Tracey: [00:00](https://www.rev.com/transcript-editor/Edit?token=vIhZl0_TLz-91_w1uAO2sxKDGUourg5uTMdPKhL4ItPsjmGesP7KalfsgT9gsQO5w2ctyBk-plxn28IBRCtkwiKz63c&loadFrom=DocumentDeeplink&ts=0.77) Hello, and welcome to NC State's Audio Abstract. I'm your host, Tracey Peake. Plastics can make life a lot easier, but they can also contain compounds that can impact your health. Heather Patisaul is a neuroendocrinologist and Associate Dean for Research at NC State's College of Sciences. Her work focuses on studying endocrine disruptors, compounds that affect the normal development of the brain and reproductive system. We're speaking with her today about these chemicals, what they do and how to avoid them. Welcome Heather.

Heather: [00:34](https://www.rev.com/transcript-editor/Edit?token=1iGEwdc8cC781ajAfs1DptxiODUxbCveTFoDQXjT1R7RWmpIqNANaldKkvy-r6d2X83EEnE61POGUFEfManITJuf614&loadFrom=DocumentDeeplink&ts=34.7) Thank you, Tracey. It's great to be here.

Tracey: [00:37](https://www.rev.com/transcript-editor/Edit?token=rNdB1gPLLZvRo2vYZR65AgDOMBbGVlhM52gTIxWbdpExHVrWn42eAJuXsrBEvAp1sWZffzFIihiED7nVxrFAJOzWj1I&loadFrom=DocumentDeeplink&ts=37.49) I'm glad you're here. Let's start by just defining an endocrine disruptor for folks who don't know what they are. What does that mean? And how many chemicals out there are classified as endocrine disruptors?

Heather: [00:53](https://www.rev.com/transcript-editor/Edit?token=DUame-4juYxdzgv1hePjpM2Da6GebkM3oiEGG3nvzpw0i5QQMLJTYfS5tA32F-4xGlxy97bLMPGho9-y5Tjv76EEmwE&loadFrom=DocumentDeeplink&ts=53.04) Well, endocrine disrupting chemicals are any chemical that can interfere with any of the hormones in your body. So the hormones people typically think of are estrogen and testosterone, but you have many others. You have thyroid hormone, insulin is a hormone. And so endocrine disrupting chemicals interfere with that hormone's ability to do its job. In terms of how many are out there in the world, the truth of it is no one really knows, but it's estimated there's at least a 1,000 that we're aware of and probably many more. Chemicals are not routinely tested for endocrine disrupting properties, so scientists are really kind of approaching this one chemical at a time.

Tracey: [01:38](https://www.rev.com/transcript-editor/Edit?token=xmkZCcl6D1PTgwDi1CADrGOW77DfzIEKbQ6lNr-9CtImje0NbdcCCKhoD8piz-hbts78PFZYdsi-w-HcV56wIZEIABo&loadFrom=DocumentDeeplink&ts=98.15) That could take a long time. Now I mentioned plastics in the intro, is that the most common culprit for endocrine disrupting chemicals or are there other products that they're found in?

Heather: [01:53](https://www.rev.com/transcript-editor/Edit?token=R8gepV54sTeQ3iyTO-z9K2r1FA1HShlAUx4y7YRYb8m7ylrEA4ZZHEZEKQQwlmtsseeFYq-J-N1OS0ooXogwe2yePiI&loadFrom=DocumentDeeplink&ts=113.3) Plastics are certainly a culprit and they've been a culprit for a really long time and it's a universal source of exposure because plastics now permeate every square molecule of space on earth from the deepest oceans, all the way up into the snows of Mount Everest. And so the plastics themselves contain endocrine disrupting chemicals, and as they break down and become microplastics, they get sticky and they'll stick to other endocrine disrupting chemicals like pesticides, surfactants, and those kinds of things. But you're going to find endocrine disrupting chemicals in toys, personal care products like cosmetics, in your dust, in your house. So flame retardants can be endocrine disrupting and they'll get into your house dust. Food packaging, unfortunately, contains a lot of these chemicals, some of your furniture and even your clothing. So they're everywhere.

Tracey: [02:53](https://www.rev.com/transcript-editor/Edit?token=UmbSarC0UFWuIOF4SjWVbasqmwuV7f6u_6bOrCj1m-rzISroH30uJLLNJsya8lOWDYwdI3l86Eth95nPF_XIPmKqVnc&loadFrom=DocumentDeeplink&ts=173.45) Probably the common endocrine disruptor people have heard of is BPA or bisphenol A, can you talk to me a little bit about what this chemical is in particular and how it gets into our body and then what it does once it gets there?

Heather: [03:14](https://www.rev.com/transcript-editor/Edit?token=KFXLtgdPE_TxpgSHGnJ_QNqx53_UCryMEomRJzqlFAtuSmi1JHcjxIjF9q2nMJCraMPlR4ZpLcAs4JpxEZjVS31OvwY&loadFrom=DocumentDeeplink&ts=194.62) Sure. BPA is a chemical that my labs worked on for a really long time. Most people have heard of it because they'll see a sticker on their plastic water bottle that says BPA free. And so those water bottles used to be made out of polycarbonate. And BPA is an additive that you can put into plastic to make it hard. So when you purchase a water bottle out of a vending machine, it's squishy, right? But the one you carry around with you is not, and it's the Bisphenol A, the BPA that's making that bottle less squishy and more resilient. They have now been remanufactured to not have BPA in them and BPA fools your body by acting like an estrogen and estrogens have very important jobs in both male and female bodies. People don't seem to associate estrogen with anything in men, but men do have estrogen. So you can get effects in both men and women from BPA exposure.

Tracey: [04:16](https://www.rev.com/transcript-editor/Edit?token=0hXLOuyXYHf-Jh8uNZaE1E1UkTCl4XPcGkmEBK945jCYPb1cIEwMGbdP2sCLUZhZWF4Jgp9BEbJnTybl1sRONqrv8C0&loadFrom=DocumentDeeplink&ts=256.91) Okay. What kind of effects are we talking about here in terms of the disruption from this extra estrogen exposure?

Heather: [04:25](https://www.rev.com/transcript-editor/Edit?token=plpQMAiML9HJdpuv5rxazxHffBDEb59nFKQcWSB6Pt15EaB5r-qUdsITJ1l4bz6VtOEeMjACwy3SKl4_kkZe2XTIMdA&loadFrom=DocumentDeeplink&ts=265.28) So that's going to depend not just on your gender, but also on how old you are. So as adults, our hormones help, estrogen and androgen help us maintain what we call our secondary sex characteristics. Basically everything that you got at puberty is coming from a lot of these hormones, like estrogen and androgen. So a chemical like BPA can disrupt those sorts of things. So in an adult, we see infertility issues. We can see higher rates of breast and prostate cancers and those kinds of things. In development, estrogen, and testosterone play extremely important roles in organ formation, not just reproductive organs, but also the brain.

 And so because you're building organs during development, if you interfere with estrogen or androgen at that time, you can get irreversible effects. My lab focuses really heavily on what's happening in the brain. And the changes that you get in the brain while other labs have looked at how these chemicals impact the development of our reproductive organs. But it puts that individual at risk later in life for genital malformations, for difficulty conceiving, high rates of miscarriage, those kinds of things.

Tracey: [05:45](https://www.rev.com/transcript-editor/Edit?token=sHYo9rYNSbWK6OVeLn3hnAIZBsw_6lrmgo4pQ0j-D2kxCM4yNPmsvZA4xe1bPHYw5ouoUifjIl5AnTTVNO8y7DdQgl8&loadFrom=DocumentDeeplink&ts=345.74) How much exposure to something like BPA is too much exposure?

Heather: [05:53](https://www.rev.com/transcript-editor/Edit?token=hW4KCxyb-kz48uyQxCN7Xv35X0egvotvh9xAf5bYw2UU-sbI8kYOS5ptI--WAMCcr7JxxwUcCTtAZwrW1AvaP5xK_4c&loadFrom=DocumentDeeplink&ts=353.82) That is always the devilish question, how much is too much, and no two scientists are ever going to give you the same answer. But I was involved in a study that was a partnership between NIH and FDA, where we dosed, the animals were dosed across a pretty wide dose range. And then as they were disassembled all of the different tissues and parts went to different labs with expertise on that tissue, for example. So my lab worked on the brain, someone else's lab worked on ovary, et cetera, et cetera. And so we all reported back, all the work was done blinded, and then we unblinded all of the data. And lo and behold, we had effects in brain, ovary, memory gland and heart at 2.5 micrograms per kilogram body weight. So that is an extremely tiny amount of chemical. And to just put that in context, right now, the food and drug administration says 50 micrograms is safe for you. Our research would say, "No, no, no, it's got to be 2.5 or below." So it can be very tiny amounts of chemical that have big effects.

Tracey: [07:07](https://www.rev.com/transcript-editor/Edit?token=1f2qdM1Z_CkUtCezqSGeQxzqPCGTmo8FFx6Yk7iB8LR4EBkC9CqulwRZgtvBBknXVx3RLwrVZGocO4k2NQbE_ZBB1NM&loadFrom=DocumentDeeplink&ts=427.51) And just to be clear, just because the BPA is in the hard plastic, does mean necessarily that if you just touch a BPA containing object, is it going to somehow transfer into your body? Or is there a way in which that happens that makes exposure more likely?

Heather: [07:31](https://www.rev.com/transcript-editor/Edit?token=PIsFPjDrGhU4k5Kl8QBDFTmj2403MTaOdh_cgiZB2KoUnYeI7MaK_DGxSwV9pl1MofGe9YkfaRUVdYWqgtAlWjVrlgE&loadFrom=DocumentDeeplink&ts=451.47) That's a great question and it really comes down to chemistry. So what's typically going to happen is whatever is in the bottle is going to leach chemicals out of the bottle. And BPA is also in the lining of tin cans or metal cans, food cans. So if you have a really acid food, so if it's tomato soup in the can, or if it's coffee in your plastic cup, that is going to react more with the plastic and pull more BPA out of the container than say water. So it kind of depends on what's in the container and how the container is made and the food that's within it. You just touching it is not really going to do much to pull any of that chemical off the surface. The other way to leach chemicals out of plastics is to microwave them. So if you put your dinner in a plastic bowl and heat it up in the microwave, that's going to cause a chemistry reaction and you're going to have BPA in your dinner.

Tracey: [08:32](https://www.rev.com/transcript-editor/Edit?token=J1EfQIhpA5x_mFiseb9gtx_-9j-vDnhoFuGP3jUoTwehY6AObRrg1UOqkk_UuvJCY1ux9QwKJaVUaj7DJ0oWpgR7Yhs&loadFrom=DocumentDeeplink&ts=512.27) So all of those microwave meals with the plastic containers, you should probably transfer that into something else to cook it, maybe.

Heather: [08:38](https://www.rev.com/transcript-editor/Edit?token=f-QGTs_v0vJxIViyVuw7HNdafROvOTbT52_g8sCxrzW-bz8_4qXSkS3dE8qZc8NGfnBEIswP4pzB_ijsPsoeYLmKiT0&loadFrom=DocumentDeeplink&ts=518.8) I've been doing that for quite some time. I know it seems kind of crazy, but it is a lot safer to just treat that as a food packaging, take your food out and heat it up on something else.

Tracey: [08:49](https://www.rev.com/transcript-editor/Edit?token=mwitFS1uN_NIPZv0kSh7xAU9t21-vujBQQly2VyZ-hCpMywyxkX3wEhVKq41oya8f5iR8gXGmFob2HA-Nj5c5lRuc6I&loadFrom=DocumentDeeplink&ts=529.9) Okay. As for the chemicals that they're using to replace BPA, do we have the same kind of data on these new chemicals about their safety in terms of endocrine disruption or other problems?

Heather: [09:05](https://www.rev.com/transcript-editor/Edit?token=PvF3NpKG9xkZ-5O6pQQq-ClrctFtk_i4h0MLbM2sZp44zEek1klvj2cHr_y9ShUmvZIU1l0fWxC3uJlGS3DCsJgcfBo&loadFrom=DocumentDeeplink&ts=545.15) Yeah, I call that the bisphenol alphabet soup. So we have bisphenol A, bisphenol F, bisphenol S and with this one chemical at a time testing approach, no, we don't have a really, a lot of good data because it's slow and it's cumbersome and it's difficult data to obtain, but for the other bisphenols that people have studied, yes, they look very much like bisphenol A, and so there's a push in the scientific community to regulate chemicals as a class. So if we know that one bisphenol is causing a problem and the others are structurally similar, we probably should make the cautious assumption that they're all going to behave similarly in the body and regulate them appropriately.

Tracey: [09:54](https://www.rev.com/transcript-editor/Edit?token=XYiHZXLdWU3qnEJeNYeyVhpbO9Bpwg8TDmGG5C4GPXxIm-NdKIxI57EljkzxRLHfFG-DOTRK-LipW9K-U6LbJcR9nKk&loadFrom=DocumentDeeplink&ts=594.98) And you were also recently part of a team that created a report on phthalates and specifically the harm that they can do to neurological development. Can you tell me a little bit more about that? What are phthalates? What were you seeing in your research and where do you commonly come into contact with phthalates out in the wild?

Heather: [10:17](https://www.rev.com/transcript-editor/Edit?token=VwKS765Hk_A1ZqYWM4Gxi1UhxGVzO2kgYWuW9QEOa46s1FEmrSoK8SpHPXooWL53o-3rYJzMKvL1YiaCxNnKK3-iFeU&loadFrom=DocumentDeeplink&ts=617.48) So that's a great question. So BPA makes plastics hard and phthalates make plastics soft. So medical tubing, IV bags, squishy dog toys, baby teethers, those kinds of things are going to have phthalates in them. Phthalates are also used a lot in building materials. So they're often found in carpeting and furniture and that kind of thing. And there's a lot of phthalates in cosmetics and personal care products. And they're also used to hold the scent in, in fragrances. So if you have fragrance like dishwashing detergent or laundry detergent, there's going to be phthalates in that fragrance.

Tracey: [11:06](https://www.rev.com/transcript-editor/Edit?token=7IYKhxDhkSvROQVUaZSNO00ECNDhSeSN-R0BrAVEW3T9QDJYVxnDF7xagLxiemC6YWphgs4x_8cFGOm_MjKbT0E6Iuc&loadFrom=DocumentDeeplink&ts=666.64) So in this report, what effects do they have on people? Are they just a straight endocrine disruptor? Is it particularly dangerous for you in terms of neurological development? What's going on?

Heather: [11:22](https://www.rev.com/transcript-editor/Edit?token=qtQYsyRrEiMkSMXI2r08Xi5X0QeYvtYyWI10fPypfnBPPap9d4-XwJtIolkkGcXYXP7awrbkWYzEnOfi9alJ7zkinkQ&loadFrom=DocumentDeeplink&ts=682.63) Well, the group itself is interesting. It's a combination of basic scientists like myself and also epidemiologists who look for evidence of effects in humans, some clinicians, physicians, and what we call non-governmental organizations. So people who work on public policy. All focused around trying to identify what chemicals are out in the world that are affecting the developing brain, that are affecting neurological health. So that's sort of the focus of the group.

 And so they took a hard look at the evidence to see where are we in terms of making conclusions about do phthalates affect the developing brain? And what was really interesting about participating with this group is four or five years ago, we all decided there really wasn't enough information and it set a really specific research agenda as to what we needed to go and learn. So in that time everyone's been working in their little respective space and then looking at the data from animals, from cell culture model and also in children, there's now strong evidence that exposure to phthalates in the womb can cause cognitive memory and other issues in children. So it is impacting brain development.

Tracey: [12:37](https://www.rev.com/transcript-editor/Edit?token=0L-aDZLy5cA8ICL2QVEwJUjTstDkpMbt7YYvkVrR9rNKWRPStdZRVWeHzKXYdDb7qULbTGeNwT99owzLI7s7fN4l1lI&loadFrom=DocumentDeeplink&ts=757.76) And what kind of cognitive issues are we seeing? Learning problems later in life? What sort of issues were we talking about here?

Heather: [12:47](https://www.rev.com/transcript-editor/Edit?token=F1fN-uYs0lRDGW33jOEfSqnlX1d0SYadz-AhxUj6irulVdSocLH06He-6KvPjX3fBptrt3ubroJp159OWbMhs8QpDZs&loadFrom=DocumentDeeplink&ts=767) Yeah, so it's a lot of learning issues, mental processing, those kinds of things. So phthalates are another big group of chemicals, just like the bisphenols are. And some phthalates are more potent than others. The primary way that they harm the body is they impair the ability for the testis to make testosterone. And in the fetus, in the male fetus, that testosterone is necessary to help build the reproductive organs of that male baby, but also the brain. And so like with many endocrine-disrupting chemicals, you tend to have more severe effects in one sex versus the other, in this case, it's males, but they have found evidence of problems in both boys and girls.

Tracey: [13:34](https://www.rev.com/transcript-editor/Edit?token=K7Dlz3MWMRAHCzCOstX_lzrw2GTD-xGhAu-7BVROvJW8mAh24RMk6gQWwpJFXJVynuMmn5A67yvY10_F1toNZCEcVmA&loadFrom=DocumentDeeplink&ts=814.12) All right. Is there anything we can really do to avoid these chemicals? They seem like they're everywhere.

Heather: [13:42](https://www.rev.com/transcript-editor/Edit?token=83FW-HEhu6Ao1fGGYzEJpOq9sos0nXkYKz_FaIv7amxIei2hwAdMIHJcN3WtTeWGTVA01yLGfRvCvE_mtv5jp4R6v3o&loadFrom=DocumentDeeplink&ts=822.27) That's the really hard part. So I kind of see myself as a person who wears two hats. I do the science because I think it's important. I think it's critical for us to understand our environment and how it's affecting us. And then I work with groups like this one and others to leverage our collective expertise and try to change policy, but that's slow. So consumers actually hold a lot more power than I do, because the way that you shop changes the industry, as soon as people decided that they didn't want [inaudible 00:14:14] in their water bottles anymore, companies had to change because consumers drive markets.

 So you can look for things that have on the label that this is phthalate free. A lot of baby toys and pet toys now might say that it's phthalate free on the label and you can make that choice. Personal care products is the biggest space where women are going to get exposed. And so you can look for companies that are making your favorite lipstick or eye shadow without phthalates. And there's a lot of apps online to help you do that. And then purchasing fragrance free products at home is another really easy way to limit your exposure. So even if you love the way your dishwashing soap smells, getting fragrance-free is probably better for your brain.

Tracey: [15:02](https://www.rev.com/transcript-editor/Edit?token=_rl58kbBA8hAfXP7WTPOezrTjRnRMB0lxEdfdOMufAworI-V5w1u0ttFiyd-HWmhBDwNl9zyz0xFracPoyOWLGGaGSw&loadFrom=DocumentDeeplink&ts=902.12) Let me circle back a little bit to the work that you've done. Is there a dosage limit with phthalates in the same way that there is with BPA, a level of exposure where you start to actually see these problems occurring? Is there a safe level of these?

Heather: [15:21](https://www.rev.com/transcript-editor/Edit?token=21yp6iXfpehIEFNZtF8sm21cxY0erVfYJlLV5tvMGzr2VLDij3SCIFeK7c0V3cE07_8-xob2MYX4lPjNP30Nibms7yc&loadFrom=DocumentDeeplink&ts=921.09) Yeah, so again, that's a really difficult thing to say. And there's an interesting story with this one too, because not all the animal models were sensitive. So as people tried to address that question, they were getting the wrong answers that they used the wrong model. But now the data is looking a lot like it is for bisphenol A, which is even at really, really low levels, low levels that have historically been considered safe, we are seeing effects. And that's because the brain in particular is super sensitive to even tiny amounts of hormone during development. So it's not surprising that these chemicals that can mimic hormones or change hormone levels can have a big effect at small doses.

Tracey: [16:03](https://www.rev.com/transcript-editor/Edit?token=R3h-JaT7tH_BYePnxVrx9-LW2Tl9IMRslpTUMzau_9heLGKbdPU07tz3gEtN3RbprR_-E0tCvp-48eq_o7zdhnVSJxA&loadFrom=DocumentDeeplink&ts=963.85) And they get into your body the same way that bisphenol A, does pretty much right? If you-

Heather: [16:09](https://www.rev.com/transcript-editor/Edit?token=jo6g5XPejFOUtXdB7QPTXEeesRwrmvataAADAAq-v9LH4hr1vvtffVZJkZMQ2iuvC6Tm57efdJkhQuts-Af7I_pCJ0U&loadFrom=DocumentDeeplink&ts=969.27) They do. Contaminated food packaging in food. They're also in your dust and you'll inhale them. So mostly oral exposure with some dermal from the makeup and breathing it in.

Tracey: [16:24](https://www.rev.com/transcript-editor/Edit?token=hjcLjwrz-SDGH8dODbXQ1oc9bWia6oGDeBrqxsY6LPByEWZ5xOc-NPiSeWpFs7qO5t7lWL2dRcpYyPGUJKnsaDWCk4o&loadFrom=DocumentDeeplink&ts=984.99) I'm trying to find a silver lining, I know there's not really one, but I am curious, would exposure to adults have similar problems or is it really, really critical to make sure, if you can't do anything else, to try to avoid coming into contact with these products when you have a child or before it's born.

Heather: [16:53](https://www.rev.com/transcript-editor/Edit?token=FySSHl5_Fcc_Avx2Jk9EC8gz_0TSPaQzS1xYnlMmqmvMW2FHkd2VXr38fQYKeTAXvLF769ahU8EE_4LGslnqBU-7JxI&loadFrom=DocumentDeeplink&ts=1013.47) No, so we kind of think about it in terms of critical windows of vulnerability. So obviously when you're building your organs, that's a really critical stage where something can go horribly, horribly wrong. So pregnant women are at very high risk when thinking about their offspring, breastfeeding is another example because a lot of these chemicals will get into breast milk and expose the young child. Puberty is a time that we think is also particularly sensitive, because again, hormones are playing a big role in shaping that transition from a childhood body to an adult body. There's less research being done in that space, but the little that's there is saying that this is also a potential critical period for exposure. And then the other potentially vulnerable time is in aging.

 So any woman who's gone through menopause where her estrogen declines, can comment on foggy brain, just not remembering where you put the keys and those kinds of things, because even in our adult life, our hormones support the brain and brain activities. And so in addition to potentially having higher risk of reproductive cancers later in life, there is some interesting work being done, trying to see if exposure increases risks for cognitive impairments in old age, but that is a new area.

Tracey: [18:19](https://www.rev.com/transcript-editor/Edit?token=rlvLXdp0UI6LWpJa1x7Az1BdOVQw8WxdC6qmanD80cFuD98TDOgyb_79mHxngtq-kA858JX2i_IgOGj06F-9g_QGHN8&loadFrom=DocumentDeeplink&ts=1099.7) Finally, my last question for you is what is the most amazing or worrying thing that you have discovered while you've been doing this research?

Heather: [18:50](https://www.rev.com/transcript-editor/Edit?token=zCaFxyInLtHuSHUOXQOQX5db5cd5Kpf_12I_9Ubc1xKmbLjsGlKZJQjfwsMtm9uF4GiFvbtW1zckHdQU3DIzKpKswmA&loadFrom=DocumentDeeplink&ts=1130.4) I think the amazing part is how much control we have over fixing this. So I have the wonderful pleasure of working with colleagues at NC State in textiles, chemistry, engineering. If we set out to make a not toxic water bottle, we can do that. And people have been able to create that, you just need the drive to get it done. So even in the cosmetics space, I used to have to go to Europe to collect all the sunscreen and cosmetic stuff that I knew didn't have these chemicals in it, because even though companies could make it, they weren't being sold in the United States. Well, that has completely changed. And so I'm just incredibly impressed at how clever we can be at solving these issues if we put our mind to it.

Tracey: [19:36](https://www.rev.com/transcript-editor/Edit?token=7MEqZULdd2h4HEGKK-wuL_ynzaYCdO5jdtmn8lmKkSHrad0AFxxzOwXSzXkvoOzeelKJw9De5StF648Qi17qx_XQTu0&loadFrom=DocumentDeeplink&ts=1176.7) Well, that is good. And it's good to know that we can make a change if we need to.

Tracey: [21:25](https://www.rev.com/transcript-editor/Edit?token=r7njUg_QxXRBKLccqTUQPj-iqZsMcJcVwjjTdsQX2qTJfnHVc9ehjUPnhZ9UTEtP2OuZ_iW2oCnnCVdpzy3k3i-eXhU&loadFrom=DocumentDeeplink&ts=1285.4) Well, I am really pleased to have had you here with me today, Heather.

Heather: [21:43](https://www.rev.com/transcript-editor/Edit?token=WWbVZuJk0JB1VwRCpKzYGroWBTi5Mqj4ArBnt0QdA-KpAB1xdc2uYXrj94THkOaWo5CYE7dsxRboVJQ93VxDlmg9tCc&loadFrom=DocumentDeeplink&ts=1303.23) Thank you very much. It was a pleasure to be here and I appreciate the invitation.

Tracey: [21:47](https://www.rev.com/transcript-editor/Edit?token=6iQHatre7rYAHsDpRMt3fomVANFPvOkP3jKt09-rgq6HewysbwjkwsPswUXpmexUHqAgS5fsk8qUpZmGLIdpQousnKs&loadFrom=DocumentDeeplink&ts=1307.92) We've been speaking today with Heather Patisaul, neuroendocrinologist and Associate Dean for Research at NC State's College of Sciences. This has been Audio Abstract. I'm your host, Tracey Peake. Thank you so much for listening.