

EARLY EUROPEAN DAYS OF BEER YEAST

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Introduction

No beer can be made without water, grains and yeast. Of these three ingredients yeast still raises the most historic questions. The earliest brewers used wild species: microbes and bacteria, flying in the air or hiding in plants, fruits, grains and wood. They must have worked on some sort of autopilot, trusting in nature: they waited and after some time their worts began to ferment as a form of noble rotting. The yeast showed up as a sort of thick fluffy blanket of foam on top of the liquid. This familiar sight occurred in the wild past too: it's a classic biochemical phenomena. It caused a quite spectacular sight for instance during the fermentation of jopenbeer, a now extinct beer from medieval and later Danzig which was exported widely. Jopenbeer's wild fermentation in upright wooden vessels of 30 hectolitres began slowly, but developed in a dramatic way. Ten to 20 centimetre thick layers of foam turned from white to blue or blueish green and then sort of exploded, marking the time when brewers had to close the vessels because they started to overflow continually. After eight to 14 days this turned into a lot calmer second fermentation, with a white blanket on the beer.¹

Those wild yeasts aren't around in breweries anymore - except in those that create lambic. Brewers have long used them without even knowing what they were and what they did. But at a certain point in history they began to understand yeast. Brewers started to harvest it after the fermentation of a wort, preserve it and actively re-use it in the next wort; and, much later, they were even made into cultivated yeast strains. The yeasts were tamed. Those wild animals had slowly and gradually been domesticated, like cats and dogs. Brewers always had

yeast at hand, and were no longer fully dependent on nature. Since then, beer behaves differently too. It tends to be a lot less vulnerable. Brewers have much more influence on their beer in terms of fermentation.

Yeast (r)evolution

So it's been quite a revolution in brewing history, but how, where and when did it take place? This is where the questions start to arise. *How* brewers came to find out we'll probably never know. Somehow they discovered that the foamy stuff was decisive. Then the idea sprang to life that they could maybe re-use it. So they began to gather it and pitched it to the next wort. It worked and they decided to build a supply.

Put down in these few sentences this may sound simple. The Norwegian yeast hunter Lars Marius Garshol really thinks re-use is or was a simple thing to try.² But let's take a closer look and also from the early brewers' perspective. It may *look* simple judging it with our knowledge, but for them it actually represented a 180 degrees turn in thinking. Brewing isn't a simple straightforward procedure in the first place, but consists of many single steps which at the same time are related closely and complexly. Developing these steps has always been a matter of trial and error. One complication may have been that brewers considered the blanket of foam to be trash. It didn't look very pretty and was left over every time, as an inferior, unwelcome side effect of the brewing process.³ Moreover, it appeared to be redundant as the layer would turn up on a wort anyway. So they shovelled it off and threw it away, just like the dregs that had fallen to the bottom.

This view may have been with them for centuries. Until of course they noted that this wasn't a dirty side effect, but actually the stuff that caused their fluid to become beer. Even if this discovery has been a sudden brain wave like the one that led to the invention of the wheel, the following change of practice has involved four thinking steps: to understand, harvest, re-use and preserve. That further complicates the so called simple phenomenon. It's not even certain that all steps took place at one time or within the same time frame. Again, brewing has always been a matter of trial and error.

As to the *when*, it's a sort of *communis opinio* that it must have been in the sixteenth century, because yeast wasn't mentioned in the Bavarian Reinheitsgebot of 1516. '[...] yeast was simply not a recognized part of the brewing', we may hear with regard to that,⁴ or other similar exclams. Even the German Brewers Association's official website for the Reinheitsgebot's 500th birthday contains the notion that yeast was not known as such in the 16th century.⁵ This assumption is still held widely.

It's a very faint and thin explanation. Beer writers or others involved tend to overlook that the Reinheitsgebot was only a Bavarian law at the time of its birth. It's a mistake to apply its validity or even its significance to other countries and areas. That becomes even more apparent when we assess the importance of Bavaria as a beer producing country around 1500. For there wasn't any. Bavaria became an important beer country in the nineteenth century, but was a wine area that only brewed beers for its own consumption up till then. Medieval Munich for instance had on average only 30 to 40 breweries. There were no valuable ways of trading goods from Bavaria either - no trains, no long canals, and no coastal shipping. The important beer producing and trading countries in the Middle Ages were Northern and Lower Saxon (where towns like Hamburg, Bremen, Lübeck and Einbeck had hundreds of professional breweries), Holland (with Delft, Gouda and Haarlem) and England, especially London - not coincidentally all coastal areas with harbours. People in these regions would probably never even have heard of the Reinheitsgebot. It wouldn't have mattered to them anyhow. The Reinheitsgebot was a national law of one country, controlling the production of beer for its own use, but with no further jurisdiction or meaning. Its wider (German) importance followed later.

By putting the regional Reinheitsgebot at the centre of things we overlook the more important (and busy!) parts of early brewing Europe and the very likely possibility that yeast was recognized, re-used and cultivated there earlier. That being said, Bavaria has also been the cradle of bottom fermenting. Although this was only locally important then, we cannot ignore it, as may be apparent from the many brewing regulations by town councils.

Dark and lesser dark ages

According to Lars Marius Garshol the knowledge of yeast in brewing must be much, much older; maybe even as old as brewing itself. He considers it likely that ancient beers were not fermented with wild yeasts.⁶ The Egyptians indeed were busy with the fermentation of honey and grains and the recreation of this process. But any evidence for their reign over the process is lacking. Garshol points to other ancient sources though, like Pliny the Elder. In his *Natural History*, finished in 77 AD, he observed the Spanish and French who had made a drink by steeping corn and employed the foam which thickens upon the surface as a leaven to bake bread.⁷

I consider it more relevant to find out about the history of yeast in the cradle of living European beers; Great Britain, Scandinavia and the German and Dutch speaking countries. But the oldest 'proof' of beer fermentation in our parts might come from a representative of one of the ancient classic civilizations, the Roman historian Publius Cornelius Tacitus. He lived and wrote slightly later than Pliny. In his first century *De Origine et situ Germanorum* or simply *Germania*, Tacitus described how the Germans in the north west of Europe also drank a liquor of barley or other grains, 'fermented into a certain resemblance to wine'.⁸

It's striking that neither of the two used the word the Romans had for beer, *cervesia* as they knew about beer in Rome. Nonetheless, wine was the Roman's staple drink and they regarded *cervesia* as a barbarians choice. These historic reports might prove that case. *Cervesia* was beer without hops, much like the early beers both Pliny and Tacitus encountered (the use of hops only spread over Europe during the thirteenth century). But they don't seem to have recognized it - probably because they never drank *cervesia* themselves.

Clearly though they recognized fermentation. They don't tell us how it was started, probably because they didn't witness it. Garshol though is keen to conclude that when yeast was re-used for baking bread, it must have been re-used for fermenting beer itself too.

This is exactly what I'm looking for, but in more professional beer brewing surroundings. During the period covered by the findings of this research, brewing was no longer a barbarians', tribal, rural or home cooking affair. It had become, as outlined before, an urban industry with factories, regulations and trade. How did the inevitable and indispensable yeast and fermentation find their way in this early European brewing industry? By tracing parts of that process, we may also learn more about how beer brewing grew and developed in Europe.

Back to our subject therefore, to search for the oldest signs of beer fermentation. How do we try to trace those parts in history? Only by looking for them in documents or manuscripts, since we still don't own a time machine.

London 1283

In a study on medieval English brewing, the medievalist Karl Hagen observes that in the thirteenth century yeast was added to wort and that even a trade in yeast existed. He concluded this after consulting a sales book of the brew house of St. Paul's Cathedral in London. It sold brewing stuff to smaller brewers. 'In 1283', Hagen tells, 'St. Paul's brew-house warden reported the rather substantial sum of 9£ 6s. 3/4d. received from sale of dregs, which contain all the yeast that falls out of suspension after the ale has finished fermenting'.⁹ This might be the oldest written evidence of the gathering, sale and re-use of beer yeast found so far.

Hagen's source is *The Domesday of St. Paul's*, an account written in Latin of medieval life around the cathedral. Parts of it are the *Compotus bracini*, the reports of the brewer, consisting of extensive lists of stuff bought and sold, like grains. They contain a.o. '*Item de fece et hujusmodi 9 pond 6 S ob. qa*'.¹⁰ The word *fece* [dregs, sediment, deposits] really points to a residue on the bottom. But were they *yeast* sediments as Hagen writes?

This turns out to be Hagen's own conclusion - for yeast itself isn't mentioned anywhere. Didn't they have this

word yet? Or if they would have had this word, then why wasn't it used? Could these *fece* for instance have been something else? It's not even mentioned from *where* they were gathered. Elsewhere the reports only state that the *fece* were preserved in a cellar. So the word could also refer to the brewing dregs of the mash, which were popular as cattle food.

Max Nelson, researcher of ancient beers, cites the twelfth century French theologian and author Pierre de Blois (or Petrus Blesensis) who, in one of his letters in Latin, speaks of 'bread made from the dregs of beer'.¹¹ Here the stage of the brewing process that produced these *faece* isn't identified either. The dregs of the mash are a very plausible candidate for the making of bread.

Still, the fact that the y-word doesn't occur in these texts makes you wonder why. If they were yeast *fece* then why weren't they named? What was their knowledge in that era? The problem of words with regard to beer and fermentation will re-occur in this overview.

Magdeburg 1309

So although it's difficult to define the re-use of yeast as a thirteenth century phenomenon, it might have been, for there is much better proof from only a few decades later. It comes from a place that's hardly ever mentioned with regard to beer and brewing history, Magdeburg. This is in Lower Saxon, an area that has been important beer wise having it's own beer style, a forgotten white beer called *filtz* or *fyltz*. The town probably had about 500 brew houses in the thirteenth century, although its doubtful whether these were all industrial breweries.

Importantly some brewing rules and regulations have been documented. This is due to enduring conflicts between townsmen and the local archbishop, Burchard III. He imposed high taxes on all sorts of goods, such as foreign beers, and also tried to force brewers to use ingredients sold by his own brewery. If a brewer refused to buy his goods he was banned from the craft.

But in 1309 Magdeburg revolted. Brewers and other citizens joined together in a collective refusal to Burchard. This payed off and on 24 November a treaty was signed in which the archbishop granted them rights and freedoms in exchange for 600 silver Marks. One of

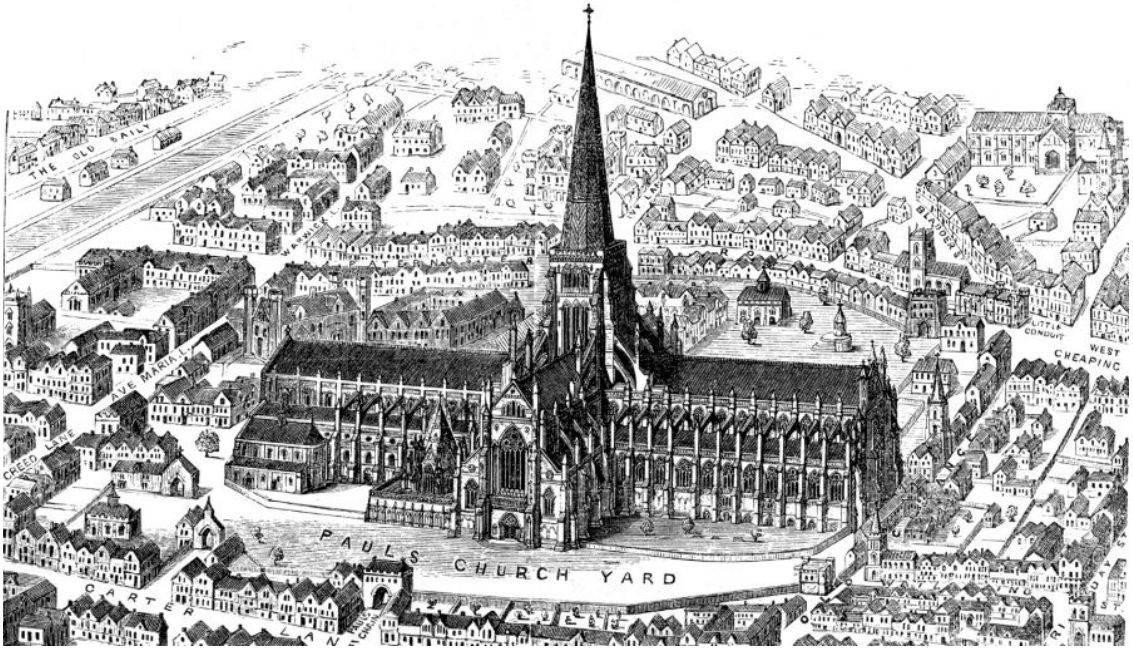


Figure 1. Engraving of St Paul's Cathedral from Francis Bond, *Early Christian Architecture* (1913). The engraving itself is from 1875. The brewhouse is barely visible: it was the first building across the street from the gate at Carter Lane, at the bottom of the picture, so one might just see the roof.

these rights read: 'Ouck so scolen die bruwer van der aldenstad des brokes und der vare ledich syn umb den ghest und scolen stellen, warmede sie willen ...'.¹² Or, 'Also, the brewers of the old town will be free to look for yeast where they want and may go forward with it like they want ...'. For this right, they had to pay an additional shilling for every *foder* (vessel) of beer they brewed.

So until then Magdeburg brewers had had to buy yeast from the archbishop's brewery. Therefore, by 1309, at least somewhere in Europe, beer yeast was traded, without a doubt after having been gathered from an earlier brew and preserved. This *may* also be the oldest European mentioning of the word yeast with regard to beer we know so far;¹³ but these are risky assertions in our digitalized research world.

Nuremberg 1320

In the same era, the process we now know as bottom fermentation came into use in Bavaria. Being largely a

wine region in the Middle Ages, bottom fermentation made Bavaria into a very remarkable beer region too - although probably nobody outside of it knew. The early Bavarian lagers were almost only sold and drank locally.

Bottom fermentation may have been introduced in Bavaria by Bohemian craftsmen, but this is just a theory. The area had the proper climate, with enduring and quite harsh winters. Brewers could ferment their worts at very low temperatures and afterwards lager them in moderately and quite stable cool *felsenkeller*, miles long manmade cave systems.

This brings forward the question: did they know about yeast and fermentation at that time? It's been suggested that bottom fermentation as a process is not possible without knowledge of the function of yeast.

The problem is of course: that's how we see it now, with the knowledge of today. We don't know in detail how early bottom fermentation took place. Could they have started it like elsewhere, with yeasts that withstood

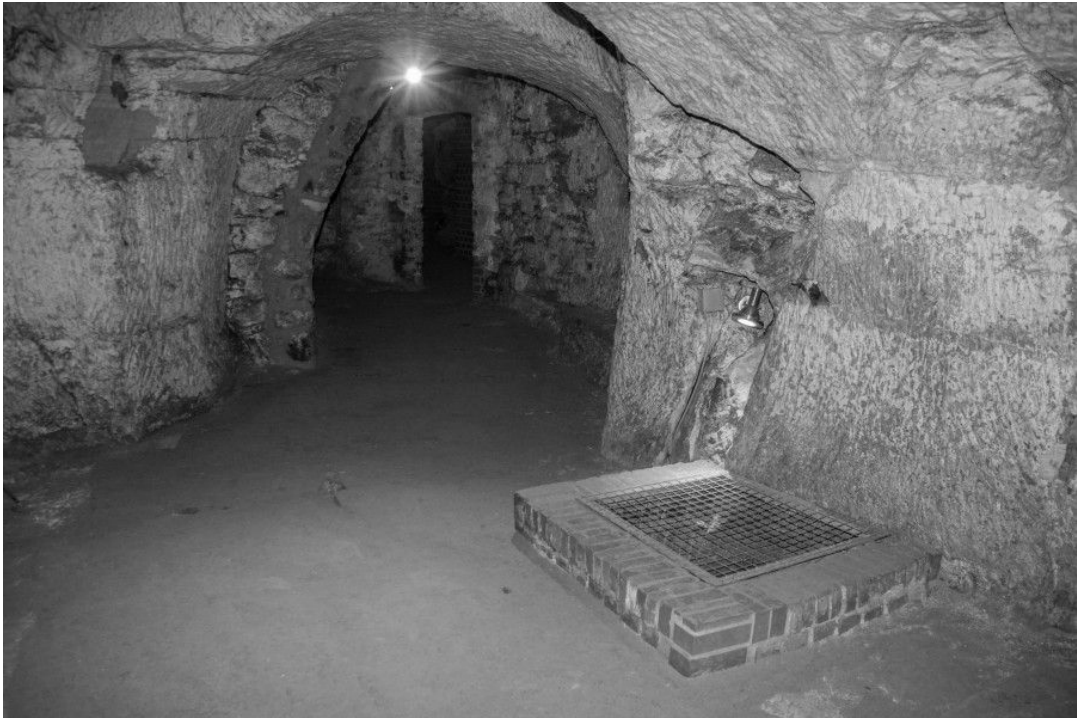


Figure 2. Felsenkeller in Schwandor, one of the old Bavarian brewing towns.

those circumstances but that were just as well not recognized? Other complications will follow.

There's also no *mentioning* of yeast or fermentation from that period. The oldest written account of what we now call bottom fermented beer is a regulation from Nuremberg in 1320, which states that it was forbidden to sell so called warm beer as if it was cold beer.¹⁴ Nuremberg brewers were only to brew cold beer between 29 September and Palm Sunday, usually end of March or beginning of April, because of the necessary lower temperatures of course. But these and other regulations did *not* speak of yeast or fermentation, like in Magdeburg, and neither of top and bottom fermentation. Those are much younger words and concepts. They were referred to as warm and cold beer respectively.

This can mean various things: they knew that they professed two ways of brewing, but they weren't familiar with the workings of yeast. Or: they were familiar with the concepts of yeast and fermentation but had no words for them, like possibly in London's Saint Paul.

Munich 1420

This word appears only another century later, more southwards: in Munich. The late Michael Jackson is one of the writers who has come forward with the suggestion that lager beer or bottom fermenting were mentioned in city statutes of 1420. It is actually the *Polizeiordnung* (police order) from that year. This text was published in 1838: '*Ein jeglicher Brauer soll das Bier das er siedet vor acht Tagen nicht ausgeben, es habe denn zuvor über sich wohl vergohren, und nicht unter sich*'.¹⁵ (A brewer should not issue the beer that he has simmered for eight days, it will have been top fermented properly, and not bottom fermented.)

This sentence has been explained in various ways, even as a ban of bottom fermented beer. Closely read, it actually states three things: no beer may be issued within eight days of its preparation; by then or even before that (*zuvor*), it's properly fermented in terms of top fermenting beer; also, by then or before that (*zuvor*), it's not yet ready when it's a bottom ferment-

ing beer. It doesn't say anything else about bottom fermented beer, not about the right issuing time and certainly not about a ban. One might conclude from it however that bottom fermenting beer could be offered *after* eight days of fermenting, which of course is way too short in our perception. Was this an incomplete citation, are parts of the police order missing or was early bottom fermenting a primitive practice with unknown features? Brewing history often leaves us with such questions due to totally disappeared knowledge and methods.

More important in this context however is that here we read *vergohren* - the better known and later German word for fermented - for probably the first time in terms of Bavarian beer. And not only that: it says *wohl vergohren*, or well (properly) fermented. So the town's administration was aware of the importance of a good fermentation process. It makes the eight day rule all the more enigmatic.

This early awareness is echoed some years later by brewing regulations from Nuremberg, the cradle of Bavarian bottom fermenting. A town council order from the end of the fifteenth century states: '*Item den bierbrauern allen zu sagen, dass sie die bier alle yedes besunder vergeren ...*'. Or: 'all brewers should ferment the beer carefully [or extraordinary]'.¹⁶

Hordaland < 1450

The similar assessment was made in Scandinavia in that era. It pops up in the old-Norse *Hálfs Saga*. This bunch of stories, filled with gods and the likes has survived in an Icelandic manuscript from around 1450. The saga itself may of course even be older, at least from the first decades of the fifteenth century.

One of the stories included, 'Of King Alrek', tells of a brewing contest. King Alrek of the Norwegian country Hordaland, who is already married to Signy, meets Geirhild on one of his journeys. She is introduced to him by his aid Koll, who considers Geirhild as a good wedding partner. So Alrek sees himself saddled with a second spouse, which of course wasn't exceptional in those days. Nevertheless he faces a problem - and he decides to resolve it by choosing the woman that brews the best ale.

In the meantime, a vague figure with the appropriate name Hood has entered. He is in fact the god Odin in disguise, and had already foretold Geirhild that she would marry a king. Hood had also stressed that she would consult him in all matters relating. This she does when the brewing contest is announced. And then follows the interesting part:

They competed at the brewing. Signy prayed to Freyja, and Geirhild to Hood. He spat on the yeast and said he'd be back for what was between the tub and her. And that proved good ale.¹⁷

Geirhild wins the contest and she and Alrek are married. But Alrek seems to have guessed that there's something not quite truthful behind Geirhild's ale. He even warns her for the complications of such a catch. Indeed by having spat on the yeast, thus creating a divine ale, Odin helped her win Alrek's heart.

This is of course primarily a good story, but not without further meaning. Odin's divine saliva points to a relevant element from the fifteenth century brewing reality in Norwegian Hordaland. There too, brewers and brewsters knew about yeast by then. The very word - *dregg!* - is in the original Icelandic text. Especially Odin's action reflects the idea that yeast was important for the success of a beer; and that there were good and better yeasts or fermentation.

Interestingly, the province of Hordaland nowadays contains the last stronghold of the farmhouse yeast kveik, slowly becoming more and more famous in the world of beer. Kveik survived, be it barely, all kinds of modernization. Apparently, there is real awareness of yeast in this area that goes back a long way.

The Netherlands 1400-1450

So the story might be a myth, but the elements were as real as can be to the Europe of that time. This is evidenced by a practical source from the same era in the Netherlands: a beer recipe. It's from a medieval manuscript of unknown origins, held in the Ghent university library, containing recipes, formulas and practical household suggestions. The extensive beer recipe in medieval Dutch is probably the oldest one in Dutch. It would translate, minus a few now unknown words, as:

To make good beer take equal quantities of barley and white grains, according to the preferred quality of beer; and if you want to, add wheat. Grind it with the other grains, put a kettle on the fire, add the flour of the so called grains to the water and stir. Let it boil to two third, remove from the fire and cool down until it is lukewarm. Then transfer it to a cask; then take good *heve* and *ondergyst*, and mix the two together. Take the decoction, add the *heve* and the *onderghist* to it and stir well. Then bring it over to a vessel and leave it to rise; it will rise *boven huut* and will be good beer on the third day, ready to be drank. And dont forget to add a little hop to the decoction, as well as bog myrtle, and that you should boil the decoction with these ingredients.¹⁸

The manuscript was dated by librarian Joris Reynaert in 1996. After serious research on the manuscript and its texts, he dated it at ‘around the middle of the fifteenth century’.¹⁹ His estimation can literally be confirmed with beer. The manuscript contains another recipe describing a substance lying in Hamburg beer or kuit. Kuit was a medieval Dutch beer that came to life around 1400 and had its heydays during the following century. The beer recipe itself also reflects important developments in Dutch fifteenth century brewing, such as a slow but certain shift from oats to barley (the ‘white grains’ could form up to 75% of a grist in the fourteenth century, wheat included even 100%) and a faster shift from gruit herbs (of which bog myrtle was the crucial one) to hops. Gruit had almost died out around 1420. The manuscript therefore should be from the century’s first decades.

In the same era the awareness of beer yeast apparently grew seriously too. For according to the recipe, the brewer had to take yeast and add it to the wort himself, in a vessel or cask. So re-use of yeast was practised in the Netherlands at the beginning of the fifteenth century. The recipe even mentions two kinds of yeast: *heve* and *ondergyst*. *Heve* (the German word for yeast is *Hefe*) translates as sourdough and as yeast, but the meaning of *ondergyst* (also spelled as *onderghist*) is unclear. It looks much like the modern Dutch word *ondergist*, which means bottom ferment. But that word wasn’t part of Dutch vocabulary until the nineteenth century when lager beers became the new standard. Needless to say that the fermentation in the recipe wasn’t bottom fermentation at all. From the text we can make up that the yeast ‘rose’ (the blanket on top of the beer) and that the beer was drinkable on the third day -

your typical medieval top fermenting beer. Possibly the word *ondergyst* refers to parts of the yeast that were left on the bottom of the beer. It would mean that both the blanket and the deposits were re-used and got different names. Using a mix of yeasts was a common practise in medieval brewing.²⁰

Paris 1489

Selling beer yeast has been a feature of its re-use from the very beginning, as becomes clear from the Magdeburg history and possibly the London one. This must have grown into a real business in the fourteenth and fifteenth century, according to regulations from Paris.

In 1268, Paris introduced by-laws for its brewers. Beer was a daily necessity, just like bread, so it was important that producers kept to rules and regulations. This regulation process was kicked off during the rule of king Louis IX, an avid reformer, and was put down in the *Livre des métiers*, or *Book of Occupations*. The first brewers by-laws then consisted of only seven rules. They outlined their financial obligations, how they had to deal with apprentices and the prescribed beer ingredients. Only water and grains were allowed, as well as certain herbs or spices on request.²¹ Hops nor yeast were mentioned; hops weren’t common in European brewing at the time, and as for yeast: it may have been unknown, unidentified or unnamed, like in Nuremberg and possibly London. The *Livre des métiers* also offers an extensive insight in the many rules for bakers, who at least later are known to have bought their yeast from brewers. But again there’s no mention of yeast in the early bakers by-laws.

The Paris regulation process then evolved further and was only completed in 1630. The brewers by-laws finally consisted of 18 articles. These later by-laws formed a *Reinheitsgebot avant la lettre*. ‘Beer’, they stated, ‘shall consist of no ingredients but good malt and hop, preserved and cleaned in the right manner’.²² This rule also defined brewing as a process ‘without adding buckwheat, ryegrass, etc.’ Those were cheaper options, but they were unwanted; probably because they were regarded as less nutritious or profitable. Such ‘bad grains’ were clearly forbidden and this prohibition was monitored quite strictly. Any beers considered inferior were poured in the Seine.²³

But in the first revision and extension of the by-laws from 1489, there's also a mentioning of yeast - not as a beer ingredient, but as a matter of trade for which separate rules are identified:

Beer yeast shall not be hawked about the streets, but shall always be sold in the brew-houses to bakers and pastry cooks, and to no others.

Beer yeast brought by foreigners shall be inspected by a jury before it is exposed to sale.²⁴

So beer yeast was sold in Paris by then, and probably even earlier; such regulations tend to reflect every day's custom. Apparently it was offered on the streets, which was regarded as unwanted. It must have occurred frequently. This can only mean that the yeast was gathered after the fermentation of beer, taken apart and preserved for future use - by bakers, but without a doubt by brewers themselves too. It was even traded widely: beer yeast was imported by people from out of town. No wonder it became subject to inspection. For how long had it been on its way, and under what circumstances?

These 1489 by-laws and their description of the *handling* of yeast are a real treat when delving for beer history. Local governments used to regulate only hard ingredients like prescribed grains for the grist, taxes and sales or safety measures. Yeast was seldom an issue. Another such rarity comes from the town of Gouda, one of the most important Dutch brewing centres. Its brewers ordinance of 1515 stated: 'One shall measure yeast only with calibrated cups, and if not he will be fined a sc,gr,²⁵ [*a shilling*] So the amount of yeast was officially prescribed in Gouda (like the different malted grains) and had to be followed up by the use of an equally officially calibrated cup.

Bamberg 1489

1489 appeared as a fruitful year after having done this research. In Bavaria the knowledge and handling of yeast were further professionalized at that time.

Around the 500th birthday of the Reinheitsgebot, in 2016, Jeff Alworth in *All About Beer* recalled his earlier interview with Matthias Trum, brew master of

Schlenkerla in Bamberg. Trum came with his own explanation for the Reinheitsgebot not mentioning yeast:

In the Middle Ages, they had a profession called the hefener, so they knew exactly. The purity law lists ingredients, right? Yeast I put in there and I get more out of it. I harvest the yeast at the end and I put it into the next batch. And that was actually the job of the hefener. [...] You started with a smaller amount of yeast and then you ended with a bigger amount of yeast.²⁶

So: yeast was not to be considered as an ingredient of beer, because an ingredient stayed in the beer, and therefore wasn't mentioned in the Reinheitsgebot. And in the meantime, they knew all too well about yeast in the late Middle Ages and how to handle it. Just look at how Trum sketches this work: 'The hefener's job was to harvest the yeast from the batches, to press out as much remaining beer as possible ['Hefenbier'], which was sold at a low price to the poor, and then the yeast was added to the next batch'. The job was even left to specialists. So when became these hef[e]ners active? Schlenkerla has records of the brewery's owners until the beginning of the fifteenth century. Some of them are mentioned with their actual occupation inside the brewery. And in the year 1489 Schlenkerla's owner Hans Steft was a hef[e]ner.²⁷

There's a fair chance that this occupation, practice and knowledge weren't new in 1489. Hefners weren't exclusive to Bamberg either - not even to Bavaria. The town of Nuremberg records them too, in a sixteenth century *Hefenordnung* (yeast regulation). From that we learn that Nuremberg hefners weren't even confined to breweries, but were independent specialized craftsmen. Like many others their craft was pictured in an emblematic poem. They also had to swear a hefner's oath that gives us an insight in the way they worked:

They are not allowed to deliver yeast out of town and may not make yeast out of fruit juices. The hefners are handed by the brewers the remains of used yeast and further garbage [...], out of which they produce fresh yeast and also the Hefenbier.²⁸

But their cheap Hefenbier implied rivalry with brewers too. Sometimes brewers reacted by not handing them the used yeast remains. In the long run this would of

Der Hefner
 Es kan von Fromen auch böses kömen.



Träu nicht der Wollüst-süssen Sünd;
 Ihr Ende macht die Augen fließen.
 Der Gsig ist von Wein ein Kind,
 Des Sündes Frucht Qual im Gewissen.
 Reist diese: lauff zum Kreuzes-Stamen,
 Trinck Trost aus IESUS Gsig-Schwamen.

Figure 3. 'Der Hefner', emblematic poem on the hefner's craft dating from 1698.

course be to their own misdemeanour, but brewers are also known to have taken care of the yeast business themselves. They didn't wait for delivery by the hefner. At such occasions they mingled good and bad yeast. Brewers also sometimes sold yeast out of town, which the hefners weren't allowed. All this raised their fury of course. The relationship between brewers and hefners was marked by interference and troubles.

In the same period specialized assistants executed yeast jobs outside Bavaria - in Haarlem, another one of the most important Dutch brewing centres. Historian Leen Alberts introduced them in his study on Amersfoort's brewing past:

Accounts of breweries in Haarlem from the first part of the sixteenth century show that their staff consisted of a brewster, two *wringsters* who stirred the mash, a *gister* and a *spondensteker*, who was to shut the bungholes of the vessel after the fermentation.²⁹

The Dutch word *gister* would translate as *yeaster* in English - just as the German *heff[e]ner*.

So there it is - the professional handling and reproduction of yeast in Bavaria much earlier than the Reinheitsgebot. The problem with valuing this is that the concept and even the word *heff[e]ner* are now forgotten. It's not in a modern German dictionary, but only survives in the nineteenth century *Deutsches Wörterbuch* edited by the brothers Jacob and Wilhelm Grimm. This was not one of their famous fairy tales: they explained the profession of heff[e]ner as an *aufkäufer von hefen, um diese zu gewerblichen zwecken weiter zu verwenden* - a buyer of yeast, for further commercial use.³⁰ The profession died out in the same century, which is why it was deleted from our culture, language and knowledge. Until Matthias Trum pointed to it.

Conclusion

In the meantime we *have* arrived in the Reinheitsgebot's sixteenth century, but so many data and details have sprung up by then - and there must clearly be others, still waiting to be dug up - that we can safely say that the knowledge and (re-)use of yeast were established in European brewing much earlier. It was already re-used

and even traded around 1300, it was identified and mentioned several times around or shortly after 1400, and it was handled professionally at least in the same fifteenth century. The lacking of yeast in the Reinheitsgebot has nothing to do with a lack of knowledge. This still doesn't mean of course that the *working* of yeast was known or understood. Brewers only saw it, were aware that it was *doing* something important and had found out that it could be kept and re-used.

This overview of early beer yeast history is also a correction and addition, in my humble opinion, of important, yearlong biological and biochemical research of *Saccharomyces cerevisiae*, our daily beer yeast. Teams of researchers from California and Belgium tried to dig into its historical development. They built a genetic family tree for *Saccharomyces cerevisiae*, and published their results in *Cell*.³¹

First they determined the order of all chemical subunits in the yeast's nuclear DNA - 12 057 500 ones. With this information, they were also able to sort of go back in time. Yeast cells duplicate and their duplicates also duplicate. Biologists know how often and how fast they duplicate. Thus they are able to define the approximate age of a cell, its mother's and father's, etc. All these data were put in computer models to look for the birth year of the first ancestor of our domesticated *Saccharomyces cerevisiae*. The calculations brought them to date this at around 1573-1604.

After which they added: 'Interestingly, this coincides with the gradual switch from home-centered beer brewing where every family produced their own beer, to more professional large-scale brewing, first in pubs and monasteries and later also in breweries'. The researchers repeated this in a follow-up of their research published in *Current Opinion in Biotechnology* in 2018.

In 2017, *All About Beer* copied it without comment.³² It should have commented, for this abstract of brewing history is flat out incorrect. Brewing, even trading beer, was already a major industry in for instance Bremen and Hamburg in the thirteenth century and just as well in the Rhine valley. In Holland, home brewing shifted to industrial brewing in the same century when towns started to grow. So it's a miss hit of three centuries.³³ In the fourteenth and fifteenth centuries Western-European brewing already was an important craft, a professional

occupation and a large scale trading industry, bound by rules and regulations. Monasteries weren't involved in this development like in Bavaria.

So what *do* these important biochemical and biological findings point to? They show the outcome of a process; our beer yeast and its domestication were *perfected* around 1573-1604. For that first ancestor of *Saccharomyces cerevisiae* wasn't there instantly. History is a gradually ongoing process rather than a collection of sudden happenings and moments in time. Brewers and hefeners will have made slow but certain progress in their jobs, developing knowledge and experience. Somewhere in this field of growing professionalism they will also have learned to identify the crucial role of yeast and to control it. Nobody still knew *how* it did what it did, but by re-using the yeast and being more and more careful and experienced with techniques and hygiene in the sixteenth century, the conditions got better and better for yeast in order to domesticate. Which it eventually did.

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4. Grimm, L. (2011) 'Beer History: Of Yeast and Shipwrecks', <https://drinks.seriousseats.com/2011/04/beer-history-discovery-of-yeast.html>
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7. See for this: Pliny (1856) *The Natural History*. Transl. John Bostock and H.T. Riley. Vol. IV, book XVIII, Chp 12. London: Henry G Bohn, p.26. Original text: 'Galliae et Hispaniae frumento in potum resoluto quibus diximus generibus spuma ita concreta pro fermento utuntur, qua de causa levior illis quam ceteris panis.' (see http://penelope.uchicago.edu/Thayer/L/Roman/Texts/Pliny_the_Elder/18*.html).
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10. *The Domesday of St. Paul's of the Year M.CC.XXII*. London: The Camden Society, p.166.
11. Nelson, M. (2005) *The Barbarian's Beverage. A History of Beer in Ancient Europe*. Abingdon: Routledge, p.149, n.7. The original text: 'Apponitur clerico, aut militi curiali panis non elaboratus non fermentatus, confectus ex cerevisiae faecibus.' (Petrus Blesensis (1847), *Pera omnia*. I. Epistolae. Oxford: I.H. Parker [etc.], pp.48-49).
12. *Urkundenbuch der Stadt Magdeburg I* (1892) Halle: Otto Hendel, p.135.
13. The word ghest, very much like the Dutch gist, is the oldest German word for yeast, which was only later replaced by hefe and gärung.
14. Schultheiss, W. (1978) *Brauwesen und Braurechte in Nürnberg bis zum Beginn des 19. Jahrhunderts*. Nürnberg: Stadtarchiv Nürnberg, p.16.
15. Von Söttl, J.M. (1838) *München mit seinen Umgebungen historisch, topographisch, statistisch dargestellt*. München: Georg Franz, p.57.
16. Schultheiss, W. (1978) op. cit. p.19.
17. *The Saga of Half & His Heroes*. Transl. Peter Tunstall, http://jillian.rootaction.net/~jay/world_faiths/www.northvegr.org/lore/oldheathen/057.html
18. De Vreese, W.L. (ed.) (1894) *Middelnederlandsche geneeskundige recepten en tractaten, zegeningen en tooverformules*. Gent: Koninklijke Vlaamsche Academie, p.101.
19. Reynaert, J. (1996) *Catalogus van de Middelnederlandse handschriften in de bibliotheek van de Rijksuniversiteit te Gent. II/1. De handschriften verworven na 1852*. Gent: Universiteit Gent, p.32. However, another dating has crept his way into historiography. The manuscript was first dated, or apparently so, by a Dutch chemist in 1934, one H.G.Th. Frencken. He was interested in artificial colourings, another subject in the Ghent manuscript. Frencken got to publish on the subject and thereby claimed that the manuscript 'was written in 1300'. He gave no proof or explanation for this assertion, but it influenced some eminent beer researchers. If the manuscript was from 1300, the beer recipe must have been from that age too, was their obvious conclusion. In his *Beer in the Middle Ages and the Renaissance* (2004), R. Unger mentions a 'Flemish book of recipes' that's supposed to date from the fourteenth century. This was dubbed by J. Alworth in his Beervana blog in 2013:

‘Indeed, we have records of brewers using yeast from long ago’, then citing Unger. L. Alberts in his Dutch thesis *Brouwen aan de Eem* from 2015 wrote: ‘Evidence for the use of yeast go back to the fourteenth century’, after which he refers to ‘De Vreese, Geneeskundige recepten, nr. 385’, which is the very recipe. They were misled by Frencken and apparently overlooked the better and more recent account of the manuscript by Reynaert.

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22. Diderot, D. et Le Rond d’Alembert, J. (1751-1772) *Encyclopédie, ou Dictionnaire raisonné des sciences, des arts et des métiers par une société de gens de lettres*. Volume 2. Paris: Briasson [etc.], p.405.

23. ‘Histoires de Paris: Des cervoisiers au Moyen Age aux brasseurs à la Renaissance, une profession toujours très surveillée et taxée’, <https://www.histoires-de-paris.fr/brasseurs/>

24. Salem, F.W. (1880) *Beer. Its History and Its Economic Value as a National Beverage*. Hartford: F.W. Salem and Company., p.19. Salem presents the Paris by-laws as dating from 1268. This would of course have meant that the knowledge and sale of yeast were also common there in that year; even 40 years earlier than in Magdeburg. Salem however was misled by his source: the famous eighteenth-century writer and Enlightenment philosopher Denis Diderot, who between 1751 and 1772 together with Jean le Rond d’Alembert edited the quite spectacular 28-volume

Encyclopédie, ou Dictionnaire raisonné des sciences, des arts et des métiers par une société de gens de lettres. The author of the article on ‘Brasserie’ or Brewery in volume 2, Diderot himself, described the Paris brewers by-laws, dated them as 1268 and then cited the full eighteen rules. Salem copied this, not knowing that the 1268 by-laws consisted of no more than seven rules (see note 21). They didn’t yet speak of brasseur for brewer but cervoisier. This would have been a brewer who used not hops, but herbs. Hops and yeast were first included in the extended by-laws of 1489.

25. *Rechtsbronnen der stad Gouda* (1917). ‘s-Gravenhage: Martinus Nijhoff, p.294.

26. Alworth, J. (2015) *The Beer Bible. The Essential Beer Lover’s Guide*. New York: Workman Publishing, p.49

27. ‘Ahnenreihe des Schlenkerla’, <https://www.schlenkerla.de/schlenkerla/chronik/ahnenreihe.html>

28. Schultheiss, W. (1978) op. cit. p.25.

29. Alberts, L. (2015) op. cit. p.103.

30. Grimm, J. and Grimm, W. (1838-onw.) *Deutsches Wörterbuch*. 32 volumes. Leipzig: S. Hirzel; see <http://www.woerterbuchnetz.de/DWB?lemma=hefener>

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33. Apparently they used as source for this Hornsey, I.S. (2003) *A History of Beer and Brewing*. Cambridge: Royal Society of Chemistry.