

Powering the porter brewery

James Sumner

Centre for the History of Science, Technology and Medicine, Simon Building, Brunswick Street, University of Manchester, Manchester, UK M13 9PL

Before canals and railways developed as a major transport network, it was seldom profitable to transport beer inland over more than a few miles. In country towns and villages, therefore, beer would be brewed either by a small 'common' brewery that supplied a handful of pubs and private customers, or in an even smaller brew-house attached to the pub itself. Many families also brewed their own beer. However, large-scale mass-production did make sense in the major urban centres – and above all in London, with its ever-growing, thirsty population. Over the course of the 18th century, a handful of London breweries began to boast plants, outputs and distribution systems far greater than anything previously in existence.

Introduction

In the 1810s and 1820s, annual outputs from the largest individual breweries in London rose above 200 000 barrels (each holding 288 pints – about 164 litres) for the first time. In 1826 the leading London brewery, Barclay Perkins, recorded an output of 380 000 barrels (about 109 million pints or 61.9 million litres) – less than the largest modern industrial plants, but still well above the output of a typical regional brewery today. In the context of early 19th-century production, such sites were seen as prodigies – colossal monuments to the power of organization and technical development.

The product of these giant concerns was not the ale popular with rural drinkers, but porter – a dark, hoppy beer that took its name from the licensed fetchers and loaders who worked and drank along the streets and waterfront of London. The peculiar technical nature of porter is deeply intertwined with the development of London breweries into huge, automated powerhouses; so too is the eventual decline of the product and its producers.

Scale, systems and steam

Travel writers of the late 18th century, keen to furnish their readers with 'curiosities' or unusual spectacles, drew naturally upon the giants in their midst. The very sight of a great brewhouse, wrote Thomas Pennant in 1790, 'exhibits a magnificence unspeakable', and the *Picture of London* for 1802 described the astonishing scale of the Whitbread brewery on Chiswell Street on the northern fringes of the City of London [1]. Whitbread had been the single greatest porter producer in former years; two or

three competitors were able to beat its output by the 1800s, but the brewery maintained a reputation for having particularly advanced technical apparatus. The engineer John Farey Jr, who surveyed many London mills and factories when he was still in his early teens, produced an impressive engraving of the site that was widely copied in encyclopedias and technical works (Figure 1).

Contemporary descriptions drew particular attention to the arrangements for power transmission at the brewery, which were among the most systematic in any industry: beams and gearing enabled the rotation of a single, central wheel to drive all the major mechanical operations automatically. Cranks and rods worked a pump to raise water from a well that was sunk deep below the brewery yard to a huge reservoir in the roof. Iron rollers crushed the barley malt, which was then lifted to an elevated storage space by the turning of an Archimedean screw – an enclosed spiral of scooped metal, rising diagonally. The brewing began with the 'mash' – the infusion of the malt in hot water in large vessels known as mash-tuns – while mechanized rakes slowly stirred the mixture. Mashing extracted the soluble fermentables from the malt, producing a sugary liquid that was then boiled vigorously with hops. Another mechanized pump filled the pan of the copper boiler, which could hold 250 barrels of liquid at a time (72 000 pints or 41 000 litres), and the rouser – a spindle with heavy chains attached – rotated to keep the hops in motion during boiling [2].

The extensive system of pipework that ran through the plant carried the hopped malt-extract into long, shallow cooling vessels and then on into the fermenting-house, where the yeast worked its magic. After the initial, vigorous period of 'primary fermentation' the beer was stored, often for months at a time, to undergo a much slower 'secondary fermentation' in order to produce the taste that was characteristic of porter. Most breweries conducted this maturation in large, cylindrical vessels of wood or brick. Whitbread, however, had developed a remarkably efficient space-saving design in consultation with the legendary civil engineer John Smeaton. Stone lining the vaults in the basement of the Whitbread plant transformed them into gigantic storage cisterns that could preserve porter through the extremes of summer and winter, the largest holding almost 4000 barrels' worth of beer (that is around 1.1 million pints or 625 000 litres) [3].

A brewery like the Whitbread operation was a huge, humming system for large-scale production, replete with pipework, conveyors, transmission shafts and storage structures designed for the greatest available economy of space and time. It is particularly interesting that this

Corresponding author: Sumner, J. (james.sumner@manchester.ac.uk).

Available online 3 May 2005

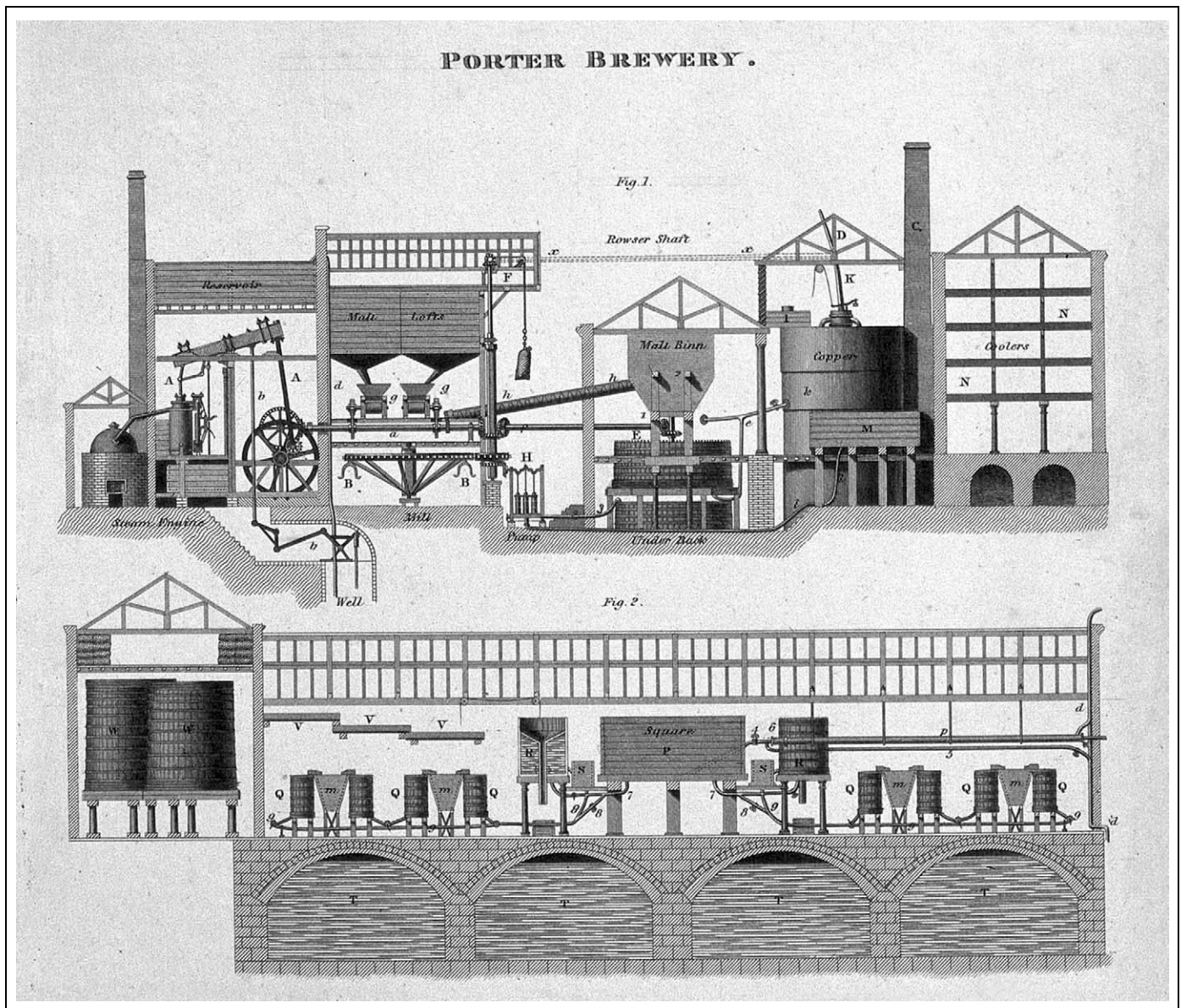


Figure 1. Whitbread's porter brewery, from an engraving based on John Farey Jr's sketches of the 1810s. The depiction is idealized in places so that all of the equipment can be seen at once. The steam engine (A) drives the great wheel (B, with harnesses), which in turn drives the malt grinders (g), lifting tackle (F), Archimedeal screw (h), stirring rakes in the mash-tun (E) and rouser chains in the copper (via the overhead shaft – x). The second elevation, taken at right angles to the first, shows some of the fermenting tuns and the huge, stone-lined basement cisterns. Engraving by W. Lowry, c. 1816, after J. Farey Jr. Image supplied by, and reproduced with permission from, the Wellcome Library, London.

concentration of production by the London brewers began before the introduction of steam: initially, the 'great wheel' at the heart of the Whitbread brewery had been driven by plodding horses. But by the 1780s, steam-engine manufacturers – in particular the rising partnership of Matthew Boulton and James Watt – were looking to expand beyond the limited market for mine-drainage pumps. The slow, heavy rhythm of brewery machinery presented a perfect commercial opportunity. Goodwyn's brewery in East Smithfield, near the Tower of London, was the first to embrace the steam revolution, erecting an engine with Watt's characteristic 'sun and planet' gearing over the summer break in production at the brewery in 1784. But Goodwyn's larger competitor Whitbread had already commissioned a more impressive machine, and almost every major brewer in London followed suit. By 1800, breweries accounted for around 17 of some 150 Watt engines in existence [4].

The engine at the Whitbread brewery was rated at ten horsepower in the informal terms of the day. But after its power was doubled in 1795, the *Picture of London* reported that it could do 'the work of 70 horses', making no more noise than a spinning wheel [5]. The operations at Whitbread were already so mechanized that the engine simply drove the old horse-wheel, which in turn drove the other machinery as before. It was even possible to bring in horses again should the engine fail – an important consideration when loss of power midway through a brewing could ruin a huge volume of valuable product. The harnesses for the horses can still be seen in the engraving of the Whitbread engine, which remained in place until the 1880s when it was presented to the Victorian Museum in Australia. It is now in the Powerhouse Museum (<http://www.powerhousemuseum.com/home.asp>), Sydney, still in working order [6].

Wonderment at the scale of brewery operations continued well into the 19th century. George Dodd's *Days at the Factories*, a book that highlighted various spectacles of industrial achievement in 1843, described a visit to the Barclay Perkins site in the traditional brewing district of Southwark, on the southern bank of the Thames. Dodd told of huge reservoirs, extensive pipework, gigantic maturation vats and a brewhouse 'nearly equaling Westminster Hall in magnitude' (Figure 2). There were 24 wooden bins 'of such extraordinary dimensions...that an ordinary three-storied house – roof, chimneys and all – might be shut up in one of them'; these contained the malt, which was transported by an overhead conveyor belt to the grinding room on the other side of Southwark Bridge Road. The porters after whom the beer was named were now needed only when materials had to travel outside the brewery – an increasingly avoidable event, as the wealthy breweries bought up the property surrounding them so they could expand their operations, incorporating cask-making and other ancillary industries on-site. So rapidly had the Barclay Perkins brewery spread through the Southwark streets that Dodd, lost amid the 'labyrinth' of storerooms and lofts, spied a small churchyard that was visible from a storehouse window, hemmed in on all sides by brewery buildings [7].

Porter and protectionism

Why did some breweries become so large? It is relatively easy to explain why other industries, such as textiles, developed large factory structures – power-driven textile mills raised production cheaply and reliably through rows of small machines made to a common design. By contrast, the industrial brewery needed several enormous pieces of equipment, often built to untested plans, which laid it open to considerable capital risk. Size did bring some obvious benefits: big brewing firms could negotiate bulk discounts for raw materials, and by buying large numbers of pubs could secure a market for their product. However, these benefits did not require a concentrated brewery. We might have expected a wealthy brewer to build up a network of small existing brew-houses, each supplying its own local pubs, but this did not happen. Nor can we assume that steam power provided the crucial advantage of concentration, because the major expansion took place before steam.

A combination of two factors, however, explains the emergence of ever-larger breweries. The first is tax. The British exchequer in the 18th and early-19th centuries depended heavily on the excise duties, levied on goods for purchase, and one of the largest earners was the beer duty – which was applied at the point of production. In rural

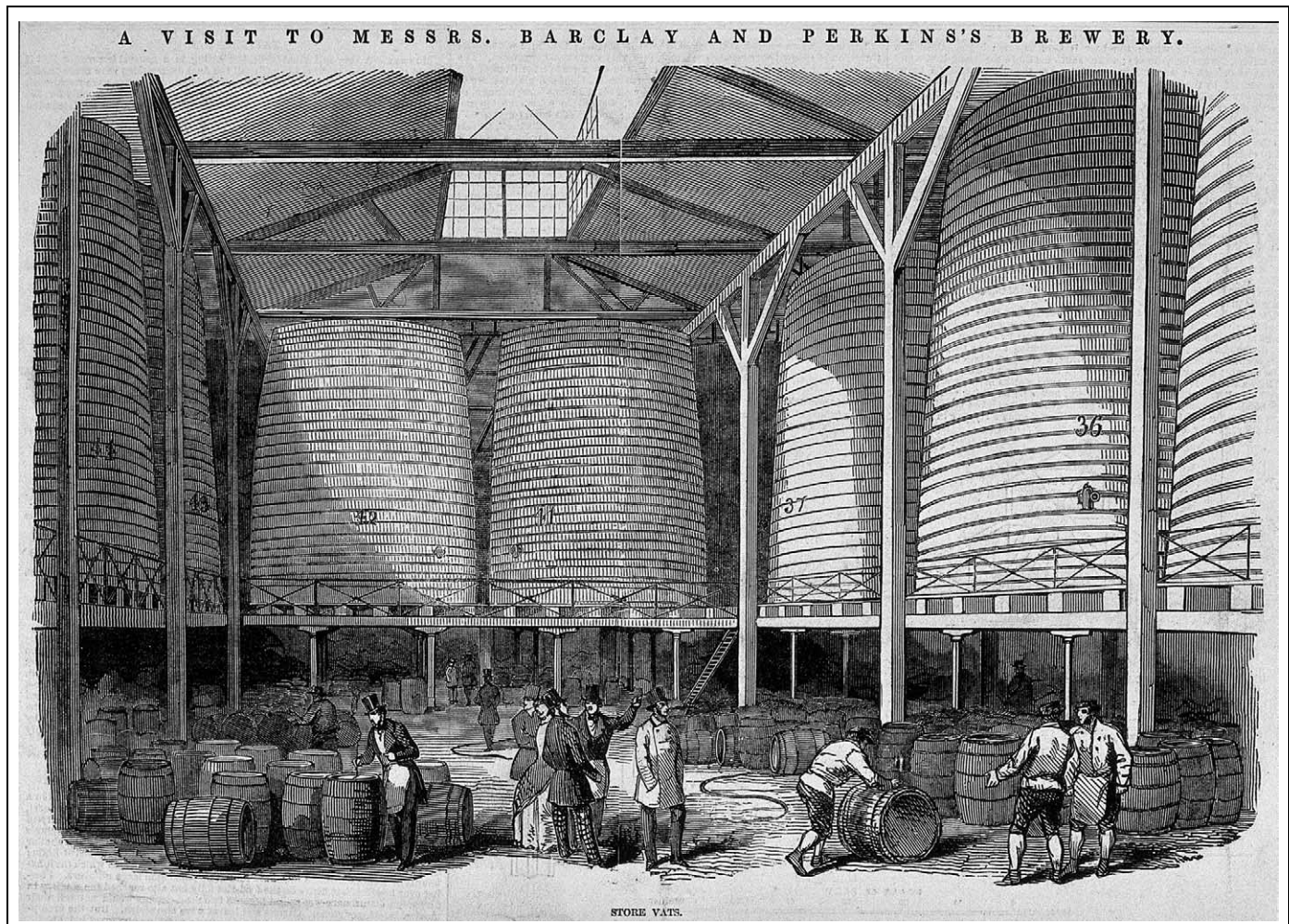


Figure 2. Barclay Perkins' immense store vats, as pictured in the *Illustrated London News*, 6 February 1847. Image supplied by, and reproduced with permission from, the Wellcome Library, London.

districts this resulted in hundreds of excise men traveling between local brewhouses, on foot or horseback, recording volume data and watching out for fraud: unscrupulous brewers could evade paying duty by adulterating strong beer with weak or by concealing newly-brewed beer via underground pipework before inspection [8]. The authorities were therefore keen to push trade into the hands of large city breweries, so long as their operations were concentrated, well-ordered and visible. Large breweries thus received higher rates of tax relief than their smaller competitors, officially on the grounds that large-scale operations suffered more wastage; whereas in reality the efficient, systematic porter breweries had the least wastage of all [9].

The second factor was the character of porter itself. There is an old and established mythology in which porter appears suddenly as a brand-new invention, usually at a very specific time and place [10]. In fact, from what little independent evidence survives we can discern that the term 'porter's beer' seems to have been coined in the early-18th century as a nickname for brown butt-beer, which was an established London drink. The 'butt' was a large cask, equivalent to three ordinary barrels, which was often used for long-term storage in the publican's cellar. The defining features of the beer were hot-dried brown malts, a specialty of the Hertfordshire maltsters who supplied London, and a much larger quantity of hops than would have been used in traditional ales. Both gave the beer a harshness that made it difficult to drink at first, but the high hop rates also dramatically extended its shelf-life. Storage in the butt mellowed the porter, creating a flavour that seems to have appealed to London drinkers [11].

Porter was therefore a more robust and reliable product than ale, and did not require the close attention that small-scale production could provide. It also increased in value as it matured, and could be treated as an investment once it had been stored [12]. Large stocks also made it easy to blend different batches of beer, smoothing out the inevitable variations to create a standard, reliable product. By the 1730s, a decade before Whitbread commenced brewing at Chiswell Street, brown butt-beer was established as a characteristic product of the common brewers in the capital, who were steadily gaining ground over the small publican-brewers who produced ale [13]. By 1760 the name 'porter' was in general use – for a time, it threatened to replace 'beer' as the generic term for malt liquors – and the porter trade was passing to an ever-smaller number of ever-greater breweries.

Porter had become the first beer in Britain whose production varied significantly from the principles of traditional ale-brewing. These were well-known because many householders and publicans still practised them; but the commercial brewery was a relatively closed world that guarded its techniques jealously. The characteristic flavour and appearance of porter thus gained a mystique, becoming an 'impenetrable secret' ripe for speculation, and attention focused on the hulking scale of porter production. Size, it was suggested, did not merely permit economy, concentration and standardization: it positively contributed to the unique taste of porter through some arcane chemical property of bulk storage [14]. The major

brewers were only too happy to encourage this belief, which undermined both the credibility of their smaller competitors and the accusation that the secret behind the taste of porter lay in dangerous additives.

Consequently, storage volume – not total capacity, but the size of individual maturing vessels or 'tuns' – became the chief source of pride among the London brewers. Towards the end of the 18th century rival brewers vied to construct the largest and most impressive tuns, until in 1795 Richard Meux commissioned a behemoth capable of holding 20 000 barrels (5.8 million pints or 3.3 million litres). A ceremonial dinner, seating 200, was reportedly held inside another such tun in 1795 [15]. Modern beer writers can seldom resist narrating, often with fanciful embellishments, the catastrophic downfall of this particular trend. In 1814, a vessel at Henry Meux's brewery off Tottenham Court Road that contained over 3000 barrels of porter burst suddenly: the force of the flood demolished the brewery wall and part of a nearby tenement row, killing eight people [16].

Tun sizes were understandably scaled back in the wake of this calamity: but the association between porter and industrial magnificence was firmly entrenched and became increasingly associated with the steam power now prominent in other fields (most obviously textiles). Around a dozen 'power-loom brewers', as they saw themselves, now reigned over London and its hinterland [17]. The favourable tax regime and the assumption of consumers that 'true' porter required an industrial scale meant that smaller breweries were unable to offer serious competition to the giant London brewer. The capital investment required to set up a large-scale brewery was immense, so there was no easy way for the smaller breweries to expand.

Vocal opposition came from free-traders, and others concerned that the power held by these large-scale breweries facilitated all manner of nefarious practices; but the only serious commercial challenge to the apparent monopoly came to nothing. The Golden Lane Genuine Beer Company, established in 1804, set out to undercut the whole of the existing industry. Employing a 36-horsepower steam engine – a level unprecedented in brewing – the partnership initially enjoyed riotous success, outstripping Whitbread to become the third-largest producer (behind Barclay Perkins and Meux Reid) in 1807. However, a series of complex legal trials – perhaps motivated by its competitors – and liquidity problems led to a fall in production. A smaller, more flexible brewer could perhaps have ridden out such uncertainty, but the acute diseconomy of such a large plant operating below capacity soon crippled the enterprise [18].

The decline of porter

A fresh challenge, however, soon developed that would lead to the marginalization of the staple product of the major brewers, and ultimately to their own extinction. Its roots lay partly in technical achievements that had led to subtle changes in the character of the drink. Research in the 1780s had established that pale malts contained more fermentable sugars than the Hertfordshire brown malts used to make traditional porter [19]; porter breweries thus

began to use a greater share of pale malts while at the same time cutting back maturation times, and adding a small quantity of charred 'black malt' to maintain the expected dark colouring of their beer. Although the gigantic scale of production survived these changes, thanks largely to improved temperature-management techniques that ensured the stability of the product, porter was in fact becoming more like a dark-coloured ale [20]. Not everyone found the change agreeable: 'the consumer', mused the brewery writer George Adolphus Wigney, 'might drink with almost as much zest, a decoction of raw and burnt coffee' as the synthetic compound of pale and blackened malts [21].

Yet the same techniques of temperature-management had been studied by the brewers of paler ales and beers who still dominated the trade further north. Ale, the volatility of which had once excluded it from large-scale production, became a carefully-managed industrial product, and with the arrival of rapid freight, via canals and railways, ale brewers based in provincial centres such as Burton-on-Trent and Tadcaster gained access to metropolitan-sized inland markets and began to produce on an ever-growing scale. Meanwhile, London tastes were changing as drinkers began to accept the increasingly ale-like porters. Faced with the growing provincial threat, and with increased competition from metropolitan ale producers such as Charrington, the porter giants had no choice but to take up ale production themselves. In 1843, Dodd found an 'ale department' at Barclay Perkins; the other producers gradually followed suit, Henry Meux's successors apparently being the last to do so in 1872.

But the famous names of the pale ale era – Bass, Worthington, Tetley – belonged to the midlands and the north. London porter was entering a long, slow decline that would terminate with its general disappearance from the public mind. Today, the name of Barclay Perkins is unknown to younger drinkers, and only a historian would recognize Goodwyn or Meux Reid. Whitbread survives, as a brand of the multinational InBev, although its only product now is a bitter – a light style, descended from the hoppy pale ales of the later 19th century. Porter itself is found today only as a revival style, brewed on a small scale by some independent breweries (for more information on the fate of the older brewing firms, see Box 1).

The colossal production plants, too, are gone. Industry in general has mostly departed from the City of London and Southwark; London's two surviving breweries, both independents, lie far out in the suburbs of Wandsworth and Chiswick. The mighty Barclay Perkins brewery was demolished in the 1980s; subsequent redevelopment revealed that part of the legendary Globe Theatre lay buried beneath the site, whose longer-lived function is commemorated in the name of Porter Street, located east of Southwark Bridge Road. The premises that Whitbread operated on Chiswell Street, although still intact, are now a conference venue, of which the majestic Porter Tun Room (still so-named) forms the centrepiece.

Nevertheless, porter has a better-known legacy: stout. The success of the Guinness brewery in Dublin and its distinctively dry, jet-black interpretation of the style has obscured its London origins as a strong variety of porter.

Box 1. Where are they now?

In 1955 Barclay Perkins merged with Courage, a Southwark ale-brewery that had grown powerful over the 19th century. Courage, in turn, passed between a series of acquirers before a 1990s merger into the Scottish & Newcastle group (www.scottish-newcastle.com).

Whitbread brewed under its own name almost to the end of the 20th century. Whitbread plc (www.whitbread.co.uk) now trades as a 'hospitality company', having sold its beer arm in 2000 to Interbrew of Belgium, which is now part of the global conglomerate InBev (www.inbev.com).

Goodwyn, the steam engine pioneer of East Smithfield, was later known as Hoare's brewery. It was acquired by the ale-brewer Charrington in 1933 and ceased to brew.

The successors of Richard Meux, and several other great firms, can be traced through a series of mergers to acquisition by the Grand Metropolitan hotel chain. Grand Met had divested most of its British beer interests by the time it merged with Guinness in 1997 to form Diageo (www.diageo.com). Henry Meux, which was set up following a family dispute in 1808, became part of Friary Meux before passing to the mainly northern and midlands group Allied Breweries and closing in 1964.

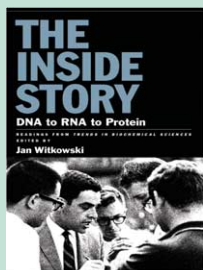
In a complex series of manoeuvres after 1990, the brewing interests of Bass (by now including Worthington and Charrington) and the former Allied (including Ind Coope and Tetley) were partitioned among the multinationals Interbrew (now InBev), Coors (www.coorsbrewers.com) and Carlsberg (www.carlsberg.co.uk). A community of small, independent breweries survives, however, including the Londoners Fuller's (<http://www.fullers.co.uk/>) and Young's (www.youngs.co.uk).

In 2004, the parent group of Guinness, Diageo, announced plans to close its brewery in Park Royal, to the west of London, transferring all production to Dublin. The proposal requires a 50% expansion in output from the Dublin site, taking annual production to six million hectolitres per year – roughly ten times the prodigious effort of Barclay Perkins in 1826 [22]. We might have expected the increasing mobility and stability of beer to bring the London porter era to a close by abolishing the advantages of concentration; on the contrary, it has done so by permitting concentration as never before.

References

- Pennant, T. (1790) *Of London*, London, p. 279 and Feltham, J. (1802) *The Picture of London for 1802*, London, pp. 248–251
- Rees, A, ed. (1819) *The Cyclopaedia, or universal dictionary of arts and sciences and literature*, London, entry for 'Porter'. This text was originally released in 1814, and was probably written by John Farey Jr himself: see Woolrich, A. (1998), John Farey Jr, Technical author and draughtsman. *Industrial Archaeology Review* 20, pp. 49–68 (op. cit. p. 67)
- Mathias, P. (1959) *The Brewing Industry in England 1700–1830*, Cambridge University Press, Cambridge, UK pp. 60–61
- Mathias, P. (1959), pp. 84–91
- Feltham, J. (1802), *loc. cit*
- Hartenberg, R. (1986) Boulton and Watt Rotative Steam Engine: An International Historic Mechanical Engineering Landmark. *American Society of Mechanical Engineers* (www.asme.org/history/brochures/h111.pdf)
- Dodd, G. (1843) *Days at the Factories*, Charles Knight, London, UK pp. 17–38
- Ashworth, W. (2003) *Customs and Excise*, Oxford University Press, Oxford, UK pp. 212–214
- Ashworth, W. (2003), p. 213 and pp. 220–221; and Mathias, P. (1959), pp. 362–364
- For instance 'Bickerdyke, J.' – the pseudonym of Charles Henry Cook (1886) *Curiosities of Ale and Beer*, Field and Tuer (London, UK), pp. 365–368

- 11 Macdonagh, O. (1964) The Origins of Porter. *Economic History Review* 16, pp. 530–535
- 12 Tuck, J. (1822) *The Private Brewer's Guide to the Art of Brewing* (2nd edn), London, pp. 6–7
- 13 Ellis, W. (1736) *The London and Country Brewer* (2nd edn), London, pp. 36–37 and p. 43
- 14 Watkins, G. (1767) *The Compleat English Brewer*, London, pp. 122–123
- 15 Pennant, T. (1790), *loc. cit.* and Mathias, P. (1959), p.61
- 16 *The Times* 20 October (1814), p. 3
- 17 The UK Parliament. Evidence of Charles Barclay, report from the Select Committee on the sale of beer by retail, 1830. *Parliamentary Papers for 1830* 10, p. 16
- 18 Mathias, P. (1959), pp. 243–251
- 19 Sumner, J. (2001) John Richardson, saccharometry and the pounds-per-barrel extract: the construction of a quantity. *British Journal for the History of Science* 34, pp. 255–274
- 20 Mathias, P. (1959), pp. 73–77
- 21 Wigney, G. (1835) *A Theoretical and Practical Treatise on Malting and Brewing* (2nd edn), Brighton, p. 234
- 22 Diageo announces plan to move Guinness brewing from GB to Ireland, 15 April 2004. Diageo news release, online at www.diageo.com/pageengine.asp?menu_id=0&site_id=2§ion_id=9&page_id=1129



The Inside Story: DNA to RNA to Protein
Readings from *Trends in Biochemical Sciences*

Edited by Jan A. Witkowski
(Cold Spring Harbor Laboratory Press)

From its first issue in 1976, *TiBS* has published articles on the history of biochemistry, and cell and molecular biology. These 'historical reflections' are fascinating stories written by those who did the research or by the best historians of science.

2005 sees the 50th anniversary of the founding of the International Union of Biochemistry and Molecular Biology (IUBMB). To celebrate, a selection of these delightful articles from *TiBS* over the years have been put together to form a collection that ranges from the earliest days of biochemistry to protein and DNA sequencing. Within *The Inside Story: DNA to RNA to Protein*, you will find charming – and truthful – accounts of research that are, indeed, the inside story.

Order your copy of *The Inside Story: DNA to RNA to Protein* by Jan A. Witkowski from June 2005 at www.cshlpress.com (US\$29.00/£16.95).