

A LITTLE KNOWN, MID-16th CENTURY DESCRIPTION OF THE PRODUCTION OF ENGLISH ALE BY JOHN CAIUS

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Introduction

Some types of beer are enduringly connected with their place of origin, even though they have for many years been produced and consumed far beyond their birthplace. Thus, beer drinkers presumably have at least a vague idea that, for instance, a beer like 'pilsener' originally stems from the Bohemian town of this name.¹ A comparable case is English ale. Yet while historians of beer have investigated the semantics of ale and how it was retailed and consumed, little is known about the internals of its production in early times. How, specifically, ale was made? The present paper introduces a text from 1556 by the celebrated English physician, John Caius, which describes this process. It appeared at a time when ale, traditionally denoting a type of fermented malt-based drink lacking hops, had become a counterpart to a new beverage, hopped beer. First, I will outline how this took place and then I will turn to Caius whose description of the production of ale is presented here for the first time in an annotated translation, along with the original Latin.

How beer and ale became opposites

A 'bit' of information is definable as a difference which makes a difference. Such a difference, as it travels and undergoes successive transformation in a circuit, is an elementary idea.²

Any investigation into what we commonly call beer is confronted with a number of dualities based on historical, cultural, geographical and, not least, linguistic factors. The first and major distinction is that between a

southern European drinking culture, based on wine, as opposed to a northern European drinking culture, based on beer, to be found in Scandinavia, the Low Countries, Britain, and Germany.³ Historically, these two traditions can be traced back to Greek and Roman antiquity where, from both their perspectives, beer drinking customs were seen as 'other' to their own culture. Beer was considered a 'barbarian's beverage' for which, in the absence of an autochthonous notion, many foreign designations (*zythus*, *cervisia*, *curmi*, *brutos*, *celea*,⁴ and numerous others) were appealed.⁵ What is crucial is that from the very beginning the wine-beer duality simultaneously implied qualitative differences such as 'southern-northern' (warm, pleasant vs cold, uncomfortable), 'inside-outside' (familiar, native vs strange, foreign, exotic) or 'cultivated-barbaric' (moderate relish vs heavy drinking or temperate vs immoderate). It matters little how true in detail these perceptions were, they were omnipresent and - as we will see - effective, whether they are stereotypes or not.

Opposite attributes occur not only with respect to evidently different substances, they can also be found within them and this occurred with the arrival of hopped beers to England. Although the evidence is slim, it is usually assumed that hops became popular as an additive to beer in Gaul from the ninth century⁶ and their use on a larger scale is well documented in parts of Continental Europe from the eleventh century onwards. Hops were introduced to England from the Low Countries in the late fourteenth/early fifteenth century,⁷ but they were not welcomed by everyone, particularly the authorities who decried them as a 'Protestant plant', a 'wicked and pernicious weed'⁸ - an example of the age-old opposition 'native' versus 'foreign'. As a conse-

quence, the use of hops was forbidden by Henry VIII in 1530, a ban that lasted until 1552 when it was repealed by Edward VI.⁹ Even when hopped beer became commonly accepted at the end of the sixteenth century ‘beer’ stood for the drink of a Dutchman, while ‘ale’ was perceived as the natural drink of an Englishman.¹⁰ It was not until the nineteenth century, by which time all malt liquor was hopped, that this opposition became redundant.

The distinction between unhopped ale and hopped beer in England was also noticed in Central Europe. In 1585, Tadeáš Hájek, court physician of Emperor Rudolf II in Prague, stated in his pioneering treatise on the production of beer, *De cervisia*, that ‘the more effete ones among the English’ (*molliores Anglorum*)¹¹ used to drink ‘a beer they call ale (*alla*) in popular speech’, which is prepared without the addition of hops.¹² For Hájek this was ‘a reason to praise it less’ because such a drink is bereft of all medicinal virtues and altogether ‘beneficial to nobody except for Venus’, that is, only as an aphrodisiac.¹³ These two types of beverage were also discussed some 30 years earlier in England itself by

John Caius, in a tract published as an epidemic swept the south of the country.

John Caius and the English sweating sickness

From 1485 until 1551 the English people were struck by five waves of a mysterious and fatal disease whose origins are still discussed today. At the time it was called the ‘English sweating sickness’ (*sudor anglicus*) because its victims suffered suddenly from heavy attacks of sweating and commonly died within a few hours. The plague was restricted to southern England, did not occur in other parts of the British Isles and crossed the English Channel to Hamburg and other German towns to eventually spread along the Baltic coast into Scandinavia and Russia. Recently it has been argued that the disease was possibly caused by a, as yet unknown, species of hantavirus carried by rodents.¹⁴

Contemporary physicians desperately tried to discover the causes of the plague and to suggest precautions and remedies.¹⁵ Among them was John Caius (1510-1573),



Figure 1. John Caius, portrait from E.S. Roberts (ed.) (1912) *The Works of John Caius*. Cambridge.



Figure 2. John Caius, portrait from Caius (1556) *Opera aliquot et versiones*. Leuven.

a distinguished English physician, president of the College of Physicians and, in 1557, responsible for the expansion of what became known as Gonville and Caius College, Cambridge.¹⁶ In 1552 Caius published a treatise on the novel epidemic, first in English for a broad audience (*A boke, or counseill against the disease commonly called the sweate, or sweating sickness*),¹⁷ and then, in 1556, in his collected works (*Opera aliquot et versiones*), an extended Latin version for the scholarly world entitled *De ephemera Britanica liber*.¹⁸ In the Latin version Caius postulated that the disease was restricted to England because only this nation drank beer excessively, particularly unhopped ale. For Caius, an ardent follower of Galen's dietetics, it was not beer drinking as such that was the problem, for he knew about the medicinal virtues of beer; rather it was the immoderate consumption (*immoderatio et intemperantia*) that weakened the constitution of 'idle persons, good ale drinkers, and tauerne haunters'¹⁹ and made them susceptible to fatal diseases. At this point Caius felt obliged to go on to an extensive, erudite digression on the history of beer from antiquity and into English ale in particular. Caius finally concluded with the statement: 'All these reasons go to this end, that persons of all countries of moderate and good diet escape this English *Ephemera*, and those be only vexed therewith, which be of immoderate and euill diete'.²⁰ Here we have again, in a new context, the previously men-

tioned opposition between a temperate love of wine versus the immoderate consumption of beer, together with a lamentation over the general decadence and decline of customs.

Caius's description of the production of ale

As already noted, Caius's description of the production of ale was not part of the English text on the sweating sickness, it only appeared in the extended Latin version. The latter was originally published by Caius in 1556 and reproduced verbatim in Roberts's edition of Caius's works (1912),²¹ including a series of minor shortcomings. My translation is based on the amended separate version by Gruner (1814)²² and on the semi-critical edition by Haeser (1847),²³ in turn with a few slight modifications of my own. The division into small paragraphs is also mine (Caius's text is originally set in one large single paragraph). Texts in square brackets [] are added for clarification. Figures in round brackets () within the translation are likewise added for clarification and refer to the graphical and verbose overviews in the Appendix below.

The text at issue here begins when Caius in *De ephemera Britanica* turns to 'the reasons of contagion' (*causis contagionis*). He then continues as follows.

[p. 367, Haeser edition] Huius rei causam quidam ad vinum nostrum hordaceum, potum nobis naturalem, quod Galli cervisiam, nostri *Alam et Beram* vocant, referunt. (...)

[p. 369] Ala et Bera suaves sunt, quod ad hordeum attinet. Id addo, quod Bera ex lupulo amarorem contrahit. (...) At id non Ala et Bera faciunt, sed immoderatio et intemperantia. (...) Quemadmodum autem Ala et Bera nunc dicemus, ut vel hinc constet, quemadmodum haec inter se distent.

Hordeum aqua perfunditur, atque ad aliquot dies maceratur, donec intumescat, et altero suo fine fatiscat germinetque. Tum emissa omni aqua per cisternae fundum, ut inutili, eximitur hordeum. Id per solum tenuiter spargitur, et bis die vertitur. Ita et omnis humor elabitur, nec acervo putredo concipitur, nec mucorem hordeum contrahit.

The reason [why Continental people are not afflicted by the sweating sickness] is seen by some as due to our barley wine, a beverage quite natural with us, which the Gauls²⁵ call *Cervisia*, our people *Ala* and *Bera*.²⁶ (...) *Ala* and *Bera* are sweet, which is owed to the barley. I add this since *Bera* [also] draws bitterness from hops. (...) Yet not *Ala* and *Bera* result in this [sc. health problems] rather it is immoderateness and intemperance. (...) But now we want to describe how *Ala* and *Bera* [are made], so that it may be quite obvious how they differ from each other.

(0) Barley is drenched with water and steeped for a few days until it swells and eventually cracks and germinates. Then the barley is removed after the water is drained from the barley, being useless, by being sent to the bottom of the cistern. The barley is subsequently loosely spread on the ground and turned twice a day so that all the moisture escapes and neither a heap of rotten substances is left nor the barley contracts mould.

Posito iam omni humore, quod paucis fit diebus, paratur concameratus fornax (bunarium dici potest [...]),²⁴ qui ignem admittit, sed non reddit nisi qua recipit. Spiramenta tamen quaedam undique per sua latera ita habet certis intervallis disposita, ut ad superiora calor facile possit commeare. Fornax ille ut est rotundus, ita pariete in quadratum extracto undique, et duo pedes altiori, quam est fornax, cingitur. Per eius ambitum tenduntur crates lignae, et super eas cilicium. Id hordeum tenuiter sparsum, quo calor per spiramenta erumpens ad singula grana pertingat, accipit.

Istis rite peractis, in fornace focus lentus et aequalis incenditur, et donec ad plenum siccatum fuerit hordeum, perennis alitur. Interea hordeum saepius die vertitur, quo aequabiliter siccetur. Cum siccatum probe fuerit, durum est et gustu dulce, tum seponitur in tabulatis ad usus necessarios, et Aëtio βύνη, nostris patria lingua Maltum dicitur.

Cum usus vocat, mola teritur, et in tinam grandem mittitur; illi aqua ferventissima, quae aliquot ante horas in cortina seorsum ebullierit, affunditur. Modus est utrisque pro potestate futuri vini. Nam si potentius placet, plus de buna; sin tenuis, plus de aqua, quam pro iusto alioqui utriusque modo admiscendum est. In ea aqua ferventissima madescit horas tres aut quatuor. Ubi omnis eius vis in aquam transfusa est, aperitur foramen quoddam in tinae fundo, circumvallatum clathro colatorio seu secerniculo vimineo, ne buna fresa inanesque scapi, quibus ea vestiebatur (inutiles nisi iumentis alendis), una cum liquore elabantur, aut foramen repleant, et liquori exitum praepediant.

Ita qua viam repperit, humor dulcis fluit, colore rutilo. Exceptus ille liquor, in aliam tinam inanem funditur, atque ad dimidias coquitur.

Interim omnis spuma tollitur et abiicitur, dein in vasa quaedam lignea, quae minus fundi, sed plus lati habeant, ex cortina refunditur, refrigerii caussa.

Ante tamen quam omnem posuit calorem superestque modicus, ex iis vasis latis in aliam tinam et eam inanem delabatur, confunditur grota, adiciuntur alterius compositionis recens alae flos, perturbantur et magna agitatione

(1) When all the moisture has gone, which happens after a few days, a vaulted furnace is prepared (that can be called a 'malt-kiln') [*bunarium*, from *buna* = malt, see below] which admits fire [heat] yet dispenses only what it obtains. But it has vents on all sides so arranged at fixed intervals that the heat can easily circulate to the upper part. Rotund as this furnace is, it is still surrounded by a wall piled up in the square on all sides and two feet higher than the furnace. Its rim is made tense by fascines and [suspended] above them is a blanket which receives the loosely scattered barley so that the emanating heat may pass through the vents to each single grain.

When all these things are completed properly, the hearth in the furnace is lit and sustained until the barley has become entirely dry. During this time, the barley is turned over several times a day in order to get it uniformly dried. When it is totally dry, it is hard and tastes sweet and is laid apart on panels [floors] ready for use. This product is called by Aëtius βύνη,²⁷ in our language *malt*.

(2a) As custom requires, the malt is ground by a millstone and sent to a large tub; there very hot water, that has boiled for some hours in a separate kettle, is added. (2b) The amount of both substances determines the eventual strength of the [barley] wine. If the drink is to be strong, more malt is needed; if weaker, more water than is otherwise appropriate has to be added. In this extremely hot water the malt is steeped for three or four hours and, when all its power is transfused into the water, an outlet at the bottom of the tub is opened. This is encompassed [covered] by a cross-barred sieve or wicker-work grid lest the crushed malt and the useless stalks that cling to it (useless, apart from as cattle fodder) exit with the liquid or clog the opening.

(3) When the liquor thus has found its way out this sweet humour flows [into an empty tub] and is reddish [golden, *rutilus*] in colour. (4) The collected fluid is then poured into another empty tub and cooked halfway through.

(5) Meanwhile, all of the foam is taken up and put off, then it is poured out again from the kettle [tub] into some wooden vessels [‘troughs’], which are less deep than broad, in order to cool it down.

(6) Yet before it has lost all its warmth and after only a moderate rest, the *grota*²⁸ flows off from these broad vats into another tub which is also empty. It is then mixed with fresh ale froth, which is added from another composition,

conquassantur omnia et commiscentur. Quo fit, ut vinum id aërea levitate floris in duplum rarescat, et virtute grotæ se excellenter purget.

Est autem grotā apozema ex bunae fresae crassamento (unde nomen habet) et liquore iam ante e buna, aqua fervente perfusa, defluente, ad spissitudinem excoctis. Dulcedinem id habet defruti, et animam praebet alae.

Ita ad horas 24, cum in motu naturali ala fuerit, agitante calore, potentia bunae et vi floris atque grotæ, in cupas seu cados ligneos circulis cinctos, antequam fex residat, refunditur, et in cellis viniis subterraneis (quod frigore melius conservatur) reconditur; sed sapore iam suavi, non, ut ante, dulci: ita libet cum Macrobio inter haec distinguere.

In iis cupis apertis ubi aliquamdiu quieverit, secretio partium fit, ut in vino ampelitate, et fex ima, flos summa petit, innatque ut spuma, et superfluit, ala in medio pura consistit. Quod superfluit, vase excipitur, et ad compositiones alae similes atque ad conciliandam panibus levitatem, ciborumque apparatus accommodatur.

Quod spumae a motu superest, incumbitque alae iam quitae, id eam conservando est, dum ab externis iniuriis defendit, et innatam vim atque animam continet. Indicio est, quod cui detractus flos ille est, statim emoritur et vappescit; contra, illo superstite, ni aestas oberit, ad extremum senium (quod tempus est alii menstruum, alii bimestre, alii trimestre, alii annum, prout plus minusve excoquatur) perdurat sapida. Rursum, si flores addas, cui prius demtus fuit, videtur ea reviviscere, et novas vires acquirere.

Cupae statim, ut infunditur ala, ideo non obturantur, quod nondum sedatus motus est, quodque alioquin iniquo loco, rarescante ala, cupae rumperentur. Ita ala fit.

and all this is stirred and with great motion agitated and commingled. Thus it happens that the [barley] wine attenuates due to the airy lightness of the froth twice and, thanks to the vigour of the *grotā*, cleans itself in an excellent way.

The *grotā*, however, is the *apozema* or decoction²⁹ from the ‘gross’ substance (whence it has its name)³⁰ of the ground malt and from the liquid that is already flowing out of the malt, after it has been drenched with boiling water, which were cooked until thick.³¹ It has the sweetness of must and bestows the soul on the ale.

(7) Thus when the ale was up to 24 hours in a state of motion, agitated by the heat, the strength of the malt and the power of the froth and the *grotā*, it is drained off into tuns or wooden vats encompassed with rings, before the yeast [*fex*] settles, and shut up in subterranean wine cellars (by whose cold it is better preserved). The flavour is already pleasantly semi-sweet [*suavis*]; not, as before, very sweet [*dulcis*], to use Macrobius’s distinction between these two terms.³²

(8a) In these open tuns, where [the *grotā*] was kept quiet for a while, a separation of the components proceeds as in wine by means of *ampelitis*³³ and the yeast strives downwards, the froth upwards and floats as foam and overflows, while the pure ale stands still in the middle.

(8b) What overflows is received in a vessel and is used for compositions similar to ale as well as for giving lightness to bread and for the preparation of food.

The foam that is left from the motion and lies on the already quiet ale has to be preserved as long as it is kept off from external damage and retains its innate power and soul. Evidence of this is that, if this froth is removed, the liquid immediately dies off and turns sour. On the other side, if the froth has survived and if not the summer stands against it, it remains savoury for an extremely long time (the time ranges from one, two or three months until one year, depending on how longer or shorter it is boiled out). On the other hand, if one adds the froth that was taken away before, it seems to revive and to acquire new powers.

The tuns would burst immediately when the ale is poured in, therefore it must be ensured that they are not closed because the movement has not settled yet and the ale would otherwise be in a disadvantageous position while it is losing its density and becomes more liquid. That’s the way how ale is made.

Bera eisdem fere modis componitur, nisi quod lupus salictarius cum primo bunae liquore sine grota decoquitur. Quod si quis paullum tritici, et eius crudi, potentiae colorisque gratia (quod fere fit) admiscet, id praeter legitimum necessariumque conficiendi modum est nostrae alae atque berae, et commendandi caussa adhibitum.

Beer is made in almost the same way, except that hops, together with the first malt liquor, are decocted without *grota*.³⁴ If anyone has a little bit of wheat and adds it for the sake of its raw power and colour (which usually happens), this is not an integral and necessary part of the way our ale and beer is made and is added in order to make it recommendable.

The process of brewing ale can be roughly divided into a number of steps that are basically the same today, from a technological point of view, as they were in the past.³⁵ Even though these stages are not always specifically demarcated by Caius and his terminology is inconsistent, they can be discerned reasonably well. Thus we have:

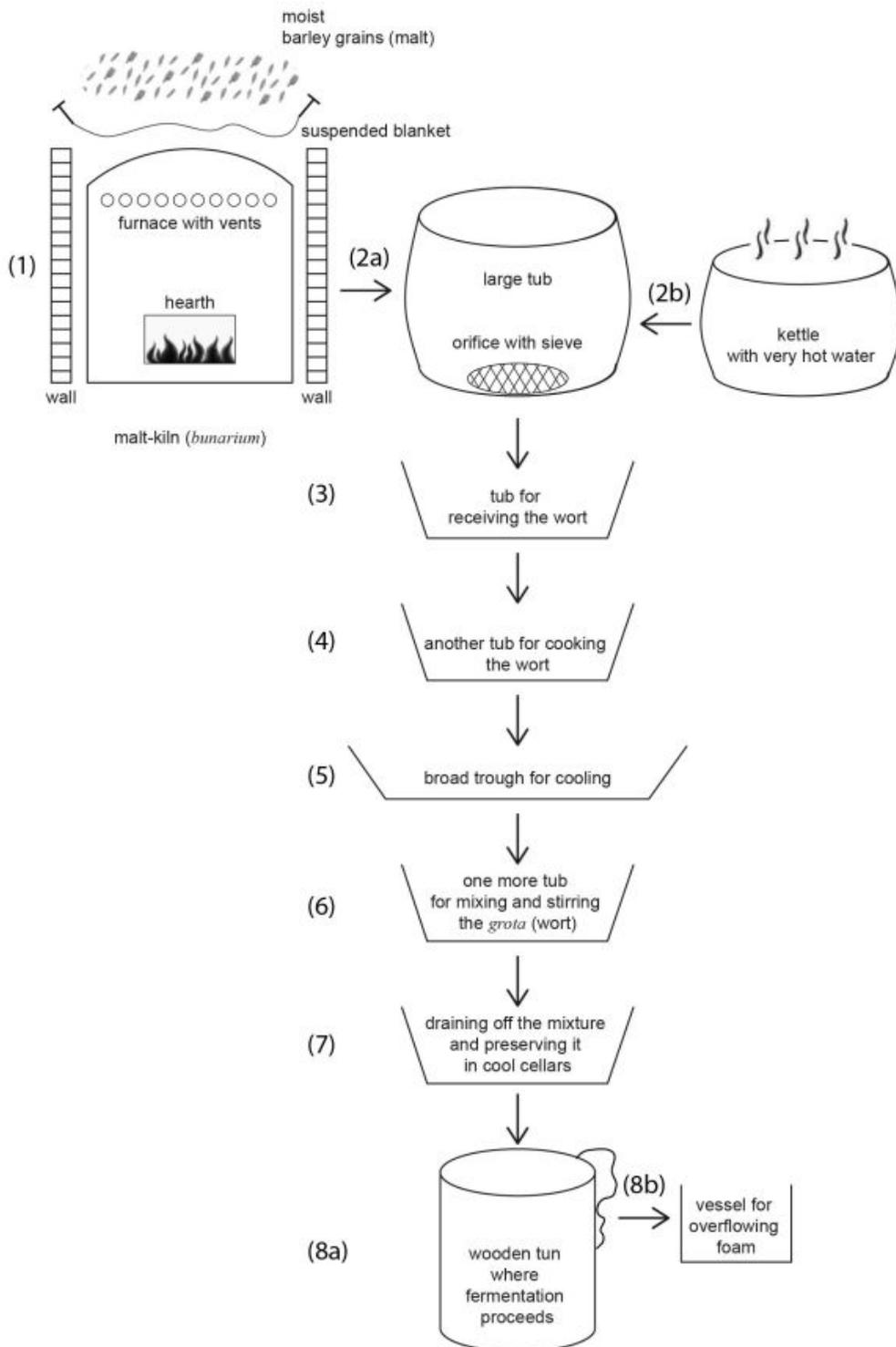
1. malting: inducing germination of grains (mainly barley, wheat, formerly also oats)
2. mashing: soaking, drying and heating the cracked grain, then grinding it to obtain a grist, the malt (*buna*); mixing it with a brewing liquor in a large mash tun (*tina grandis*)
3. lautering: extracting a ‘gross, thick’ liquor, the groats (*grota*) from the mash tun; then draining it off in tuns or wooden vats (*cupas seu cados ligneos*); Caius’s *grota* apparently is the same as what somewhat later Hájek called *cremor polentaceus* (‘malt broth’), a ‘lutinous and viscous substance’ (*substantia lenta et viscida*),³⁶ in a more recent term, the wort
4. adding hops, together with the wort, and boiling the mixture
5. fermenting: starting fermentation in an open tun (*cupa*)
6. maturation of the product, then filling it in casks and finally delivering them to the innkeepers

The final actions of maturing, filling and delivering are not described by Caius, as is, naturally in the case of ale, step 4 concerning the addition of hops. They are all dealt with to a greater extent in Hájek’s treatise of 1585. For reasons of clarity I have tried to visualise the steps in a diagram (Appendix), using Caius’s own wording.

Towards new brewing techniques and tools

Both Caius’s short description and Hájek’s extensive treatise remained singular texts. The next important work, published by William Harrison in 1577, was focused solely on the initial steps of malting and mashing (and was restricted to hopped beer).³⁷ It took more than a hundred years until two further books on the art of brewing appeared, but they do not stand comparison with Caius’s or Hájek’s writings. Worth’s (a physician with strong Paracelsian-chemical orientation) *Cerevisiarum comes*, of 1692, is a rather obscure work³⁸ and similarly Tyron’s book, *A new art of brewing, ale, and other sorts of liquors*, of 1690, though much better, is overloaded with medical and dietary advice (Tyron was a food reformer) and also with astrological speculations.³⁹

In England a new stage was not reached until Michael Combrune’s *Essay on brewing* from 1758,⁴⁰ suggesting the use of a thermometer in brewing,⁴¹ and in Bohemia by Franz Andreas Paupie’s multivolume *Die Kunst des Bierbrauens* of 1794 (in two parts, reedited 1820-21 in three parts, Czech 1801),⁴² likewise introducing the thermometer (and hydrometer) into brewing and suggesting new methods of malting, mashing and hopping. Neither Combrune nor Paupie mentioned the writings of Caius or Hájek, who represented an overcome tradition of brewing that was no more up-to-date due to new technology.



Appendix: steps in the production of ale (according to Caius).

Notes to the graphic

0. Obtaining malt: Barley is poured over with water and steeped for a few days until it may swell and finally crack and germinate. The barley is loosely spread and turned over twice a day.

1. Then a **vaulted furnace** (*concameratus fornax*) with vents on all sides at fixed intervals is used as a kind of malt-kiln (*bunarium*). This furnace is rotund and surrounded by a **wall** (*paries*) that is two feet higher than the furnace. Inside the furnace is a **hearth** (*focus*) for heating. Above the furnace a **blanket** (*cilicium*) is suspended, which receives the previously spread and germinated barley grain that is then dried.

2a. Mashing: After kiln-drying, the grain is sent to a **large tub** (*tina grandis*).

2b. Very hot water, that has been boiled before in a separate **kettle** (*cortina*) is added to the grain, resulting in a mixture in modern times called the **mash**.

3. Lautering: Approximately three or four hours later a **hole** (*foramen*) at the bottom of the tub is opened, which is covered by a **cross-barred sieve or wicker-work grid** (*clathro colatorio seu secerniculo vimineo*), in order to detain malt residues (spent grains, chaff). A sweet humour flows off in a reddish (golden) stream, the **wort** [albeit not named so by Caius], which is collected in an **empty tub**, in brewing today called the lauter tun. [This tub is not explicitly mentioned in the text but follows cogently from Caius's wording: thus, first there must have been an empty tub for receiving the humour, then *another* empty tub (*aliam tinam inanem* - see next step) for cooking it.]

4. The collected fluid is poured into **another empty tub** (*aliam tinam inanem*) and cooked halfway through.

5. The foam is removed and the fluid is poured out again from the kettle (*ex cortina*) [should be the tub (*tina*) from the previous step 4, not the kettle (*cortina*) from step 2b] into **wooden troughs** [my term] (*vasa lignea*), which are less deep than broad, in order to cool down.

6. The *grotta* (= wort) flows off into **another (one**

more) empty tub (*aliam tinam inanem*), is then mixed with fresh froth from another ale composition and all this is heavily agitated and combined.

7. After 24 hours the *grotta* it is drained off into **tuns or wooden vats** (*cupas seu cados ligneos*) and stored in cold subterranean cellars. The flavour of the liquor is now mildly sweet (*suavis*).

8a. Fermentation: In the **open tuns** (*cupis apertis*), where the *grotta* is kept for a while, a separation of the components proceeds (fermentation): the yeast (*fex*) sinks downwards and the froth floats on top as foam, some of which overflows [that is, Caius describes top-fermented beer, as it predominantly was made in the sixteenth century]. The ale remains in the tuns, while the overflowing foam is intercepted in a **vessel** (*vas*) and used for later batches of ale brewing, bread making and other food processes. (8b)

References

1. Pilsen is the traditional German name in once bilingual Bohemia, present-day Plzeň in the Czech Republic; see also Oliver, G. (ed.) (2012) *The Oxford Companion to Beer*. Oxford: Oxford University Press. pp.651-653.
2. Bateson, G. (1971) 'The Cybernetics of "Self": a theory of alcoholism', *Psychiatry: Journal of the Study of Interpersonal Processes*. Vol.34, No.4. pp.1-18.
3. Engs, R.C. (1995) 'Do traditional western European drinking practices have origins in antiquity?', *Addiction Research*. 2. pp.227-239; Nelson, M. (2014) 'The geography of beer in Europe from 1000 BC to AD 1000', in Patterson, M. and Hoalst-Pullen, N. (eds.) *The Geography of Beer*. Dordrecht: Springer. pp.9-21.
4. The latter name, originally denoting a beer from Spain, is etymologically the origin of the English word ale and the Anglo-Saxon *ealu*, respectively, which in turn was adopted from the Danish invaders and their *oel/øl*, see Nelson, M. (2005) *The Barbarian's Beverage. A history of beer in ancient Europe*. London: Routledge. pp.54, 83, 156; Meibomius, J.H. (1668) *De cervisiis potibusque et ebriaminibus extra vinum aliis commentarius*. Helmstedt. chap. 8 and 15; Hornsey, I.S. (2003) *A History of Beer and Brewing*. Cambridge: Royal Society of Chemistry. p.254; Jones, N.R. (2012) 'Ale', in Oliver, G. (ed.) (2012) op. cit. p.27; information on the other names just mentioned can readily be obtained via the index of Nelson's book (2005), keyword 'beer, terms'.

5. Meibomius, J.H. (1668) op. cit.; Nelson, M. (2003) 'The cultural construction of beer among Greeks and Romans', *Syllecta Classica*. 14. pp.101-120 and Nelson, M. (2005) op. cit.

6. Nelson, M. (2005) op. cit. pp.108-109 and Nelson, M. (2014) op. cit. p.17.

7. This date is accepted by several authors, however other notable researchers have argued that hops were imported from Germany to Anglo-Saxon Britain before this date, being known in the eleventh century or earlier, although presumably this remained restricted to sporadic instances and not necessarily for use in beer; see Schönfeld, F. (1938) *Obergärige Biere und ihre Herstellung*. Berlin: Parey. p.177; Wilson, D.G. (1975) 'Plant remains from the Graveney boat and the early history of *Humulus lupulus* L. in W. Europe', *New Phytologist*. 75. pp.627-648; Nelson, M. (2005) op. cit. p.112; Meussdoerffer, F.G. (2009) 'A comprehensive history of beer brewing', in Esslinger, H.M. (ed.) *Handbook of Brewing. Processes, technology, markets*. Weinheim: Wiley. pp.1-42.

8. Quoted from Corran, H.S. (1975) *A History of Brewing*. Newton Abbot: David and Charles. pp.53-55; Unger, R.W. (2004) *Beer in the Middle Ages and the Renaissance*. Philadelphia: University of Pennsylvania. p.100.

9. Oliver, G. (2012) op. cit. p.324; Monckton, H.A. (1966) *A History of English Ale and Beer*. London: Bodley Head. pp.66-70. On the other hand, this ban cannot have been too strictly enforced since we have a contemporary report that describes no less than three kinds of hopped English beer, see Brudus Lusitanus (1544) *Liber de ratione victus in singulis febribus secundum Hippocratem*. Venice. p.80r. Brudus Lusitanus (Manuel Brudo, fl. sixteenth century), was a 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.

10. Kylstra, H.E. (1974) 'Ale and beer in Germanic', in Turville-Petre, G. and Martin, J.S. (eds.) *Iceland and the Mediaeval World. Studies in honour of Ian Maxwell*. Melbourne: Melbourne University Press. pp.7-16; Unger, R.W. (2004) op. cit. p.100.

11. A more friendly translation would be 'the Englishmen of weaker constitution'.

12. Hájek, T. (1585) *De cervisia, eiusque conficiendi ratione, natura, viribus et facultatibus opusculum*. Frankfurt. pp.33, 51; for details on Hájek's work, see Funk, H. (2015) 'Tadeáš Hájek's De cervisia: a sixteenth century treatise on

the brewing of beer with hops', *Brewery History*. 163. pp.41-55.

13. Hájek, T. (1585) op. cit. p.51.

14. Heyman, P., Simons, L. and Cochez, C. (2014) 'Were the English sweating sickness and the Picardy sweat caused by hantaviruses?', *Viruses*. 6. pp.151-171.

15. In 1529, for instance, the well-respected German physician and botanist Euricius Cordus published a tract entitled *Eyn Regiment, wie ma sich vor der Newen Plage/ Der Englisch schweiß genant/ bewaren/ Un so man damit ergriffen wirt/ darin halten sol*. Marburg. Cordus, like Caius later, warned that particularly the 'Swelger und Fresser' ('debauchers and devourers') are threatened by this plague.

16. On Caius's life and works, see - instead of a variety of older contributions - 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, rectifying some obstinate myths about Caius in earlier sources.

17. There also exists a facsimile edition by Malloch, A. (1937) *John Caius, A Boke or Counsell against the Disease called the Sweate* (1552). New York: Scholars' Facsimiles & Reprints. In recent times Caius's tract was ranked among the 'classic descriptions of disease', see Major, R.H. (1945) *Classic Descriptions of Disease. With biographical sketches of the authors*. Springfield, Illinois: Thomas. pp.202-206.

18. 'Ephemera' was an old Galenic term for a kind of fever that lasted only for a short time ('one day's fever').

19. Caius, J. 'A boke or counsell against the disease commonly called the sweate or sweating sickness', in Roberts, E.S. (ed.) (1912) *The Works of John Caius*. Cambridge: Cambridge University Press. pp.1-36.

20. *ibid.*

21. Caius, J. (1912) 'De ephemera Britanica liber', in Roberts, E.S. (ed.) op. cit. pp.77-80.

22. Caius, J. (1814) 'Alae descriptio', in Gruner, C.G. (ed.) *Zosimi Panopolitani de Zythorum confectione fragmentum, nunc primum Graece et Latine editum*. Sulzbach. pp.72-74.

23. Caius, J., (1847) 'De ephemera Britanica liber', in Haeser, H. (ed.) *Scriptores de sudore Anglico superstites. Collegit Christianus Gottfridus Gruner. Post mortem auctoris adornavit et edidit Henricus Haeser*. Jena. pp.369-371.

24. I have omitted a longer clause, which - characteristic of Caius's pedantic but nonetheless imprecise manner of writing - provides only irrelevant information.

25. More precisely, the Gaulish Celts, see Nelson, M. (2005) op. cit. p.51 and Arnold, J.P. (1911) *Origin and History of Beer and Brewing. From prehistoric times to the beginning of*

brewing science and technology. Cleveland: Alumni association of the Wahl-Henius Institute of Fermentology. pp.142-147.

26. It should be noted that already in Anglo-Saxon times *cervisia* is largely attested in Latin documents (see e.g. Monckton, H.A. (1966) op. cit. p.39), while I could find almost no evidence for the use of *bera*, particularly not in Wright, T. (1883) *Anglo-Saxon and Old English Vocabularies*. London: Truber & Co. or Meibomius, J.H. (1668) op. cit. Chp. 14, who only knows *biera* or *bira*; I suspect Caius adopted it from Continental literature, or, more likely, coined the term autonomously, Caius himself once speaks of the ‘novitate vocabulorum Alae & Berae’ (Caius, J. ‘De ephemera Britanica liber’, in Roberts, E. S. (1912) op. cit. p.81).

27. See Aëtius Amidenus (1553) *Aetii medici graeci contractae ex veteribus medicinae sermones XVI*. Vol. 2. Venice. p.592r. Aëtius was a Byzantine Greek physician and medical writer from the mid-fifth to mid-sixth century; βύνη was commonly transcribed in Latin as *buna*, just as in Caius’s text down below. The etymology of βύνη is uncertain and controversial, see Gronovius, J. (1701) *Thesaurus Graecarum antiquitatum*. Vol. 9. Leiden. p.612.

28. *Grota* seems to comply with *gruit*, a polyvalent Germanic term with various meanings, denoting a special beer type, a brewing privilege, a mix of herbs used as additive instead of hops (‘gruit beer’), a kind of flour or, finally, a type of ferment, see Meusdoerffer, F.G. (2009) op. cit. pp.11-12; Meußdoerffer, F. and Zarnkow, M. (2014) *Das Bier. Eine Geschichte von Hopfen und Malz*. Munich: C.H. Beck. pp.54-55; Nelson, M. (2005) op. cit. pp.110, 166; Unger, R.W. (2004) op. cit. p.30-34. However, somewhat different from these well-documented meanings, here explicitly a ‘decoction’ is meant, which apparently is the wort (see note 31), but a translation more in keeping with the period and etymologically closer to the Latin term might be ‘groats’. It seems that Caius has coined the term *grota* by himself, the common Latin spelling was *gruta* (Fuchs, J.W. (ed.) 1988 *Lexicon Latinitatis Nederlandicae Medii Aevi*. Vol. 29. Leiden. pp.2271-2272, under ‘gruta’; Arnold, J.P. (1911) op. cit. p.236).

29. Apozema, Greek ἀπόζεμα, is a decoction, a syrup-like liquid obtained by boiling some vegetable substance; see Isidore of Seville, *Etymologia* 20.3.21 and chapter ‘Of making Apozema’ in Barrough, P., (1610) *The Method of Phisick, Containing the Causes, Signes, and Cures of Inward Diseases in Mans Body. from the Head to the Foote*. London. pp.398-399.

30. *Grautr*, *grot*, *grut* and several other similar derivations originally all meant ‘thick, coarse, big’ (De Vries, J. (1958)

Altnordisches etymologisches Wörterbuch. Vol. 3. Leiden. p.185, under ‘grautr’). Caius derives *grota* from *crassus* (‘solid, thick, fat, gross, stout’), using the word *crassamentum*, a medical term for blood clot.

31. I understand Caius’s *grota* as wort. There existed no established Latin term in England or elsewhere for wort, Kurath, H., Kuhn, S.M. and Lewis, R.E. (eds.) (2001) *Middle English Dictionary*. Vol. 18, Part 2. Ann Arbor: University of Michigan. pp.918-919 have only one evidence (*barzisa* = worte, apparently just a variant of *brasium*, another Latin term for malt); Hájek (1585) op. cit. p.24, likewise circumscribed wort as a ‘malt broth’ (*cremor polentaceus*) that was repeatedly ‘decocted’ (*decoquitur*).

32. The Roman grammarian Macrobius (*fl.* fifth century AD) distinguished, referring to Homer, between a ‘pleasant’ (*suavis*, ἡδύς) and a ‘sweet’ (*dulcis*, γλυκύς) must, the latter being considered harmful (*Saturnalia* 7.7.16); see also Mamoojee, A.H. (1981) ‘Suavis and dulcis. A study of Ciceronian usage’. *Phoenix*. 35. pp.220-236.

33. In antiquity, *ampelitis* (from ἄμπελος, grape-vine) was a kind of bituminous earth used in viticulture, see Pliny, *Naturalis historia* 35.56.194. Caius makes a quite lame comparison because the substance was applied to ‘separate’, i.e. to keep off, vermin from the vine stock.

34. At this place Caius’s description is somewhat obscure, he seems to differentiate between a primary malt liquor (= the mash) and a secondary decoction called *grota* (= the wort). This is correct but the wort is inevitably derived from the mash and cannot be skipped in favour of hops. It seems that ‘grota’ here means ‘gruit’, that is, an herb additive (compare note 28), which would be in line with the usual brewing process.

35. Thomas, K. (2011) ‘Beer: how it’s made - The basics of brewing’, in Schiefenhövel, W. and Macbeth, H. (eds.) *Liquid Bread. Beer and Brewing in Cross-cultural Perspective*. New York: Berghahn. pp.35-46; Esslinger, H.M. (ed.) (2009) op. cit.; Narziss, L. (1992) *Die Bierbrauerei. Die Technologie der Würzbereitung*. Vol. 2. Stuttgart: Wiley.

36. Hájek, T. (1585) op. cit. p.26.

37. See William Harrison’s *Of the food and diet of the English* (= book III, chapter 1 of his *Description of Elizabethan England*), which was appended to Raphael Holinshed’s *Chronicles of England, Scotland and Ireland from 1577*. The text is reprinted in Arnold, J.P. (1911) op. cit. pp.367-368).

38. Worth (Y-Worth), W.Y. (1692) *Cerevisiarii comes* [sic] or, *The New and True Art of Brewing*. London.

39. Tyron, T. (1690) *A New Art of Brewing Beer, Ale, and Other Sorts of Liquors*. London.

40. Combrune, M. (1758) *An Essay on Brewing. With a view*

of establishing the principles of the art. London.

41. Sumner, J. (2007) 'Michael Combrune, Peter Shaw and commercial chemistry: the Boerhaavian chemical origins of brewing thermometry', *Ambix*. 54. pp.5-29.

42. Paupie, F.A. (1794) *Die Kunst des Bierbrauens, physisch - chemisch - ökonomisch beschrieben*. Prague; on Paupie, see

Basářová, G. (2003) 'Der legendäre böhmische Brauer František Ondřej Poupě (Franz Andreas Paupie) 1753-1805', *Jahrbuch der Gesellschaft für die Geschichte und Bibliographie des Brauwesens* 2003. pp.129-146; Teich, M. (2005) 'A chapter in the history of transfer of information on attenuation', *Brewery History*. 121. pp.40-46.