Kevin Verstrepen Looking Forward

Kevin Verstrepen is professor in genetics and genomics at KU Leuven and group leader in Systems Biology at VIB (Flanders Institute for Biotechnology). He serves as the director of the VIB Center for Microbiology, director of the Leuven Institute for Beer Research, and Honorary Professor at Nottingham University. He was the Guest Speaker at the 2017 ASBC Annual Meeting.

We asked him about what was coming up in brewing research and technology.

1. In terms of brewing yeast research, what area do you feel is the least understood and should be focused on more in the future?

As a yeast researcher, I am inclined to list a series of obvious open questions in my field. How does yeast influence hop character or beer ageing? Can we breed yeasts that make flavorful alcohol-free beer, or that make brewing cheaper and greener by performing ultra-high-gravity fermentations?

However, these are questions that several labs, including mine, are already focusing on. We have already made tremendous progress and are still moving forward every day. The real grand challenges are even more complex, and the true breakthroughs are impossible to predict. That said, I am intrigued by the question of whether we can predict a beer's flavor by just measuring specific compounds. I am playing around with the idea of using machine learning to try and develop algorithms to do just that. It would make is easier to develop exciting new beers, or to improve existing ones. Or perhaps even to start mixing beers, much like whiskies or cocktails.

Another completely understudied aspect in brewing is the effect and role of lipids. We know that some lipids in wort are vital for fermentation, but also that they can cause off-flavors. However, what we generally call "lipids" is in fact a very complex mixture of extremely different molecules; it really is way more complex than just sterols and fatty acids. And, it seems likely that some lipids play different roles than others. Bernard Van den Bogaert, the former owner of brewery De Koninck in Antwerp, is for example convinced that sphinglopids are the key to happy yeasts. Perhaps it would be possible to adjust filtration and/or simply add specific lipids so that we keep the positive effects without the negative ones?

Thirdly, it would be interesting to have more high-quality studies into the precise health effects of beer, and alcohol in general. It clearly is a mixed bag, but there are so many flawed studies floating around, and I hate how people are just cherry-picking studies that fit their vision.

2. What are some technology options that the brewing community can leverage from other industries?

It is good to first take a step back. GMOs were already “hot” in the nineties. Everyone saw them as the next big thing, and some breweries were really experimenting with them. Things rapidly cooled down when some environmental organizations and lobbying agencies started influencing public opinion, helped by unrelated emerging problems and scandals related to industrial food production such as Creutzfeldt-Jacob disease (“mad cow disease”).

Moreover, in some cases, they had a point because GM technology was really in its infancy, and some companies and researchers were perhaps underestimating and denying the inherent risks, while legislation was also running behind the technological progress. Moreover, many of the consumers simply do not understand the technical details, and often pick a camp based on feelings rather than a clear insight.

As a result, the debate quickly became very unnuanced and divisive. Interestingly, this was mostly the case for the use of GMOs in food and beverage production. The use of GMOs for medical applications never received as much scrutiny and criticism, partly because risks are lower and easier to contain, but also because the anti-GMO lobby was smart enough to realize that it would be much harder to swing public opinion against the use of GMOs to produce better drugs.

Since large food companies do not want to put their reputation on the line, they abolished much of their research into GM. One big exception are some plants that are not typically directly used for human consumption, such as cotton, feed corn, and canola, as consumers did not have to see a label that mentioned “GM” on it.

Recently, new technologies like CRISPR-CAS emerged, which made it easier to precisely engineer genomes without making any unnecessary changes, like the introduction of antibiotic markers. While in yeast, researchers have been able to do this for a longer time, this was not true for other GMOs, including plants and animals, where CRISPR-CAS really started a revolution, with a few products for human food consumption already making it to the market.

Specifically, the technology allowed the development of a new generation of GM plants that contain only a few changes in their DNA, which also (can) occur in nature, but spread over many individual plants or genetic lineages, some of which may not even be suited for agricultural use. CRISPR-CAS allows bringing these together in one lineage that is suitable for farming. Because several countries have ruled that plants that only contain such natural variations, or variations that could likely occur in a natural way, are not to be considered GMOs (even if they were in fact made using CRIPR-CAS, a clear GM technology), this is reviving the field. The whole trend is often pushed by smaller companies, which do not fear as much for their reputation.

Interestingly, as a result of the above, I now also observe movement in the brewing world again. Many of the new craft breweries are not afraid to stick their heads out and innovate. Some even told me they would like to use GM yeast and clearly label the beer as such,

irrespective of legal obligation, but rather as a special feature that sets their product apart from the masses. So, it will be interesting to see if we will soon start drinking craft beers made with GM yeasts and hops. If so, the larger breweries may follow as soon as they think that the field is safe, while some may never follow, in some cases perhaps partly to exploit the non-use of GMOs to convince consumers just how traditional and close to nature they are.

3. Beyond CRISPR/CAS, what other recent advances in technology do you feel will become more pertinent to the brewing community in the future, if any?

Clearly, a fantastic but also scary technology that is coming our way is "synthetic biology," where researchers make large pieces of DNA, or even complete genomes, from scratch in the lab. By adding this synthetic DNA to existing cells, or even by exchanging a cell's natural DNA with a synthetic genome, it becomes possible to make synthetic organisms that are completely designed in the lab. In fact, while George Church of Harvard University wants to use synthetic biology to revive the mammoth, a group of researchers is already making a synthetic yeast strain. This so-called Sc2.0 project is already halfway. In my lab, we are using synthetic biology to generate novel yeasts that can produce bioethanol from waste. I bet that in some years, more will follow; possibly also hops and other herbs, or even barley and wheat.

4. What's your favorite beer?

I realize that it is a boring reply, but I honestly like many styles, and much will depend on the time of day. I guess most of us prefer a lager over a stout after mowing the lawn, but after dinner on a foggy fall evening, this might change. Being Belgian, I do have a weak spot for our specialty beers, including lambics, Belgian style wheat beer, golden ales, and of course our trappists, from doubles over triples to quadruples. But, I must also admit that when I returned to Belgium after having lived in Boston for 6 years, I really missed the U.S. ales, and especially many of the fantastic flowery IPAs produced by a growing number of great craft brewers. At that point, some Belgian brewers were being snobby and liked to make fun of the "crazy, over-hopped" beers from the U.S. that "do not require much skill since the hops mask most shortcomings." I must say that I have very little patience for such beer snobs: those who will look down on any beer just because it is made, or not made, in a big brewery or in the wrong country, or wrong style. I have witnessed firsthand how little of that prejudice translates into a clear preference in blind tastings, or in failure when trying to produce such an "easy" beer. Luckily, much of that attitude has disappeared, and Belgian brewers have realized once again that what made them great is a combination of craftsmanship, a willingness to learn from anyone, and an open and adventurous mindset. So, I can now enjoy a series of fabulous IPAs with a Belgian twist. Belgian wheat IPA, anyone?

I guess I only have one drink a week that does not depend on the weather, my mood, or the meal I am having. Every Friday night, I go to my favorite local bar (7 p.m., ViaVia in Heverlee, for those who care to find me), order some tapas and drink an Orval, partly because it is such a lovely special beer, and partly to toast to my father, who must have been the brewery's biggest fan.