

## Interview with Gary Beauchamp

**[RB] Global warming, adaptation, peak oil, water scarcity, pandemic preparedness, cancer research...we've got all of these really important issues; how important is the research here?**

[GB] Haha...that's funny. You talk about those things and there's a meeting, almost as we speak, at Penn campus, organised by a guy named Saul Cass [?], which is all about food and all of these things that you've mentioned. Unfortunately, I can't go to it ... I argue, at least in the developed world, that the most serious diseases that we deal with are diseases of excess, mainly excess consumption – sugar, salt, fat and food in general. And that, since the chemical senses are essential in determining whether, and how much you will consume, therefore we are at a position which is extremely important in terms of human health.

And maybe if you look at the opposite side, when this institution was founded one of the ideas was that if you understood how the sensory systems worked then you could get people to eat things that are not so palatable but would actually be more healthy. That's why I'm interested in insects, because there's a food that we ignore and it's abundant.

So, I think that on the first level what we do here is pretty trivial, if you think about it in terms of a pleasure that's associated with a good smell or a good wine, etc. But, drilling down a little bit lower than that, it seems to be that we're onto something that seems to be quite important.

And then there's the harder argument that we, like a lot of other scientists, are doing the basic research which is not really clear what will come of it. And you have to have a belief, and history would give you confidence in such a belief, that ... there's an organisation in the army that expects that 90% of the things that they research and develop will be useless, but 5%, things that you wouldn't have been able to anticipate, will result in breakthroughs in research and results.

**[RB] Yes, I think that the unanticipated discoveries have always been a very important part of science. It's probably been the hardest part to attract attention to, or to sell, because nobody is particularly interested in investing in something when they don't know what the outcome will be.**

[GB] There's no question about that. In fact, yesterday I was in a meeting in town for the Association for Independent Research Institutes (places like this), except most of the ones there were big, big places like the Jackson Labs in Bar Harbour, they have all the mice; Cold Spring Harbour, which is another one which has been around for 150 years, has Nobel prize winners, Jim Watson was the director, etc. So, anyway, it's interesting that their leaders were absolutely fixated on genomics and they are putting hundreds of millions of dollars into trying to decipher the genes behind everything. It's a huge mathematical issue/puzzle. And it was interesting to me that these two separate organisations were almost doing the same thing. And I have some connection to Harvard, and they are also doing this work. So, everybody is moving into this direction [genomics] and it makes you wonder if it's the time to go in some other direction.

**[RB] And it seems as though Monell is taking the more applied approach where, rather than unpicking that puzzle, you are taking what we already know about genetics and finding applications for that knowledge.**

**So the first question that I asked you, which was obviously a provocation...How often do you have to defend yourself against those sorts of questions? For example, before sponsors.**

[GB] Every day [laughs]. Well, before sponsors we don't have to do it at all. Because, before sponsors – while they may claim to worry about this – what they worry about is profit; they want to sell things. So, there's no doubt that in the food, flavour and fragrance world that what they say is totally dependent upon its sensory characteristics, particularly the chemical sensory characteristics. So, their fundamental interest in this is pure self-interest.

**[RB] So, they know what you do, they know how to engage with you, and they know what they're going to get from you ...**

[GB] Right. So, this may be changing but, in terms of the longer period of time, they have very little interest in, say, our clinical work. And much more interest in specific things that they might be involved in or, the more long term looking ones, in basic revolutionary ways to look at flavour. The biggest one in the food industry, and to a lesser degree in the flavour industry, is to see how molecular biology might somehow benefit them. They have this strong feeling, probably because of this very strong company called Senomyx in California, that has taken receptors and has used those to try and identify novel sweet taste enhancers and things of that sort.

**[RB] For product development?**

[GB] Yes.

**[RB] So, when you say that you have to defend your research all the time, who are you referring to?**

[GB] I'm referring there to people such as donors for core funding, or to individual people. Or, our biggest donor by far, who is National Institutes of Health (NIH), who are attending to public health, I've spent considerable effort trying to get the message through that the chemical senses are not the minor senses and that vision and hearing are the most important things, because they impact upon health.

**[RB] So, reprioritising the senses, which is fighting against this hierarchy in public opinion which has lasted for a very long time.**

[GB] Right. And the reason for the public opinion in NIH's historical perspective is very reasonable. If you lose your sense of smell, it's not such a big deal – to be honest. And losing sense of taste is so rare that it's not even very significant factor. But, if you lose your sense of vision and hearing, that's serious business.

**[RB] This is an argument that's also used in ecology: so, if a certain bug in the amazon goes extinct and we don't know how to use it yet, then what's the value of it? Are we going to miss it? I hope that we are eventually able to move past those sorts of arguments that measures perceived importance based upon 'what happens if we lose it?' It's not a zero sum game.**

[GB] I think that this is the psyche, and if you look at say the NIH, there's a whole institute devoted to vision, there's an institute that's mainly hearing that we're a tiny little piece of, and it really is driven by the development of visual aids, the development of hearing aids, and things of that sort – clinical issues – and [the belief that] the chemical senses have been inferior. I've got books up there on sensory biology that are four inches thick and 85% [using fingers as reference – not stating actual percentages] will be on vision, and the remainder will be on the other sense.

**[RB] Yes, I've noticed that imbalance in the literature as well.**

[GB] And that's changing actually. And it's changing in part because the science in the chemical senses are so interesting.

**[RB] In one journal, the Senses in Society, I noticed this imbalance. And browsing this literature at the beginning of my research and asking the question, where am I going to find relevant information on the chemical senses in the humanities, rather than in the sciences? And here's a whole journal devoted to the senses and every second or third article will have something to do on taste or flavour. So, it does seem to be changing. I hope so.**

**Now, you sit on the board of NIH, the Science Foundation, the Institute of Medicine, and probably others. Is this sort of government engagement a requirement in order to bend the ear of government towards your work? How much is about positioning?**

[GB] It's a requirement of everything, no matter what you're doing. And because so much of our support does come from the government then there's no question about that. We probably should do more. Government bureaucracy, NIH, it's a huge organisation and we only interact with a little tiny piece of it. We have one advantage; one of our board members, Alan Leshner, he is the CEO of American Association for the Advancement of Science (AAAS), so in his position he is probably the most prominent scientific spokesman in the United States. Not to say that he spends a lot of time talking about us, but the fact that we're even connected to him is of great use to us.

**[RB] I live in an embassy so I understand a little bit about the back stage of government and what it takes to get them on board with a project; it's a sort of dance that you do with sponsorship and government in order to allow you to do what you do. You talked a little bit about profit bias in the corporate world, does that bias ever have an influence on your science? So take for example, sodium research as a factor of obesity, so here's something that is government policy, there's a vested interest in the manufacturing industry, and then there becomes a strong focus inside of Monell on sodium and obesity; that's just a part of this sort of dance as well, isn't it?**

[GB] Well, yes and no. I mean, obviously there is no doubt that choices people do in terms of their research here is necessitated in part by what they can get funded. That's for sure. That's true whether it's funded by government, industry or foundations; they set the broad parameters. So, there's a person who is writing a book on something to do with the food industry and some component of his book is about how the food industry is using scientists to benefit themselves. I haven't seen the book yet, but the guy who wrote it is a Pulitzer Prize winning New York Times reporter, who is a digger. And he's been really sniffing around this place, because we exist in the nexus between industry ... [government and scientific research]. And so, he's definitely going to have stuff in his book about the extent to which industry has controlled what we do. So, bottom line is, of course industry is going to support research which is of interest to industry, that's obvious. And our only counter to that is, the research we do is what we do, and the results are what we get, and we have absolute rules about having to publish them, we have absolute control over all the data, if a company is sponsoring a particular project here they have no way to stop the publication of anything that we publish. We've got all sorts of examples where the results didn't come out the way that they wanted, sometimes they do. Most of what we do isn't like that; it's not like we're doing clinical trials where a drug is being tested, which is where the real rub is.

**[RB] Yes, it's more about the knowledge which underpins the products here.**

[GB] Right. Right.

**[RB] I think it's an interesting relationship. When I first came here, my sponsor is Givaudan, who I've really had very little contact with. So, on the first day I was taking a tour of Monell and I mentioned this and "the evil empire" was the comment, which I found curious. I don't understand the nature of the politics within the industry, but...**

[GB] Actually, Givaudan is one of my favourite companies. Having said that, there certainly is a subset of people, even people here, who have different views on the role of industry. And I think that there are true dangers in working with industry, that there are individuals at this university for sure (University of Pennsylvania) that absolutely would never do it; but they will work with government and to some degree government also guides things...

**[RB] Yes, there's a lot of crossover there. I've seen this from the perspective of food policy, which is, Monsanto, for instance, versus the organic grocer, and people have these incredibly strong opinions about it [government-industry interconnection], and a lot of it is merited based on past behaviour. Corporations are now are trying to become a lot more sensitive very quickly about how things play out in the public, and you see Nestle taking a very quick backtrack on some of the practices that they were doing in the 70s and 80s. So, it all seems to be coming into line, but I think that the answer lays somewhere in the middle. You [we] are part of the system, you work within it, you benefit from it as well. Living in India I see people wearing leather shoes and a leather hand bag but won't eat beef, and how can you take that version of morality seriously.**

**Taking this in a bit of a different direction: Philly seems to be a biotech hub, it seems to be a special place for biotech research.**

[GB] Not quite as much as Boston but yeah.

**[RB] So, how did that come to be? Even this street alone there are biotech institutions lined up. That's quite unusual, it takes quite a concerted effort to get to this situation. So, how did that happen?**

[GB] I actually don't know the answer to your question. Just in general, why? I don't know, but Philadelphia had a lot of research and medical facilities here. There are more medical schools here than in New York City. So, the major research university here is Penn. and it's very strong in bio-science since forever, which is why we are here, actually. We were one of the first buildings here and the idea was that scientists, mainly from academia, could set up small companies that could grow and build. I don't know if Boston was before that, but it's sort of like what was going on in Silicon Valley with their start-ups.

**[RB] It's an interesting thing for me because I didn't realise before I came how concentrated the scientific knowledge was in this area...**

[GB] It's also the case that for historical reasons, that the pharmaceutical and flavour industries were particularly focused in New Jersey. So, IFF was there, Givaudan was there, General Foods, So there was this concentration, at least in our field, that was happening.

**[RB] Now, how does it [research into sensory science] play out? I mean, is it pretty friendly? Do people sort of go back and forth and exchange knowledge? Or, is it a friendly competitive area? Or, does it get ...**

[GB] I guess it depends on your personality, is the answer to that. Like every other business, it's very competitive in terms of making discoveries. Regarding discoveries: you either do or you don't. And the clearest example of that is in the identification of olfactory receptors [Buck and Axel]. They did it,

and there where a whole bunch of people trying to do it at the same time, and there are all sorts of stories about that Richard Axel actually told several graduate students to try to do this independantly, and Linda was the one who succeeded. So, he even had competition within his own structure.

**[RB] Yes, it's the sort of industry where you want to nurture a degree of that in order to produce results.**

[GB] Particularly true of molecular biology, because in other areas there is usually a gradual accrual, where as in molecular biology you have big leaps. We were the first to identify the sweet receptor but we got scooped, we got screwed by our competitors and, in the end, didn't get credit for what we should have. The worst scientific experience of my life. I think that this is the way it works in some cases. Now, on the other hand, there are a lot of very good collaborative people in the business, and there's are collaborations between academia and industry as well that are good. But the bottom line is that there are different rewards in academia then there are in industry.

**[RB] So, whenever there is direct competition then it can get a bit nasty, but in complimentary areas...I'm thinking about Paul Rozin, who I didn't realise was right down the street, but when I talk about him here, your scientists know him, they like him. So, it's an interesting thing...**

**So, how does that compare on a global level? I saw that you're doing research in Singapore – there they also would like to create a biotech hub. China, who are racing down the genome as quickly as they can. Is it a sort of 'Space Race' to use a political science term?**

[GB] I don't know about that. Our view is that the scientific universe will start tilting in that direction. It seems to me that there's no question. And when you visit China, in the research facilities it can be a little bit scary. They have the opportunity, if they want to get rid of all of the rats, then they'll do it because they've got so many people to do it. If they want to do well in science then they will do it, because they've got so many people, and so many smart people; so it seems crazy not to keep an eye on that.

It's interesting. This guy who's the new head of the Jackson Laboratory is well known in Singapore because he was there for ten years setting up a genomics institute. He left in part because Singapore was moving away from supporting pure, basic stuff and wanted to get some return on investment. One of the reasons that they were interested in us coming there was because we might sit in-between their attempts to set up the Asian hub for nutrition research, on one hand, and having in Singapore lots of food companies operating in Asia on the other. So, it would be the sensory aspects similar to what we do here. But we're a very small institution so our board is particularly leery of getting too involved in foreign escapades.

**[RB] Small but, I think, potent. In the sense that Monell is recognised around the world for excellence in this area, and it's very focused as well, as opposed to doing a shotgun approach. And so, coming toward the end of our questions, as a champion of this research, your research has a direct impact on the work that I'm doing in the arts, trying to facilitate some cross-disciplinary links. What sort of message would you like me to go out from here with? I think that the question that you asked during the presentation [how do we get people to stop using the word 'taste' to describe flavour?] was an interesting one, and I thought about it later. Isn't it that people just want things to be simple? Why shouldn't we just keep calling the tri-factorial sensations that happen in the mouth 'taste'?**

[GB] Yes. I've thought that way as well. And, of course, science has had a long history as well, and we have books and journals going back hundreds of years where the anatomists have told us what taste is – and it's difficult for us to change that too. The trouble that I have, I guess, is that a scientific exhibit at a scientific museum, the American Museum of Natural History is the most prominent science museum in the United States, and in that [context] it was confounding. So, if they had said in advance that 'we are using the word taste to mean all of these sensory systems and we're going to call gustation one component of it'...it's pedantic but it's important because they are totally different sensory systems. They're organised differently, they go to different parts of the brain. What's interesting about them, of course, is that somewhere they come together to give you a single percept. I think that's why 'taste' has such power, because it is a single percept. I guess that even chefs don't, at least consciously, separate those things into different sensory systems.

In my own work, salt is one of the basic tastes, and we spend a lot of time here trying to understand how it works. And why people like it. And many people in the food industry (not usually those who are doing the work) suggest to reduce the salt and add more oregano/garlic/etc. (flavour components)...it's a different sensory world [flavour not taste]. It makes a difference if you think about those as one in the same system versus different systems that somehow come together, and have evolved together, but have evolved on very different pathways.

So, I do think it's important, at least from a scientific basis, to make these distinctions.

**[RB] So, if you're working in a professional capacity then you should really be able to talk the talk.**

[GB] I guess that's what I would say. Sometimes I think that it's a stupid argument and I shouldn't even bring it up anymore.

**[RB] So I guess the question is, what is the word that describes all of the sensory aspects of this sensation?**

[GB] Well, the word that I would use is flavour. At least in the English language, nobody would say that it doesn't include both taste and smell and irritancy.

**[RB] Ok. So switch to flavour.**

[GB] I'm not telling you to do it.

**[RB] But I will. My work is a little bit in the middle, in the sense that I'm a facilitator working on the side of programming and, in this capacity, I have an avenue to educate. As I travel around the world and give presentations, as I gave here, for instance in the art world or among chefs, I can offer three or four slides just on how sensory perception works. So, I have a chance to reach out to those people and am curious from your perspective, from Monell, what's the message? What do you want me to take away from here? Not to get too technical, just some ideas that I can pass on. So, that's my interest in this.**

[GB] Again, to go back to salt which I'm hooked on and I think is sort of a magical ingredient. The interesting thing about that, that we totally don't understand, is salt makes things salty but it also makes things better, and it does it in ways that nobody truly understands. But, those ways powerfully drove animals to try to find it, and plant eating animals which we evolved from, really were (driven to find it). So, salt gives a feeling of fullness, it gives a feeling of thickness, all things that the volatile components of flavour, the olfactory components, just don't have.

**[RB] Yes. I guess it's a bit like adding surround sound to an otherwise normal audio recording. Are we any closer to synthesising, of finding a substitute for salt?**

[GB] There is no substitute except for potassium chloride or lithium chloride. Lithium chloride is a great substitute but it's poison.