#404_ Prof. Marion Hetherington – Psychology and Development of Food Preference & Eating Behaviour

DANNY LENNON: Professor Hetherington, welcome to the podcast.

MARION HETHERINGTON: Thanks for having me.

DANNY LENNON: Like I said, I'm very excited to dive into a lot of these topics, and I think something that might set the stage for people early on, is when we think about this psychobiological approach to human appetite, you've written really excellently in some of your work about the mistake we might make if we were to consider appetite solely on the basis of physiology or psychology, particularly when we think around what drives food intake, and that they're inextricably linked. I was wondering, could you just frame that for people of what is the most accurate way we can think of that overlap between physiology and psychology, when it comes to appetite.

MARION HETHERINGTON: Well, as a behavioral scientist, I'm very interested in human behavior, but you just can't get away from the fact that human behavior is driven by really strong physiological needs. However, food intake in our society, as everyone is aware, is very much shaped by our culture, by our cuisine, by our environments, and to a great extent, what we eat is part of our identity. So when we think

about psychobiology of appetite, we're thinking about the behaviors that we express, and we think about what drives those behaviors. And, in particular, I'm very interested in genetics, and I'm interested in the genetics of obesity, for example. And the way that I understand that is to think about the risk factors for obesity being highly heritable, and then how that's expressed in terms of behavior. And I'm not saying that genes are destiny, I'm simply saying that the genes are really important, and as a psychologist, I need to understand a little bit about the heritability of some of these eating treats and risk factors for overweight obesity, so that I can understand behaviors better. So when we talk about eating behavior, we're thinking about biological drives, and we're also thinking about, overly from our society, from social aspects, such as eating as families, and thinking about the larger sociocultural themes around food. So eating for fuel is quite a simple notion, but actually, we eat for more than fuel, we eat for a number of different reasons, and that's what I'm interested in.

DANNY LENNON: Fantastic. And we're certainly going to dive into a number of elements within that. One of the areas that I wanted to lead off with, because I find this incredibly interesting is around the area of preference for foods and acceptance around foods. And I know that you and your group have looked at the development of food preferences in infancy, and then how that manifests later in life. Can you maybe just give an introduction to some of that work, and then for maybe people who are unfamiliar, what's the first couple of things we might need to know about what we're actually talking about with food acceptance and preference?

MARION HETHERINGTON: Yeah, absolutely. So in terms of food preference, where a child might prefer one food over another, or in terms of acceptance, that's the willingness to eat something and to consume it. It really starts at conception, and people have a hard time thinking about that, because food preferences are very much

something that is expressed by children when they're capable of making choices, and food preferences are usually measured at the point where you can look at behaviors more explicitly. However, we know that the first 1000 days influences food preference, and we know that because we know that the fetus is swallowing about a liter of amniotic fluid per day in the third trimester. And therefore, we know that some of the mother's diet that is the volatiles from her diet, some of the compounds in the diet that then migrate into the amniotic fluid are then experienced by the fetus.

So when we think about food preferences, we think about those which are innate, so we talked about genetics being very important, so we know that we have an innate preference for sweet taste, because we're mammals, and milk is sweet. And then the other things that we know about food preferences is, is that they are acquired, so we have an innate preference for sweetness, and beyond that, we have to acquire a preference. And some of those preferences are laid down by what the mother was exposed to. And if you think about it from an evolutionary point of view, mother has lived to the point where she's had a baby, and therefore what she's eating and her diet has secured her viability. So having those flavors from the diet and the amniotic fluid means that those preferences are actually going to help that baby and help that child to choose foods that the mother has chosen that are safe enough, and have ensured her growth, her health, her wellbeing to the point of being able to have a baby. So a fifth preference measure is often done in children, when they're a bit older and old enough to make choices, but actually, the roots of that choice are way back in genetics, and also in terms of the maternal diet, through pregnancy and also through breastfeeding. So we know that experience is important.

DANNY LENNON: That's fantastic. And I think one of the interesting question that throws up then is if we have this impact of the maternal diet, and

then what the child is exposed to in those first couple of years as well, I suppose people are wondering how deeply then entrenched do those preferences become, to what extent are they maybe modifiable or not based on further ways we could try and change the child's diet as it gets a bit older?

MARION HETHERINGTON: Well, certainly, food preferences are modifiable, but the problem in terms of behavioral science is that if you look at meta-analyses of studies that have been done to encourage children to eat, say vegetables or different types of fruits, as they get older, the window of opportunity has passed by the time children get to school age. So there's a wonderful meta-analysis and systematic review conducted by Charlotte Evans, at the University of Leeds in the Department of Food Science and Nutrition, and she sampled all of the research that have been done in trials, which had tried to encourage children to change the preferences for fruits and vegetables. And in the end, she had a sample size of about 24,000 children, and she found that by school age, you can change fruit preference a little bit and increase intake of fruits a little bit, but you certainly can't do much for vegetables. And so, all these different trials that had used all these creative methods of encouraging children to try vegetables, after five years of age, the overall outcome on intake was minimal, was negligible. It's about 0.07 grams of vegetables.

So what we take from that is that, okay, food preferences are modifiable, but there's a window of opportunity, and that window of opportunity is very much around maternal diet, exposure through amniotic fluid, breastfeeding, because breastfeeding has so many different benefits, it includes flavor, exposure, and complementary feeding. There's a window of opportunity because babies have no expectations at six months when they're getting solid foods – if moms are giving vegetables that's going to set them up for liking vegetables

for life. And that data has been supplied by Sophie Nicklau in Dijon. She looked at complementary feeding, and she looked at foods given to children in nursery, and looked at food preferences at two years of age, and found that it tracked right into adulthood, into when the people were 22 years of age. So we know that food preferences track, but we also know that food preferences are developed during that first 1000 days, and that if you try to encourage children to eat different foods at age five, it's really hard, it's not impossible, it's just really hard, because by five years of age, children at school age already have been exposed to multiple foods, and it's really hard to make them eat vegetables at that point.

DANNY LENNON: Right, yeah. It becomes fascinating, because I think oftentimes when we talk about the health impacts of diet on our overall health, we understand that it's this cumulative exposure over long periods of time that what matters most. And again, most people will acknowledge that, yeah, what a mother is going to consume during pregnancy and maybe what the child is going to consume in those first few years, that obviously impacts its health, but now, based on the fact that you're saying, can impact their preferences going forward, it has this cumulative effect on a much longer, maybe even lifelong diet quality that someone may otherwise have an aversion to, let's say.

MARION HETHERINGTON: Yeah, for sure. And I think that even if moms are not able to breastfeed, for example, our studies show that if you add vegetable flavors to formula milk at the time of complementary feeding, then that can help them to acquire a liking for vegetables. So there are different points along the timeline in early life, that allow children to be exposed to flavors that will then set them up to have the best foundations for healthy eating. So if moms are feeling sick during pregnancy, and they don't really particularly want to eat vegetables, that's okay if they breastfeed, because then if they're breastfeeding and they're eating vegetables,

then the babies will get the flavor of some of those vegetables, for example. And then if moms can't breastfeed, if they're adding vegetables to formula at the time of complementary feeding, or giving vegetables to babies, then that's great too. And if they don't manage it, at least, if they're role modeling, if they're showing that they really like vegetables, for example, in their parenting, then children will acquire a liking through mimicry, and children love to copy what their parents are doing. But then, by school age, then you start to get peer influences, and you have the influence of teachers and other important adults in the child's life, so it's more difficult to then encourage children to eat well.

And at school meals, for example, there's a lot of waste that people talk about, because vegetables are not eaten, and there's not enough vegetable liking to encourage children to eat vegetables at school meals. And what we're seeing in our research is start early and offer vegetables in a repeated way, in a varied way. And if you give them often enough, then by the time they get to school meals, those vegetables will be eaten, those vegetables will not be wasted. So a lot of these worries that parents have about feeding, they sometimes worry that they've not done enough in pregnancy, or they didn't breastfeed or they didn't offer vegetables, enough complementary feeding. But as long as they themselves are eating vegetables and eating a healthy diet, a lot of that will be transmitted to children through example, and through the commensality of family eating, which is very enjoyable, but a lot of families don't sit around the table, and they don't eat as a family very much. So that's something that we would encourage, because we know that it's important for child development, and it's also important for food preference development.

DANNY LENNON: So just to kind of go on with some of those practicalities for maybe mothers that are thinking about what is the, quote-unquote,

right way to go about this, if they are aiming to get their child exposure in those early couple of years to some of these foods, for example, vegetables, is it simply a matter of just exposure over time, that's the mechanism that's leading to this preference, or there are some nuances in there that your work has shown will correlate with a higher probability of a preference or a liking going forward?

MARION HETHERINGTON: So starting back at the genetic ideas, first of all, if a child is born with an avid appetite, they're at an advantage in terms of being willing to accept lots of different foods, and we know from the work by Clare Llewellyn and Alison Fildes – Clare is at UCL, Alie is now at the University of Leeds, lucky for us. But they are part of the Gemini study, which was founded by Professor Jane Wardle, and in those studies of twins, the Gemini study was a study of twins, they looked at eating traits, and they found that some eating traits are highly heritable. So enjoyment of foods and an avid appetite is highly heritable, so is fussiness. So some children are going to be more fussy, even if the moms have eaten a fantastically healthy diet in pregnancy, even if the moms have breastfed – by the time complementary feeding comes around, those children might be more resistant to eating vegetables or any foods for that matter, because fussy children can be fussy around lots of different foods, new foods, anything that's novel. So those are some of the mitgating factors.

But interestingly enough, another thing that Alie Fildes and Clare Llewellyn have found is that some eating traits are not heritable, they're learned, like emotional overeating. That's something that is acquired. So in terms of what parents might be thinking about doing the right or wrong thing, there's no such thing. It's just parents need to be armed with the best information and evidence, but they need to know that some of these things are not modifiable easily, because some children are born fussy, and some babies are born with an

avid appetite, and some babies are born with a really good way of cluing into internal cues. So some babies are very satiety responsive, so they've got a good appetite, but they know when they're full, and they will stop eating. And their research is all about trying to get parents to understand their baby's communication cues. So in terms of right or wrong, I can't speak to that, because there are no right or wrong ways, but what I would say is, in our modern age, a lot of people feed their babies when they're on their device, and therefore, they're not looking at what the baby's communicating to them; and the other thing is that babies are very capable of nutritional wisdom, but they can only express that nutritional wisdom if the parents are offering a healthy variety.

So in terms of the vegetable story, for example, this is a food that tends to be very much underwritten in this country, we don't eat enough vegetables in this country, and that's a real problem, for the very reasons you gave earlier, which is around health. But you can't really encourage children to eat vegetables unless they like them, and they will only learn to like them through exposure. So eating foods are highly heritable, some of them are acquired, but most of these ones I'm talking about avidity of appetite, enjoyment of food, to tie to responsiveness, these are highly heritable. So when parents are feeding their child, they have to think about the temperament of the child, and they have to think about what does that child communicate to me, and if you're on your device, like a phone or whatever, TV or whatever, you're not really tuning in, so I would say, really importantly, is, understand your baby and what they're telling you, and it doesn't matter that the baby hasn't finished the bottle formula, or they haven't finished all that's on their plate, parent provides and child decides, and that's something that Ellyn Satter talks about in her research, if you offer the baby these foods like baby led weaning, then let the child decide

what they're going to eat rather than thinking that babies are not capable of nutritional wisdom, which they are, if given the opportunity to.

DANNY LENNON: That's fantastic. I think even knowing some of what you just said there is really powerful for parents, the fact you said that fussy eating, for example, being this genetic underpinning is really useful for a parent to know. One of the things I've heard some parents discuss is way they'll have a child that has a particular aversion to certain types of foods that they come across; and I know in some of your research you've talked about this where on one side where we're trying to develop a liking, it's through this repeated exposure, and it takes this kind of cumulative effect; however, on the other side, when, unfortunately, maybe an inversion to an otherwise healthy food occurs, that could be off the back of just one bad exposure as opposed to multiple. Can you maybe just talk about some of how a food diversion may come about in that sense, and then, if there's anything for parents to worry about, or, how to work around something like an aversion?

MARION HETHERINGTON: Yeah, I mean, it's classic psychology for the aversion learning, and one of the first times it was discussed as psychology was through Martin Seligman, and he had an aversion to Béarnaise sauce. And it was basically that even after this lovely meal, and he had steak and Béarnaise sauce, but then the next day, he got a kind of flu and he fell sick. And he attributed that sickness to the Béarnaise sauce, and it was a virus that was the source, as nobody else was sick. But that's really a classic example of how aversions are developed. So if you have a baby who is being fed a food, and then they're sick, they might always pair that experience with that food. And I would say, if children have very, very strong food aversions, then dance around them, choose a different food if they don't like spinach, then offer cabbage; if they don't like broccoli, then offer spinach; if they

don't like this or that, then dance around it. And the way that we do this in research is we offer foods which mask the flavor of the vegetable that is disliked.

I'll give you an example from my own experience, which is that when I lived in Dunblane, we used to have a garden we could grow courgettes, because the Scottish climate allowed courgettes to grow in abundance, but my son wasn't that fond of courgettes. So I was a sneaky chef and I put my courgettes into banana bread, and I snuck my courgettes into any food that he would then be eating, but he wouldn't be aware of it. And then, as he got older, I made them more obvious by making roasted vegetables where I snuck them in and they were there, and he could fish them out, or he could eat them, and he's learned to eat them, I know he loves them.

So there are lots of methods that you can get around food aversions or food dislikes. Aversion, if it's a sickness related aversion, that's going to be very hard to undo. Because as Martin Seligman showed, this idea of pairing sickness with a food flavor that is a protective mechanism, this is inbuilt in us to ensure that we don't eat things that are going to make us feel sick, and it's so powerful, and it's such an important facet of our survival mechanism, so I would dance around it. So if children don't like a certain type of food, one food or two foods, then offer an alternative. Another thing to do is to, for example, if they don't like broccoli, offer it with cheese sauce, so that the broccoli bitterness is dampened down. So a lot of our research is about masking the flavor of foods because nutritionists love to hear that they're actually eating the food, no matter how it's done. Whereas psychologists are very interested in children acquiring a knowledge of what foods they like, so that they can put that into practice, so they know that they like broccoli or they know that they like courgette and they will then go out buy it when they become independent consumers. Whereas

nutritionists are all about, well, doesn't matter, it just matters that they eat it, and then they get the benefit of it.

DANNY LENNON: Fantastic. A couple of times you've mentioned around this wisdom that babies can have in communicating their like or dislike for certain foods, even before that's verbalized. And one of the really fascinating things I find about a lot of the research that you've done is being able to look at these facial cues and other expressions from the child to work this out, and that, at least to me, it doesn't seem like a very simple or easy thing to do. Can you maybe explain about how you go about that in research and maybe some implications from that too?

MARION HETHERINGTON: Yeah, so one of the things that we understand about babies' communication is that although before they can speak, they are able to show emotion, anyone who's seen a crying baby knows that, but they're also capable of much more subtle communications. And this was first discovered by Jacob Steiner, and he basically filmed babies when they were first, I mean, hours old, and they were exposed to distilled water, which is a neutral stimulus; and then exposed to sucrose and solutions, that sweet citric acid and solutions that's sour and quinine sulfate which is bitter, and they also gave them salt and water. And I think what he found with the facial expressions of the babies who were just hours old, was that there was this very stereotypical response to sweetness, which was licking the lips, and sort of almost like a smile, very positive affective response. And then with sour, there was a lip pursing, anyone who's seen a child eat grapefruit for the first time will know about lip pursing. And then for the bitterness, there was gape. And this is a fundamental response to the bitter taste, which is shown in non-human primates. So you see this in the chimpanzee, you see in the orangutans, you see in the tamarin monkey. They all show positive affective response to sweetness, because there's an inbuilt desire for sweetness, because we're mammals. And you

can see it in the rat, and then with humans, and other non-human primates, we see the gape response to bitter.

So nutritional wisdom is partly inbuilt, you know, there's a love of sweetness, you don't have to learn to like sweetness; but with bitterness, there's rejection; and with thoroughness, there's the lip pursing and slight dislike, and then that is reduced – that dislike is reduced with exposure. But the other aspect of nutritional wisdom, which is really important to mention, is that a pediatrician called Clara Davis, in the 1920s-1930s, she worked in Chicago, and she had access to – she did some work in Boston, she did some work in Chicago, and she published her work, and it was basically around children who were being fed by nurses because the babies were from an orphanage, and when it's time to introduce solid foods at six months, Clara Davis organized for these nurses to offer raw and cooked foods. So raw chicken, raw haddock, raw liver, raw brains, all that stuff plus cooked beef, cooked marrow, cooked everything, and she gave vegetables and fruits. So she offered a tray of foods with a variety of foods, and the idea was, okay, we are mammals, will they just choose the orange juice and the milk and the sweet foods like fruit, or will they choose a wide variety of foods. And in all the babies that she studied, so it was 15 babies in total, and she looked at their eating behavior, not only for a few months, but she actually followed them for a few years, and she had amounts of data, but these babies selected a variety of foods, they grew well. A couple of them chose cod liver oil, but you know... they actually chose it, and it reduced their likelihood of getting rickets.

These studies, whilst not entirely ethical, because these were babies that were quite vulnerable, they grew well, they were really protected from ill health, and they did not just choose the foods they preferred, the chose a wide variety foods which were maintaining their health and wellbeing. No, caveat is they

were not given French fries and confectionery and all that stuff, this is the 1920s when Clara Davis started out, 1928 when she published her first paper. So we don't know what would have happened if they had all that other stuff, which was high energy density, highly palatable foods, some may say ultra-processed, I wouldn't use that word, but high energy density foods are highly palatable. Nonetheless, if you provide a child with a variety of foods, they will do well. And sometimes, moms resist giving foods that they themselves don't like, so if they don't like spinach, they're not as likely to give spinach to their babies. And in that window of opportunity, at the time of complementary feeding, it's really important that moms offer these foods, even if they themselves don't like it. And the communication that babies show, yes, you're right, it's hard to quote that behavior, but we've done it systematically, we've drawn from other research studies, and we have evidence, not just from humans, but from non-human primates, that some of these behaviors are highly stereotypical.

DANNY LENNON: Super fascinating. So off the back of that and you've introduced issues around the food environment now and access to hyperpalatable calorie dense foods, so if we start thinking of the child that's moved beyond the situation where all its food intake is dictated by its parents, to now a situation maybe where they're in school, or socially, or even into adolescence where they're making more of those decisions, one of the issues that arises is now just over selecting certain foods for health reasons, but the issue of potential overconsumption of calories because of this food environment that you've just perfectly described. So in that situation, and I think you highlighted this at the start of our discussion that we obviously have some physiological control over food intake, and various different hormones with feedback loops, etc., that tie into satiety. But there's then a clear psychological aspect that impacts those hormones, but then there's also these

environmental and behavioral cues that act completely outside of our hunger or energy requirements. So in terms of how that plays out in some of the literature with children, once they start getting access to make their own food choices, what are some of the first few things we're starting to see from a psychological sense of what might be driving overconsumption of calories?

MARION HETHERINGTON: In terms of overconsumption then, let's begin at the beginning, which is that some of these eating treats, as we mentioned, are highly heritable, they're stable, it doesn't mean to say that you can't do anything about it, you just have to manage that. So if you've got a child with an avid appetite, then you manage that, and the way that you manage that is that you offer them foods that are high in nutrient density, low in energy density. So my supervisor, my PhD supervisor some years ago, no, but I still am collaborating with Barbara Rolls, she's written a few books on Volumetrics. She's built this book, and several versions of this book, that's the top selling book for Volumetrics, it's around weight management. But the idea is that you've got foods which are high in nutrient density, low in energy density, so they're very filling, but they're not going to deliver a lot of calories. Right?

So if you've got a child who is very avid in appetite, then if you fill them up with really delicious, nutrient dense foods, then that's going to help them to understand that their hunger is manageable. On the other hand, if you've got an avid appetite child and you're rewarding them with foods that are high in energy density, then that means that they're going to acquire a liking for highly energy dense foods, and that's the food that they're going to expect every time they're hungry or distressed. So getting back to your question around where does this all begin, and what do we need to look out for, where are the roots of overeating, partly they're eating traits, and then partly it's what the parent does about that.

So there are four types of parent really, in terms of responsiveness to the child's communication, and what they demand of their child. So in psychology terms, there are four types of parenting, there's indulgent parenting, there's authoritative parenting, there's uninvolved parenting, and there's authoritarian parenting. So if we start with indulgent parenting, they're all about responding to the child with no demands. So they just give them what they want, whenever they want, okay, so the children have got freedom to choose what they want, because parents are really indulging their food preferences and all of that, but they don't expect anything back. An authoritative parent is very responsive to the child's hunger and satiety, but they have a demand, which is that they've got to eat a certain food, and they've got to do it in a certain timeline, here's the meals, this is permissible. So there's a kind of high demandingness this as well as a higher responsiveness.

And then you've got uninvolved parents who're kind of like not responding to their child, and are not really demanding anything of them; and those are parents who are just very free, and they're kind of not very supportive. It's kind of rare, but it happens. And then, you've got authoritarian parents who are all about the, you will eat these foods, so they're high in demandingness, but they're not responding to the child's communication. So it's like a quadrant of high demandingness, low demandingness, high responsiveness, low responsiveness to the child. So in terms of the roots of overeating, if you have authoritative parents who respond to the child's temperament, and respond to the child's eating traits, they're going to manage those eating traits in a healthy way. But if you've got an authoritarian parent, who's just directive and rule based, and regardless of details, responses, or child's preferences, then that child, when they get out into the real world environment, they're just going to go mad. Because they can

now eat all these foods that they're not supposed to eat, and all this. So I think authoritative parenting sets that child up to eat under certain circumstances, and not to overdo it.

So that's where it all starts, so it's eating treats. So if you've got a child with an avid appetite, they're likely to want to overeat, but you've got to manage that, and I would say, manage it, volumetrically. And then, you might have a child who's really fussy, and again, you respond to that, and you give them the foods that they will eat, but you make sure that you demand something back, you respond to their fussiness, but you have expectations of them. Right? And then you might have a child who is, whenever they're distressed, you might use food as a comfort. Well, right there, you're setting up that learning around, when I'm distressed, I want a sweet food, or I'm distressed, I want a treat food. And unfortunately, in our culture, we do that a great deal, we use foods as treats. And nobody treats anybody with an artichoke or an asparagus, what we do in this country is we tend to use high fat, high sugar foods, or high salt, high fat foods as treats, but they're not really treated as treats anymore, because people are eating them every day.

So in terms of overeating, it all starts with parenting, and responding to the child's eating treats, and it's by the time they get to school, if an authoritative parent has set them up in such a way that they don't overeat because they've not been given foods when they're distressed, have not had food for comfort, they've not used food to soothe, then food is something that you eat, and you eat till you feel, and then you stop. And we see things like eating in the absence of hunger in early childhood, which is a kind of template for later binge eating. So we see eating in the absence of hunger, so these experiments are done where you give a child a meal, you stop eating when they're full, you wait 10 minutes, and then you give them a coloring inactivity, and you have snacks on the

side and you say, you know, if you want some snacks, have some snack. So some children, they'll go on with the coloring, and they're not the least bit interested in the food, they've just had a meal and they're full. Some children are very responsive to the presence of food, especially high energy density, highly palatable foods, and they will overeat, and we see that in nursery in really early life.

So not offering these foods, when the child is full, not having these highly palatable foods around for a child that has a highly avid appetite, but offering them instead nutrient dense foods, no fruits veg, you know, fill them up with this, and they're no longer hungry.

DANNY LENNON: Yeah, it's fascinating, even thinking through some of that, it's very much what we would need to do for ourselves, as adults, we tend to think that we're more rational than we actually are, I think, and often people will talk about how to change your food environment in those very similar ways. You also mentioned Barbara Rolls who was actually on the podcast maybe well, five years ago now at this point, I think, but just for people listening, they can reference that if they do want to dive more into the Volumetrics. But a number of points you made there, Marion, are really interesting that I wanted to touch on, that relate to overconsumption not only in children And adolescents, but continued on then into adulthood. And in one of your, I think it was one of your review papers, you talked about how satiation can be disrupted by a number of means that relate to the foods that are being provided, whether it's a new novel food that we add in during a meal, or afterwards, the social context within its consumed. And then, also you mentioned around extraction, and I think that would relate to some of what you just said, whether a child or otherwise is doing something at the same time as eating, that can maybe impact then our ability to stop on cue. So I just wanted to maybe touch through some of those at first. The first around this variety

effect or changing the types of foods, because one of the concepts I came across before is around a kind of a sensory specific variety, and if you change foods that are very different, I'm going from savory to something more sweet, for example, you can consume a lot more than if you're stuck with just consuming one food. And I'm wondering, could you just elaborate a bit more on what we know about food choices, foods available on the table as we're consuming a meal, and how that relates to consumption over overall intake?

MARION HETHERINGTON: Yeah, I mean, sensory specific satiety is the phenomenon that I studied with Barbara Rolls many years ago now, 30 years or so ago now. And basically, what we found was that when you like a food, food preference, it's got a high looking at the beginning of a meal, and as you proceed through the meal, it becomes less and less pleasant. And that sensory specific satiety, because if you offer that food again, so if you get Mac and Cheese, for example, which has been famously studied ad nauseam in our field, but Mac and Cheese is very popular. So if you eat a little bit of Mac and Cheese at the beginning of a meal, it tastes wonderful, because you're hungry, and it tastes good; and then as you proceed through the meal, it becomes less and less pleasant. And if you offer that person more Mac and Cheese at the end of the Mac and Cheese, they're likely to say, no thank you; they're more likely to say yes to pudding or something sweet, you know, something like a yogurt or whatever it might be. However, there's been lots of studies where if you offer the Mac and Cheese, and you then introduce another flavor, so a French fry or ketchup or something else, then that will extend the meal, because you are disrupting satiation to the eaten foods, which is the Mac and Cheese.

So variety is important in terms of vegetable preferences in getting children to like tiny tastes of lots of different vegetables, but variety is also known to promote overeating; and that's

partly because we are omnivores, and we need to eat more than one food to stay healthy. We are not koala bears or pandas where we have a single source of food, we have lots of different sources of our foods are for healthy eating, we have to have a variety. So inbuilt to our appetite system is a love of variety, because variety serves us very well. But in terms of satiation, if you're eating a food, and you introduce another flavor, you will probably eat more of it. Same thing applies if you're eating a food like popcorn and you're watching a movie, you're focusing on the movie and you might look down at the bucket and discover it's gone, and you look at the floor and think you must have spilled, but it didn't spill, you ate at all, but you weren't aware.

So variety disrupts this association, and it encourages you to eat a lot, which in some circumstances is good, because we need variety to stay healthy. But in some circumstances like a buffet, it encourages us to overeat. So at a family meal, you've got a variety of foods, and all I would say is our research shows that we try not to have competing foods on the table. So my PhD student Liam Chawner, he's done a research study where he's had highly liked foods next to vegetables, of course, kids always go for highly liked foods, and by the time they've eaten highly liked food, they've got no space for the vegetable. So if you have competing foods, whereas if you have highly liked vegetables with less liked foods by the side, then they're going to be eaten first. But another clever strategy is to give vegetables as a starter which is what Barbara Rolls has done, she's given vegetables as the starter, and then the main meal, and it means that you're getting that vegetable and the child before they then had the competition with these more liked foods like macaroni and cheese or whatever it might be, or the pasta meals are available.

So variety is very important for us as omnivores. Variety, unfortunately, can stimulate overconsumption within a meal, and

from meal to meal. And as you mentioned earlier, distraction is disruptive to satiation. So what we would say is eat mindfully, eat slowly and carefully, and then move on to the next food, because if you eat your broccoli first, then you add your vegetable pasta, or whatever it might be, then at least that's been eaten, and you might not like more broccoli, but you're going to go on to your pasta. So Barbara Rolls has shown this time and time again, with her studies on variety, the more variety we introduce, more sensory variety, the more macronutrients, the more flavor, complexity, the more we eat. And anyone who's ever gone out to a buffet, will know that for sure.

DANNY LENNON: Yeah, it's so interesting to think through all this. There's so many questions I could ask Marion. I know we're coming up close to time here, so I'll start wrapping things up before we do. But before I get to my final question or so, is there anything that we have touched on or opened a discussion on here that you want to close up any loops on or wanted to add before we start wrapping up?

MARION HETHERINGTON: Well, one thing that I think is important to mention again, is this idea of distraction, because I've mentioned the movies and eating popcorn, but the same applies when we watch TV, and we're eating our meal in front of the TV, which is a pretty bad habit. And also our gadgets, our phones, and even a study done by France Bellisle who works in Paris, she showed that even listening to the radio, while you're eating serves as a distraction, and people eat more when they listen to the radio. So I would say it's really important to be mindful so that we take time and enjoy food, and that we appreciate the food that we're eating that will help stimulate satiation, and we pay attention to satiation and satiety, and then we're more likely to be satisfied with that one meal. But if we're distracted, I mean, probably everybody's had this relationship with food where they're eating, but they're at their desk, and they're typing something and they look for their Mars

bar wrapper, whatever, and they can't find it and it's gone. It's because you just haven't mindfully eaten, so you've mindlessly eating that meal, or that food rather, I think, and you do have no recollection of it. And that's really not helpful, because memory is an important determinant of what we eat at the next meal, and it's an important determinant of how much we eat at the next meal, and that's been uncovered beautifully by Professor Suzanne Higgs at the University of Birmingham. So if you disrupt that memory formation, and you disrupt eating by distraction, then that's going to leave you open to over-consuming.

DANNY LENNON: Brilliant. So before we get to the very final question, for people who want to find more of your work online, or information about the lab or contact you on social media, all those types of things, is there any places you would like to divert their attention to?

MARION HETHERINGTON: Well, I have a Twitter presence, and I have a website at the University of Leeds, and anyone can contact me through email or through direct messaging through Twitter, so @marion_mh.

DANNY LENNON: Brilliant. And for everyone listening, I will link up to that in the show notes to this episode, as well as a number of relevant papers that relate to this particular discussion, so you can check all of those out. And with that, Marion, it brings us to the final question I always end the podcast on, which can be to do with something completely outside of what we've discussed, if you wish. And it's simply: if you could advise people to do one thing each day that might have a positive impact on any area of their life, what might that one thing be?

MARION HETHERINGTON: Well, I would say, we all need to eat more vegetables, and I would say that having a love of vegetables is going to help the environment, it's going to help local farmers. And if you think about the air miles, then choose local, eat fresh, eat well, eat slowly, and enjoy what you eat, because eating is a pleasure. And I think when I

talk to nutritionists a lot, I get a little bit dizzy with all the absorption rates of this and that nutrient and vitamin, etc. And as a psychologist, I just want to promote the idea of the pleasure of eating, even when it involves vegetables.

DANNY LENNON: Fantastic. Yeah, and that's it, we eat for a multitude of reasons beyond what we need from a nutritional standpoint, and I think all of that is included within a healthy diet. So fantastic. Marion, thank you so much, I've really, really enjoyed the discussion and I've really enjoyed your work. It's been so informative to me. So I really appreciate you for doing this.

MARION HETHERINGTON: Thanks, Danny.