Bio-medi English

Stem cells

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[00:00]

[00:30]

So today, just some basic information about stem cells, I don't want to have difficult, make it difficult for you guys.

[00:41]

So, I think it is pretty basic information today.

We'll be, ah, we'll be in online, little online test we'll take.

Very easy.

Umm, and we're going to be talking about different types of stem cells.

Where we, where you find stem cells.

Maybe you already know this, this, a lot of this material.

And why stem cells are such an important part of biology today.

Umm, you can see the title 'Future Biomedicine working with stem cells.'

[01:17]

So, without any further a due, we'll start.

Today's lecture, only about an hour and 10 minutes.

So, I hope.

Yeah, I think we'll be done about 4:15, I think, okay.

Anyway, working with stem cells.

Stem cells, you can follow me first paragraph.

Stem cells have the remarkable potential to develop into many different cell types in the body, you probably know that.

Stem cells are like a repair system.

So if we have cells in our body or damaged in some way, stem cells can differentiate or change into the cells that we need.

For example, blood cells, stem cells that in our blood are in a bone marrow can change into white blood cells or red blood cells or platelet cells, um, to help when we need, when we need that help.

Okay, when a stem cells, now we are saying about stem cells, is that can divide and replenish which means a stem cell can divide and become another stem cell.

So they can live for a long, long, long time.

As long as we are living, stem cells can stay replenished in our bodies.

Right, when a stem cell divides, each new cell has the potential to remain stem cell or become another type of stem cell with a more specialized function.

Example: muscle cell, red blood cell, or a neuron or brain cell.

[03:06]

So, you and I, we have stem cells, right?

Those are called adult stem cells.

Adult stem cells only have certain potential.

They can only become limited number of stem cells in our body.

We're going to talk about other types of stem cells that have more potential.

So, we're going to talk about potential of stem cells.

Okay, introduction.

Research on stem cells is advancing the knowledge giving us more knowledge and more insights about how organisms develop from the beginning of the cell, we've studied last week.

Who remembers, after, after we have fertilization, the egg and the sperm come together.

What cell, what do we call that cell?

(Student Answering)

Embryo or the very early stage is called the zygote.

Okay, zygote is in embryo, okay the very beginning stage of the embryo.

So, today we're going to talk about different stages of that process and the stem cells that are found in those types of cells.

Okay.

So, we can learn about development of the human being and how healthy cells replaced damaged cells using adult stem cell.

It is very promising area of science and it is leading to discoveries maybe of cell-based therapy.

Today we are going to talk about Parkinson's disease.

Parkinson's disease is a disease of older people and there something problem in there brain, cells are dying and these cells have produced certain chemical in these people's brains.

Parkinson's disease, without this chemical, their bodies get very stiff and have problems of moving, and finally their organ shut down and they die.

So, we're going to talk about stem cell therapy can help these people and hopefully in the future we might see a reduction of people dying from Parkinson's disease.

Okay.

That type of medicine is called regenerative or reparative medicine and very similar to last week's we talking about cloning and have cloning has certain benefits.

It is related to this type of therapy.

Okay.

However, stem cells, we have only been studying stem cells, embryonic stem cells for about 12 years.

[06:02]

In 1998 is when we, a scientist learned how to extract embryonic stem cells, grow them in the laboratory.

So, 12 years is not a lot of time, right? to study something.

So, every day, as every new day goes by, scientists are learning new things about embryonic stem cells, adult stem cells, and umbilical cord stem cells.

And as soon as they learn new things, it also brings up new questions that they have, okay?

So perhaps if you follow stem cell research or you are in biology or science, you might…

So, a lot new this, a lot of new discoveries, but a lot of questions, too, because this is a new field.

All right, learning objectives, today.

What I want you guys to learn?

Hopefully, you can identify different types of stem cells.

You also, I hope, be able to tell the difference between different types of cells and how that can be used.

Explain how stem cells can be used to treat different diseases or disorders, like Parkinson's disease.

Describe the impact of stem cells for future uses in medicine and science.

And understand the future research needed to make stem cell treatment or reality.

Okay, these types of learning objectives, you can see them here.

These are things that maybe on a test.

I might put on your writing question, okay?

So, that is why I put them here, hopefully you learn about them.

Okay, let's go into the lecture, the reading you guys reading.

First paragraph, what are stem cells and why are they important?

Okay, so, two basic properties of stem cells that make them different than not your other cells.

One of those is that stem cells are unspecialized cells.

Which means un, not specialized.

There is not special function.

Stem cells the, you have in your body are not really doing anything for you, right?

There's not special function for them.

So they are unspecialized.

The good thing, though, is that the stem cells have the ability to become special cells.

So they can differentiate, which means change into a special cell type depending on what you need.

So that is why they are so useful.

Okay, so here we go.

Three kinds of stem cells that scientist are studying and working with.

And these three kinds, what is the first kind?

[09:03]

Embryonic stem cells, okay, ESC, embryonic stem cells.

What's the other kind of stem cells?

Umbilical cord stem cells.

Does everybody know what is the umbilical cord?

The umbilical cord, all of you have naval or belly button.

When you are young, the umbilical cord is what is attached to your mother, okay?

So, inside that umbilical cord, inside the umbilical cord is blood, the blood going through there.

That blood is, has stem cells that can be taken out.

So, umbilical cord stem cells are being researched very, very important research being done on these stem cells found in the umbilical cord.

Okay uh and the last type are adult stem cells and adult stem cells don't look the name adult.

Adult means a grown human right?

I would be an adult, you are adults because you are over 18 years old.

But children also, babies and children have adult stem cells okay?

So adult stem cells are a little misleading name.

Okay these stem cells are very different.

We can see embryonic stem cells come from an embryo of course.

And last week we talked about an embryo.

An embryo is a growing bar of cells right?

That is going to turn into a human being if it is human embryonic cells.

Okay embryonic stem cells are grown in a laboratory in vitro.

They can be isolated from human embryos and there are different stages of embryonic stem cells.

The very early stage from the zygote those stem cells are called totipotent stem cells we'll talk about later.

Then later on there is a stage where you have a blastocyst.

The brattices inside the blastocyst are different type of stem cells and then we go further on after development and you have fetal stem cells which come from a fetus.

Embryo and fetus what is the difference?

We'll see a little bit later I'll talk about that.

[12:00]

Okay good so what they're saying here: twenty years ago scientists were working with mice and working with mouse embryonic stem cells.

Twenty years ago they learned how to extract these stem cells and grow them in the laboratory.

So as they work with these mice stem cells, they were able to finally learn how to extract human stem cells.

So as I told you guys it wasn't until 1998 when they learned how to extract human embryonic stem cells and grow them in the laboratory okay?

So it is a very new science.

We're working with embryos.

You're working with embryonic stem cells.

It is about last week, there are a lot of ethical issues right?

Anytime you're working with human embryos that is a growing ball of cells, but it is a growing ball of cells that is going to become human being.

So the ethics and the legal issues surrounding that are very strong and very important

So here in his reading about where they're getting the embryos for the study how are they getting them, that is very important.

Dr, Hwang has problems in Korea: where is he getting his embryos.

And that was one of the problems that got him into a lot of trouble.

And any time a scientist is working with stem cells, embryonic stem cells, there is a lot of legal and ethical issues in steps that you have to follow.

If you don't follow it correctly, you're research can be shut down and you can lose your license and you can have a lot of trouble as we know from other scientists.

Okay how do they get these embryos?

Well it says infertility purposes couples who can't get pregnant men and women for some reason they are unable to have kids what can they do?

Well there are ways people can do in vitro fertilization right?

They take the sperm from the man and egg from the woman and they try in vitro fertilization.

Now when a couple wants to do this process, they aren't just taking one sperm and one egg and they say okay let's see.

No, of course not because just last week we talked about cloning, when you're doing this process many many times it is going to fail right?
It is not going to work.

So when they do a vitro fertilization they're going to take many sperm many eggs and they're going to try this.

[15:00]

If a couple's doing this and they get one embryo to work and they take it, then all these other embryos that are growing in vitro, they don't need.

So the scientists go to the couple and they say uh could we use these embryos for our research.

And if the couple gives their informed consent, their legal issue, and say yes you can use our embryos for your research, then the scientist can use them.

And that is what he is reading here.
You have to follow these legal steps or else you're going to have big problems.

Okay so getting informed consent.

Many of stem cells that scientists use are coming from the blastocyst stage of an embryo and how long is that?

Well you can see here it says between three to eight days after fertilization of the egg.

You will have the blastocysts forming.

Inside of the blastocyst which you can see here this is the blastocyst, inside the hard ball of cells, you will find stem cells.

And these stem cells are going to be grown into the child as a baby

So those stem cells inside the blastocyst can become any type of cell in the body pretty much almost any type.

Heart, liver, bone, brain, you can see all the different type of cells it can become.
And then adult stem cells, stem cells in adult tissues and it says here, such as bone marrow, muscle and in your brain and you have stem cells there.

Those stem cells ,depending on the area where they're finding the stem cell, those stem cells are able to change into certain type of cells in your body.

For example the stem cells found In your brain can be your nerve cells.
Stem cells found in your bone marrow can be blood cells.

White blood cells are platelets so there are three type of blood cells .

Adult stem cells that you and I have are able to be extracted medically.

However the process of getting them is much more difficult and much more painful and can cause problems you know the person could die because you're having surgery, but obtaining adult stem cells be done.

[18:03]

The process is much more difficult than maybe getting embryonic stem cells okay, but it can be done so a lot of people feel that we need to put a lot more money into this type of research on adult stem cells.

Why?

Well, just like last week we talked about when you're working with embryos, you're going to have a lot of ethical issues right?

Cause these are growing humans that means you kill the embryo.

As we talked about last week, a lot of people consider that murder.

You're killing a human life.

For example, my brother was a priest.

He feels like, if you kill one embryo that is not worth saving thousands of lives.

It is still wrong.

Okay other scientists doctors, probably disagree with that part.

But if we use adult stem cells or umbilical cord stem cells, then there aren't a lot of ethics we have to look at right?

Because you aren't using any embryos you aren't killing any life.

The umbilical cord is already there, it is already moving, and it can survive getting stem cells.

So there is some differences with what stem cells we should spend more money researching.

Okay so these three diseases are three of the main disorders or diseases that scientists are hoping stem cells can help cure.

Today we'll talk about Parkinson's disease overall.

But also diabetes and heart disease are two more diseases in the future you might see stem cells being able to help.
Scientists are studying stem cells to help you to help treat certain diseases.

We talked about that.

So, cell-based therapy.

Okay, Parkinson's disease is one of these, one of these diseases.

Also, by studying stem cells, scientists are hoping that this is going to give them an opportunity to test drugs. Okay?

New drugs that they come out with they can use stem cells as kind of a test to see

how these drugs will affect human development and also birth defects.

Some of you might be, might know about the drug thalidomide which was back in the 1960s.

The drug that women were taking, pregnant women were taking to help to ease their morning sickness or their problems during pregnancy.

[21:02]

And it also helped with people who can't sleep well.

If people aren't sleeping well, they take this drug.

However, these pregnant women have their kids, these babies have major child defects.

Some of them, the kids are born with no arms or some of them have some nerve disorders.

So this drug was terrible.

It was, it was getting in, it was crossing through the placenta, and getting into the babies' system and causing some major developmental problems.

Of course, we don't want that ever to happen again.

So, by testing, using stem cells, we are given an opportunity to test different drugs and see how developments of cells react to these different drugs.

So, there, there are benefits to stem cells, using stem cells.

Okay, so we are talking about Parkinson's disease.

So, let's see. What is it? What is Parkinson's disease?

Parkinson's disease is a nerve degenerative disorder.

Degenerate means dying, okay?.

So, neuro-, your brain.

So, inside people's brains, cells are dying. There are some cells that are dying.

Parkinson's disease happens to people who are older, over age 65.

And, this is pretty, pretty prevalent.

2% have the population is diagnosed with Parkinson's disease.

Actually my mother in law died of Parkinson's disease last year.

So, it is, some of you might know people with Parkinson's disease, pretty common.

What's happening?

Well, I told you there's chemical in the people's brains, Dopamine.

Parkinson's patients, cells in their brain are dying. These cells are called DA neurons.

These cells produce Dopamine which is a chemical.

And this chemical helps muscle, muscle movement.

So, without this chemical, without Dopamine, people's bodies, they get rigid, which means hard.

Their muscles aren't moving as easily.

People with Parkinson's disease lose their ability to speak because the muscles in their jaw are so tight. Okay?

And, they also can't move well.

So it makes muscles rigid.

So what can we do? Stem cells therapy.

Because here some of that difficult parts for scientists with stem cells.

One thing they want to help, they don't know how these stem cells remain unspecialized and self-renewing for many years.

Stem cells, I told you, stem cells can become stem cells, can become stem cell ,can become stem cell.

[24:03]

So they renew and they live for a long time.

Scientists are not really sure how do they do that, why do they do that.

But another question, another thing that is boggling for scientists is this, identifying signals that trigger the cells to become specialized, which means we have stem cells, how do the stem cells become specialized cells, how do they change into specialized cells? What is happening?

Or how can we make a stem cell become a specialized cell?

With Parkinson's disease, how can we make these stem cells become DA neuron cells?

How can we make these stem cells become cells that produce Dopamine?

Okay, and what they are saying here and her reading, what she was reading is that some laboratories in their studies, they have been successful in developing methods to change the stem cells to differentiate into cells that are similar to DA neurons.

So, they have found the way to do this.

And, that is why we are getting very excited that wow, if we know how to differentiate the stem cells, into, to act like DA neurons, then we should be able to treat people with Parkinson's disease.

And remember, stem cells, like we said, stem cells can self-renew, which means they can become, we can grow more and more stem cells just with few stem cells, we can make many, many more.

So, by doing this, we can treat, with just a limited amount of stem cells, we can treat many, many people with Parkinson's disease. Right?

So, there's a lot of excitement about this type of study.

Right. Next.

[Student Speaking]

So, they are telling us here how they were successful.

[27:00]

They are working with this one experiment, a recent study few years ago, a recent study done on mice.

They had mice with Parkinson's disease.

They needed DA neurons.

So they took the stem cells, mouse embryonic stem cells.

And, they introduced this gene, you can see the gene, neuro 1.

They introduced the gene into the stem cell.

And that made the stem cell differentiate into DA neuron. Amazing.

They then injected these neurons into the mice, into the mice's brain.

And, what did they notice, says here, it, the cells released dopamine. Okay?

So they were able to release dopamine, and they increased the motor function, which means the movement.

So the muscle movement became better.

So it is working.

So that gave a lot of excitement to treating humans.

And what did they do with human treatment?

Now you can see, you can see in this picture here what's happening when they were treating humans.

First of all, this is the stage where they are getting stem cells.

And you can see what is this? Can you read? Fetus.

Okay, this is a fetus.

Embryo, then we have a fetus.

What do you think, what is the difference that you noticed between embryo and fetus?

You can see.

[Student Speaking]

You can see this, the fetus are looking very much like a human baby.

This, this is like 8 to 10 weeks, 8 to 10 weeks after the development, we have a fetus.

And the fetus started to look a lot like a human baby.

But this stage, this stage of development is where we are getting the stem cells for this type of research.

Um, a lot of people don't like that because you are going to be killing the fetus.

And the fetus is looking a lot like a human.

That makes a lot of difference for some people, Right?

Other people, embryo and fetus, the same.

But, some people think an embryo doesn't have any blastocysts, doesn't have any characteristics of human, right?

There's no arms, legs, faces, body parts.

So that is not human not yet.

But when we get to this stage, people 'um hm'

This is starting to look like a baby.

Anyway, they take the tissue from the mid-brain of 8 to 10 week fetus.

So, they are taking tissue from out of the brain stem cells.

[30:00]

They grow in vitro in the laboratory.

Then they take the stem cells and they inject them into the brain of the patient with Parkinson's disease, here this red area is where they have their dopamine is lost in this area.

So they inject the cells and that is the cells produce dopamine, they increase the mobility, movement, okay?

And hopefully in the future, this treatment will be able to be used for people with Parkinson's disease and help them survive.

But again, as you can see, many people are going to have a problem with this type of research also.

You're killing a fetus to save old people.

You only have to kill one fetus but you can save many people, all right where is the balance?

Who is more important, right?

Some people don't agree with it.

Okay.

Very good.

Okay, so you might see in the future, some cure for Parkinson's.

Okay, next part going to be talking about potency of stem cells, okay?

We learned about adult stem cells, embryonic stem cells, and umbilical cord stem cells.

Now we're going to talk about the potency, so the potency of stem cells means the power or the strength of certain stem cells.

Depending where they come from, they may have different type of potency, good.

We're going to be talking about three different potencies, totipotent stem cells, pluripotent stem cells, and multipotent stem cells, okay?

Also, one thing you guys should know is that these the potent stem cells can also be divided into categories depending on different types of cells, for example stroma stem cells which are found in a connective tissue, and these cells are differentiated into bone, cartilage, fat or connective tissue cell.

So you can see that there are four different types of cells, stroma stem cells can differentiate into four different types of cells.

And hematopoietic stem cells which are found in blood, okay?

They can change into three different types of cells, red blood cells, white blood cells or platelet cells.

[32:57]

Those are found in adult tissues, those are adult stem cells.

But you can see, even adult stem cells have the ability to change into two or three different types of cells, okay, which is important to know.

And then cord blood, it says, although stem cell Richard has found that this type of stem cell found in cord blood, does have the potential to become other types of cells.

Okay, let's go to totipotent stem cells, what are they, sir?

Yeah, your turn.

Totipotent cells.

(Student Speaking : …stem cells can be found in the earliest phase of embryonic development within the first few division of fertilized egg. These early stem cells actually comprise the embryo have the potential to differentiate to embryonic and extra embryonic cells, totipotent stem cells therefore have the capacity to form completely new embryos that are capable of developing into new organism.

Okay, good, phew you are finished.

Okay, totipotent stem cells, what stage of development do we find totipotent stem

cells?

Found in early stages, here we can see single cell embryo.

The sperm hit, meets the egg, he have fertilization, we have totipotent stem cells.

Totlpotent cells, the cell starts to divide, two, four, eight, sixteen cells, those cells are totipotent cells.

Totipotent stem cells, what is that mean?

Those stem cells can develop if we separate them, like we talked about last week with cloning, we separate those cells, they can grow into a completely new human being, right?

Just like we've talked about with cloning, identical twins, we separate cells in the laboratory, those cells can grow into organism, they grow into a child, a human being.

That is how we can clone humans.

All right.

So, totipotent cells can be any type of cells in your body.

They also grow into a new human.

All right, those are found in the early stages, okay?

[36:03]

One to three days, right, or one to two days.

Pluripotent cells.

Here's are next type stem cells.

They can be almost, almost every kind of cell in the body.

Almost over two hundred different cell types they become.

These cells are called pluripotent where they are found?

They're found in embryonic stem cells.

These cells are found in the embryo, more a little further along between five to eight days in the blastocysts and like we've talked about where Parkinson's disease, these kind of cells can also be found in the fetus, okay?

Pluripotent stem cells.

You can see five to fourteen days, also 8 weeks to 10 weeks we have a fetus, those stem cells are also pluripotent stem cells, changing into almost every type of cells in your body.

Okay, so… multipotent.

Limited, a limited amount of cell types.

Adult stem cells, stem cells are found in your bone marrow, we talked about this hematopoietic, these are the stem cells found in cord blood, umbilical cord blood, these stem cells found in cord blood are called multipotent because they can only change into a limited amount of cell types.

For example, red blood cells, white blood cells and platelet cells.

Maybe two or three or four type of cells, not many.

Those are called multipotent cells, you can see they're found in the umbilical cord, they're found in adult stem cell sources, bone marrow or peripheral blood.

These, it said, unlike pluripotent stem cells, mutlipotent stem cells do not have the ability to become a variety of different cell types, they can only be a few.

However, these types of stem cells are capable of self replicating in order to repair specific organ tissue.

So what they're saying is that adult stem cells are able to become stem cells and become stems cells to self replicated to change into stem cells.

So you can produce more and more of them.

Okay.

Very good.

Now, we will have a quiz.

Here we have a sperm, sperm meets the egg, we have fertilization.

[38:59]

The cell, the zygote begins to divide, two, four, eight cell stage embryo containing early embryonic stem cells.

Early embryonic stem cells, what do we have here?

This is a zygote, okay.

All right, at this stage we have totipotent stem cells.

Toti-, toto-, that means total everything, totipotent can be all types of stem cells, all types of cells in your body, can become any cell in your body, total potential.

Zygote continues to develop, after seven days after fertilization, we have a blastocyst.

Inside the blastocyst, what kind of stem cells?

What kind of stem cells do we have inside here, students?
Pluripotent.

Pluripotent, almost any kind of cell type in the body.

Poly means more or most.

So pluripotent cells are found in a blastocyst, they can become almost any kind of cell in the body so very important.

The child continues to develop, the cells continue to divide and grow, and after the eighth week, we are talking about eight to ten weeks, what do we have now?

What is this called?

This is a fetus.

So now we have a fetus.

What kind of stem cells can we get out of fetus?

Pluripotent.

The fetus still inside body is still developing, still cells are growing, these stem cells are also pluripotent.

They can change into almost any type of cell type in the body so still these cells are pluripotent.

And this is eight to ten weeks after development.

This is what we are talking with Parkinson’s disease.

This is where the stage where they take the stem cells out of the fetal brain tissue.

Okay.

[42:00]

Here is after birth.

So the baby is born, what do we have here, what is this?

That is called the umbilical cord

What we talked about, inside the umbilical cord there is umbilical cord blood.

And that blood has stem cells, those are called hematopoietic stem cells.

We talked about that.

These stem cells, however, what are they, what potency?

They are multipotent.

And multi means many or much so it has much potential.

These types of stem cells, hematopoietic stem cells.

They can change into three different type of cells, red, white or platelet.

So there is good potential, three different types of cells, multipotent.

She's Korean, look at that.

Okay, well, now we have a child and as you guys know, children have adult stem cells.

And the adult stem cells can be found in the brain, nerve cells, so this adult… the stem cells found here can only turn into nerve cells.

Stem cells found in blood can become blood cells, red, white, platelet.

Muscle cells, it can become muscle.

Bone cells bone, skin cells skin.

So the adult stem cells can be found in many places but like I said to you guys very difficult to obtain those stem cells, right, okay.

These stem cells again multipotent.

Okay.

Now, one more thing I want to talk about.

The good thing about cord stem cells is that after you born, these days many people are doing this these days with umbilical cord stem cells

A woman has a baby and their stem cells in umbilical cord, so many people are now starting to, when they have a baby, they tell scientists to take, they pay someone to take their umbilical cord stem cells.

And then they can put them in to… like a ‘stem cell bank’ and then they freeze their stem cells and then during their life their your stem cells they’re your umbilical stem cells during your life, you have some problem, some blood disorder, or you need stem cells, they can get your stem cells from your ‘umbilical cord stem cell bank’.

[45:04]

Okay?

I will take some stem cells please, and they…

So there is a lot of interest in that studying umbilical cord stem cells and saving those stem cells for you to use later in life.

Umbilical cord stem cells are good for you if they’re your umbilical cord of course because it is a perfect match, right, with your body.

Also for your mother, so those stem cells can be used for you or for your mother or even for your father.

And also even for your brother or your sisters.

So umbilical stem cells are very useful and are started to be used more today and saved, there are some companies that will save those stem cells for you.

All right.

Adult stem cells also perfect match, of course, for your body so you can get out of your, some of your stem cells from your body, and keep them frozen for you, then when you have a problem, you might be able to use these to give you help, okay.

All right, we’re almost done, last slide, I’ll go quickly we’d be out of here in five minutes.

So, this is kind of review, we’ve talked about these different things.

What are the unique properties of all stem cells?

We’ve talked about this.

Stem cells are a little bit different, right?

They have three general properties.

These properties are, they can divide and renew themselves for a long time.

That means they have long term self renewal or vocabulary word, proliferation.

Pro-life, proliferation.

So proliferation they continue making more stem cells, they can live for a long time, even in the laboratory stem cells can live more for a year, okay?

So that is one good thing.

Another… where am I?

Okay, another property.

We've talked about, they are unspecialized these cells.

Stem cells have no special purpose.

So they okay they are unspecialized cells but they can, where am I, they can produce specialized cells.

And what that means is differentiation.

So, stem cells are unspecialized but can become specialized cells through differentiation.

Now, what is the problem?

Well, I told you, stem cells, scientists still studying and learning new things all the time.

[48:03]

Some of the things they don't know about is how to do this, how to differentiate these stem cells.

With Parkinson's disease, they found a way to differentiate stem cells in mice.

But what are they studying now, so they're studying the signals that are happening inside and outside the cells when they differentiate.

What genes are being introduced to the cell to make it change into a specialized cell.

What is happening outside the cell, what chemicals are around the cell, or what molecules are involved with differentiation.

What contact does the cell have with the other things in the environment.

So by studying these things, scientists are hoping to learn about how to find out

when the cells and how the cells are going to differentiate.

All right, and the last part of our lecture today, looking the last paragraph.

Adult stem cells, a lot of research being done on adult cells.

I told you guys that adult stem cells are multipotent.

They only can change into a limited range of cell types.

So scientist think, adult stem cells and umbilical cord cells, they're very good but they're limited.

The potency is limited, so embryonic stem cells are better, because they can change into many stem cell type.

But what is interesting here is as recent studies, it says right here, until recently it had been thought that blood forming cells in bone marrow which are called hematopoietic stem cells could not give rise to the cells of very different tissue, such as nerve cells.

Okay.

So until very recently, scientists are thinking hematopoietic stem cells which are the stem cells found in umbilical cord blood could only become blood cells only become red blood cells, white blood cells or platelet.

But recent studies, says here, however a number of experiments over the last several years have raised the possibility, okay, so that means it may be possible that stem cells from one tissue may be able to give rise to cell types of the completely different tissue which is called plasticity.

[51:00]

Plastic, so kind of able to bend into another stem cell, so these hematopoietic stem cells may be able to become nerve cells also, which is very amazing, right?

Because now they're starting to find out that adult stem cells, they thought, could only become certain types, now maybe they have the ability to become even more types of cells.

So research into these areas are very important, a lot of money being put into these areas and hopefully if this is correct if plasticity of adult stem cells is correct then we might see, we might be able to use adult stem cells for a lot of cell based treatments which would be very good because we're not having to use embryos, right?

Not killing any embryos or using any fetal stem cells, we can use umbilical cord stem cells or adult stem cells which would be a lot better cause less argument around people ,less ethical issues, less legal issues, umm so much better.

So that is one positive thing that they’re finding out about adult stem cells.

I’m very nice.