

TPWKY

This is Exactly Right.

(This Podcast Will Kill You intro theme)

Erin Welsh

Hi, I'm Erin Welsh.

Erin Allmann Updyke

And I'm Erin Allmann Updyke.

Erin Welsh

And this is This Podcast Will Kill You.

Erin Allmann Updyke

Yeah. Welcome everyone.

Erin Welsh

Welcome. Welcome, welcome. This episode, I'm very excited about it because it's very different than our normal episodes.

Erin Allmann Updyke

It's very different. Can I be completely honest? I was really stressed out about it.

Erin Welsh

(laughs) Same.

Erin Allmann Updyke

Because it's so different than our normal episodes but finally today as I was like organizing all of my notes, I got really excited about it.

Erin Welsh

Ooh good, okay, good. I'm very excited to hear what you're gonna tell me.

Erin Allmann Updyke

Yeah, I hope that you like it. (laughs)

Erin Welsh

I'm sure that I will Erin, come on, come on.

Erin Allmann Updyke

I'm very excited to learn all about what you're gonna tell me today Erin, cause I know very little about it.

Erin Welsh

(laughs) Well and your nerves may have gone away but my nerves are still here and I'm still nervous that I'm not gonna do a good job. But you know what? It'll be okay.

Erin Allmann Updyke

It's okay, we always feel that way and we just do our best, Erin.

Erin Welsh

That's true. That's true. We do do our best.

Erin Allmann Updyke

Yeah, yeah. What are we even talking about today, Erin? I feel like the suspense has been building.

Erin Welsh

I know, I know. We are talking today about Henrietta Lacks.

Erin Allmann Updyke

Henrietta Lacks! And her cells.

Erin Welsh

And her cells. You may have heard her name in your Intro Bio class or in your Cell Bio class or maybe in your class on medical ethics.

Erin Allmann Updyke

Yeah.

Erin Welsh: Maybe in the HBO movie that just came out. There are tons of different ways that you may have heard about Henrietta Lacks and we're going to kind of try to cover a lot of those different ways or contexts in which you may have heard her name.

Erin Allmann Updyke: Yeah.

Erin Welsh: Including things like tissue culture and the ethics of informed consent and also like who was Henrietta Lacks?

Erin Allmann Updyke: Yeah, that's the part I'm most excited about.

Erin Welsh: Yeah, me too. And there's a lot to cover so maybe we should begin where we usually do?

Erin Allmann Updyke: We should which is always with a quarantini.

Erin Welsh: A quarantini. Erin, what are we drinking this week?

Erin Allmann Updyke: This week we're drinking Ambrosia.

Erin Welsh: Ambrosia.

Erin Allmann Updyke: The drink of the gods that confers immortality.

Erin Welsh: Immortality. And we will learn so much more about what immortal means, hopefully.

Erin Allmann Updyke: Oh I'm really excited to talk about it, yeah.

Erin Welsh: Okay good. Okay but first what is in Ambrosia?

Erin Allmann Updyke: Well of course, being in the Midwest, Ambrosia salad's like a Midwest thing, right?

Erin Welsh: I think so. Or is it a Southern thing?

Erin Allmann Updyke: Maybe it's a Southern thing. I feel like I've seen it here. Anyways, it's rum and coconut cream, pineapple juice, orange juice, some grenadine, you blend it all up so it's like an ambrosia salad in a glass with rum.

Erin Welsh: Yeah, I think it's going to be better than the actual ambrosia fruit salad.

Erin Allmann Updyke: I hope so cause I'm not a big fan.

Erin Welsh: You mean you don't like mayonnaise with your fruit?

Erin Allmann Updyke: Wait is it mayonnaise? I thought it was Cool Whip.

Erin Welsh: Oh no it is... Well it's not Cool Whip, it's actually sour cream I think.

Erin Allmann Updyke: Oh okay.

Erin Welsh: Just like...yeah. But I think you could also include mayonnaise or cottage cheese or yogurt or cream cheese or pudding. I'm on the Wikipedia page, in case you can tell.

Erin Allmann Updyke: I was like are you looking at a recipe right now? (laughs)

Erin Welsh: (laughs)

Erin Allmann Updyke: Well anyways, we'll post the full recipe for that quarantini as well as our nonalcoholic placeborita on our website thispodcastwillkillyou.com and all of our social media channels.

Erin Welsh: Yes indeed. All right, what other business do we have to take care of?

Erin Allmann Updyke: Well as always we have a Goodreads list and a bookshop.org link on our website. We also have merch by incredible artists on our website. We have links to transcripts, we have nonalcoholic episodes, so much. Thispodcastwillkillyou.com.

Erin Welsh: Ooh, Erin, good job.

Erin Allmann Updyke: Thank you.

Erin Welsh: You covered everything, I was like is there anything...I can't think of anything else.

Erin Allmann Updyke: I think that's everything.

Erin Welsh: All right, well.

Erin Allmann Updyke: Okay.

Erin Welsh: In that case-

Erin Allmann Updyke: Shall we take a break and then get started?

Erin Welsh: Let's do it.

TPWKY: (transition theme)

Erin Allmann Updyke: So let's start with what a cell culture is because a lot of people that aren't you, Erin, maybe have never used cell culture.

Erin Welsh: (laughs)

Erin Allmann Updyke

So cell culture essentially just means growing cells, any kind of cells, could be human, could be other animals, could be bacteria, yeast, whatever inside some kind of artificial medium like in a bottle or a petri dish, something like that. So we have cell cultures of all different kinds of cells. In order to grow cells of pretty much any tissue type, you just need some basic environmental conditions like a stable temperature, a nice pH, some kind of substrate which might just be like a petri dish, and then you need growth media which is just a fancy word for fluid or gel or something that has nutrients, vitamins, salt, sugars, so that cells can grow and thrive and reproduce. So the use of cell culture in biology at this point is so essential to the study of both basic science, like our basic understanding of cell biology, and also to applied clinical research.

We use cell cultures to understand underlying cellular mechanisms that underlie all of life on planet earth, but we also use them to study new drugs to see if they're toxic to cells to understand the effects of radiation or viruses or cancer on cell function. We use cell culture to grow viruses to make vaccines like the rabies vaccine or hepatitis or chickenpox vaccines. And we also use cell cultures for a ton of what are called biopharmaceuticals which are things that cells produce that we can then use as drugs like enzymes, proteins, antibodies that we use for cancer treatment or infectious disease treatment. We produce hormones, clotting factors, like so many things that people rely on everyday are only possible because of cell culture.

Erin Welsh

It's unbelievable.

Erin Allmann Updyke

It's amazing.

Erin Welsh

It's like hard to overstate how basic they are in like essential-

Erin Allmann Updyke

Right. Essential. Absolutely.

Erin Welsh

I used HeLa and mouse macrophage cells as an undergrad to study these different proteins on plague bacteria to see which ones were involved in adhesion or invasion of the cells.

Erin Allmann Updyke

That sounds incredible.

Erin Welsh

So cool.

Erin Allmann Updyke

My lab in my master's program we used Vero cells which are from an African green monkey kidney to test whether the viruses that we were finding in seawater were infectious, although I didn't do that cause I could never keep my cells alive. (laughs)

Erin Welsh

(laughs) I just remember being so fascinated by, when I was doing these essays, by making sure that like oh are the bacteria actually infecting these cells?

Erin Allmann Updyke

Right.

Erin Welsh

And you would like put the flask under the scope and see everything. I couldn't believe what I was seeing.

Erin Allmann Updyke

Right?

Erin Welsh

This incredible process that you read about. I still can't get over it.

Erin Allmann Updyke

I can tell that you're getting little chills when you talk about it.

Erin Welsh

I am getting little chills. (laughs)

Erin Allmann Updyke

Okay so Erin, in our kind of history section you'll be going through the history of HeLa cells, which are the cells that were taken from Henrietta Lacks without her permission and used and how big of an impact they've had on scientific knowledge. But the question that I wanna answer in this section is why were Henrietta Lacks' cells such a massive step forward in cell culture technology? And what makes the cell lines that we use for cell culture today so different than what was used before HeLa?

Erin Welsh

Mm-hmm.

Erin Allmann Updyke

Okay.

Erin Welsh

I'm very excited, oh my gosh.

Erin Allmann Updyke

Me too. It's pretty cool. So before Henrietta Lacks' cells were taken from her and became what we now know of as HeLa cells, scientists were still trying to grow mammalian and human cells from tissues. But they always died and usually after a pretty short period of time. So you could run like one experiment and then you'd have to harvest more tissue or more cells then start all over. So the reason that HeLa changed everything is because Henrietta Lacks' cells didn't die. They kept growing and replicating and continue to do so today like 70 years later.

Erin Welsh

Mm-hmm.

Erin Allmann Updyke

And so Henrietta Lacks' cells became what is known as a cell line. And a cell line essentially means cells from whatever, humans or other animals, insects, plants, bacteria from any tissue that can be grown in culture indefinitely. Why and how?

Erin Welsh

Yeah.

Erin Allmann Updyke

Okay. So let's first understand Henrietta Lacks' cells, the first cell line. These cells came from a sample of tissue from cervical cancer. And we already discussed in our HPV episode how cervical cancer develops as a result of HPV infection, so I'll just ever so briefly review that for anyone who didn't listen or forgot. We know that high risk HPV strains have a couple of different proteins, e6 and e7, that integrate into our genome, like get into our DNA and turn off a few genes called tumor suppressor genes. And what this does is it allows for cells to grow in an uncontrolled manner.

So all cells follow a very specific cell cycle as they grow and divide and they spend most of their time in a phase called interphase where they grow and also replicate their DNA and then they undergo mitosis, which is the actual division of chromosomes, and then cytokinesis which is when the cell divides into two separate cells. And along the way there's a lot of different checkpoints, usually during that interphase, that ensure that cells grow at an appropriate rate, so not too quickly, we have to ensure there's enough nutrients to sustain growth and division and to make sure that the cells aren't replicating any mistakes or problems in the DNA. So the proteins that we talked about in the HPV episode affect these parts of the cell cycle primarily, they encourage excessive growth and division that allows for division of cells even if there are problems or mistakes in the DNA or even if there's maybe not enough nutrients, they'll just keep growing and growing.

Erin Welsh

Mm-hmm.

Erin Allmann Updyke: So that's part of the equation. But that isn't quite enough to cause cells to grow indefinitely.

Erin Welsh: Yeah.

Erin Allmann Updyke: That's part of what accounts for cells that can grow more rapidly and persist longer but there's another piece that we have to understand and that is telomeres.

Erin Welsh: Oh! I love them.

Erin Allmann Updyke: I know right? So a telomere is the end part of our chromosomes, it's like a cap on the end of our chromosomes. The very, very tips. In general, during normal DNA replication it can be very difficult for ourselves to fully replicate the entirety of the chromosome. So often the very, very ends of the chromosomes where the telomeres are actually become shorter with each cell division. This is normal, this happens as a normal part of cell division. So the telomeres are there as like an insurance policy like, 'Okay well we miss the very end but we don't really need it, no big deal'. But as cells divide and divide, those ends get shorter and shorter with each division and eventually once the telomeres are sufficiently shortened it actually triggers an arrest of growth, an arrest of the cell cycle, and no more cell division.

Erin Welsh: Mm-hmm.

Erin Allmann Updyke: So you can kind of think of it like every cell having a limited number of times it can divide before those telomeres get too short, like you've heard your heart only has a certain number of beats or whatever.

Erin Welsh: Yeah.

Erin Allmann Updyke: I don't think that's really true but it's kind of like that idea, all right?

Erin Welsh: (laughs)

Erin Allmann Updyke: But in some cells like cancer cells, they've lost the ability to sense when telomeres get too short and they keep on dividing and dividing and dividing. So they get shorter and shorter with each division. Now eventually those cells too will die or at least stop replicating because of damage. Once you get too damaged in your DNA, then you just have damaged DNA and that cell can't continue to divide.

Erin Welsh: Right.

Erin Allmann Updyke: So there has to be something else going on here.

Erin Welsh: Yeah.

Erin Allmann Updyke: How can this cell line keep dividing indefinitely? Truly indefinitely.

Erin Welsh: Does it add on length?

Erin Allmann Updyke: Erin, it sure does.

Erin Welsh

Interesting.

Erin Allmann Updyke

Turns out there's an entire group of enzymes called telomerase. I don't know if that's the proper way to pronounce it but I think it's close. Telomerase is an enzyme that specifically replicates just those telomere sequences to make sure that they are not lost or shortened during replication which allows cells to escape what is a normal mechanism that says cells should only divide a certain number of times and then stop dividing. If you turn telomerase on and you have that enzyme present, then these cells will be able to divide forever. And as it turns out over 90% of cancer cells, most cancer cells have additional mutations beyond just in those tumor suppressor genes that we talked about that turn on the expression of telomerase. (trumpeting sound)

Erin Welsh

And so telomerase and telomeres also have something to do with aging, like the process of aging.

Erin Allmann Updyke

Yes.

Erin Welsh

Cause I know that that's what a lot of anti-aging studies or whatever focus on.

Erin Allmann Updyke

Yes. It's thought that they have a large amount to do with aging, that like cellular senescence is governed by telomeres and like the length of telomeres.

Erin Welsh

Right. And so it would make sense that more quote unquote "insults" to your body through stress or inflammation or whatever would lead to cells turning over more quickly which leads to faster aging, period.

Erin Allmann Updyke

Exactly. Yeah, at a cellular level. Like aging at a cellular level.

Erin Welsh

But there's also the downside that it is cancer.

Erin Allmann Updyke

It is cancer.

Erin Welsh

Interesting.

Erin Allmann Updyke

Yes. And so that's because... Okay I feel like what you're getting at is some really interesting things.

Erin Welsh

(laughs)

Erin Allmann Updyke

Right because the thing about HeLa and many of our cell lines is that they have mutations in not just telomerase, right. They have mutations in these other properties like p53, like p-retinoblastoma, these other genes that also control how rapid the cell grows and if it can grow but still miss other important cell cycle checkpoints like that DNA is in tact, etc. Telomerase is separate from all of that. So if you could induce just telomerase, you could in theory get a cell to divide indefinitely that doesn't have the other properties of cancers.

Erin Welsh

Right, like there would still be all of the checks in place except for the fact that the telomeres would just not shorten.

Erin Allmann Updyke

Not shorten, exactly.

Erin Welsh: Right.

Erin Allmann Updyke: And so that is actually a way that people have started to generate cell lines today.

Erin Welsh: Interesting.

Erin Allmann Updyke: Right? It's amazing.

Erin Welsh: Are these cell lines proprietary?

Erin Allmann Updyke: Oh probably.

Erin Welsh: Yeah, I thought so. (laughs)

Erin Allmann Updyke: Yeah I mean every cell line that's developed-

Erin Welsh: Nowadays, yeah.

Erin Allmann Updyke: Yeah. But yeah, so today we have a lot of different cell lines. HeLa was the first but now we have so, so, so many.

Erin Welsh: Yeah.

Erin Allmann Updyke: We have cell lines from mice, from dogs, from humans, from so many different animals. We have them from kidney cells, from ovaries, from embryos, we have cell lines from so many different things that we can use for very specific purposes. And because we've learned so much about the cell cycle and about these specific controls on what can make a cell immortal, we can then create new cell lines, we can use viral vectors or engineer viruses like HPV to integrate into genomes and cause these changes that can then turn a normal cell into an immortal cell. Or like I mentioned already, we can just induce the production of telomerase so that we can then hopefully keep all of the other normal cellular architecture rather than more cancerous architecture that HPV infection would cause.

Erin Welsh: Interesting.

Erin Allmann Updyke: I know.

Erin Welsh: Oh, this is kind of tangentially related.

Erin Allmann Updyke: Okay.

Erin Welsh: But we got a couple of emails from people reminding us that cervical cancer is not absolutely 100% associated with HPV.

Erin Allmann Updyke: Yes.

Erin Welsh: It's very, very, very, like the vast, vast majority like 99% but there are some cases that are not caused by HPV.

Erin Allmann Updyke

Yeah we should have said that in our intro as a correction. But yes, it's like 99.7 or 99.9% of all cervical cancers are known to be associated and caused by HPV.

Erin Welsh

Yes.

Erin Allmann Updyke

Yeah. So thank you to the people who reached out.

Erin Welsh

Yes, thank you.

Erin Allmann Updyke

Anyways so back to cell lines. (laughs) The last thing that I want to point out that I think is important not only to kind of understand cell culture and cell lines - but also because when we kind of talk about the current status of cell culture I wanna talk a little bit more about it - is the difference between an immortal cell line and a stem cell.

Erin Welsh

Mm-hmm.

Erin Allmann Updyke

So I think a lot of times when people hear, especially if you don't have a lot of training in biology and don't work with cell cultures all the time, when you hear cell culture, a lot of times what people think of are stem cells. And I think that's because they get a lot of headlines because they can be controversial.

Erin Welsh

Right.

Erin Allmann Updyke

So immortal cell lines like HeLa and stem cells are not the same. Both are used in scientific research and both are incredibly important but there's some pretty important differences. Immortalized cell lines like HeLa come from what are called primary tissues to begin with, which means they come from differentiated, like you can think of them as grownup cells, like kidney cells or macrophages which are white blood cells or cervical epithelial cancer cells in the case of HeLa. So these cells are differentiated. They have a particular function in our bodies, they have a specific kind of architecture and so cells from a kidney are going to be different than cells from a cervix. And whenever these cells divide, even when they do so indefinitely, they stay roughly the same. Stem cells on the other hand are undifferentiated. So these cells have the potential to become any or many different cell types from like a neuron to a kidney to a liver cell to a muscle cell to whatever.

Erin Welsh

Right.

Erin Allmann Updyke

So sometimes people describe stem cells as like a little kid that has the potential to be anything they want to be when they grow up and differentiated cells as a grownup who has one job or function.

Erin Welsh

Oh wow. That makes me sad.

Erin Allmann Updyke

I know, right? I don't like that analogy at all cause you can change careers.

Erin Welsh

Yeah.

Erin Allmann Updyke

But anyways, I really tried to come up with a better one and I couldn't so that's what I got. But anyways, so that's kind of the biggest difference between stem cells and differentiated kind of adult cells. There are two different kinds of stem cells as well in humans. There is embryonic stem cells which are where we began, so a zygote becomes embryonic stem cells, that's how we all formed in utero. And these cells can become literally any cell type, they become every single cell in our body. But even as grown humans we have stem cells in our bodies as well, they're called somatic stem cells, meaning they are in our body currently rather than in an embryo, and these are very important because they serve to regenerate cells in our body that need regeneration. So like in our skin, for example, in the basal layer, the very bottom layer, there are stem cells that are epidermal stem cells that not only continually divide and produce more epidermal stem cells but they can also differentiate into grownup skin cells.

Erin Welsh

Mm-hmm.

Erin Allmann Updyke

Right. And then we also have like in our bone marrow hematopoietic stem cells which can become all of our blood cells - red blood cells, white blood cells, platelets.

Erin Welsh

Right.

Erin Allmann Updyke

So the big difference between embryonic stem cells and most somatic stem cells is that the somatic stem cells can only become one or a few different kinds of cells whereas embryonic can become literally anything.

Erin Welsh

Literally anything. Right, right.

Erin Allmann Updyke

So that's just like to keep in mind, they're different. Most cell lines that we use don't come from embryos or embryonic stem cells, they come from differentiated animal or human cells, so they come from a piece of tissue and then they are made into a cell line. That's it, Erin! Do you have any other questions for me about cell culture?

Erin Welsh

Oh. I'm trying to think. So the whole thing about there's a limited number of times that a particular cell line or particular cell can replicate before the machinery just shuts down, that's the Hayflick Limit, right?

Erin Allmann Updyke

Yeah.

Erin Welsh

How much does that vary across different cell types?

Erin Allmann Updyke

Ooh, that's a good question. I don't fully know but based on how different cell types function in adult humans, I would guess that there's quite a bit of variability. And maybe not necessarily in what that limit could theoretically be but at least in what that limit is in a normal human body, for example.

Erin Welsh

Right, like in practice.

Erin Allmann Updyke

Exactly.

Erin Welsh

Yeah. Okay. Interesting.

Erin Allmann Updyke

Yeah. So Erin.

Erin Welsh: Yes.

Erin Allmann Updyke: Let's talk about where these cells came from.

Erin Welsh: Let's do it. Let's take a quick break first.

TPWKY: (transition theme)

Erin Welsh: So Erin, you have taken us through HeLa cells, what they are, some of what they can be used to do, and lots of other aspects of tissue culture. But as we know, that's just one part of the story of HeLa.

Erin Allmann Updyke: Right.

Erin Welsh: And I feel super lucky that I get to tell the rest of that story or at least like a good chunk of it, which is the story of the woman behind those cells, Henrietta Lacks, and the legacy she has left behind both in terms of scientific achievements but also in raising these important questions of ownership, informed consent, what it means to be immortal.

Erin Allmann Updyke: Mm-hmm.

Erin Welsh: Right off the bat, I want to say that this is such a big story that I can't focus on all of it but fortunately there are other great resources out there including the book where I got most of this information, 'The Immortal Life of Henrietta Lacks' by Rebecca Skloot. And there's also a movie based on the book on HBO. And we'll of course post these resources on our website so you can read more. Okay, so who was Henrietta Lacks?

Erin Allmann Updyke: Right.

Erin Welsh: The answer you would probably come across in most biology textbooks, especially ones that were published let's say 15 years ago or so, is that in short Henrietta was a black woman who died of cervical cancer in 1951 at the age of 31 and from whom cells were taken, a lot of books might actually say "donated", that gave rise to the most ubiquitous immortal cell culture line that has been used in every type of scientific research you could think of.

Erin Allmann Updyke: Literally.

Erin Welsh: Literally. And that alone is an incredibly impressive one sentence, maybe like a run-on sentence, biography. But what it doesn't tell you is that she was also a mother, she was a daughter, a wife, a friend, a sister, someone who was more than just those cells and the legacy that they have left and continue to leave behind. One of the themes that has come up more than once on this podcast, many times on this podcast, is the problem with the lack of humanity in medicine or science. It's often more straightforward or efficient to look for what we can measure or observe directly to make a diagnosis or to detect patterns within a population. And of course the application of this statistical analysis and data collection and the development of diagnostic criteria, it's all been hugely beneficial. But you know how people say you can't see the forest for the trees?

Erin Allmann Updyke: Yeah.

Erin Welsh: This is kind of like the opposite, losing sight of the trees for the forest.

Erin Allmann Updyke

Right.

Erin Welsh

It's so important to remember but way too easy to forget that behind each of those data points, behind each person diagnosed with a disease, behind each person who makes a discovery or a diagnosis is a human being with an entire history and life of their own. And I think keeping that humanity in science and seeing both the forest and the trees probably makes you a better scientist and a better physician and probably just a better human overall.

Erin Allmann Updyke

Yeah.

Erin Welsh

And that's a big reason kind of why we include these firsthand accounts in our episodes, to ground these topics in real life, to remind ourselves and hopefully listeners that these diseases don't happen just like in a textbook, they happen to real people, people experience them. And that's also why for this episode rather than including a firsthand account, we wanted to focus almost this whole history section on this person, on the firsthand account, on the person behind these HeLa cells.

Erin Allmann Updyke

Yeah. We weren't lying when we said this is a very different episode.

Erin Welsh

Yeah. So who was HeLa? We keep saying HeLa. HeLa stands for Henrietta Lacks, the first two letters of her first and last name. Henrietta Lacks was born Loretta Pleasant in Roanoke, Virginia on August 1, 1920. Henrietta was only four when her mother Eliza died and to help take care of Henrietta and her nine siblings, her father Johnny brought the family to Clover, Virginia where Henrietta lived with her grandfather Tommy Lacks. Johnny's family had lived in Clover for decades. His ancestors had farmed the land while enslaved and they continued to farm tobacco after slavery ended. Henrietta spent her childhood working on the farm, milking cows, feeding chickens, taking care of the pigs and horses, planting and collecting tobacco leaves. Getting to school wasn't as simple as hopping on a bus, it was a long 2 mile walk each way and Henrietta made that walk everyday through 6th grade.

In her free time, she and her cousins would swim in the swimming hole or play tag or hopscotch or they would take their earnings and go to the movie theater where they would watch black and white movies, sitting the only place they were allowed which was in the colored section. Henrietta's friends described her as lively and tough, someone who always stood her ground but also someone who was warm and sweet and generous. The person who made you see life in technicolor when you were around her. When she was 20, Henrietta married David or Day Lacks. Over the course of their relationship they would have 5 children: Lawrence, Elsie, David or Sonny, Deborah, and Zakariyya born Joseph. Not long after getting married, Henrietta and Day moved up to Baltimore where there was a huge boom in industrial jobs now that the U.S. had entered into WWII. Henrietta didn't love living in Baltimore in the city, so she would take the kids back to Clover as often as she could which was most every weekend.

And among her friends and family, Henrietta was known for being an amazing cook, spending hours everyday putting together rice pudding or slow-cooked greens or spaghetti and meatballs, cooking tons and tons of food so she could feed her kids and her husband as well as whatever cousins happened to stop by. In the evenings she and Day would play cards and listen to music if he was off work and if he wasn't, she would after go out dancing with her friend Sadie. But life for Henrietta wasn't always this house full of delicious food or nights out dancing, there were also some incredibly tough times, like when she took her daughter Elsie to Crownsville State Hospital which used to be known as the Hospital for the Negro Insane. Elsie, who was deaf and seemed to suffer from epilepsy would die in that hospital when she was 15 which was after Henrietta died, but Henrietta's family talked about how dropping Elsie off there was one of the most difficult times for Henrietta, something that she never quite recovered from.

And so for 10 years Henrietta and her family lived in Baltimore through these ups and downs. And then one cold and rainy January day in 1951, Day drove Henrietta to Johns Hopkins Hospital where she had an appointment to check out what she called "a knot on her womb". Just a few months before this appointment, she had been at the same hospital where she had given birth to Zakariyya but there was no note left behind about this knot or lump or any sort of cervical lesion or irregularity. But she knew that there was something there, something that was causing her a lot of pain and irregular bleeding. She saw a local doctor first who said it was a syphilis sore but the test came back negative, so he recommended that she head all the way to Johns Hopkins, which was a 20 mile drive. And there wasn't anything particularly special about Johns Hopkins itself, it was just that the other major hospitals that were closer wouldn't treat black people. Even Johns Hopkins was segregated.

At Hopkins she was seen by gynecologist Howard Jones who took note of the pain that she described, the bleeding between periods, and the fact that she felt a lump on the neck of her womb. And when he examined her he found the lump that she mentioned which he described as a cervical tumor, one unlike any he had ever seen before and he would never see the likes of again. It was a hard mass about the size of a nickel, but unlike other cervical lesions, this was shiny and purple. He compared it to grape Jell-O and it bled so easily, like just with the smallest sort of poking.

Erin Allmann Updyke

Yeah.

Erin Welsh

He cut off a little bit for a biopsy and told Henrietta to go home and wait for an answer. She didn't have to wait long. A few days later on February 5th of 1951, Henrietta received the news that the tumor on her cervix was malignant and that she would have to return to the hospital for treatment, which at the time consisted of radium tubes being stitched into the tumor and nearby tissue.

Erin Allmann Updyke

Ugh.

Erin Welsh

Sounds incredibly painful. So the next day she was back in the hospital undergoing this painful procedure, fortunately while unconscious under anesthesia. And during this procedure the surgeon, Lawrence Wharton Jr, sliced two dime-sized pieces of tissue from Henrietta's cervix. One from the region where there was a tumor and the other from the unaffected region.

Erin Allmann Updyke

Whoa.

Erin Welsh

Dime-sized seems big, but yeah.

Erin Allmann Updyke

It does seem big.

Erin Welsh

Yeah. He then packaged these up to be sent to a tissue culture lab run by a guy named George Guy where they were then processed by a lab employee named Mary Kubicek. Mary cut up the tissue into tiny, tiny bits and placed them into culture tubes with nutritional broth, making sure to keep the tumor tissue separate from the normal tissue. She labeled the tubes 'HeLa', the first two letters, like I said, of Henrietta Lacks' first and last name, and that was the standard naming procedure in the lab. Mary didn't expect much to happen, honestly, because the lab had worked on cell culture for years and the highly sought after immortal human cell line was beginning to feel like a pipe dream.

Erin Allmann Updyke

Can I ask a question?

Erin Welsh

Yeah.

Erin Allmann Updyke

So was this a lab that they were just taking samples from everyone, just trying to grow cells unsuccessfully?

Erin Welsh

Yeah.

Erin Allmann Updyke

Okay, okay.

Erin Welsh

Yeah. (laughs) I mean tissue culture had kind of fallen out of fashion for a while and so this lab was one of the main ones still working on it.

Erin Allmann Updyke

Still trying. Okay.

Erin Welsh

Yeah. Cause it seemed hopeless to find this immortal cell line where you could actually do sustained research on a particular cell. Yeah.

Erin Allmann Updyke

And was it kind of standard practice that surgeons would take samples of everyone that they were operating on?

Erin Welsh

Yes, absolutely. So that's what's sort of the the interesting thing and it's also what surprised me. To be honest, in 'The Immortal Life' book which was published in 2012 I believe, I'm not sure whether anything has changed but at least according to that book, a lot of the ownership of tissue ends in the operating room. Like once that tissue is removed from your body, whether it's your appendix, whether it's whatever, that no longer belongs to you and you as an individual can't... Like there's been a lot of legal battles over the ownership of cell lines and what seems to be the case is that an individual cannot own their own cell lines which I think is very interesting, unless you were a scientist and you developed it yourself or whatever.

Erin Allmann Updyke

Right, you develop your won cell line, then you can. But if someone takes it from you...

Erin Welsh

Right, anyway, yeah.

Erin Allmann Updyke

Anyways, sorry.

Erin Welsh

So yeah. (laughs) And so yeah, George and his wife Margaret had worked for years and years for an immortal cell line.

Erin Allmann Updyke

Wait, they were married?

Erin Welsh: Yes.

Erin Allmann Updyke: Oh I didn't know that.

Erin Welsh: So, Margaret different than Mary.

Erin Allmann Updyke: Oh.

Erin Welsh: But Margaret also worked in the lab, yeah.

Erin Allmann Updyke: Okay, okay.

Erin Welsh: And apparently an immortal cell line had been found before using mice cells but the Guys didn't want mice cells, they wanted to achieve this with human cells. And so they tried and failed and they tried and failed for 30 years.

Erin Allmann Updyke: Wow.

Erin Welsh: So you asked where did they get all of this tissue to try on?

Erin Allmann Updyke: Yeah.

Erin Welsh: Yeah, I mean, quote unquote "donation".

Erin Allmann Updyke: Right.

Erin Welsh: So they would partner with different physicians or surgeons who would take it from a patient and way more often than not, I mean it was like the standard rule was to do this without the patient's knowledge, without their consent. And that was the common practice at the time. I think that there are some different consent rules today in terms of like... But I don't think you are legally required - you go it?

Erin Allmann Updyke: I'll talk a bit more about it.

Erin Welsh: Okay good. Okay. It's surprisingly, correct me if I'm wrong, not that different today.

Erin Allmann Updyke: It's not, Erin. It's not.

Erin Welsh: Yeah, yeah. So anyway. One of the doctors that George Guy had partnered with was this guy named Richard TeLinde who was a gynecologist trying to get to the bottom of whether or not in situ cervical cancer posed a threat and could become invasive or whether it would just remain in place. We talked a little bit about this discussion in our HPV episode.

Erin Allmann Updyke: Right, yeah.

Erin Welsh

And TeLinde was firmly in the 'in situ cancers are precancers and super dangerous' camp. And so he was like, 'Okay, if only I can compare the cell types of these two cancers alongside normal cervical cells, I can show that I've been right all along and that all of these hysterectomies I've performed were not unwarranted.' So he was like a big, you know, 'Oh there's cancer, we're gonna do a hysterectomy.'

Erin Allmann Updyke

Were gonna cut the whole thing out, yeah.

Erin Welsh

Yeah, exactly. And so he formed a deal with George Guy where he would provide Guy with cervical cancer tissue from his patients and Guy would try to culture the cells.

Erin Allmann Updyke

Okay, it's all coming together.

Erin Welsh

There we go. Any person who walked into Johns Hopkins and was diagnosed with cervical cancer would have a tiny bit of their tissue sent off to George Guy's lab without their knowledge, needless to say nor their consent.

Erin Allmann Updyke

Okay.

Erin Welsh

One of these people was Henrietta Lacks. So back to Henrietta's cells in the lab. Usually what happened next and what Mary certainly expected to happen was that the cells in these tubes would maybe hang on for a few days at most but would eventually die.

Erin Allmann Updyke

Yeah.

Erin Welsh

And this is exactly what did happen to the bits of tissue taken from the unaffected region of Henrietta's cervix.

Erin Allmann Updyke

Ooh.

Erin Welsh

But it didn't happen, not even close, to the bits of cancerous tissue. The cells in those tubes didn't just hang in there, they grew and they grew and they grew. Mary had never seen anything like it before and she hurried off to tell George. After hearing the news from Mary, it occurred to him that this could be what they've been looking for all those decades. Finally an immortal cell line. And he wasn't shy about his discovery, he made an announcement on television holding up a tube of cells that he promised would help conquer cancer.

Erin Allmann Updyke

Whoa.

Erin Welsh

He told his colleagues who asked him to send them some of the cells so that they could play around with them, and then when they received the cells they in turn grew more and sent those around the world. But as the news of this immortal human cell line called HeLa was spreading among the medical community, not just at Johns Hopkins but seriously around the world, there was one person who knew nothing about it. The person whose name was on those cells, the person from whom they had been taken. Henrietta Lacks.

Erin Allmann Updyke

Yeah.

Erin Welsh

By the time Guy had made his television appearance, Henrietta had returned home from the hospital. And although initially she seemed to be getting better from the radium treatments, the improvements didn't last. Over the next several months, Henrietta grew weaker and felt aches and pains in her abdomen. She hid it well though with just her husband and a few of her friends and cousins in the know. But then she took a turn for the worse. Follow Up doctors visits had found a mass attached to her pelvic wall and tumors on her uterus, kidneys, and urethra.

Erin Allmann Updyke

Oh my gosh.

Erin Welsh

Her pain was unbearable to the point where she just couldn't hide it anymore. And her doctors wrote that treatment was not really possible, the tumors were inoperable and pain relief was the only option, which for the most part seemed to be ineffective. During one of these doctors visits, actually, TeLinde tried to take more of the tissue from Henrietta's cervix again without her consent or knowledge but it was too full of toxins due to her advanced disease and the cells died in culture. Henrietta spent the last month of her life in the hospital at Johns Hopkins dealing with unbearable pain, high fevers, nausea, and new tumors that seemed to appear daily. When Day brought the children to visit she watched them through the window until she was unable to get out of bed anymore. And on October 4th, 1951, Henrietta Lacks died. And while her family and friends saw it as an occasion for mourning, George Guy saw it as an opportunity to collect more samples from this woman who produced the first immortal cell culture line.

Erin Allmann Updyke

What?

Erin Welsh

It was...yeah. So he asked Day for permission for an autopsy without making it explicit that they wanted more samples from her or that they got samples from her in the first place.

Erin Allmann Updyke

In the first place.

Erin Welsh

Yeah. And I think what's interesting about this is that while it was legal at this time to take tissue from a living person without their consent, it was not legal to perform an autopsy or take tissue from the deceased without consent.

Erin Allmann Updyke

Right and that's still true, like the rules that govern what you can do with tissues from a dead body are very strict.

Erin Welsh

Yeah. Right, they are. But they're not as strict for those that are living which is just fascinating.

Erin Allmann Updyke

It's so bizarre.

Erin Welsh

Yeah. And at first Day said no way, but they asked again when he came to the hospital and he finally agreed to a partial autopsy. Mary Kubicek, who first cultured Henrietta's cells, stood next to the pathologist as he cut samples from Henrietta's bladder, bowel, uterus, kidney, vagina, ovary, appendix, liver, heart, lungs, and of course cervix, placing them into petri dishes for later research. Finally the autopsy was complete and Henrietta was allowed to rest. She was buried in the cemetery behind the house where she grew up in Clover but as we know, just because Henrietta stopped living doesn't mean she stopped impacting people's lives. There's this quote by someone named Irvin Yalom where the basic gist of it is that everybody dies twice. The first being your actual death and the second when the last person who knows you dies.

Erin Allmann Updyke

Yeah.

Erin Welsh	And if that's the case, Henrietta's memory will be carried on for a very long time, in part due to the important conversations that have taken place because of her quote unquote "donation" and this question of consent and in part because of the many people who have done so much to bring awareness to her life and experiences. And another part, again, due to the incredible achievements made possible by HeLa cells. So let's talk a little bit about those.
Erin Allmann Updyke	Yes, let's.
Erin Welsh	So as I mentioned, even before Henrietta died, her cells were being sent all over the world to laboratories not just in biomedical science but chemistry, physics, engineering, I mean you name it. Like you said, any kind of research you could imagine, for sure HeLa cells have been involved.
Erin Allmann Updyke	Yeah, definitely.
Erin Welsh	And even though the cells were pretty easy to maintain in the lab, demand still outpaced supply like by a lot.
Erin Allmann Updyke	Wow.
Erin Welsh	In 1952 the United States experienced the worst polio outbreak in the nation's history with thousands killed and tens of thousands left paralyzed and everyone demanding a vaccine for the disease. And even though there were many people researching a polio vaccine as we know from our polio episode back all the way in Season 1-
Erin Allmann Updyke	A long time ago.
Erin Welsh	Long time ago. Progress was slow because the virus was difficult to grow in cell culture and often had to be grown in live monkeys. That is until HeLa cells came along.
Erin Allmann Updyke	Wow.
Erin Welsh	Which were found to be able to be infected with poliovirus. A massive cell production laboratory was set up at Tuskegee University, the first of its kind. At first the cells that were produced here were pretty much only for polio research but eventually when it became apparent that there was not going to be a shortage of HeLa cells, the Tuskegee Center began sending the cells not just to polio labs but to anyone who wanted to use the cells to study basically anything. \$10 a sample plus Air Express fees. These cells were soon used to study all kinds of viruses to develop in standardized tissue culture techniques, to work on best practices for freezing and storing cells, and so much more. Erin, you went into a bunch of the things and it's funny when I was planning on this episode I was like, oh I'm gonna go through all the things that they accomplished. Like there's no way to even begin to list them.
Erin Allmann Updyke	No, there's no way. Right.
Erin Welsh	Like it's...yeah. And this early work though using HeLa cells helped to build the foundation of a field that would later go on to allow for stem cell isolation, cloning of whole animals, in vitro fertilization. The study of HeLa cells also led to the discovery that there weren't 48 but rather 46 human chromosomes and then this then led to the growth of the field of diagnosis of genetic diseases involving chromosome abnormalities such as Down syndrome or Klinefelter syndrome or Turner syndrome.
Erin Allmann Updyke	Wow.

Erin Welsh

Yeah. HeLa cells were blasted with radiation during the Cold War to look at the effects of radiation on a cellular level or they were used to observe the effects of steroids, hormones, vitamins, cancer, stressors, bacteria. Basically if you can think of a biomedical or really any kind of research topic, HeLa cells were there as part of it.

Erin Allmann Updyke

Yeah.

Erin Welsh

It was clear that the application of HeLa cells in biomedical research was basically endless and soon the demand for the cells once again outpaced the production capacity of Tuskegee.

Erin Allmann Updyke

Wow.

Erin Welsh

So a new company was started, Microbiological Associates, which shipped out Henrietta's cells to whoever could pay. And even though you probably would have guessed this already, I'll note that no one in the Lacks family had been told about this endeavor, much less given any compensation for the industry that had grown out of the cells taken from Henrietta without her consent. At this point, the excitement around Henrietta's cells had grown beyond just what people were using them to do research on. The public had started to learn about them as well. News articles began appearing about the cells but these articles didn't focus just on the scientific achievements made possible by HeLa cells, they also wanted to talk about the woman herself. But this presented an issue for the doctors who took and used her cells without her permission.

Using her real name in the article would not only link the Lacks family to those cells, meaning whatever genetic or cellular information that arose from this research could be tied to them, but another reason and maybe the real reason that TeLinde and Guy cared was because it meant that the Lacks family would also then learn that Henrietta's cells were taken without her permission to create a profitable industry. The laws at the time weren't as protective of a patient's rights as they were today even though it's only marginally more in terms of informed consent and patient confidentiality. But it was still clear at that point that that's where the laws were headed and as a compromise the editors of some of these articles agreed to change her name, Henrietta's name, to Helen L. And it was also said in this article that the tissue was taken from her after her death.

And so from this article on, this was like one of the first articles about Henrietta and the fact that they were her cells, Henrietta Lacks would be changed to Helen Lane or Helen Larson, leaving her family in the dark about the existence of her cells. But even if the Lacks family didn't know about the cells and their connection to them, many researchers did and they would soon be knocking at the door. By 1966, HeLa cells had been in use in all kinds of research for 15 years and cell culture technology had also greatly advanced with the isolation of many other different cell lines. But then came what I think in the book was referred to as 'the HeLa bomb'. In 1966 it was suggested that many of the different human cell lines that scientists believe they had isolated and conducted research on were actually HeLa-contaminated, meaning that HeLa had taken over them, meaning that they weren't what they thought they were.

Erin Allmann Updyke

They weren't what they thought. Yeah.

Erin Welsh

Yeah. And so this vigorous quality of HeLa cells had long been known but this massive takeover was on a whole other level. Cause if this were true, that meant millions of dollars of research money and years of research were essentially wasted because they were done on cells with properties that may not have been there.

Erin Allmann Updyke

Right, yeah. Like you thought that you were working with a kidney and you were working with HeLa.

Erin Welsh

Exactly.

Erin Allmann Updyke

Yeah.

Erin Welsh

But okay, first things first, researchers were like, 'We need to get a handle on the extent of the contamination that exists and once we get that done we want to find a way to better control contamination in the future.' And so both of those things could be achieved by developing a test specifically for the presence of HeLa cells. So keep that in mind.

Erin Allmann Updyke

Okay.

Erin Welsh

We need a test specifically for HeLa cells.

Erin Allmann Updyke

Okay.

Erin Welsh

Yeah.

Erin Allmann Updyke

It's not gonna be good.

Erin Welsh

No. By the 1970s, the misleading names of Helen Lane or Helen Larson began to fall out of use as journalists and scientists began to set the record straight, with one person in a letter to Nature suggesting that it might be time to authenticate her name, quote, "and let He La enjoy the fame she so richly deserves." So even though Henrietta's real name and connection to the cells began to be widely known among the researchers who cultured her cells, the family still had no idea of their existence until 1973 when Babette, Lawrence's wife, met the brother-in-law of a friend of hers. And this brother-in-law of her friend worked at the NIH and when Babette mentioned that her last name was Lacks, he was like, 'Oh that's strange, I work with cells from someone name Henrietta Lacks.' And Babette was like, 'Well that was my mother-in-law's name but she died 25 years ago.' And he was like, 'Oh my gosh, that's whose cells I work with!'

Erin Allmann Updyke

What?

Erin Welsh

And obviously this led to a lot of confusion for Babette, the news that this guy worked with her deceased mother-in-law's cells and the fact that he ordered them, quote, "just like everyone else".

Erin Allmann Updyke

Right.

Erin Welsh

Which implied that there were people all over the country and even all over the world who had access to her deceased mother-in-law's cells.

Erin Allmann Updyke

I can't even imagine how bizarre...

Erin Welsh

Right. It would've felt like a violation or an invasion maybe.

Erin Allmann Updyke

Yeah.

Erin Welsh

I mean this was yeah, in many ways this seemed like some sort of a nightmare. First they took Henrietta's cells without asking and it seemed likely or at least possible that next they would try to conduct non consensual research on her relatives, which was not an unfounded fear. Because while discussing this problem of HeLa contamination, one of the scientists suggested that a lot of the headache could be resolved if they had genetic markers to test for the presence of HeLa cells. And one way to do that would be to test Henrietta's children as well as Day Lacks. 'No problem,' one of the doctors said, 'they're still patients at Johns Hopkins so we can call them right up.' And that's what they did. Yeah. According to the postdoc put in charge of collecting the blood from the Lacks family, she called up the family and explained that they wanted to draw some blood from the family members so that they can develop these genetic markers. But according to Day, what they said was that they wanted to test for the same cancer that Henrietta had in her children.

Erin Allmann Updyke

Oh dear.

Erin Welsh

And so they agreed and blood was drawn. Did anyone attempt to obtain informed consent? No. Did anyone fill out an IRB? No.

Erin Allmann Updyke

No.

Erin Welsh

And while those requirements were not yet finalized in the law, they were only months or days away from being finalized.

Erin Allmann Updyke

Oh my god.

Erin Welsh

And when Deborah asked Victor McKusik who spearheaded this effort about her mother and about her cells, he ticked off some things that they had helped to accomplish like the polio vaccine, this genetic research, atomic bomb testing, etc. And then he handed her a book that he had edited called 'Medical Genetics'. In that book she found jargon-filled sentences and a photo of her mother that no one had ever remembered providing and certainly had not given permission to print.

Erin Allmann Updyke

What?

Erin Welsh

Yeah. And this was as far as he went to explain how her cells were still alive even though Henrietta had died and why they had taken her cells and how they had accomplished those things. And they certainly didn't tell Deborah any cancer results because they weren't testing for cancer, of course.

Erin Allmann Updyke

Right, of course not.

Erin Welsh

They left the Lacks family with way more questions than they attempted to answer. And over the next few decades the answers would be slow to come. A reporter for Rolling Stone named Michael Rogers, who was one of the first if not the first reporter to contact the Lacks family about Henrietta, published an article that led to many other reporters and people knocking on their door, some well-intentioned, others very much not. But overall, over time this narrative was shifting from what have these cells been used to accomplish to what does informed consent mean? What rights does a person have over their body? How can patient privacy be insured, especially in this age of genetic research? Can genes be patented? And finally after all this time, who was the person from whom these cells were taken?

Erin Allmann Updyke

Yeah.

Erin Welsh

And many people have worked to raise awareness about Henrietta Lacks and her story, especially her family and also Rebecca Skloot who wrote the book 'The Immortal Life of Henrietta Lacks'. And Henrietta's story is still invoked in discussions of how race intersects with informed consent and tissue research and patient privacy. Some institutions and companies that have profited off Henrietta's cells are finally donating money as a small step towards acknowledging her contribution. And Henrietta's legacy extends far beyond the scientific and medical advancements that her cells helped to achieve. There is now the Henrietta Lacks Foundation which provides, quote, "financial assistance to individuals and families particularly within minority communities who were involved in historic research cases without their knowledge, consent, or benefit. This includes the cases of Henrietta Lacks and HeLa cells, the Tuskegee Syphilis Studies, and the Human Radiation Experiments, among others."

In addition, several institutions have awarded Henrietta honorary doctorates, there are plans for a Johns Hopkins research building to be named after her, she's now in the National Women's Hall of Fame, her name has been tied to laws protecting participants in clinical research trials, there are plays and songs about her. I mean the list could go on forever, just like her cells. So Erin, even though I feel like I went on forever, there's so much I didn't cover and I'm very excited to hear what you're gonna tell me about what HeLa cells and what informed consent and tissue culture research is up to today.

Erin Allmann Updyke

Oh I can't wait to tell you, we'll take a quick break first.

TPWKY

(transition theme)

Erin Allmann Updyke

There have been over 110,000 research articles published using HeLa cells. Estimated.

Erin Welsh

That's incredible.

Erin Allmann Updyke

Three Nobel Prizes have been awarded for work with HeLa cells, most recently in 2014 for the development of advanced microscopy techniques that allow you to view cellular growth like live while it's happening.

Erin Welsh

Whoa.

Erin Allmann Updyke

And like we kind of mentioned many times already, HeLa cells have been used for literally everything that you can imagine, from the study of virology to cancer therapeutics, drug delivery systems, basic cellular function, cell signaling. Everything, everything.

Erin Welsh

(laughs)

Erin Allmann Updyke

There's a visual that I'll link to that I think kind of gives you a little bit of a clue of just like the array of topics and just how many there are. But literally everything that we do in biology has been done on HeLa cells.

Erin Welsh

It's incredible.

Erin Allmann Updyke

It's incredible. We have come amazingly far in the last 70 years in terms of our understanding not only of cellular, developmental, and molecular biology but also in our ability to use this knowledge for therapeutics, for vaccines, things that we talked about in so many previous episodes this season and in previous seasons like in our Huntington's disease episode when we talked about developments in gene therapy and the potential for something like CRISPR to change the game when it comes to genetic diseases. This is only possible because of in vitro cell lines.

Erin Welsh

Mm-hmm.

Erin Allmann Updyke

We have made immense strides in developing specific, targeted cancer treatments like monoclonal antibodies. We've also developed treatments for things like even COVID and other infectious diseases.

Erin Welsh

That's amazing.

Erin Allmann Updyke

We are getting better and better at developing cell lines, both from human cells but also animal cell lines to produce very specific proteins and antibodies that are closer and closer to exactly like a very targeted type of structure that we want to produce. It's really difficult to over... I don't think it's possible to overstate the impact that these cells have had.

Erin Welsh

No I think it's probably like one of the biggest things in biomedical research history.

Erin Allmann Updyke

Right, right. So many things. So another future foray that we've touched on in the past in our organ transplantation episode is the development of induced pluripotent stem cells.

Erin Welsh

Ooh.

Erin Allmann Updyke

Okay. So let's talk about this a little bit. Pluripotent stem cells are like embryonic stem cells, they can become any type of cell but induced pluripotent stem cells means that you take cells from a grown human, like a full adult human or a kid but a fully differentiated cell, and using things that are too complicated for me to fully understand and talk about but including telomerase, you can cause these cells to revert back to being stem cells. We have the technology to do this today. And this means that not only can you develop an immortal cell line from any person's cells, but you can develop stem cells from any individual cells which means that those cells could then be induced to differentiate into any other cell type.

That type of technology combined with technology to grow cells in three-dimensional structures, it's the exact type of technology that makes it even imaginable to someday be able to grow entire human organs which could change the game when it comes to treatment of chronic and currently incurable diseases. And even though we don't have that technology right now, the fact that it's even something that we can dream about is only possible because of HeLa cells, because of Henrietta Lacks.

Erin Welsh

Mm-hmm. Yeah.

Erin Allmann Updyke

Yeah. It's hard to even put into words how influential this has been, yeah.

Erin Welsh

I know. Yeah.

Erin Allmann Updyke

But even though that's hard to put into words just how influential in terms of scientific achievements HeLa cells have been, like you mentioned a lot Erin, we have to recognize what a massive kind of ethical issue had arisen because of this. Not only was it using cells without her permission, it was also identifying these cells as belonging to her, thereby releasing information about her and her family members without their knowledge or permission.

Erin Welsh

Right.

Erin Allmann Updyke

And the thing is, like you kind of alluded to Erin, we really haven't completely fixed the system to ensure that this could never happen again.

Erin Welsh

Not at all, it's very alarming.

Erin Allmann Updyke

Yes. So currently the common rule, that's what it's called, it's the code from the Department of Health and Human Services that details the protection of human subjects, basically laying out the requirements for IRB, Institutional Review Board review, and everything that pertains to the ethics of human subjects research in the United States, at this point in time still allows for the use of biospecimens without informed consent so long as they are de-identified. So no longer can you take a cell and call it HeLa, thereby knowing that it came from Henrietta Lacks, but you could take a tissue sample from someone, slap on a number that isn't their medical record number but is just some other number, and thereby make it de-identified, so it has no association with them, without ever telling them. The problem is-

Erin Welsh

(laughs) Yeah.

Erin Allmann Updyke

-that that is not keeping up with the times. Today you could sequence a genome from that cell and have all of that genetic information.

Erin Welsh

Yeah.

Erin Allmann Updyke

And especially when you think of how many people swab their cheeks and then send in their DNA to be sequenced to all of these different companies, then you have that information and can compare it across these databases. In light of how much technology has progressed, that type of allowance for allowing the use of biospecimens without informed consent, it's problematic. There are some new regulations that have come into play that say that if there is going to be any genomic analysis of human data, then you do have to obtain informed consent. But that's still just one piece of it. So really even though this was last reviewed in 2017, which wasn't that long ago-

Erin Welsh

Oof, yeah.

Erin Allmann Updyke

It's still out of date at this point.

Erin Welsh

I mean, like we know that technology moves faster than ethics and laws.

Erin Allmann Updyke

Always.

Erin Welsh

But the writing has been on the wall for a very long time.

Erin Allmann Updyke

Right.

Erin Welsh

It was more than on the wall in 2017 as well.

Erin Allmann Updyke

Exactly, exactly. Yeah. I think, you know the good thing is... So 2020 was Henrietta Lacks' 100th-

Erin Welsh

100th anniversary of the day she was born.

Erin Allmann Updyke

Right. And so I think that because of that there was a large amount of celebration because of that and I think that more and more we are having these conversations.

Erin Welsh: Right.

Erin Allmann Updyke: But like you said Erin, people are only just not barely beginning to actually put their money where their mouth is both literally and figuratively to make substantial change in the way that we deal with ethics in human research studies. There have been two or three institutes in the U.S. and the U.K. that have made either a single large donation or have committed to make donations to the Henrietta Lacks Foundation every time that they develop new cell lines from HeLa cells. The head of NIH also got a large grant and is donating a portion of it to the foundation. So people are kind of just finally starting to recognize that because of the impact that these cells have had, like there needs to be reparations back essentially.

Erin Welsh: For sure, yeah.

Erin Allmann Updyke: But it's still not nearly at the point yet that it needs to be.

Erin Welsh: No, right.

Erin Allmann Updyke: But it's at least a start.

Erin Welsh: It's a start. It's a start. Just a delayed start.

Erin Allmann Updyke: Yeah. So we wanted to make this episode in large part just to kind of get this story more press so that people can really hear about it, and a lot of people have asked for us to cover it. But we also wanted to put our money where our mouth is so we also made a donation to the Henrietta Lacks Foundation.

Erin Welsh: Yeah.

Erin Allmann Updyke: So small step but a step nonetheless.

Erin Welsh: A step, yeah.

Erin Allmann Updyke: So with that, sources?

Erin Welsh: Sources. (laughs) My source list was very short for this episode, primarily I used 'The Immortal Life of Henrietta Lacks' by Rebecca Skloot and a few articles here and there that I will post on our website.

Erin Allmann Updyke: I'm jealous Erin, I have a long list of articles because I had to learn all about telomeres and things but I'll post the full list of all of the sources that I used if you wanna learn more about the cell cycle and cell lines and also what we use HeLa cells for today and kind of the future of cell culture and cell lines. On our website thispodcastwillkillyou.com under the EPISODES tab you can find the full list of our sources for this episode and every single one of our episodes.

Erin Welsh: Yes. Thank you to Bloodmobile for providing the music for this episode and all of our episodes.

Erin Allmann Updyke: Thank you to the Exactly Right network of whom we're extremely proud to be a part.

Erin Welsh: And thank you to you, listeners, for listening and for recommending this episode.

Erin Allmann Updyke

Yeah. We hope that it lived up to your hopes and dreams and expectations.

Erin Welsh

Yeah. (laughs) Well until next time, wash your hands.

Erin Allmann Updyke

You filthy animals!