everybody. This Doctor Karlfeldt, and I'm excited to do this sort of presentation in regards to subject that I think is extremely important for for everyone to know, because a lot of us, we think about cancer, we think of, you know, it's this, this one tumor and it's just a tumor.

And, you know, do whatever it is that we can shrink that tumor. And we don't recognize the complexity of what cancer truly is. And because we don't recognize that we are not bringing in all the type of therapies that are are needed in order to be able to dress this complexity.

So I'm going to do a little bit of a PowerPoint just to kind of highlight the complexity that exists within the within the tumor. Excited to learn a little bit more, because I always think that there's always power and knowing.

So we're going to be talking a little bit about the complexity of cancer. And what's important to understand is that a tumor is not just a tumor. You know, it's not just a lump, you know, it is a complex ecosystem, and it has a number of different cells and types and subpopulations.

And that can then influence the tumor as a whole. So, you know, it is not just the same kind of cell the whole time that you know, that they're all the same cells.

There are, you know, kind of like a city that says, look at LA, for instance. You get the city as a whole, you know, which we can pretend is the tumor.

Some people think LA is a tumor. And and then you have then, you know, different counties and then you have different neighborhoods within those counties.

And then you have different, you know, houses within those neighborhoods. And then you have different individuals that live in these houses. So all of these things, you know, creates these this complex ecosystem, you know, with many different cell types and many different kind of sub subpopulations.

So one part of the tumor is not the same as another part of the tumor. And each one of them can then influence the tumor as a whole. And the tumor exist in a in a tumor microenvironment, you know.

So you as an individual, you know, we have the nature versus nurture. You know, where nature you got your genetics, but then you have the nurture kind of what what you've been exposed to and the environment that you're in.

You know how that impacts you. And it's the same with the tumor. The environment around it will then determine a lot of its behavior. So we can't just look upon the tumor by itself.

We got to look at it in the environment that it's in. And then we have the genetics in the tumor. And that's altered based on epigenetic influences. So again things that we do, things that we are exposed to will then actually change the epigenetic manifestations, how genes are performing and how going on right there.

So we'll talk a little bit more about that. I just want to kind of start so you can see that all these different things that are taking place at the same time, and you need to consider all these factors in order to be able to be successful in your treatment.

Again, you can't a tumor is not just a tumor. Looking then at the tumor ecosystem, we have this cell diversity. So every cell is not the same within the tumor tumors a complex ecosystem containing tumor cells as varied as as well as in different like endothelial, hematopoietic and stromal and other cell types.

And all of them can influence the function of tumor as a whole bunch of different cells that do a bunch of different

things, and they're all impacting the tumor and what it does, you know, and also these additional cell types that can influence the tumor cells directly and can create metabolic changes, such as creating hypoxic environment and nutrient fluctuations, meaning that this tumor getting more sugar is getting more of this nutrient, that nutrient is it starving.

And in other areas, all of these cell types can control that and can also control whether the tumor area is very, you know, whether it has oxygen or not, have oxygen.

And so all of that can then be controlled by all these different cell types that are all different. And so by functioning as this complex ecosystem, you know, the overall tumor fitness can then be enhanced.

Yeah. Ultimately impacting therapy failure. So meaning that it's kind of like a a neighborhood coming together with all these different skill sets. And you know so and to protect you know what what is going on within the neighborhood.

And so you have the plumber, you have, you know, the electricity or you have somebody, the policeman that's there. And, and all of these factors come together to protect the tumor, making it more able to resist treatment.

So you got to consider that as well. And then within within the tumor ecosystem, in addition to, you know, having all these different types of cells, all these different individuals that exist there, then you have then what's called sub clones, you know, so there exists multiple tumor cell sub populations within a single cancer.

Again, it's kind of like, you know, within the city, bunch of different neighborhoods. You have a bunch of different counties and all these are different subpopulations.

And the all behave differently. And they're all impacted by stressors differently. So you know what may work in one area as a treatment, you know, as a therapy may not work in other section of the tumor.

So again, that's why it's important to be able to have a well-rounded type of, of therapy. And that's why any great therapy, you know, in in a great of oncology cancer therapy and become so important because you got to consider all these different factors and you have them functional, diverse cells within these sub phones.

All of that impacts response to therapy. And each clone contains a mixture of cells that vary with respect to their stem and also ability to proliferate, including relatively dormant cells, you know, cells that are just going to hanging out, chilling.

And they're not these fast dividing cells, but so each clone that a mixture of all these different cells and together all these factors represents and the functional diversity present within the single genetic sub clone.

So so yeah, it's it's really fast. Cancer is fascinating, you know. So you see, it's not just these dumb lump. Yeah. It is a it's an entity in itself.

And it's this ecosystem within itself that you just got to respect. So, and then we have the, you know, talked about the tumor microenvironment. Then what's fascinating is that there's actually a crosstalk.

There's communication between the environment the tumor microenvironment and the tumor cells. And so this crosstalk can actually impact then how the fitness of the tumor cells and how they behave and the tumor microenvironment can actually turn normal cells into cancer stem cells.

That's how important the tumor microenvironment is. And there are things that you can do to control the tumor microenvironment. And we're not going to be able to, you know, time wise, be able to get into all of that right now.

And then the tumor microenvironment can then actually confer then cancer cell therapy resistance. Yeah. So it can then assist in helping the tumor to resist therapy.

So again very important you know and then behavior tumors depending on the environment that they're in. So it's kind of like like you you know certain environments you behave in one way their environment you behave in another way.

So if we alter the environment to optimize, then the the effect of the therapy will be much more successful. So and then we get epigenetics. Yeah. So epigenetics it's kind of like the software of the cell directing how genes, you know the hardware should should function.

So it's not the gene cinema self, but it's the software telling the genes it should be turned on turned off active or. Yeah. So all of that is controlled by the epigenetics.

And it also can alter then gene expression patterns within the cell. And which is fascinating can activate things like oncogenes, cancer causing genes or deactivate tumor suppressor genes.

So all of the all of this relates them to the epigenetic component. So we got the, you know, all the different types of cells within the tumor. We got all these different sub clones.

And then we got the tumor microenvironment. And then within each cancer cell we also have the how the genes how they're behaving. So all these areas we can impact and we can address using different therapies.

And so the epigenetics and influences and cancer cell growth response to treatments ability to spread. Yeah. So obviously these are important factors to to be able to address.

And then we got the cancer stem cells. So cancer stem cells are subset of cells within the tumor that have stem like stem cell like properties you know.

So you think of them as kind of like master cells of a tumor having the power to recreate the entire tumor mass. So do we want to be able to deactivate these or get rid of them.

Yeah. Because even though we're able to shrink a tumor, if they're still there, they can recreate the entire tumor mass. And you know, we don't want that.

Nobody wants that. And while they're small subset, you know, their unique behaviors make them a major focus in cancer research as effectively targeting cancer stem cells could lead to more durable and complete cancer treatments.

You know, and we understand why, you know, because they can recreate the whole tumor and and they have the ability. Yeah. Circulating cancers or cancer stem cells can continually divide and regenerate new tumor cells.

And they have the ability to give rise to various cell types found in the tumor. So they can help to all these different types of cells and sub populations.

They can recreate all of that. They have all that information. And so they play a crucial role in initiating and sustaining tumor growth. And associates, you know, since they can recreate all of this, you know, they they they play important role.

They like the, the like I said, the master cells of the tumor. And and they exhibit cellular plasticity, meaning that they can, they're very flexible in what they can become and do and they can move actually between being a stem cell and a non stem and also non stem state.

Yeah. Which is fascinating. So they're not just locked into being one type of cell. They can actually cloak themselves and be this and be that. And that makes it even harder to treat.

So yeah. So this ability to answer the resilience and challenges and in targeting them. And so the therapy challenge is then you know chemotherapy and this is important to understand so that you don't think I'm going to do

chemotherapy.

And that's all there is. I'm going to shrinking the tumor. It's much more than that. You know you gotta you gotta respect the the cancer, the complexity.

And so you got to lean in on it and so many other different ways. So the chemotherapy, it helps by tackling the fast growing cells but often misses the slower sleeping ones.

And that's important. So it's only one type of of cells that chemotherapy goes after. It doesn't mean that doesn't have any value. It it does I mean so so you always get to see, you know, pros and cons with any kind of treatment.

So after the treatment these sleeping cells can then wake up and then they can start a new cancer. And chemotherapy can sometimes change the mix of cells within the tumor.

And this change made and might make cells stronger and better at surviving. So here you have, you know, all these different cells. You have the fast growing ones, you get a slow ones and you do the chemotherapy you kill then the fast growing.

So obviously now you have a different type of mix of cancer cells left. You know, they and the majority of them, you know, since they survived the, the, the chemo treatment, the majority of them will probably survive that chemo treatment again, because it is not the type of cells that are left that are impacted by that chemo.

And also now they have a gain, the information that they need in order to be able to deal with the assault of the chemo. And they can then confer that information to other cancer cells, you know, so that they they are all becoming then resistant to that treatment.

And so so we have yeah, some cancer cells are already strong against the chemotherapy even before treatment starts. You know. So obviously they are the ones that are surviving.

And then next time we try to chemo they are still strong against the chemotherapy. And chemotherapy might make these strong cells more common by getting rid of the weaker.

Once again we are choosing the population. You know that is the stronger ones. So chemotherapy can either make some cells stronger or highlight the already strong cells that were there from the beginning.

The tumor microenvironment plays a role in adaptive drug resistance as well as the same. A genetic makeup can be sensitive or resistant to drugs, depending on the context that Duran.

So that's fascinating. So you like I mentioned, you know, whether you're in this environment, you know, you behave in this way and then that environment, you behave in that way.

So, you know, you have two cells with the exact same genetic makeup. But you know, if they are in this tumor microenvironment, you know, they they may die from the cancer, from the chemo or from, you know, whatever type of therapy you're choosing or but if they're in this, you know, this type of tumor microenvironment, they won't, you know, because the tumor microenvironment is actually assisting that cell and supported to survive, you know, during this onslaught of of the chemo and the tumor microenvironment, like we mentioned, it can actually then initiate stem cell like programs and cancer cells.

So tumor microenvironment through that crosstalk that I was talking about is able then to change cancer cells into then stem cells cancer stem cells. And they are really hard to kill.

So if we can control the tumor microenvironment which again there are, you know, therapies and techniques, you can do that. You can then reduce the production of these cancer stem cells.

And you can also reduce the resistance to therapy. So you know, as mentioned cancer stem cells very therapy

resistant. In fact they can become actually more active after chemo and radiation therapy.

You know. So and that again, that's why it's important to have integrative therapies along with so that you can then calm down the activity and the aggressiveness of of these cancer stem cells.

And there are techniques that where that can be done. So so therapy. Yeah. What should it account for. Well it needs to account then for the health of the tumor microenvironment.

It need to account for that. But genetic factors in need to account for cancer cell stem activation. The complex ecosystem of a tumor that shrinking a tumor or tumors does not equate with beating cancer.

You know, those are two different things. Yes, because the tumor shrinking doesn't mean that you're beating cancer. You know, you're shrinking a tumor.

We don't know what's going on with the rest of the body. We still have the the sleeping, the dormant cells that that are are not being impacted. We still have the cancer stem cells, all of these.

And we still have, you know, the environment that, you know, this tumor exists. You know what what is the health of that. And so chemo radiation, you know, like potentially change the behavior of the tumor at different cancer drivers will express and the various sub clones of the cancer will shift based on the composition and signaling of the tumor microenvironment.

So yeah. So again the complexity. So what can you do. Well you can go to our website the Carvel Center. We have a huge amount of resources available there.

You know lots of information. And also if you are dealing with cancer, I do offer a free 15 minute a consult. You can just call our center (208) 338-8902.

Or you can email us at info at the center. And you are going to love my new book that I just published called A Better Way to Treat Cancer. And it will address all the different things that, you know, the issues that that I've, that we've discussed during this presentation.

And I really wanted patients to become empowered and know what is available and how to integrate therapies and also for patients, for people out there, obviously, you know, the best cancer is the one that we never have.

And so by learning more about cancer, the risk factors, the emotional, the physical, chemical, all these different factors that you need to address and look at and kind of see where I'm at, where I'm at at risk and address that before you get to a point where you have to deal with a big C word.

So I look forward to hearing from you.