Welcome to W&L After Class, the lifelong learning podcast. I'm your host, Ruth Candler. In every episode, we’ll have engaging conversations with W&L’s expert faculty, bringing you again to the Colonnade even if you’re hundreds of miles away, just like the conversations we have every day after class here at W&L. You'll hear from your favorite faculty on fascinating topics and meet professors who can introduce you to new worlds and continue your journey of lifelong learning.

Our guest today is Tyler Lorig, the Ruth Parmly Professor of Cognitive and Behavioral Science. Tyler has been with W&L since 1988, including 14 years as chair of the neuroscience program. His research into the olfactory system has led to dozens of publications as well as stints as a visiting scholar at the University of Chicago and Duke University, and a position as Science and Technology Policy Congressional Fellow in the U.S. office of Senator Dianne Feinstein. He's also served as a consultant to the smell and taste industry, NASA and the Monell Chemical Senses Center, the world’s largest research institution devoted to smell and taste. Welcome to W&L After Class, Tyler.

Thank you so much, Ruth. Real pleasure to have this conversation with you.

I’d like to begin today by discussing something you once told me: that the sense of smell is way more important than we’ve believed it to be. Why is that?

It is a good question. And certainly we wander through the world not paying any attention to smell. Wherever people are listening to this podcast now, they haven’t noticed the smells around them. They are doing whatever it was they were doing, going about their business, maybe listening to this while they’re doing some work, and they are paying no attention to the outer world around them.

But frankly, the air that you’re breathing right now is full of smells, and you’re just not noticing them. It turns out that by watching your brain activity, by looking at your behavior, we can actually see those smells influence both your brain and your behavior. And it makes a real difference in your life. It’s surprising how much of a role smell plays in what you do. Everything from how you’re cooking, how you enjoy your food, to who you meet, how you believe that perhaps there's something wrong—if you meet someone who’s anxious and don’t quite know what it is, there’s something about that interaction that tells you you need to pay attention—all of those cues that are out there tell you about what’s going on in the world. And it’s something that we just rarely bring to our consciousness, we just don’t notice.

Well, I’m sitting here in person with you for the first time in quite a long time. And I’m not smelling anything but trying to.
And I’ll just point out, you’re in a smell lab, which has… the room next to you is full of little bottles of things that smell.

Ruth Candler 03:16
We may have to go on a tour of that after the podcast.

Tyler Lorig 03:18
That sounds great.

Ruth Candler 03:19
So one of my favorite examples of how, you know, smell can trigger certain emotions, like loneliness, or feelings of connection or even anxiety, as you said. Why do certain fragrances affect us this way? And are we hardwired to react to smells emotionally?

Tyler Lorig 03:37
The hardwiring part is always difficult for a scientist to be absolutely sure about, but we have really good evidence that we are absolutely built in a way that makes having those connections very likely to happen. And so the part of the brain that we know that is involved in smell is a place in the brain called the limbic system. And it’s a big, big part of your brain, but it’s also a part that’s very much involved in emotionality. And it makes a lot of sense that our interaction with each other, and especially our children, that sort of thing makes for an interaction in which the smell comes to be associated with the person’s health, associated with that individual.

We all have our own unique smell. And so knowing that tells us a lot about them and tells them about their health. Take for instance the students who will soon be leaving Washington and Lee and graduating and going home and they go back home and, you know, it’s… you can see the scene from the movie: Mom is there at the doorway. The freshly minted graduate comes to the door. Mom holds out her arms and hugs them and she puts her nose right behind their ear and sucks in an enormous amount of air from their hair, and she is bonded with them again. That is a connection that goes back to infancy.

So we know that that smell—that is something that is, once again, unique to this individual, to this child, and that mom has smelled—she has captured that. I’ll give you… pardon me if I throw in some data. So we’ve, you know, my colleagues in the field, we get to do very odd studies. So what you do is you get 10 babies, you put them in little tiny baby T-shirts, and then, you know, they spend a few hours in those little T-shirts. And then you put the T-shirts in individual bags. And you say to the moms—they’re identical T-shirts—you say to the moms, pick out your baby from these 10 T-shirts. How many mothers make mistakes in doing this?

Ruth Candler 05:53
I would say none.

Tyler Lorig 05:54
None. So mothers are unbelievably good at doing this. And so it’s one of the things that has this bond that we just, you know, don’t even think about. And we get, as I said, we get information from others. We think about food and taste, as… you know, how that is really associated with smell. And I can certainly tell you more about that in a minute. But the connection to social is really, I mean, one of the things that I think is most important.

Ruth Candler 06:22
I’m just… I’m thinking about, you know, hugging each of my children, especially—I mean, they’re adult children—but after the pandemic, and how I couldn’t let them go, and I had to. And I was smelling them, but I never thought about it, right? Well, are there other examples of ways that sense of smell affects us that we might not be aware of?

Tyler Lorig 06:44
We all sort of know that smells can make you hungry. So we tend to be aware of those smells, and we tend to get ready for that meal and have a lot of anticipation about the meal based on the odors that are there. And so when you do know the smells, when you do recognize them, they do help you in figuring out, sort of, what to expect from the food you’re going to get.

But there are certain foods—coffee is a wonderful example. The smell of coffee is much beloved by the planet, but the flavor of coffee less so. So we do a lot of things to try and make the flavor of the coffee palatable and try our best to get that smell in it. So you have a fancy coffeemaker. You have, you know, you freshly grind your beans, all of these things to get as much of the odor, the aroma, of the coffee into what you’re doing. And so you may actually use some milk or cream to reduce the bitterness that’s there, maybe a little sugar to help reduce that bitterness so you’re not put off by that part of the coffee. But yeah, we… Smells prepare us for all sorts of things.

Ruth Candler 07:51
When I think of smelling something, I think of the process of bringing something up to my face and inhaling through my nose. You know, like one would with a flower or a loaf of fresh-baked bread. I was surprised when I heard you mention once that there are actually two ways one can smell something. And I know that we’re all familiar with smelling through our noses. But would you explain the other way we smell and how it differs?

Tyler Lorig 08:17
Sure. It’s… most people really don’t have any idea that we smell things through our mouths. So let me… let’s do the geek side of this. It may be “after class” but that doesn’t stop me from labeling things for you. So when you bring that flower to your nose and you sniff it, that’s called orthonasal smelling. And it’s the way we always smell things.

That’s the way we think smell works. But probably more important is smelling things that are actually in your mouth. So I’m going to take everybody back to childhood and to that event where their brother or sister or friend made them laugh while they were drinking a soda, and the soda came right out their nose. And I mention this because I want you to realize there’s a pathway from the inside of your mouth to your nose and out. So that pathway, which was filled with soda at one time, very uncomfortably I’ll
add, that pathway is something that has air in it, and that air can be filled with the molecules that we smell.

So you’ve got to keep in mind we’re always smelling molecules, chemicals that are out there. The food you eat is made of chemicals. And so those chemicals have a certain kind of volatility. They get energized by the heat in your mouth. As you chew them and start breaking them down with saliva, they become more volatile, and those chemicals actually move up through the back of your nose into the top of your nose where you smell things, and then you can exhale them. You can actually exhale the flavors that you’re smelling. And so, why… People who learn to do wine tasting and professional tasters, for instance, will take tiny little sips and push air out their nose slightly to smell things more effectively. And they’ll do this in kind of like little tiny anti-bunny sniffs. So it’s kind of… instead of sucking in the air three times, sniff sniff sniff, they’re actually pushing that air out to get it to move all over this mucous at the top of your nose where the receptors are. And that’s called retronasal smelling.

And so retronasal smelling is the way you experience the world of food. And it’s a really confusing thing, and for people who, sadly—as we get over the pandemic, and people who are dealing with COVID, and who’ve had smell loss, they recognize all too well that their enjoyment of food is tremendously diminished. And they didn’t necessarily understand why, and it’s because their smell has been affected, even though it’s in their mouth.

**Ruth Candler 10:57**

So does, then, the sense of vision also affect or at least set up expectations of our sense of smell?

**Tyler Lorig 11:06**

Yes, it does. We’ve actually done some of that work here so that we can show you something that you expect, and then kind of trick you so that you get a different odor. And so you actually prepare—and this is one of the really interesting things about the way the sense of smell works. We know, from work that we’ve done here and has been done elsewhere, that you actually prepare your nose and… this is… so… there’ll be some geek-out in this, but your… so… your nose, up at the top of the nose, there is this mucus. And in that mucus, there are receptors, and we’ll talk about the receptors, I hope, in a little while. Those receptors go into an olfactory bulb that is a neural… part of your brain, a bunch of neural tissue that holds very complicated circuitry that sends it to the rest of the brain. And what happens when you smell something is that you activate the receptors.

And we kind of think of that as passive, right, that you… here’s a rose, I smell it, the molecules come in, they go into the mucosa, they go into the olfactory… they activate the olfactory bulb, and it goes back into the brain, I go, “Ooh, a rose.” And that’s all great. But what really happens is seeing that rose causes your brain to send out essentially a pattern into the olfactory bulb that needs to fit what you’re going to experience there. So you’re anticipating what’s going to be there. So I can actually do this through vision. Or I can tell you, for instance, I have a little vial in the other room. And I would say to you, “Ruth, here. Smell this. It is an absolutely wonderful strawberry smell.” And you would smell it and go, “Oh, that is nice.” And I just go, “That’s great. Oh, I’m sorry, I have the wrong one here in front of me. This is actually cherry.” And you say, “Oh, it is.” And then I go, “Sorry. It’s peach.”
Trickery!

Tyler Lorig 12:58
Trickery. It is. But, you know, it shows us that—and Erich Uffelman and I did this as part of a chemistry demonstration—that we want to realize that our brain is set up to be adaptive to the world. And so when I get information that helps me make a decision, I actually use that to make my best guess about what I’m experiencing. So if I’m told something, and I put out the pattern for it, and it’s not a perfect match, but a pretty good match, I accept that if I trust the person telling me. That match helps us. And so that can come from me hearing it from you, it can come from me seeing a picture, it can come from a beautiful, elegant plate that a chef has prepared, all of those. I’m not a big fan of dining in the dark, by the way, because I think that that plays a huge role in your perception.

Ruth Candler 13:53
Even though we all have an olfactory system that functions the same way, we can end up disagreeing completely about whether something smells good or tastes good. For example, my mother-in-law loves the smell of skunk, which I find quite unpleasant. Or another example is that I used to love the smell of cilantro until my son said it reminded him of the scent of a stinkbug. And it does, but how is it that two people can smell the exact same thing but have completely different reactions?

Tyler Lorig 14:27
Yeah, that is a great question. And the answer is, I think, one of the most interesting ones in the field, frankly. It is the case that when you go to smell something — and the likes and dislikes you have — they’re a function of, you know, both the anatomy that you bring to this as well as your experience. And we don’t often think that experience changes anatomy, but it absolutely does.

So we know that your experiences literally alter your brain. And so as you smell the world, and as you have these experiences of stuff you like and stuff you don’t like — stinkbugs, for instance — so, yes, there are chemicals in stinkbugs that are very similar to some of the chemicals that are in cilantro. They’re not too far off. But cilantro has a bunch of other parts to it. But if you concentrate on that part of it now, because you’re attending to that piece, because, once again, you’ve been primed that that’s the part you want to pay attention to, does it really smell like a stinkbug? Yes, it does. So you’ll notice when you smell coffee, there’s a little hint of skunk.

Ruth Candler 15:32
Skunk, yeah, yeah.

Tyler Lorig 15:33
And, you know, so we have this—and, by the way, perfumers and other people who are creating things for you will want to add a little dissonant note to it—so something’s not so sweet, or it makes it more interesting, it gives it some character. But what’s really happening is that the way we smell things, our genetics plays a huge role in this.
So our genes have the ability to encode for a thousand different kinds of olfactory receptors. And so an olfactory receptor is the little sensing cell in your body that picks up the chemicals that are coming from the air — coming from inside your mouth, or the outside air and orthonasal smelling. So those olfactory receptors, you would say, “Well, there are a thousand of them, that’s a lot.” It is. How many kinds of different receptors are there in the eye? There are four there. So you have, you know, one for light and dark and three for color, if you’re lucky. And so that’s all you have for seeing this amazing world of vision that we have with all of the colors that we can see.

And so if I tell you you have a thousand receptors, interestingly, in humans, only about a third of those actually become functional. So we have roughly two-thirds of those receptors that stay nonfunctional. And so whatever your third is, now you’ve got… it’s roughly 350 receptors. My 350 is different from your 350. And so that 350, when I smell the world, when I smell a wine, when I smell coffee, when I smell something else, that turns out to mean that my experience of that is utterly different than yours. I don’t smell coffee at all the way you do.

And, you know, and yet we say, “Oh, this is good. Yeah, it’s… I really like it. It’s got, you know, a really strong aroma,” or, you know, “It’s very strongly roasted,” right? So we’ll have this example. What does roasted mean? What is that flavor? You know, what is the smell of roasted? So, you know the smell of roasted because it’s kind of a functional description. I can’t give you an objective determination of what roast it is. So you now are smelling this, whatever roasted smells like to you, yes, you’ve identified in the coffee. I may have an utterly different experience of roasted and I’ve identified it in the coffee too. And so we agree. And we walk off believing we’ve smelled the same thing. And we haven’t.

I’m colorblind. I’m red-green colorblind. So you and I, you know, we look around the room and I can name all the colors for you. I, you know, I can name the reds and the greens and the blues and all these other colors. We know that, because one of my receptors doesn’t work right, that I don’t experience the world the way everybody else does but we’ll absolutely agree on the color that’s there, even though I don’t have the same experience of it that you do.

Ruth Candler 18:31
That’s fascinating. Okay, on those, like, the fundamental differences between people’s experience, you once said that body odor is a window to the soul. What do our bodies communicate via scent that we may be completely unaware of?

Tyler Lorig 18:51
Another really good question. There’s a long… there’s a potentially long answer here. And I will say — I give credit where it’s due — this was a quote from the liner notes of a Talking Head album.

Ruth Candler 19:02
Which I think is so cool.

Tyler Lorig 19:03
So the thing is that, so, our bodies are built as little odor factories. And I know that sounds odd. When you were a kid, or in, you know, in sixth grade, you wondered why we have hair, right? Why do we have
hair? Hair is weird. Why would we have hair? You know, it’s just such a weird thing. We’ve got hair, you
know, sort of all over. Not really, you know, yes and no, some more than others. And so, what is it
about that?

And the answer is there are scent producing glands associated with almost every hair follicle on your
body. You are producing smells. You are producing smells that have to do with your immune function.
You’re producing smells that have to do with your current health status, which is actually governed
partly by your immune function. You have, as I mentioned, your own individualized scent that is a result
of your genetics and how both your immune system and its interaction with the world and the other cells
and the things that are going on respond. And so, yes, you — and it’s associated with the foods you
eat. So, you know, the foods you eat change how you smell. Some do.

So those… all of those kinds of things will produce this. And it happens mostly from sweat. You
produce sweat, the odors that are associated and excreted, you know, from these little glands that are
associated with the hair follicles on your head waft into the air or into, as I mentioned before, your
mom’s nose when she hugs you and puts her nose behind your ear. And that turns out to tell an
enormous amount about how you are. And so we use that information to judge things like anxiety. I
mentioned when we were talking earlier that someone shows up and you have this feeling that
something’s not quite right. Dogs are not the only ones who actually smell anxiety. We can do that. You
can actually smell anxiety.

A study was done — these are always great studies to talk about. So first, you get a bunch of people
who give their informed consent that we’re going to put scent collecting pads underneath their arms.
We do such interesting research. So people agree to that. And then you have them watch movies. You
have them watch a movie that is really scary, you have them watch a movie that is funny, you have
them watch other kinds of movies. And then you put those scent pads for each one of the movies in a
jar. And you have naïve people, who’ve also signed something that says they’re going to smell scented
pads from underarms, they actually are asked what kind of movie did this person smell, you know, what
did they experience? And for the scary movies, people are really good at identifying that. So other
people can smell sweat and know that the person was anxious when that happened. They’re not so
good at humor, things that make you laugh and are funny, that’s kind of transitory. Being frightened is
certainly something that we have a scent for. And yes, dogs smell it, we smell it. We know those things.

A study was done actually fairly recently, looking at the degree of severity of a person with the flu. And
this is pre-COVID. This was two years ago. This was a Swedish study in which they looked at a large
sample of people who had different flus, and were, you know, either severely affected or not really so
much. And they had these underarm pads that they took, then they gave them the samples in jars, they
gave them to a group of people and would say, “Is the person sick and how sick are they?” And people
were really good at making a determination of that, from that, from just the scent of it. So we can do
that.

And actually, I mean, more intriguing still is this connection with romantic involvement. We know, for
instance, that people whose partners have gone off for a trip or something will often sleep with their
pillowcase, or their pajama top, or some aspect that has their scent on them. And, sadly, I’ve — in a
number of cases when I’ve given lectures, and I’ve had an elderly person come to me and said, “I can’t part with my husband’s or my wife’s clothing, because whenever I miss them, I just walk into the closet and it’s like they were here again.”

So we are connected in a really strong way. And that tells us about their immune functionality. There’s evidence that we’re making part of our selection of romantic partners on the basis of smell, to choose someone who has an immune system that’s pretty different from our own. And, of course, that would optimize our strategy for having more immunity in our offspring. So it makes pretty good biological sense to do so. So we get a lot of information from this. Way, way more than people ever imagined. And, you know, we use products all the time. We don’t think about the kinds of things we use to scent our own world, whether those are products to… that… deodorizers or our own deodorizers that we might use. But we spend a lot of money on that every year.

Ruth Candler 21:13
[Laughter] Let’s discuss the job of a food chemist, or what is sometimes known as a flavorist. You’ve said that flavorists design the world. How much is our day-to-day world shaped by scientists who manipulate us through smells?

Tyler Lorig 24:33
Well, it’s… It’s a lot. We do have flavorists who are making decisions about what’s going into many of the products we have. And I’ve often talked about when you go to a grocery store and you look around, if it’s in a package, a flavorist has made a decision about what, you know, it’s going to smell or taste like or both.

And so as far as manipulating us, I… it’s… What they’re trying to do is create a product that people want to use. And so they’re going to optimize that to try and create a product that we like and want to buy again. And so if you go to buy a candle, for instance, right, so you, you want to scent your home, it’s… you may have cooked something that you don’t like the odor of, and you want to mask that. So they, you know, these flavorists will work on scents that help you accomplish that. So they’ll get there. You know, the flavorists are doing this as a job. They’re trying to actually create the best products for the market.

But we do this too. So your grandmother made chocolate chip cookies before you came to visit, right? Or she cooked whatever your favorite was, she scented that house so you would absolutely love it. She, you know, the smell of that is, you know, going back to Grandma. We do this, we have, you know, we actually love smells. And I… this sounds so, so unusual, but we’ve done this since the beginning, actually, before recorded history, right. So we, you know, we’ve had flowers in funeral ceremonies since, you know, we find pollen in graves. So we sent flowers off with, you know, the deceased, preparing the way. Cleopatra had a room filled with rose petals when Mark Antony visited. Her hair was waxed with smelly oils, which were supposed to be alluring. The… you know, we have frankincense and myrrh, right, those are smells that… those were some of the best smells available. And they’re, they were unbelievably — and by the way, still are — unbelievably expensive.
I was actually talking to somebody this morning about incense. And there’s a Japanese incense ceremony and a particular type of incense that is the result of a piece of wood that has kind of steeped for hundreds, if not thousands, of years in a peat bog. And when you dry it out, it produces the most wonderful smell. And it’s roughly about $13,000 an ounce, and you burn it. So that kind of thing means that we actually really, really love smells. You know, the flavorists are just conforming to, you know, the pressure the consumer is putting out there to say “Yes, give us products that we want to use.” And I, you know, I think that’s actually a good thing. If you have a product that is healthy and is health promoting, then I think you’ve got a great, great synergy there.

**Ruth Candler  27:37**
That kind of reminds me of when you walk into a grocery store, and the first thing you are hit with is that smell of the fresh baking bread. And it’s not on your shopping list, but you’re gonna walk out of there with that loaf of bread.

**Tyler Lorig  27:51**
Well, yes, that’s absolutely true. And it is... if you have a pleasant smelling store, you will stay there longer. You know, so that’s the...

**Ruth Candler  27:59**
I didn’t even think about that.

**Tyler Lorig  27:59**
This is one of the things that’s... so, you know, and the more time you spend, you know, walking the aisles, you go, I think I could use this. So, you know, on the other hand, they’re creating a good shopping... they’re trying to create a good shopping experience and have recognized smell is part of that.

**Ruth Candler  28:15**
So if you’re a flavorist, trying to design an appealing scent for food or perfume, how would you account then for the huge variation in individual perceptions of smell?

**Tyler Lorig  28:27**
Yeah, that goes back to that genetics question that we talked about. This — and this is just one of the most amazing things to me — I have often, you know, mused over the fact that when you go to a restaurant that’s not very expensive, there’s often a really long menu there of the different things you could have. And yet when you go to a really expensive restaurant, there, they are offering one item tonight. So — and it's awesome, by the way — but how do they make it awesome?

And, you know, so you’ve got all of these different, you know, genes that are there, everybody... it's not totally unique, but it's really close. You know, imagine 350 options there. So it’s rare to find somebody who has identical genes in this. And by the way, even twins do have different preferences as a result of the experiences they’ve had. So that plays a role in this too. What you would have to do in order to create something that is delicious or smells great if you’re a perfumer, for instance, for all of these folks, even if they, you know, don't have the same receptor pool, is that you would need to have something
that’s really complicated. And so you would actually create a dish that has this wealth of flavors in it, you know, tremendous mixture of things that are out there. And it would seem very complex to people and they would hopefully identify one part of it that they could then pay attention to and would enjoy and, you know, they would say, “Oh, I just... the cilantro is really good in this.” Unless they happen to be thinking about a stinkbug, right? And then not so much, then they go on and they don’t notice that and they go on to, you know, notice the rosemary or something, some other piece of it.

So yeah, having that complexity is actually the key to this. And so those dishes that you get at the really nice restaurants are often very complicated.

**Ruth Candler 30:22**
So Tyler, when I was researching content for this podcast, I stumbled across the term super taster. And I hadn’t heard that before. What makes a super taster different from the rest of us? Like is it experience? Or are they different in some way physiologically that gives them this advantage?

**Tyler Lorig 30:41**
So the answer is both. And super tasters are interesting. Many people will believe that they have a really strong sense of taste. And they often do, and it’s often very highly developed. But they don’t necessarily have some of the characteristics of super tasters, which have to do with a very dense field of receptors on the tongue.

So we’ve been talking about the nose. And now we’re going to transition to talking about how the tongue works. So the tongue has clumps of tastebuds on it. We’re all familiar with taste buds. And so those tastes are going to give us the classic taste qualities, right, which is sweet, salty, bitter and sour. And probably you’ve heard of a newer taste, which has been around actually, for only 100 years, called umami, which is a savory taste. We really do have receptors for that. But those taste buds actually come in little clusters. And there’s a difference in super tasters: they have more of them, and they are clustered much more densely on the tongue. And that helps people to actually have a greater experience for this.

So super tasters are folks who often have a cluster of bitter receptors, and they’re not happy about that. They can… it can be really off-putting because the coffee that we’re talking about as having that nice roasty flavor is just much, much, much too bitter for them to enjoy. They absolutely cannot tolerate that. It actually kind of reduces some of the options they have for different kinds of things. So it’s interesting but, yes, it is definitely a genetic trait as well as changing one’s experience.

**Ruth Candler 32:31**
Well, when I first came across that term, I was thinking it was a positive thing, a great thing, but it sounds like it could be detrimental as well.

**Tyler Lorig 32:40**
It really can be. Super tasters, their nutritional needs are usually met. That… there’s not much of a literature that I’m aware of on any kind of problem with nutrition, but I think they do end up having, especially the ones who have bitter receptors and bitter sensitivity, I think that kind of limits some of
their options. Because there are just many, many foods that we think of that have a bitter component to them, mostly green vegetables.

Kids are really exquisitely sensitive to bitter, and so part of the reason they don’t want to eat their green vegetables is that bitter component. There’s a reason they don’t like coffee unless it’s, you know, filled with sugar and cream. So when a kid is first drinking their first coffee, they’re going to put a lot of sugar in there and a lot of cream in it, and then they can… then the coffee’s okay. Their… the idea of drinking black coffee is awful. And honestly my students, in my classes I’ll ask if they’re drinking with, you know cream, how they take their coffee and…

Ruth Candler 33:43
Lots of cream, lots of sugar.

Tyler Lorig 33:44
Lots of cream and sugar is still common. And it’s something that changes as… with age. As we grow older, we start having a preference for bitter, and then you start having things like international bitter units that are used to gauge ales and beers that tell you about how bitter this beer really is. And it can be awfully bitter.

Ruth Candler 34:06
So that’s super tasters. Let’s consider super smellers. My colleague in lifelong learning is fond of a trick question that originated with you. His question is, “What creature has the most powerful sense of smell?” And, you know, as I guessed, it was either going to be a dog or an elephant, but he takes great pride in announcing that the answer is a salmon. And he says that, you know, he learned this factoid from you. Why is the humble salmon the world’s greatest super smeller?

Tyler Lorig 34:42
Yeah, I’m… The salmon has some competition — let me just get that out there and I’ll tell you about that in a second too — and by the way dog and elephants are a good choice. That trunk is awesome for smelling things, but dogs do unbelievable things. So, you know, the idea of that dog, that bloodhound scenting the escaped convict with the, you know, the… they do that. They really do. Dogs are tremendously useful in… we have dogs that are sniffing COVID now, so we have, there are COVID sensing dogs.

Ruth Candler 35:15
You see dogs in international airports, for drugs, right.

Tyler Lorig 35:18
Right. So dogs really do have that abilities, but salmon are even more amazing. And I think we have to go to the Pacific Northwest now. So, I want you to go, I want you to see those beautiful pine trees. I want you to smell that fresh air, whatever that may mean. And I want you to listen to the babbling brook that is full of little salmon fry that soon will head off into the ocean. So they’re going to head downstream soon, and make their way out into the Pacific. I have seen the Pacific. Many people who
are listening to this will have seen the Pacific. Some, I hope, are looking at it now. But as you look at that, that’s a lot of water. That’s a lot of water. There’s a lot of water in the Pacific Ocean.

Okay, the salmon spends up to eight years out, you know, wandering, eating, having fun. And then it’s time to breed and they return to their home stream. And so the question is, how do they get there? And the answer is that if you stop their olfactory bulb from working, they can’t get back to home. They don’t come back. And so we know that… we know that the salmon use olfactory cues, almost exclusively, to determine where they came from. So whatever it is about the tiny little tributary that is there, there’s something literally about the water in that tiny little tributary that goes downstream and is then released into the Pacific Ocean, and they find it.

So they can make a determination, and they do this by the sense of smell. They have noses, they’re just not obvious. And so they… the sense of smell turns out to be a crucial part of this. And that one molecule that is out there that tells them, that reminds them of home, they turn toward it, and then they’ll find another and then another and that, you know, it becomes more and more dense as they move closer and closer to it so they can ultimately home in on where that’s coming from. And it is truly astonishing.

And I’ll add that, as we have problems with the things that are being put into the Pacific, it’s… you know, can actually interfere with that ability. So we hope that the salmon keep coming home, and that we’re careful about what goes into those oceans to make sure that they can get there.

Ruth Candler 38:11
That’s a good, good reminder.

Tyler Lorig 38:18
The other thing in their competition is the lowly moth. Yes, the moth. It’s… There are some really large ones that are used in research. But moths — male moths — male moths have these absolutely beautiful antennae. And if you were to look at them, you would go, “Oh, they have little feathers stuck in their head.” And they do. They look absolutely like these wispy little feathers that are stuck in their heads, and that’s their olfactory apparatus. That’s how they sense the world.

And it, you know, we can’t measure one molecule in a room. But we can calculate one molecule in a room. And we calculate that it takes literally a single molecule in a room for a moth to change its behavior in flight toward a source. And that particular odor that changes their behavior in males is, of course, the odor of a female. So females that are ready to reproduce emit a particular odor and, literally, based on our calculations, a molecule is sufficient to change a moth’s behavior and move them in that direction.

Ruth Candler 39:11
Let’s talk a little more about food. Why do we like some foods hot and others cold? And is that related to smell, taste or both?

Tyler Lorig 39:24
It’s related to chemistry. My friends in the chemistry department will be thrilled to hear this. It’s related to chemistry, so… and energy! So once again, we’ve been talking about how it is that we perceive the chemical world. So smell and taste are our chemical senses, and the food we eat is… it’s chemicals.

So if you’re having water, that’s hydrogen and oxygen, it’s… so… our food world is nothing but chemicals, and so the broccoli you had last night, the tuna you’re thinking about for lunch, all of those things are actually chemicals, and the chemicals as you chew them and break them down and your saliva starts breaking them down, they emit odors. And so, in other words, the chemicals become volatile. They break away, and they actually go into the air which is in your nose and that’s how you get the retronasal smelling we talked about before.

So that means that you’re getting this information from chewing it. And, of course, if you want to add energy to something, you add heat. And so if I now heat this by my body temperature, chewing this in my mouth, I warm up what I’m getting. That warmth actually turns out to make it more volatile, you get more chemicals in this, you get a richer experience. And so heating your foods turns out to volatilize many more chemicals that normally don’t have enough energy to sort of leave their substrate and get into the air.

And as a result of that, you have a much richer experience. Ice cream, for instance, has almost no smell. And that’s because you have this icy cold substance that doesn’t volatilize until you put it in your mouth. Then you enjoy the ice cream. It doesn’t smell beforehand. If you put hot fudge on it, then we have something, right. So the hot fudge on top of the ice cream makes for, I think, a wonderful experience, and… that… you know, you get that beforehand, but that chocolate just jumps out at you. It tells you you’re about to have something wonderful coming your way, and that means that you’re actually going to have the ice cream, which is going to be slightly warmed by this, melted by it, and then you’re going to get the vanilla of the ice cream.

So the hot and cold of this make a big difference about what you experience. You can reduce… so you literally can reduce the flavor of food by chilling it and enhance its flavor by making it hot. Which sounds like you would never want to reduce the flavor of food, but you absolutely do. And one of the examples of this, it happens with wines.

So if you are going to have a red wine, you normally will have a red wine that is… you know, slightly cooled at room temperature or slightly, you know, just below room temperature. And that’s because red wine has a lot of sugar in it. It’s actually very sweet, typically very sweet wine. And when you have it this way, you get all of these very interesting volatiles that come from this and the relative warmth that’s there. White wines actually have a pretty strong bitter component. And so if you take a… try a warm white wine. Give your… just slightly warm your white wine, a small bit of it, and see how you like that. It’s not going to be necessarily a great experience, but on the other hand, you want to reduce, often, these bitter components that are part of white wine. And you do that by chilling it. And it’s a very effective way just by manipulating the temperature.

Everybody who has had iced tea knows that when you are putting… you… someone makes you fresh iced tea and they go “Oh, it’s still hot and it’s gonna melt the ice,” and you go, “That’s okay, I’ll have it
anyway.” And you… They pour it in there, and sure enough, it melts the ice and you put some sugar in
and you’re going yeah, that’s good. And you taste it and go, “Oh, that’s not sweet enough.” And you
taste it again, “that’s not sweet enough,” put a little more sugar in and that’s fine. Now it sits there for a
couple of minutes, the ice does its thing and reduces the temperature of the tea and you taste it and
then you go, “My god, that’s so sweet.” And you’ve just learned that the temperature plays an
enormous role in your taste perception, right? The sweet, salty, bitter, sour, umami that’s out there.

So you get sweet enhancement, bitter suppression as you chill something, and more toward room
temperature you’re going to get things that are going to have all this rich volatility that we have. And if
you want to have more of that, you could actually slightly warm them, which people would do with
brandies or something like that.

Ruth Candler 44:05
Moving away from the olfactory system and into the department of cognitive and behavioral science,
when you first came to W&L, the name of your department was psychology. But recently the
department name was changed to cognitive and behavioral science. Why the change?

Tyler Lorig 44:24
That’s a wonderful question, and I really appreciate you asking. It was a big change for us. It was a
really big change. It’s actually a very big deal to change the name of the department, and it’s something
that not many colleges have done yet. So it was a good step for Washington and Lee. I’m very pleased
that it was something that the administration thought was a good idea. And I did too, and I’m happy to
tell you the answer to this, and it really has to do with our curriculum and what our students expect from
the major that they get here.

You know, we have a curriculum that requires statistics courses — actually requires two statistics
courses for an undergraduate major. And one of those courses requires students to do a research
project. And then we actually have a, you know, a senior capstone that usually requires a research
project that is an experimental project as well. Our curriculum is about sensory psychology, which is
what I do, it’s about neuroscience, it has to do with many different things. What it has not so much to do
with is therapy. And so at Washington and Lee, that has never really been a focus of our undergraduate
education. Psychology was founded here in the 1930s. And it, you know, concentrated on learning and
memory, education. It had to do with industrial psychology, figuring out ways to help workers be more
productive, choose people for the right jobs. It did not have much to do with well-being or those kinds of
things. And the reality is psychology never had anything to do with that until after the Second World
War, when we needed a lot of therapists to deal with the soldiers coming back. And the government put
an enormous amount of money into education at that point, and we started to see psychotherapy
emerge. But that was, you know, that was the domain of Freud and psychiatry, which is a really
different field.

So our department was always a little different than other departments out there. And, you know, I’ve
spent 33 years teaching brain and behavior as an introductory psychology course. And students were
always… said, “What has this got to do with psychology?” And I said, “Well, this is actually psychology
the way it started. And the other part is something that you’re going to learn about in graduate school, if that’s what you choose to do.”

And so my colleagues agreed that it was probably a good thing to do, because one of the outcomes of this is not just a name change, but it’s what employers expect. I mean, this makes a huge difference. Psychology is one of those popular majors on American campuses. And, you know, our students would just be another psychology major at this point, yet they’ve had very different training than many of those other students. And so we wanted to make sure employers understood that. And so cognitive behavioral science turned out to be, we felt, the best name for it. You know, it’s going to cause an employer to say, I’m not really familiar with cognitive behavioral science, tell me what that is. And a student has a chance to say, well, it’s about learning about the science of behavior. I know how to make questionnaires, I know how to do statistics, I know how to read a scientific report, I know how to think critically about the data and figure out an answer to those questions. And when they explain that, the employer would say, we would like you to work for us. And so that’s one of the things that we’re looking to do is to frankly, I think, brand our product better.

Ruth Candler 48:01
I think that’s so brilliant. I remember when my husband started out as a freshman in college, he was a psychology major, and his father was like, “Well, what are you going to do with that?” And you had talked about the wide variety of things that our graduates can do with this major. Can you tell us some?

Tyler Lorig 48:22
Oh, sure. Well, I… This is a… You know, think about a student who comes out of a program where they have had courses in how to make questionnaires, how to actually do research. And I’ll just ask your listeners: How many of you have gotten an email with a questionnaire about something that you’ve purchased, or your company or some other thing today? As a person who has spent a lot of time with questionnaires, I will promise you that they’re not going to give the person who’s getting this, usually, a lot of good information. There are good and bad ways to make questionnaires, and how you go about doing it and following, frankly, some simple rules can make a big difference.

So our students understand that and they know how to do the statistics once those questionnaires come in. Furthermore, they understand how you think about the world from a scientific framework. We actually view cognitive and behavioral science as a science as the rest of the world does. And so they come to this with a scientific frame. But it’s a scientific frame about people primarily, and so how to look at people’s behavior.

The kinds of jobs they can have are unbelievably varied. Making those questionnaires, we would all benefit from that. I would love for products to get better. And giving people feedback that is good feedback that they understand is good feedback, that would be great. Doing something that has to do with safety, for instance, health. One of the huge problems in medicine is getting people who are prescribed medicine to take the medicine they’re prescribed. They call it compliance. Do what the doctor tells you to do. It’s a very difficult thing to do. It would be great to take a behavioral and cognitive science major and put them on this to improve the methods of training people once they leave the doctor’s office, or to have a chat with them and say, “Now, the doctor has prescribed you this. How are
you going to, you know, comply with that? Let’s talk about how that’s actually going to work in your life.” And so that would be a great thing to do.

But, so compliance measures, understanding compliance better, understanding safety — how is it that you go about designing a building for better egress? How is it that you go about designing a building to support the needs of the people that are in it? Working with architecture departments to build, you know, more habitable buildings because of this, all of those are things that students have actually come to me and been interested in. And one of my students is actually looking at an architecture school right now, for exactly that reason.

So those are just a few, frankly, of the things that are out there. And we’ve been talking about food and flavor. I work with these companies over the years that are trying to make better products. You know, what would you imagine the impact of coming up with a really flavorful, delicious food that people enjoyed that was really nutritious, reasonably priced, and turned out to be healthy, and, you know, not too calorific? We might actually see people changing their eating habits, seeing the net weight of Americans decline for a change as opposed to increase. And, you know, what a wonderful thing that would be. All of the many horrible diseases that are associated — inflammatory diseases and others — that are associated with being overweight. And so there’s a chance here, there’s a real chance to do things that actually impact people, using the science of behavior.

Ruth Candler 51:48
Sounds like wonderful opportunities for our graduates. So before we wrap up our conversation today — if you’ve listened to any of our podcasts, you’ll know that we do what we call our lightning round, which is just some questions to get to know you better.

Tyler Lorig 52:06
Haven’t we done enough already? [Laughter]

Ruth Candler 52:08
No, we have not. So with 30 plus years experience studying the olfactory system, what is the most surprising discovery you’ve made?

Tyler Lorig 52:22
Um, you know, well, it wasn’t a discovery I made… Well, I discovered it, but I was told it, so, that’s a discovery, I guess. You know, I came into this… My graduate training was about vision and hearing, and I did a postdoc that had to do with smell where I treated it like just another channel of sensory information, right, so you’ve got vision and hearing, and then there’s smell, and taste, you know, gets in there too. And I was looking at it from its, you know, that standpoint, and, you know, trying to understand some basic things with it.

And frankly, there… smell is not a big field. So there weren’t many of us, and so it was, you know, we all get together once a year in Florida to talk about what we’ve learned. But I went off and did a sabbatical at University of Chicago, and it was a scientist there who, you know, we were talking about
something, and she turned to me and looked at me like I just had two heads and said, “It’s social, don’t you get it? It’s a social sense.”

And that was this profound moment for me when I actually realized that it wasn’t just another channel — it had to do with human interactions. It had to do with people getting along with other people and what you know about them and how we, you know, make choices about this and the, you know, the closeness we have and the deep shared experience, all of that was part of smell. It was more than just a sensory channel. And that was a huge… that was huge for me. That kind of unlocked a new side of the field that I never knew before, and it’s just absolutely wonderful.

Ruth Candler 54:03
Your huge a-ha moment.

Tyler Lorig 54:05
It was, it really was, and she knew. She could see that and she just kind of laughed.

Ruth Candler 54:10
Well, I’m gonna put you on the spot now and ask you to share with us your favorite smell and favorite taste.

Tyler Lorig 54:17
Oh, favorite smell and taste… You know, I like food. That… you may have guessed that, and I… you know, it’s kind of like whatever is cooking now. I just don’t… I don’t know that I have… I love, you know, the scent of flowers is absolutely wonderful. I love that, but I’m… I just move around. I don’t feel like I’ve got a favorite, I just love so many of them. It can be very eclectic, but whatever is cooking now is kind of what I like best. And I…

Ruth Candler 54:49
I can understand that.

Tyler Lorig 54:50
You know, I cooked a lot of bread over the pandemic, so I think that’d probably be my top choice.

Ruth Candler 54:57
With your love of food—

Tyler Lorig 54:58
Mm hmm.

Ruth Candler 55:00
—what is your favorite place to eat a meal in Lexington?

Tyler Lorig 55:05
Um, I like the Red Hen. I think the Red Hen’s wonderful.
Ruth Candler  55:08
Talk about a mixture.

Tyler Lorig  55:10
It is. You know, it’s a place that has a lot… I mean, they… it’s a very creative menu. And, you know, that may not be to everyone’s taste. We, you know, there are lots of people who want to have very, you know, a kind of predictable experience. And I am happy to have a, you know, an unpredictable experience in that.

Ruth Candler  55:31
When I’m there, I’m always very open to whatever the chef wants to make. So you’re officially retiring at the end of June. What will you miss most about W&L once you’ve retired?

Tyler Lorig  55:46
You know, that’s an easy question. I will miss teaching. I actually really enjoy telling the stories that we’ve been talking about. And this is how I teach. I mean, that’s for better or worse. Giving these stories is one of the things that I thoroughly enjoy and sort of getting people to hear the stories and kind of be amazed by the same things that amazed me is one of the things I love most, and honestly, interacting with our students has been really, really great. And finally, I don’t know many faculty who are going to miss their colleagues, but I am going to. At other colleges, I don’t think that’s necessarily one of the things that’s going to make the list, but I will miss the friends that I have worked with for so many years. They are really spectacular faculty members and good friends.

Ruth Candler  56:42
Well, you’re not leaving Lexington.

Tyler Lorig  56:44
No, we’re gonna hang around.

Ruth Candler  56:46
So on that note, what are you looking most forward to in retirement?

Tyler Lorig  56:52
The schedule change. I’m interested in…

Ruth Candler  56:58
Sleeping late?

Tyler Lorig  56:58
Yeah, sleeping late would be great. I hadn’t thought of that yet. Sleeping late would be a really good thing. I could get good at that. I’d like to try that. But yeah, I… you know, people often think faculty members are, you know, they teach their classes and, you know, they chat with students, and then they go home. And it doesn’t work out like that. That is not the way it works. You do teach your classes, you
do chat with students, but then you have your research, which in my case is kind of time-consuming because there are a lot of computers that all have to be programmed to do the particular experiment we’re going to do. We build equipment — if you wanted to have a tour of the lab, you’ll see the electronics bench that we have so we can build the equipment we need to do this. All of those things go into it. And it’s… it really is time-consuming. And being able to have some flexibility in just figuring out what you’re going to do when you’re going to, you know, do the routine parts of the day will be wonderful.

Ruth Candler  58:00
That sounds lovely. So next week, our Class of 2021 will be graduating. What would you like to tell them? What one piece of advice would you like to give them?

Tyler Lorig  58:15
Um, you’ve had… this is gonna sound like, I think, many commencement addresses. I’ll try to make it a little shorter. You know, they have had a spectacular education, they… I’m actually really proud of the education we provide here, I really am. And they’ve had a wonderful opportunity to do this.

And I would say, especially to the class that’s coming out in cognitive and behavioral sciences, you know, you guys have gotten some experiences, some skills here, that are really, really valuable. And you just need to let people know. So I would not let a label define you. If somebody wants to call you a psychology major, you can just say, “Well, I’m a psychology major that’s, you know, in some ways, but we call it cognitive and behavioral science. And I have a lot of experience doing the statistics and research and the science that you need done.” And so resist that label. And by the way, resist the label when it comes to looking for jobs to apply for, as you go through this long list and you see the things that are there. Don’t… If they read into the list that’s there, read into the description and see if you find some of the things that they’re looking for interesting. If you do, apply, you know, and let the people on the other end say, “No, not what we’re interested in.”

But if they see your background, they’re going to be interested, because the chances are that that is something that they’re not used to. And it’s just a matter of letting that happen and not locking yourself out because you’ve used a label to tell you what you believe it is.

Ruth Candler  1:00:01
Thanks, Tyler, for joining us today. It’s been a wonderful conversation, and I’m glad that we could have one last lesson with you before your retirement.

Tyler Lorig  1:00:10
Thank you. It’s been a pleasure to have had one last lecture.

Ruth Candler  1:00:14
Thanks as always to you for listening. We hope you’ve discovered something new. I know I have. And if you’d like to read more about today’s podcast and check out other ways to continue your lifelong learning with W&L please visit our website, wlu.edu/lifelong.