Funding for Yale Cancer Answers is provided by Smilow Cancer Hospital.

Welcome to Yale Cancer Answers with Doctor Anees Chagpar.

Yale Cancer Answers features the latest information on cancer care by welcoming oncologists and specialists who are on the forefront of the battle to fight cancer.

This week it’s a conversation about CAR T cell therapy with Doctor Timothy Robinson. Doctor Robinson is an assistant professor of Therapeutic radiology at the Yale School of Medicine where Dr. Chagpar.
is a professor of Surgical oncology.

Tim, maybe we can start off by you telling us a little bit more about yourself and what it is you do.

Sure. So I am a radiation oncologist, which means that I treat tumors or cancers using radiation therapy and I have a clinical presence, so I treat patients. I specialize in the treatment of hematologic malignancies as well as CNS disease. I also have a small lab that tries to work more on the research side, trying to figure out how to do these things better.
And so tell us a little bit more about what your lab is up to.

Sure, my lab has been working on ways to try and figure out with lymphoma how to make our treatments better.

As a radiation oncologist, Lymphomas are unique in that many cancers we use radiation to treat many different cancers and solid tumors, but lymphomas and other so called liquid tumors, so lymphoma, myelomas, leukemias are actually exquisitely sensitive to radiation.
and so it’s another place where radiation can actually be helpful. However, even though in general these tumors tend to be very sensitive for aggressive lymphomas that have kind of blown through all the conventional treatments, we actually will sometimes even for them see that they will actually grow through radiation treatment and we don’t have a good understanding of why that is. And so my lab is interested in understanding how those tumors become resistant to radiation and then also how are those tumors becoming resistant to some of these new and
these emerging therapies like cellular therapies like CAR T cell therapy that have really kind of revolutionized our treatment of these tumors. But they still don’t always work and we’re trying to figure out ways to make them work better. So tell us a bit more about what exactly CAR T cell therapy is. I mean some of our audience may have heard of it, it seems to be something that is fairly novel. Many of our audience may know the standard surgery, chemotherapy, radiation,
00:02:37.292 --> 00:02:40.808 maybe even have heard about immunotherapy.
NOTE Confidence: 0.9352219
00:02:40.810 --> 00:02:43.042 But CAR T cell therapy sounds
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00:02:43.042 --> 00:02:44.530 really new and interesting.
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00:02:44.530 --> 00:02:46.555 So can you tell us a bit more about
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00:02:46.555 --> 00:02:48.530 what it is and how it works?
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00:02:48.530 --> 00:02:49.730 Well, it is new and interesting,
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00:02:49.730 --> 00:02:51.010 you’re correct.
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00:02:51.010 --> 00:02:53.470 So CAR T cell therapy,
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00:02:53.470 --> 00:02:55.726 what it stands for is chimeric
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00:02:55.726 --> 00:02:58.109 antigen receptor, T cell therapy.
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00:02:58.109 --> 00:03:01.140 So chimera meaning a mix and then
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00:03:01.234 --> 00:03:03.538 antigen receptor is basically what
NOTE Confidence: 0.938576366666667
00:03:03.538 --> 00:03:05.610 they’ve done it’s actually very cool.
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00:03:05.610 --> 00:03:07.506 It almost sounds
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00:03:07.506 --> 00:03:08.454 like science fiction.
NOTE Confidence: 0.938576366666667
00:03:08.460 --> 00:03:10.290 So what they can do is they can take your
immune cells, or your T cells specifically, which is why it’s called CAR T cell therapy. And your T cells are part of your immune system that can recognize of course foreign antigens, infections, but also potentially, cancers. And basically what you can do is you can take somebody’s individual T cells, you can take somebody has an aggressive, you know, lymphoma that’s grown through all the chemotherapy treatments that are kind of standard of care. And they have this aggressive lymphoma that’s just not responding for those patients.
CAR T cell therapy has been approved.

And what you can do is basically take the immune cells out of that patient, put them in a Petri dish, genetically engineer them to go after markers on those cancer cells, kind of have a pep rally in the Petri dish get them good and revved up and then inject them back into the patients.

And then those CAR T cells they’re chimera because they’ve now been put with a specific marker to kind of heat sink towards the cancer cells, so it’s a chimera or mix of your normal T cells,
but now kind of targeted towards the cancer cells. And with that approach we can actually cure people who previously really didn’t have any curable options. And really what you need is kind of a specific target to go after. And this has been a very exciting area in cancer overall, but it’s been very successful in pediatric leukemias but also in adult lymphomas.
T cell lymphomas, B cell lymphomas.

So if you’re taking people’s T cells out of them and they have a lymphoma, especially if they have a T cell lymphoma, how does that work exactly?

Yeah, sure. So it’s a great question. The thing is that right now, we’re still figuring this out. CAR T cell therapy works great for B cell lymphomas because almost all B cell lymphomas and many B cell leukemias over-express a very specific kind of protein on their surface and it happens to be called CD19 and that’s kind of the bullseye so to speak.
It’s a protein that is over-expressed on malignant B cells or lymphoma cells, but not really over-expressed on any other cells in the body. And that’s the target that the CAR T cells go after. We’re trying to figure out how we could go after T cell lymphomas which are very aggressive. But as you point out, those don’t necessarily have the same markers and we haven’t cracked that nut so to speak, but we are trying to figure
out specific markers on T cell lymphomas that might work as well, but we haven’t figured that out just yet.

And so if you have these T cells that are going after these markers on B cells for B cell lymphoma, is it true that, it sounds like that’s great, it sounds like you’re just kind of getting your immune system to go after these cells and kill them off, some of our audience might get confused between that and immunotherapy.

Is this a form of immunotherapy and if so, does it need to be administered with chemotherapy as immunotherapies do or is this something that is just...
your body being revved up and those T cells having gone to the pep rally in the Petri dish, as you say, just going out there and doing their job? Typically when we give this therapy, yeah, the conditioning so to speak is expected to act on its own and that’s what they call lympho depleting chemotherapy. So what they will do is give you about 3 days typically worth of chemotherapy that will kind of suppress your immune system,
get your T cells that are there to kind
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of calm down and get out of the way.
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And then two days later they go
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ahead and inject the CAR T cells and
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do the job of getting rid of the cancer.
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So on one hand it is the
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immune system going after the cancer,
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but on the other hand we kind of tend
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to distinguish
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CAR T is cellular therapies
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because you’re taking cells out,
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you know genetic engineering
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then putting them back in.
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And so we tend to call those
cellular therapies.

But I mean it really is splitting hairs a little bit because it is still the immune system being used to go after the cancer.

Yeah. So I mean, it sounds really cool, right? And it sounds like that would be something that would be the ideal.

Here is one of the cells in your body that has gone awry and created a cancer. And now all you’re doing is you’re kind of helping your body to target those cancerous cells and fight them off just like they were designed to do.

So what’s the downside?
I mean are there side effects to CAR T cell therapy? And what about the financial cost? Sure, these are all good points and first and foremost, it doesn’t work all the time. So for patients with relapse refractory aggressive lymphomas, we’re trying to figure out ways to make it work better. But for those patients, their cure rates are quite low. With CAR T cell therapy, we appear to be getting about a 40% durable response.
which you could kind of call a cure for those patients. And so it’s not perfect. It doesn’t work for everybody and that’s what we’re actually trying to do is to make that better so that it does cure everybody, but 40 percent is a pretty good number when you’re talking about a setting where almost nothing else works well. And 2nd, in terms of toxicity, first of all, the biologic toxicity, so one of the things that can happen is that there are some patients it actually is similar to immune therapy in that some patients
will just sail right through it and won’t even bat an eye. But then some patients can have dramatic side effects or toxicities and they tend to be self limited which is good. And the biggest one that we worry about with CAR T cell therapy is this thing called cytokine release syndrome or CRS and what that is, we’ve taken these T cells and thrown a PEP rally inject them in and then they see a lot of tumor and they get real excited. Your immune system when it revs up can secrete a lot of cytokines and sometimes it’s such a powerful kind
of storm of cytokines that it can actually cause a severe toxicity. Probably the most feared toxicity is something called ICANS or this kind of neurologic toxicity where it can actually result in something as severe as not being able to talk or even being temporarily paralyzed like a kind of Guillain Barre type syndrome in the hospital. And that happens actually not infrequently, it varies by the exact cellular product. But I mean in some of the products that can be as high as 30% rate of having a toxicity so bad that
people can temporarily be stuck in the hospital not able to speak and the vast majority of those are self limited and go away with close monitoring. But there certainly is a potential for real toxicity especially in the acute setting chronically. So far, again, we don’t have super long term follow up, but these patients seem to do well long term. It really is kind of that acute window. And then lastly on the financial toxicity, you know this is an expensive therapy.
the number that I’ve heard cited

most often because obviously

our healthcare systems are complex

and opaque and can

be very difficult to navigate,

but around $400,000 is

the number that I’ve heard.

Holy Dinah.

Yeah, holy Dinah.

And that’s obviously

a very high price tag.

So insurance clearance is of importance.

I mean the good news is that insurance

does cover this and approve it when

it’s appropriate and the FDA approvals

have kind of been moving up
as appropriate for patients with bad disease. But that’s the thing with cancer care these days. You could do a whole segment. I’m sure you’ve done many segments on the cost of cancer care, which is a rapidly moving target. So you know, on the one hand you could say, oh my gosh, $400,000, this is crazy, how is this ever going to be a real solution? We should just abandon this. But I would also say that technology improves over time. And so as we get better at doing this, we
figure out cheaper ways to do it,
I think that will be a natural thing
that will kind of evolve over time.
Right now we’re just excited
to be curing folks who before
we’re kind of carrying a death sentence.
we’re kind of carrying a death sentence.
I just have to take a
breath at that, nearly half,
$1,000,000 price tag for therapy,
$1,000,000 price tag for therapy,
especially when you say that
it doesn’t always work.
So how often does it not work and
what do you do then?
Is this something that you then repeat,
so multiple courses of CAR T cell therapy at,
$400,000 a pop?
And if so, how many times do you do that?

Yeah, so to be honest, I think it’s important to keep in mind, it’s easy to kind of talk about this academically, which is great and very important. But I’ll give you kind of an example of a case that I saw, one of the earlier cases. I had a gentleman who had been referred to the Cancer Center I was at where I’d actually started out at Moffitt Cancer Center before I came to Yale who happened to do.
some of the first CAR T therapies. And so they’re a big center there. And anyway, this was in the early days around 2018 and I had a gentleman with a diffuse source B cell lymphoma that had been through 6 lines of therapy. And I don’t know the price tags of all the therapies he went through, but they weren’t small either. Chemotherapy, rituximab, he had a stem cell transplant. Two rounds of radiation and his cancer kept coming back, and it kept on coming back to the point that actually it caused his leg to necrose and he actually had...
00:13:04.989 --> 00:13:06.690 to have an amputation
NOTE Confidence: 0.949198844444445
00:13:06.690 --> 00:13:08.551 from the lymphoma attacking it.
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00:13:08.551 --> 00:13:12.404 And that's when I met him and
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00:13:12.404 --> 00:13:14.612 so he came to see me,
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00:13:14.620 --> 00:13:15.495 we did a little bit of chemo,
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00:13:19.257 --> 00:13:21.343 was able to survive for another
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00:13:21.343 --> 00:13:22.727 two years cancer free.
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00:13:24.319 --> 00:13:26.162 kind of get him through that danger
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00:13:27.879 --> 00:13:29.607 and then get the CAR T cell therapy.
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00:13:37.050 --> 00:13:38.890 cold truth is that if you have a
really refractory disease that’s life threatening and if you don’t fix it, I mean the alternative is death. And happy to speak on that more. Certainly, I mean I think that CAR T therapy has its place.
We’re going to learn more on the other side of the break about how it could fall short and some of the work that you’ve been doing to kind of improve outcomes in those patients right after we take a short break for a medical minute. Please stay tuned to learn more with my guest Dr. Tim Robinson.

Funding for Yale Cancer Answers comes from Smilow Cancer Hospital where their oncodermatology program treats dermatologic concerns including very dry skin itching and skin changes that arise as side effects from chemotherapy. Genetic
testing can be useful for people with certain types of cancer that seem to run in their families.

Genetic counseling is a process that includes collecting a detailed personal and family history, a risk assessment, and a discussion of genetic testing options. Only about 5 to 10% of all cancers are inherited, and genetic testing is not recommended for everyone. Individuals who have a personal and family history that includes cancer at unusually early ages, multiple relatives on the same side of the family with the same cancer,
more than one diagnosis of cancer in the same individual, rare cancers, or family history of a known altered cancer predisposing gene could be candidates for genetic testing. Resources for genetic counseling and testing are available at federally designated comprehensive Cancer centers such as Yale Cancer Center and Smilow Cancer Hospital. More information is available at yalecancercenter.org. You're listening to Connecticut Public Radio. Welcome back to Yale Cancer Answers. This is Dr. Anees Chagpar and I'm joined tonight by my guest, Dr.
We’re talking about improving outcomes for patients undergoing CAR T cell therapy.

And for those of you who are just joining us, right before the break, we were talking about this fairly novel treatment, cellular therapy with CAR T cells, which is basically taking out your own T cells, putting them into a Petri dish where they have a pep rally, as Tim would say, getting revved up to fight against particular antigens, and then they are reinjected into your body where they do their magic.
And Tim, right before the break, he told us a nice case that you had seen early on in your career where somebody who had failed multiple lines of chemotherapy and Rituximab and radiation and stem cell transplant really got CAR T cell therapy and did well for at least two years thereafter. So certainly it has a role to play. But it is not without toxicity. It certainly has some biologic toxicities as we talked about before the break and a significant price tag for those of you just joining us. That price tag was estimated to be roughly $400,000.
And so Tim, the part that I want to talk about in this next segment is the issue that you brought up in passing before the break, which is it doesn’t always work. So tell us a bit more, how often does CAR T cell therapy not work? And why is that? Why is it that some people may have what seems to be a miraculous response whereas others not so much? Yeah, exactly. So that’s the $400,000 question.
is where this is being actively studied by a lot of groups, why do some patients respond and others not respond and what are the mechanisms of resistance and what are the prognostic kind of factors that help us understand that. One of the major prognostic factors that we’ve seen is the total amount of disease that somebody has. So we quantify this using a term called metabolic tumor burden, or even just the size of the tumors. And we use the term metabolic tumor burden. If somebody gets a PET scan,
these are scans that can trace the amount of metabolic activity in the cancer. Add that all up and we can get a volume of how much disease and how active it is. And we have seen repeatedly and multiple investigators have seen this, that when you have a high burden of disease, those patients don’t do as well with CAR T. As we learn more about this, there’s different mechanisms, but what we think is that basically there’s many reasons why CAR T cells can fail and I will list a few.
One, we have seen that sometimes the target they go after, the CD19 can become more elusive or down regulated and then that can be a way for cells to kind of evade this therapy. Fortunately for us the B cell lymphomas tend to be fairly dependent on that. So we don’t think that’s a major source of resistance, but it’s theoretically there and it happens in leukemia. The other things that can happen, the biggest issue, is just a worn out immune system. And what we have learned is
that if somebody’s T cells, you can take them out of their body and genetically engineer them to put them back in. But if you look at many of these T cells in patients, especially patients who’ve gone through multiple rounds of chemotherapy and what we’ve seen is that the more chemotherapies that people have been through before they get the CAR T, the more worn out and exhausted their immune system is and probably the worse they do. And so we think that one possibility is
that if somebody’s immune system, if their T cells, they can only fight so much before they become exhausted. And then lastly something that my lab has been interested in actually really clinically is what about the tumor microenvironment. So again if you have a very large angry tumor, in a PET scan you’ll see what’s called a necrotic lesion oftentimes and we think that those are areas where there’s a lot of those tumors are taking up a ton of sugar and burning it so fast that
It’s actually sucking up all the oxygen. So there’s no oxygen or there’s a lot of hypoxia. There can be a lot of lactic acid in these tumors. And if you put a T cell and exposure to hypoxia or acidosis, they can’t really function. And so part of the rationale for radiation is where I’ve become interested is, how do we prevent the CAR T cells from not getting worn out, from fighting just an enormous amount of tumor where it’s just too much tumor to fight?
How can we use radiation to help kind of get rid of these areas of hypoxy and acidosis that are just really defeating the T cells? So tell us more about that. I mean is the idea that maybe these people should have CAR T therapy upfront before they ever get chemotherapy, tell us more about what your findings are showing us? Yeah, sure. So I think you kind of mentioned 2 viable options, both of which are being pursued. So I'll start with the first one, which is, what about getting CAR T earlier up, on the docket?
And that’s being actively explored. And so you know, CAR T cell therapy when it first got approved, it was only for patients who’d been through two prior chemotherapies that didn’t work. So that had to be the minimum, but typically they’d seen many more, five or six even. And that’s where we got a 40% cure rate. But then what we saw is that there’s been recently trials where after a single line of chemotherapy has failed, all those patients used to go to something called an
autologous stem cell transplant. And again, this is not my area of expertise, but actually the cost of an autologous stem cell transplant from what I understand is actually quite pricey as well. So it may be quite comparable to CAR T cell therapy.

And so anyway, they basically would try and do that. But there's randomized trials where they did autologous stem cell transplant versus CAR T for patients with bad disease that either came back, within 12 months after they just blew their chemo.
through first line chemo altogether. And they saw that CAR T therapy did a much better job of getting rid of the disease than the stem cell transplants. So that’s one thing that’s been happening is that we’ve moved from third line to second line and now there’s even trials for patients with first line treatment for high risk factors, for example, just patients with tumors we don’t expect to respond to chemo, bad genomic markers, these kind of double hit or triple hit lymphomas, things like that.
There’s folks who are exploring introducing CAR T therapy at that line. And so really what you’re getting is moving it further up in the process. So that’s kind of one option and people are certainly doing that. The other option is well what about radiation and trying to reduce the tumor burden. And so this is another possibility and I certainly believe for some patients that this may actually be helping them out and we’re trying to kind of figure out ways to confirm that. Right now there’s many clinical trials that are getting up and running where that’s exactly what
we’re doing is we’re taking patients with large or bulky tumors and we’re going to use radiation to basically shrink those tumors down right before they get the CAR T cell therapy to reduce the tumor burden to get rid of those acid laden and hypoxic environments and really just try and give the CAR T cells a better chance to fight. And there’s also some evidence kind of which is very early stages that suggests that radiation may actually help stimulate the immune system and may actually help the CAR T
cells recognize these cancers better.

And so we're exploring all those options.

The other thing that our audience might be thinking about, especially when we talk about hypoxia and hypoxic environments, is the role of hyperbaric oxygen chambers. I mean a lot of people have heard about these hyperbaric oxygen chambers and maybe asking themselves, is that a role for CAR T therapy to kind of fight where we can get more oxygen into these environments. Or is it more the tumor micro environment itself that may or may not be influenced.
by these hyperbaric oxygen chambers. Can you kind of shed some light on that?

So the truth is that no one's looked at that. It's an interesting idea. However, I suspect it would be a very bad idea. The issue is that right now hyperbaric oxygen, at least in the radiation world where we use it, is that if somebody's had radiation therapy and they had to have high doses of radiation with chemo, and they have wound healing issues or some other toxicities from radiation, this is getting very high doses of radiation that we don't have.
to use as much in lymphoma.

But hyperbaric oxygen can be a way to help with wound healing.

And the reason why I mention that is that one of the big contraindications or sources of extreme caution is that if anybody has active cancer, they’re very wary to do hyperbaric oxygen because anecdotally, they’ve seen cases where people have done hyperbaric oxygen and the cancer has sprung back to life. And so for example, I had a patient with CAR T therapy who I did radiation.
We got rid of this giant, very angry tumor.

It was ulcerating.

And the tumor destroyed so much of the tissue around the leg that you still have ulcers, even though the cancer has been gone for a year.

And they still are being cautious about doing hyperbaric oxygen because they’re worried that if there’s any cancer cells left over, they will kind of bring those back with the vengeance.

The other point I would mention is that it’s kind of more of a technical modeling perspective, but I think it’s valid.
Is that, I mean I think it’s interesting is that if you look at a tumor and you see these hypoxic and low glucose, highly acidic environments. And you think, how am I going to fix that? Should you increase blood flow, should you increase oxygen as you’re mentioning? And as it turns out, the most effective way to normalize the tumor microenvironment from a metabolic perspective is actually to turn the cancer cells off or kill cancer cells.
Because the problem is, that you have this kind of large number of tumor cells that are sitting there going at full tilt, you have this necrotic center oftentimes. And if you add more oxygen, all you’re gonna do is feed the ones on the outside just as much. But then there’s gonna be more to spill over towards the middle and there’s plenty of cancer cells waiting, ready to go to soak up those resources. And so really from a modeling perspective, and this is one of my mentors from back at Duke, what they saw, was that really the most effective
A way to normalize the environment was really to slow down the metabolism or kill the tumor cells. And that trying just to kind of feed it more to normalize, it really doesn't work out that way. So certainly people are looking at how we can do CAR T cell therapy better. And so what's next for your lab going forward? Yeah, so a few things. One, I'm excited about the clinical trials that are going on, trying to figure out what's the best way to combine radiation to make CAR T work better.
And the thing that I'm excited about is because it's just very pragmatic.

We know radiation works to shrink down tumors.

These tumors tend to be responsive.

We know that can debulk tumors.

There's been studies showing that if you do radiation before CAR T,

I mentioned that the total amount of disease burden predicts outcome,

well if you look at patients who get radiation, the tumor burden after radiation does the better job of predicting it than the tumor burden beforehand.
So in other words we may be able to kind of convert high burden of disease patients to lower burden and give them more favorable outcomes. And I’m excited to see where these different clinical trials kind of end and these clinical trials using radiation with smaller doses to give novel ways to try to wake up the immune system. And so I’m very excited to see where these land. And then two is more on the molecular side. I haven’t mentioned this too much, but I actually one of the things my lab studies is splicing and we think that alternative splicing may actually
be one of the mechanisms by which CAR T cell therapy actually may not work. We actually think that there may be alternative splicing that is driving resistance in these lymphomas because splicing is something that occurs aberrantly in many hematologic malignancies. And my lab has been investigating this and so hopefully in the next, year or two, we’ll kind of hot off the press we’ll get that out. And that’s something we’re actively pursuing. Dr. Timothy Robinson is an assistant professor of therapeutic radiology.
00:28:37.062 --> 00:28:38.940 at the Yale School of Medicine.

00:28:38.940 --> 00:28:40.740 If you have questions, the addresses,

00:28:40.740 --> 00:28:42.995 cancer Answers at yale.edu and

00:28:42.995 --> 00:28:45.729 past editions of the program are

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00:28:47.734 --> 00:28:48.838 form at yalecancercenter.org.

00:28:48.838 --> 00:28:51.222 We hope you’ll join us next week to

00:28:51.222 --> 00:28:54.850 learn more about the fight against

00:28:54.850 --> 00:28:57.496 cancer here on Connecticut Public Radio.

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