR219]

SENATOR LATHROP: Is there a prohibition by the Regents of that study or that work? [LR219]

JIM TURPEN: Yeah, Dave, do you want...Dave is... [LR219]

SENATOR LATHROP: If that is part of your presentation then maybe what I'll do is wait

until the three of you have each had an opportunity to visit. Okay. Thanks. [LR219]

SENATOR ASHFORD: Doctor, just following up on one...the lines that are in existence, the stem cell lines that are in existence today under the NIH, well, that are federally funded, that research, where do those lines...how were those lines produced? They're not produced through somatic...that was through the embryonic process? [LR219]

JIM TURPEN: Those were produced by the leftover embryos from in vitro fertilization. So regular embryonic stem cell approach, not somatic cell nuclear transfer... [LR219]

SENATOR ASHFORD: And I don't want to take away from other...anybody else here, but the somatic nuclear cell transfer process is a process that is...was developed, in I take it, within the last few years, several years, ten years? [LR219]

JIM TURPEN: Actually the first examples of somatic cell nuclear transfer occurred back in the 1950s and... [LR219]

SENATOR ASHFORD: For other reasons? [LR219]

JIM TURPEN: Well, it was basically using amphibians, asking very direct scientific questions. So the general approach has been around, it has just been in the last few years that it has advanced to the point where it is successful in mammals, and it has not advanced to the point where it is successful in primates or humans. [LR219]

SENATOR ASHFORD: And at the present time it's not utilized, it's not a process that has successfully resulted in therapeutic cloning? [LR219]

JIM TURPEN: No it hasn't. [LR219]

SENATOR ASHFORD: The destroyed eggs...could you just talk to me very briefly about

the destroyed eggs you talked about. How...what is that, how does that happen? And how are they destroyed? [LR219]

JIM TURPEN: During the normal reproductive cycle? [LR219]

SENATOR ASHFORD: Well, the eggs that are used in the somatic nuclear cell transfer come from... [LR219]

JIM TURPEN: Oh, those eggs. They would have to be obtained from egg donors, because it's necessary to have a fresh, unfertilized egg, recently been released from the ovary, so it will be necessary to get egg donors who are going to willing to undergo those procedures to give you those unfertilized eggs to receive the nuclei. [LR219]

SENATOR ASHFORD: Okay. Here's something that just has bothered me since the beginning of this thinking about this process: and that's Dr. Condic's point about the marketability or sale of these eggs, or this process of...and to be honest with you, just so you know, that bothers the heck out of me. And I...could you tell me about that? I mean, you have to purchase these eggs, I assume. Or there has to be some sort of process, or there could be donations of these eggs, I guess. How do you...not you, but how does someone approach a woman and... [LR219]

JIM TURPEN: And get those eggs? [LR219]

SENATOR ASHFORD: ...get those eggs. [LR219]

JIM TURPEN: No, that is a barrier that is going to be very difficult to overcome. In order to do that you have to find altruistic people. I was just at a meeting last month where the whole future of therapeutic cloning was discussed, and the Harvard researchers indicated that yes, that was a major barrier that they had: getting people who were willing to donate those particular eggs. I know, based on reports of that meeting, that

they were facing a similar problem in Great Britain. The people from Great Britain pointed out that there could be some difficulties here because it's perfectly acceptable for males to be paid for donating their sperm, and yet it's not acceptable to have any kind of remuneration for females for donating their eggs. So the issue is really...can go on a little farther. But that is a major barrier that somehow has to be overcome. There is no question about that. [LR219]

SENATOR ASHFORD: Okay. Thanks. Any other questions? Thanks, Dr. Turpen. Let's just go on to the next testifier. [LR219]

STEVE RENNARD: Mr. Chairman, members of the committee, my name is Steve Rennard, I'm the Larson Professor of Medicine at UNMC. I'm a pulmonary physician, so I'm trained in internal medicine. I'm a clinician with a specialist in lung diseases. And I what I want to talk about today is five questions. First is, why is a person who takes care of adults with lung diseases interested in stem cells? Secondly, I'll try to address the issue of whether adult stem cells can be used to restore lung function. And then why embryonic stem cell research is needed. And finally I'll just touch on what is being done at present with embryonic stem cells at UNMC and what the potential of that research is. As I mentioned, I'm a physician. I take care of patients, adult patients with lung diseases. My main interest is in an illness called chronic obstructive pulmonary disease, or COPD, which is currently the fourth leading killer of Americans, more than 125,000 Americans will die each year from COPD. And it's increasing. Now the major cause is cigarette smoking, and we have a very active program trying to address cigarette smoking to try to prevent COPD. But 20 percent of people who die from COPD, which comes to about 80 people a day, are lifelong nonsmokers, and so COPD is a major public health program even in the absence of cigarette smoking, which is its major cause. Now people with COPD have several things going on in their lungs. They can have bronchitis or emphysema. Perhaps the easier to understand is emphysema, and this is where the stem cell research really comes in. In emphysema what happens is the lung tissue is destroyed. You can sort of use this as a kind of paradigm for many chronic

diseases of adults where tissues, as people age, begin to suffer the ravages of time and damages due to the environment, whether its cigarette-smoking or not. And as a result, tissues degenerate and disease develops. Now when I was medical school, we were taught that emphysema is irreversible. Once the lung tissue is destroyed, that's it, and the disease is only relentlessly progressive, and people slowly develop progressive limitations of their activities and progressively worse shortness of breath until they finally succumb. That's not the case. It's very clear, in fact, that emphysema, at least, in animals, can be reversed. And in fact, we have a very active research program pursuing those investigations. The discovery that emphysema could be reversed in animals was made only ten years ago. And that same approach has been tried in people. And in fact, unfortunately, that same approach didn't work. And so the time to advance these studies to try to help advance the therapy of emphysema, the time to advance those studies into human cells, in any case, is now. Now our current therapies for diseases like emphysema can certainly help people to some extent. There is no doubt that the therapies can improve peoples' symptoms, but the benefits are limited. The disease is, generally speaking, relentlessly progressive. And none of our treatments slow the rate at which the disease progresses or reverse the disease. That's the long-term goal of stem cell research as it applies to human diseases. That is, the concept is that it is clear that the lung, at least in some mammals, in mice, has the ability to regain function once it's lost, although that doesn't seem to happen in people as simply. And this then leads to the question is: how can we then use the understanding that this is a possibility to discover how to make it happen in people? And so stem cells research is one area of very active research pursuit to try to achieve that goal. Now stem cells can be pursued in this. And it doesn't necessarily have to be embryonic stem cells. And so the question is, can adult stem cells be used to try to restore tissue function. And at UNMC we have a very active research program in the use of adult stem cells for specifically that purpose. The research to date, unfortunately, suggests that the potential for adult stem cells is quite limited. The number that get into the lung, the organ I'm interested in, is very small. And their capability, at least as far as we understand it at the present time, to do potentially useful things in the lung also seems to be highly restricted. That potential

though is not completely without utility. And in fact, a number of therapeutic applications, not unfortunately to restore lung function in emphysema, are being considered and that research is advancing. The question of course is how to use adult stem cells most effectively to try to address these therapeutic goals. And this is where embryonic stem cell research really comes into play. By definition, as we've heard from the experts so far this morning, embryonic stem cells, by definition, possess the ability to form all of the tissues of the body. So these cells clearly can make all of the cells that would be required to restore lung tissues. One goal of embryonic stem cell research then, is not necessarily to use those cells to build lungs, but rather to understand how those cells build lungs, so that once that road map is understood, that adult stem cells potentially could be manipulated so that they could be used as therapeutic interventions. Another important thing that's been mentioned this morning is that embryonic stem cells have the potential for forming cancers. That's true, but actually adult cells have the potential for forming cancers too. Lung cancer is another disease that unfortunately is one that I have to deal with rather frequently. One of the amazing things about embryonic stem cells is they form tissues, is that they do undergo the various processes, including replication and cell division that lead to the formation of tissues. And then they turn that process off without forming cancers. Understanding the mechanisms by which stem cells do this has the potential, of course, so that these kind of understanding can be used to develop therapies that...where stem cells, whether they're embryonic or adult, could be applied without the risk of forming cancer. And it even has the potential for developing therapeutic approaches that potentially could control the development of cancer in people who don't have other lung diseases. Well, what research is being done with embryonic stem cells at UNMC? And there's a very limited research program. As far as I know, there's only three researchers currently using human embryonic stem cells at UNMC, although research in animal cells is more extensive than that. All of the research is being done with cell lines that were approved by...for that purpose by President Bush. In my laboratory we're attempting to understand how embryonic stem cells differentiate into one kind of cell that is present in the lung that we think is very important in determining lung structure, because we believe if we

can understand that we can understand how those structural elements can lead to restoration of lung structure. A parallel line of investigation is those same cells can lead to scarring in the lungs. And so uncontrolled activity of those cells may lead to other lung diseases. And so understanding these processes is what we're intending to do. Doctor Ira Fox, who is in the department of surgery and is interested in liver transplantation, is attempting to understand how embryonic stem cells can be induced to differentiate into liver cells, with the potential for that to be an option...rather than whole organs for liver transplantation. And Doctor Angie Rizzino at the Eppley Cancer Institute is exploring the master mechanisms that...the cellular and genetic mechanisms that are involved in controlling the switches that regulate how embryonic stem cells undergo this differentiation process. Now the potential for the research that is being done at UNMC is, as I mentioned, there is many kinds of the fibroblasts, the cells that we're interested in, present in tissues. The current concepts suggest that those cells are important in regulating how a tissue responds to injury, why some people can maintain their lung structures throughout their life, even if they smoke cigarettes, and other people will develop emphysema even if they don't smoke cigarettes. And so we're interested in how that can happen. As I mentioned, we may also be able to, through similar processes, understand other scarring diseases and the biology can be extended to diseases outside the lung. As I mentioned, Dr. Fox's work with liver cells has the potential for being able to use these cells rather than whole organs for transplantation, which would obviously be a tremendous boon for people with many kinds of liver disease. And finally, Dr. Rizzino's work, which is really very basic, should help us understand precisely the mechanisms that regulate the switches that make an embryonic stem cell what it is and allow it to turn on some genes that allow it to form some organs, and at the same time, turn off other genes that prevent it from becoming a cancer. Understanding the processes at that level has important biological implications for all of the things we've been discussing this morning. Thank you. [LR219]

SENATOR ASHFORD: Thanks, Doctor. That was very, very informative. Any questions? Let me just...if I could just ask, there's obviously a fundamental difference

between using these cells, embryonic stem cells, for research purposes and for therapeutic cells. We're not...I believe Dr. Condic indicated, and it's fairly obvious, we don't use these cells for therapeutic purposes. [LR219]

STEVE RENNARD: That's correct. [LR219]

SENATOR ASHFORD: And they're not used for therapeutic purposes anywhere that you know of? [LR219]

STEVE RENNARD: The human embryonic stem cells? [LR219]

SENATOR ASHFORD: Right. [LR219]

STEVE RENNARD: I don't know if they're not...that they're not used anywhere. [LR219]

SENATOR ASHFORD: It's not a common... [LR219]

STEVE RENNARD: I suspect...as far as whether there is no reputable places that are using them for therapeutic purposes. [LR219]

SENATOR ASHFORD: Maybe in Korea. Everything seems to happen there. (Laughter) But hopefully we're better at it than the Koreans are, I hope. But anyway, the...so these embryonic stem cells came to the university from another place, they came... [LR219]

STEVE RENNARD: Yes, we have two lines of embryonic stem cells. Both are the so-called President-Bush-approved lines. One came from University of Wisconsin, the other came from University of California, San Francisco. [LR219]

SENATOR ASHFORD: And how do we...do we apply for them or how to do they come to us? Do we have to submit a proposal as to what we're going to use these for? Is that

how it works essentially? [LR219]

STEVE RENNARD: Yes, there's actually...the university guidelines actually have a...this is an area of research...as actually all of our research has to conform with university guidelines and policies. And so the research that is done for this, actually, each research project has to go through an approval process. And each...so that the research projects that we proposed were approved by the university. Then we have to then acquire the cells from those institutions. There is some training that is involved in that. The cells are not so easy to grow. So the training actually teaches us to do that. Then we acquire a small amount of the cells. Since they can replicate in the petri dishes, as has been described this morning, we can then expand them and maintain stocks of those cells at UNMC. And as I said, that's what we've done with two of those strains of cells, one from each of those universities. [LR219]

SENATOR ASHFORD: And I take it, from Dr. Turpen's testimony that those cells were not the result of somatic nuclear cell transfer but were embryonic cells. [LR219]

STEVE RENNARD: Yes. [LR219]

SENATOR ASHFORD: All right. I guess that's all I have. Senator Pirsch. [LR219]

SENATOR PIRSCH: Just a quick question: you said you obtained the two strains of cells from the University of Wisconsin and California. Once you obtain those...for every need then you obtain...you go back and ask for those or do you have those then on... [LR219]

STEVE RENNARD: Well, we hopefully keep them. They're rather expensive to obtain from those sources. And so what you do is you get a small amount of the cells, and they will grow, and so you put them into culture and you expand them. We can freeze them back down. Actually, when we get them, they're in a little tube, frozen. And so we freeze

them back down and keep frozen stocks of those cells available. [LR219]

SENATOR PIRSCH: Okay. [LR219]

STEVE RENNARD: And so we have expanded the cultures and maintained them at UNMC. While the cells may have sort of infinite division potential, as has been discussed, they clearly do change with time. And so the cells undoubtedly are not the same now as they were many divisions before. And so it is important to take the cells out after they've been frozen and thawed and put back into culture and put back into the freezer and to compare them, because the cells will change, which does limit their utility as research tools. Because the longer they're in culture, the further away they are from actual embryonic cells. [LR219]

SENATOR PIRSCH: Thank you. [LR219]

SENATOR ASHFORD: Thank you, Senator Pirsch. Senator...you're going to wait. Okay. So we'll have other opportunities probably. But thanks, Doctor. Oh, I'm sorry. Senator Schimek. [LR219]

SENATOR SCHIMEK: Just a quick question that was prompted by your last response: are there any long-term implications for some of these cells that might be used, say, to cure lung disease or whatever, in the next generations? If in the experimental or petri dish stage they gradually over time change, are there long-term implications then for their ability to change over time? That is a key question, isn't it? [LR219]

STEVE RENNARD: Oh absolutely, and I think that trying to understand how these cells...how the biology of these cells works as their manipulated in vitro is going to be key for that. I think that everybody working in this field would...if there's any consensus is that the cells that we're working with now have no potential for being used as therapies themselves, because of the kinds of changes that have taken place to them in

vitro. That doesn't mean that we can't address important scientific questions with them, which we're hoping to do. But the issues of how the cells need to be appropriate handled before they can be used therapeutically is one that's absolutely crucial and will have to be addressed. [LR219]

SENATOR SCHIMEK: Okay. Thank you. [LR219]

SENATOR ASHFORD: And just to follow up on that: and the therapeutic part of this is though it may be...it may be has been used or may be used somewhere some place we don't know, but basically the research aspect of this is in complement to utilization of adult stem cells, better understanding how they react? [LR219]

STEVE RENNARD: Oh, absolutely. [LR219]

SENATOR ASHFORD: And adult stem cells, just for the record, are not necessarily adults' stem cells, they are stem cells that are no longer pluripotent. [LR219]

STEVE RENNARD: Correct. And so adult stem cells could from cord blood, for example. [LR219]

SENATOR ASHFORD: From cord blood...and that does hold promise? [LR219]

STEVE RENNARD: Oh, absolutely, I think adult stem cells, even from adults hold promise. The problem that we have at present is that we can't manipulate those to do the things that we want. [LR219]

SENATOR ASHFORD: For the research? [LR219]

STEVE RENNARD: Well, we can't manipulate them to do the things that we want therapeutically, so we can't make them make new lung tissue as well as we wanted to

do. If we could do that, then we would then try to develop therapies based on that. Hopefully the embryonic stem cell research will sort of light the roads, that we know which path to travel, and it may be that adult stem cells would be valid therapies or valid therapeutic tools to use, if we understood how to manipulate them correctly. Embryonic stem cell research holds the promise of shedding light on how to do that. [LR219]

SENATOR ASHFORD: Okay. Thank you, Doctor. Anybody else? Next. [LR219]

DAVID CROUSE: (Exhibit 5)Thank you. Mr. Chairman, members of the Judiciary Committee. My name is David Crouse, and I serve as the associate vice chancellor for academic affairs at UNMC. And I'm also a professor of genetic cell biology and anatomy at the same institution with Dr. Turpen as a colleague. In my career as a research scientist, nearly all of it at UNMC, I spent nearly 20 years, most of it funded by the NIH, working to develop a better understanding of adult stem cells and the roles that they play in bone marrow transplantation. And I still teach graduate courses in that area. So I'll come back to that in a little bit in terms of some personal experience with stem cells. I want to come back to things that have already been mentioned but give you just a different perspective on them. Why is it, again, that embryonic stem cell research has not led to direct therapeutic applications? That's a very common reason for abandoning stem cell research that is placed out in front of us. And I'll address that question. When I began my research career back in the early 1970s, the use of adult stem cells for bone marrow transplantation was still considered highly experimental. That was in spite of the fact that those cells had been discovered in mice and other animals in the 1950s. So this is 20 years from their discovery in mice, and actually knowledge about them even 50 years prior to that, before they were applied in the clinic. That makes an awfully long calendar, but unfortunately, that's the way medicine sometimes runs. Early attempts at bone marrow transplantations in humans faced many significant hurdles. The very technical ones that faced physicians in many new trials at that time, there were political, and believe it or not, even ethical hurdles for bone marrow transplantation. The patients who received bone marrow transplantation at that time in the 1970s, often the

preparatory regime was one of very high-dose radiation, which would eliminate their own bone marrow and prepare them to receive the bone marrow that would be transplanted. So they faced problems that could result from that transplantation which would otherwise be lethal. And there was great debate as to whether or not this was an ethical approach to treating patients. The other problem was that the bone marrow that was used in those days often came from somebody in the family, but not necessarily genetically identical. And therefore there were immune rejection problems. And there were actually activities of the grafted cells against the patient. We call those graft versus host disease. Those were thought for a period of time to be almost insurmountable problems. People did not give up. There was a long period of time when they were studied, clinical trials ran, animal studies going on concurrently. And indeed the animal studies--I'll have to admit I'm also an admirer of mice; I like Mercedes as well. (Laughter) Most of my career was spent with mice. And they are an incredibly valuable tool, along with lots of other species. We at the med center now have done over 3,600 transplants. That's a lot of transplants. It's not longer quite the risky procedure that it was, even ten years ago, even five years ago. It gets better every day. We're approaching the point that some transplants are almost outpatient. They're not quite, but they're getting very, very close. That has happened by a combination of animal research and the parallel work in clinical trials. And all this is with and for the most part adult stem cells. We transplant bone marrow. We transplant peripheral-blood-derived stem cells. And we transplant cord blood stem cells at the medical centers--not very many cord blood units, but we have transplanted them. And I want to go back to the peripheral blood one, because that's a particular interest of mine. Back in the late 1970s, early 1980s, I knew, I was aware...few experiments in animals, none really in humans...that the blood probably contains stem cells, it probably contains stem cells. It was very hard to get funding for that kind of research. And I was fortunate to land an NIH grant of in about 1982 that let me look more carefully at mice and also at pigs, and see whether or not we could isolate and work with peripheral blood stem cells in those species. Well, we did. And I had a clinical colleague at the Medical Center, Anne Kessinger, who was interested in doing this in people. She didn't wait for the human research to fully...for the

animal research to fully uncover the mysteries of how this might work. She began her efforts with human patients at that same time. And she worked very, very hard at it. She is now known, really, as the founder of peripheral blood stem cell transplantation. Among the very first ones done in the world, they were done at our med center. They are now actually the standard by which most transplants are done. We use far more peripheral blood stem cell transplants than we do bone marrow transplants. We just now have shortened and we call them all stem cell transplants, we throw them all in the same bag. That wouldn't have happened if we didn't have the opportunity to both look at the human system and the animal system in parallel and draw some comparisons between them. I think it's a very important point that I want to make. If scientists had abandoned bone marrow transplantation in the 1960s and 1970s, and if they had abandoned peripheral blood stem cell transplantation and the inquiry that went on with that in the 1980s, we would not be where we are today in terms of having effective therapies for these diseases. I'm sure that Dr. Condic has also faced these same kinds of problems in her own research. It's well known in the lay press that the central nervous system injury, which is what she's interested in--reading her web page and her papers--it's still not been successfully treated, although many researchers, and many, many, many millions of dollars have been spent on trying to find ways of treating and understanding spinal cord injury or other kinds of nerve injury related to the central nervous system. That's been going on for over 30 years. Indeed, in her own NIH grant, and I'll quote you from her grant, this is in her abstract: the adult central nervous system or CNS does not readily support axonal regeneration following injury. These experiments--she's describing her project--will greatly strengthen our understanding and potentially provide a basis for improving the regenerative performance of adult neurons. We don't have an answer yet for spinal cord injury. And Dr. Condic is well aware of that. I'm very pleased that she is pursuing that. It's something that is desperately needed. We have patients with spinal cord injuries around the world and we don't understand how this works. But using adult systems isn't the only potential approach to that. And I want to reemphasize that: it's not the only approach. She surely would not suggest that we stop funding stem cell injury research because there have been no outcomes, there is

no cures, and there have been problems, it has not worked smoothly all the way through. Clearly the translation of basic science discovery to the application at the bedside is not a rapid process. It does not happen overnight. In some ways, some will see that as problematic. We don't get there fast enough. This entire country is in a hurry. We want the answer today or tomorrow. We don't want the answer in a year or five years. Unfortunately, that's the way people believe. But in the world of medicine and science this affords patients safeguards from inappropriate clinical applications, and allows what we called evidence-based medicine to move forward. And it's a very important concept. The lack of present clinical applications of human ESC, only nine years after the very first isolation, and discovery and description, in the presence of incredible opposition to their use and significant lack of federal funding it would not be surprising that there are no clinical treatments with them. In fact, I would dodge a clinical treatment if somebody handed it to me today or tomorrow. We don't know enough yet. That is why we do the research. If you don't do the research you will not get the answer. And we must do comparative research. And I seriously mean that. We need to look at all sources. I'm a total believer in adult stem cells. I totally support the use of cord blood stem cells. But we can't discount the unique potentials which have been mentioned by all speakers, the unique potentials afforded by embryonic stem cells and in very unique situations that might be available through somatic cell nuclear transfer. And the issue of the science is those potentials are there and we should not abandon it in favor of what some people see as really a biased ethical perspective on why we should not use certain types of stem cells. So why don't we just go ahead and use adult bone marrow for everything? Dr. Condic mentioned all these diseases that are treated. Investigators at UNMC, as Dr. Rennard has already said, and across the country, are trying to use these cells in many, many different ways. Don't go away thinking that adult stem cells are not an active topic of research. They're a very hot topic in research. However, in spite of the fact...that fact and the claims by opponents of embryonic stem cell research that adult cells can be used for a really wide variety, and Dr. Condic gave you a list, conspicuously absent from that list were Parkinson's disease, spinal cord injury, diabetes, and I could go a lot of other neurodegenerative diseases that are not on that

list. They have not been treated with adult stem cells successfully. There are claims, if you want to go to Turkey or Uzbekistan or Azerbaijan, or Brazil, or a few nice beach places in the South Pacific where you can get your therapies for these diseases for about $30,000 to $50,000. Don't go there. (Laugh) Those are shams built on what I'll call the hype of stem cells. And I want mention the hype about stem cells, because I think it's important that you understand that many of us, and certainly all of us at the med center, just take issue with claims that say, we're going to have a cure next year. That is a serious mistake by people who support embryonic stem cell research. I don't have a crystal ball that tells me that the answer will be there next year or even in five years. But I don't have a crystal ball that says it won't be there. And therefore I cannot support blocking these pathways of potential research just because we don't know and have not seen that they will be successful. Why would we do the research if we knew it worked? We don't know it will work, that's why we do the research. Let me come back to some more things about what could be found. And I want to kind of drift of into another area. Is there any reason to use embryonic stem cells or cells from somatic cell nuclear transfer if they don't ever get to a clinical application? Dr. Condic rightly pointed out that there are problems with embryonic stem cells: tumor formation, control, immune rejection. I accept those are all problems. Those are all problems. Again, that's why we do the research. She alluded to one type of cell that I want to come back and pick up on. She alluded to being able to manipulate normal cells, for example, a skin cell, to make it behave like an embryonic stem cell. And I want to let you know that at least two groups, actually, more than two groups, two groups have gotten a lot of press for doing this. Doctor Yamanaka in Japan and Dr. Rudy Jaenisch in Massachusetts, both have performed studies in which they were able to take skin stem cells, not human, skin stem cells and insert in them a number of genes--actually the number of genes tried were rather large--but they ended up being able to show that if they put the right four genes in--and genes have interesting names, these are called klf4, Sox2, Oct4, c-Myc, they got fancy little acronym names... [LR219]

SENATOR ASHFORD: What was that? [LR219]

DAVID CROUSE: Yeah you want that for the record? (Laughter) [LR219]

SENATOR ASHFORD: I just...yeah, could we get those spelled or...no, go ahead. [LR219]

DAVID CROUSE: I'm sorry. I just had to point...the number of genes out there, we know there are like 30,000 genes in each of us that are different. We don't know much about a lot of them. And we certainly don't know how they interact. And we certainly don't know how important they are in stem cells. Well, what's interesting about this study is they were able to take those four genes in the right combination, and doing some other magic in the laboratory they were able to take a skin cell and make it act like an embryonic stem cell. It never went through the process of forming an embryo, which is the ethical argument that people always lift up. It never did that. They took it directly from being a skin cell to being an embryonic stem cell, acting like an embryonic stem cell. They were able to differentiate it into types of cells. They were actually able to do some transplant work that showed that it could move to the right places and do some of the right things--really remarkable studies. When I heard the presentation that Yamanaka gave at the international stem cell meetings a year ago, it's one of the first times I've ever seen a group of 1,000 or 1,500 scientists get up in an audience and applaud a person for science. Okay? This was a breakthrough. This was a big, big breakthrough. And many of us believe--and I support Dr. Condic--it would be wonderful if we could find a way to get to stem cells, pluripotent stem cells that didn't involve an embryo. I mean I accept that as being wonderful. But one thing I want you to clearly understand, how did we know what four genes to put in? Where did he get that information? By studying embryonic stem cells he learned which genes seemed to be important, how they were turned on, how they were turned off, when, what they did when they functioned, and was able through a sorting process to come down to--actually he had about 30 to start with--and they tried all kinds of combinations and came up with four. So this was a remarkable exercise in scientific productivity. But it

required understanding embryonic stem cells and studying very carefully embryonic stem cells from the start. So it is critical to know that what we learn from embryonic stem cells may not ever mean we're going to use embryonic stem cells for therapy. I think that you need to know that. What we learn from embryonic stem cells and cells derived through somatic cell nuclear transfer may have equal importance in being able to control, regulate, differentiate, and ultimately derive therapies that don't involve those cells. And I think Dr. Condic would agree in that. That's a wonderful hope for an outcome. But we still need those embryonic stem cells. What other alternatives are there? And I'm not going to go through this because of time. I had a long list. Dr. Condic mentioned a few. But there's...scientists are remarkably inventive, that's why they're scientists. And they have tried all kinds of ways to get embryonic stem cells, including the one I just described. People have fused cells with existing embryonic stem cells to make them act like an embryonic stem cells. It works. The problem is you got then two sets of nuclear material in there and you got to figure out how to get rid of one of them. We don't know how to do that. People have tried to use a number of crippling gene systems, where they put a crippled gene in in the somatic cell nuclear transfer process so the cell becomes crippled and can't form a placenta. If it can't form a placenta then it obviously can't form a functional embryo and this is caused alternative nuclear cell transfer. It's been proposed to the President and various bioethics counsels as another way of getting around the issue. People still take issue with it, but it's another way. And I won't go on to list all of them, but there are a lot, and they continue to come about on a regular basis. What I want to really kind of come down to at the end is something we haven't talked a lot about, but I want you to know why do we care. What are the impacts of these restrictions in Nebraska should they come about? And I want to review first what is going on in other states. Currently 15 states in this country ban reproductive cloning, fifteen states out of our 50 states. Only five states ban embryonic stem cell work including therapeutic and reproductive cloning, only five states. Let me list them for you: North and South Dakota, and Arkansas are three--there's nobody there doing any research in this area or that really cares. It's pretty easy to get a law through the system when you don't even had a medical center, which North and South Dakota don't have,

at least a functional one like ours. The other two are a little interesting: Indiana and Michigan. Indiana, the big debate there is the language of the law in terms of how they define an embryo. So they're tied up in court in Indiana. And Michigan is kind of at a Mexican standoff, if I can call it that, in which the Governor opposes the legislative attempts to overthrow the bill which bans the work in Michigan. We don't know what the outcome of that will be. But let me tell you what happened to Iowa. Iowa was on that list. Until last year there were six states that banned this work. And Iowa, last year, and I'm sure, since we're their neighbors you may have all read that in the news, Iowa overturned their law which banned cloning, all forms of cloning. It's very similar to our law, except not nearly as punitive. It is...you know, they fine you. [LR219]

SENATOR ASHFORD: We don't have a law yet, Doctor. (Laughter) [LR219]

DAVID CROUSE: No, I know, but I mean the proposed law. The proposed law, ours is a class IV as I understand. So that was overturned last year. One of the reasons was the argument the University of Iowa made. Mary Hendrix, who was a prominent researcher and department chair at Iowa, during this debate, working with early embryos and embryonic stem cells, or wanting to work with them, was literally unable to do what she wanted to do. And she pulled up stakes and moved her entire research shop to Northwestern University on the outskirts of Chicago. And she's been very productive there, particularly in the political climate which exists in Illinois, which actually pays for the research. They don't not only ban it, they pay for it. You're probably aware of what happened with the Stowers Institute in Kansas City, Missouri. They vigorously opposed the legislative bills in Missouri that would restrict embryonic stem cell and cloning work in that state, and the clear intention there of this $3 billion endowed research foundation was to leave the state of Missouri and go to either Massachusetts or California, where the climate was better. I don't mean temperature climate. (Laughter) It still remains an issue. They got their way through brute force of dollars. I mean I'll admit that. They put an enormous set of resources into sponsoring a constitutional amendment in Missouri which prevents Missouri from passing a law that's more restrictive than the federal law.

And it was very hard to get that out of the Constitution, so it's probably going to be there. But it hasn't stopped the opposition in Missouri, which continues, and the Stowers is still reluctant to build in Missouri. And they had planned very large expansion of their research enterprise. Because of the lack of funding in a number of states--we don't ask for funding here--but many states didn't have funding, and the federal funding is slim. And I'll come back to that in a minute. The federal funding is slim. A number of states now actually support embryonic stem cell research, and some include somatic cell nuclear transfer in that. Among the states that actually fund embryonic stem cell research are California, Illinois, New Jersey, Massachusetts, Connecticut, and Maryland, and there are four others that have legislative approval to do so or pending approval to do so. But they haven't actually allocated the funds, so there is no dollars there, although their law now says that if they're going to fund it they can do that. It's interesting that the number of states there has been increasing and not decreasing. Overall the state funding of those handful of states that fund the research--and this is on the books funding, I don't know how much has actually been spent, there's been great debates about that--but the funding in those half a dozen states, or a little more than that is $500 million a year. Sounds like a lot of money--it is. It's 20 times what the National Institutes of Health spends on embryonic stem cell funding. Twenty times, because of the restrictions on the kinds of cell lines and what you can do. Twenty-four million dollars approximately was spent by the NIH. It's not a lot. This has also been important within the NIH, the people we get much of our grant money from. The Bush restrictions have had a huge impact there. There's lots of other turmoils at the NIH, but one of them has to do with the way that NIH is currently being regulated. They can't touch an embryonic stem cell line other than the approved lines to do anything. They've lost very prominent scientists. Dr. Mahedra Rao left just last year and he moved to the private sector so he could pursue his interest in embryonic stem cell work. And he was a stem cell director in the NIH. Just last March, probably faced with these kinds of removals of people, in Senate testimony the director of the NIH, a Bush appointee, Dr. Elias Zerhouni, came out rather strongly for the first time in support of embryonic stem cell research being expanded. And to quote him directly, he said, "...it is clear today that

American science would be better served and the nation would be better served if we let our scientists have access to more [human embryonic] cell lines." First time anybody has come out that directly at that level confronting the President--he didn't fire him, by the way. He's still the director of the NIH. And last but not least, this is really important to UNMC. We really are a major player in the economic development in Nebraska. And we're proud of the fact that we play that role. We have no intentions of seeking state funding for this kind of work or anything related to it. That's not our intent to say anything to you today or the scientists in this state to say anything like that. We still don't want to damage, however, our ability to attract and retain the best and the brightest students. It's also been mentioned by the opposition that we would say that. And that's because I think they know that we seriously believe that's a problem. It not only can damage our ability to attract students and attract faculty and retain the faculty. But whether you know it or not, half the physicians in this state and half of almost all the other health professionals in this state, except for nurses, are trained at our Medical Center. We are very proud of the fact that we retain large numbers of our own students who are Nebraska kids. We're very proud of that. And we want to be able to continue doing that. Two years ago, not least year, two years ago you had testimony from two of our students who came before you and talked about the impact of these kinds of laws on their potential and their interest in the kinds of science that they want to pursue. And the students are watching. I don't know whether you know it or not. But they are watching and they are concerned. And we certainly don't want to damage our ability to attract and retain those students as well. Now can this are of research be ethically regulated? Well, I say yes, right off the bat, yes. You can provide regulations. In fact, one of the things I invite is some form of oversight. We have some now. There are mechanisms set up that I want to describe. For much of the research involves these embryos that are left over--I'm not going to go back into that in much detail--but the great majority of the scientific community that works in this area believes that the use of these embryos fulfills an ethically and moral solid outcome and potential benefit for many persons who may suffer debilitating diseases, even though it may be a ways in the future. What we learn could be incredibly powerful. The creation of the somatic cell nuclear cell lines,

transfer cell lines, which are derived by this technically complex process that Dr. Turpen described, I want to remind you one more time that these are derived from a group of cells formed without prior fertilization, no egg and sperm combination. There's no conception. There's no genetic uniqueness. There's no implantation. There's no pregnancy. And many of us see that as quite different from the embryo that's actually defined by the NIH and by many, many other agencies. They define it as the product of fertilization. SCNT is not that. They are simply not the same as an embryo produced that way. And I want to quote something I found really fascinating, and I'm not sure I can get his name pronounced correctly. Father Tad Pacholczyk of the National Catholic Bioethics Center, recently distributed a flier in the Omaha area that was actually produced by the Family Research Council--both of these are very much opposed to stem cell research, both of these organizations--in this flier I think it was his eighth myth, he states, "In the future it may be possible to inject elements of cytoplasm of a woman's ovum into a somatic cell to 'reprogram' it into a stem cell. If so, there would be no fundamental moral objection to this approach to getting stem cells." So it's okay to take cytoplasm of an egg and put it in a somatic cell. But it's not okay to take a nucleus of a somatic cell and put in the cytoplasm of an egg. That's a fine line that's defined by a particular ethical viewpoint and not science. Okay? I want to make it very clear on that. The National Academy of Sciences in 2005, and then amended in 2007 to make a few little detail changes, produced a set of widely-read guidelines that have provided strict but workable mechanisms for oversight of embryonic stem cell work, including somatic cell nuclear cloning. Although these recommendations do not have the force of law, other National Academy of Sciences recommendations often find their way into that process eventually. These guidelines have been adopted by many universities and research institutes nationwide and have served as a model throughout the country, throughout the world. UNMC has adopted those parts that are applicable to what we are permitted to do under our Board of Regents guide laws...guidelines. And as Dr. Rennard said, that's part of the oversight that we give him. We have a special embryonic stem cell oversight committee, which is defined in these National Academy of Sciences' guidelines. And that looks over the research before it's conducted. The

guidelines, prior to the...and this is very close to the end...the guidelines prior to this are interesting in that most people don't recognize, and Dr. Condic has said...I can't remember if it was her, that you're not allowed to destroy an embryo with federal money. And that's been true actually since 1995, well into the Clinton administration. And then it was modified to better define embryos in 1998. But this goes back a long ways. It's actually, in the funding bill for the NIH that that language occurs. It's called the Dickey-Wicker amendment. I've always loved that name...but that is the name of the amendment. In 1999 the NIH, in the Clinton administration, found a way through the morass of not being able to destroy an embryo yet allowed the research to go forward and published guidelines for producing, for utilizing embryonic stem cells that were produced in the private sector or not using federal funds, and for their application and research programs. And they solicited proposals for grants in the fall of 1999 and people were beginning to apply. And lo and behold we change administration and a cap was put on it and the time-out was given and President Bush came out with his proclamation in the fall of 2000 which basically said, you can only used the ones that were produced before this date. Even though the NIH had a very extensive, elaborate set of guidelines that now, when you look at them, look very much like the National Academy of Sciences' guidelines. So there are ways to provide reasonable oversight that scientists will accept and that scientists can work within and even have public input on those guidelines. And I want to close by making it very clear that our university has been very proactive in regulating research in this area. We have our escrow committee which oversees specifically embryonic stem cell lines. The recommendations of our presidential bioethics committee in 2000 predate the Bush administration policy and our very similar to the recommendations of the National Academy of Sciences with the exception that those guidelines do not permit in the university system somatic cell nuclear transfer at this time. We'd like to continue to be responsible stewards of the science that we pursue at the university and we assure you that we don't take that opportunity and responsibility likely. And I thank you and I'd be happy to respond to any comments. [LR219]

SENATOR ASHFORD: Any questions of Dr. Crouse? [LR219]

SENATOR LATHROP: You know, I might have questions but I'm wondering if you want to break for lunch and then... [LR219]

SENATOR ASHFORD: Let's break for lunch and then actually I think the gentlemen are going to come back for a half hour again after the public testimony too. So we could do it at that time. I would suggest Dr. Crouse and Dr. Condic go to lunch and settle this for us. (Laughter) And if they need... [LR219]

DAVID CROUSE: I'm sorry I missed your talk last night because I would have liked to have gone. [LR219]

SENATOR ASHFORD: Well, you know, an hour isn't bad, with...let's come back about 1:15. Thanks very much. [LR219]

DAVID CROUSE: Thanks [LR219]

(RECORDER MALFUNCTION - SOME TESTIMONY LOST)

SENATOR LATHROP: [LR219]

STEVE RENNARD: [LR219]

SENATOR LATHROP: [LR219]

STEVE RENNARD: [LR219]

SENATOR LATHROP: [LR219]

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SENATOR ASHFORD: [LR219]

SENATOR PIRSCH: [LR219]

STEVE RENNARD: [LR219]

SENATOR PIRSCH: [LR219]

STEVE RENNARD: [LR219]

SENATOR PIRSCH: [LR219]

SENATOR McGILL: [LR219]

STEVE RENNARD: ...be applied to further the research. And so let's put it in perspective: Human embryonic stem cell research is much easier now than it was a few years ago because it's easier to grow the cells. However, the cells that are easier to grow are not the President Bush-approved cell line. So we are somewhat compromised by the fact that these are only cells that we can currently use, and these are the only cells that we will use at the present time, are cells that require a rather kludgy culture technique. On the other hand, the research is much easier to do because we can apply powerful new molecular genetic techniques that didn't exist ten years ago. So we have it much easier than people did five years ago, although other people have it easier than us. [LR219]

SENATOR McGILL: Thank you. [LR219]

SENATOR ASHFORD: That's was a good question; a very good question. Senator McDonald [LR219]

SENATOR McDONALD: You talked about what other states are doing, and whether they don't ban the process of the research but do have ethical guidelines, was the comment that was made. Could you elaborate on that? [LR219]

_____: Could I...? [LR219]

SENATOR McDONALD: Either one of you. I think it was your comment about other states, what they do and... [LR219]

JIM TURPEN: I think it was Dr. Crouse, is what they do in other ones. []

SENATOR McDONALD: Okay, I'm sorry. [LR219]

JIM TURPEN: But I do know that there are oversight committees, for example, in California, that review all of the embryonic stem cell work that is done under their initiatives. Almost every institution has this embryonic stem cell oversight committee, so that the professional organizations are very concerned about monitoring how stem cell research is doing; informed consent of patients, if that is appropriate; those kinds of issues. So there is a great deal of professional oversight within the scientific community. NIH has published guidelines, the National Academy of Sciences has published guidelines, the International Society for Stem Cell Research has also published guidelines. They're all very, very similar, and people in the area tend to follow those guidelines. [LR219]

SENATOR McDONALD: And that would be the ethical guidelines is what we're talking about. [LR219]

JIM TURPEN: The ethical guidelines, all of those kinds of issues. [LR219]

SENATOR McDONALD: Thank you. [LR219]

SENATOR ASHFORD: Just maybe a very few couple of...first of all, this is so impressive, all of you. I mean, you're dealing with spinal cord injuries and liver and lungs, and you're all so impressive, and I'm glad you're all, no matter what sort of research you're using, you're all working on wonderful things. So we're blessed that you're doing that. I guess I have a couple of just quick questions. The 24...I think it's 24; 24 lines of stem cells under the Bush...22 lines...and they generate numbers of these sort of test tubes that are sent out and are used by UNMC and other institutions. And I guess I'm just a little fuzzy, again, and I can ask this later and I don't want to belabor it, but is there a relationship, in your opinion, between the success--eventual success--or

even current success, of some of your research with the proliferation--that's a pejorative way to say--of embryonic stem cells for research purposes? The more embryonic stem cells that are available for research purposes, the better? And I think maybe that Senator McGill was getting at that a little bit in her question. Or is it the brain power, which there is an immense amount of that in here today? The brain power, the technology, and the embryonic stem cells, and what is it? Is there, in your opinion, a correlation, if you will, between the number of lines of stem cells that would be available for research, and your eventual ability to produce advancements in your field? [LR219]

STEVE RENNARD: I'm not sure that I can answer the question precisely in terms of the relationship, but... [LR219]

SENATOR ASHFORD: And I probably doesn't have a precise... [LR219]

STEVE RENNARD: ...but I think the answer is yes. And the reason I would say that is while the technique for starting these cells was described fairly clearly, once you get the cells in the dish, this isn't an off-the-shelf technology, and every time you do this, what you...the cells that are growing in the dish are going to be different each time, and for a whole variety of reasons, not least of which is that the stem cells are trying to differentiate. Which means that if you had a large menu of stem cells to choose from, they won't all be the same, so some of them are going to be much more attractable to use to apply to certain kinds of problems than others would be. And it wouldn't necessarily be that the same line of cells would be most useful for all purposes. And so it may be that if Dr. Fox wants to understand how is it you can make a cell become a liver cell, that one kind of or a small subset of the available embryonic stem cells would be best for that purpose, whereas for the work that we're doing, is how do cells become the kinds of fibroblasts that regulate the formation of lung structure, it may be that completely different strains of embryonic stem cells are maybe more applicable for that purpose. And you can do that to any particular problem that anybody looks for it. In fact, the experience, and I hesitate to use the word "data," but the experience is that when

there is a multiplicity of cells available, that are available in culture, and are used by different investigators, different investigators use different kinds of cells because they have different potentials to address different questions. So the answer to your question, I would suggest, is, yes, although it's not a... [LR219]

SENATOR ASHFORD: Possibly yes, or... [LR219]

STEVE RENNARD: Oh, I think it's very likely yes, that the more cells available, the more people will be able to answer more questions more easily. [LR219]

SENATOR ASHFORD: There are researchers around the country at other universities that utilize embryonic stem cells that are not from these 22 lines. Is that correct? Is that the norm or is it unusual? At Northwestern, they use lines that are not from...and maybe that's a question that... [LR219]

STEVE RENNARD: I can't answer that question... [LR219]

SENATOR ASHFORD: In your field, maybe. How about in your field? [LR219]

STEVEN RENNARD: In the lung regeneration field, it hasn't advanced as much as, for example, in the liver regeneration field or the pancreatic islet cell regeneration field. And as far as I know...so I don't know the answer...the questions that we're asking are actually much simpler questions at a more primitive level than those. And so I think that there is probably not much use of those cells among...there are only a few of us that are doing this work in the lung at the present time. But I suspect that if things advance at a proper speed, that there will be people who will be using them shortly. [LR219]

SENATOR ASHFORD: Okay. I believe that's all I have. Anyone else? Thank you, both, very much. The drill here now is to move to the public testimony, and we're going to spend an hour on that, up to an hour. How many testifiers are here that would like to

talk about this issue? Okay, one, two, three...eight. Our normal rule is three minutes. We're going to extend it to five minutes today, but at the end of the hour we are going to move back to the summary testifiers, the experts that are going to kind of sum up for us. So let's move to the public testimony then. Would someone like to proceed up to the desk? And have people signed in, have their sign-in sheet filled out? Jono, could we maybe hand those around to the ones that are...let's hand them around to the other testifiers so they can fill out the forms. And we're going to have that little light; the light will come on with the yellow light when we would ask you to sum up, sort of. [LR219]

MONNIE LINDSAY: (Exhibit 6) Good afternoon. My name is Monnie Lindsay. I'm the Nebraska State Coordinator for and a national board member of the Parkinson's Action Network. I'm here to talk today about hope. Hope is a tough commodity to come by when you have a chronic neurodegenerative disease for which there is no cure. Embryonic stem cell research and therapeutic cloning, in particular, offer hope to the million-plus Americans suffering from Parkinson's disease. I was diagnosed with Parkinson's disease 14 years ago when I was 38 years old, and only four years out of law school. My right arm simply stopped working. I was lucky: Medications gave me an additional eight years of practicing law. As it progressed, however, Parkinson's disease robbed me of my career as a lawyer, and my home in Chicago. I did not come to the decision to support embryonic stem cell research lightly. I initially was inclined to oppose it. But after reading the facts, eliminating the misinformation about the source of the cells, and even talking to my brother John, at bit, whom many of you know, and doing some serious soul-searching, I concluded that embryonic stem cell research is prolife. I wanted to take a brief moment to stray from my prepared talk here to just emphasize a point that Dr. Turpen mentioned this morning, and that is that a great deal of promise with respect to embryonic stem cell research and the somatic cell nuclear transfer, in particular, is not so much in the area of therapeutic applications, but in the area of drug development. It takes an average of 12 years to get a new neurologic drug through the FDA process. Eighteen months of that is for recruiting patients for clinical trials. And if they can recreate Parkinson's disease or any other disease in the petri dish

using the diseased somatic cell of an adult patient, they may be able to head off some of that time. And I'll tell you that a year and a half in the life of a Parkinson's patient is a very long time. Senator Orrin Hatch, who of course, is ardently prolife, supports embryonic stem cell research. And I'm now quoting, "The passionate defense of life should not stop at birth...To me, an advocate for life has to consider not only our obligations to a group of cells with the potential for life, but also our obligation to our fellow citizens--men, women, and children who will face untold suffering and lose many years of life unless there is a medical breakthrough." Senator Hatch continues, "Some, particularly in the right-to-life community, argue that research on adult stem cells actually holds greater promise than the study of embryonic cells. Although adult stem cell research would clearly offer a preferable political solution, most leading scientific authorities...assert that embryonic stem cell research is by far the more promising course to follow at this time. For now, a ban on the use of embryonic cells could materially impede progress, and the hope that this new field represents would be diminished and perhaps lost." I echo the sentiments of Senator Hatch. Please support the Parkinson's disease community by supporting embryonic stem cell research. Thank you. [LR219]

SENATOR ASHFORD: Thank you. Any questions? Thanks a lot. May we have the next...? Good afternoon. [LR219]

JAMES DAKE: (Exhibit) Good afternoon, Senators. My name is Jim Dake. I'm from Ames, Nebraska, and I was before your committee back in March, testifying regarding this bill. What I've asked the Clerk to hand out to you is the copy of the Iowa bill, signed into law, regarding stem cell research and regarding cloning. Having looked at it and everything, I guess I'm taking off my hat as a person with MS, and putting back on my hat of being a lawyer. And that sort of language looks like what we need in Nebraska as far as addressing one of the things that people do have a concern about, in that they have been talking about this human cloning bill, and it address that. It also talks about somatic nucleus transfer of the nucleus of the thing for the...the therapy. I think we've

got a number of attorneys on the panel here. You've got the feeling of being a jury who has listened to expert testimony after an afternoon, and are just full of all sorts of questions and concerns. However, I would ask you to sit back and look at the fact that you are on the Judiciary Committee of the Nebraska Unicameral. And our number one rule is...or your role is in making laws for the state, and I think that Senator McGill, earlier, had asked a question that I don't think anybody really addressed and answered: Do we need a law like this, to ban the scientific research on the therapeutic cloning? And I would point out that in the 1400's, Galileo Galilei, who was the father of astronomy and physics, did a number of things. He embraced the concept that Copernicus had put out about 100 years before him that the Earth was not the center of the universe; that, in fact, our solar system was centered around the sun. He was basically banished from the church for putting together that sort of thing because it went against scripture, it went against the teachings. And the church said that while, well, he may be correct about that, but it goes against scripture and the teachings so we're not going to allow it; he faced the Inquisition at the time, and in the last couple years of his life, had to say, oh, I didn't mean it, I didn't believe it. Well, and here we are and we're in a world that does realize that the universe doesn't center around the earth, and it works like that. So when you get questions about theology and morality and all of those kind of things messing in with all sorts of, all of this, you grow concerned about the fact that the force of law is being used in a bill such as the one that was proposed and that I discussed at length with Senator Chambers in m last hearing, that this really difficult. So I guess the number one thing I would say is, right now, that bill as it stands is vague and overbroad. It's unconstitutional. And I guess I would go back to Senator McGill's question, and answer, we don't need a law that prohibits the research. I think that something like Iowa has done, I think we should possibly take up, and take a good look at just exactly what they've done concerning that, so. [LR219]

SENATOR LATHROP: Very good. Any questions from any of the senators? Seeing none, thanks for coming down, Jim. We appreciate your thoughts. [LR219]

STACY LAMPRECHT: Mr. Chairman and members of the committee, thank you for listening to us this morning, or this afternoon. As we've all been sitting here today, we've heard brilliant testimony on both sides of... [LR219]

SENATOR LATHROP: Can I have you give us your name? [LR219]

STACY LAMPRECHT: Yes, it's Stacy Lamprecht. [LR219]

SENATOR LATHROP: And, Stacy, you brought your daughter with you today? [LR219]

STACY LAMPRECHT: Yes. Chloe. Chloe Lamprecht. [LR219]

SENATOR LATHROP: Okay. And Chloe is sitting next to you today? [LR219]

STACY LAMPRECHT: Yes, she is. [LR219]

SENATOR LATHROP: Okay. I'm sorry for interrupting here. [LR219]

STACY LAMPRECHT: No, that's fine; that's fine. You've heard brilliant conversation this morning from brilliant minds on both sides of the issue. However, my goal today is to talk to you as a mother, a mother of a child who has Type 1 diabetes. And I want you to get a firm understanding of what we have to go through, what Chloe has to go through on a day-to-day basis. 4,380: the number of times Chloe will poke her fingers for blood sugar level in one year; 157 injections with a 3-inch needle into her abdomen so she can use an insulin pump. Using an insulin pump spares her from 2,200 shots that she would have to take instead of using a pump. Fifteen scheduled trips to the doctor's office, a year, for blood tests drawn from her little arm; $21,000 of medical bills not covered by insurance, covered by our family out-of-pocket; four phone calls everyday to Chloe's school ti find out how she is doing and to chart her blood sugar levels; 365 blood sugar checks at 1 a.m., 365 blood sugar checks at 3 a.m., by me, Stacy

Lamprecht, the mother of a child with Type 1 diabetes, Chloe Lamprecht. What people don't understand about having diabetes is that it isn't about taking a little insulin before you eat and that everything will be fine. It's not about obesity. It doesn't come from eating poorly or from not exercising. There is a genetic predisposition in an environmental and an emotional trigger that ignites the disease. Diabetes is a full-time disease that requires full-time attention from everyone in Chloe's life. Family, friends, coaches, and teachers: diabetes impacts all of us. Chloe has never said to me that it's not fair for her to have Type 1 diabetes. Actually, Chloe had told me on our diagnosis day that God had picked her to have the disease because he knew that she was strong and that another child not as strong as Chloe would be scared and not able to give themselves shots or smart enough from protecting themselves from passing out. Another child was spared from dealing with the disease. As I wept and cried for hours upon hours, Chloe put her arm around me and said, it's okay, Mom, everything is going to be fine. That's my Chloe: tough as nails. But to me as her mom, I want all of you to know that it's not fair that at the age of 7 Chloe had to learn how to keep herself alive on a daily basis. It's not fair that Chloe has to sit out at soccer games, basketball games, golf, or to miss class because she has just had a low-blood sugar episode. It's not fair that her pushy mother has to barge in on slumber parties and bust her out for eating things that other girls are eating...I'm assuming she is probably rolling her eyes at me because she absolutely hates that when I do that, but it's a fact of life. It's also not fair nor humane for people to try to stop her from receiving her cure. By saying no to research, you're telling her that you're not willing to help her receive her cure. But I know that all of the bright individuals sitting before us today know better. You know that children shouldn't go through life with diabetes or any other disease, and you all have the power to help us all. All I ask is that you think with an open mind and open heart when you are asked about your views on stem cell research. Think of us and all that we go through on a daily basis, but most of all, think of the children and all the families that could be spared such hardships. One thing that hasn't really been talked about much today is we've talked a lot about stem cell research and therapeutic research and all these things, but our family not only supports research for finding a cure, but we also

believe that someday preventative measures will also come from stem cell research. Our dream as a family is that children will go to the doctor at their six-year checkup, their kindergarten physical, and that they'll receive a shot for Type 1 diabetes, an immunization much like getting a shot for the chicken pox. So I wanted to say thank you for listening to us to day. We're fighting here today with a voice of all people facing medical challenges in the world today, and thank you for your support. [LR219]

SENATOR LATHROP: Terrific. Thank you. [LR219]

STACY LAMPRECHT: Thank you very much. [LR219]

SENATOR LATHROP: Are there any questions? Okay. Thanks, and thanks, Chloe for coming down. [LR219]

STACY LAMPRECHT: Thank you, Senator Lathrop. [LR219]

SENATOR ASHFORD: The next testifier. Do we have someone...? [LR219]

RITA HEJKAL: My name is Rita Hejkal and I live in Omaha, and I'm fairly nervous although I have done this one other time in my life. In 1997, I was diagnosed with multiple sclerosis, but I've had the disease for at least 20 years, probably at least 25. Multiple sclerosis or MS is fairly unique in that each person's symptoms and course of disease is unpredictable. When I wake up in the morning I don't know if I'll be able to see that day or need prism glasses or if I'll be able to walk unassisted or if I'll need my cane or I won't be walking at all, or whether I'll be feeling pretty well or I'll have debilitating pain. The uncertainty is one of the really trying things about having MS. One thing that is almost certain with MS is that the usual course of the disease, most people start out with relapsing, remitting, we get worse, and then we improve, and we get worse, and we improve. Eventually, that course develops into something called secondary progressive. And at that point there are no periods of remission; it's just

downhill after that, usually fairly swiftly. So naturally, those of us with MS and any other incurable disease--you've heard from some already--we feel desperate for a cure, a cure in our lifetime. Some people, and I will be bold and say they are unscrupulous people, prey on this vulnerability of ours and use us to promote a cause that, at best, is unpromising in terms of a cure. In 25 years of embryonic stem cell research in mice, not one mouse has been cured of anything--not one mouse. We're not talking about do we have a therapy that can be tested in humans; we haven't cured a mouse. It doesn't sound very promising for treatment for us in our lifetime. Last spring, the Judiciary Committee held hearings on a bill that would prohibit cloning of human beings, and many people desperate for a cure--and I understand that desperation--begged the committee to defeat that bill. I remember one child, very eloquent, very articulate, who testified in favor of cloning, which she believed would provide a cure for her Type 1 diabetes. Not long after, theWorld-Herald reported on an exciting development in the quest for a cure for juvenile diabetes or Type 1 diabetes. I don't know if you saw the big spread in theWorld-Herald; it was April 11 in theWorld-Herald.. Here's the story. It's a report of very promising research. The diabetics involved were able to not use insulin anymore. They don't call it a cure at this stage because it's very early and a small study. But the graphic misleads the reader to believe this was a cloning triumph, but this triumph is just like all the other triumphs in stem cell research: It's a triumph of adult stem cell research. Even the article eventually helps you see it. But the graphic, if you didn't read the article, you just would say, oh, my gosh, look what cloning did for us. Cloning didn't have anything to do with that--nothing. It was adult stem cell research that was done at Harvard in the animal stages--very promising--and then the funding dried up and they had to switch to another country to fund the human trials, which were very, very successful. Even though some people would like to portray those of us who support only ethical research as extremists, the fact is that Nebraskans elected a governor, both of our senators, all three of our congressional representatives, and President, who are on our side. I'm here today to try to help you try to understand that what you what decide has real consequences for those of us with incurable conditions. If you want to be truly compassionate and do what you can to help find cures for spinal

cord injuries, MS, diabetes, other conditions, then you will work for and vote for the ban on human cloning and human embryonic stem cell research. UNMC is already a leader in adult stem cell research and treatments, and some people, some of them from UNMC, are pursuing a course of action and advocacy that will divide Nebraskans, delay the day when actual cures are developed, and bring shame to our state. I ask them to stop that direction. Help unite us as a state behind what we can all support: adult stem cell research. Thank you. [LR219]

SENATOR ASHFORD: Any questions of Rita? Thank you, Rita, very much. [LR219]

CHIP MAXWELL: Mr. Chairman, members of the committee, Chip Maxwell, M-a-x-w-e-l-l. I am the executive director of the Nebraska Coalition for Ethical Research, but that's not the hat I'm wearing right now. I'm going to take that off and I'm a general citizen who actually used to serve in this body, and I just have a quick observation. Cloning has surfaced a lot today, understandably so. It's moved front and center in the state debate about stem cell research, and nationally. My first year in the Legislature was the last year of the fetal tissue wars. It was 2001. And what we were told by UNMC officials was, all right, we want to preserve our right to work with fetal tissue, but this is not a slippery slope; we're not angling for embryonic stem cell research; and, cloning, forget it, that's off the table. That's what was said in 2001. Fast-forward to 2005 when this committee was dealing with the same issue. I was no longer in the Legislature but if you read the transcript from that hearing in 2005, there was a parade of witnesses affiliated with UNMC; perhaps a half dozen people saying, oh, my gosh, don't ban cloning; it's crucial to embryonic stem cell research. The culmination of that testimony was Dr. Crouse, it's on page 97 if you want to check the transcript, saying not only are cloning and embryonic stem cell research going to go forward, but we hope it happens in Nebraska; we've got the facilities and the talent to turn this into clinical applications right here in Nebraska. Page 97 in the transcript, 2005. Dr. Crouse noted today that this year in Iowa, Iowa lifted its statutory ban on cloning humans and then destroying them as embryos to get their stem cells. Last year, in Missouri, I'm sure you followed that, the

big debate about the state constitution in Missouri. It's now enshrined in the state constitution of Missouri. You can clone humans and then destroy them as embryos to get their stem cells. I'm not sure half the people in Missouri knew what they were voting for, but that's the law now; it's in the constitution in Missouri. The march is on; the march of the procloners is on. This issue is not going away. As long as there are advocates for embryonic stem cell research, there are going to be advocates of cloning. And now, Senator Schimek made a very good point. She said, you know, whatever we decide, somebody is going to be mad at us. And that's true. Oftentimes, being a politician, it's like being an umpire in a big baseball, and the tying run is coming around third, heading for home; here comes a throw from the outfield, the runner slides, the catcher applies the tag...imagine if the umpire said, I'm going to take a neutral position on this; I'm going to take the middle ground; I'm not sure if that runner is out or safe, you could make a good argument either way, so I'm just going to take a pass on this one. You've got to make a call. Okay? And I'm suggesting you are in this position now. The train is coming down the track, the runner is coming in, it's time for the Legislature to make a call on cloning. That's why it's become such an important part of this debate. That's why kind of lurking in the background is LB700, which is pending in this committee. Remember, we're not talking about leftover fertility clinic embryos. We're talking about using cloning to make human embryos and then destroy them to get their stem cells. We're talking about systematic production and destruction of embryos, and in this case, using cloning to do it. So I just want to be clear about that. That's why it keeps surfacing and that's why some of us are concerned. I think there is a perception, who are these Chicken Littles running around yelping about cloning?--Look out, cloning is coming. UNMC seems to be soft-peddling it. A lot of scientific and political problems with it. But I'm telling you, it fits hand-in-glove now with embryonic stem cell research. As long as there are people coming at you about embryonic stem cell research, they are also going to be advocating cloning. So I suggest the time has come that the Legislature has got to make a call, out or safe, yes or no, on whether it's okay to use cloning to make human embryos and then destroy them for stem cell research. Thank you and I'd be happy to answer any questions. [LR219]

SENATOR ASHFORD: Just real quickly, Chip. You made the differentiation that we've been talking about today, between embryonic stem cell research derived from somatic nuclear cell transfer and also from in vitro fertilization: two different sources of stem cells. [LR219]

CHIP MAXWELL: I guess I just make this observation:... [LR219]

SENATOR ASHFORD: What was the point...I mean, what was the point you were making there? [LR219]

CHIP MAXWELL: Oh, well, that we are...one of the arguments floating out there is, hey, we just want to use the leftovers from fertility clinics; they're going to go to waste anyway; we just want to use those. We're not talking about that. LB700 doesn't address that. [LR219]

SENATOR ASHFORD: No, I know. I understand that doesn't address it, but... [LR219]

CHIP MAXWELL: Oh, okay. [LR219]

SENATOR ASHFORD: Are you saying that that source is...? What are you telling me about those cells that are derived from...? [LR219]

CHIP MAXWELL: Well, what I am saying is, by contrast with cloning, we're talking about a systematic plan to make new embryos for the purpose of destroying them for research. I would say that's a different ball game we're talking about now. [LR219]

SENATOR ASHFORD: Is there a difference in your mind between that process and the whatever is leftover from in vitro fertilization? [LR219]

CHIP MAXWELL: Oh. No, actually...I would say no. Now, remember, I'm not...I assure I'm not a medical professional. [LR219]

SENATOR ASHFORD: I'm just trying to understand what you...you made...I mean, you are...you were talking in terms of LB700. [LR219]

CHIP MAXWELL: Here's the way I explain it to people. Cloning is very similar to IVF in that it's another way to produce a human embryo outside the body. The way it works for me as a layman, and what I tell the people that I talk to, is with IVF, 23 plus 23 equals 46; 23 chromosomes in the egg, 23 in the sperm, you get them together and you've got a 46-chromosome organism called a human being. With cloning, zero plus 46 equals 46. That egg is going to have everything stripped out of it, you're getting all the chromosomes from the donor cell, but the end result is the same thing: 46-chromsome organism called a human being. So I would say, to me, there is no difference in the result, whether you're talking about an IVF embryo or an embryo produced by cloning. Am I addressing your question? [LR219]

SENATOR ASHFORD: Well, I guess the LB700 talks about somatic nuclear cell transfer. [LR219]

CHIP MAXWELL: Correct. [LR219]

SENATOR ASHFORD: But IVF...embryos from IVF processes are not part of this bill, is that... [LR219]

CHIP MAXWELL: That's my understanding of the bill. [LR219]

SENATOR ASHFORD: And then...but is that the...then...but do you oppose that, as well, or does your group oppose deriving cells from...? [LR219]

CHIP MAXWELL: From using fertility clinic embryos? We oppose the idea of using a human at any stage of life as raw material for medical experimentation. I would put it that way; yes. [LR219]

SENATOR ASHFORD: But would you...what would your opinion be on the...and I think all the experts talked about it today, about the embryonic stem cells derived from some other source, if not from those two sources, let's say, from another source, whether it's through an induced iPS cells, induced pluripotent state, that would not bother you because there is no destruction of an embryo. [LR219]

CHIP MAXWELL: Correct. [LR219]

SENATOR ASHFORD: Would you at least...I'm trying to find points of agreement, not necessarily just with you, but with everybody,... [LR219]

CHIP MAXWELL: Sure; sure. [LR219]

SENATOR ASHFORD: ...that those types of cells that are pluripotent, that there is a validity in the argument I think everyone is, all the experts have talked about today, that those cells in the research processes of trying to find, even to better use adult cells, that using these embryonic cells that are pluripotent do help in finding out how the adult cells work and how they could be used, for example, more effectively in a therapeutic way. That's what I was hearing most everyone say today. [LR219]

CHIP MAXWELL: You are exposing my ignorance because somewhere there I lost you. If we can find cells and turn them into... [LR219]

SENATOR ASHFORD: Pluripotent...if you can find a way to, other than through the destruction of an embryo, which is what I'm hearing you say, to utilize those cells for research purposes to, in a variety of ways, the liver example or the lung example or the

spinal cord example or whatever it is, to utilize those embryonic cells arguably derived from some other source, but as part of the process of learning how to better use adult stem cells, because it's part of the mapping how you figure out how those cells work, that having the pluripotent cells is a, at least I've heard everyone here say this, they are important resources in this kind of research. [LR219]

CHIP MAXWELL: If you can manipulate the genes and get yourself the equivalent of an embryonic stem cell without having hurt any embryos, that's fine. Yeah, no problem there. [LR219]

SENATOR ASHFORD: So...okay. I mean, that's not a trick...I'm just trying to understand. [LR219]

CHIP MAXWELL: That's all right; sure. [LR219]

SENATOR ASHFORD: So it's the destruction of the embryo, in a nutshell, that is your concern and your group's concern. As spokesman, that's the group your concern... [LR219]

CHIP MAXWELL: Correct; correct. [LR219]

SENATOR ASHFORD: Thanks. Any other questions? Thanks, Chip. [LR219]

CHIP MAXWELL: (Exhibits 8 and 9) Oh, I guess I should mention, there were two people who asked me to submit written testimony for them. I'm not going to read them. For the record, it's Judith Nanfito, N-a-n-f-i-t-o, and Bernadette Esposito, E-s-p-o-s-i-t-o...okay. [LR219]

SENATOR ASHFORD: No, no. Go ahead. [LR219]

CHIP MAXWELL: Esposito is E-s-p-o-s-i-t-o. [LR219]

SENATOR ASHFORD: No, and I appreciate that. We discussed that earlier, and I appreciate you doing it that way. [LR219]

CHIP MAXWELL: Thank you. It's a great hearing. [LR219]

SENATOR ASHFORD: Thanks, Chip, very much. Greg. [LR219]

GREG SCHLEPPENBACH: (Exhibits 10 and 11) Good afternoon, Senators. My name is Greg Schleppenbach, S-c-h-l-e-p-p-e-n-b-a-c-h. I just have a very quick point. My big frustration in this whole debate, I think is that it tends to miss or ignore what I consider the central point of contention: Does this research involve destroying a human being? All of the arguments that are being made in the defense of embryonic stem cell research and somatic cell nuclear transfer, cloning, would be relevant and compelling if the subject being destroyed is not a human being. We do and we must have ethical boundaries to protect human subjects. So the fundamental question is whether or when early human beings will be included within the boundary of protection as a human subject. I find it particularly disturbing that the proponents of embryonic stem cell research and cloning provide little or no defense, ethical or otherwise, for their proposition that embryos have no moral status worthy of protection in law. I find it interesting, if not perplexing, that the other side, and it's I found a noncompelling argument that somatic cell nuclear transfer does not produce an embryo. Primarily seem to hang their hat on the argument on the issue of fertilization, that somatic cell nuclear transfer doesn't involve fertilization therefore it's not a human being. And it was a though they were suggesting that this creates an ethical distinction between the two, that's it's okay because it's not fertilization, which gives the perception that they have some moral regard for an embryo that comes about as a result of fertilization. And yet, I think if you asked them directly, do you think the embryo produced through in vitro fertilization has any more status?, most, if not all of them, would say they do not.

Obviously they have no problem with and want to move forward with embryonic stem cell research using embryos produced through in vitro fertilization. So ask that you give particular consideration to that question. It's the reason LB700 exists; it's the reason we're here today. It's this central contention about are we discarding, are we destroying a human life or not in this research. And yet, there is all this talk about the economic development, about losing researchers and all that. None of that would matter if what we're talking about is killing human subjects to do it. It would be noncompelling. I have just a couple of handouts here. One is on "What is an Embryo," that has citations from quite a number of different scientific resources suggesting that an embryo marks the beginning of a human being, and a second one, compelling evidence, testimony, quotes, from proponents of embryonic stem cell research and cloning, saying that somatic cell nuclear transfer does indeed produce a human embryo. Thank you. [LR219]

SENATOR ASHFORD: Thanks, Greg. Any questions of Greg? Thank you, sir. [LR219]

GREG SCHLEPPENBACH: Thank you. [LR219]

JULIE SCHMIT-ALBIN: (Exhibit 12) Mr. Chairman and members of the committee, my name is Julie Schmit-Albin. I'm executive director of Nebraska Right to Life, and I believe that the testimony that you've heard today may have great bearing on what you do with LB700, so I'd like to reiterate Nebraska Right to Life's support of LB700 and our desire to see you submit the original bill to the floor because we do feel strongly that this is an issue that the entire body should be able to debate and come to some agreement on. I feel a little bit like a clone of Chip Maxwell at this time, because he said everything I was going to say. But Chip is right. I mean, in 2000, when the aborted fetal tissue debate came forward, some of you were here, and we do recall UNMC's main argument was saying, you know, we're not creating a demand for aborted babies here; we're simply using the by-product of abortion by using aborted fetal tissue research at UNMC; so please just go away and leave us alone and let us do our research. And, you know,

we've come a long way from then, because if you look at that argument then and now you look to the point that we're talking about creating new human life for the express purpose of destroying that life for research, I mean, that's a long leap, and one which I don't believe senators felt in 2000 that they would be facing in 2007 and 2008. So we do see this as a further attack on the sanctity of human life. I noted that Dr. Crouse's testimony this morning practically every time he mentioned embryonic stem cell research, in the same vein he said somatic cell nuclear transfer. Chip is right; the end-game is cloning. That's where they want to go. You go to the transcripts of your Judiciary Committee hearings on March 10, 2005, and March 7, 2007, and there was representative after representative from UNMC that said, leave the door open to cloning; they opposed the cloning ban on the table at that time. Dr. Crouse also said he believes that this research can be ethically regulated. How do you ethically regulate creating new human life for the express purpose of killing that life for research, and where is UNMC ever going to be willing to draw the line? What if tomorrow scientists finally decide that, you know, those ten-year-old children with Type 1 diabetes really make the best research subjects, or those 87-year-old women with Parkinson's, we need to start harvesting their cells because we've decided that they're really the best research subjects? All the prolife movement has ever said from the beginning of this whole bioethical debate back in 2000 was, please, Legislature, draw a line in the sand at some point, and where is UNMC willing to draw the line? And I haven't seen a point where they're willing to draw the line. So, again, appreciate your hearing us out today and we would like to see LB700 proceed. Thank you. [LR219]

SENATOR ASHFORD: Thanks, Julie. Any questions of Julie? Thank you. [LR219]

BRIAN FINLEY: Good afternoon. I'm Brian Finley. I'm a physician and I live in Papillion, Nebraska. From my standpoint and what I do every day, is care for patients and try to give them hope when they have chronic illness or acute illness. Occasionally I am successful in helping them get through an acute illness. Rarely do I cure many chronic illnesses, and that's going to be true, at least in my opinion, in the near future and as far

as I can see into the future. I guess my concern is that when you talk about somatic nuclear cell transfer, is that the very process occurs by taking an egg, a human egg, very specifically, and transferring nuclear material into it. It is not that you are cleaning the entire cell. They are leaving the cytoplasm because obviously there is something important in egg cytoplasm that allows that egg to then develop or that nuclear material to have some material to work on and then produce different cell types. Those egg cells cannot be produced by man. They come from one source and one source only, and that's the female ovary. The female ovary is inside the body, as you all are well aware of, and there is no other way to get to it. There is no zipper; there is no window; it takes harvesting. And so for me, as a physician, I can't proceed with the research that puts my patients in harm, and I think that that's one of the things that needs to be looked at. Research for itself is needed; we do it all the time; we support it. But there has to be a line that you say, do no harm first. It's what I've been taught and that's what I live by. So I guess I would ask you to look very hard and inside your heart to realize where that...we can't take a sperm cell and take the nucleus out and replace it. There is something unique, we do not understand it, I'm not sure we ever will. Dr. Collins, the head of the genome project, recently was quote as saying he's finally come to realize that the junk DNA, and that's what we initially labeled it when we did the genome project, we understand it's somewhere between 3 and 5 percent of what the genome or the genes do, and we've mapped them. But the other 95-97 percent is all about control of the rest of it. Ninety-five percent is a vast amount of knowledge that I don't think any amount of time, even millions of years, that we're going to be able to unravel. With that being the limitation, then I think this is an area that you can't go down that road, simply for the protection of the patients and the people that I take care of on a daily basis. [LR219]

SENATOR ASHFORD: Thank you, Doctor. Any questions? Thanks, Doctor. Any other further testifiers today? Thank you all very much for your contributions. Those are all good insights. I think what we're going to do now is goo back into the experts and ask them to sort of sum up, and they have up to a half hour to do so, sum up, having heard

the comments of the other experts and the members of the public, to kind of fill in whatever gaps they wish to or come to whatever conclusions they would like us to be left with. So with that, I mean, there is no beauty in who goes first, but why don't we just go back to...we can switch if you want if you don't want to go first. Oh, Dr. Crouse isn't here. Well, why don't we do it this way. How many experts do we have that are going to sum up for the two groups? Dr. Condic, are you going to speak? And how about on...? You'll have three. You'll have three. All right, why don't we start with Dr. Condic and then we'll go to someone from UNMC and then we'll go back, and...is that all right with you two? That will be my thoughts. That's fine. [LR219]

SENATOR SCHIMEK: Mr. Chairman, may I ask? It's a half an hour for all three of them together, right? [LR219]

SENATOR ASHFORD: Well, I told them, coming in, they had a half-hour each. [LR219]

SENATOR SCHIMEK: Each? That's another three hours, Senator. [LR219]

SENATOR ASHFORD: No, each side. No, it's an hour together. It's a half-hour each, so that's what we're going to do. That's what I gave everybody as the guidelines. That's what we're going to stick with. So Dr. Condic, then we'll move over to UNMC and then we'll...let's see, it's 2:45 p.m., so at the very latest, 3:45 p.m. we'll be finished. All right? [LR219]

MAUREEN CONDIC: Okay, great, so if someone could come and slap me when it gets to be about 3 o'clock. I don't want to talk for more than 15 minutes. So I had a number of concerns about the things that were testified on by the other gentlemen who spoke to you today. Dr. Rennard was asked several questions about what is the real utility of or the limitations to the existing embryonic stem cell lines, human embryonic egg stem cells lines that are available. And he talked about the fact that the cells change over time, in culture; that they're contaminated with animal products. And although pressed

several times for how this imposes limitations on the ability to use these cells for research, he really couldn't give us any good examples. And the reason for that is there are no good examples. The reality is, the changing of these cells, over time, is due to the genetic drift that I already talked to about, the genetic instability. And that is not something that can be fixed by new stem cells lines, because new stem cell lines are going to accumulate genetic errors and drift and change over time, exactly the way the existing lines will. So this is an intrinsic limitation to the type of cell that we're dealing with. The fact that they are contaminated with animal products, these are (inaudible) concern, but there have been at least three published papers that give relatively simple mechanisms for getting rid of these contaminations. So if it's really of huge importance for the experimental design you have to get rid of these animal contaminating factors, it can be done; it has been done. It isn't really a limitation. The third thing is, there are problems with putting human embryonic stem cell lines into animals that go far beyond any animal contaminations that might exist, the biggest of which is animals see human cells as foreign, and will reject them. That's the major limitation, which is part of the reason why I keep coming back to the fact that working with animal cells in animals is a better and stronger model. Lastly, what I want to emphasize is that the whole idea of going back and forth between model and human cell lines is, of course, true. We do this all the time. But how many cell lines do we need really to do this? If what we're trying to do is pioneer the work, go as far as we can with the efficient animal models, and then check things with human cell lines, this is a very common way of doing research. But we don't need and we don't get any advantage from additional cell lines in doing this. If you look at the case of cancer, there are more than 200 kinds of cancer affecting the human race. The International Cancer Genome Project indicates that there are 786 cancer cell lines, worldwide, that are done, that are used for all cancer research. Less than four cell lines per cancer type. And we all seem perfectly content with this. Why? Because there is actually a disadvantage to going to a new line. People like to work with established lines because then you profit from all the other research that has been done on those lines by everybody else. You don't have to go back to square one and characterize all of the boring basic things about the cell line; you know a lot. You can profit from other

people's research. So research does tend to focus down onto a limited number of cell lines that are well-characterized, that we know a lot about because you don't have to reinvent the wheel every time you get a new cell line. Starting from the very beginning, going through all the basic routine characterizations before you can even do anything with it. And for this reason, the 22 Bush cell lines are responsible for more than 90 percent of all the publications in the embryonic stem cell field, worldwide, and this includes countries that have absolutely no restriction on funding of stem cells. They can make their own stem cell lines, they can do what they want, they can produce as many embryonic stem cells lines as they want, but they don't do that and they don't do it for a very good reason. Because 22 lines are being researched in America; there are hundreds of publications on them; we know more about them. People want to use things that know things about. So even when there are no restrictions, people go back to those same lines. And they do it for good reasons; for the same reasons that we have only 786 cancer cell lines for all the research worldwide. Dr. Crouse made a number of statements that I was concerned about. I'm going to try to decide which are the most important ones. Dr. Crouse repeatedly made the point that progress itself cannot define or cannot be the arbiter necessarily of what we do in science, pointing out that in my own field as spinal cord injury research, we've been working on this for quite some time and haven't cured spinal injury. I apologize to all the patients; I should be working in the lab and not here testifying in Nebraska. But I think this is really an auspicious point: The point is, I do not make claims about curing people tomorrow--I don't. I don't try to tell people this is what is going to come out of our research. Moreover, last time I checked, my research did not raise any great moral controversial issues, and I think it's incumbent upon the people who do raise those issues, who are asking the public to accept things that at least some components of the public find morally objectionable, those are the people who have to justify it. And if they are justifying it by progress, they have to show me their progress. That's my only point. I understand that research is hard and I understand we don't always make great progress, but those are the points that I would like to make. [LR219]

SENATOR ASHFORD: Thank you, Dr. Condic. That's all right. I mean, we can... [LR219]

MAUREEN CONDIC: I'm going to keep going. I've got a few more points yet. (Laugh) [LR219]

SENATOR ASHFORD: I mean, you're not obligated to spend the whole... [LR219]

MAUREEN CONDIC: Yeah, I could. I could talk less, but I'm not sure that's constitutively possible for me, actually. (Laugh) So Dr. Crouse further goes on to make the point that adult stem cells, although they have been shown to benefit many diseases, he notes that some diseases are not on that list, and I find this extremely specious for at least three reasons. First, many of the adult stem cell populations that have been characterized have really only been found for a few years, so this is early days. And I think it's really unreasonable to hold a standard to cell lines that have only been discovered, or cell populations that have only been discovered recently, that they should have cured everything on the planet. Secondly, many of the conditions that he mentioned actually have shown benefit from adult stem cell research, and I'll comment only to spinal cord injuries since this is my field of research. There have been a number of very promising studies using adult stem cells in animal models for spinal injury, showing improvement. So it is not the case that brain injuries and brain diseases are not being treated by nonembryonic stem cells. And mostly, I think this is somewhat hypocritical to claim that adult stem cells be somehow pilloried for not having treated all possible conditions, when, as a way of sort of garnering support for embryonic stem cells that have treated no conditions. You know, if we are going to (inaudible) adult stem cells on the one hand because they have not treated everything, well, don't we have to hold all stem cells to the same standard? Dr. Crouse points out that there are ancillary benefits of doing embryonic stem cell research. For example, he notes that the technique of reprogramming adult cells that we've heard so much about, perhaps one of the most important scientific findings in the last 20 years, that we can take adult

fibroblasts and turn them into the functional equivalents of embryonic stem cells. He points out that the four genes that were required to do this transformation were discovered by the study of embryonic stem cells. What he fails to note is that those discoveries were made in animal embryonic stem cells. So this is exactly my point: We can take an animal model; we can drive it forward very rapidly because we have all of the scientific power. We discovered these four genes in an animal model. And guess what? We're not applying this to human cells to see if we can translate that information that we learned from studying animal embryonic stem cells to a human model. Dr. Crouse also notes that there is this disparity between the funding from the NIH, only a mere $24 million for human embryonic stem cell research, compared to the $500 million that has been devoted by the states, although not all of that has gone to embryonic stem cell research. And I would like to note that I have sat on NIH panels that review human embryonic stem cell research grants for neural diseases. And I can assure you that there is absolutely no bias. And in fact, there is a bias in favor of human embryonic stem cell funding. So the way the NIH works is grants are initially reviewed by a panel of three scientific experts, and they all vote on them. They rank them in decadals, so the top 10 percent, the next percent down. If you are below the fiftieth percentile line, you're considered unscored. And if a single voter votes you above that line, the grant has to be discussed by the full panel, unless you are a embryonic stem cell grant, a human embryonic stem cell grant. Then, no matter how you are ranked by the experts, you must be discussed. So all human embryonic stem cell grants are discussed by the full panel, and when they are not funded, it's not because of ideologues, it's not because of lack of funding, it's not because of Bush restrictions; it's because those grants propose I'm going to get in a Model T and I'm going to drive down a back country road at 15 miles an hour, whereas on the other hand, the grants that they are competing against are driving those Maseratis 110 miles an hour down I-80, and fellow scientists, experts, atheists, hard-nosed people who really don't care about preserving embryos whatsoever, vote the grants down. They vote them down because it's bad science. Not because of Bush restrictions but because the grants proposed cannot compete because the science is not the best way to approach the questions. Fifty people sit on those

panels, and the last three times I've read those grants, 100 percent of each of those, every single one of those 50 scientists voted those grants down; every single one. We haven't funded a single one because it's bad science. Not because I've been brainwashing them; because people don't like to fund bad science. I'd like to close with some remarks or some comments on the comments of Dr. Turpen. Dr. Turpen persists in a very strange definition of what is and what isn't an embryo, insisting that cloning cannot be considered to produce an embryo because there is no fertilization, no fusion of egg and sperm, and there is no unique genome. I hope that we can all agree that that's his definition. However, this raises at least two very interesting questions that I would like you to put to Dr. Turpen if you would. First, by this definition, Dolly the Sheep, the cloning of Dolly the Sheep did not produce an embryo because there was no fertilization and it was not a unique genome. So the only possible thing I can conclude to, was that Dr. Turpen must hold that Dolly the Sheep was simply a very unusual collection of sheep cells; sheep cells that baaed, ate, and produced lambs. So I would like you to ask Dr. Turpen, since Dolly the Sheep was produced by a process that did not produce an embryo, is she really just a collection of sheep cells that happens to have this Frankensteinian animation associated with her, or was she a sheep? Secondly, Dr. Turpen goes through a very lovely description of what happens during the initial stages of human development that we...the zygote divides to produce totipotent cells. There is some debate about how many cells preserve the ability to make a fully intact individual. But the fact that there have been born identical quadruplets would suggest that we can divide those cells up to the four-cell stage and still get a fully formed individual out of it. But in the case of identical twins, when those cells divide at the four-cell stage, there is no union of sperm and egg there, and there is no unique genome. So by both of the criteria that Dr. Turpen defines as the criteria that give us an individual embryo, an individual person, that didn't happen. So I would like to ask Dr. Turpen, which of those quadruplets, which three of them are not human beings? You know, we could give one as the product of union of sperm and egg. Well, what about the other three? Clearly, unless we're going to deny the humanity of identical twins, we have to say that human beings can come about by processes that do not involve fusion

of sperm and egg and a unique genome, because in the case of identical twins, they are even more identical than a cloned individual would be. They actually share even mitochondrial DNA, so they're quite identical, but they are nonetheless distinct human beings. And I think I will stop there. If there are any questions? [LR219]

SENATOR ASHFORD: Just one last one. Is there not agreement amongst all of you that the pluripotent nature of embryonic stem cells, whether...if they're...assuming they could be created from some other source other than the destruction of an embryo, do have value in research? [LR219]

MAUREEN CONDIC: As I tried to say in my presentation, I think I even had a slide to this effect, I am not an anti stem cell biologist. I think embryonic stem cells are extremely interesting. I think pluripotency is a fabulous and fascinating scientific topic. [LR219]

SENATOR ASHFORD: And it's used. [LR219]

MAUREEN CONDIC: And it's used, or it can be used. It can become a component, understanding the properties of pluripotent cells can become a component of understanding biology overall, the same as studying fruit flies or all the other crazy things that scientists study. [LR219]

SENATOR ASHFORD: Did you accept...in the discussion about the liver, because of the nature of the liver that that pluripotent cells have a...that you can see how that would progress to a greater stage in the liver than, for example, the lung? Does that make any sense to you? Do you...? [LR219]

MAUREEN CONDIC: I apologize if I am going to mischaracterize Dr. Rennard's point of view. I think he was simply pointing to the fact that the liver research may be closer to a clinical application than the research in the lung. I think, again, the jury is still out in

terms of whether or not...I mean, the proposal or the description of the research in the liver that was given suffers from all of the concerns that I tried to lay out this morning. Yes, if we can take embryonic stem cells and turn them into bona fide functioning liver cells that work to replace liver function, it may be a way of treating children or other patients who have metabolic diseases of the liver, so their liver is there and intact but not functioning correctly. By replacing those cells with now genetically normal cells that can function correctly, but that "if" is subject to all of the caveats that we discussed this morning. If we can... [LR219]

SENATOR ASHFORD: Okay. That's a fair answer. I mean, I'm not trying to...I understand the caveats. Right; okay. [LR219]

MAUREEN CONDIC: Right. But it does not mean that research is any closer than any other research. [LR219]

SENATOR ASHFORD: Okay. Thanks, Doctor. Thank you very much. Thanks for coming. Dr. Crouse? Is Dr. Crouse here? Does Dr. Crouse wish to speak? [LR219]

DAVID CROUSE: (Exhibit) Excuse me. I have a day job. Again, I am Dr. Dave Crouse. I think you know that already. I want to come back to a few points. I'm sorry I wasn't here to hear what has happened in the intervening period, and some of this may have been covered, it might change a little what I would have said. But let me make a few major points anyway. I think we have tried to present and agree that adult stem cells from sources like bone marrow and blood and core blood are very valuable, and may have therapeutic implications that we don't have a clue about today, and they should be pursued vigorously with a great deal of effort by scientists across the country and the world. We simply take exception with the fact that that should exclude any other sources of stem cells; that we need to put equal efforts into the variety of sources that are used. Research doesn't work that way. You compare things. You look at the different outcomes from different products and see which ones provide the best outcomes or

potential outcomes that might have a clinical use. I don't think any of us in the stem cell world believe that adult stem cells are going to cure or be able to be effective therapies for everything. But I equally don't think that the embryonic stem cells will be able to cure and be effective therapies for each of them. But we need to do the research to be able to make out those differentiations. And it may take a long time to sort that out over the period of time. The animal models have actually proven to be quite promising. I didn't make a point earlier this morning, but there have been applications of animal embryonic stem cells in animals models that have been effective. Yes, there have been occasions of tumors, but there are other papers in which there have not been occasions of tumors, things like that. It's not an all or none. Dr. Condic, herself, said this is not black and white; there's parts of grey. And, yes, there are areas that right now we don't know the answer. And certainly there have been successes. There have been treatments of spinal cord injuries in rats, not only with embryonic stem cells from mice, but also from human sources, that were differentiated into normal cell types to treat spinal cord injury in rats, and those have shown some success yet there. We simply state that the books are not closed, that embryonic stem cells or somatic cell nuclear transfer are ineffective. And if there is legislation that prevents people from doing that, then we simply won't know. We won't participate in that activity to find out, and I think it's important that we have the opportunity to particpate in that. I don't particularly have the same crystal ball that some people have. I can't predict the failure today means that it will never work. I can't say that because we've not been successful with embryonic stem cells to present, that we will never be successful with embryonic stem cells or that the embryonic stem cells have insurmountable difficulties. I simply don't know that. I also can't do the numbers quite the way Dr. Condic did this morning. I don't know about statistics, but sometimes I know that they can be quite misleading. You can derive almost anything you want if you put the numbers together correctly. The way we normally test stuff like this is by asking questions, and science would call those hypotheses, and we test those hypotheses. And we derive, through the process, often complemented by peer review, by the people who look over our shoulders, and say, are you doing this in a scientifically sound way and an ethically sound way and a fiscally responsible way, and say, are you

doing the research correctly? We fully expect that and we invite that. We think that the scientific methods should be applied. We should test different things. And again, legislative inhibition in this area would actually block that pathway. I think...I understand you are alternating, so what I'll... [LR219]

SENATOR ASHFORD: We are, and we don't have to take...I mean, we're just trying to get out the main points, Dr. Crouse. [LR219]

DAVID CROUSE: Well, let me, because I did miss part...I maybe should give you the opportunity to ask me some questions, and let it go from there. [LR219]

SENATOR ASHFORD: Does anyone have a question of Dr. Crouse? I just have one procedural question. If an application for a grant is made to NIH, or an embryonic stem cell research grant of some kind utilizing stem cells that are in the 22...like some of the stuff you are doing now, is that...? That is limited to those 22 stem cell lines... [LR219]

DAVID CROUSE: It's absolutely limit to those. [LR219]

SENATOR ASHFORD: So when there is a proposal made to NIH, it's for utilizing those 22? Potentially? I mean, that's the... [LR219]

DAVID CROUSE: Right. Actually...I mean, it's a little...we say 22... [LR219]

SENATOR ASHFORD: I'm sure that's a very simple way to say it, but go ahead. [LR219]

DAVID CROUSE: Yeah. I was going to make a point that hasn't been made, at least not while I was here. The actual number of cell lines that are listed in the NIH bank, is, I believe, 78. Unfortunately, a large number of them are either not available or no longer functional or otherwise compromised and not used. So the number that's actually

utilized is in the range of 22. If you actually look at the publications that would come out those cell lines in the past few years, it's a much smaller number than that. It might be as low as 6 to 8 that are actually utilized. The reason...there are several reasons. One, is some of the are compromised and no longer work; they didn't come out of the freezer the way they should. And there is a problem with all those cell lines that goes back to the very beginning of their derivation. In the very early days of this particular science field, embryonic stem cell lines were derived by utilizing what we call mouse feeder layers. Feeder layers are kind of a fertilizer for the cells to grow on. They're nonfunctional cells that are prevented from dividing themselves, and we use them as a feeder to grow the embryonic stem cells. So that all those cell lines, every one of them, has contamination from mouse products. So there is no expectation, no hope, no reason to think that any of them would ever be used therapeutically. I want to make that really clear. On the other hand, the 400-plus lines that have been derived since then, many of them by very fine laboratories across the country, have been made available to other people who are not utilizing federal funds and are not necessarily all derived that way. Some are derived on feeder layers and some are not. So the technology change is also applied to embryonic stem cells. The embryonic stem cells that are available today are probably better than the ones that were... [LR219]

SENATOR ASHFORD: So there are 400 lines out there. [LR219]

DAVID CROUSE: At least 400. Four hundred was the last tally I saw. [LR219]

SENATOR ASHFORD: And you would...you theoretically could be utilizing those or would be utilizing those if the Board of Regents would allow you to do so? [LR219]

DAVID CROUSE: If the Board of Regents did, we couldn't do it with federal money. Federal money is restricted to the registry-approved lines, which is a smaller number. [LR219]

SENATOR ASHFORD: Or you could use other money. [LR219]

DAVID CROUSE: You could use other funds; yes, you could. [LR219]

SENATOR ASHFORD: Okay. Thanks. Any other questions? Thanks, Dr. Crouse. [LR219]

DAVID CROUSE: Okay, thank you. [LR219]

SENATOR ASHFORD: Okay. [LR219]

JOHN SAFRANEK: John Safranek. What I would like to do is try to advance this debate. We all have...we have busy lives. We all have things that we could otherwise be doing. We've been dealing with these issues for several years, and the problem that I see that we're...the reason we continue to deal with this, is because the ethical issue has never been resolved. And my point is, if we would address the ethical issue, we could hopefully get over this debate. If the University of Nebraska Medical Center can convince us, if they can tell us why the cloned individual should not be protected, we wouldn't be down here in front of you; we wouldn't be taking up your time. The ethical issue would fall off the map. We wouldn't need hearings. We wouldn't need to keep occupying everyone's time. We could resolve the whole debate. I think most of the people on our side would be willing to drop the issue entirely, which would be great for the Legislature and everybody else. [LR219]

SENATOR ASHFORD: How would we do...? If we drop the issue of what? I'm sorry. I'm out there. There's an offer there, and I was trying to...it got my attention. [LR219]

JOHN SAFRANEK: Absolutely. And this is the point. The point is, we go through the hearings and we talk all about the science; we talk all about stem cells. And we go on and on. And the fundamental issues...all our side wants answered, is why isn't the

cloned individual worthy of protection? The whole argument comes down to Dr. Turpen's definition of a human...of the product of cloning. And our point is very simple: Look, he may say it's not an embryo, but that thing is a human being. It's a human life. Dolly the Sheep, was a sheep, okay? By Dr. Turpen's definition, Dolly the Sheep wasn't an embryo. Okay? Nevertheless, she was still a sheep, okay? Is Dolly the Sheep a sheep? That's the question for Dr. Turpen. He claims that if you clone something, if you clone a sheep, because it doesn't take place sexually--it took place asexually through cloning--it's not a sheep; it's not a sheep embryo; it's not a sheep life. The same thing with the human being, okay? We usually reproduce sexually. Dr. Turpen's definition is that we do...since cloning is asexual, therefore we can go ahead and experiment on it. Okay? My point is, that cloned product is going to grow up into...it would grow up into a human being. Has all the characteristics of a human embryo. It's a human being, just as Dolly was a sheep embryo. She grew up to be a sheep. Dolly was a sheep her whole life: as an adult, as a baby, as a lamb, and at one day of cloning. That's why she was a sheep. We call her Dolly the Sheep because she was a sheep. Okay? [LR219]

SENATOR ASHFORD: She didn't 'do very well though, I mean. [LR219]

JOHN SAFRANEK: She bore six children. She lived, I think half the expectancy. There were some genetic problems. I pointed out human beings have genetic problems, but it doesn't make us any less human. Okay? The scientists will tell you that she was a sheep. We all know that. As I said, if it looks, walks, and quacks like a duck, it's a duck. Okay? If it has the genetic makeup of a sheep, which everyone acknowledges Dolly did, if she acts like a sheep, eats like a sheep, bears lambs, we say she's a sheep. Okay? That means she was a sheep her whole life. She didn't suddenly become a sheep. She was a sheep embryo. She was a... [LR219]

SENATOR ASHFORD: I think your point is well-taken. I mean, I think we get the sheep... [LR219]

JOHN SAFRANEK: Okay. [LR219]

SENATOR ASHFORD: I mean, we get the...I mean, I'm not...I understand. [LR219]

JOHN SAFRANEK: No, no, no. No, I appreciate this; I appreciate this. And it's the same thing with human beings. His argument is if you reproduce asexually, okay,... [LR219]

SENATOR ASHFORD: I think there might be some concern or dispute, Doctor, between, if I might, between three, two, three, five cells, in the first day or so of...versus a human being. I think that's where...I'm not...I'm suggesting you might have disagreement there on an ethical grounds. I mean, I...we may not agree...or all of us in the world may not agree you're right, but we can understand what you're saying. [LR219]

JOHN SAFRANEK: Right. And, see, Dolly the Sheep, here is my question: Was Dolly the Sheep, did she have a sheep life right after cloning? Well, of course she did, because she was a sheep her whole life. Okay? It's the same thing with human beings. And so my point is, look, let's advance this debate. Let's ask Dr. Turpen those two questions. Dr. Condic brought up an interesting point. When it comes to identical twinning, initially you have fusion of the egg and sperm, okay? But the next...the twin or in the triplets are reproduced asexually. The initial one was produced sexually; the next one is produced asexually. The cell just divides off and then grows up into that human being. And he might say, well, it really was a product of fertilization because an egg and sperm took place initially. No, that created the first one, but those other ones were reproduced asexually, okay? Well, by his definition, if they reproduced asexually, they're not a human life; they're not a human embryo. Which means what? We can experiment on them? We can destroy them. [LR219]

SENATOR ASHFORD: Well, I mean Dr. Turpen can defend himself, but I think he... [LR219]

JOHN SAFRANEK: All I'm asking that you ask those questions that Dr. Condic brought up, and that will advance the debate, at least the way we see it. And that's all I'm trying to do. [LR219]

SENATOR ASHFORD: No. And I appreciate your point. [LR219]

JOHN SAFRANEK: Okay. [LR219]

SENATOR ASHFORD: Any other questions of Dr. Safranek? [LR219]

SENATOR LATHROP: I'm kind of, you know,... [LR219]

SENATOR ASHFORD: You're kind of warming up to a question, I think. [LR219]

SENATOR LATHROP: I am. Because while you're talking about the sheep, I'm wondering, honestly, if Nebraskans for Ethical Research, the group that you represent or that you speak for, are right and true, then doesn't this debate take us into in vitro fertilization, whether that's right, or...? If we ban...? If this is wrong, isn't it equally wrong to be involved in creating these embryos in the lab for families that can't have children? [LR219]

JOHN SAFRANEK: I would say this. We don't...as far as I know, I don't think we have any position on this. I think that the position I know that Ben Nelson has talked about, and Germany has, they say if you fertilize those, they should be implanted. And so that protects human life, and so that would be my response to that. If you're going to create new human beings, then we should be...oh, let's put it this way: At a minimum, we should not allow scientists to destroy them, okay? If they're human beings...and, again, we're just following where the reason takes us here. Okay? If they're human beings,... [LR219]

SENATOR LATHROP: And that's what I was thinking while you were talking about the sheep is, where does reason take us in this discussion? Let me ask you this question, because this has not come up today, and we're approaching the end and I hope you are the person to answer this question. But at what point does the ethics debate weigh...these eggs get essentially incinerated, or these embryos get incinerated. Do we not take that into account? Do we say that that's a better end to their existence? [LR219]

JOHN SAFRANEK: If they're human beings, the bottom line is, we can't kill innocent human beings, even it's going to lead to research development, even if it's going to advance the scientific research; even if it's going to save lives. [LR219]

SENATOR LATHROP: You are a medical doctor, though, right? [LR219]

JOHN SAFRANEK: Absolutely. [LR219]

SENATOR LATHROP: What's your practice? [LR219]

JOHN SAFRANEK: I do emergency room medicine. [LR219]

SENATOR LATHROP: Okay. Well, this isn't something foreign to you. People aren't adopting these embryos. I mean, it's not like folks are saying, I feel so strongly about this I'm not going to have my own child; I'm going to have an embryo implanted. So do we leave them in the freezer forever? [LR219]

JOHN SAFRANEK: I would say, with all human life it's better to allow it to die. Actually, we don't know what's going to eventually take place with in vitro fertilization with these leftover embryos; we really don't. But let's just say that those are your two choices: to kill them or to allow them to die. Again, what do we do with all other life? That's the

question: Is it a human life? If it is, treat it like human life. [LR219]

SENATOR ASHFORD: Doctor, can I just follow up, because...if I might, because this is a...I think we're getting to a real key issue here. At least in our state, and when I was here in the Legislature we did this; we gave individuals a choice as to what could be doing with their organs. Now, I realize someone has died when that occurs, but that person is give a choice over how those organs are going to be used. If they're going to be used for research, they can so denominate that. I guess, you know, choice enters into that. [LR219]

JOHN SAFRANEK: No, see, I love your analogy because I think that's exactly the case. This shed lights on the issue. [LR219]

SENATOR ASHFORD: I mean, where does choice...? I guess my question is, do you wait until that person is dead, or...? [LR219]

JOHN SAFRANEK: Absolutely. Absolutely. We don't go...we don't take organs out of human beings that are alive if you're going to kill them. Why? [LR219]

SENATOR ASHFORD: Well, I'm making that analogy, not...I am making it more not to something that's going to be destroyed. Senator Lathrop's point, where if these embryos would be destroyed for whatever reason, that...and one of the reasons, it's always been explained to me, is that the mother, the parents, whatever, don't want to pay to have those embryos maintained, so they're destroyed. Now, I don't know if that's the way it always works, but can't that parent have a choice over...as opposed to destruction, that that embryo can be used for research? I mean,...no, you'd say no. [LR219]

JOHN SAFRANEK: I would say no. Absolutely...I mean, we have to...my point is, you know, these are the fundamental issues in terms of how we treat human life. [LR219]

SENATOR ASHFORD: No, I get you. They're fundamental. [LR219]

JOHN SAFRANEK: And I would say with the transplant, we can't kill somebody who is living to get their organs, even if it's going to advance science or save lives. [LR219]

SENATOR ASHFORD: I understand there's a difference. [LR219]

JOHN SAFRANEK: The same thing. [LR219]

SENATOR ASHFORD: I understand there is a difference, but I... [LR219]

JOHN SAFRANEK: Okay. But, you know, let's ask those questions and resolve that definition, and that's going to advance the debate. [LR219]

SENATOR ASHFORD: I appreciate your point, Doctor, and I wasn't...I'm just... [LR219]

JOHN SAFRANEK: No, and I appreciate the question. Senator Schimek. [LR219]

SENATOR ASHFORD: Senator Schimek. [LR219]

SENATOR SCHIMEK: Yes, thank you, Mr. Chairman. I'm trying not to ask questions because I think it's been a long day here for everybody. [LR219]

JOHN SAFRANEK: Sure. I appreciate that. [LR219]

SENATOR SCHIMEK: I have to follow up on your discussion, and that is with people who have serious diseases, those people are alive. They may be a six-year-old child or they may be an 80-year-old man, but they are alive. And some would say that what you're suggesting is to say to them, well, just go ahead and die. And we don't give them a choice about whether they can make use of research that might be developed. And, I

mean, I think you can argue both sides of this from a prolife perspective, and that is preserving life that's already viable and out there. [LR219]

JOHN SAFRANEK: I appreciate that question. And, you know, I see people suffering like this everyday in the hospital, and it's moving and it's compelling. But the bottom line is, we cannot sacrifice the principle that we need to protect human life. [LR219]

SENATOR SCHIMEK: But you are. [LR219]

JOHN SAFRANEK: Now, let me... [LR219]

SENATOR SCHIMEK: You are. [LR219]

JOHN SAFRANEK: Let me continue. [LR219]

SENATOR SCHIMEK: Please. [LR219]

JOHN SAFRANEK: Okay. When you say...let me ask you this: Would it be appropriate, in that 80-year-old who is dying, anywhere close to death, to use his or her organs if this is going to save a lot of other lives? Of course not. [LR219]

SENATOR SCHIMEK: If he so chooses, yes. [LR219]

JOHN SAFRANEK: Well, I don't think we even allow that. If you went in and said, I want to transplant my heart, take it out and transplant into somebody else, they won't do it because they're killing you. [LR219]

SENATOR SCHIMEK: Well,...oh, yeah, right. [LR219]

SENATOR SCHIMEK: But you are. [LR219]

JOHN SAFRANEK: Okay. And so it's only after the human beings have died that we harvest their organs, okay? So we're not...you know, the bottom line is, this principle protects that 80-year-old. We're protecting that 80-year-old and six-year-old because we're saying, your life cannot be violated. It doesn't matter if you are vulnerable, it doesn't matter if you're weak, it doesn't matter is nobody care about you, nobody even knows about you, like an in vitro embryo. None of those things matter. Why? Because you are a human being and we do not take the lives of human beings, whether you're 80 years old and destined to die in a day, or whether you are one-day-old created in vitro fertilization embryo or a cloned being. [LR219]

SENATOR ASHFORD: So the answer then is to keep all of those embryos frozen and alive. [LR219]

JOHN SAFRANEK: Yes. [LR219]

SENATOR ASHFORD: I mean, technic...not to... [LR219]

JOHN SAFRANEK: I would say, maybe we take...I mean, this is a question that Ben Nelson brought up. I mean, do we need to consider something like Germany has...? [LR219]

SENATOR ASHFORD: Where is Ben Nelson when we...? (Laughter) [LR219]

JOHN SAFRANEK: No, do we need to consider some legislation where we say we're going to implant all of them and respect the lives? [LR219]

SENATOR ASHFORD: I mean, I'm...just so you know, I'm very bothered by the fact...not by anything you're saying, because I think it's stimulating discussion, but I am...on the embryonic side, I am bothered by the part about the destruction of these

embryos, and I get what you're saying, but it is very bothersome to think that possibly those embryos could be used to positive ends, and then...but they're destroyed. I mean, to me, that's a tough one. But...so that's one of my tough ones. I mean, maybe that's easy for you, but for me it's tough. [LR219]

JOHN SAFRANEK: Right. Because the way I see this, there are other human beings like those embryos that are going to die, but we don't allow them to be killed. [LR219]

SENATOR ASHFORD: Yeah. And I know that's not a somatic nuclear cell transfer issue, but it is one that's bothersome. But, okay. Thanks, Doctor. [LR219]

JOHN SAFRANEK: Thank you. [LR219]

SENATOR ASHFORD: Does anybody on the other group...? We have, theoretically and actually, we have 25 more minutes--not only theoretically, so. [LR219]

STEVE RENNARD: Thank you very much. I will be brief, I hope, and I'll try to...but I'm going to take the discussion in a slightly different line. First, I'll say that I was very happy to see Dr. Crouse return, or otherwise I would have had to have given his remarks, as well. And I'll point, as a lung physician, that his shortness of breath was because he was running so hard to get here, which made me very happy. I hope from this (inaudible) for some concern. But I am a physician and I take care of patients. I do basic research, as I described before. And I also do clinical research, and it's in that context that I would really like to address, very briefly, some of the points that were raised by Dr. Condic. First, she mentioned that there is enough cell lines. And I think that actually depends very much on the specific use. In the field in which I work, if we go to publish a paper and we describe some feature of, for example, the cells from the lungs of a patient with emphysema, and we have a single cell line, the paper would not be considered by any of our premier journals because it's very unclear that those results are generalizable. The number of cell lines that would be required for any specific publication is actually

increasing rapidly as people now want to see statistically meaningful comparisons to other cell lines. And so the number of cell lines available for any specific purpose is likely to increase as the demands on the information become more rigorous. The second point I'd like to address is Dr. Condic made some calculations based on how many people would have to be donors for eggs if this research were to be conducted and lead to production...(recorder malfunction--some testimony lost).....which doesn't exist, making a whole variety of assumptions that the yields of various things that would come in, and whatever, based on current knowledge. And I think that there's really...that that particular speculation is based on a large number of assumptions, and it really isn't, doesn't have very much face validity. But even if it did, it represents a hypothesis, and, in fact, the scientific method is that you don't just accept a calculation. It's a hypothesis; it could be tested. For example, how many cells, if they were derived that way, to be used for it, that would require actually new experimentation to provide information to find out exactly what is required, and to reject a series of scientific investigations based on a priori assumptions is something that I find very difficult to understand. Finally, the issue that I would like to address is the resource allocation one. And with this, I actually completely agree with Dr. Condic's comments, but completely disagree with her conclusions based on the way the NIH works. Is the NIH commitments to embryonic stem cell research is actually rather modest; $24 million seems like a lot, and frankly, it would be if I actually had it. But for the various kinds of research that we do, it's an extremely modest investment. To develop one new therapy with a drug, for example, the current estimated costs for development is about $750 million, so it completely dwarfs that kind of expenditure. So the concept that a $24 million investment is going to lead to a novel therapy seems completely inappropriate with the amounts of resources committed. Secondly, the way the NIH vets research by peer review, was accurately described by Dr. Condic, and the fact, the best science is the science that goes forward. The best science that's likely to lead to insights in the way stem cells are regulated and the way adult stem cells, in fact, could be used, is going to be research that's going to bring to bear on the problems the most information available. And so as Dr. Crouse pointed out, we certainly advocate the use of adult stem cells for research purposes and

potentially for the development of therapies. We advocate the use of nonstem cells, such as differentiated cells, such as the liver cells that Dr. Fox has used previously, or the lung cells that we study in our lab, in addition to the stem cells, both adult and embryonic, that we study. Only by putting together all of these things do you, in fact, have the most competitive grants. And, in fact, those are the grants that are the most likely to be most successful because that would be the best science. And so the peer review process at the NIH, in fact, is going to favor the research that's best able to address the key questions, and that's going to be the research that brings the most tools to bear on the problem. And to hamper that research by prohibiting or banning certain lines of investigation is only going to compromise that, only going to compromise that to further. And finally, much has been said here about levels of oversight, and I have, as an individual who does human studies research, who asks people to volunteer to participate in experiments where there are uncertainties and potential risks, this is research that clearly needs to be regulated at a whole variety of levels. We regulate it locally within our institution, we regulate it at the state. And, in fact, for embryonic stem cell research, this is also regulated at the level of the NIH, which...and the mechanisms for that have been discussed. Thank you very much. [LR219]

SENATOR ASHFORD: Thanks, Doctor. Any questions? Thank you very much. [LR219]

SENATOR LATHROP: Do you mind if I ask a couple? [LR219]

SENATOR ASHFORD: No. A couple is good. No, I'm kidding. [LR219]

SENATOR LATHROP: I'll ask one question, and it will be broad enough and it will take him 45 days to answer it. We are, as a body, taking up the question of regulation of this activity. If we look outside of the Nebraska Legisalture, where else is this being regulated? For example, the Board of Regents has something to say about it. Are there organgizations that regulate this type of research, nationally? [LR219]

STEVE RENNARD: Dr. Crouse, I'm sure, has more expertise to be able to answer that question than I do. But, in a nutshell, is, yes, there are others organizations that have provided some types of oversight for regulating the various research. So, our institution, the regulatory pathways is there is a specific committee that has to approve all embryonic stem cell research. And as Senator Ashford has pointed out, we have to make applications to that committee at the time we would make an application for a research project, whether it would go to the NIH or any other funding agency. In addition, we have to comply with all of the regulations that have been established by the Board of Regents which defined sort of the scope of what we can do. In addition, if we apply to specific funding agencies, they can have their own sets of regulations. So the NIH has its own set of regulations that would, of course, pertain to NIH-funded research. I'm certain that the same would apply for other types of regulation. The other kinds of regulations, for example, that have been mentioned today that have come from various other scientific organizations, have been proposed. It's my understanding those are in the way of guidance rather than in regualtions with which we need to comply. I'm speaking now personally rather than for the university. But make no mistake, research that's conducted on these types of things needs to be done in an open way and it needs to be subject to public review, and at a basic principle these things that are offered as guidances are ones that I personally take very seriously. I suspect that everybody else who does this at our institution, does as well. And so we take those guidances extremely seriously, even if they don't have the effect of mandatory regulations. [LR219]

SENATOR LATHROP: So the regulations now come at the NIH if you go to them for funding, otherwise it's just guidance? [LR219]

STEVE RENNARD: If we go to the federal government for funding, then we have to deal with the federal government's regulations. We also have regulations that come from the Board of Regents with which we are obliged to comply. [LR219]

SENATOR LATHROP: Thank you. [LR219]

SENATOR ASHFORD: Senator Pirsch. [LR219]

SENATOR PIRSCH: Other than the federal funding through you said...is that primarily NIH? Or who's the federal funding source? Is it geneally kind of dispersed or is it generaly one or two sources, or...? [LR219]

STEVE RENNARD: Okay. So other are other sources of funding for biomedical research at the federal level other than the NIH, although the NIH is far and away the largest source of such funding. There is funding for biomedical research, for example, from the Department of Defense; much less from the National Science Foundation. I don't know if either of those organizations fund any human embryonic stem cell research. I know that I personally have never applied to any organizations other than the NIH to fund that part of research. But, yes, there are other entities within the federal government that could potentially support that. [LR219]

SENATOR PIRSCH: Are there other nongovernmental sources of funding, foundations, etcetera that do within (inaudible)? [LR219]

STEVE RENNARD: Oh, yes. And, in fact, if they are nonfederal government funding sources, then they need not comply with the federal mandates on the restrictions for the things. And this has been the source of many of the cell lines, for example that Dr. Crouse mentioned of those 400 cell lines, many of which are easier to grow, and so forth. [LR219]

SENATOR PIRSCH: I see. [LR219]

SENATOR ASHFORD: Thank you. Thanks very much, Doctor. We have 15 minutes, Dr. Safranek, and then one other person from...Dr. Turpen, are you going to speak, as well? And that will be it, so let's try to wrap it up in 15 minutes. [LR219]

JOHN SAFRANEK: I would like to start off just by saying, I think when we're done here, if any of you need a ride back to Omaha, is there an extra seat in the Maserati? I think there might be. I also want to correct something I said previously, and perhaps that we have done. We're always referring to UNMC as somebody pointed out to me in one of the breaks; they didn't appreciate that I was referring to them as UNMC. UNMC is not a monolith on this issue, and were you to be willing to protect the names of the individuals testifying, we could have brought individuals from UNMC up here to testify on our behalf. It wouldn't surprise me in a prolife state like this, if you could find as many students and other technical people at university who would be on this side of the room, or else they would be on this side of the room. We're talking about a particular stance which is promoted from the top of UNMC and obviously not by UNMC universally here. We come to the end of another debate or near it, and do you feel as though we're really any closer to any substantive issues here? We've brought up not only practical issues which we have engaged on, but a variety of ethical issues, virtually none of which we've engaged on. I would like to spend time on just a couple of these. One is your concern, and this comes up over and over again, on the utilization of embryos which present as surplus embryos unused by the original parents, and what's to be done with them. Although we talked about them being destroyed, actually by and large they're just left to die. Many of them are just completely, little by little, over time, unusable. Some IVF facilities actually bury them. They have a formal burial service. There is a survey done on what happens to these embryos, and there are facilities that have a formal burial service where they take them out and put them in the ground and say a prayer over them. And so a variety of things are done with these, and there is obviously no harm whatsoever in just letting them die. All of die whether we want to or not. There is no moral harm in that. It's a tragedy; it's a part of the human condition. There is no evil in it. So, in addition, every day we have patients dying in front of us, with corneas, kidneys, skin, organs which could be used. They die without donations. This is a tragedy in a way. We don't view it is a moral tragedy. It's too bad. We don't say the patient is wrong for not donating. We don't force them to donate. We let them die. If they choose to

donate, it's a wonderful thing; somebody benefits from it. Embryos, obviously they have no choice. They are individuals. They have nothing to say about it. Like the vast majority of us, and of our patients out there who die without donating anything, they die; they pass; that's the end. It's not a tragedy. It's what happens. And I don't think that to allow in vitro embryos to die is necessarily evil. To say they died; we didn't kill them; we didn't use them; we just let them be. There is nothing wrong with this. This is how we handle deaths of adults, as well. Finally, we are faced with the moral issues here. And I would just like to cap for you what I see as university's ethical views here over the past two years. When the debate was on the use of the aborted fetal remains, they said it's dead already, regardless of whether they had any...felt any complicity with the abortion, it's dead already. Then we came to the issue of purely embryonic stem cell research, not cloning. And the argument by university, Dr. Rosenquist had a letter to the editor just recently, and Harold Andersen puts out the same issue: they're going to die anyway. There is no harm in letting them die anyway. There is a harm in actually killing them, saying, no, it's better off to kill them to destroy them for stem cells, than to let them be. It's a principle with which we disagree. Finally, when we come to cloning, which is the immediate issue for the bill in the Legislature here, the argument cannot be, it's already dead, and it cannot be, it's going to die anyway. This is an embryo that's actually created for the express purpose of its destruction. The university's take on this is to get out of this, it's not really an embryo. It is an embryo. Let's have a frank discussion on what we should do with that. Or let me give me a more straightforward example. Suppose university wanted to do embryonic stem cell research and needed regular embryos created by fertilization. Would it be wrong, university, to hire young Nebraskans to donate eggs, to have them fertilized at a local clinic, specifically so that they could be destroyed for the sake of developing embryonic stem cells lines? Would that be wrong? If it would be wrong, tell us why it would be wrong. If not, tell us why not. [LR219]

SENATOR ASHFORD: Doctor, I'm not going to...this is not to cut you off, but we've got about seven and a half minutes left. I'm going to give that... [LR219]

JOHN SAFRANEK: I'll leave it at that. I think that there are substantive issues here, and examples that can be brought up that define the moral issue that we could talk about and that would clarify university's position. Instead, we're left with a muddled view of, which has basically been no position at all. Research, whether it takes the life of an embryo at any stage, regardless of how that's been derived. So let me...I'll stop there. [LR219]

SENATOR ASHFORD: Yes. Good. Okay, thanks. Dr. Turpen, seven and a half minutes. [LR219]

JIM TURPEN: Well, first off, I would like to thank the senators, all of you, for having this interim study for giving both the scientific community and the ethical community, if you will, the right to come before you and present their points of view. I think it's a very important debate, and I think you're doing the right thing, seeking all opinions to help you as you make your decisions. Let me first reiterate that the university's scientific community worldwide is in opposition to reproductive cloning. So this is one place where we clearly can find common grounds. There is no moral, scientific, ethical, legal reason that we should ever go down that pathway; that we should ever attempt to clone a human being for reproductive purposes. In order to realize that potential, that cloned human being has got to be implanted into the wall of the uterus. And so another place where we can reach common ground, I think, would be, and have safeguards that would prevent the implantation of any of the products of somatic cell nuclear transfer. And in the NIH and NSF and International Society for Stem Cell Research guidelines, there are specific prohibitions for allowing these products of somatic cell nuclear transfer to go beyond 7 to 14 days without being placed in a dish. The second thing I would like to point out, once again my definition has raised some concern that has been brought before you. I need to point out, I hasten to point out, that's not my definition. That is the definition of the National Institute of Health, that is the definition of the National Academy of Sciences, and that is even the definition of religious bodies. And the reason

that I adhere to that definition and the reason I think that definition is so important is because we are talking about human beings. And I think what we talk about when we're getting to the point of fertilization, is this what does it mean to be a human being. We don't talk about cattle beings; we don't talk about sheep beings; and we don't talk about mice beings or mouse beings. We talk about human beings. Something special about humans that comes about at the time of fertilization: the union of the egg and the sperm. The argument has been brought up that I must respond to concerning twins. Frankly, this is a disingenuous argument. They begin by fertilization. It is a biological event that happens post-fertilization. Twinning occurs in families, so there is a genetic basis for twinning. To say that by using the definition of fertilization I am denying being or humanness to twins is really pretty far-fetched. But I would like to point out something else that comes from the discussion of twins. And what twins show us is that individuality is not imprinted at the time of fertilization. If we have twins that arise at the two-cell stages, we have two individuals, so individuality has happened there. If we have twinning that occurs at the four-cell stages, we have four individuals. So individuality cannot be imprinted or cannot be put into to the developing human until the four-cell stage. We even have examples where twinning occurs after implantation where twinning occurs between 7 and 14 days. So when twinning occurs under those circumstances, it's not until 7 to 14 days when that twinning takes place that we could say the individuals have been invested with their individuality. What that tells us is that the innercell mass of the blastula stage is not the stage when individuality is imprinted into the developing embryo, that this under certain circumstances can happen much later in development. That is addressing the whole concept of what do we mean when we talk about being, and a human being. I have five children. Two of them were conceived the old-fashioned way, and three of them were conceived with the aid of assisted reproductive technology, a technology that required years of painstaking research to perfect, research that was opposed by many of the groups represented here today. To assert that a skin cell from my arm and a collection of proteins and singling molecules, molecules with no moral status of their own, are the moral and ethical equivalent of my children, is difficult to comprehend. As a scientist, I have profound

reverence for the zygote and the conception of a genetically unique individual by the process of sexual reproduction. This event represents the cornerstone of all of biology. Perhaps we should consider the proposition that those who assert otherwise are actually the ones who are devaluing human life. Thank you. [LR219]

SENATOR ASHFORD: Thank you, Doctor. Thank you all very much. Let me just say...thanks, Dr. Turpen...if I might, this concludes the hearing, but let me say that I...in the, I guess going on ten years that I've been involved in the Legislature, I've never been involved in a hearing that has, both from the standpoint of my colleagues in the Legislature on this committee, and those who spoke today, have done more to...(recorder malfunction). [LR219]