On the Sensation of Freshly Grated Lemon Zest

Anneli Käsmayr and Thomas A. Vilgis Talk About Food Innovation, Taste and Emotion

AK: *Mr. Vilgis, I would like to start this interview with a personal question that stems from my work as an artist. For the 'Sound in Savor' series I am compiling gustatory memories from people I talk to in a taste archive.*
What is your strongest taste memory? Can you describe it?

TV: It is undoubtedly a memory from my childhood: Sour tripe. It is a taste I can always recall and which I still miss as much as ever since I moved away from southern Germany.

AK: *Tripe is a regional specialty which I imagine not everyone is familiar with. Can you describe the taste more precisely, i.e., what is the consistency like, the aromas – what do you taste first?*

TV: Plain tripe, part of the digestive tract of bovines, is something a lot of people find disgusting. But if the tripe is cooked well then its surface is extraordinarily soft and a little rough, because the structure of the stomach remains intact of course. It releases a delicious flavor that is somewhat reminiscent of offal, but is also very meaty. It has a subtle acidity and the long stewing process produces a consistency that is hard to find in virtually any other food. For us in Swabia it is of course always served with spätzle and the dish is indescribable – even as I talk about it now, it triggers a feeling of longing.

AK: *Yes, I can well imagine. Favorite dishes like that have a strong emotional component as 'soul food'. But back to the taste. Is there tomato in the sauce too?*

TV: For us in the Swabian Alb region there has generally been very little tomato, but more vinegar for the specific sour tripe recipe. There are regional differences of course. In Italy, for example, the proportion of tomato is considerably higher, and the same applies in southern France where you can also get tripe. The way we do it is to stew the classic stewing

vegetables – onions, some celery, carrots – along with it for a long time. The vegetables are then broken down and the thickness of the dish comes from the release of the collagen in the tripe. It is really delicious, with a slight stickiness, the "viscoelastic part of strong umami flavour", or 'schlotzig' as we say in Swabia.

AK: *Does that mean proteins change as a result of the enduring heat?*

TV: Yes, this veal tripe of course contains a large amount of collagen, which turns to gelatin during cooking, but it also has a very fine meat structure between the collagen fibrils. The muscle meat consists of very short fibers with a lot of connective tissue, meaning it is very flexible so that the bolus, i. e. the grass, is kept in motion. It is a highly complex food if you consider the biology and the physiology of the animal. It is also a very juicy meat.

In our recipe we add normal wine vinegar, although you can play around with it a bit in gastronomy of course and develop the dish very rustically. You can add wine or fine vinegar to it. This can be added in several stages during cooking so that the cooking process is controlled accordingly. In the classic cuisine I enjoyed as a child, however, that was not an issue of course, and we would just add a dash of vinegar at the beginning of the stewing process and another at the end and it turned out great. You ended up with a lot of sauce – that is the way Swabians like it.

AK: *What difference does the acidity make when it is added before and after the stewing process?*

TV: The acidity added before the cooking naturally ensures that some proteins break down, denaturate and hydrolyze more quickly as a result of the acidity. It is purely about the technicalities of cooking, although my mother did not know that of course – it was just passed on through the recipe. The final dash of vinegar adds to the taste, with the addition of salt and sometimes parsley or whatever other herbs were available. Allow to cook for another 5–10 minutes and then you have got a mouthwatering dish. These days of course you can do it with lemon or lime juice too, but this was back at a time when there was no other option in the Swabian Alb region.

AK: *How often did you eat the dish?*

TV: At least once every two weeks; it always depended on when the local butcher's slaughtering day was. I come from a small town and if the butcher got a fresh cow then first he would get the offal. Then once he had removed that, the stomach, the tripe, would be cleaned and cooked. It was not like today when everything is available all the time, it was only on the slaughtering day. Then there was the blood sausage and liver sausage and everything we would call 'Schlachtplatte', meaning 'slaughter plate'. In fact it was a relatively easy dish to cook; you can leave it to simmer gently on the

stove, you cannot really go wrong with it. And that is something we would do often, for example if it were laundry day and there was not much time for cooking.

AK: *Do you sometimes deliberately relive this taste experience just to indulge yourself?*

TV: Absolutely. Back then I moved to the UK after my PhD defence, where you could not get it of course. Then I came back to Mainz and asked about tripe, only to be told "We do not have that here at all, it is pet food". I was initially shocked to discover there is something of a 'tripe divide' straight across Europe: You can only find it to the south of a line level with Heidelberg, i. e., in Saxony and in southern Thuringia, then up towards Poland. And at the time this was not clear to me, because for me it was a little delicacy, something extraordinary, and so I wanted to eat it again but could not get it. Since then I have always bought tripe when I have seen it, be it in Strasbourg or in southern Germany, or even in Provence. Wherever I get it, I always cook it at least once. But not like it was back then, I could not recreate it, but I use my own ideas so the taste varies – you either bring in the acidity differently or add mustard to it depending on the market conditions and your own preference.

AK: *How did you as a physicist actually end up in the field of taste research?*

TV: I spent many years conducting research into polymers, i. e., soft systems: plastic materials, rubber, non-metallic materials, which can be worked and molded with low levels of force. Emulsions and paints are included here, as are fillers and absorbent materials for diapers, for example, or even car tires, adhesives and dissolved polymers. Then later I became interested in proteins, and at that point you are actually quite close to foodstuffs. Then there was the huge boom in molecular cuisine and I changed tack entirely. All the knowhow from soft materials can of course be easily transferred to foods, and then it does not take long before the idea emerges to work on taste, too. With normal materials it is not about the taste. It is true that the molecular structure determines the macroscopic properties, i. e., if I want to improve a bicycle tire so that it lasts longer and suffers less wear, these properties can be traced back to the molecular structure on the nanoscale. Here there is always a structure-property relationship, which is a concept in materials research that has played an important role for a very long time. And it is similar with foods: In addition to the elements that fundamentally change, i. e., texture, mouth feel and firmness to the bite, there is the connection of the taste to the molecular structures. More precisely, the speed at which taste is released based on specific molecular processes is the be-all and end-all. And in that regard for me it is crucial to link up the expertise from both areas.

AK: *Specific processes in cookery that draw on knowledge of physics have been known for centuries. Can you actually determine a point at which cooking was changed by science?*

TV: Food technology has existed for a long time. However, it was not until the 1980s that people began to consider molecular structures. Back then there were so-called 'molecular gastronomists' who dealt with the topic in more depth and tried to establish what changes during the cooking of a puree, why pasta dough works so well, why bread has nice bubbles and a structure, and how this can be controlled. This was long before the hype about molecular cuisine, as driven by Ferran Adrià.

My own experience during my studies in the early 1980s concerned meatloaf. I had encased a hard-boiled egg in minced meat and then, whilst the whole dish was being cooked, it fell apart completely and there was no longer any meatloaf, but rather mince. That was whilst I was doing my doctorate. Here specific adhesive properties of the bits of minced meat had failed and it became clear to me that there was undoubtedly more to it than that which I had gathered from home. That is a point I like to remember, because there is a lot of materials research in cooking too.

AK: *Recently there has been a stronger focus in research on the artificial (re)production of foods, for example the production of meat in a laboratory, which has caused quite a stir of late. In one of your last research projects you looked at the production of soy milk. I would be interested to know: Could you theoretically produce cow's milk artificially too?*

TV: It would be very laborious technologically. You can of course create a product similar to milk, but in terms of the microstructure, it would never equate to what a cow is able to produce. In raw milk the fat is encased in a phospholipid layer, which creates another complete membrane around the fat particle, a lipid bilayer that stores enzymes and proteins as can be found in any cell. The main task of this milk is to pass these substances onto the calf, the offspring of the cow. Of course that is something nature does unbeatably well. Creating such things in the laboratory – no one would be able to afford that sort of milk.

AK: *Madness.*

TV: Yes, it is crazy. You can actually recreate the nutritional value; you can take the milk fat and assemble the proteins, but creating the structure is virtually impossible. You really have to hand it to Mother Nature and her ingenious biological processes.

AK: *In your scientific work you disassemble fundamentally natural structures. How are your feelings towards nature changing here?*

TV: As before, I have tremendous respect for nature. Personally I am a huge fan of natural foods and I really love cooking. Of course it is true though that research permits a great deal of insight into foodstuffs. At the Max Planck Institute we carry out fundamental scientific research, so we aim to understand the molecular correlations. This permits a different way of looking at foodstuffs and food itself. There is a great deal of ideology in the various teachings on nutrition, and naturally research puts this into perspective, so you get a feel for how things happen in nature and what benefits we get from that. Up until a few years ago I still did not even know how much physics was involved in human beings digesting droplets of fat from emulsions. Or what role bile acids play – it is thoroughly fascinating when these phospholipids are replaced and suddenly fat is released. Through this research you become ever freer of ideology and you no longer believe what all the nutritionists love to preach concerning what is healthy or unhealthy.

AK: *What sort of topics are you talking about here?*

TV: Gluten, for example, which is currently so vilified. From a scientific perspective that makes no sense at all. There is a small percentage of people who cannot tolerate gluten and/or its by-proteins. Gluten is a very long protein that generates rubbery properties. This has the advantage that bread dough, for example, is very elastic. This is also evident in how difficult it is to produce baked goods that have the same mouth feel and baking properties but do not contain gluten. But really our bodies do not care at all where the amino acids come from.

AK: *What I find very exciting about current nutritional trends is their dichotomy. On the one hand we have Slow Food, neighborhood gardens and a now extreme regional trend, on top of which the last few years have seen an increasing trend towards street food and, on the other hand, the laboratory meat we mentioned or the lifestyle product* Soylent*, which is being hyped as the modern food replacement or, as you can see on the website, as "simple, efficient and affordable".*[1] *The idea behind this is that you pack all the nutrients human beings need to survive into a liquid. What is your take on that?*

TV: That is possible from a scientific perspective of course, but the question arises as to how our stomach and digestive tract will react after a long period of having nothing to do. In evolution too we see that if, as the paleo movement proposes, we were to have a diet like our ancestors 50,000 years ago, there would be foods we are no longer able to digest because we no longer have the bite for them and because, over the course of time, our intestines have shortened, and the enzyme situation has changed. *Soylent* is a step further: Why would I need peristalsis if the digestive tract no

1 | 'Soylent' lifestyle product: www.Soylent.com (accessed on Apr. 15, 2015). The slogan now reads: 'Healthy, convenient, affordable food'.

longer needs to move semi-solid boluses through it? What happens with enzyme production, the pancreas, if the proteins have already largely been broken down? It would not have anything left to do. The physical components of digestion are largely redundant with this sort of nutrition, and I cannot say whether the intestines would become slacker or even shorter in that case, but I imagine they would. The reason I find this *Soylent* funny is that it would represent the end of an eating and cooking culture and that is something I would fight until my dying breath. I want to see my food in advance, to taste it in all its facets and to prepare it in all sorts of different ways. For me *Soylent* is something that is strongly reminiscent of food for the elderly. I became familiar with this field when my father was in a nursing home and it ultimately resulted in a book on nutrition for those who have difficulty swallowing.

It tackles the issue of how you can actually keep older people eating independently for as long as possible and thus contributes to maintaining a feeling of self-worth. Similarly to *Soylent*, there are liquids like starch and sugar cocktails that contain everything the body needs: trace elements, vitamins, essential amino acids, minerals and the right quantities of fat. For me and my food biography and culinary future though, *Soylent* is of no interest.

AK*: Yes, I agree with you on that.* Soylent *makes no sense at all when subjectively I can see that it is first and foremost the aromas that really speak to me in cooking. Freshly grated lemon zest or a sprig of rosemary – for me these are the experiences that make me enjoy cooking.*

TV: In reality cooking actually begins when you buy the products at the market. If you can tell the season and sense that now asparagus, for example, is ready and the first beans start to appear, then that is something I long for, because I have a certain sensualism with regard to food and cooking. And neither do I need tomatoes in winter. They do not taste of anything; they are hard and have a consistency that makes you want to run a mile! In winter I have entirely different flavors in mind, so you can really make the very most of a cabbage in all possible variations. As soon as the spring gets underway again, you go back to thinking precisely about lemon zest, the first sprigs of parsley, the first chives …

AK*: Rhubarb, peas!*

TV: … Exactly. Then you suddenly start to live very differently again. And all that is something I do not want to miss out on or replace with any sort of groundbreaking nutrition drink or smoothie. It is already happening with these energy drinks, which is a load of nonsense.

AK: *What I find extreme about* Soylent *is the fact that there is only one taste sensation*[2] *and I actually ask myself what that does to you? But with* Soylent *it is not exactly about the taste, it seems. Nevertheless, if I look at how closely emotion and taste are linked, i.e., how sensory satisfaction can actually also be a pleasurable experience, then I find the idea of only ever experiencing one taste as very menacing. You initiated a research project on the correlation between emotion and the gustatory stimulation of a dish with researchers from Humboldt University Berlin. What exactly is being studied there?*

TV: The idea for that came to me because I really like going to eat at top restaurants. I was interested for various reasons and I am always curious about the cook or chef's thought process behind the dish. It struck me that personally I get a feeling of extraordinary satisfaction from a complex plate rich in components, yet without the feeling of fullness that comes from having too many calories: a profound satisfaction, although the number of calories is actually much smaller. And it struck me that I actually do not put weight on with this sort of cuisine. I am also able to resist feelings of hunger without any great difficulty if I know something great is coming up. I was therefore interested in whether a direct correlation might exist between the feeling of satiety and the complexity of a meal. Together with Professor Werner Sommer, a professor for cognitive psychology at Humboldt University in Berlin, we conducted some simple experiments relating to this involving two meals with the same caloric content, one presented in deconstructed form and one normally. The study has just been evaluated.[3] Actually the eating times change with increasing complexity, and it is also possible to see a slowing down of the increase in glucose. The paper has now been published in open-access form and can be viewed by anyone who is interested.

AK: *It would make sense that through some kind of archaic imprinting we are compelled to consume a variety of nutrients and are therefore always looking for different tastes.*

TV: Yes, exactly. It is the same as the idea that you should eat a varied diet or consume 'five a day', but evolution has also taught us that we have not always been able to get hold of all nutrients at all times. Back in the past too we ate a variety of things that were available at the actual point in time in relation to the seasons. Evolution showed us what we have to eat, otherwise humanity would not have developed the way it did. And it is also through trying different things that man has discovered what is good for him and what he can eat. Thus a plate rich in different components is not only important for the reward center, but is also linked to a variety of nutrients. If you do that regularly then it makes no difference if you do not eat

2 | In December 2016 *Soylent* introduced new flavors of their drink products (available in addition to the powder in the product range).

3 | Łuczak et al.: 2016.

an orange on a particular day. It is all about the variety. You should never look at these things in isolation, but rather in relation to everything else.

AK: *That fits in very well with your taste-physical reinterpretation of the culinary triangle of Claude Lévi-Strauss,*[4] *which has also found enormous resonance with cultural theorists. What does it mean?*

TV: I was not familiar with the culinary triangle until a few years ago either, but I think it is a thoroughly wonderful clarification of the transition from nature to culture, where cooking and the utilization of fire play a huge role for human nutrition. Previously people only had uncooked food available to them, but the cooking process suddenly permitted a huge availability of energy, greater diversity of taste and the development of social culture. For me this was an interesting idea that still represents the very essence of cooking today. There is raw food, cooked food and fermented food, which Lévi-Strauss dubbed rotten. Take the example of cabbage: There is cooked and raw cabbage as well as sauerkraut. The old and modern cooking techniques that we acquired even in molecular cuisine fit precisely into this triangle. The food has a raw structure, through heating something changes, and fermentation changes something else. And then of course I end up back in the depths of my materials research. Thus when I cook purposefully, I also change the food to that extent. For me that was a fundamental clarification, which forms the basis of my fascination for this culinary triangle.

AK: *Is it not also the case that every culture has cultivated dishes in all three categories for millennia? Fermentation plays a role everywhere, albeit in different ways.*

TV: Fermentation has been around for a long time. Its oldest-known applications date from around 9,000 years ago. Yet fermented foods were around even before that. People could find fermenting fruits – a valuable foodstuff – and in some regions early humans even developed enzymes so that they could actually eat them. Long before the birth of Christ people began to ferment foods in order to preserve them or make them palatable – examples include phytonutrients and even milk. In the beginning people were very strongly lactose-intolerant, because they were dosed with lactose as a source of energy through the mother's milk. If you then eat normally, the enzyme is no longer necessary and breaks down. That is the case with all animals, and humans were the same. It is only over the course of time and through adaptation that the enzyme has redeveloped in specific regions, although not in all, hence even today there are still many people who are lactose-intolerant. In parts of Asia, for example, cow's milk has never become fully established, and in the African and European sphere it has been proven that the settlement of people correlates to the

4 | See p. 154 f.

developed tolerance of milk products. Here the acidification of milk was an obvious way to break down all the lactose. Anyone can eat yoghurt and cheese as long as it is well fermented. Hence through the fermentation process, people also learnt to preserve things.

AK: *The bacteria that are involved in the fermentation process are very beneficial to human health too. A large part of our immune system is found in the flora of the gut. Over the last few years, so-called 'effective microorganisms' or EMs coming from Japan have become very popular and have not only been adopted for health reasons, but also offer huge benefits in agriculture. In New York it was brought to my attention when examples for waste reduction in big cities were presented as part of a festival held by the New Museum in 2011. One of these was a Japanese compost known as Bokashi, which uses EMs to break down matter particularly quickly without putrefaction processes. The pleasantly acidic smell of this compost really struck me.*

TV: That was undoubtedly a form of lactic acid fermentation, which is non-toxic. That is why in food production you always need to add sufficient salt, because the salt prevents pathogenic microorganisms that produce specific toxic products from building up in the first place as a result of putrefaction. If something smells pleasantly acidic then that is always an indication that lactic acid bacteria and yeasts predominate. Nevertheless I would be wary of simply ingesting these sorts of foreign microorganisms because you do not really know what is happening there. First you need to understand exactly how our gut flora works. Of the billions of bacteria, these are at least known in terms of their genetics, yet every individual is entirely unique in this regard. Actually you would have to make a specific cocktail for each human being.

AK: *On the other hand, there are many studies into the fact that our gut flora have changed for the worse as a result of our diets, use of pharmaceuticals, etc., and thus specific fungi like candida and also skin diseases are taking hold.*

TV: There I also see the connection to Lévi-Strauss: If your diet corresponds to the regularities – raw, cooked, and fermented – then people have actually always eaten this way, so it is good for you. That is why I would advise staying away from convenience products, the sort of highly processed and therefore no longer naturally balanced foods. These are non-toxic, but we do not know what the long-term consequences are on the ecosystem of the gut flora, for example, if you consume these exclusively. The same also applies to *Soylent*. You cannot get any more processed food than this product. That could actually have long-term side-effects in microbiological terms too, in the form of fostering diseases, changes in the flora and hence shifts in the standard of health. And if I no longer need to chew, then it may be the case that my teeth fall out at some point. But before that happens, I would actually be much more concerned about 'social neglect' if the eating culture were no longer perceptible, as can currently be observed

in our highly industrialized society. I do not want to say that everything was better before, but it is true that the sociological function of eating was more strongly rooted in society. If you sit down with other people at a table morning and evening, that is naturally going to mean more than simply the consumption of food. It gives structure to the day and provides for varied meals and encounters. The function of eating at McDonald's these days is an entirely different one, because there the food becomes a side issue. And in all these discussions we are currently having about diet trends, be they vegan, vegetarian, paleo, pegan, raw food or even *Soylent*, this is entirely forgotten.

AK*: In contrast, what I find very stimulating about the trends such as specialty coffee or the enthusiasm for spirits like gin, vermouth or vodka and even fruit wines and craft beer, is the taste diversity that develops. This perhaps, in turn, represents a countertrend to* Soylent: *the need for regional specialties, for varied aromas, the success of very small-scale producers. Or even the concept of the German association 'Educated drinking'.*[5]

TV: People always used to laugh at me when I said I get my beer from Belgium or France. For me personally, beer is actually comparable with wine when it comes to enjoying a meal. For many people who eat at home, alcohol has to have a certain function; it has to match well with the taste. And here beer has long been underrated – perhaps partly because of the German purity law. The craft beer movement is now shifting away from this; with the use of aromatic hops or ingredients that actually do not correspond to the purity law requirements and cultured yeasts you can suddenly discover entirely new aromas. And that is another hype which, like other trends, will also disappear eventually. In Great Britain, gin is 'the' national drink. And that is also the great thing about it, because lots of people explore these things which also represent the manifestation of a piece of regional culture.

AK*: For years you have also been pursuing the idea that you do not always need to be drinking alcoholic beverages if you want something interesting to drink with your meal (including at home). I am particularly pleased about that because for some time now I have been involved in a working group on the topic of 'Non-alcoholic Enjoyment'.*[6] *In the 'Foodpairing' book you placed a great deal of emphasis on non-alcoholic accompanying drinks, something that I had previously only ever seen with any degree of consistency in the German-speaking region with Roland Trettl and his columns in the magazine 'Lust auf Genuss'.*[7]

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5 | Website of 'Bildungstrinken' ['Educated drinking']: http://bildungstrinken.com/ (accessed on Jan. 5, 2017).

6 | Website of the working group 'Genuss Alkoholfrei' ['Non-alcoholic Enjoyment']: http://www.genuss-alkoholfrei.de/ (accessed on Jan. 5, 2017).

7 | Trettl, R.: Columns on non-alcoholic drink pairing, in: *Lust auf Genuss*, issue 8/2012 – 1/2014, Offenburg.

Unlike premium gastronomy, where many places are now offering non-alcoholic drinks pairings.

TV: Sometimes wine is simply essential – it is of course the classic drink to enjoy with food, but there is this idea of bringing to bear the aromas that are in the food with a light drink. What I found problematic was that the options for non-alcoholic accompanying drinks were either water, non-alcoholic beer or some kind of fruit juice, but a juice with a proper, high-quality meal – that sends shivers down my spine. It is simply too sweet and too viscous, even as a cocktail, it just seems wrong. That is why we thought it has to be done differently, it should be easy. One aspect of wine is not only its aromatics, but a certain astringency. This astringency is good for us, but it cannot really be achieved with food. I had a formative experience in this regard in encountering Asian culture, in which green tea has this same astringency. It is a watery drink that acts as a carrier for aromas. It was from this idea that we developed ideas for drinks that are light and highly viscous – they have to be drunk like a wine or a beer. And it is precisely in this direction that many new restaurants are now heading with young chefs full of innovative ideas – you need only think of names like Nils Henkel, Sebastian Frank or Felix Schneider.

AK: *These ideas are of course sometimes a little more costly to put into practice, but are really exciting in the way they enhance the aromas. I am convinced that in five to ten years' time there will also be finished products on the market here.*

A further future trend I would like to talk to you about is the consumption of insects, which are considered a good source of protein. At the beginning of 2015 an article appeared in Brand eins *business magazine about food hacking in Silicon Valley, which included details of a start-up that produces cookies as a low-allergen product using insect flour.*[8] *You have already experimented a little using locusts and maggots, for example as part of a cooking project at the University of Osnabrück. Does that excite you from a culinary perspective?*

TV: You can fry the insects, which makes them delightfully nutty and crispy. And if you extracted the proteins from them you could even make substitute products like tofu or something similar. But you also need to account for the fact that a mealworm is around 1–2 cm in size, so you need a lot of them to make a full plate. If you want to feed a family of four or five, then you need an appropriate amount of matter. A cow might bring 800 kg of meat to the table, so only one slaughter is required and you can live for a long, long time on the result, but with mealworms you need to kill millions of them to feed a five-person family, which raises some questions with regard to animal ethics. What I find tricky though is the

8 | *Lecker Grillen-Kekse*, *Brand eins* (issue 02/2015) – *Was Wirtschaft treibt*, available online at: http://www.brandeins.de/archiv/2015/marketing/food-hacking-silicon-valley-beyond-meat-bitty-foods-hampton-creek-lecker-grillen-kekse/ (accessed on January 26, 2016).

reduced variation in taste. You can smoke and salt the mealworms but at some point that becomes boring, because the food does not have the same potential as a vegetable, for example. The aromatic possibilities of a vegetable are extremely diverse – meat is already limited here because of its molecular structure. One is based on pectin-cellulose, whilst the other is protein – they have different temperatures, and the maggots and insects are undoubtedly the most boring. That is why I think that it might work in the food industry as in the example of the cookies, but not in "family scale" home cooking. I have some serious doubts there.

AK: *On the subject of vegetables: You talked about the particular diversity of aromas in sous-vide preparation in relation to the culinary triangle. Might that be something that could make it into the realm of home cooking?*

TV: Yes, most definitely. I can cook food at home this way even without a sous-vide appliance – I can easily do it in the oven, for example. I recently cooked a whole celeriac sous-vide, so the entire bulb in the skin with some Tonka beans, Ethiopian coffee, a little sugar and salt for the osmotic effect and some butter so that the aromas are released in the fat, in one of those plastic bags. It then remains in the combi-steamer for an hour and a half at 87 degrees, is then chilled in water and simply marinates for up to two weeks in the fridge. It is an unbelievable experience! It is only with recipes like this that you realize just how much you can do with vegetables – more than you would ever dream of. Hence for me food trends are somewhat secondary; I observe them and have fun with them, but as long as I have food from the garden or can buy it at the market or in the countryside around Mainz then that is trend enough if I approach it with my own quirky ideas.

AK: *So to use the words of* Michelin-*starred chef Vincent Klink: "Voll ins Gemüse!" – Vegetables are the way forward!*

TV: Exactly!

AK: *Through your job you have the extraordinary opportunity to explore what fascinates you in scientific terms. What other topics are you particularly interested in?*

TV: One example is the question of what else you can do with the fat particles of nuts and soy beans. Or what you can do with specific plant sugars, these types of oligofructose that make up all root vegetables, for example, from chicory to parsnips. These are very specific short-chain sugars that are not built on starch but rather on fructose, which are probiotic and yet are not digested by humans. These are the sorts of interesting physical phenomena that I am looking at in my research.

AK: *Your popular science books convey a lot of knowledge and get people excited about letting loose and discovering new taste sensations. Your latest book 'Kochen für Angeber' ('Cooking for Showoffs') in particular – the title of which was perhaps chosen a little reluctantly – represents a very humorous and inspired approach to aromas and techniques in avant-garde cuisine. Even just the graphic integration of the seemingly handwritten comments on the texts in the book is really fun. It takes your book 'Aroma', which was presented with the highest accolade by the* Gastronomische Akademie*, to the next level in a practical, user-friendly way. How did you end up getting interested in aroma pairing?*

TV: Classic food pairing has been around since about 1990, when people assumed that you could match up two foods if they had the same key aroma. But for me that was too narrow; it lacked aromatic contrast and so I took a new approach to the whole area. What it was really all about for me was the fact that the mere existence of an aroma did not really express anything. In coffee, for example, you have a sulfuric aroma that can also be found in salmon, so it is said that you can combine coffee and salmon. Personally though I am not sure that this is the reason why the combination tastes good. It is not just the one aroma, which is released very differently by the coffee of course than by the salmon, and most importantly it depends on how I prepare a food so that the aroma actually reaches my nose in the first place, and how quickly it is released and what exactly this odor-activity is. There is a whole series of structural questions: What does the molecule look like? How is it released from the food? That means that here there is a lot more to take into account to emphasize the food pairing than the mere existence of aromas. And that was the idea behind the book 'Aroma': working with aroma groups to understand the pairing using herbs and spices. This opened up a whole new world to me. And the 'Foodpairing' book was based on the same idea, but here the aroma groups were not limited to herbs and spices, but to food as a whole. It is true that it is highly complex, but it worked there too and it was simply logical. Classic food pairing is therefore the combination of the same things, but of course you also need to create contrasts to keep things interesting. For example cucumber, melon, borage, salmon and goat's cheese all have an identical aroma. You can combine these and make a great salad out of them, but the salad is not that exciting and after the sixth forkful you know how the seventh is going to taste. If I add some contrasts to it, however, then it suddenly becomes exciting.

AK: *At the beginning you said that you have many reasons for visiting top restaurants. Can you elaborate on that?*

TV: It is curiosity for one thing. Visiting a top restaurant is a huge experience for me and is actually a piece of culture – it has a similar value to a music-lover's enjoyment of opera. For me it is a veritable culinary opera when there are several courses. And what I also find interesting is the

development: What changes, for example, with molecular gastronomy? On top of this, I like to see the particular signature of the relevant actors in the kitchen.

AK: *Does the overall presentation also play a role for you personally? I.e., how the space is designed, what sort of atmosphere there is?*

TV: No, not at all, I only have eyes and all senses for the plate. For example, I could never have a business lunch in a top restaurant, because my discussion partners would take up far too much of my attention. Then I would consume my dish without focusing on it, which for me is a travesty in cultural terms. In that regard I prefer to go with like-minded people who can also keep quiet for ten minutes and immerse themselves in the taste. I am also very happy to go for dinner on my own when I am traveling for meetings or conferences. It is a great experience to be entirely alone with the plate and the service and the chef (in the kitchen), so you can dedicate yourself entirely to the food. Some people like going to the theater or to a rock concert – I like going out to eat. I simply like the discovery element of it, entering the unknown. I want to know what the people there do and I am open to various ideas. Unfortunately there is just not enough time – I work 12-hour days – but when I am retired then I will catch up with it all. Hopefully.

AK: *I will take your word for it. Thank you for talking to us.*

The interview was recorded on April 22, 2015 and was revised in December 2016.