BREWERY HISTORY

Brewery History (2018) **173**, 19-46

SITUATING HAJEK'S TREATISE ON BEER IN THE DISCOURSE OF THE SIXTEENTH CENTURY

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The process of brewing has remained essentially the same from the Middle Ages to today. It includes clearly distinguishable steps from the preparation of the malt to the cooling and storage of the finished product. What has changed is 'only' the technical equipment (that is, diverse kinds of vessels) and the organic additives, in particular the use or non-use of hops.

While many historical studies are available regarding the retail and consumption of beer, there is little research literature about the technical details of brewing and this is particularly true of the beginning of the sixteenth century. Yet it was precisely this era in which two scholars independently presented remarkable technical descriptions, one in England and the other in Bohemia in Central Europe. Their names were John Caius (1510-1573) and Tadeáš Hájek (c.1525-1600).

Caius and Hájek were celebrated physicians who excelled in various disciplines. Caius was President of the College of Physicians and, in 1557, re-founder of today's Gonville and Caius College, Cambridge.[1] Hájek served as court physician to Emperor Rudolf II in Prague and is still esteemed for his astronomical studies.[2] Caius and Hájek did not know each other personally, but probably knew about the importance of each others work.[3] Both were involved for different reasons in the production of beer; Caius, oddly enough, in connection with a fatal epidemic in England in the 1550s, Hájek, by contrast, at the request of a colleague at Prague Castle who was interested in the medical benefits of beer. Furthermore, Hájek's mother was married twice to rich Prague brewers. Caius's investigation resulted in a short, but comprehensive text, while Hájek in 1585 published an entire book on the matter, entitled *A small work on beer, and its method of preparation, nature, powers and faculties*. The two texts were written in Latin and have been introduced recently by the present author in *Brewery History* (Caius: No. 165, 2016; Hájek: No. 162, 2015). In the case of Hájek, however, only an extract was translated. Consequently what is still lacking is a complete translation of his booklet.

To date there have only been two Czech translations of Hájek's treatise, both published in the nineteenth century; R. Bartuch (1878) 'O pivě a způsobách jeho přípravy, jeho podstatě, silách a účincich', *Kvas*, and K. Nademlejnský (1884) 'O pivě a jeho vyrobě, povaze, silách a vlastnostech', *Pivovarké listy*. They are acceptable but outdated, difficult to access and, for obvious linguistic reasons, beneficial only for a limited readership. Moreover, they lack explanations and visual aids (diagrams and suchlike) by the translators. The translation presented here aims to reverse these deficiencies.

Figure 1. Bethlehem Chapel in downtown Prague, where the famous Czech reformer Jan Hus preached after 1402. Hájek's parents' house was just around the corner.

Figure 2. In 1566 Hájek bought his own house at 'Ovocný trh no. 573/12' ('Fruit market'), still the name of a square in the centre of Prague. Hájek's house was called 'U červeného srdce', that is, 'At the red heart', so it could be the house to the right; see Vetter, Q. (1926) 'Tadeáš Hájek z Hájku', Říše hvězd. *6, pp.169-185.*

DE CERVISIA,
EIVSQVE CONFI-
CIENDI RATIONE, NATV-
ra, viribus, & facultatibus,
opuſculum:

AVTHORE
THADDAEO HAGECIO
ab Hayck.

FRANCOFVRDI
Apud heredes Andreæ Wecheli,
MDLXXXV.

Figure 3.

Tadeáš Hájek z Hájku, A small treatise on beer, and on its method of preparation, nature, powers and faculties. Frankfurt: At the heirs of Andreas Wechel, 1585

To the illustrious and famous hero William of Rosenberg, Vice-King of Bohemia, his most benevolent Lord, Tadeáš Hájek z Hájku sends many greetings[4]

Dedicatory letter

Even if I, offering a small study on beer to Your Illustrious Highness, may seem to present an insignificant or very simple present, I hereby submit some of my work that competent reviewers of the subject will hopefully judge as being neither downright unworthy and illegitimate, nor too undeserving for Your Highness to accept.

If the consideration of the whole of nature is a sign of a liberal and noble spirit; and if the greatest rulers have always been concerned with it; and when I introduce and explore a certain small part of natural history, namely, the one pertaining to the diet of many peoples, so I am convinced that reasonably my gift could not, or should not, be condemned as dishonourable, useless, annoying and therefore unworthy of your position. However, at this point certain good-for-nothings wrinkle their nose, and these petty gourmets, accustomed to daily delicacies, ask what have fine people to do with beer? The plebs may produce and drink it, the physicians may discuss its nature, powers and faculties and the rulers take plenty taxes thereon. So be it! Now would someone please remove it not only from the table, but throw it out of his whole dominion.

Who would be so insane and barbaric to say that knowledge of beer's production and nature be ignoble, especially when it is no secret that this beverage was also known to kings and princes and was welcomed in many rich kingdoms and provinces, and still is. Although Your Highness abstains by nature both from wine and this type of drink, being happy with the common drink of all living beings [i.e. water], so I have nevertheless no doubt that you will work to ensure that beer is not banned, just as Your Highness is committed to the altars and home stoves. And there is also no shortage of help from others. As no one despises brewing beer, there is no one who does not strive to do so with the greatest zeal and effort, a situation attested to by the numerous breweries being rapidly built everywhere. Nowhere has it been seen that these buildings are being demolished or neglected, yet numerous sanctuaries can be seen that are either completely destroyed or poorly patched up.

We more often see smoke rising from malt kilns than from altars.[5] No wonder, some say, from the former we gain something while the latter causes us loss: *profit always smells fine whatever its source may be. We are human beings*, they say, *nothing human is alien to us*.[6] If only we do not act under this pretext of humanity whilst simultaneously espousing atheism; and do not in the manner of Lucian[7] declare as fables the writings of Moses and the Gospel, and even the tables of the old and new covenant. Therefore, due to the immediate profit that is brought about by the preparation of beer, there is no one who would not gladly be involved in it. But the comprehension of its nature can only be enlightening for scholars and experts in natural sciences, a knowledge which Epicurean [utilitarian] people consider and scorn for pure speculation because it affords no discernible benefits. That is why I have tried in this little book to expound both the preparation as well as the causes from which the nature of beer should become completely clear. Whether I have succeeded, others may judge.

About myself I can say nothing except that I was missing skill, not enthusiasm. I became involved in this matter as an author many years ago, prompted by the very famous imperial personal physician, Mr Julius Alexandrinus, a man of the highest judgment, humanity and education. When he wrote that excellent work on matters of health,[8] which is now worn down by passing through many men's hands, he wanted to say something about the grain beverage that we call beer and asked me about the manner of its preparation. Being a very dear friend of mine, I sincerely wanted to do him a favour, but this process was unknown to me. After receiving from brewers simple, rough, but sufficient information I began to formulate the method in Latin, including causes and exploring the end product. However, since during writing much comes incidentally to mind, and I, so as not to interrupt the flow of thought, simply surrendered to the pen (because, of course, it usually is easier to correct in order to remove the superfluous than to supplement the missing), the notes grew to many pages, even though I had initially believed to be able to

summarize all on one piece of paper. Thus I had this rude and shapeless draft just as it had emerged and gave it to Julius to read so that he could obtain from it what he might believe useful for his purpose.[9] But since I have found a little more leisure time, I have polished it slightly, and brought it into the form and order of the booklet that now comes among the people under the name of Your Illustrious Highness.

For the most part I have described the method of preparing Czech wheat beer as beers from other provinces are not known to me, except what I have learned from others, namely that their preparation differs somewhat from ours. If there are notable differences, I have no doubt that those who know about them will describe them after our example, so that the natures of beers from every region can be recognized. That they may do this, I beg them fervently.

Beer has also been written about by the most learned Mr Johann Placotomus,[10] but his book came to my eyes only after I had completed my own. What we both expound on the subject and each of us emphasize as correct, is that I maintain that the mixture [property] of beers is 'warm' and 'moist', while he claims it is 'warm' and 'dry'.[11] Whether I have philosophized correctly on the reasons, I submit readily to the judgment and evaluation of others, especially those who have not made statements regarding this matter on the basis of opinion and hearsay, but rather, thanks to daily intercourse, have learned about the strength and nature of beer and are thoroughly familiar with the subject and are experts. Actually, I have often heard otherwise excellently skilled people, who, once they had come to beer regions, have attacked this type of drink in a peculiar way. They have banished it from the tables of both the healthy as well as the sick. If this was done by strangers, I would be less surprised as when local people, including those who, I would say, were born and nourished with beer yeasts,[12] who, however, as soon they have the throat moistened with a foreign drink, after returning back home had no qualms to seize the pen against the drink of the fathers. But they have received just punishment for their ingratitude. It happened namely in a certain populous community that, after someone had blamed the drink of the fathers in a publication, he met with such dislike, with even such a deep hatred, not only among the ordinary people but also among youths, that this despiser was most severely forced out of their collective gatherings whenever he was seen in the market place and streets.[13]

This study was written many years ago, as I have said, and many people have demanded it. The first to be offered it was Your Illustrious Highness and you kept this dedicated manuscript to yourself for nine months during which you read and studied it, and [eventually] made clear that it has been fully approved and requested that it be published. I would have been very happy to fulfil His kindest wish a long time ago, but in the interim many different things would have cropped up and have prevented this work enjoying the public light.

Finally, after all obstacles are removed and the shackles unravelled, the book comes to the public under the auspices of Your Highness. For the same reason for which I once presented, donated and dedicated the manuscript, now I present, donate and dedicate the same text typeset in letters and published. Nothing more do I solicit from Your Highness than to receive favourably this delay in the publication and think that a special spirit of the book might have been responsible for it. For it is plausible that, as it evolved at court, it brought along with its creation a courtly peculiarity: that answers are given only rather slowly and with difficulty, and that promises and pledges are accomplished even more slowly and in a more cumbersome manner. And there is no doubt that Your Highness will deign to protect graciously, together with my person, this little book, which protects a good part of the diet in most kingdoms and provinces wherefrom much profit comes, which by no means is to be despised. Indeed, that Your Highness may do so, I ask for again and again in all humbleness and with due respect.

Your Highness fare well. Prague, in our house. February 1 in the year of our Lord 1585.

1. On the different types of drink

In general, there are three types of drink that people use all over the world, both in good health and when ill: water, wine and beer. Of these, there is in each case a very large number of types and these differ from each other very much in form, way of preparation and, finally, with respect to their powers and faculties.

To say something about drinkable, simple water: from the very beginning, from the creation of the world up until to Noah (the 'herald of righteousness' [2 Peter 2]), this was a common drink for all living beings. It was used for a long time by the people of this age and they were satisfied with simple food, did not know the specialties and delicacies of Apicius[14] and lived for almost a thousand years for water contributes the most to both the length of life and maintaining health. We point out that the first thing Noah established, after the Flood, was a vineyard [Genesis 9] and thus made wine (previously neither vine stock nor wine had ever been mentioned). Consequently, lifetimes were shortened by one-tenth, perhaps for no other reason than so many people consumed this kind of drink without considering their gender or age and without any moderation. It does not seem to be without reason then that Solomon lamented more people perish by inebriation than by the sword.

If one takes into consideration, however, the circumstances in which the use of wine was permitted, we find not everyone everywhere was allowed to drink it.

When Noah[15] was already an old man and stricken in years, God showed him this new and hitherto unknown kind of drink. His nature had been weakened and worn out by, on the one hand the sorrows and most tiresome complaints that he experienced on the Ark, listening to the cries, lamentations and the most miserable perishing of the whole earth, and, on the other, by the many and enduring troubles that he had to undergo, feeding and looking after so many living beings during the time of the Flood.

So [God showed Noah] that this drink (wine) would in some degree rebuild, invigorate and consolidate his nature, being a sweet refreshment, a nutritious drink to rebuild and restore the flaccid powers. For elderly people love two things most, according to the testimony of Solon:[16] good wine and a pleasant conversation with learned people. Hence the laws seem to originate that young men up to 22 years should refrain from wine, and women throughout their whole lives, at least those in Athens (according to Plato, Laws 2).[17] In ancient Rome this was actually observed with the utmost piety.

With the introduction of wine drinking water, as I mentioned earlier, a common beverage of all living beings, gradually began to be despised and neglected, as if it had been created just for animals and not for people. Wine, however, as the true nectar, was coveted by all. Yet, water also had its place.[18] Iulius Frontinus[19] wrote that the Romans were satisfied with drinking water for more than 440 years, drawn either from the Tiber or from wells or springs. In fact, even today, both the common people and the lowest rabble in Rome drink water brought in by donkeys. The gourmets and prosperous, however, preserve the Tiber water in large earthen vessels in wine cellars where it remains uncorrupted, not only for many days but for months and years, what one might rightfully consider as being remarkable. A peculiar art of preserving these waters is applied here, which was utterly unknown in those ancient times. For if the water is preserved in the way we have described, it clears faster than one might think, settles down, and becomes suitable for drinking and preparing food. We have read that even the kings of the Persians - who were later called, after the loss of the empire, Parthians - drank exclusively from the river Choaspes. Strabo believes that the same kings, because of the curative nature of its water, also drank from the river Eulaeus in the city of Susa (in the Susiana area) which flows around the summit where the old residence of the Persians kings was situated.[20] Finally, Agathocles recalls in Athenaeus[21] waters, called by the Persians the Golden One, formed from 70 sources from which no one drank except the king and his eldest son because it was forbidden under pain of death to do so.

Over time drinking plain water became despised, but those many who wanted wine instead were unable to afford it either because of its scarcity due to an absence of knowledge regarding grape cultivation and wine production or due to the region lacking clear skies and sun and the soil was infertile. Therefore, perhaps because envy and rivalry prevailed that others possessed such a sweet, lovely and wonderfully restorative and sustaining drink, a so-called divine nectar, which oneself lacked and had to drink the same drink as common cattle: people began to think how they could produce something at least partially resembling wine. Consequently they turned from the simple to the complex, artificially refining water, of which there are now almost an infinite number of different kinds. Those who want to know about these in detail may consult Pliny, *Naturalis Historia* 31.2.

Today, a sugared beverage is common among the Turks, who abstain from wine in accordance with the provi-

sions of Mohammed, which their king and his family drink and is said to be relished not unlike our most noble wine. There is also water mixed with honey, and another drink is made of milk and honey and is very inebriating, like those that the Lithuanians, Ruthenians, Muscovites and the Sarmatians produce.[22]

There are also people who make drinks from oats that strongly affect the brain. Other drinks are made from barley, millet, anise, fennel, raisins and the like, or from seeds or fruits such as apples and pears, or even, without going into detail, from plants and spices, boiled and steeped or distilled. This is not the place to go on about the species, subspecies and forms of wine, nor of the different varieties in colour, odour, taste, ways of preparation, powers and faculties. For these one should refer to Pliny's *Naturalis Historia* book 14 and to book 7, 8 and 12 of Galen's *Methodus medendi*, likewise to book 5 of Galen's *De sanitate tuenda* where everything is discussed in detail.[23]

Rather, I want to confine myself to the kind of drink that is based on water, which people have attempted to imbue with different qualities to such a degree that their great enthusiasm can be observed. Obviously they left nothing untried in inventing, composing and making the drinks tasty. In fact, people everywhere, both then and now, never seem to be busier than when manufacturing various types of drinks, as if nature had not provided the healthiest water that all other living creatures utilize. This is what Pliny, in *Naturalis Historia* 14:22 [recte 14.29.150], attests when he writes that people did not grow tired of working on it and, as if they wanted to demonstrate their talent, there may exist 195 different kinds of drink. But if one considers all different types, almost twice that number have been invented.

There is no doubt that most of these types of drinks are either totally extinct or forgotten. Just as, on the other hand, no one will deny that in later times, and even in our time, new and previously unknown beverages were devised and have become common to humans.

2. On the different names of the drink that once was made from grain and is still produced this way today

If someone is preparing to write about this kind of drink that is made skilfully from ordinary water, grain and hops, for which the term beer (*Cerevisia*)[24] is commonly used, it seems appropriate to explain at the beginning the original meaning of this designation. Consequently, a definition should be given that explains the thing itself, plus its components, causes and the whole process of preparation, as well as examining its effects and utility. From this the whole nature of beer, its powers and faculties may be more clearly distinguished and recognized. This is the single, ultimate goal of our tract.

The designation Cerevisia[25] appears to come from Ceres, goddess and creator of grain,[26] which is often metonymic with grain itself or with bread, just as the god Liber (Bacchus) stands for wine. It is called the 'grain beverage'. It is difficult to determine when the name Cerevisia originated or how it came down to us. There is no doubt that it has, as I said, its origin in Ceres, but it remains unclear from where its suffix crept in and where the full, new name Cerevisia arose. About this I have heard no explanation by anyone, therefore I must frankly confess that I do not know what *Visia* means nor from which language the word comes.[27] It is clear that it is neither Greek nor Latin, Italian, Spanish, French, German, Slavic or Venetic.[28] Nevertheless, the Latin name is now retained only by the German and Venetic people together with the use of the thing itself.[29] Perhaps we could say that the name of the drink Cerevisia was adopted from the powers of Ceres because the full power (*vis*) of Ceres (that is, of grain) was boiled into water.

Be that as it may, we need not discuss in any more detail the concept of Cervisia as long as it is clear to everyone what we mean by this word. Whatever this name means and for whatever it was invented by its author, it seems to be much younger than the ancient cereal drink itself. Historians testify that the Egyptians were the first to describe this drink, not long after the death of Noah. However, different views are expressed by these historians insofar as they do not name one and the same thing or this specific type of cereal drink with a unique name. For they call the drink that was made from barley *Zythus* as does Theophrastus [*De causis plantarum* 6.11.2] and Pliny, *Naturalis historia* 22:25 [recte 22.82.164] who states: *From cereals they make beverages: Zythus in Egypt, Celia or Ceria in Spain, Cervisia and many [other] types in Gaul and other provinces*.[30] The Greeks have applied various other names. They called it οἶνος κρίθινος, i.e., a barley wine,

a drink that was made from barley.[31] Aristotle called the same beverage (according to Athenaeus) πίνον,[32] from which the name is derived that is used by ourselves, the Bohemians, and other Slavic peoples, who in their native language call every grain drink *Piwo* and οἶνος (wine) *Wino*.[33] Our language actually has a great affinity with the language of the Greeks,[34] which seems to have developed due to proximity and habit in Paphlagonia, Galatia[35] and Asia Minor, where this language was at home before the Trojan War, of course, and long before it moved into the regions where it now abides. One indication of this is that many words, the dual number, figures of speech, and other things are identical and common between us and the Greeks. But these are not the subject of this treatise.

There are other Greeks who called the same barley drink βρύτος as Sophocles did in *Triptolemus* and Hecataeus in *Periodus Europae*,[36] where he says that the Paeonians[37] drink βρύτος made from barley and παραβίη, which, however, was prepared from millet and conyza (fleabane or elecampane).[38] Diodorus Siculus [*Bibliotheca historica* 5.26.2] assures that Zythus was made not only in Egypt but also in Galatia (Gaul)[39] with these words: *So strong is the cold air in Galatia that in this region neither wine nor oil is produced. Therefore, people are forced to make a drink from barley which they call Zythus*.[40] Also Dioscorides [*De materia medica* 2.87-88 Wellmann] reports that once two types of beverages were made from barley, one called Zythus, the other Curmi.[41] But neither he nor any other of the ancients praise this beverage in any way, nor do they describe how it was produced. Therefore we cannot guess how our beer or the way in which it is made differs from that of the ancient cereal drink.

Yet they have this in common, that they are made from barley and other cereals. However, I am inclined to believe that regarding the way of preparation, ours differs greatly from that of the ancients. Averroes, who lived about 1160 AD, mentions beer (Cervisia) in his work entitled *Colliget*, book 6 in chapter 9 on the diminution of food [Averroes 1542: 94r-94v], which, as he says, was usually made of raisins with and without seeds, the one made from seedless raisins being better for the old. Likewise, he praises beer, which has the colour of wine: *Beer, as it is made by us, is not called old, unless it exceeds more than six months; made in a shorter period of time, it is not suitable for the preservation of health*. So at the times of Averroes beer in its whole substance has been different from that of the ancients and also from modern beer because it was not made from cereal grains but from raisins.

Beer is thus a drink that is made artificially from water, grain and hops and purified properly, so that the human body, exhausted from the constant drain of body fluid, again is supplied and revitalised with beneficial moisture. Finally, that it is ensured that the natural thirst is appeased.

3. On the choice of grain and its preparation into malt (or Polenta or Bynum)

After the name Cerevisia has been explained and a definition of beer has been proposed, we now proceed to the method of its production, presenting all things necessary. We will mainly talk about wheat beer or white beer production, since this is commonly consumed in the kingdom of Bohemia and Poland, as well as in certain areas and cities of Germany, for all other beers are prepared in the same way, with just a few changes, be it wheat or barley beer or a mixed type.

Thus, if beer is to be made from wheat, first the best and noblest wheat is selected which surpasses all others in weight and glossy colour. This is usually winter wheat which is called by Columella [*De re rustica* 2.6.1] 'robus' as more delicate, lighter and cheaper wheat is unsuitable and is never used for brewing beer. So one takes 20 chori or bushels [*modii*][42] according to Prague measurements, enough for a brewing process in which 24 vessels are to be filled, of which a single vessel contains not more than four buckets. This will be steeped for two to three days with river or spring water in a large tub [*alveus grandis*] which is walled with tiles, until it is washed, soaked and swells due to sufficient maceration. For steeping special water needs to be selected since with river water, which is softer than spring or well water, humidifying and soaking takes place more rapidly, which is why one should take care that it is not drenched more than necessary.

The reason for moderate steeping chiefly seems to be that the power concealed within the dried grain spreads, pours forth and extends over the body of the grain. But I want to lay emphasis on a 'moderate steeping', in

order that is does not extract the full force of the grain and of the finer substances into the liquid due to soaking longer than necessary, something we want to achieve with infusions of drugs where we elicit especially the powers contained in the finer substance. This steeping of grain is done with cold water, not warm or lukewarm, and not in a heated room, as with drugs, thus preventing, due to the heat, the force of the grain passing onto the liquid. Likewise, only whole and not cracked cereal grains are soaked lest all the strength of the grain is lost too easily, but is preserved in the fruit pulp and in the substance.

When the grain is soaked and swollen enough it is poured on the floor or on a dry board and turned frequently with shovels and wooden spades, especially for the purpose that it receives by the tossing and turning some warmth and loses the moisture it has initially absorbed to a certain degree. Now it begins to emanate its pleasant aroma that comes from the vapours that have been expelled, triggered by the internal heat of the wheat. The grain is now immediately formed into flat piles, lest the inner warmth disappears as it would if the grain lay scattered and spread, but instead is maintained and increased.

This work is usually repeated two to three times. Meanwhile, by the power and effectiveness of the aforementioned warmth, the grains begin to burst and the tender germs begin to emerge, like tendrils or fibres by which the grains mutually entwine. Here, however, the brewer again must be careful that the grain is germinated no longer than necessary lest it lose its special power. It is therefore required that the grains are immediately turned over with a wooden spade and the pile scattered so that, after the grain has been cooled for a while, further growth is prevented and the grains that are tangled and clumped together by their fibres are loosened and separated again via this spreading and ventilation. This work is very necessary and attention is paid that nothing is overlooked or done carelessly, lest the grain keeps growing or, what can easily occur, develop mould. After the grain has been loosened and aerated, it is removed, distributed in wooden baskets and dried at a moderate heat. For this purpose an oven is lit from below with oak, birch or beech wood (but mostly oak is used) in the malt house or malt kiln; and the grain is turned over very often in these baskets and then, as I said, roasted with a low flame.

It is known that drying or roasting is essential so that the malt can be ground easily - becoming somewhat spicy or smoky - and also to dispel the unpleasant smell which it has acquired during steeping and all the work just mentioned. However, it must be ensured here again that while drying nothing is burnt or overheated and reddens too much. The wheat or barley that was prepared in this way acquires a new name. That is, it is no longer called wheat or barley, but rather unground *Polenta* ('groats') or, as Aëtius likes to call it, *Bynum*.[43] For he (Aëtius) prefers barley prepared in the said manner to be called Bynum, a name that we can transfer, not without good reason, to our wheat-malt. The German word for Polenta is *Maltz*, from which Latin Maltum is derived, the Bohemians, however, call it *Slad*, due to its sweetness.[44]

After roasting two brewers join in and disperse and ventilate the malt with wooden shovels and spades. A third brewer sprinkles everything softly with water with the express aim of slightly cooling the grain and preventing the beneficial vapours evaporating, so that the internal force of the grain is retained. Soon after it is formed into heaps with a broom and remains so for two to three hours in order to settle and to maintain its inner warmth, a process repeated after two or three hours. This moistening must be done carefully otherwise grinding would be impossible, as something like porridge would be produced. The purpose of dampening is that the best part of the grain does not transpire and evaporate and that when ground no dust is produced. For corn which is ground or milled, being properly dried or roasted, gives off a fine dust that sticks to the grindstone and the walls. To prevent this and lest something be destroyed of the better substance during grinding itself, where no fine flour dust is desired (but only a rather crude and coarse meal), the grain is usually moistened with water.

This unground malt or Bynum or polenta is now put into grain sacks and brought to the mill to be ground into coarse flour: in this state it was formerly called κρίμνον[45] [krimnon] or polenta. One can use the same names for this, adding, to account for the difference, what the flour was made of, for instance, wheat or barley krimnon, or ground wheat or ground barley polenta. Similarly, one can call it ground wheat or barley malt or Bynum, or simply coarser wheat or barley flour.[46]

When the draymen bring this flour from the mill they express signs of utmost joy hollering with stentorian

voice Malt, malt! Whether this is because they shortly will have something to fill and expand their stomachs from the large and extremely voluminous beer barrels, drinking not in small sips, gulping down until they are bursting; or because they, just as the couriers or those Pegasean messengers, wish to sound their arrival by blowing the horn or trumpet and to call for fresh horses without delay: these carters by their cries give a sign to the brewers and remind them to appear immediately in order to carry away the milled malt. This transformation of wheat to ground meal is the first required step. Based on this, the brewing of the beer can finally be undertaken and completed in a manner that will be presented below.

[Summary of steps in chapter 3 on the preparation of grist and malt, added by the present translator; compare the steps in Briggs and Hough.[47]

1. Grain (preferably wheat) is wetted for 2-3 days in a large tub.
2. The wet grain is spread on a board, turned over frequently and stacked in small piles.
3. The grains start to germinate. They must be loosened and aerated and are then packaged in wooden baskets. The grains are dried at low heat in an oven: the result is called malt.
4. The malt is loosened and aerated and slightly moistened.
5. Finally, the malt is put into sacks in order to be ground in a mill into meal or coarse flour.]

4. On the preparation of the malt juice [wort]

First, in a spacious copper cauldron [*ahenum*], which is only intended for brewing beer and stands on a stove, spring water is boiled as thoroughly as possible. In this boiling state, it is cast into extremely voluminous tuns or vats [*cupa, cadus*], and immediately the cauldron is refilled with fresh water and boiled in the same manner and decanted. This is repeated four times.

Shortly afterwards, as much ground malt is added as is necessary, usually enough for a single batch. The same amount of malt and water is not used everywhere, in certain cities more malt is used, in others less. Consequently the beers are not of the same quality, some are more unmixed (stronger), other more diluted (weaker). In Prague you take for one brew run 20 measures or Prague bushels[48] of ground malt and enough water that at the end of the process 24 barrels can be filled. In the Moravian town of Jihlava,[49] where stronger beer is produced and exported to Vienna, from 52 measures of malt 100 buckets of beer are made to which six or at least five measures of hops are added, effecting a slightly bitter taste. After the malt is, as mentioned, put into boiling water, it is stirred very carefully and vigorously with spades or wooden scoops, so that it accurately receives, exhausts and imbibes by the seething heat all the strength and power of the malt and converts it to a thick, sticky, glutinous kind of sap, broth or juice (= wort).[50] That this can be achieved more easily, the malt was ground into coarser flour.

After the pin is pulled from the bottom of the tun [*cupa*] the resulting opening being covered with a sieve made of straw (lest also the malt flows out with the liquid), a portion of this fluid is drained in to an underlying tub [*alveus*].[51] Then about two buckets thereof are transferred into a thermal container [*caldarium*] and, after the appropriate dose of malt, which was taken from a vat [*cadus*], was added, are cooked at a very high heat. The seethed mass is again returned from the thermal container to the previous vat [*cadus*] and mixed with the juice that is left there together with the malt. Then the cauldron/thermal container [*ahenum/caldarium*] is once again filled with the same juice and cooked with the same firepower as before and emptied into the vat [*cadus*]; then recast for the third time and brought to the cauldron and, as described, seethed.[52] Finally, the cauldron and the tub or groove [*alveus, canalis*] are washed out with the pure, sweet-tasting juice.

This is the correct preparation of the wort, all the steps having been described. It consists of soaking the wort and boiling it three times. And is it not difficult to discuss the reasons for this preparation, especially when we recall what was said at the beginning about the steeping of the fresh wheat in cold water and compare it with the maceration of the ground malt in boiling water. Then probably only the following has to be added and the question answered: why after soaking the malt and extracting the wort, this wort was additionally boiled three times and whether the maceration of the malt did not exhaust all its power and finer, most valuable substance, transferring them into the liquid and leaving behind in the malt only the coarse, earthy and useless parts; furthermore, whether many finer parts were not dissolved into vapour by the boiling, leaving

behind only crude and useless particles? I believe that the following should be replied to these doubts, as long as no better explanation is available.

Although the maceration might have preceded, nonetheless this step [of repeated boiling] seemed necessary because the wort [*succus*] was extracted unchanged and unaltered from the way it was found inside the malt itself, so that the wort would have been matured and even led to the point of absolute maturity and made more suitable for our purpose. Furthermore, [multiple boiling is required] because the parts of the sticky and viscous substance of the malt and thus its force could not sufficiently be brought out by the maceration, and for this reason a further seething or cooking has been added, not only that the whole substance of the malt and the inwardly hidden power and potency will be evinced, which entirely migrates into the substance of the liquid, but also that the raw juice at recasting is brought to maturity and converted.

Finally, I say, in the wort the finer parts are not so easily dissipated by boiling and made to disappear as can be observed in other things, especially rhubarb and similar plants where the purgative power contained in the finer parts and the dispersible substance is achieved by little boiling, in the case of multiple and prolonged use, however, is completely scattered and destroyed. In the wort, by contrast, the lighter and more fluid parts, because they always are a little thick and sticky, neither can evaporate so easily nor does, although some part in fact evaporates, something of the powers and faculties decay and is diminished. For all the power and faculty of the wort lies in its coarser nature, is thick, sticky and viscous and is sunk deep in it and can be transferred only by vigorous boiling in a suitable liquid. The same we find in must and freshly boiled wine, which the more they are cooked, the more they increase in viscosity. For this reason, a three-time and strong boiling of the juice with malt is applied.

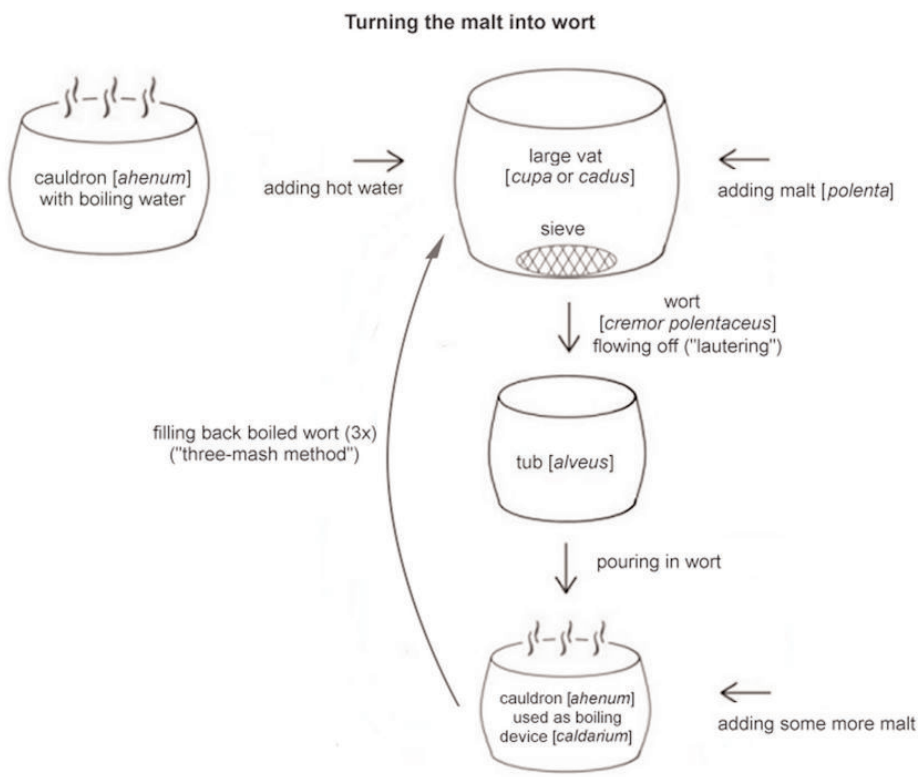

Figure 4. Flow diagram of chapter 4, added by the present translator.

5. On adding hops which give beer its shape

So much shall be said about the entire preparation of the malt juice [wort, *cremor polentaceus*]; still lacking is to consider the remaining part, which concerns adding hops and fermenting the beer. Now, when the wort is completely cooked and all of it poured into that tun [*cupa*], the bung of the tun is opened and a certain quantity of the wort is allowed to flow off into an underlying tub [*alveus*], and from there it is run back to the copper cauldron [*ahenum*], into which two chori[54] of hops flowers are thrown and roasted at a low heat until the wort that was poured in is almost consumed. Here the brewer must indeed be attentive again to roast the hops properly and not scorch them, by which the beer would then get a bitter taste or smell of smoke and charring. Then to that roasted hops, which is left in the cauldron, by means of a pipe as much of the wort is added as the cauldron can hold. It is left to bubble up for some time, until finally the whole force and effect of hops is transferred into the wort itself.

All of the remainder of the juice (wort) in the vat or tun [*cadus, cupa*] is discharged, through the bung of the vat [*cadus*] often mentioned before, in the underlying tub [*alveus*] and transferred out of it again in other vats [*cadi*]. While this happens, the brewer jumps in the aforementioned vat which is already free from juice (wort), and digs up and turns the malt remainders that are left in it with a wooden scoop. A little later, he lets the hop juice [*cremor lupulaceus*] be taken out of the cauldron or thermal container [*ahenum, caldarium*] using buckets and poured and sieved by means of baskets or filter basket into the remaining vats and vessels [*cadus, tina*], into which the malt juice [*cremor polentaceus*] was distributed. Here you must, however, be extremely careful to prevent the [hop] juice from freezing and dying in them when it is poured into the many

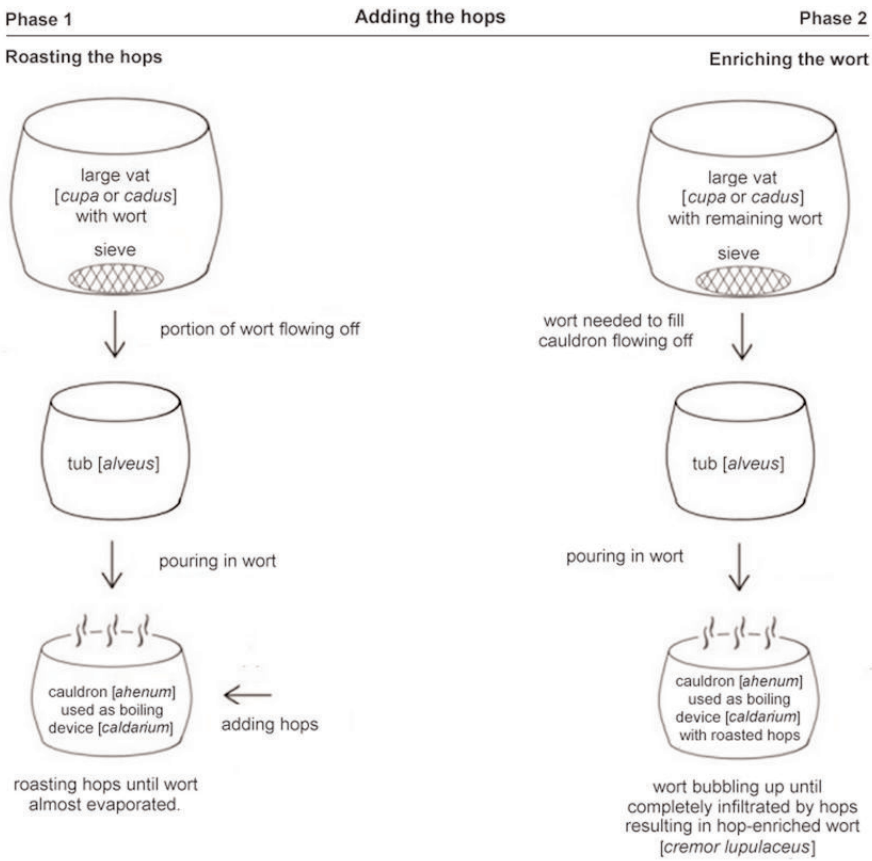

Figure 5. Flow diagram of chapter 5, added by the present translator.

vessels or barrels [*tina seu dolium*], which usually happens most likely in winter. Therefore, the whole [hop] juice is usually collected in due time in a single vat or, in the summertime, cast into various vats [*cadus*] and stored for some time, until it has cooled down.

6. On adding beer yeasts or sediments

When the [hop-enriched] wort [*cremor (lupulaceus)*] that has been collected in one or more vats has reached the correct temperature, about half a bucket of beer yeasts [*faeces*][55] or thick sediment [*crassamenta*] is immediately poured into it, which the beer, already distributed in vessels, usually casts out while fermenting. By this addition of yeasts, the beer is, so to say, planted or cultivated, changing from a wild plant into a domestic one.

7. On pouring the beer in casks

Now two porters remove the beer from those vats with their customary tubs or jars, having pushed through the two bungholes a lever and put upon the shoulders, and fill the beer vessels (called by the ancient authors *seriae* or *orcae* [tuns, casks],[55] which are oblong and can take almost four jars), after they have been placed sequentially in place. Barley beer, however, is filled in pitched vessels.

In these vessels the beer first starts to ferment and effervesce, and the dregs begin to bring to bear its power in such a way that it fills the entire room in which it is heated with steam like a dense fog; if by chance someone enters this room unprotected, he immediately falls down suffocated. But that the beer can cease boiling more quickly, it is customary, especially in winter, to set up glowing charcoal in this room. Then, in that ebullition the sediment, which is ejected through the upper bunghole of the vessel, is collected in tubs that are placed beneath. This is called the hop dregs or first drop since it contains many hops and therefore is very bitter. All the dregs are poured into a single barrel; in them a white foam swims above, as in milk, which is skimmed off and set aside in a wooden bowl which is pierced with small holes. The foam is like a kind of glue and serves the hatters to make the hats firm. After the foam has been skimmed off and cleaned from glue and hop dregs, the same sediment is again sequentially poured back in single casks, which are filled with beer, and the beer is boiled up for a second time by the dregs and secretes a sediment-like substance which is slightly larger than the previous one. These are called the secondary dregs and serve to bring the freshly cooked beer to ferment, while they are also used most often by our people instead of a ferment to bake bread and all kinds of pastries.

8. On the transport of beer already apt for drinking

When the beer is completely fermented and cleaned of dregs and no further sediment is present (which in the summer needs three days, in the winter six), it is suitable to drink and so delivered to the innkeepers and citizens. But, due to the boiling heat, some beer having spilled out, the brewer has yet the final task to ensure that all barrels are completely filled. Therefore, a container is opened and from it all the other are filled and very carefully sealed with a lid and a stopper. When these vessels eventually are full of beer, they are driven away by beer carters and delivered to the citizens and innkeepers, as has just been said, in order to give it the crowning touch freely and with great pleasure.

9. Reflections about the reasons of adding hops

Since a discussion to consider the reasons around the adding of hops [in chapter 5] could not comfortably be inserted, as the course of the presentation had already begun, I thought that something about it should be added separately right here in the middle [of our treatise].

Hops are what gives beer, as it were, its shape and not only ensures that it is beer, but rather that it is good beer, durable and healthy for drinkers. For the hops, whose flowers are only used for this purpose, are warm and dry in the second degree (as their bitterness and that heavy smell, which they emanate, indicate), and that wort, after having been cooked thoroughly, has adopted a certain toughness and viscosity; as the wheat itself also holds inside some of this toughness and stubborn nature and is warm in the first degree, but only moderately dry and wet, and therefore oily and sticky.

The malt or polenta, being of the same nature, should indeed be assessed: whether it is not of a little less

intense quality and rather dry. It certainly follows by necessity that even with this same nature the malt juice [wort] itself is also drenched and acquires airy [gaseous][56] and watery parts, mixed up with each other, as the viscosity itself clearly seems to indicate, by which it also obtained its slippery power.

If someone drinks that wort, this is not different from lubricating and disturbing the belly with must because it is also viscous, and everything that lubricates is viscous. Yet things that are so viscous indicate that the airy substance is mixed to a high degree with aqueous parts. Such is the nature [of wort] and the mixture is neither long-lasting nor could be used conveniently [if it would not be stabilized by the addition of hops]. It is in fact very easily exposed to putridity and corruption and most of all attracts mould and acid. For if the heat and the airy components are evaporated and only the earthy parts are left that are not completely depleted by the heat, but already spoiled by the cold, the wort by necessity must immediately become sour. Therefore, in order to be able to meet that shortage and natural decay effectively, people in a very clever and erudite way contrived to add hops: by whose aid both states of nature (namely the airy and the aqueous one), which are mixed in the wort itself, are better enclosed, as if they were protected in this way in the middle by glue and held together, so that the parts of the substance in this mixture are not easily separated by a slight irregularity and the whole mix is not spoiled and does not attract mildew or acid.

Furthermore, hops are also added to mitigate by its bitterness [the sweetness] of wort and to attenuate its flatulent effect, which lies in its viscosity; likewise, to improve the taste, so that a more powerful and healthier drink might be produced; finally, in order to achieve a cleansing and penetrating effect. Now if this effect can be found in most beers only to a minor degree because just a few hops are added and a lot of water, which greatly weakens the forces of the wort and the hops, nevertheless, we do not want to deal here with the errors and faults that occur in the production of beer, be it intentionally, by negligence or mistake, but with the true and genuine preparation of this drink: wherever it happens, there should be such power in that drink due to the addition of hops as we have just described. For this reason, we want that those accessory faults, in whatever way they have been incurred, should be far away from our beer while we will never exclude hops from it, for hops, so we would like to say, are the soul and entelechy (completion) of beer. As I was told, in England a beer is made without the addition of hops, which the English of weaker constitution[57] usually consume. It is called Ale [*Alla*] in popular speech, about which we want to write more in chapter 12.

10. On the reasons for adding beer dregs

It remains to explain the reasons for adding beer dregs [*faeces*]. Above [in chapter 6] it was said that the beer, so to say, is cultivated like a plant by the act of pouring sediment into it. To understand this properly, two things are usually considered above all: namely the right measure and the time which is particularly important for this activity. It is necessary that it is added when the beer has reached the correct temperature and is not too warm, nor killed by the cold. When the sediment (which is also warm, as the bitterness indicates) is added for reasons of fermentation and heat, fermentation and heat can never succeed if the sediment is poured into chilled or boiling or still too hot beer, as it is possible that the beer will outdo the heat of the sediment through both states of its own heat, namely the current and the virtual that it receives from the hops.

Effervescence, however, happens like this: the sediment consists of airy, sticky, viscous substances, but as it is bitter, this proves that there are certain parts in it that are earthy and burnt to a larger extent. The airy substance I call so in difference to the substances that set down after the completion of the effervescence on the bottom of the vessel and are earthy and coarse. For the sediment contains airy and aqueous parts, which were mixed and blended by the heat, as that stickiness and viscosity show. Beer actually is aqueous by nature and less sticky. When both these substances are mixed, of which the first follows its airy and the latter its aqueous nature, the airy dregs strive to be carried upwards, while the beer, which is aqueous and heavy, seeks to get down. And through these various movements the whole body of the beer is moved, shaken, fermented and heated; and all debris contained in the beer is thrown out through a bunghole of the vessels situated above; but the coarse and more earthy part of the dregs is pressed onto the bottom of the vessel and is, so to say, the substrate on which the beer lies, protecting it, so that the substrate

does not evaporate easily. Thus nature itself separates by means of heat and fumes, which are included in both substances, the two parts from each other.

Furthermore, since by that ebullition and agitation of the gases [*spirituum*][58] the 'bulbs' [bubbles, *ampullae*] and the froth are produced, and these do not just cover the surface of the beer, but rather are in the whole body, the bubbles and the froth are firmly connected with it [the beer body] by its viscosity, as long as the beer endures; where this comes from and how this is done, seems to be in need of a very brief explanation.

Those things happen, as Galen writes, from the mixing of the two substances, the airy and the aqueous one. And the cause of this mixture are either both substances or the violent movement of only one substance or a strong heat. In the sea, says Galen,[59] the water is broken by strong breezes into many small parts; in the malt [juice] [*polentis*], however, due to the intense heat, as well as in water heated by fire and set in motion, froth. But the only reason why the froth is held together is, of course, the airy substance that, when added to the water, shakes it by a violent movement, so that the water is broken and dashed into tiny particles and reversely the substance is crushed to pieces by the water.

Thus, when the dregs, which we called airy, mix with the beer, some violent movement is stimulated in this mixing, as it happens by the wind in the sea and rivers. Furthermore, also the internal heat of both substances causes that the dregs diminish by rubbing and crush the beer itself into smallest parts and pieces, and they in turn are smashed by the beer: by such destruction and violent movement bubbles and foam are necessarily produced. These endure sometimes as long as the beer itself, but sometimes they are distributed and disappear very quickly. The reason is the substance itself of the dregs and the beer. Because the closer and more glutinous the substance of the beer was and equally of the sediment, the more durable is the froth; but that what was thin, is resolved quickly and easily, as it is also evident in pure and clean water. Even if this by heat of the fire had obtained bubbles and froth, they nevertheless would disappear very quickly. Hence it is that our people judge the quality and durability of the beer according to the perseverance of the froth, because it is the surest sign of a natural, appropriate heat in which that air and gas [*spiritus*] that produce the froth is included, and at the end also the beer itself remains unchanged, without any corruption. But if it happens that the heat of beer has decreased and the gas [*spiritus*] is exhausted or consumed by evaporation, then the beer gets weak and only an aqueous substance is left, which later more easily is exposed to spoiling. This may suffice on the preparation of the beer and the reflection on the causes of it. Others will be more accurate and detailed, I have contented myself with that raw sketch of mine and also with the errors committed in it.

About the preparation of the other type of beer, the beverage of the rural population (which is made from the malt residues that are left after brewing of the former beer), there is no need to waste words uselessly. For it is completely the same type of preparation as in the first type of beer: it is not different from this, even if it is more watery and not as strong as that.

11. On the different types of beer

One can collect a great many differences among beer types, but it is not necessary to trace details. If we have designated the primary and most important differences, the other can be understood without problems. The differences thus are first in the matter, because some beers are made exclusively from wheat, other only from barley, and again others in a certain way are mixed and aligned from both at the same time.

Most beers differ in the manner of preparation. A few require to be prepared on one way or another, to be cooked shorter or longer, and the beers cooked quickly hold usually less long; the longer cooked beers, by contrast, are usually more durable and do not get sour and spoiled as easily as those other beers.

They also differ in what time of year they are made. While some are prepared at all times and on all days of the year, as our wheat beer, others, such as barley beer, are made at certain times, only during the winter and in early spring. Only made once a year, in March, is the beer from Opava; it is called *Martiana*,[60] which the people of this county use instead of medicine when they feel uncomfortable; thus they do not make much use of medicine. When this beer is drunk more abundantly, it creates real martial persons [*Martios*]. Very similar to this is the beer from Jihlava and many others

that are produced in the Kingdom of Bohemia; among these, the beer from *Žatec* holds the first place, called the male one, because, compared to other beers, it seems to bring masculinity. Closest to it is the beer from *Rakovník*, then the beer from *Slaný*, thirdly, the beer from *Rokycany*. In last place, other beers can be situated, which are similar to these, wherever they may be produced.

Not to be passed over in silence is a barley beer which once in Prague by members of the college of Charles IV [1316-1378], the most meritorious father of our country, and elsewhere in monasteries and inns was prepared in the traditional way and was called *Conventum*,[61] a name derived, if I am not mistaken, from the monastic communities and colleges of priests. It is not so long ago that this beer began to be used more rarely, now it seems that, most certainly, the name has perished with the thing itself due to an extreme increase in prices for grain, hops, wood and nearly all other things, which, if we compare this time to the preceding one, were ten times as high to say the least. It thus happened that the use of this beer came almost to a standstill; where it is still produced, it has lost in particular the former quality and healing properties of beer and is now degenerated. And so it happened that people use [barley] grain more for baking bread than for cooking beer.

Finally, beers differ particularly in their consistency, taste, colour, odour, age, and the powers and faculties. In the consistency they differ because some are thicker than others, and others are thinner: those remain in the body longer, while these pass through easily. All that are of medium substance, also remain for a medium period of time.

The colour, being not independent of the substance, is in all beers yellow like oars or pale yellow, reddish or pale reddish. However, the common people divide the beers into white and black, although in reality no beer is coloured this way. The wheat beers are called white; those that are yellow like oars or pale yellow and thinner; barley beers are called black which tend to be reddish and are thick. However, such colours stem from the cereals, hops and also by cooking, depending on whether they are more or less mixed and cooked longer. Thus the colours of the beers happen to be lighter or darker.

Figure 6. Figure 1: Map of today's Czech Republic showing the beer towns mentioned by Hájek.

The taste of beer is sweet or semi-sweet, bitter or semi-bitter. All wheat beers tend to sweetness, whereas barley beers are bitter or at least tend to bitterness, depending on whether they contain more or lesser hops. For the bitterness comes from the hops.

The odour seems to be common to all of them, and they do not smell unpleasant, almost like the malt or *polenta* itself, mixed with the odour of the hops. With regard to the age beers also differ, some are young, others old. The powers and faculties, finally, differ most from each other: some cause bloating, constipate, lie heavy in the stomach and provoke colic, kidney diseases and dysuria and stranguria;[62] other beers strengthen, nourish, cleanse and go through readily. But about the powers and faculties of the beers we want to talk in the next chapter.

12. On the powers and faculties of beer in general

It remains to assess of the things discussed so far the powers and faculties of beer, as well as to examine whether what the ancients have said about it is also true for our own beer. The ancients all expressed everywhere that the drink is harmful and very unhealthy, perhaps because they have enjoyed more the fruit of the vine than the mash of Ceres (grain).[63] Our current authors followed the ancients and told the same thing preferring, as it seems, to take up the opinion of their ancestors, rather than fathom the matter thoroughly, based on their own research. Thus, none of the old or the recent authors has completely and consistently passed in writing on the theory of preparing this drink. And as we see this omitted by them, for whatever reason in the end, all that was brought forward by them about this drink is necessarily suspicious.

Testimonies from ancient authorities[64]

But let us examine what the ancients have handed down on this issue, where Dioscorides[65] made the beginning with these words: *A beverage is made from barley, which is called Zythus*. It is diuretic, affects the kidneys and nerves, impairs the cerebral membranes, causes flatulence, creates a harmful humour and engenders elephantiasis. Dioscorides writes almost the same about a drink, which he calls *Curmi*: it certainly causes headaches, produces a bad humour and damages the nerves. Galen[66] follows Dioscorides in Book 6 of *De simplicium medicamentorum temperamentis et facultatibus* where he says almost the same in the following words: *Zythus is significantly sharper than barley and of bad humour since it originates from putridity; it is therefore also flatulent; partly it is sharp and hot, but mostly cold, watery and sour*. Paulus Aegineta[63] judges similarly in Book 7: *Zythus, which they call Cervisia, consists of a composite material, it is sharp as made from putridity, and cold because of the sour quality, therefore also has a bad humour*. Theophrastus,[64] who is older than these writers, says in chapter 15 [of Book 6, nowadays 6.11.2] of *De causis plantarum* that a wine is made from barley or wheat, or what the Egyptian calls Zythus, based on a conversion of the original nature and a slight putrefaction.

Difference between ancient and modern beer: Zythus vs Cervisia

Whether these testimonies do justice to our Cervisia, others may judge. I on my part, when these authors just cited claim that the drink comes from putridity, would not deny that such powers inhere in their Zythus, but I will never concede that they might be attributed to our beer. Because it is not made of rotting fruits, nor by pure soaking, rather it is made from cereals which was previously prepared in malt and ground into coarse flour, finally sufficiently cooked and mixed with hops - as it was explained by us in sufficient length and backed up with strong arguments. Therefore it should become clear and comprehensible to everyone that our beer is different from the Zythus of the ancients in almost every respect and has nothing in common with it. So thoughtless act those who attest the powers and faculties of the ancient Zythus to our beer and to bring in conjunction forcibly. They really cause great injury to truth itself. If someone attributes to barley-water the same powers as to *Ptisana* [barley-gruel][65] boiled out in the broth of pullet, we can say that he knows nothing about medicine. Even less right, I say, is the opinion that our beer, as the Zythus, arises from putridity, that, so to speak, the preparation of malt has the same effects as putrefaction. Of which I do not know whether it could still be granted if we chose to examine exactly the nature of putrefaction.

Putridity[66]

I would call it [the whole process] rather a change or an awakening of powers lying dormant in a cereal grain. That is to say, the substance remains and is not corrupted. Well, all right! There may have been some slight putrefaction of the grain, or a mode of or tendency towards putrefaction, like doctors are used to assume when the say that fevers are inflamed by putridity of the humours, even if it is not putridity yet, but only its beginning. And still it does not seem to follow from this necessarily that the beer that is cooked from it consists of bad humours. Does not arise even from the grain, which is put in the earth and initially is caused to putrefy and to corrupt, something else that is equally commendable as excellent? Similarly, when someone looks at the preparation of malt in the old days, does is not seem to entail some putrefaction? Nevertheless, none of the ancestors dared to say that because of this fact malt consists of bad humours. Which is because the stain could not be washed away either from *Ptisana*, which the authors had praised so much, nor from many other substances, that it first requires some alteration or beginning putrefaction before they can be consumed.

But is the fermentation in the production of bread something other than a kind of putrefaction? And yet, by this invention highly esteemed bread is made. Things are also fermented by the heat of the sun, by fire or by horse manure, so that later more easily the parts can be separated by distillation. Likewise some things get putrified at the beginning of the distillation, and then they are distilled so that the best that is hidden inside is brought to the outside and the useless parts are separated from the useful ones. We would, therefore, even if beer were made from putrified grain, still not say that because of this it contained bad humours. Those disreputable powers and faculties may be accorded to the Zythus of the ancients, not to our modern beer, whose production is completely different from that of Zythus; therefore, the powers and faculties are likewise different and diverse.

The powers and faculties of beer

In order to judge the powers and faculties of this beverage more expeditiously, we will first determine the composition[71] of beer, always and everywhere with regard to those two principles by which a complete demonstration and faithful rendering of things is usually obtained; that is, the senses and experience on the one hand and a clear notion on the other. Hippocrates wrote in his book about epidemics[72] that one must examine food and drink by one's own tests, unlike Galen who wants to apply a just balance of reason while exploring all natural properties. From this viewpoint the latter wrote in book 1 of *De alimentorum facultatibus*,[73] that long-standing knowledge along with solid and defined experience is needed, then knowledge regarding smell and taste, which inhere in the things examined, additionally knowledge of the consistency which can be sticky, loose, tight and easy or hard, and, finally, almost not to be perceived or recorded in due form.

The composition (temperamentum) of beer, its basic properties

Thus we have to evaluate the powers and faculties of beer: if it acts in a nutritious, purgative, secreting, abstergent or diurectic manner; and if everything is caused by the primary qualities by which I mean by heat, cold, humidity and dryness.[74] First, what can be found of these properties in our beer? To make this more understandable, we want to single out the taste as the highest teacher in this matter and follow him as the leader, as it reveals not only the composition, but also the other powers which are called the secondary and tertiary ones. For the sweetness (we are talking now only about wheat beer, which is called 'white'),[75] which is tasted in the beer, does not come from honey, but is more or less noticeable depending on how much of the aqueous liquid has been added. Furthermore, flexibility and viscosity indicate that it has a moderate heat inside.

The three components of beer: grain, malt and hops

Moreover, as beer is a mixture of three substances, it follows that the qualities and nature of those things are intermingled for beer is composed of water, grain or malt and hops. The differences between these individual components I will not explicate, since they are explained at the appropriate points. Regarding the choice of the water, it is either thinner and softer or harder and thicker, so that partly a thinner and more pungent, partly a fuller, thicker and stickier beer is produced.

All agree and confirm that plain water is by nature cold and humid. Here [in the case of beer], however, it will be very diluted by the boiling process, it is milder and therefore less cold, as if it had received a certain fiery power within itself. It does not even retain its former sweetness and, transformed by the power of the fire, it has lost its original nature.

Malt from wheat, because it is torrefied, attains a heat above its natural warmth, and it dries only moderately. Malt from barley, however, is less warm than that from wheat. Barley is generally cold and dry, and as a result of torrefaction obtains a small degree of warmth or heating, including an increasing dryness. Therefore barley has a more cleansing power. The flowers of hops are warm and dry in the second degree and have a laxative, diuretic and detergent power; they also affect the head. These are the qualities and natural properties of the three substances that are used in different mixture as the ingredients for preparing beer.

Differences among the Bohemian beer types, their nutritional powers

I add also the mixture of sediments, about their airy nature we have spoken above [in chapter 10], and from which it is clear that beer [in Bohemia] is generally cold and humid. But if you compare the beer types with each other, so many either fall below or exceed this gradation; and the passive qualities are of a dry rather than humid nature, as we are accustomed to judge regarding the nature of wine. This is because, in the preparation of these [native] beers, rarely are the same amount of malt or hops added to the water, as we have explained above [in chapter 5], and they are not cooked in the same way. So it happens that the beers containing more malt and less hops are sweeter than others; however, those that contain more hops are more bitter and affect the head. Beers from wheat are generally sweet and light, those from barley bitter and more viscous.

Finally, this too is clear, that our beer is composed in such a way that when drunk it neither cools nor extinguishes thirst, and externally applied it wonderfully relieves pain, reduces inflammation and is remarkably helpful for reducing, if the weary parts of the body are kept warm with it.[76]

It is, however, well known that everything endowed with these faculties is called ἀνώδυνα, παρηγεικὰ and λυσίπον,[77] and that it is warm in the first or second degree, of light substance and finally composed in a way that lets it be in accordance with our body through a familiarity of the elements. For since it relieves pain, makes its cause endurable, creates a pleasant heat and keeps the substance of the body warm, all this must with necessity stand out by a moderate heat of its own. Of this kind are mallow, marshmallow, chamomile, melilot, linseed, and others. Among these, our white beer can be rightfully numbered.

Wheat beer versus barley beer

Those beers that are less mixed or purer are regarded as warmer and cause a more glutinous, stickier and thicker blood; they have good juices and are very nutritious, especially if they are prepared from the best grain and well cooked. This nutritional power comes only from wheat beer and how nutritious such beers are can be seen in both sexes. Most people, who by the constant consumption of beer, especially strong wheat beer from Hradec Králové,[78] have become fat, who previously were slim. This local beer can truly be called the queen of wheat beers for it is endowed with a goodness which up to now no one could emulate though many have tried and often used the malt, water and even the brewers from this city.

In nursing women this nourishing power is even more evident, because it stimulates milk production and increases the amount produced. It is known that what milk generates is regarded as warm and humid, just as, conversely, that what extinguishes milk, as cold and dry; and that which prevents its production is considered to be cooling and desiccating. Barley beers, especially of the stronger sort, as are produced in Bohemia in Rakovník, Žatec, Slaný and in Świdnica in Silesia,[79] seem to outperform wheat beers in this regard, as they have a much faster effect and for this reason are desired by nursing women to an amazing extent. For women with too little milk in the breasts, after taking a sip of this beer and sleeping a little bit, suddenly have the 'vials' (mammary glands), that is, the receptacles of milk, swollen with milk. Apart from this faculty these beers are also diuretic and provoke menses.

It could rightly be asked by someone why wheat beer so significantly exceeds barley beer in nutritional power and why it is said to be warming, while the latter cools; and why wheat beer should be more effective thanks to the power of warming, but barley beer cools. On the other hand we see that almost all barley beers may be drunk much faster than wheat beers. However, it is no more surprising, I think, if one turns eyes and mind to the manner of preparation of the two types of beer and wonders whether not also in barley some nutritious juice could be included, which can fill the substance of the solid parts and is apt to nourish and foster. That this is less perceptible in wheat beer is because this kind of beer is prepared more diluted by water. Would it be less mixed and cooked properly, there would be no doubt that it is more nutritious, as is clearly to observe in beer from Hradec Králové and similar beers.

But there are also sweet barley beers which are produced in Prague. However, due to too much sweetness and an insipid taste and because they are too strong and viscous they cannot match up in quality to the other beers that we have mentioned. For howsoever nutritious they might be, they provide but a thick juice, provoke blockages of the intestines, are encumbering in the stomach and weigh heavily on chest; they cause shortness of breath, generate bladder stones and are so harmful to the body as raw beers, that is, beers that were not cooked sufficiently or were prepared incorrectly, entailing blockages, cause bloating in the abdomen and entrails which stays there and vanishes only with difficulty; beers that are neither laxative nor abstergent, that do not quench thirst and promote colic, stones and gravel.

Spoilage of beer

The same drawbacks and errors are caused by young and not properly purified beer, for it distends the stomach, upsets, engenders pain of the intestines, stones, nephritis, and dysuria and stranguria.[80] Beer that is not properly fermented is cold (resulting in thickness of the humours, flatus, blockages, and the body does not warm up after its use), and the same can be said of young and not yet properly purified beer. In passing it should be noted that what is cold is also sweet, like certain types of pumpkin, which are commonly referred to as melons. Moreover, beer which already has become acidic and is corrupted, is very harmful to the nerves, the kidneys, and the stomach; finally, it creates a vicious humour.

Some beers also become acidic due to old age, or insufficient cooking or because only a few hops were added. They also get corrupted and become easily acid on summer days, save they are stored in very deep and cold cellars. For the surrounding warm air sets free the natural warmth of the beer, so that it is readily acidic. But it seems remarkable, and perhaps can only be explained by a certain ἀντιπάθεια, that wheat beer recoils from the fragrant scent of roses.[81] Because if roses are brought into the cellar or if at least a butler crowned with a garland of roses steps in, the beer spoils immediately and becomes acidic.

Weaker beers decompose much faster and they are less suitable as food and when they are acidic, they are less nourishing; but by the bitterness and thinness of the substance (the simplicity of the beer material), they act very laxative causing diarrhoea due to the amount of water and by reducing the viscosity [of the digested food] and especially they have diuretic effects.

Different types of English beer, including ale

Since, however, the English also make use of a beer that they prepare in their own way, I chose to add in this place how the learned Brudus Lusitanus evaluated it. He has thus in his booklet about the right way of nourishment during certain fevers[82] bequeathed to the English what he wrote down in these words: *One of the drinks that the English commonly use is of different types, that is, very strong, moderate and weak. They differ according to the strength and weakness, the ability to warm or cool, and the strength or weakness of the substance. Among the English, the drink is always prepared in three ways, namely watery, which they call simply beer, medium, which is called three-halfpenny beer and powerful beer, which they call double beer. Simple beer has the same effects as watery wine, because it is laxative, cools and promotes digestion. And one should not be deceived and believe that the beer warms due to its bitterness, because the parts that make the beer bitter are low compared to the other parts that cool in the beer. Which can be seen by the ratio of hops to water and the amount of barley. In addition, the bitterness escapes quickly from the beer, while the strength of the remain-*

ing parts continues until it is finally transformed into another substance. The powerful beer, which they call double, warms stronger and has a slightly different intensity, just as powerful wine. The three-halfpenny beer is of medium nature, it warms manifestly, but it is not particularly strong.[83]

Brudus [1544: 96v] mentioned in the same place yet another beer which the English of weaker constitution tend to drink and which they call ale [*alla*] in popular speech. I have been told that it contains no hops at all, a reason to praise it less. And the same Brudus says that it is excessively bloating and fever patients have no benefit from it because it neither warms nor is laxative or promotes any excretion and it does not quench thirst. In addition, it is a drink that spoils easily and seems to have a similar effect on liquids in its vicinity. Moreover, its substance is such to dissolve all too quickly into gaseous vapours that adversely affect head and nerves; besides this, it is a substance that is so destructive as to induce damage to the liver and spleen. In sum, this beer is beneficial to nobody, except for Venus.[84] Those, however, who have consumed this drink in good health, need not dismiss it as causing illness, advises the same Brudus.

Medical ill effects and benefits of beer

Furthermore, all beers that are drunk in large quantities fill the head with thick vapours, but not for everyone with an, as I would say, equal balance pan. For here, as everywhere else, age, nature, time, place or region, as well as the way of life and habits must be taken into account; and likewise regarding the current deliberations it seems to be extremely necessary to consider the constitution of the people or drinkers, respectively. In order to mention only a few, experience may serve as a teacher. For people with a weak stomach beer consumption is more harmful than for others. For it burdens, excites phlegm (viscid mucus) and 'salicismus',[85] distends due to flatulence; and when the stomach has trouble with the excretion, it hangs in the intestines and does not contribute to expulsion. By contrast, people with a readily digesting belly and intact stomach do not feel any of these inconveniences. To sum up, for people with a strong and robust physical nature (as the inhabitants from the seventeenth parallel right up to the north) beer is pleasant, useful and healthier than for those with weak and too delicate a constitution who, even by the slightest breeze, immediately become sick.

Thus, when this beverage is prepared properly, it is healthy and nutritious. It strengthens and stimulates our spirit and confirms the soul, does not affect the nerves and does not lead to apoplexy, paraplegia or to what we call in Greek κάρος (lethargy) and κώματα (trance). It does not cause any disruption of the nerves, excite neither epilepsy nor cramps and spasm, nor arthritis, which is associated with all wines. Therefore, one can observe that these diseases can be found in only a few people that are familiar with this drink. We see that all the nations that consume this drink, such as the English, Swedes, Danes, Saxons, those living in the greater part of Germany, in Bohemia, Silesia, Poland, and in all of Sarmatia[86] are not less vital and lively than other people who consume wine and honey. These are also very beautiful, very healthy and very strong men, in short, it is a very useful drink for all ages and both sexes, something that by no means applies to wine. It is also very well known what Plato in book 2 of his work on laws and Galen in book 1 of his work on the preservation of health[87] have written about the use and nature of wine, where the consumption of wine is prohibited for boys up to 22 years. There is no doubt that, if these authorities would have known our way of making beer, they would have allowed it for boys and adolescents and would have preferred it to any other drink made with water. The Romans, where for females the consumption of wine was a felony, undoubtedly would by law have allowed beer drinking for their women.[88]

13. On factitious or seasoned beers

As well as wines beers are seasoned with herbs or aromatic substances. The kind of seasoning is twofold as in wines. Either during the making of the beer some herbs are boiled in, like absinthe, cloves, mint, laurel berries, anise; or, after the beer has been brewed and poured into vessels, a bunch of herbs, roots and spices is thrown into the vessels. The second method is also applied to the following powder, which imparts a pleasant taste and at the same time ensures the health of the body. Ginger and cinnamon are taken for this, two drachms[85] of each, roots of Illyrian iris, aromatic sweet flag and laurel berries, a drachm of each, and bitter oleander, clove and

nutmeg, half a drachm of each. These ingredients are crushed into a powder and wrapped in a small ribbon of linen and then placed in a vessel. Others make a coarse powder of aromatic sweet flag, zedoary, cloves and laurel berries. However, all these things can easily be customized to individual tastes.

14. On different things made from beer

First, different types of food are made from beer. But particularly widespread and known here in Bohemia is a dish made from beer served as breakfast for children as well as for adults, namely a soup with egg yolk and a

DE CERVISIA, EIVSQVE CONFICIENDI RATIONE, NATVRA, viribus, & facultatibus, opusculum:

AVTHORE THADDAEO HAGECIO ab Hayck.

FRANCOFVRDI Apud heredes Andreæ Wecheli, MDLXXXV.

THADD. HAGECII

aquæ copiam; & lubricant, ob viscidi tatem; & maximè per vias vrinæ transfundit. Quoniam autem Angli quoque Cerusia suo modo parata vtuntur, quid de eo censuerit Brudus Lusitanus, vir doctus, placuit huic loco scribere. Ita ergo in libello de ratione victus in febribus ad Anglos in hæc verba scriptum reliquit: *Potus, quo communiter Angli vtuntur, multiplex est; nempe vehemens, medius & imbecillior. Discrimen inter hos penes vehementiam & imbecillitatem, calfactionem & refrigerationem, & penes substantiæ crassitiem & tenuitatem habetur.* Apud Anglos triplex semper paratur potus; nempe aquosus, quem simpliciter Cerusiam dicunt; medius, quem trihapenninam; potens, quem duplam Cerusiam nuncupant. Simplex eosdem effectus præstat, quos vinum aquosum: apetit siquidem, refrigerat & distributionem adiuuat. Nec decipiatur aliquis credens, ob eius amaritudinem calfacere: partes enim, quæ Cerusiam amaram reddunt, paucæ admodum sunt, si ad reliquas conferas, quæ in ipsa refrigerant. Quod colligere ex ratione lupulorum poteris ab aquæ & hordei portiones. Citò præterea amaritudo à Cerusia euanescit: reliquarum verò partium facultas tamdiu permanet, donec in aliam transmutetur substantiam. Potens Cerusia, quâ duplicem dicunt, potenter calefacit, & aliquid habet vehementiæ, vt potens vinum. Trihapennina, mediæ natutæ est; manifestè calefacit, in nullo tamen vehemens est. Meminit adhuc Brudus

No._8780 (page 445).
One of the earliest works on brewing.

Figure 5. British auction catalogue (Sotheran, H. (1921) Bibliotheca chemico-mathematica. Catalogue of works in many tongues on exact and applied science, with a subject-index. *Volume 2. London. p.450 passim) offering a copy of Hàjek's treatise to which recipes for making beer by 'a contemporary English hand' were added.*

little butter, for which wheat beer is more suitable than barley beer.

There is also a porridge made of beer, to which bread of coarser flour has been added, stirred with a little butter.

There are people who in the morning drink warmed beer spiced with ginger or pepper, especially if they want to leave the house or go on trips. It strengthens namely in amazing ways the stomach.

People who are exhausted from a trip, let their feet be washed with warm beer combined with butter and apply it in the evening at the resting place likewise to the horses, in the belief that they are more flexible and quicker the next day.

Vinegar is also made from beer, but it is not as sharp and palatable as wine vinegar, not as effective and not suitable in small portions.

Finally, by certain people a fiery wine is made from the yeasts or sediments that are left at the bottom of the vessels, people who earn their livelihood alone with this and who do not a contemptible work because they travel with vehicles up to Saxony to sell it. Recently, some genteel ladies here in Bohemia, enticed by the profit (which tends to be sweet with greedy people, regardless of where it comes from), were intent on producing this wine and thus have people of humble origin, who therewith earned their livelihood, robbed of their basis of existence. This fiery wine they sell off their subordinates publicly through retailers, to have the people drink it. The simple country people are sipping this beverage with toasted bread or sage leaves instead of breakfast, so most of them return home quite drunk.

References

1. On Caius, see Nutton, V. (ed.) (2018) *John Caius. An autobibliography*. London and New York: Routledge; Nutton, V. (1987) *John Caius and the manuscripts of Galen*. Cambridge: Cambridge Philological Society and Brooke, C. (1996) *A History of Gonville and Caius College*. Woodbridge: Boydell & Brewer, pp.55-78.

2. Regarding Hájek, a concise biographical overview is available in English by Hellman, C.D. (1994) *The comet of 1577*. New York: AMS Press, pp.184-193. In non-Czech literature there is some confusion about Hájek's name. His correct, full name is Tadeáš Hájek z Hájku, that is, Tadeáš Hájek from Hájek. In Czech háj means 'grove', and hájek is a diminutive meaning 'little grove', alluding to his father's house near the famous Bethlehem Chapel in downtown Prague (see Figure 1), which might have been located in such a grove. In the Czech language of this time the letter 'g' was used instead of 'j', thus his name was spelled then Hágek, on the title pages of his Latin writings Hagecius (see Figure 3).

3. Interestingly, Hájek's eldest son Simon studied in England, first in Oxford, then in Cambridge, where he took his B.A. in 1581; see Prinke, R.T. (2010) 'Beyond Patronage: Michael Sendivogius and the meanings of success in alchemy', in Pérez, M.L., Kahn, D. and Bueno, M.R. (eds.) *Chymia: Science and nature in medieval and early modern Europe*. Newcastle-upon-Tyne: Cambridge Scholars Publishing, pp.175-231 (p.198).

4. Guilelmus Ursinus de Rosis (William of Orsini-Rosenberg, in Czech Vilém z Rožmberka, 1535-1592), High Burgrave of Bohemia and great patron of arts and sciences. A biography of this important personality is available only in Czech, see Pánek, J. (2011) *Vilém z Rožmberka. Politik smíru*. Prague: Academia.

5. An irreproducible Latin pun: *maltaria quam altaria*.

6. Quotations from the Roman satirists Juvenal (*Satires* 14: 204-205) and Terence (*Heauton Timorumenos*, 77).

7. Lucian of Samosata (fl. second century AD) was a famous Greek satirist, who in two works ridiculed Christianity; see Betz, H.D. (1959) 'Lukian von Samosata und das Christentum'. *Novum Testamentum*. 3, pp.226-237.

8. See Alexandrinus, *Salubrium sive de sanitate tuenda, libri triginta tres* (1575). On Julius Alexandrinus (1506-1590) see Khautz, F.C.F von. (1755) *Versuch einer Geschichte der Oesterreichischen Gelehrten*. Frankfurt and Leipzig, pp.204-228.

9. Alexandrinus made very little use of Hájek's work.

10. Johann Placotomus (Brettschneider; c. 1514-1577), German physician and pedagogue; author of *De natura et viribus cerevisiarum et mulsarum opusculum* (1551).

11. According to the ancient (Hippocratic/Galenic) theory of the four humours each body or substance (human, animal, vegetable, mineral) consists of four basic components (*humores*, 'fluids') each having the basic properties or qualities 'warm' (*calidus*), 'cold' (*frigidus*), 'dry' (*siccus*) and 'moist' (*humidus*); the balance (or imbalance) of these properties determines the specific 'temperament' (*temperamentum*, literally 'mixture') of the individual body or substance. The medicinal or dietary effects of these four qualities furthermore were divided in ascending order into

four degrees of intensity, from 1 (mild) to 4 (vehement) (Harig, G. (1974) *Bestimmung der Intensität im medizinischen System Galens*. Berlin: Akademie and Scully, T. (1995) 'Tempering medieval food', in Adamson, M.W. (ed.) *Food in the Middle Ages*. Westport, Connecticut: Greenwood). Besides these so-called primary qualities secondary qualities as tastes (*dynameis*, e.g. sweetness, bitterness) and medicinal effects (*virtus*, e.g. astringent, cleansing) were also considered. On the four humours theory in antiquity, see Nutton, V. (1993) 'Humoralism' in Bynum, W.F. and Porter, R. (eds.) *Companion encyclopedia of the history of medicine. Volume 1*. London, New York: Taylor & Francis and Scarborough, J. (1984) 'Early Byzantine pharmacology', *Dumbarton Oaks papers*. 38, pp.213-232; in the Renaissance Harig, G. (1966) 'Leonhart Fuchs und die theoretische Pharmakologie der Antike', *Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin*. 3, pp.74-104. and concerning beer in particular Nelson, M. (2005) *The barbarian's beverage. A history of beer in ancient Europe*. London: Routledge, pp.33-34 and Nelson, M. (2011) 'Beer: necessity or luxury?', *Avista forum journal*. 21, p.76. This doctrine remained predominant well into the seventeenth century (Harig, G. (1974) op. cit. pp.201-203). In Greek and Roman antiquity grain generally was considered as cold and moist; wine as warm and beer as cold (= effeminate), cf. Nelson, M. (2005) op. cit. pp.33-34, 73 & 116). Hájek, by contrast, considers beer as warm - see chapter 12 of his treatise.

12. For details, see chapter 14 of Hájek's treatise.

13. It is uncertain to which episode Hájek is alluding here.

14. Marcus Gavius Apicius, a Roman gourmet and lover of luxury, lived in the first century AD (Pliny, *Naturalis historia* 9.30.66 and 10.68.133). Not to be confused with Caelius Apicius (fourth century), allegedly the author of a cookbook *De re coquinaria*.

15. The following passage on Noah is Hájek's free interpretation and, as such, is not found in the Bible.

16. Solon (c.638-558 BC), an Athenian statesman and lawmaker.

17. Plato, *Leges* 666a-c; cf. Nelson, M. (2005) op. cit. pp.38-39 & 133-134). Actually, Plato suggested that no one under 18 should be allowed to drink wine. Reiterated by Hájek in chapter 12.

18. On the evaluation of water in antiquity, see Nelson, M. (2011) op. cit.

19. Frontinus, *De aquaeductu urbis Romae*. Sextus Julius Frontinus (c.40-103 AD), well-known as author of technical treatises.

20. The rivers Choaspes (present-day Karkheh) and Eulaeus (present-day Ulai) are located in Susiana (Elam), today's Khuzestan Province in Iran; Hájek refers to Strabo, *Geographica* 15.3, see also Smith, W. (1856) *Dictionary of Greek and Roman geography, Volume 1*. London, p.874.

21. See Athenaeus, *Deipnosophistae* 12.9. Agathocles (fl. third century BC) was a Greek historian whose work is lost. He is quoted by Athenaeus of Naucratis (fl. second to third century AD) in his multivolume *Deipnosophistae* ('The learned banqueters' and some other title versions). Athenaeus cites references to beer in ten authors which have not survived in any other source, see Nelson, M. (2005) op. cit. p.119.

22. Baltic, Slavic and Iranian speaking (the Scythian Sarmatians) people, the latter living between the Vistula and the Danube and Don; mentioned again in chapter 12 (note 82).

23. See Galen (1825) *Methodi medendi libri XIV*. Kühn, K.G. (ed.) Volume 10. Leipzig and Galen (1823) *De sanitate tuenda libri VI*. Kühn, K.G. (ed.) Volume 6. Leipzig, respectively.

24. The word used by Hájek for beer is *Cerevisia*. It is the original meaning of this Latin word that Hájek deals with in the following. Names of beverages are mostly spelled with a capital letter at the beginning in Hájek's text.

25. There were three common spellings: *Cervesia*, *Cervisia* and *Cerevisia*, see Cornish, F.W. (ed.) (1898) 'Cervesia, cervisia, cerevisia', *A concise dictionary of Greek and Roman antiquities*. London, p.157; Hájek used alternately *Cerevisia* and *Cervisia.* Nelson, M. (2003a) 'The cultural construction of beer among Greeks and Romans', *Syllecta classica*. 14, pp.101-120 noted that the Greeks and Romans knew a series of foreign names for 'beer' but had no indigenous term for this beverage ('beer' being understood as any sort of maltose-based fermented cereals, diluted with water as well as undiluted).

26. A long-lasting misconception, dating back to Isidorus, *Etymologiae* 20.3.17. It is now commonly accepted that *cervisia* is not a Latin but a Celtic word, composed of two parts. The first part refers to *ceir*, meaning 'wax' or 'honeycomb', see Arnold, J.P. (1911) *Origin and history of beer and brewing. From prehistoric times to the beginning of brewing science and technology*. Cleveland: Wahl-Henius Institute of Fermentology, pp.142-148 and Nelson, M. (2005) op. cit. p.51; regarding the second part, see next note. The Romans adopted and Latinized the Celtic term.

27. According to Arnold, J.P. (1911) op. cit. p.146 *Visia* comes from *wysg*, *uisg*, Celtic for water (as in 'whiskey'); see also the next note. In the last sentence of this paragraph Hàjek derives *Visia* from Latin *vis* (force), which is, as he concedes, only an expedient.

28. Venetic (*Henetum*, as Hájek preferred to write with an H at the beginning, following a Greek writing convention in Latin) was the language of the Celtic Venetians. The language that Hájek had in mind, however, is not this language, but Breton, the language of the Celtic Bretons, who later inhabited the area where the Venetians used to live.

29. Regarding Hájek's statement that Latin *Cerevisia* was still retained in the Breton language, see for instance the *Catholicon*, a trilingual Breton-French-Latin dictionary by Jehan Lagadeuc (first printed edition 1499, possibly Hájek's source). This dictionary has an entry on *Cerues* (Breton), *ceruoise* (French), *ceruisia* (Latin). Hajek was, however, mistaken in believing that the Breton word was derived from the Latin, see also note 26. As to *Cerevisia* in German; see Meibomius, J.H. (1668) *De cervisiis potibusque et ebriaminibus extra vinum aliis commentarius*. Helmstedt, section 12.13-14 providing highly questionable sources according to which *cervisia* might be derived from German words such as *Gehrwys* (a drink made by fermentation) and *cerwe* or *zerwe* (wheat, grain).

30. On Zythus, see Nelson, M. (2001) ζυτουργεῖον: a scholarly ghost word', *Mnemosyne*. 54, pp.721-723 and (2005) op. cit. pp.21-24 & 126), additionally Meibomius, J.H. (1668) op. cit. chapter 4.

31. On οἶνος κρίθινος, see Becker, J.H. (1822) 'Bier', *Versuch einer allgemeinen und besondern Nahrungsmittelkunde, Volume 2*. Stendal. pp.109 & 116 and Anonymous (1750) *ΟΙΝΟΣ ΚΡΙΘΙΝΟΣ. A dissertation concerning the origin and antiquity of barley wine*. Oxford, p.8.

32. Athenaeus, *Deipnosophistae* 10.67. The word πίνον is probably derived from πίνω (to drink), see Nelson, M. (2005) op. cit. pp.34-35 and next note. Nelson suspects that it is not proper Greek, but a Macedonian word from Aristotle's homeland.

33. Hájek is mistaken: *pivo*, the Slavic (Czech) term for beer, is derived from *pít*, to drink, and considered cognate to Latin *bibo* and Greek πίνω (to drink); thus, originally *pivo* (and probably also πίνον) simply meant 'drink' and not specifically 'grain drink', see Janyšková, I. (2001) 'Poznámky k staroslověnskému pivo', *Slavia*. 70, pp.361-363. The same applies to the German word *Bier*, see Lloyd, A.L., Lühr, R. and Springer, O. (eds.) (1998) *Etymologisches Wörterbuch des Althochdeutschen, Volume 2*. Göttingen and Zurich: Vandenhoeck & Ruprecht, pp.81-83 on *Bier* and its precursor *bior*.

34. A general relationship between Hellenic and Slavic languages was postulated well into the nineteenth century but is not by modern linguists; instead, a relationship between Greek and some Balkan languages (Illyrian, Thracian, Phrygian) is now postulated, see Meier-Brügger, M. (2003) *Indo-European linguistics*. Berlin: Walter de Gruyter, pp.28-29.

35. *Paphlagonia* and *Galatia* were regions on the Black Sea coast and in central Anatolia, present-day Turkey. The Galatians (as the Paphlagonians) were a Celtic tribe and thus in many ancient sources (e.g. Diodorus Siculus - see note 39) *Galatia* is used synonymously with *Gallia* (Gaul); cf. Sulimani, I. (2011) *Diodorus' mythistory and the pagan mission. Historiography and culture-heroes in the first pentad of the Bibliotheke*. Leiden: Brill, p.212.

36. *Triptolemus* is a play of the tragedian Sophocles (fl. In the fifth century BC), lost except for a few fragments; historian Hecataeus of Miletus (c.550-c.476 BC) wrote *Periodos ges* ('Travels round the Earth', including Europe), which also survived only in fragments; cf. Nelson, M. (2005) op. cit. p.32.

37. A Thracian (?) tribe in Macedonia, see Nelson, M. (2005) op. cit. p.125.

38. According to Athenaeus, *Deipnosophistae* 10.67; on βρύτος and παραβίη, see also Nelson, M. (2005) op. cit. pp.20-21 & 125.

39. See note 35. Greek historians, such as Diodorus Siculus, Strabon or Polybius, wrote Γαλατία when referring to the country of the Celts or Gauls, Γαλλία or Κελτική were only rarely used variants. Hájek writes *Gallia* for Gaul earlier on in his text and *Galatia* for Galatia in Anatolia, but here he follows Diodorus in writing *Galatia* for Gaul without making the reader aware of this. The context, however, in which Diodorus used Γαλατία eliminates all doubt that actually Gaul is meant.

40. On Diodorus's problematic statement about Zythus made in Gaul, see Nelson, M. (2005) op. cit. p.51.

41. On *Curmi*, see Nelson, M. (2003b) 'On a beautiful girl and some good barley beer', *Études celtiques*. 35, pp.257-259.

42. *Chorus* was an old German measure of capacity for grain of varying content. A *modius* is about 9 litres. Regarding the measures used here and in the following chapters, see Hultsch, F. (1882) *Griechische und römische Metrologie*. Berlin.

43. From βύνη (see Aëtius Amidenus (1553) *Aetii Medici Graeci ccontractae ex veteribus medicinae sermones XVI, Volume 2*. Venice, p.592r), cf. Meibomius, J.H. (1668) op. cit. 14.8, 26.6); usually in Latin spelled buna, see Gruner, C.G. (ed.) (1814) *Zosimi Panopolitani de Zythorum confectione fragmentum, nunc primum Graece et Latine editum*. Sulzbach, pp.69-70. Hájek, for whatever reason, altered the feminine term into a neutrum.

44. Czech slad = malt, from *sladký* = sweet; hence *sládek* = maltster, brewer.

45. Κρίμνον = coarse meal, cf. Dioscorides, *De materia*

medica 2.90 Wellmann; likewise *polenta* here means meal, contrary to Hájek's previous definition as malt.

46. Hájek's distinctions are anything but clear - mixing grist, meal and malt.

47. Briggs, D.E. and Hough, J.S. (1981) *Malting and brewing science. Malt and sweet wort, Volume 1*. Bury St. Edmunds: St. Edmundsbury Press, p.4.

48. *Mensuras xx, seu medymnos Pragenses*: according to ancient metrology a *medymnus* (or *medimnus*) had about 54 litres, resulting here in a filling capacity of ca.1,000 litres.

49. See the map in chapter 11.

50. *Chylus*, *sorbitio*, *cremor*, *succus*: all meaning juice or broth. Hájek has no special term for 'wort', but circumscribes it by these words. His preferred term is *cremor polentaceus* or simply *cremor*. *Cremor* means thick juice, broth; *polentaceus* is derived from *polenta* (barley meal), which is Hájek's favourite term for malt (compare chapter 3), adopted from Pliny, *Naturalis historia* 18.14.72, see Anonymous (1750) op. cit. p.25. Henceforth I translate *cremor* and its synonyms straightforwardly by 'wort'. Regarding wort and malt, the subject of the present and the next chapter, in modern brewery, see Briggs and Hough (1981) op. cit. and Briggs, D.E., Hough, J.S., Stevens, R. and Young, T.W. (1982) *Malting and brewing science. Hopped wort and beer, Volume 2*. New York: Chapman & Hall.

51. In modern brewiny this step is called 'lautering': separating (rinsing off) the solids and chaff to extract an intermediate product, the wort.

52. In modern brewing this is called 'three-mash method' or 'Dreimaischverfahren' (Narziss, L. (1992) *Die Bierbrauerei. Die Technologie der Würzebereitung,Volume 2*. Stuttgart: Wiley-VCH, pp.164-168.

53. On *chorus*, see note 42. It remains unclear which capacity is meant here, Nademlejnský, K. (translator) (1884) 'O pivě a jeho výrobě, povaze, silách a vlastnostech', *Pivovarské listy*. 2, p.92 translated the term as 'handful', Bartuch, R. (translator) (1878) 'O pivě a způsobách jeho přípravy, jeho podstatě, silách a účincích', *Kvas*. 6, p.295 as 'quarter' (of what?).

54. Hájek's Czech translators render *faeces* as 'yeast', see Bartuch, R. (1878) op. cit. pp.295 & 366; Nademlejnský, K. (1884) pp.93 & 189); Basařová, G. (2000) 'Přínos Tadeáše Hájka z Hájku českému a světovému pivovarnictví', in Drábek, P. (ed.) *Tadeáš Hájek z Hájku. K 400. výrocí úmrtí*. Prague: Společnost pro dějiny věd a techniky, p.88, using the Czech synonyms *droždí* and *kvasnice*. Actually, Hájek and his contemporaries had no clear concept of yeast. In fact, often the term *faeces* switches between 'yeasts' that developed in the fermentation vat and dead yeast cells or sediments ('dregs') which sank to the bottom; as a consequence, I prefer to translate *faeces* in the following chapters as 'dregs'. For a short historical overview of the discovery of yeast which did not occur around 1830, see Meussdoerffer, F.G. (2009) 'A comprehensive history of beer brewing', in Esslinger, H.M. (ed.) *Handbook of brewing. Processes, technology, markets*. Weinheim: Wiley-VCH, pp.31-32 and Bamforth, C.W. (2009) *Beer. Tap into the art and science of brewing*. Oxford: O.U.P., pp.43-48.

55. Both types of vessel had no definite capacity.

56. This is expounded in the tenth chapter.

57. Hájek's term *molliores* has a connotation of 'more effeminate, unmanly'. Repeated in chapter 12.

58. On the interpretation of spiritus as gas, see Kopp, H. (1845) *Geschichte der Chemie, Volume 3*. Braunschweig, pp.176-177.

59. Hájek refers to Galen (1576) 'In prognostica Hippocratis commentarii tres', in *Omnia quae extant opera: in latinum sermonem conversa, Volume 4*. (Quarta classis). Venice, 202v; in Galen (1830) *Hippocratis prognosticon commentarii I-III.*, in Kühn, K.G. (ed.) Volume 18-2: 1-317. Leipzig, p.177 the Latin text is somewhat different.

60. *Martiana* = March beer, maerzen; today in Czech called *Březňák* - from *březen* = March.

61. *Conventum* is also the room where priests and religious brothers used to meet. In German this kind of beer was called *Nachbier*, a weak beer made after the first brew (as opposed to the much stronger *Patersbier*, which was reserved for the superiors).

62. *Dissuria*, *dyssuria* = difficulty to urinate; *stranguria* = strangury, i.e. urinating in drops with pain.

63. Hájek's text has the obscure term 'colamine Cereali'; Nademlejnský, K. (1884) op. cit. p.241 suggested 'sacred gift of Ceres'.

64. The subheadings in this chapter are by the present translator.

65. Dioscorides (c.40-90 AD) was a Greek physician, pharmacologist and botanist, author of the most influential *De materia medica*. Hájek refers to *De materia medica* 2.87 Wellmann (*Zythus*) and 2.88 (*Curmi*).

66. Galen (c.130-c.200 AD) was a Greek physician in the Roman Empire. Besides Hippocrates, Galen was highly esteemed and of singular importance. Hájek refers to Galen (Galen (1826) *De simplicium medicamentorum temperamentis et facultatibus libri I-VI*. Kühn, K.G. (ed.) Volume 11, Leipzig. p.882.

67. Paulus Aegineta (c.625-c.690) was a Byzantine Greek physician, author of a medical encyclopaedia *Opus de re medica*. Hájek quotes from the translation by Johannes

Guinther, see Paulus Aegineta (1542) *Opus de re medica*. Translated by Johannes Guinther. Venice, 295r.

68. Theophrastus (c.371-c. 287 BC), successor to Aristotle in the Peripatetic school and auhor of *Historia plantarum* ('Enquiry into plants') and *De causis plantarum* ('On the causes of plants'). Hájek quotes from the translation by Theodorus Gaza, see Theophrastus (1552) *De historia plantarum libri IX cum decimi principio et de Causis, sive earum generatione libri VI*. Translated by Theodorus Gaza. Leiden, p.378.

69. On *ptisana* ('barley-gruel'), see Galen (1823) *De alimentorum facultatibus libri III*. Kühn, K.G. (ed.) Volume 6. Leipzig, pp.501-504 and Galen (1823) *De ptisana*. Kühn, K.G. (ed.), Volume 6. Leipzig, pp.816-831; most elucidating, also with respect to the making of beer, is Darmstädter, E. (1933) 'Ptisana. Ein Beitrag zur Kenntnis der antiken Diaetetik', *Archeion*. 15, pp.202-215. See also Vassès, J. (translator) (1543) *De victus ratione in morbis acutis, sive de ptisana*. Paris.

70. For more ancient testimonies on the irritating phenomenon of putridity in connection with beer, see Nelson, M. (2003a) op. cit. and (2014) 'Did ancient Greeks drink beer?', *Phoenix*. 68, p.42, note 101.

71. *Temperamentum* in Latin, εὐκρασία in Greek, literally the 'well-balanced mixture' (of humours). In terms of humoralism it is expressed, in short, as 'a given substance has those humours', that is, it has these specific properties that effect health (balance) or disease (imbalance) in the human body. Consequently, any therapy was carried out according to the *contraria contrariis* principle, for example, an excess of 'hot' humours was countered by 'cold' humours, and vice versa. As to the first formulation of this doctrine in Hippocrates, see Coxe, J.R. (translator) (1846) *The writings of Hippocrates and Galen*. Philadelphia, pp.99-108 and the remarks in note 11 above.

72. Hájek refers to *De morbis popularibus*, see Hippocrates (1894) *Opera quae feruntur omnia*. Kühlewein, H. (ed.) Volume 1. Leipzig, pp.180-245. The Greek physician Hippocrates (c.460 - c.370 BC) is known as the 'Father of western medicine'.

73. See Galen (1823) op. cit.

74. In antiquity grain generally was assumed to be cold and wet; wine was rated as warm and beer as cold, cf. Nelson, M. (2005) op. cit. p.33.

75. Wheat beer was called 'white' (pale) in Bohemia, as opposed to 'black' (dark) barley beer, see chapter 11.

76. For instance by using hot compresses.

77. Medical termini technici meaning 'painless', 'calmative' and 'palliative'. Hájek's second term παρηγεικός does not exist in Greek in this spelling, surely the Hippocratic term παρηγορικός is meant.

78. See the map in chapter 11.

79. Regarding these towns, see the map in chapter 11.

80. See note 62.

81. Hájek refers to what in terms of modern botany is called allelopathy (meaning chemical interactions between plants) and what was known since Greek antiquity as 'antipathy' (ἀντιπάθεια) and 'sympathy' (συμπάθεια) of plants, see Zadoks, J.C. (2013) *Crop protection in medieval agriculture. Studies in pre-modern organic agriculture*. Leiden: Sidestone, p.138-140.

82. Entitled *Liber de ratione victus in singulis febribus secundum Hippocratem*, see Brudus Lusitanus (1544) *Liber de ratione victus in singulis febribus secundum Hippocratem*. Venice, pp.79v-80r. The author Brudus Lusitanus (Manuel Brudo) was a sixteenth-century Jewish-Portuguese physician who practiced for a while in England, see Friedenwald, H. (1939) 'Immortality through medical writ of error. Dionysius: a Portuguese Jewish court physician with notes on Brudus Lusitanus, his son, and on Pierre Brissot', *Bulletin of the history of medicine*. 7, pp.249-256.

83. An early twentieth century British auction catalogue (Zeitlinger, H. and Sotheran, H.C. (1921) *Bibliotheca chemico-mathematica. Catalogue of works in many tongues on exact and applied science, with a subject-index, Volume 2*. London: Sotheran, p.445 and after p.450) listed a copy of Hájek's work, to which recipes for making beer, written 'in a contemporary English hand', are added; see the reproduction of the page in Hájek's text just translated along with recipes in the figure down below.

84. That is, it acts as an aphrodisiac.

85. The term *salicismus* in Hájek's text remains obscure, possibly some kind of salt intoxication was meant. Perhaps it is a mistake on behalf of the typesetter.

86. Sarmatia in antiquity was part of Greater Scythia. The Iranian speaking Sarmatians settled a region around the northern coast of the Black Sea (roughly present-day Southern Russia), cf. note 22. See also Nelson, M. (2005) op. cit. p.41 on the drinking-habits of the Scythians.

87. See Plato, *Leges* 666a-c (already referred to by Hájek in chapter 1) and Galen (1823) op. cit. chapter 1.11; Galen does not specify age restrictions but speaks generally of young people.

88. For more ancient testimonies on the supposed harmfulness or benefits of beer, see Nelson, M. (2003a) op. cit.

89. Drachm = ancient unit of mass, ranging from about 3.4 to 4.3 grams.