The St. John’s Hospital Cemetery and Environs, Cambridge: Contextualizing the Medieval Urban Dead

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The excavation of four hundred complete and partial in situ burials from the Hospital of St. John the Evangelist, Cambridge, represented one of the largest medieval hospital osteoarchaeological assemblages from the British Isles. The significance of the group is enhanced by the detailed investigation of a carefully maintained network of pathways associated with the cemetery, the archaeological sequence that pre- and post-dated its use and a number of contemporary properties that were situated immediately outside its bounds. This evidence allows the cemetery to be placed within its urban context in a way that is rarely possible. The overwhelming majority of the burials were extended west-east aligned supine inhumations without grave-goods. Atypical burials included examples aligned east-west and south-north, a double burial, a prone burial and individuals buried with a jet crucifix and a brooch. Other significant finds included a nearby pit with four bodies in it, an anthropomorphic bone handle and a reused cruciform horse harness pendant. The proportion of males and females in the burial population is similar, whilst individuals who died under the age of sixteen are relatively uncommon and individuals aged under five are completely absent.

INTRODUCTION

In 2005–12 the Cambridge Archaeological Unit (CAU) conducted a series of archaeological interventions on behalf of St. John’s College, Cambridge, within a street block situated directly opposite the college’s entrance; bounded by Bridge Street, St. John’s Street and All Saint’s Passage (Illus. 1) (Cessford 2012; see also Hall and Dickens 2005; Cessford 2006; 2009; Newman 2008; Cessford and Dickens 2011). This work has revealed a complex sequence of urban remains (Illus. 2), including in particular a significant proportion of the cemetery of the Hospital of St. John the Evangelist (henceforth the Hospital). The site of the Hospital itself, situated beneath the current St. John’s College, has been subject to more limited archaeological investigations by the CAU between 1991 and 2011 that have partly elucidated the nature of the high–late
ILLUS. 1 Location plan of archaeological investigations
Discontinuous section of the overall archaeological sequence, highlighting the graves and other features contemporary with the cemetery, with inset of side-on view of thirteenth–fourteenth century prone burial F.958
The aim of this article is to address several issues:

- What was present before the Hospital and the cemetery were established and how the site was transformed to create the burial ground
- The layout, organization and environment of the cemetery
- The profile of the burial population
- The nature of burial practice and any deviations from the norm
- The influence of the cemetery upon a densely occupied street block
- The impact of the burials on subsequent activity

BACKGROUND

Before discussing the cemetery itself it is necessary to consider what activity took place on the site prior to its establishment and also to examine what is known of the main Hospital site. There is evidence for activity in the area during the prehistoric and Romano-British periods, including one burial (F.982; Illus. 3) initially believed to be later in date before it was radiocarbon dated to the late 1st–3rd century cal. AD (Table 14). This evidence has little direct relationship to the later occupation and will not be discussed here. The one feature that had an enduring influence on the medieval and later site is the line of a Roman road that was preserved by the line of Bridge Street, indicating some level of landscape continuity and the probability that the ford over the River Cam retained its significance. The medieval sequence commences in the early tenth century, although the area had presumably been utilized for agricultural purposes prior to this by the community that is known to have occupied the Castle Hill area across the river since at least the eighth century (Cessford et al. 2007). The earliest evidence for activity at the site was heavily truncated, but appears to represent a scatter of features — including traces of timber buildings — that suggest there was some form of dispersed occupation prior to the establishment of more intensive urban settlement in the area. By the mid-/late tenth century, this occupation had expanded markedly and the area was recognizably urban in character.

The newly established street block had two principal frontages, along Bridge Street and St. John’s Street respectively; these appear to have been of broadly similar importance, although the Bridge Street frontage may have enjoyed a slight primacy. Initially, there appear to have been six rectangular plots fronting onto Bridge Street and four fronting onto St. John’s Street; their boundaries could be identified through the presence of either ditches or distinctive rows of pits (Illus. 3). The investigated portions of these properties all displayed signs of intensive occupation and activity, largely relating to their backyards, with evidence for gravel quarrying, timber structures, yard surfaces and two wells (F.586/1057 and F.046/365).

Occupation continued throughout the tenth to twelfth centuries. The nearby church of All Saints, later known as All Saints in the Jewry, was in existence by c. AD 1077–93 (Riley 1867, 55; for location see Illus. 1). Pertaining to this period was a pit (F.939), radiocarbon dated to the late tenth to mid-twelfth century (Table 14), which contained a group of four partial cat skeletons. The remains were completely devoid of cut marks.
and although none were newborn or very young, all were aged less than 15 months. This suggests that they comprised a group of unrelated, relatively young cats that were disposed of en masse.

The creation of the cemetery meant that a significant portion of four existing domestic plots had to be cleared of obstructions. It is likely that existing features such as ditches, pits and wells were filled in and any above ground structures demolished. Whilst it is impossible to associate any individual feature with this clearance with

ILLUS. 3  The street block before the cemetery, showing the location of the Romano-British burial and eleventh-/twelfth-century wells
absolute certainty, there are a number of features that stratigraphically immediately preceded a general levelling deposit associated with the construction of the burial site and contained pottery that indicates they date to the late twelfth to early/mid-thirteenth century; including Developed Stamford ware, pink shelly ware, Lyveden/Stanion ware, Ely ware and various coarsewares (Table 1; Illus. 4.1). Approximately half of the coarseware forms a homogeneous group in a single sandy grey fabric; we have termed this previously unrecognized ware Cambridge-type sandy ware. The only recognizable forms present were jars, although given the relatively small assemblage this may not be representative. These were all wide-proportioned and of rounded form, with everted rims and a mixture of rilled and thumbed decoration (Illus 4.2–4.4). The material from these immediately pre-cemetery features is of interest because it can be relatively closely dated and also because it appears to include items that were deliberately discarded rather than being removed by their owners. This includes an almost complete sandy ware jug (Illus. 4.5), a decorated spoon (Illus. 5.1) (MacGregor 1985, 181–83), spindle whorls (Illus 5.2–5.3) and a comb (Illus. 5.4).

The Hospital itself was certainly in existence by 1204 having been established c. 1195 (on the documentary evidence for the hospital see Rubin 1987 and Underwood 2008). It was founded by townspeople as a ‘hospitale simplex’ (simple hospital) and was initially the ‘pauperium bordam’ (poorest of shacks) erected on a valueless piece of waste ground, although it soon became a ‘locus religious’ (place of religion) with an ecclesiastical licence and under ecclesiastical supervision. This description is somewhat at odds with an area that had been part of the town for c. 250 years, but whilst an element of rhetoric may have been involved there is also likely to have been some basis in reality. At the Chapel Court site there is evidence that after a prolonged period of alluviation a major program of land reclamation was initiated in the late eleventh/early twelfth century. A substantial ditch with an associated tank was inserted perpendicular to the river. The ditch may have also functioned as a channel for small vessels. This land reclamation then continued with establishing a network of smaller ditches both parallel and perpendicular to the River Cam. By the mid-thirteenth century the area was dry enough for buildings to be constructed, although the main ditch continued in use as a channel until the fifteenth century.

Recent investigations on the main Hospital site have been very restricted, although these can be supplemented by records of two buildings known as the Infirmary and Chapel that survived until the 1860s (Babington 1864; 1874; Willis and Clark 1886, vol. II, 296–97). The location and nature of the earliest Hospital buildings remain unknown, although some fragments of moulded stone from a mid- to late twelfth-century building with a large arch discovered at Chapel Court may derive from an early chapel. The structure later known as the Infirmary was probably constructed as a chapel in the early to mid-thirteenth century. This was later replaced by the structure known as the Chapel, recent small-scale investigations of this structure revealed the presence of clunch (a local type of chalk) stall footings and a tiled floor within the quire. Redeposited fragments of clunch mouldings from sixteenth century deposits at the Chapel include several pieces with three-quarter hollows flanked by fillets dated c. 1250–1400, whilst an in situ door jamb with a similar moulding was also encountered. A group of moulded stone from near the cemetery contained closely comparable material of c.
| Phase                                      | Ware                      | Count | Weight (g) | Mean sherd weight (g) |
|--------------------------------------------|---------------------------|-------|------------|----------------------|
| **Romano-British**                         | **Total**                 | 24    | 384        | 16.0                 |
|                                            | Residual Romano-British wares | 4    | 30         | 10.0                 |
|                                            | Thetford-type ware        | 4     | 101        | 25.2                 |
|                                            | St. Neots-type ware       | 7     | 119        | 17.0                 |
| **Early pre-cemetery occupation (early/mid-tenth century)** | **Total**                 | 15    | 250        | 16.7                 |
| **Main pre-cemetery occupation (mid-tenth–late twelfth century)** | **Residual Romano-British wares** | 87    | 1378       | 15.8                 |
|                                            | Thetford-type ware        | 510   | 13371      | 26.2                 |
|                                            | St. Neots-type ware       | 670   | 8684       | 14.4                 |
|                                            | Stamford ware             | 21    | 271        | 12.9                 |
| **Total**                                  |                           | 1288  | 23704      | 18.4                 |
| **Latest pre-cemetery occupation (late twelfth–early/mid-thirteenth century)** | **Residual Romano-British wares** | 50    | 1010       | 20.2                 |
|                                            | Thetford-type ware        | 179   | 4358       | 24.3                 |
|                                            | St. Neots-type ware       | 201   | 2212       | 11.0                 |
|                                            | Stamford ware             | 15    | 146        | 9.7                  |
|                                            | Developed Stamford ware   | 1     | 5          | 5.0                  |
|                                            | Pink shelly ware          | 23    | 655        | 28.5                 |
|                                            | Lyveden/Stanion ware      | 16    | 405        | 25.3                 |
|                                            | Ely ware                  | 94    | 1322       | 16.3                 |
|                                            | Cambridge-type sandy ware | 76    | 3199       | 42.1                 |
|                                            | Misc. coarsewares         | 81    | 1427       | 17.6                 |
| **Total**                                  |                           | 736   | 14949      | 20.3                 |
| **Equivalent to pre-cemetery occupation in immediately adjacent investigation** | **Thetford-type ware**    | 125   | 1447       | 11.6                 |
|                                            | St. Neots-type ware       | 149   | 1291       | 8.7                  |
|                                            | Stamford ware             | 3     | 26         | 8.7                  |
|                                            | Lyveden/Stanion ware      | 1     | 9          | 9.0                  |
|                                            | Ely ware                  | 4     | 45         | 11.2                 |
|                                            | Grimston ware             | 1     | 3          | 3.0                  |
|                                            | Misc. coarsewares         | 25    | 439        | 17.6                 |
| **Total**                                  |                           | 308   | 3260       | 10.6                 |
ILLUS. 4  Late twelfth-/early to mid-thirteenth-century pottery

1) Relative proportions of late twelfth-/early to mid-thirteenth-century pottery fabrics, by weight
2) Reduced sandy ware jar, decorated with waves of incised lines
3) Reduced sandy ware jar, decorated with horizontal incised lines and an applied, thumbed vertical strip
4) Jar in dull brown, hard fabric with slight sand content. Decorated with an applied, thumbed collar and a similar vertical strip
5) Oxidized orange ware containing some sand and white flecks of white quartz sand grains. Medium proportioned shouldered hollowed rim jug with a stabbed strap handle and rows of stamped triangular and rectangular decoration on the body. Closely paralleled by a jug identified as Huntingdonshire Fen Sandy Ware (Spoerry forthcoming)
ILLUS. 5 Late twelfth-/early to mid-thirteenth-century artefacts

1) Bone spoon, handle decorated with incised lines, projecting knobs at junction with head and spatulate head with a rounded end
2) Bone spindle whorl
3) Chalk spindle whorl, decorated with incised lines
4) Composite bone comb, Type 7 irregular form of tenth–eleventh century (Ashby 2011)
1260–1340, apparently from a freshly-demolished high-status religious building. This material was reused in the late sixteenth–mid-seventeenth century and may derive from alterations undertaken to the Chapel. One of these pieces was a sill cut from a drafting block, where one joint retained a palimpsest of geometrical marks from superimposed 1:1 designs (Illus. 6). This is a stonemason’s working drawing (Adamson 2014) and is comparable to another drafting block associated with the Chapel (Biddle 1961). One possible context for the construction of the Chapel is in 1280–84 when the Hospital population briefly expanded due to the presence of ‘the Scholars of the Bishop of Ely’, prior to their move to Peterhouse (Underwood 2008, xxvi).
construction of the Chapel led to a change of function for the Infirmary, giving rise to its post-medieval name. To the south of the Chapel there was probably a cloister surrounded by buildings and accounts of c. 1498–1507 mention repairs to the ‘hall, cloister, kitchen, buttery, bakehouse and almshouse’, some of which were at least partially of timber or wattle-and-daub construction (Underwood 2008, xxviii).

During the medieval period burial took place at both the cemetery and the Hospital, where the master and brethren, plus major benefactors and other prominent individuals would have been interred. Recent investigations revealed that the Chapel sealed deposits containing disarticulated human bone, presumably related to burials associated with one of its predecessors. A charnel pit discovered in 1938–39 contained the remains of at least a dozen individuals (Daniel 1939); these probably derive from burials associated with the Chapel disturbed during the construction of Second Court in 1599–1601.

The documentary evidence indicates that the Hospital was established to care for the ‘poor and infirm’ and under the Augustinian rule (adopted in 1250), if not earlier, the Hospital was to be for poor scholars or other wretched persons. Pregnant women, lepers, the wounded, cripples and the insane were all specifically excluded (Rubin 1987, 157). In the time of Henry IV (r. 1399–1413) the Hospital was still to be for the ‘maintenance of poor scholars and other sick people’ (Rubin 1987, 110). As a charitable institution reliant largely upon donations from the burgess community of the town and relatively wealthy inhabitants of nearby villages the other major function of the Hospital was religious intercession on behalf of its benefactors. Over time the nature of the Hospital changed, by the late thirteenth and more especially the fourteenth centuries donations were largely to maintain chantries, chaplains at either the Hospital or elsewhere whose role was to pray for the benefactor. By the fifteenth century the Hospital housed only a few token almspeople and its activities were linked more to chantry services and charitable distributions. This decline in numbers was matched by a proliferation of other institutions taking care of those who might previously have fallen within the remit of the Hospital, as c. 1470–85 four sets of almshouses were established in Cambridge (Reynolds 1959).

THE CEMETERY (Cessford 2015 S01, S02, S03, S04, S05)

The Hospital acquired the ‘right of burial wherever they wished’ in 1204–15 and most probably in 1204 (Karn 2013, 10), although a cemetery is not explicitly mentioned. The right to a graveyard was confirmed in c. 1222–25 (Karn 2013, 107) and two gifts to the Hospital in c. 1225 were accompanied by requests for burial (Underwood 2008, xiii note 7). These documents may well relate to the main Hospital site rather than the cemetery. The graveyard was established by taking over four existing domestic plots, either in their entirety or more probably leaving a portion of their frontages in domestic occupation to provide rental income. Unfortunately, the documentary evidence for this is largely undated. The cemetery was definitely in existence by 1250 (Underwood 2008, nos 74–75) and it is conceivable that it was established as late as c. 1230–40, although it may well have been several decades older. Mid-thirteenth century references to the burial ground as the novum cimiterium hospitalis (new cemetery of the hospital) have led
to the suggestion that there was a separate early to mid-thirteenth-century ‘old’
cemetery (Rubin 1987, 181 f. 233; Underwood 2008, xii–xiii). Whilst this is possible,
the ‘old’ burials may simply have been interred in and around the Hospital chapel or at
the nearby parish graveyard of All Saints.

LAYOUT AND ORGANIZATION

The cemetery was accessed by an entrance leading on to St. John’s Street, located
outside the area of investigation (Illus. 7). It almost certainly possessed some form of
physical boundaries, with evidence for a series of shallow ditches along the eastern side
of the burial ground (for location see Illus 2 and 7). There was no physical evidence on
the northern and southern boundaries; by a process of elimination these are likely to
have been defined by fences or hedges. The major feature within the cemetery was a
network of long-lived gravel paths; there were also some probable footings, a well and
there is indirect evidence for a structure of some kind outside the area investigated in
the form of material deposited in later features (see below).

Three gravel paths were identified (Paths A–C; Illus 7–8) forming a complete circuit
running immediately inside the cemetery’s perimeter as well as bisecting it from west to
east. Although these features post-dated the earliest phase of burials, they appear to have
been in existence for several centuries and a sequence of up to eleven surfaces was
identified (Illus. 8). This evidence reveals carefully and laboriously constructed, and
subsequently well-maintained, pathways. The extreme stability of the paths is evident
since their locations and alignments varying only minutely over time; the cemetery was
carefully maintained over the long term. Furthermore, from the perspective of the
archaeological project, the paths provided an invaluable aid in phasing the sequence of
interments.

Similar paths are known from a number of medieval cemeteries, although they have
often been indirectly inferred from circumstantial evidence rather than by their survival
as discrete physical entities. Paths often appear to have been long-lived and spatially
dominant elements, used during the burial ceremony itself and also potentially for other
religious processions (Gilchrist and Sloane 2005, 36–37).

The paths comprised ‘sunken’ linear features 1.05–1.3 m wide and cut to a depth of
0.25–0.6 m, often truncating earlier interments. Each contained a layer of distinctive
orange-brown gravel 0.05–0.15 m thick laid in their base whose upper surface was
situated 0.1–0.2 m below the general height of the surrounding surface area. Therefore,
each metre length of path required 100–400 kg of gravel. By the thirteenth century
gravel could not have been obtained in large volumes from the immediate vicinity and
would have been brought in by cart from pits situated over a mile away. This effort was,
in part, presumably a response to the relative looseness of the fills of earlier graves and
other underlying features, which would have made creating a stable access route
difficult. The paths were well-maintained and the sides of their cuts appear to have
been quite stable, suggesting the presence of wooden edging. Eventually, their surfaces
became worn and required replacement. New layers of gravel were introduced between
six and eleven times, depending upon the path in question, underlining the degree of
care and investment which was employed in their maintenance. In some instances it
appears that later graves reused earlier path surfaces to effectively form a basal lining for the grave (Illus. 22).

There were two successive shallow clay-filled cut features, located towards the south-east corner of the burial ground (F.1039, 1044). These may represent footings for some form of structure, such as the base of a cross or similar sepulchral monument. In the fourteenth–fifteenth century a well (F.584) was established on the southern edge of the cemetery, cutting through numerous earlier burials. This is paralleled by wells from a
illus. 8 Views of Path A facing west-north-west, plus contemporary burial and truncated earlier burials, and section through sequence of eleven gravel surfaces of Path B facing south-south-west.
number of other cemeteries, these may have ‘possessed some symbolic significance’ and been linked to ‘spiritual cleansing’, although in at least some instances they also fulfilled more prosaic functions such as supplying water for fishponds (Gilchrist and Sloane 2005, 43–44). Whilst the well in the cemetery may have provided water for visitors it was not particularly conveniently located for this and it may well have been linked to the activities taking place nearby on the southern fringe of the burial ground (see below). The well was backfilled in the fifteenth century and its fills contained a considerable quantity of disarticulated human bone, this included twenty-three crania plus numerous vertically aligned long bones indicating rapid deposition. Some of the fills were waterlogged and three wooden items were recovered; a bowl, a peg or tool handle and a wedge. The face-turned wooden bowl, made from ash (Fraxinus excelsior L) has what appears to be a letter ‘T’ incised onto the exterior of its base with a rase knife and a drilled hole for hanging the bowl from (Illus. 9.1). Such ownership marks on bowls were often necessitated by a communal environment, such as a hospital, where individuals wished to identify their personal dining items. The carefully shaped peg or tool handle was cut from a radially faced billet of oak (Quercus spp) and has an octagonally cross-sectioned shaft, flaring out to a sub-rectangular cross-sectioned head with a slightly concave hollowed face meeting at a bevelled end (Illus. 9.2). The wedge is also made of oak and cut from box-quartered timber.

There is some evidence that there may have been a building such as a small chapel or charnel house in the cemetery. Although no direct evidence for this structure survived, some material from later features may derive from it. A late sixteenth-/early seventeenth-century pit near the north-east corner of the graveyard contained a quantity of disarticulated human bone plus some fragments of moulded stone and a piece of stucco. The stone included two Ketton stone (a limestone from Rutland) weathering or coping fragments of uncertain date; these may have been derived from the same structure as two other Ketton stone coping fragments that were reused in the footings of an eighteenth-century wall nearby, which date to c. 1300–1400 on stylistic grounds. Although the Ketton quarries are only believed to have become significant suppliers in the sixteenth century and were employed in Cambridge from the late fifteenth century (Purcell 1967, 48–53), there is documentary evidence that they were in use by the thirteenth century and a growing body of evidence for the use of Ketton stone in fourteenth-century Cambridge (Cessford and Dickens in prep.). It also appears that Ketton stone was employed specifically for coping stones because of its intense hardness (Samuel 1989, 142). The stucco fragment, which is quite delicate and cannot have travelled far, has two partial faces that depict windows with a partial ogee arch and cusp and dagger tracery of reticulated style, which can broadly be characterized as depicting late thirteenth-/mid-fourteenth-century Decorated style architecture (Illus. 10.1). Traces of pale lilac paint survive on each face, although this may have become discoloured over time. Another pit of broadly the same date on the northern fringe of the cemetery contained a variety of building debris, all of which appears to represent material discarded when more useful fragments were selected for reuse. Moulded stone included three small clunch fragments that are probably from a tomb chest of c. 1300–1400 (Illus. 10.2) and a fragment of a Barnack bowtell (a round or corniced
ILLUS. 9  Ash bowl and oak peg or tool handle, from the fifteenth-century fill of a well on the southern fringe of the cemetery
ILLUS. 10 Material that may derive from a building located within the cemetery, recovered from two late sixteenth-/early seventeenth-century pits

1) Stucco fragment with depictions of late thirteenth-/mid-fourteenth-century Decorated style windows
2) Three small clunch fragments, probably from a fourteenth-century tomb chest
3) Two fragments of moulded decorative bricks, with traces of whitewash, that imitate stone-work tracery
moulding below the abacus in a Tuscan or Roman Doric capital). There were also some relatively ornate moulded decorative bricks with traces of whitewash that show signs of having been forcefully removed from a structure (Illus. 10.3). Although too small for certainty, these probably derive from a late medieval window or chimney and were designed to create the visual impression of tracery.

There were also several green-glazed floor bricks, plus over eighty Collyweston stone tiles.

Although there was no evidence for contemporary rubbish pits within the cemetery, the presence of pottery that must be contemporary with the usage of the burial ground within grave fills and other deposits associated with the graveyard suggests some level of refuse disposal (Table 2). There are also some fragments of glazed red earthenware and fineware from Ely, which only began to be produced in the early sixteenth century (Cessford et al. 2006, 46–71), indicating that burial continued until close to the end of the Hospital in 1511. In general only small quantities of material were recovered from individual graves. There is no definite evidence that any of the pottery was actually used in the cemetery — although strainers are rather more common than in domestic assemblages of the period from Cambridge (Cessford and Dickens in prep) — and it appears likely the pottery derives from the surface dumping of material, potentially derived from middens elsewhere.

Some of these features, particularly the well but also the paths and in certain respects the pottery that is contemporary with the cemetery, emphasize that a medieval urban burial ground was a space for the living as well as the dead (Gilchrist and Sloane 2005, 43–46). This is also true of the features on the cemetery fringe and to some of the evidence relating to the environment of the burial ground (see below).

THE CEMETERY FRINGE

Immediately to both the north and south of the cemetery were rows of substantial timber-lined pits, seemingly created gradually over time. These features were contemporary with the burial-ground’s usage. It is uncertain if these pits represent activity undertaken on the edge of the graveyard under the auspices of the Hospital, or whether they were instead located on the edge of adjacent tenements. As there is no evidence for a boundary between these rows of pits and the burials — particularly on the northern side, where preservation was excellent — and as some of their fills contained significant quantities of human bone, it appears most likely that they formed part of the overall cemetery complex and fulfilled some light industrial purpose(s). There is evidence from other sites for rubbish disposal and industrial activity occurring on the fringes of burial grounds, interpreted as indicating either a lack of clear boundaries or temporary encroachment on un-utilized areas rather than a true dual function (Gilchrist and Sloane 2005, 45–46). In this instance the evidence suggests something rather more structured and organized.

To the north of the burial ground proper there were two large pits; the earlier was created prior to the burial ground’s establishment, but continued in use. This pit was sub-rectangular in form, measuring 2.3 m by 2.0 m in extent and 2.3 m deep (F.391). An oval pit replaced the first one, measuring 6.2 m by 2.8 m in extent and 0.4 m deep, with a deeper sub-square shaft at its western end 1.6 m by 1.5 m in extent and 2.1 m
| Ware                      | Cemetery count | Cemetery weight (g) | Cemetery mean sherd weight (g) | Non-cemetery count | Non-cemetery weight (g) | Non-cemetery mean sherd weight (g) |
|---------------------------|----------------|---------------------|--------------------------------|-------------------|------------------------|----------------------------------|
| Romano-British wares      | 358            | 3469                | 9.7                            | –                 | –                      | –                                |
| Middle Saxon wares        | 2              | 28                  | 14                             | –                 | –                      | –                                |
| Thetford-type ware        | 939            | 15936               | 17                             | 69                | 1040                   | 15.1                             |
| St. Neots-type ware       | 1516           | 12264               | 8.1                            | 82                | 868                    | 10.6                             |
| Stamford ware             | 125            | 882                 | 7.1                            | 4                 | 20                     | 5                                |
| Total pottery definitely earlier than cemetery | 2940           | 32579               | 7.1                            | 155               | 1928                   | 12.4                             |
| Developed Stamford ware   | 15             | 148                 | 9.9                            | 3                 | 32                     | 10.7                             |
| Pink shelly ware          | 7              | 89                  | 12.7                           | –                 | –                      | –                                |
| Lyveden/Stanion ware      | 142            | 1399                | 9.9                            | 58                | 645                    | 11.1                             |
| Ely ware                  | 947            | 14556               | 15.4                           | 199               | 3021                   | 15.2                             |
| Cambridge-type sandy ware | 4              | 18                  | 4.5                            | –                 | –                      | –                                |
| Blackborough End-type     | 6              | 24                  | 4                              | –                 | –                      | –                                |
| Miscellaneous coarsewares | 1516           | 15418               | 10.2                           | 365               | 3440                   | 9.4                              |
| Brill                     | 9              | 75                  | 8.3                            | –                 | –                      | –                                |
| Total pottery that may be either earlier than or co-eval with the cemetery | 2646           | 31727               | 12                            | 625               | 7138                   | 11.4                             |
| Hertfordshire fineware    | 5              | 67                  | 13.4                           | –                 | –                      | –                                |
| Bourne D                  | 1              | 2                   | 2                              | 2                 | 12                     | 6                                |
| Dutch glazed red earthenware | 1          | 4                   | 4                              | –                 | –                      | –                                |
| Essex redware             | 127            | 1197                | 9.4                            | 80                | 706                    | 8.8                              |
| Hedingham ware            | 55             | 566                 | 10.3                           | *                 | *                      | *                                |

(Continued)
| Ware                  | Cemetery count | Cemetery weight (g) | Cemetery sherd weight (g) | Non-cemetery count | Non-cemetery weight (g) | Non-cemetery mean sherd weight (g) |
|-----------------------|----------------|---------------------|--------------------------|--------------------|-------------------------|-----------------------------------|
| Essex greyware        | 1              | 17                  | 17                       | 2                  | 5                       | 2.5                               |
| Grimston ware         | 50             | 1088                | 21.8                     | 5                  | 123                     | 24.6                              |
| Scarborough ware      | 8              | 130                 | 16.2                     | 1                  | 21                      | 21                                |
| Cambridge-type scraffito | 3            | 35                  | 11.7                     | 1                  | 2                       | 2                                 |
| Surrey Borders ware   | 16             | 254                 | 15.9                     | 2                  | 10                      | 5                                 |
| Toynton ware          | 10             | 157                 | 15.7                     | -                  | -                       | -                                 |
| Unidentified finewares | 21            | 320                 | 15.3                     | -                  | -                       | -                                 |
| Siegburg stoneware    | -              | -                   | -                        | 1                  | 17                      | 17                                |
| Langerwehe stoneware  | -              | -                   | -                        | 2                  | 783                     | 391.5                             |
| Tudor Green           | -              | -                   | -                        | 1                  | 8                       | 8                                 |
| Babylon-type ware     | 2              | 8                   | 4                        | -                  | -                       | -                                 |
| Broad Street fineware | 4              | 21                  | 5.2                      | 5                  | 7                       | 1.4                               |
| Glazed red earthenware| 37             | 427                 | 11.5                     | 12                 | 124                     | 10.3                              |
| Plain redware         | 68             | 889                 | 13.1                     | 2                  | 31                      | 15.5                              |
| Raeren stoneware      | 2              | 20                  | 10                       | 3                  | 55                      | 18.3                              |
| **Total pottery definitely coeval with the cemetery** | **298** | **3837** | **12.9** | **94** | **896** | **9.5** |
| Langerwehe stoneware  | -              | -                   | -                        | 2                  | 783                     | 391.5                             |
| Tudor Green           | -              | -                   | -                        | 1                  | 8                       | 8                                 |
| Babylon-type ware     | 2              | 8                   | 4                        | -                  | -                       | -                                 |
| Broad Street fineware | 4              | 21                  | 5.2                      | 5                  | 7                       | 1.4                               |
| Glazed red earthenware| 37             | 427                 | 11.5                     | 12                 | 124                     | 10.3                              |
| Plain redware         | 68             | 889                 | 13.1                     | 2                  | 31                      | 15.5                              |
| Raeren stoneware      | 2              | 20                  | 10                       | 3                  | 55                      | 18.3                              |
| **Total pottery definitely coeval with latter stages of cemetery or post-dating it** | **113** | **1365** | **12.1** | **25** | **10970** | **40.3** |

| Total                 | 5997           | 69508               | 11.6                     | 899                | 10970                   | 12.2                              |
deeper than the main pit (F.356). The digging of this latter pit appears to have disturbed six or seven graves. An additional smaller west-east aligned pit, resembling a grave and 1.7 m by 0.45 m in extent and 1.0 m deep, was dug to hold the charnel remains from these graves (F.346). The human remains appear to have been placed within this pit in a wooden box; at the base were four crania forming a square, over this were two layers of six and five femora respectively, with shorter limb bones over these (MNI 6).

To the south of the cemetery there were four regularly arranged vertically sided flat bottomed pits, 1.95–2.2 m by 1.7–2.1 m in extent and originally 1.6–1.8 m deep, all dating to the fourteenth century (F.415/436, 417, 420, 435). The pits were carefully created and probably timber-lined. They must have fulfilled some form of specialized light industrial function, although as they did not cut entirely through the natural gravel they would not have held water. As the pits are inter-cutting they must have been utilized sequentially, although the overall order is impossible to determine as all four pits cannot be placed in a single stratigraphic sequence. Three of the pits contained relatively carefully arranged human bone in their bases (MNI 3, 7 and 16 based upon crania). During construction works in 1877–79 a local antiquarian, Professor Thomas McKenny Hughes, observed the upper portions of these or similar pits, which he interpreted as a 'deep ditch ... where first seen [this feature] was full of human bones, but as these were all scattered and fragmentary it is probable that they were only the bones dug up in making new graves in that overcrowded ground which were disposed of by throwing them into the deep ditch that bounded the churchyard on the north side' (Hughes 1898, 378). This discovery of human remains has led to a considerable amount of popular speculation, principally linking them to the Black Death, which has become increasingly lurid over time (Williamson 1957, 51; Evans 2010, 97; Gummer 2010, 188–89).

After the fourth pit (F.435) went out of use, its bottom 0.2 m was backfilled with a deposit containing disarticulated human remains (MNI 1, no crania present). Four bodies were then deposited in the pit: a west-east aligned (all alignments give the head end first) prone probably female old adult (F.458), an east–west aligned supine mature adult male overlying it (F.457), an 11–12 year-old who was aligned south–north with their legs flexed and body prone (F.459) and an east–west aligned prone body with flexed legs of 6–9 year old (F.460) (Illus. 11). The male and probable female both had lesions on their lower spine characteristic of incipient arthritis. The probable female also had a compression fracture commonly associated with spondylolysis in the fifth lumbar vertebra. The four bodies were hurriedly disposed of and appear to have been simply ‘tipped’ into the pit. Whilst the four bodies may be unrelated individuals who died at the same time they could conceivably have comprised a familial group; possibly a father and two children plus mother or grandmother. The rest of the pit was then backfilled with material that contained significant quantities of disarticulated human bone (MNI 2, based upon crania). Radiocarbon dating of one of the skeletons indicated a date in the mid-thirteenth to late fourteenth century (Table 14). Such coterminous group burials, as opposed to larger mass burial pits or double burials, are relatively rare. The closest parallel is a group at St. Mary Merton, Surrey, dated c. 1300–90, where a carefully dug rectilinear grave, 1.75 m by 1.1 m in extent, contained three individuals all aligned west–east (Gilchrist and Sloane 2005, 157; Saxby and Miller 2007, 84, 97, 151). The first
ILLUS. 11 Mid-thirteenth-/ late fourteenth-century coterminous group burial in pit on the southern fringe of the cemetery, view facing west-north-west
burial was an older adult male in a prone position, the next a child aged 7–12 who had been placed in a flexed position on their side and the final interment comprised an older adult male laid in a supine, spread-eagled position partly overlying the earliest burial. Their positioning indicates that these individuals ‘were casually disposed of, possibly thrown in’ and it has been suggested that they may represent ‘victims of a local episode of infectious disease or an accident’ (Saxby and Miller 2007, 84, 97). Other examples of multiple burials of two to seven bodies arranged in horizontal groups were also present at St. Mary Spital (Connell et al. 2012, 13), although as these have not been published in detail it is impossible to determine how comparable they are.

The care taken in digging the pit contrasts strongly with the hurried manner in which the bodies were disposed of. It also appears that the process of backfilling the pit had commenced prior to the deposition of the bodies. It thus seems likely that one of a series of light industrial pits on the edge of the burial ground had gone out of use and was in the process of being backfilled when some form of incident occurred that led to four deaths. Something about the nature of these deaths meant that it was imperative to dispose of the bodies rapidly and the location of the pit on the cemetery fringe rendered it in some sense appropriate.

**Cemetery Environment**

by Rachel Ballantyne and David Smith

The fifteenth-century waterlogged fills of the well (F.584) on the southern edge of the burial ground were sampled for plant and insect remains, shedding light on the environment of the burial ground. The insect and plant remains demonstrate that the area in and around the cemetery included open, nutrient-enriched land with occasional shrubs that can be characterized as waste or rough ground/grassland. This may have been significant in terms of colour (see below) and also symbolically in the sense of cemeteries as green spaces (Gilchrist and Sloane 2005, 44). There is also evidence for insects associated with the decaying corpses of the graveyard, some settlement waste plus cess and dietary evidence that may relate to the inhabitants of the Hospital.

All taxonomic nomenclature follows Lucht (1987) for beetles and Stace (2010) for plants. Waterlogged wild plant seeds, probably from local vegetation, include nettle-leaved goosefoot (*Chenopodium murale*), chickweed (*Stellaria media*), violet (*Viola* sp.), cow parsley (*Anthriscus sylvestris*), fool’s parsley (*Aethusa cynapium*), black nightshade (*Solanum nigrum*), dead-nettle (*Lamium album/purpureum*) and honeysuckle (*Lonicera* sp.). The surrounding area would appear to have been largely open, nutrient-enriched land with occasional shrubs. The insect fauna is dominated by a range of plant feeding beetle species, normally associated with waste ground and to a lesser extent grassland. There is considerable evidence that a stand of common nettle (*Urtica dioica*) occurred in the immediate vicinity. This is shown by forty-five individuals of the weevil *Cidnorhynus quadrimaculatus* recovered who, along with several individuals of *Brachypterus urticae*, *Ceutorhynchus pollinarius* and *Apion urticarium*, are highly associated with this plant. There is also evidence for poppies (*Papaver rhoesas* and *Papaver spp.*), with twenty individuals of the weevil *Ceutorhynchus contractus* which, along with small numbers of *Stenocarus ruficornis*, are normally associated with this plant. Other plant
species from waste ground that are also indicated include vetches (*Vicia* spp., the host plant of *Apion pomonae* and *Sitona suturalis*), common mallow (*Malva sylvestris*, host plant of *Apion aeneum*), bird’s-foot-trefoil (*Lotus pedunculatus* or *L. corniculatus*, host plant of *Sitona waterhousei*), shepherd’s purse (*Capsella bursa-pastoris*, host plant of *Ceutorhynchus erysimi*) and ribwort plantain (*Plantago lanceolata*, host plant of *Mecinus pyraster*). The presence of rough ground is suggested by a number of ground beetles, such as *Nebria brevicollis*, *Loricera pilicornis*, *Harpalus aeneus*, *H. rubripes*, *Amara plebeja* and *A. familiaris*. A relatively small number of the ‘dung beetles’ *Aphodius prodromus* and *A. granarius* were also recovered, perhaps indicating some meadowland or pasture in the area. These two species are often associated with cattle dung lying in open ground, but also appear to be common inhabitants of settlement in the archaeological record. Another find that sheds some light on the cemetery environment is a frog, which apparently hopped onto a body in an open grave and was buried along with the deceased.

Several beetle species recovered are associated with decaying animal bone or the burial environment. *Omosita discoidea* (four) and *O. colon* (one) are typically found on the dried bone and hair of carrion (Harde 1984). *Rhizophagus parallelocollis* (ten), better known as the ‘graveyard beetle’, is commonly found in and around burials and buried corpses at some depth below ground (Peacock 1977). These species probably owe their origin to the presence of the adjacent burial ground or possibly came in with the human bone that was deposited into the well. These species are not a common part of the insect fauna associated with urban material. In the nine samples analyzed from the Grand Arcade and Christ’s Lane sites in Cambridge there were no *Rhizophagus parallelocollis* or *Omosita discoidea* and only one *Omosita colon* (Cessford 2007). They do occur in small numbers in deposits such as food waste and, perhaps more commonly, in the waste left over from butchery, bone working and tanning. In this case the numbers are indicative of the presence of the cemetery.

The waterlogged plant remains also provide some evidence for diet. Numerous corncockle seed-coat fragments (*Agrostemma githago*) are almost certainly from human faeces. These poisonous, grain-sized seeds were difficult to remove before flour milling and so their fragmentary remains probably represent ingested bread or other flour products. Other possible foods include hemp seed (*Humulus lupulus*), blackberry (*Rubus* subgen. *Rubus*) and plum/cherry (*Prunus sp.*). The many elder seeds (*Sambucus nigra*) are hard to interpret since these may represent either faeces or nearby shrubs as this plant thrives on the margins of settlements. Charred remains of wheat, barley and oats indicate likely oven ash deposits, along with probable arable weed seeds (buttercups, orache, corncockle, knapweed, stinking chamomile and darnel), plus great fen sedge and true sedges.

A small component of the insect fauna might be derived from settlement waste and rubbish, although members of this group also can be found widely in the ‘natural’ environment around archaeological sites in small numbers. For example, the crypto-phagids, lathridiids and the ‘woodworm’ *Anobium punctatum* are components of ‘house fauna’ (Kenward and Hall 1995). Similarly, *Cercyon analis*, *Omalium excavatum*, *O. rivulare*, and the various *Oxytelus* species are all associated with settlement waste in the past. A single puparia of the small fly *Thoracochaeta zosterae*, which is particularly associated with cess pits, was found. There is no evidence that cess pits were present
within the cemetery, which may indicate that some of the insect remains were re-deposited, either from contemporary features elsewhere or from earlier features on the site that pre-date the burial ground.

**Burials, Typical and Atypical**

The burials in the cemetery were arranged in rows (Illus. 12) and although stratigraphic sequences of up to eight or nine burials were identified it appears that there were six ‘cemetery generations’, defined as ‘the period of time taken to fill the space available before burying over it again’ (Heighway and Bryant 1999, 195). Various lines of evidence — principally the density of burials in the investigated areas, the likely extent of the burial ground and an allowance for other factors — indicate that c. 1000–1500 individuals were interred, with c. 1350 the most likely number. These values exclude burials that may have taken place in and around the Hospital chapel, which probably numbered in the low hundreds. Based upon these values an average of 3.2–4.8 burials took place per year, broadly comparable to the four burials per year that were interred between 1235–80 at St. Mary Spital, London (Thomas et al. 1997, 117). This would broadly equate to a burial every 2.5–3.75 months.

It is, however, unlikely that the rate of burial was uniform throughout the existence of the Hospital. Documentary evidence (see above) suggests that the rate of burial is likely to have been higher during the period c. 1200–1300/1350, declining after that point as the role of the Hospital changed and there was a growing preference for burial in parish churchyards. Although burial certainly continued until the late fifteenth century, as confirmed by ceramic evidence (see above), the radiocarbon dating supports the hypothesis that two thirds of the burials predate c. 1350 (see below). At a rough estimate burials may have occurred at the rate of 4–8 per year between c. 1200–1350 and 1–3 per year between c. 1350–1511.

As far as can be ascertained, burial followed a spatial progression in a series of rows, with stratigraphic indications that the interments in any given row commenced to the south and ran northwards and that the rows began on the western side of the burial ground and ran eastwards. Whilst this is based upon relatively limited evidence, the pattern does appear to be consistent. There is no evidence for any spatial patterning of burial by age, sex or other factors, which supports the idea that burial occurred in strict linear progression.

The identifiable grave cuts were rectangular in form with rounded corners; the majority were broadly aligned west-east (most are in fact closer to west-north-west by east-south-east) and measured 1.75–2.1 m long by 0.4–0.7 m wide and 0.4–0.6 m deep. Although a few graves appear to have been dug specifically for particular individuals — for instance, a c. 1.05 m tall child was found in a particularly short 1.15 m long grave (F.377) — the majority appear to have been dug to a relatively standard size; so that a c. 1.25 m tall older child/young immature individual lay within a 2.1 m long grave (F.354). This suggests that some, but not all, graves may have been dug in advance of being needed. One possibility is that this occurred prior to the winter, when ground conditions would have potentially made digging graves considerably more difficult. The pattern of surviving skeletal remains and grave cuts demonstrates that the majority of individuals (>70%) were definitely not interred in coffins and there is no
ILLUS. 12 General view of exposed skeletons facing west-north-west, these are the uppermost burials and represent the two to three latest cemetery generations
positive evidence for the presence of any coffins at the site. Similarly, there was no
definite evidence for the use of shrouds, although the pattern of skeletal remains makes
it likely that some, but not all, bodies were enshrouded. In general the bodies were
placed in an extended west-east aligned supine position without grave-goods.

The phasing of medieval cemeteries is often problematic, primarily because of a
combination of stratigraphic complexity and the fact that burials typically represent a
continuum of individual events rather that discrete phases of activity (for relevant
discussions see Kjølbye-Biddle 1975; Boddington 1987; 1996; Gilchrist and Sloane 2005, 12). Taking into account all the available evidence, the burials have been divided
into three phases (Early, Mid and Late), each corresponding to two cemetery genera-
tions. A more precise phasing system based on single cemetery generations was not
adopted, as too few burials could be categorically assigned to single generations to make
it useful. Of 395 individuals from the cemetery, 227 (57.3%) can be assigned to one of
these phases, 141 (35.9%) can be assigned to some mixture of two of the three phases
and 27 (1.7%) cannot be meaningfully phased. One side effect of the meticulous
excavation is that highly truncated skeletons, where relatively few bones remained in
articulation, were recognized as burials. Whilst it is impossible to be certain, experience
on other sites subject to more hurried investigation under less favourable circumstances
suggests that c. 25% of the most truncated skeletons recovered from the cemetery might
have been missed under such conditions. The recovery of a higher proportion of
heavily truncated skeletons does, however, mean that a concomitantly lower proportion
of skeletons can be accurately sexed or aged by osteological methods.

The impression from the archaeology is of a regimented impersonal burial process,
wherein an individual was interred in a pre-dug grave following a standardized rite.
There are, however, a few atypical exceptions; including east-west aligned burials,
south-north aligned burials, a double burial, a prone burial and individuals buried
with grave-goods. If one excludes the burials with grave-goods, but includes the
coterminous group in a pit, the atypical burials are all located towards the edges of
the burial ground. Four burials of mixed date were aligned east-west rather than the
usual west-east: these comprised a female (F.1021) and a probable female (F.1040), a
double burial of two mature adults (F.503) and an adult of unknown sex (F.1038). Such
east-west or ‘reversed’ burials are not convincingly linked to priests in the late medieval
period contrary to popular supposition and it is unclear what the phenomenon repre-
sents (Gilchrist and Sloane 2005, 153). All four east-west burials were situated on the
eastern side of the burial ground, immediately adjacent to the burial ground boundary.
The position of the skeletal remains suggests that the individuals were not shrouded.
Although there does appear to be a spatial element to this phenomenon, the majority of
burials on the eastern side of the cemetery were on the normal west–east alignment.

Two successive burials, probably dating to the fourteenth century, of an adult of
unknown sex (F.397) and a probably male adult (F.393), were aligned south-north
and appear to have ‘blocked’ a west-east aligned path (Illus. 13.1). Due to nine-
teenth-century truncation it is unknown what lay to the west of these burials, but if
the burial ground possessed a chapel or charnel house it may have been located
here. There was a single thirteenth-/fourteenth-century prone burial of a mature
adult male (F.958) (Illus 2 and 13.2); such interments may be deviant or penitential
ILLUS. 13 Views of selected atypical burials, facing west-north-west

1) Path B which is cut by west-east aligned burial F.395, which is in tum truncated by atypical fourteenth century north-south aligned burial F.393
2) Thirteenth-/fourteenth-century prone burial F.958
3) Thirteenth-/fourteenth-century double burial of individuals F.1147–48
burials or alternatively they indicate casual or hurried burial (Gilchrist and Sloane 2005, 154). As this individual was placed in a particularly deep grave cut (>0.84m), it is conceivable that the body was not deliberately placed in a prone position, especially if it was shrouded. There was one thirteenth-century double burial, with a mature adult male (F.1148) and an immature individual (F.1147) interred within the same grave (Illus. 13.3). Such coterminous double burials are quite common in many cemeteries; however, they typically consist of an adult usually female and a child, and are assumed to be mother and child, or of two children (Gilchrist and Sloane 2005, 155–57). This is not the case in this instance, making this a moderately unusual burial.

Evidence for clothing and grave-goods is rarer than at most hospital cemeteries (Gilchrist and Sloane 2005, 80–106), principally because this was a purely lay graveyard with no clerics present. Several items that were found in graves might represent grave-goods, but their positions were ambiguous and it is equally possible that they represent incidental inclusions of either residual material from earlier activity at the site or contemporary refuse, both of which are clearly represented in the ceramic assemblage from the cemetery (Table 2). Ambiguous items include a copper-alloy buckle, a lead weight or spindle whorl, a Roman coin, a fifteenth-century jetton, a naturally perforated stone and several knives. Some of these items such as spindle whorls occur as definite grave-goods at other contemporary cemeteries (Gilchrist and Sloane 2005, 102–03), but in the absence of supporting evidence remain questionable. The only definite grave-goods were a copper-alloy brooch and a jet crucifix, whilst the status of a copper-alloy cruciform pendant is less clear.

The copper-alloy brooch was located on the upper right torso area of an adult female aged 27–35, with the point of the pin pointing upwards and outwards (F.256) (Illus. 14.1). This must, however, be treated with caution given the potential for collapse occurring in the torso of a decomposing skeleton. Due to later truncation it is possible that there was originally a matching brooch on the left hand side. This burial probably dates to the fifteenth century and the brooch has a 25 mm diameter open annular frame decorated with a series of quite widely spaced transverse indentations and a 26 mm long separate pin, attached to a constriction at one point in the frame. Such brooches are often difficult to distinguish from annular buckles; they originate in the twelfth century and are common throughout the thirteenth–fifteenth centuries (Biddle and Hinton 1990; Egan and Pritchard 2002, 248–55). Decorated brooches are relatively rare from burials. There is one clear example from St. Oswald Gloucester dated 1086–1540 (Heighway and Bryant 1999, 134 and fig. 3.13), but in most cases it is difficult to determine if the items are brooches or buckles. The majority of examples from Smithfield, London, were found in pairs in the pelvic region and are therefore not comparable (Grainger et al. 2008, 20–21, 37–40).

A copper-alloy cruciform pendant was found in association with a carefully arranged charnel bundle deposited during the thirteenth–fourteenth centuries (Illus. 14.2). The position of the pendant, combined with the fact that the form of the charnel bundle indicates it was wrapped in textiles, suggests that the pendant was associated with some form of cord used to secure this wrapping. The pendant is 31
1) Copper-alloy annular brooch found on right upper torso of adult female F.256, deposited in the fifteenth century
2) Jet crucifix pendant found associated with adult male F.241, deposited in the fifteenth century
3) Copper-alloy cruciform horse harness pendant found associated with charnel bundle, deposited in the thirteenth–fourteenth century
mm high and 21 mm across, with expanded terminals decorated with three incised lines and a forward facing suspension loop and it is in fact a piece of horse harness. The pendant would have been attached by a pin — usually made of iron — to a copper-alloy mount, which would in turn have been attached to a leather strap (Griffiths 1986; 1995). It is probable that this pendant had become detached from its mount and was reused in a funerary context because of its cruciform shape. It has been suggested that some such pendants were used as personal jewellery and that the use of cruciform horse harness pendants may be linked to clerics or could reflect private devotion (Griffiths 1995, 83, 89). In this instance it appears that its form plus its small loop rendered it appropriate for reuse securing a charnel bundle.

A crucifix pendant made from Whitby jet (Kenward 2013) was found in association with a mature adult male, who was probably interred in the fifteenth century (F.241) (Illus. 14.3). The crucifix is slightly damaged and its base is broken — although as the depiction of the body is complete it is likely that no more than 1–2 mm has been removed — and there is slight damage behind the right hand of Christ. The pendant is 31 mm high by 26 mm across and is a standard, four-pointed Latin crucifix, with an upright post (stipes) and a single slightly flaring crosspiece. It has a plain back and was suspended from a small hole drilled through the upper arm of the cross. Christ is depicted wearing a simple loincloth (perizoma) and with his legs crossed. The crucifix shows signs of wear and polish, indicating long-term use, and was almost certainly a treasured possession. This breakage was apparently relatively fresh when the crucifix was deposited, suggesting that this damage may be why it was disposed of. Objects made from jet, including pendants, are occasionally found in late medieval burials, and it is possible that the material was believed to possess occult natural power (Gilchrist 2008, 139–40). The manufacture of jet crucifixes was a development from the manufacture of jet cross pendants at Whitby Abbey in the late twelfth century (Pierce 2013), with crucifixes dating to between the mid–late thirteenth and fifteenth centuries (Cherry 2013a and b; Coppack 1984; Hinton 1990, 644–46, no. 2046). The only other examples associated with burials are a poorly dated discovery from Old Malton, Yorkshire (Hodgson 1902, 115) and one found against the third to fourth cervical vertebrae of a mid-fourteenth to mid-fifteenth-century burial at Cathedral Green, Winchester (Hinton 1990, 644–46, no. 2046).

**DISTURBING THE DEAD**

Many of the burials were disturbed before the burial ground went out of use. A range of factors led to disturbance, including the insertion of later burials, paths (for examples see Illus. 8) and other features. There was no discernible reluctance to disturb earlier remains. Despite this the graveyard appears to have been kept relatively free of loose charnel, as the only human bones found in general deposits associated with the cemetery were relatively small and not immediately recognisable as human to the non-specialist.

In at least one instance this disturbance took place when the corpse was only partially decomposed. Located beside the feet of a later burial (F.370), which had presumably disturbed it, lay a prone east-west aligned articulated cranium, mandible and eight
uppermost vertebrae derived from a probably female mature adult. Although estimating
the timespan of this is problematic (Bent et al. 2004; Mann et al. 1989), it is likely that
disturbance occurred within c. 10–50 years of the original burial. This raises the issue of
whether some of the more heavily truncated skeletons, which have been interpreted as
the remnants of in situ burials, are actually semi-articulated charnel that was placed in
such a way that mirrored burial practice. Certainly, disarticulated long bones were often
laid along the long axis of a burial cut, this effectively being the most practical option. In
most instances, however, the earlier burials had completely decomposed prior to
disturbance. Many of the disturbed bones were placed around or over the recently
deceased individual (Illus. 15). A wide range of placements and arrangements were
apparent, with no discernible overall patterning. In some cases the bones were neatly
stacked, whilst in others were probably wrapped in textiles. Some bones were also re-
interred in pits that had been dug for other purposes. However, there are clear cases
where pits were specifically dug to dispose of disturbed human remains, although the
latter scenario appears to have been rare. Yet even when all these modes of re-
deposition are taken into account they are insufficient to account for the quantity of
bone that must have been disturbed, suggesting that the cemetery may also have
possessed a charnel house.

illus. 15 Fourteenth-century burial F.359 with and without charnel placed around head, facing
west-north-west
THE CEMETERY POPULATION

by Natasha Dodwell

Excluding a single Romano-British skeleton (see above), a total of 404 complete or partial skeletons were analyzed, including four skeletons from a mid-thirteenth–/late fourteenth-century pit (see above). As it is estimated that c. 1000–1500 individuals were originally interred in this cemetery, the articulated skeletons analyzed here represent c. 27–40% of the original burial population (see above). In addition, a large quantity of disarticulated human bones was recovered re-deposited in grave fills and in post-cemetery features, but this does not form part of the analysis presented here, in part because radiocarbon dating indicates that some of this material (F.204) may not derive from the graves (see below). Based upon analysis of a sub-sample and the volume of material recovered, the disarticulated material would equate very roughly to c. 300–400 complete skeletons.

PRESERVATION

Because of the degree of truncation and inter-cutting, the skeletons ranged from complete or near-complete bodies to those which were represented only by a limb or an articulated extremity. In crude terms, the post-excavation assessment demonstrated that over half (59%) of the articulated individuals consisted of less than 25% of the skeleton (Illus. 16). However, a more detailed breakdown indicated that just over 70% of the skeletons analyzed (no. = 286) had (partial) skulls and/or innominate bones, the elements most useful for ageing and sexing (no. = ninety-seven, 24%, had a skull/partial skull, no. = 114, 28.2%, had innominate bones and a further seventy-five, 18.5%, had both skull and innominate) (Illus. 17). Whilst there is some post-mortem

![Histogram of completeness of individuals in the cemetery]

ILLUS. 16 Completeness of individuals in the cemetery
breakage, which prevented certain metrical data being collected, the surviving elements were in excellent condition, with most joint surfaces surviving intact and very little abrasion/erosion of the cortical bone (grade 0–1 as described by Brickley and McKinley 2004, fig. 6). Small green stains on the cortical bone, indicative of contact in the ground with copper alloy, were recorded on five individuals (F.506, 510, 703, 721, 868) perhaps suggesting the presence of small shroud pins, although no such artefacts were recovered from these grave fills.

Comparative sites

For comparative populations the two most useful types of site are other broadly contemporary infirmary hospital cemeteries, usefully collated by Gilchrist and Sloane (2005) and supplemented by St Mary Spital, London (Connell et al. 2012) and broadly contemporary local parish cemeteries. Unfortunately, most recent developer-funded investigations of medieval burial sites in Cambridgeshire have been of such a restricted scale that the population samples are too small to provide meaningful comparators or have not yet been published. Osteoarchaeological data from the larger excavations of parish churchyards at All Saints by the Castle (Alexander et al. 1972) and Church End, Cherry Hinton (McDonald and Doel 2000; Ferrante de Ruffano and Waldron 2006) remain unpublished and unavailable. Very few substantial medieval populations from parish cemeteries have been published locally; Ormesbury St Margaret (Anderson 2009) and Crowland Road, Haverhill (Waldron 2005) have been used, as well as general summaries of the British late medieval evidence (Roberts and Cox 2003).

Methodology

All sediment from basal grave fills in immediate proximity to the skeletons was sieved through a 4 mm mesh to aid recovery (Mays et al. 2012). Immature remains were aged where possible by the stage of epiphyseal fusion and metrical data (Schaefer et al. 2009),
the stage of dental development (Brown 1985) and dental eruption (Ubelaker 1989). With the adult skeletons, age was assessed by the stage of epiphyseal fusion (Schaefer et al. 2009), by examining changes in the appearance of areas of the pelvis (Lovejoy et al. 1985; Brooks and Suchey 1990) and molar wear (Brothwell 1981). No attempt was made to sex immature individuals. The sex of adult skeletons was determined by dimorphic characteristics of the pelvis and skull (Buikstra and Ubelaker 1994).

Falys and Lewis (2011) have highlighted how the numerous and varied age categories used in osteological reports can hinder comparative analysis. Those employed in Gilchrist and Sloane (2005, 17) have been adopted for this analysis as it was felt that they would be most useful when comparing data from other medieval hospital cemeteries. The assessment of age obtained for each of the various ageing techniques is held in the archive. The age categories used are: Foetal (+/-0 years old), Infant (0–5 years old), Child (6–10 years old), Immature (11–15 years old), Young adult (16–25 years old), Mature adult (26–45 years old), Old/elderly adult (46+ years old), General immature (6–15 years old), Non-adult (<15 years old) and Adult (16+ years old). A five-point sexing scale was used: male, probable male, undetermined, probable female and female. Where truncation or the absence of sexually dimorphic elements prevented observations, adult remains were classified as of undetermined sex (und.). No attempt was made to sex immature remains. For analysis, data for probable females and females and for probable males and males were pooled, unless otherwise stated. Adult stature was estimated from femoral length using the standard male and female regression formulae of Trotter (1970) and is expressed in centimetres. Most measurements are expressed in metres to an accuracy of the nearest centimetre and statistical calculations are expressed to one decimal place. Pathological lesions were described and scored using accepted methods presented in Brickley and Mckinley (2004). This and other metrical data is available in the archive.

DEMOGRAPHY

The number of individuals dying in each age category, and their sex where it could be established is presented in Table 3. Within the cemetery, sixty-one individuals (15.3%) died before they were sixteen years old, with half of those dying between the ages of 11–15 years (no. = thirty). Amongst the burial population and the vast quantity of disarticulated material that was scanned on site (but not recorded), no neonates or infants below the age of five years old were recovered. Reasons for the absence of young children from the burial population will be explored below.

In a ‘normal’ pre-industrial cemetery population one would expect to see a peak in mortality amongst the very young, possibly a spike amongst young women of child-bearing age and then another peak in both sexes in the elderly age category (Waldron 1994, 23; Roberts and Manchester 1995, 25) but this is not the case in the Hospital assemblage. When observing the burial population as a whole (all phases amalgamated), adult mortality for both sexes peaks between the ages of 26–45 years (Illus 18–19), although the high number adults of undetermined sex should be considered. Of the adults that could be sexed (no. = 159) 54.1% were male (no. = 86) and 45.9% were female (no. = 73) (Table 3), a male: female ratio of 1.17: 1 (Illus. 20).
### Table 3

Demographic profile of skeletons from the cemetery, figures in brackets include skeletons in contemporary pit. No foetal remains or infants (aged ≤ 5 yrs) were present.

| Age               | Male | Male | Female | Female | Und | Total |
|-------------------|------|------|--------|--------|-----|-------|
| Child (6–10 yrs)  | 0    | 0    | N/A    | 0      | N/A | 25 (26) |
| Immature (11–15 yrs) | 0    | 0    | N/A    | 0      | N/A | 30 (31) |
| General immature (6–15 yrs) | 0    | 0    | N/A    | 0      | N/A | 6 (6) |
| Young adult (16–25 yrs) | 7    | 12   | 6      | 19     | 4   | 27 (28) |
| Mature adult (26–45 yrs) | 9    | 34 (35) | 6    | 27     | 5   | 2 (2) |
| Elderly adult (46+ yrs) | 4    | 16   | 3      | 8      | 2 (3) | 11 (12) |
| Adult (16+ yrs)    | 1    | 3    | 4      | 2      | 6   | 131 (131) |
| Total             | 21   | 65 (66) | 19    | 56 (57) | 17 (18) | 161 (161) |

[ILLUS. 18](#) Number of individuals in the cemetery in each age/sex category.
Skeletal remains have been assigned to five phases (Early, Early–Mid, Mid, Mid–Late, Late), plus a few that could not be phased (no. = 27, 6.75%) (see above). The ratio of immature individuals (younger than sixteen years) to adults is constant at c. 1:5 through the phases (Table 4). Taking the cemetery as a whole, both female and male mortality peaks between the ages of 26–45 years in all periods, except for the Early phase where death peaks between the ages of 16–25 years (Table 5). There does appear to be a general peak in the proportion of males in the Late phase. Closer examination of the data for this latest phase indicates that all male age groups are disproportionately over-represented in comparison to women, which might indicate a change in the nature of the population being buried.

**Stature**

The femur was the most common limb bone that could be measured, surviving in ninety-five adult skeletons from the graveyard that could be attributed a sex and in a further two from contemporary pit F.435 (Table 6; Illus. 21). The average male and female heights (1.69 m and 1.58 m) are similar to those recorded in the region for this period (Anderson 2009, 14). Male mean height was remarkably constant through all phases (average 1.67–1.69 m), whereas the female mean height varied from phase to phase with no distinct trend. The shortest female skeleton (F.731), measuring only 1.46 m (4 ft. 9 in.) dates to the Early–Mid phase. In fact, in the cemetery as a whole seven
women were below 1.52 m (5 ft.) (F.256, 264, 360, 700, 731, 900, 905); at Ormesby St. Margaret the women were also particularly short for the region and period, with four being below 5 ft. (Anderson 2009). Nutritional status and disease in childhood affects the chances of achieving potential stature in adulthood. It should be noted that there was often a disparity amongst the non-adult burials between ages derived from dental eruption and development and those calculated using long bone length, a phenomenon often observed in archaeological samples such as Wharram Percy (Mays 2007, 97–100). Dental ages were consistently ‘older’ than ages calculated by long bone length (3–4 years); suggesting perhaps a strong influence of environmental factors on skeletal

### Table 4: Number and percentage of adult and immature individuals by cemetery phase

| Phase    | No. individuals | No. adults | % Adults | No. non-adults | % non-adult | No. sexable adults | % sexable |
|----------|-----------------|------------|----------|----------------|-------------|---------------------|-----------|
| Early    | 51              | 43         | 84.3     | 8              | 15.7        | 21                  | 41.2      |
| Early-Mid| 80              | 68         | 85.0     | 12             | 15.0        | 28                  | 35.0      |
| Mid      | 94              | 78         | 82.9     | 16             | 17.1        | 36                  | 38.3      |
| Mid-Late | 63              | 53         | 84.1     | 10             | 15.9        | 23                  | 36.5      |
| Late     | 85              | 71         | 83.5     | 14             | 16.5        | 45                  | 52.9      |
| Unphased | 27              | 26         | 96.3     | 1              | 3.7         | 6                   | 22.2      |
| Total    | 400             | 339        | 74.7     | 61             | 15.3        | 159                 | 39.8      |
TABLE 5  Breakdown of age groups and sex by cemetery phase

| Phase       | Child (6–10 yrs) | Immature (11–15 yrs) | General immature (6–15 yrs) | Young adult (16–25 yrs) | Mature adult (26–45 yrs) | Elderly adult (46+ yrs) | General adult (16+ yrs) | Males | Females | Male:Female ratio |
|-------------|------------------|-----------------------|-----------------------------|-------------------------|--------------------------|------------------------|-------------------------|-------|---------|-----------------|
| Early       | 3                | 4                     | 1                           | 13                      | 8                        | 6                      | 16                      | 12    | 9       | 1.33:1          |
| Early–Mid   | 5                | 6                     | 1                           | 10                      | 17                       | 6                      | 35                      | 14    | 14      | 1:1             |
| Mid         | 7                | 7                     | 2                           | 18                      | 23                       | 7                      | 30                      | 17    | 19      | 0.89:1          |
| Mid–Late    | 3                | 5                     | 2                           | 15                      | 7                        | 6                      | 25                      | 10    | 13      | 0.77:1          |
| Late        | 7                | 7                     | 0                           | 18                      | 26                       | 6                      | 21                      | 29    | 16      | 1.81:1          |
| Unphased    | 0                | 1                     | 0                           | 1                       | 2                        | 3                      | 20                      | 4     | 2       | 2:1             |
| **Total**   | **25**           | **30**                | **6**                       | **75**                  | **83**                   | **34**                 | **147**                 | **86** | **73**  | **1.17:1**      |
### Table 6  Stature estimates by sex and cemetery phase

| Period       | Sex   | Minimum (m) | Maximum (m) | Mean (m) | SD (mm) | No. of individuals |
|--------------|-------|-------------|-------------|----------|---------|--------------------|
| Pit          | Female| 1.59        | 1.59        | 1.59     | N/A     | 1                  |
|              | Male  | 1.65        | 1.65        | 1.65     | N/A     | 1                  |
| Early        | Female| 1.52        | 1.72        | 1.63     | 97.1    | 3                  |
|              | Male  | 1.61        | 1.76        | 1.68     | 46.0    | 9                  |
| Early–Mid    | Female| 1.46        | 1.59        | 1.54     | 55.5    | 6                  |
|              | Male  | 1.63        | 1.78        | 1.69     | 51.1    | 7                  |
| Mid          | Female| 1.56        | 1.69        | 1.62     | 42.0    | 9                  |
|              | Male  | 1.62        | 1.77        | 1.69     | 41.6    | 9                  |
| Mid–Late     | Female| 1.48        | 1.60        | 1.56     | 43.1    | 8                  |
|              | Male  | 1.65        | 1.70        | 1.67     | 17.0    | 5                  |
| Late         | Female| 1.48        | 1.70        | 1.57     | 58.8    | 14                 |
|              | Male  | 1.59        | 1.78        | 1.69     | 49.2    | 21                 |
| Total        | Female| 1.46        | 1.72        | 1.58     | 60.6    | 39                 |
|              | Male  | 1.59        | 1.78        | 1.69     | 43.9    | 56                 |

**Illus. 21** Changes in male and female stature by phase
development within this population, particularly given the relatively low mean heights of the adult population.

**Dentition**

Dentition could be examined from ninety individuals from the cemetery (seventeen non-adults, seventy-four adults, of which forty-one were male and thirty female), plus the elderly adult probable female from the pit group (F.458). Prevalence rates for various dental pathologies are presented in Table 7 and prevalence rates by age and sex group in Table 8. Prevalence rates of periodontal disease and caries are similar to those presented for the later medieval period in Roberts and Cox (2003, tables 5.17 and 8.2), although it should be noted that their figures represent data amalgamated from many different sites, and therefore simply present an average for the period. Prevalence rates of ante-mortem tooth loss and abscesses at the cemetery are lower (Roberts and

| Dentitions Affected | % crude prevalence rate | Teeth/positions Affected | % true prevalence rate |
|---------------------|-------------------------|--------------------------|-------------------------|
| Caries              | 74                      | 45                       | 60.8                    | 1630                    | 103                      | 6.3                      |
| Abscesses           | 74                      | 12                       | 16.2                    | 2041                    | 14                       | 0.7                      |
| AMTL                | 74                      | 42                       | 56.8                    | 2041                    | 154                      | 7.6                      |
| Periodontal disease | 74                      | 28                       | 36.8                    |                         |                          |                          |
| Calculus            | 74                      | 69                       | 93.2                    |                         |                          |                          |
| Hypoplasias         | 74                      | 33                       | 44.6                    |                         |                          |                          |

**Table 7** Prevalence rates for dental disease amongst adults in the cemetery

| No. of individuals | % Caries | % Abscesses | % Ante-mortem tooth loss | % Periodontal disease | % Calculus | % Hypoplasias |
|-------------------|----------|-------------|--------------------------|-----------------------|------------|---------------|
| Non-adult         | 17       | 1.45        | 0.00                     | 0.00                  | 88.24      | 64.71         |
| Adult male        | 41       | 6.30        | 0.78                     | 9.07                  | 36.59      | 97.56         | 48.78         |
| Adult female      | 30       | 6.33        | 0.50                     | 5.78                  | 40.00      | 86.67         | 40.00         |
| Adult unsexed     | 3        | 6.49        | 1.15                     | 3.45                  | 33.33      | 100.0         | 33.33         |
| All adults        | 74       | 6.32        | 0.69                     | 7.55                  | 36.84      | 93.24         | 44.59         |
| **Total**         | 91       | **5.33**    | **0.56**                 | **6.20**              | **30.77**  | **75.82**     | **48.35**     |

**Table 8** True prevalence rates of caries, abscesses and ante-mortem tooth loss and crude prevalence rates for periodontal disease, calculus and hypoplastic defects, by age and sex group
Cox 2003, table 8.2), but within the range recorded for other sites of the period, and rates of calculus and enamel hypoplasia are higher (Roberts and Cox 2003 tables 5.18 and 5.21). Males and females exhibit very similar patterns of caries and abscesses; although the rates for ante-mortem tooth loss (AMTL) and enamel hypoplasias are somewhat lower for females. Hypoplastic defects, thought to represent episodes of nutritional and/or physiological stress in childhood, were recorded in almost half of the surviving dentition with 64.7% of all immature dentitions having at least one enamel defect. The canines were the teeth most commonly affected. In almost all of the dentitions examined, from both adults and immature individuals, slight to heavy deposits of calculus (mineralized plaque) were recorded on at least half of the surviving teeth, suggesting poor oral hygiene. Four immature individuals (F.192, 254, 377, 737) had one or more carious lesions on their deciduous teeth; this suggests either weak enamel, poor dental hygiene, a diet rich in starchy carbohydrates or a combination of these factors (Hillson 1996, 269). Three adults (males F.513, 806, female F.707) had maxillary incisors that exhibited abnormal wear altering their shape, which may have resulted from para-functional wear from some habitual atypical activity.

**Pathological changes**

**Joint disease**

Sixty-two individuals, all adults, exhibited degeneration of the intervertebral discs and/or had joints exhibiting osteoarthritic changes (as defined by Rogers and Waldron 1995, 44). Twice as many males as females were affected (Table 9), and for both sexes the incidence was greatest amongst the mature adults. The spine, particularly the lumbar and lower thoracic vertebrae, is the area of the body most affected by degenerative changes, with the crude prevalence rates of other affected joints presented in Table 10. Diffuse idiopathic skeletal hyperostosis (DISH), a bone-forming condition characterized by large flowing osteophytes down the right side of the spine and entheses on the sites of other ligament and tendon attachments, was positively identified in four males (F.241, 250, 364, 739, plus possibly F.745). DISH appears to afflict the elderly, is far more common amongst men, as observed at the cemetery, and is linked to a number of possible causes including diabetes and obesity (Roberts and Manchester 1995, 120–21). The prevalence rate (CPR - crude prevalence rate = 1.2% or possibly 1.5%) is at the lower end of those afflicted for the period as reported by Roberts and Cox (2003, 246).

|                | Female | ? | Male | Und | Total |
|----------------|--------|---|------|-----|-------|
| Young adult    | 1 (1.6%) | 0 | 2 (3.2%) | 0 | 3 (4.8%) |
| Mature adult   | 12 (19.4%) | 0 | 21 (33.9%) | 0 | 33 (53.2%) |
| Elderly adult  | 6 (9.7%) | 1 (1.6%) | 14 (22.6%) | 0 | 21 (33.9%) |
| Adult          | 0 | 1 (1.6%) | 1 (1.6%) | 3 (4.8%) | 5 (8.1%) |
| **Total**      | 19 (30.7%) | 2 (3.2%) | 38 (61.3%) | 3 (4.8%) | 62    |
table 5.9), being more similar to the rate recorded at non-monastic sites than at monastic ones. Although the disease itself is not fatal, its associated complications (back pain and stiffness, difficulty in swallowing, pulmonary infections) might well have needed treatment. There is often an increased frequency of gout, itself associated with obesity, renal impairment and excessive alcohol intake, in individuals with DISH (Rogers 2000, 172). In the cemetery, one of those with DISH (mature adult male F.364), had the erosive lesions characteristic of the gout on the distal ends of both first metatarsals; this is the only individual where this disease was positively identified.

Infectious diseases

Non-specific periosteal lesions were recorded on fifty individuals, all but four of which were adults. The crude prevalence rate for adults is 13.6% (46/339), which is within the range calculated for the period by Roberts and Cox (2003, table 5.5). In those skeletons where sex could be attributed, men were more than twice as likely to have the lesions as females (twenty-five males, ten females), a trend also observed elsewhere (Roberts and Cox 2003, table 5.5). Amongst the adults the most common location of periosteal reaction was on the shafts of the fibula and tibia, particularly the tibia, suggesting chronic infection and possibly ulceration of the lower legs. Femora and feet were the next most common site to exhibit periosteal changes with single examples recorded on the pelvis, sacrum and maxillary sinuses. Three adults (F.191, 775, 928) and an immature individual (F.281) had periosteal lesions (both healed and active) on the visceral surfaces of ribs suggestive of pulmonary infections, possibly tuberculosis; in the case of F.191 this is highly probable as they also have distinctive scalloped, lytic lesions on the vertebrae (see below). In addition, three immature individuals (F.185, 188, 1018) had evidence of non-specific infection either on the tibiae, scapula, or sacrum and vertebrae. A single case of osteomyelitis was recorded in the left tibia of a robust mature male (F.364), who also had periosteal reactions on the tarsals and suffered from gout and DISH.

|           | No. Female | No. male | Und | No. total | % Overall crude prevalence rate |
|-----------|------------|----------|-----|-----------|--------------------------------|
| Spine     | 15         | 30       | 1   | 47        | 11.8                           |
| Wrist/hands| 2          | 4        | 0   | 7         | 1.8                            |
| Elbow     | 0          | 2        | 0   | 2         | 0.5                            |
| Shoulder  | 2          | 1        | 0   | 3         | 0.8                            |
| Sternoclavicular | 2    | 0        | 1   | 3         | 0.8                            |
| Ankle/foot| 5          | 5        | 2   | 12        | 3.0                            |
| Knee      | 3          | 2        | 0   | 6         | 1.5                            |
| Hip       | 1          | 1        | 0   | 4         | 1.0                            |
Cumulatively these conditions would have caused considerable suffering and any medical provision the Hospital may have been able to provide would have been of benefit.

Three individuals — a young probable male (F.191), a young female (F.360) and a mature adult (F.703) — exhibited erosive scallop-like lesions on vertebral bodies, which are characteristic of tuberculosis. Extra spinal involvement was also recorded in the ribs and pelvis of the younger individuals. The crude prevalence rate of 0.9% (3/339 adults) is obviously not an accurate reflection of the prevalence of tuberculosis in the burial population, as not all individuals had vertebrae/ribs/pelves to examine. In addition, it should be noted that tuberculosis only affects the skeleton in approximately 5–7% of cases (Aufderheide and Rodríguez-Martin 1998, 133).

**Trauma**

Twenty individuals, all adults (ten male, seven female and three unsexed), had fractures to one or more parts of the body (Tables 11–12). These fractures reflect a variety of traumatic episodes. The majority of fractures are compression fractures in the vertebrae, which can result either from a sharp vertical force, possibly by falls on to the feet or buttocks, or from underlying conditions such as osteoporosis or infection (Galloway 1999, 96; Roberts 2002, 339, figs 1–3). Both sexes are affected, with the lumbar and lower thoracic vertebrae being the most common sites. There are four instances (F.256, 296, 744, 852; two males, two females) of fractures to the ulna shaft, known as parry fractures, and these may represent evidence of interpersonal violence, where the arm has been raised to defend the head from a blow. Two examples of fractures to the distal radius, or Colles’ fractures, both in females (F.927 and 970) were recorded and these may have been the result of falling onto an outstretched hand (Roberts 2002, 339). Fractures to the scapula are rare, but the location of the one recorded here (mature male, F.376) is the most common; the result of high-energy blunt trauma, such as a blow to the back or a fall from a significant height (Duckworth and Blundell 2010, 150). The fractures in the feet (F.378, 552, possibly 970) are the result of more everyday incidents; severe twisting of the ankle and something heavy falling on the big toe or it being violently stubbed against something (Duckworth and Blundell 2010, 214). The majority of the fractures are well healed. Non-union was observed in two instances (in the scapula the acromion remains separate from the neck as does the tuberosity of the fifth metatarsal). One of the radii (F.970) is healed and well-aligned, but foreshortened and the fractures in the big toe and little finger have resulted in ankylosis with grossly mal-aligned joints.

A single case of spondylolysis, a particular type of spinal fracture where the spinous process separates from the vertebra body, was observed in a mature female (F.717) in the main cemetery, with a further case seen in the elderly female (F.458) from the pit. In both cases the fracture occurred in the fifth lumbar vertebra and was associated with a compression fracture. It is usually asymptomatic and, whilst there may be a congenital predisposition to the condition, repeated bending and lifting in an upright posture (rather than a single traumatic event) can lead to the fracture (Roberts and Manchester 1995, 78).
Within the cemetery, there is only one possible example of sharp force trauma. A young adult male (F.353) has an ovoid/sub-rectangular depressed area above the right orbit, with coarse new bone suggesting a healing wound from a blade struck from the postero-lateral direction (Illus. 22).

| Feature | Age          | Sex  | Fracture site                                                                 |
|---------|--------------|------|-------------------------------------------------------------------------------|
| 256     | Mature adult | Female | Compression fracture ninth thoracic, possible left ulna (healed callous on distal shaft) |
| 257     | Elderly adult| Female | Compression fracture first lumbar vertebra                                   |
| 296     | Young adult  | Male  | Right distal ulna                                                            |
| 363     | Elderly adult| Male  | Right distal ulna                                                            |
| 364     | Mature adult | Male  | Unsided rib                                                                  |
| 367     | Young adult  | Female | Compression of twelfth thoracic vertebrae & fifth lumbar vertebrae, body of twelfth thoracic vertebrae collapsed & fused to first lumbar vertebra |
| 376     | Mature adult | Male  | Left scapula, non-union of acromion and neck                                |
| 378     | Adult        | Male  | Possible left second metatarsal head                                          |
| 393     | Mature adult | Male  | Compression of third–fifth lumbar vertebrae                                  |
| 458*    | Elderly adult| Female | Compression fracture of fifth lumbar vertebrae, also spondylolosis           |
| 527     | Adult        | Male  | Right fifth metatarsal (non-union of the tuberosity)                         |
| 717     | Mature adult | Female | Compression fracture of fifth lumbar vertebrae, also spondylolosis           |
| 744     | Elderly adult| Female | Right distal ulna                                                            |
| 777     | (Older) mature adult | Male  | Compression of twelfth thoracic vertebrae                                    |
| 852     | Adult        | Male  | Left distal ulna                                                             |
| 924     | Young adult  | Male  | Collapse on right side of third–fifth cervical vertebrae associated with ankylosis of bodies and articulating facets on right side. Cleft neural arches of third–sixth cervical vertebrae |
| 927     | Elderly adult| Female | Left distal radius                                                           |
| 935     | (Older) mature adult | Male  | Compression of fourth or fifth lumbar vertebrae                              |
| 958     | (Older) mature adult | Male  | Fifth lumbar vertebrae, slight wedging                                       |
| 970     | (Older) mature adult | Female | Left distal radius well healed but foreshortened, left foot 1st metatarsal & phalanges fused & misaligned |
| 1007    | Young adult  | Male  | Compression of tenth thoracic vertebrae                                      |

* - from nearby burial pit
A total of seventy-seven individuals had orbits that could be examined (fourteen immature, sixty-three adults). Twenty-six individuals had lesions characteristic of cribra orbitalia (six females, nine males, two unsexed adults, nine immature; 33.8%). Of the 142 orbits examined, forty-three were affected (30.3% TPR – true prevalence rate). These rates are similar to those reported in the large assemblage from St. Mary Spital, London (Connell et al. 2012, 121). Eleven individuals had lesions characteristic of porotic hyperostosis, two of these also had cribra orbitalia. The previously accepted aetiology of these conditions, specifically iron deficiency anaemia suffered in childhood resulting from malnutrition, dietary deficiency, chronic blood loss or intestinal diseases, has been questioned by recent studies. It appears instead that porotic hyperostosis and many cribra orbitalia lesions are caused by megaloblastic anaemia, acquired through a combination of depleted maternal vitamin B12 reserves during nursing and gastrointestinal infections around the time of weaning (Walker et al. 2009).

**Table 12** Location of fractures and crude prevalence rate within the cemetery, % crude prevalence rate = no. individuals affected/no. adults in the cemetery

| Bone affected | No. adults with fracture | % crude prevalence rate | M | F | Und | Left | Right | U/S | Comments |
|---------------|-------------------------|-------------------------|---|---|-----|------|-------|-----|----------|
| Scapula       | 1                       | 0.3                     | 1 |   |     | 1    |       |     | Non-union of the acromian and neck |
| Ulna          | 5                       | 1.5                     | 2 | 1 | 1    | 0    | 3     |     | All well healed |
| Radius        | 2                       | 0.6                     | 2 |   | 1    | 0    |       |     | Well healed, one foreshortened |
| Hand          | 1                       | 0.3                     | 1 |   | 1    | 0    |       |     | Ankylosis and misalignment of fifth proximal. and mid phalange |
| Rib           | 1                       | 0.3                     | 1 |   |     | 1    |       |     | |
| Vertebrae     | 9                       | 2.65                    | 5 | 1 | 1    | 0    |       |     | Predominantly affecting lower thoracic and lumbar vertebrae |
| Feet          | 2(?)                    | 0.3                     | 1 | 1 | ?1  | 1(?) | 1     | 1 | Non-union of tuberosity in Fifth metatarsal, ankylosis and misalignment |
Congenital and developmental disorders

Four individuals (two males, a female and an immature individual aged c. 12 years, F.359, 556, 802, 902) showed evidence of *spina bifida occulta*, a condition where one or more of the sacral neural arches are incomplete, but which is usually asymptomatic. The child (F.902) also had a ‘butterfly’ vertebra (eleventh thoracic) caused by failure of the notochord to recede (Barnes 2012, 75–78). This in turn had caused scoliosis, or twisting of the spine which had pulled the spinous process of T1 to one side. Other than the scoliosis the condition would have been asymptomatic during early childhood, but
would have led to severe back pain if an individual engaged in carrying or heavy lifting (Barnes 1994, 38). A young adult (F.924) has cleft neural arches in their cervical vertebrae and these are described below with other vertebral anomalies.

Two male adults had bifurcated ribs; an elderly probable male (F.251) and a mature adult female (F.770). These defects are asymptomatic and are thought to have a strong genetic component (Barnes 1994, 72, 77). A mature adult male (F.392) had a condition known as bilateral concha bullosa, where the nasal passages are restricted by the gross expansion of the inferior nasal concha (middle turbinate). This is likely to have led to breathing difficulties, increased congestion and possibly poor sinus drainage (Walker 2012, 12). A mature adult male (F.184) had a severely misshapen, bowed sternum, characteristic of Pectus carinatum (pigeon breast), a disorder than can follow familial lines (Barnes 2012, 120) and can be asymptomatic, although the extreme curvature in this individual may have been associated with breathing difficulties. Developmental dysplasia of the hip was diagnosed in two individuals; a young female (F.197) and a mature male (F.518). In both cases the condition is bilateral. Four individuals (F.289, 385, 508, 523) had smooth, bony spurs towards the base of the lateral border of the scapula. The only two that could be attributed a sex are male and in at least one case the anomaly is bilateral. The aetiology is uncertain, but its smoothness suggests that a it is congenital condition rather than being an enlarged muscle attachment.

Vertebral anomalies

Four individuals have a transitional or extra vertebra; one had an extra thoracic vertebra at the thoracic-lumbar border (F.373) and three (F.360, 724, 745) have an extra lumbar vertebra at the lumbo-sacral border. Two individuals have isolated single conjoined vertebrae that are probably not pathological/the result of trauma; single second to third thoracic block vertebra (F.360) and single second to third cervical block vertebra (F.361). A young adult (F.924) is afflicted with vertebral anomalies in the neck, resembling type II Klippel-Feil syndrome (Barnes 1994, 67) which would have resulted in stiffness and scoliosis, with curvature to the right side; multiple block third to fifth cervical vertebrae with right lateral collapse/wedging of those bodies. Additionally, the third to sixth cervical vertebrae have cleft neural arches.

Neoplastic disorders

Erosive, ragged-edged lesions, characteristic of secondary neoplastic lesions were recorded on the skulls of two individuals. In an immature individual (F.194) the lytic lesion penetrates the ectocranium, and is slightly undercut into the diploë, and in an elderly adult male (F.363) the lesion penetrates both the inner and outer tables and is larger in diploë.

Discussion of pathological changes

Many diseases only affect the soft tissues and not the skeleton, and acute infective diseases are likely to have killed people in the past quickly before bony changes developed. With this caveat in mind there is little evidence for serious conditions within the cemetery that would have required particular medical care. Cases of chronic,
possibly longstanding conditions such as tuberculosis, DISH and neoplastic disease were observed in the burial population and whilst these diseases and related complications may have caused considerable suffering, they are not unique to hospital cemeteries and their prevalence is no higher than at other sites. The Hospital charter stated that it was to exclude leprosy sufferers and no evidence for this condition was identified, although leprosy manifests too rarely on bone for this to be taken as definitive evidence of absence. Several skeletal markers point to nutritional, physiological and pathogen stresses in infancy. Adult stature, although slightly shorter than typical for the period, is similar to that recorded in other sites in the region, although there is a far greater range in female compared with male stature suggesting they may be more affected by nutritional stresses in childhood or, with reference to the osteological paradox they were more successful in adapting and surviving these childhood stresses (Wood et al. 1992).

The consistent discrepancy between dental age and that calculated by long-bone length amongst immature remains also suggests a compromised nutritional status in childhood. Cribra orbitalia, recorded in over a third of individuals where an orbit survived, showed no differences in prevalence between the sexes. The high crude prevalence rates of hypoplastic lesions on the tooth enamel also point to episodes of childhood disease and/or nutritional disease. The fracture types are those sustained from everyday accidents, but also possibly from inter-personal violence. Inflammatory infections, specifically to the lower legs and probably resulting in painful sores, were relatively common and were recorded in twice as many males as females. Similarly, degenerative diseases were more common amongst males, but in both sexes the spine was involved more frequently than other parts of the skeleton. The high prevalence of calculus (dental plaque concretions), recorded in almost all the dentitions, suggests a diet rich in carbohydrates, presumably cereals, combined with poor oral hygiene.

NON-METRIC TRAITS

The presence/absence of only two non-metric traits thought to be familial were selected for recording. Of eighty-two individuals with a frontal bone present, eight retained the metopic suture (9.76% TPR; F.193, 194, 251, 260, 263, 359, 392, 753). Six were males or possible males, one a female and one immature. Although all bar two dated to the Late period, they were spread across the burial ground (one potential cluster lay in Area 2, where F.260 lay above F.263, this is likely to be coincidental as one burial removed most of the other, suggesting a considerable time delay between the burials). Of 171 individuals with one or more distal humeri surviving nine exhibited a septal aperture (CPR 5.3%, TPR 4.4%; F.192, 256, 281, 393, 756, 806, 925, 633, 1045); no spatial clustering was apparent.

MUSCLE ATTACHMENTS

Many of the adults, both male and female had pronounced muscle attachments, particularly on the humeri, suggesting long-standing physical activity involving the upper body. Five individuals, three female and two immature (F.260, 295, 701, 772, 725), had deep, negative depressions at the entheses or sites of muscle insertions,
particularly, but not exclusively in the lower limbs. The high frequency of grooves or ‘fossae’ at muscle and ligament attachments in immature skeletons relates to normal growth patterns and can persist into young adulthood (Villotte and Knüsel 2013, 141), but two individuals exhibiting these deep fossae are mature adults. Another possible explanation may be a fault in the hormone related protein (pTHrP), which drives the formation or excavation of entheses (Wang et al. 2013).

**Discussion**

The age and sex profile from the cemetery varies significantly from that seen at other known infirmary hospital cemeteries (Gilchrist and Sloane 2005, table 19) and from parish cemeteries in the region such as Crowland Road, Haverhill (Waldron 2005) and Mill Lane, Ormesby (Anderson 2009) ([Illus 23–24](#)). Explanations as to why the demographic profiles are so different, particularly given the high proportion of the original cemetery examined, are discussed below.

Amongst the adults, the proportion of males and females is similar, whereas in other medieval British infirmary cemetery populations younger males dominate. This trend could be explained by the inclusion in these published groups of burials from in and around the church, likely to include clergy as well as other wealthy (possibly mainly male) benefactors. The cemetery examined is physically separate from the Hospital itself and its chapel and so may contain only the poorer inmates and a small number of

| Cemetery                  | <5 | 5-15 | Adult |
|---------------------------|----|------|-------|
| St. John’s Hospital, Cambridge |   |      |       |
| St. Mary Spital, London, OAS |   |      |       |
| St. Mary Spital, London, OAA |   |      |       |
| St. Nicholas, Lewes       |   |      |       |
| St. Leonard, Newark       |   |      |       |
| St. Faith’s Lane, Norwich |   |      |       |
| St. Margaret, Ormsby      |   |      |       |
| Crowland Road, Haverhill  |   |      |       |

[ILLUS. 23](#) Broad age profile of selected cemetery populations
lay donors. At St Mary Spital, when only the area of the burial site away from chapel is examined (known as OA11) the profile is similar to that of the burial population under consideration (Thomas et al. 1997, 112, Table 15).

At the cemetery, the lack of a peak in mortality in young females (a trend observed in a ‘normal’ mortality profile and attributed to complications related to childbearing (Roberts and Manchester 1995, 25)) – creating double closed brackets can be explained perhaps because the rules of the Hospital specifically prohibited the treatment/admission of pregnant women (Rubin 1987, 157) unlike other Augustinian institutions such as St. Mary Spital, London (Connell et al. 2012, 193). The complete absence of children below the age of five is less easily explained. At St. Leonard, Newark infirmary hospital, there were no individuals aged under sixteen, although the other two infirmary sites had a small number of children under the age of five years (Table 13). In addition, the cemetery does not match the profile of the probable almshouse hospital cemetery at St. Giles, Brompton Bridge, Yorkshire (Gilchrist and Sloane 2005, Table 21) or the leprosarium of St. James and Mary Magdalene, Chichester (Gilchrist and Sloane 2005, Table 20). Demographic profiles of parish cemeteries in the region, such as Crowland Road, Haverhill (Waldron 2005) and Mill Lane, Ormesby (Anderson 2009) are also dissimilar, showing a high proportion (c. 30%) of individuals under the age of sixteen, including neonates and even a pre-term foetus. Whilst there is evidence in the medieval period for neonates and the very young to be buried adjacent to churches/chapels (Cessford
Comparative cemetery populations. Data for St. Mary Spital, London (OA5), St. Nicholas, Lewes, St. Leonard, Newark, and St. Faith’s Lane, Norwich derive from Gilchrist and Sloane 2005. Data for St. Mary Spital, London (OA11) is from Thomas (1997), Ormesby St. Margarets is from Anderson 2009 and Crowland Road, Haverhill is from Waldron 2005. * Age categories vary between authors; at St. Faith’s Lane, Norwich, immature is defined less than 20 years, while at Ormesby St. Margaret, it is defined as less than 18 years. Otherwise, immature is classified as 15 years or less.

| Site                          | Cemetery type | Date     | No. of indiv. | No. adults | <5 yrs | <5-15 yrs* | M  | F  | ?  | Comments                                      |
|-------------------------------|---------------|----------|---------------|------------|--------|------------|----|----|----|-----------------------------------------------|
| Cemetery                      | Hospital      | 13th–16th| 400           | 339        | 0      | 61 (13.9%) | 86 | 73 | 180|                                               |
| St. Mary Spital, London       | Hospital      | 13th–16th| 102           | 69         | 6 (5.9%)| 27 (26.4%) | 43 | 18 | 8  | Open Area 5                                   |
| St. Mary Spital, London       | Hospital      | 14th–16th| 108           | 96         | 0      | 12 (11.1%) | 49 | 41 | 6  | Open Area 11                                  |
| St. Nicholas, Lewes           | Hospital      | 12th–14th| 103           | 93         | 6 (5.8%)| 3 (2.9%)   | 67 | 16 | 20 |                                               |
| St. Leonard, Newark           | Hospital      | 12th–16th| 87            | 87         | 0      | 0          | 66 | 11 | 10 |                                               |
| St. Faith’s Lane, Norwich     | Franciscan    | 13th–16th| 136           | 92         | 0      | 44 (32.4%) | 76 | 24 | 0  | No individuals aged less than eight years     |
| Ormesby, St. Margarets        | Parish        | 11th–14th| 62            | 45         | 12 (19.4%)| 10 (16.1%)| 18 | 27 | 0  | Neonates and foetal remains present           |
| Crowland Rd, Haverhill        | Parish        | 11th–14th| 355           | 241        | 48 (13.5%)| 55 (15.5%)| 110| 98 | 33 | Neonates and foetal remains present           |
and Dickens 2007, 167–69; Connell et al. 2012, 5) this was not to the total exclusion of them being interred within the cemetery proper. The fact that not a single identifiable individual or disarticulated bone could be aged under five years, and that only 6.3% of those in the excavated burials were under ten years old, must either indicate that children this young were not present in the Hospital, or that if they were then they were buried elsewhere, perhaps close to the main Hospital or Chapel.

**Stable Isotope Analysis**

Carbon and nitrogen stable isotope analysis was undertaken by Mary Price on bones from 106 skeletons (Price 2013). The δ13C samples show little variability; their range is just 1.8‰ with a mean value of -19.1‰, indicating minimal marine input into the diet. The δ15N range is broader, with a mean value of 12.3 and a range of 6.0‰; this may indicate significant variation in the sources of dietary protein, though this is not conclusive without further work. There was no evidence for any statistically significant change in diet over time, or variation based upon sex or age. There was, however, some minor sex and age related variation that may be meaningful. The mean δ15N value is higher for individuals identified as definitely male than for those identified as definitely female and the spread of δ13C values is lower for females than for males. The reasons for this are unclear. It appears that young adults may have consumed a slightly different diet from non-adults and more mature adults, or that they consumed a very different diet for part of the year. One possibility is that the young adults were involved in harvest activities away from Cambridge and consumed a different diet at this time. Elevated δ13C and δ15N might suggest that harvest workers were given better access to dietary protein, and specifically to marine fish since both carbon and nitrogen are enriched. The cemetery data was compared to published results from 632 individuals from fifteen sites in the British Isles of broadly similar date (Price 2013, 53–63). The results fall within the typical range of results from other sites, although there do appear to be statistical differences between individuals of different social status and from different geographic localities.

**Radiocarbon Dating**

Ten samples were submitted for radiocarbon dating (Table 14). Radiocarbon dating of medieval urban cemeteries can be fruitful, but is problematic due to the potential impact of dietary offsets, such as those linked to marine component and the fact that bone collagen is slowly turned over throughout life on a c. 10–30 year cycle. Overall, determinations often produce results that are rather earlier than other evidence indicates (Bayliss et al. 2004; Sidell et al. 2007). Although marine fish apparently played an increasingly important role in medieval England after c. AD 1000 (Barrett et al. 2004), the average δ13C values for the individuals from the cemetery suggest that marine resources did not form a significant proportion of the diet and only relatively low quantities of fish bone have been recovered from excavations in Cambridge. Although exactitude is impossible, it is probable that the determinations are c. 10–20 years earlier than their true date. Additionally, it is unlikely that the very earliest and latest interments at the burial ground were dated. Indeed, it is possible that no traces of the earliest
| Laboratory no. | Material dated | Feature & context       | Description                                          | $\delta^{13}$C | Radiocarbon age (BP) | Calendar date (95% confidence) |
|---------------|----------------|-------------------------|------------------------------------------------------|----------------|----------------------|--------------------------------|
| SUERC-50570   | Human right tibia | F.982 [3566]            | Adult in pre-cemetery pit                            | -19.0          | 1849±30              | cal. AD 85–236                  |
| SUERC-50578   | Cat, two right femora | F.939 [3413]          | Cat in pre-cemetery pit, less than 6 months old     | -19.8          | 997±30               | cal. AD 985–1152                |
| SUERC-50568   | Human rib         | F.901 [3299]            | Young adult, male, from early phase of cemetery      | -19.4          | 782±30               | cal. AD 1207–1281               |
| SUERC-50572   | Human rib         | F.902 [3301]            | Immature individual, from early phase of cemetery    | -19.8          | 711±30               | cal. AD 1255–1385               |
| SUERC-50571   | Human rib and right fibula | F.377 [3241] | Child from mid phase of cemetery (earlier of two)    | -19.5          | 743±31               | cal. AD 1223–1290               |
| SUERC-50574   | Human rib         | F.395 [3288]            | Older mature adult, male from mid phase of cemetery (later of two) | -19.6          | 622±30               | cal. AD 1291–1400               |
| SUERC-50573   | Human rib         | F.367 [3207]            | Young adult, female from late phase of cemetery (earlier of two) | -18.8          | 710±30               | cal. AD 1256–1385               |
| SUERC-50569   | Human rib         | F.364 [3196]            | Mature adult, male from late phase of cemetery (later of two) | -19.1          | 614±30               | cal. AD 1295–1401               |
| SUERC-50564   | Human rib         | F.457 [4096]            | Younger mature adult, male from co-terminus burial   | -19.4          | 693±30               | cal. AD 1265–1388               |
| Beta-240952   | Human right femur | F.204 [2010]            | Disarticulated adult bone, from late 16th–early 17th century pit | -19.6          | 980±40               | cal. AD 991–1157                |
interments survive, as some of the stratigraphically earliest burials contained disarticulated human remains that cannot have derived from any surviving identified burial.

Bayesian analysis (http://bcal.sheffield.ac.uk; Buck et al. 1999) confirmed that burial began in the thirteenth century, with nothing to contradict the documentary date of c. 1200–40, and definitely continued until the fourteenth and probably the fifteenth centuries (Table 15). The determinations are fully compatible with the phasing sequence and indicate that if burial took place throughout the existence of the cemetery (c. 1200–1511) then the rate of burial was much greater during the earlier part of this period, c. 1200–1350 (Tables 15–16). Whilst it is unlikely that the cemetery phases correspond to documented events, at a broad level it is probable that the Early and Mid phase burials pre-date the Great Mortality of 1348–50 and the Late phase burials post-date it. The determinations also support the assumption that burial did not continue after 1511.

### Table 15
Probable dates of cemetery and its phases based upon Bayesian analysis of the radiocarbon determinations, figures in brackets allow for determinations being 10–20 years earlier that the true date of the skeletons

| Phase Description          | 95% Probability | 68% Probability | Probability pre-dates 1348 (%)
|----------------------------|-----------------|-----------------|-----------------------------|
| Start of cemetery          | 1158–1279       | 1226–73         | 100.0                      |
| Early/Mid phase transition | 1253–93         | 1268–83         | 99.7                       |
| Mid/Late phase transition  | 1282–1377       | 1282–1375       | 70.1                       |
| End of cemetery            | 1290–1660       | 1297–1450       | 20.1                       |

### Table 16
Likely duration of cemetery and its phases in years, based upon Bayesian analysis of the radiocarbon determinations

| Phase Description | 95% Probability | 68% Probability |
|-------------------|-----------------|-----------------|
| Early phase       | 1–128           | 1–45            |
| Mid phase         | 1–106           | 1–100           |
| Late phase        | 1–332           | 1–102           |
| Overall cemetery  | 24–425          | 55–222          |
OUTSIDE THE CEMETERY

Throughout the centuries when the burial ground was in use, the rest of the street block was occupied by eleven thriving domestic plots, which led to the creation of rich and complex stratigraphic sequences. As far as can be determined, the occupation of these plots and the activities that took place in their backyards (which were the main focus of investigation) were typical of sites excavated in Cambridge. The cemetery had a negligible impact upon neighbouring properties. Only a small quantity of human bone was found outside the graveyard; two fifteenth-century features located 5–10m east of it contained a few vertebrae and hand and foot bones, which need represent no more than one individual (for location see Illus 2 and 7). Whilst some contemporary pottery and other material was recovered from the burial ground, there is no evidence that this derives from the neighbouring plots rather than elsewhere. Overall, therefore, the cemetery appears to have been a self-contained entity.

The bulk of the archaeological features and material culture are broadly typical of the period in Cambridge; they will not be discussed in detail here but this can be found in the grey literature reports. The street block lay within the heart of the Jewry that was established c. 1135–44 (Hillaby 2003). No definite evidence for a Jewish presence could be identified, although a hoard of coins and jewellery recovered nearby in the early nineteenth century may be linked to this group (Cessford and Newman 2012; for location see Illus. 1). The property on the corner of Bridge Street and St. John’s Street was not investigated, but appears to have been the most impressive in the street block. In a document of 1267 this was described as ‘the land with stone houses and buildings which Isaac son of Samuel the Jew once held’ and it later became known as the Stonehostel. Two pieces of ashlar, one recovered from a thirteenth-/fourteenth-century context, the other from a fifteenth-century context, both date to c. 1070–1200 and may derive from these buildings.

One notable discovery was a bone knife handle (Illus. 25) recovered from a fifteenth-century ditch fill (for location, see Illus 2 and 7). This exquisitely carved piece depicts a female figure wearing a large headscarf or hood that is held in place by a decorative headband; to either side of her head, stylized ears of corn are depicted. The surviving fragment measures 32mm in length by 21mm in width and is 7mm thick; it was manufactured from large mature mammal long bone, perhaps cattle or horse. This striking artefact belongs to the small though widespread group of high medieval secular anthropomorphic bone and ivory handles (Bencard 1975; Howe 1983; Hall 2001). Thirty-three such handles are known, including eight from the British Isles, and they appear to largely date to the late thirteenth and early fourteenth century (on the initial stylistic dating of c. 1250–1350 with an outlier at c. 1400 see Bencard 1975, 58–9. For dated British examples see Armstrong and Ayers 1987, 290; MacGregor 1985, 170; 2000, 165; Hall 2001, 169). The closest parallel is the example interpreted as depicting a ‘Maying’ celebrant recovered from an early fourteenth-century context in Perth, and it is possible that the imagery on both these handles is associated with aspects of seasonal or fertility symbolism (Hall 2001). The present example, although recovered from a fifteenth-century context, is stylistically similar to these earlier examples and is highly worn, suggesting that it was a valued and long-lived item.
One other discovery of note was a metalworking workshop, established in the fifteenth century (for location see Illus. 7). Here, secondary smithing activity took place within a rectangular timber-framed building with a clunch-built sill, which contained a gently pitched clay floor into which was set an off-centre tile-lined drain.

ILLUS. 25 Late thirteenth-/early fourteenth-century bone knife handle depicting a probably female figure, deposited in a fifteenth-century ditch.
This workshop continued in use until the early sixteenth century and was the first of three successive structures that indicate continued metalworking activity until the seventeenth century. The associated evidence demonstrates that high-temperature forging and welding of iron was taking place at the earliest workshop with hearth bases, spheroidal slag droplets, cindery iron slag, hammer-scale, waste iron and tuyeres all present in this phase. There is also evidence that coal was being used as a fuel, at a time when this was the exception rather the norm, which was probably imported from Newcastle via King’s Lynn (Lee 2005, 161–2).

**AFTER THE CEMETERY**

The period after 1511 largely falls beyond the scope of this article. It is, however, relevant to consider how the presence of the burials affected later activity at the site, especially as most considerations of the later treatment of high-late medieval human remains have focused upon sites that continued to function as burial grounds (Gilchrist 2003; Tarlow 2011; Cherryson et al. 2012). Between 1511–50/60 the area of the former graveyard was divided between four properties fronting onto St. John’s Street. The cemetery area itself was largely occupied by gardens, with a cask-lined well (F.362) and a few pits (Illus. 26). One of these pits (F.223) was dug soon enough after the original burials that it contained three semi-articulated legs, probably from two individuals. In 1550–60 the area was combined into a single property. This became the St. John’s College Pentitionary by 1581 (which provided additional accommodation for undergraduates) and survived as such until 1877. The site itself continued to be an open garden until the mid/late seventeenth century; the cask-lined well continued in use, parts of the area were covered with yard-like surfaces — some incorporating waste from nearby ironworking — and a number of pits were dug.

Whilst some of these pits truncated burials (for an example see Illus. 22), around half appear to have deliberately halted when they first encountered human bone, or at just above this height. Four of the pits contained significant quantities of human bone (F.129, 133, 529, 657); in all four instances, the quantities involved were too large to derive from the pit in which they were deposited. It therefore appears that disturbed human bone was retained at the Pentitionary for a time and then deposited in pits. In most instances this human bone showed no sign of any particular organization, the sole exception was a pit (F.129) where seven crania were placed upside down on the base. Long bones from a similar number of individuals were then placed horizontally in a criss-cross pattern before other smaller bones were piled around. It is notable that in comparison to the other investigated areas within the street block the density of pit digging in the post-medieval period was much lower in the cemetery area and the pits are generally shallower. This suggests that a memory of the presence of the burial ground was retained by the occupiers of the properties. A radiocarbon determination on a disarticulated bone from a late sixteenth-/early seventeenth-century pit (F.204) is significantly earlier than the determinations from the cemetery proper (Table 14). The most probable conclusion, unless the determination is simply a statistical anomaly, is that human bone from the adjacent parish graveyard of All Saints, which was in existence by
illus. 26 Disturbance to the cemetery and environs after 1511; only truncations that would have removed in situ skeletons are shown.
c. 1077–93 (Riley 1867, 55; for location see Illus. 1), and the Hospital cemetery have both been disturbed and become commingled.

From the mid-/late seventeenth century onwards the area began to be built over. As a result, pits and similar features ceased to be dug. Most of the wall foundations were too shallow to disturb the burials, but some cellars were deep enough to do so (Illus. 26). A fellow of St. John’s College, the antiquary Thomas Baker (1656–1740), noted that at the Petitionary site ‘the many skulls and bones dug up under the neighbouring houses sufficiently evince that a cemetery has been there … this cemetery might have been for the poor and infirm that resorted hither [to the Hospital]’ (Mayor 1869, 43).

In 1877 all existing buildings on the site were demolished and the area levelled prior to the construction of the Selwyn Divinity School (now known as the Old Divinity School), which opened in 1879. The Old Divinity School had substantial wall foundations and was partially cellared; overall, c. 40% of the burial ground was disturbed (Illus. 26). Many skeletons were presumably removed in their entirety, whilst others were truncated (see Illus 12 and 13.3) with evidence that some bones that protruded into foundation cuts were pulled out. Other protruding bones, perhaps those that proved difficult to pull out, showed signs of being deliberately cut through, this process appears to have involved the forceful use of digging tools in a confined foundation trench that can be viewed as relatively uncontrolled and violent. Although many smaller bones were incorporated into general construction deposits — and also probably removed from the site entirely — the larger and more easily recognizable human bones such as the humerus, tibia, femur, hip bone and crania in particular appear to have been stored on site for a time and periodically disposed of when the trenches for building foundations were backfilled (Illus. 27: Table 17). At least eight such deposits were identified and it is likely that several more remain in situ.

As already discussed, the local antiquary Hughes was aware of the disarticulated human remains in pits along the southern fringe of the cemetery (Hughes 1898, 378). Hughes was, however, unaware of the existence of the main burial ground, which was being extensively disturbed at this time, and associated the disarticulated remains with the church of All Saints, itself demolished in 1865 (Cam 1959, 124). There is no evidence that the existence of the cemetery proper was brought to the attention of the authorities in the 1870s, indicating that the disturbance and re-interment of the human remains was a surreptitious act in contravention of the 1857 Burial Act. These events also took place after the disturbance of the graveyard of St. Pancras Old Church, London, in 1866–67 during the construction of the St. Pancras railway terminus, which led to great public outcry at the exhumation of over seven thousand individuals who were re-interred (Emery and Wooldridge 2011, 190–94). Further disturbance of the disarticulated human bone in the Old Divinity School footings took place during the early/mid twentieth century, when various garden features were dug alongside the building (Newman 2008, 48).

By the late twentieth century, study of the documentary archives of St. John’s College meant that the approximate location of the cemetery was known. Its scale and extent were, however, unclear; indeed, it is unlikely that the re-development of the Old Divinity School would have involved the creation of substantial new cellars had this information been available.
Illus. 27  View of disarticulated human bone from the cemetery deposited in the construction cut for the Old Divinity School in 1877–79, facing north-west, and relative frequencies of different skeletal elements in the deposit (by MNI)
DISCUSSION AND CONCLUSIONS

The recovery of four hundred complete or partial in situ skeletons from the lay cemetery of the Hospital — all of which were assigned to at least a broad age category, and of which 161 adults could be definitely or probably sexed — represents one of the largest medieval hospital burial assemblages from the British Isles.

The establishment of the cemetery led to the obliteration of four previously occupied plots, removing all visible traces of them. This creation of tabula rasa was by no means an uncommon event in towns such as Cambridge; it must have occurred at a number of other religious sites, as well as at the Norman castle and around the settlement’s perimeter when the town ditch was established. Later on, similar events would also be associated with the establishment of many of the colleges of the University,

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**Table 17** Minimum number of individuals calculated by skeletal element for one of the large deposits associated with the construction of the Old Divinity School

| Skeletal element | MNI | MNI % of commonest element |
|------------------|-----|----------------------------|
| Skull            | 28  | 22.6                       |
| Shoulder girdle  | 8   | 6.5                        |
| Vertebrae        | 7   | 5.6                        |
| Ribs             | 4   | 3.2                        |
| Right ox coxa    | 36  | 29.0                       |
| Left ox coxa     | 41  | 33.1                       |
| Sacrum           | 19  | 15.3                       |
| Right humerus    | 74  | 59.7                       |
| Right ulna       | 16  | 12.9                       |
| Right radius     | 14  | 11.3                       |
| Left humerus     | 49  | 39.5                       |
| Left ulna        | 17  | 13.7                       |
| Left radius      | 10  | 8.1                        |
| Right femur      | 105 | 84.7                       |
| Right tibia      | 54  | 43.5                       |
| Right fibula     | 9   | 7.3                        |
| Left femur       | 124 | 100.0                      |
| Left tibia       | 55  | 44.4                       |
| Left fibula      | 3   | 2.4                        |
| Patella          | 1   | 0.8                        |
| Hands/feet       | 2   | 1.6                        |
particularly King’s College. The establishment of the graveyard could be viewed as shifting this space from an area for the living to one for the dead. This would, however, ignore the fact that burial is much more a reflection of the needs of the living than of the dead. This is exemplified by the paths, which are for the convenience of the living, as well as the features on the fringe of the burial ground and the well that supplied water.

Whilst the cemetery was in operation it appears to have had a negligible impact upon adjacent properties, whose archaeological sequences appear typical of the backyard activities that occurred throughout Cambridge. The environment of the area in and around the burial ground included open, nutrient-enriched land with occasional shrubs that can be characterized as waste or rough ground/grassland with common nettles, poppies, vetches, common mallow, bird’s foot trefoil, shepherd’s purse, ribwort plantain nettle-leaved goosefoot, chickweed, violet, cow parsley, fool’s parsley, black nightshade, dead-nettle and honeysuckle. This vegetation would have meant that the graveyard was a largely green space, albeit with occasional flashes of red from poppies at the appropriate time of year. This would have contrasted strongly with the quite bright orange of the gravels paths. Whilst older burials are likely to have been relatively invisible, recently backfilled graves would have stood out against the green background as low dark brown–black earthen mounds. The cemetery can be viewed as a place of contrasting colours and in the absence of evidence for more formal above-ground monuments the impact of the dark mounds of recent graves against a green background may have been the only visual memorial that the recently deceased hospital inmates had. The presence of the poppies, which flower colourfully from June through to September, also suggests that the experience of the cemetery may have varied markedly throughout the year. Whilst undeniably speculative this does suggest that archaeologists need to explicitly consider the emotional aspects of medieval cemeteries, both the space and the individual graves that comprise them (Tarlow 2000). The graveyard might be conceived as a relatively cheerful open green space in the centre of the town during summer, whereas if the placement of a child/young immature individual (F.354) in an overly long pre-dug grave does indicate a winter burial, then the visual incongruity could easily have emphasized contemplation of a life cut short at a bleak time of year.

The majority of the burials can be characterized as highly uniform and standardized, where a corpse was placed in a pre-dug grave in a supine position on a west–east alignment with no noticeable attempt to individuate or commemorate the event. Burial is likely to have been a relatively regular occurrence, taking place every few months. Children under five were completely absent and individuals aged under sixteen are relatively uncommon. The complete absence of young children must either indicate that they were not present in the Hospital or, if they were, that they were buried elsewhere. Both options are possible, especially given the physical separation of the graveyard from the main Hospital by an intervening road. Males were slightly better represented than females, but not markedly so in contrast to other comparable cemeteries (Gilchrist and Sloane 2005, table 19). In particular, there was no peak in mortality amongst young females, presumably reflecting an absence of women who died as a result of childbirth due to a rule against pregnant women in the Hospital. Several
skeletal markers point to the fact that the burial population had suffered from nutritional, physiological and pathogen stresses in childhood. Although a range of pathological changes was identified on the skeletons, the prevalence rates for these are not marked. There is little evidence for serious conditions that would have required particular medical care. This could reflect that the main role of the Hospital was the spiritual and physical care of the poor and infirm rather than medical treatment of the sick and injured. A few individuals, particularly those suffering from multiple conditions or with a healing wound, would have benefited from medical treatment, but these represent an extremely small minority of the burials and there is no direct evidence for treatment. In contrast, other cemeteries such as St. Mary Spital, London, have produced more evidence for healing and treatment (Connell et al. 2012, 210–17), albeit from a much larger number of skeletons.

Within this overall pattern there were a few unusual burials. Eleven such examples were identified, and when allowance is made for the impact of later disturbance and other factors, the likely number of such atypical burials is c. 60–70. As the unusual burials represent a rather heterogeneous group, discussing them collectively is perhaps misleading. Assigning any particular meaning to them is also problematic; at one extreme, the two south-north burials that ‘block’ one of the pathways must represent an officially sanctioned act that was deliberately undertaken to create some form of message. As the gravel path was not re-laid afterwards, and there was presumably a low mound above each of the graves, this would have created a lasting visual statement for those using other parts of the cemetery. In contrast the east-west (i.e. reverse) aligned burials need not represent deliberate acts at all, and even if they were they would have been indistinguishable from other burials after the grave was backfilled. Other events, such as the coterminous burial in a pit and the double burial must presumably have been officially sanctioned, although they need not have had any associated purpose beyond the interment itself. It is not certain whether the occasional grave-goods would have been visible during the burial; in any case, given that the jet crucifix and cruciform pendant were broken, none of these represent particularly expensive or ostentatious items. They may well reflect private individual statements, whereby another inmate or a member of staff ensured that the deceased retained a particularly treasured item.

One noteworthy absence is the lack of any large co-terminus burial groups that might be associated with the Black Death of 1348–50. In the post-medieval period plague victims from Cambridge were buried on Midsummer Common and Coldham’s Common (Williamson 1957, 58–59). Although documentary evidence is lacking for the fourteenth century it is possible that the same practice applied at this time.

Disturbance of the interred skeletons occurred frequently whilst the cemetery was in use, with the remains treated with varying degrees of respect. After the burial ground went out of use it is clear that the memory of its presence was long-lived, with disturbance relatively infrequent and a degree of care usually shown to the bones. Respect and care were, however, demonstrably absent in the 1870s, when secrecy, illegality and expediency appear to have been overriding factors during construction activity at the site.
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The reports relevant to the cemetery are all accessible at the Library of Unpublished Fieldwork Reports hosted by the Archaeology Data Service at http://archaeologydataservice.ac.uk/archives/view/greylit/

SUPPLEMENTAL DATA

Supplementary files for this article are included on the Archaeological Journal’s online platform (http://dx.doi.org/10.1080/00665983.2014.984960), including phased grave plans (Cessford 2015 So1), Harris matrix (Cessford 2015 So2), general photographs of parts of the cemetery (Cessford 2015 So3), photographs of a selection of burials (Cessford 2015 So4) and a simplified burial catalogue (Cessford 2015 So5).

BIBLIOGRAPHY

Adamson, R. H. 2014. Stonemasons’ drawings on building fabric: diversity, form and function, Archaeol. J., 171, 258–88
Alexander, J. A., Browne, D. and Spratling, M. 1972. Excavation at Comet Place/St John’s Place. Unpubl. Rep, Cambridgeshire County Records Office
Anderson, S. 2009. The human skeletal remains, in H. A. Wallis. A Medieval Cemetery at Mill Lane, Ormesbury, St Margaret, Norfolk, 11–27, East Anglian Archaeol. 130, Gressenhall: Norfolk Archaeological Unit
Armstrong, P. and Ayers, B. 1987. Excavations in High Street and Blackfriargate, Hull Old Town Rep. Series 5, Hull, East Riding Archaeological Society
Ashby, S. 2011. An atlas of medieval combs from northern Europe, Internet Archaeol. 30, http://dx.doi.org/10.11141/ia.30.3
Aufderhide, A. C. and Rodríguez-Martin, C. 1998. The Cambridge Encyclopaedia of Human Palaeopathology, Cambridge: Cambridge University Press
Babington, C. C. 1864. On some remains of the Hospital of St. John the Evangelist at Cambridge, Cambridge Antiq. Committee, II.5, 351–63
Babington, C. C. 1874. History of the Infirmary and Chapel of the Hospital and College of St. John the Evangelist at Cambridge, Cambridge: Deighton, Bell and Co.
Barnes, E. 1994. Developmental Defects of the Axial Skeleton in Palaeopathology, Boulder, CO: University Press of Colorado
Barnes, E. 2012. Atlas of Developmental Field Anomalies of the Human Skeleton, A Paleopathology Perspective, Hoboken: Wiley-Blackwell
BARRETT, J. H., LOCKER, A. M. AND ROBERTS, C. M., 2004. ’Dark Age economics’ revisited: the English fish bone evidence AD 600–1600, Antiquity, 78, 618–36.

BAYLISS A., SHEPPARD POpescu E., BEErAV—AthyFIeld, N., BRONK RAMSEY, C., COOK, G. T. AND LOCKER, A. 2004. The potential significance of dietary offsets for the interpretation of radiocarbon dates; an archaeologically significant example from medieval Norwich, J. Archaeol. Sci., 31, 563–75.

BENCARD, M. 1975. Om et middelalderligt knivskaft fra Ribe, in V. Andersen, V. Bruhn and S. Mogensen (eds) Festskrift til H K Kristensen, 35–61, Ribe, Historisk Samfund fra Ribe Amt.

BENT, D. D., FORBES, S. L. AND STUART, B. H. 2004. Review of human decomposition processes in soil, Environmental Geol., 45, 576–85.

BIDDLE, M. 1990. Artefacts from Medieval Winchester Part II. Object and Economy in Medieval Winchester, Winchester Stud., 7, Oxford: Oxford University Press.

BIDDLE, M. AND HINTON, D. A. 1990. Annular and other brooches, in Biddle 1990, 639–43.

BODDINGTON, A. 1987. Raunds, Northamptonshire: analysis of a country churchyard, World Archaeol., 18, 411–25.

BODDINGTON, A. 1996. Raunds Furnells: the Anglo-Saxon Church and Churchyard, English Heritage Archaeol. Rep., 7, London: English Heritage.

BRICKLEY, M. AND MCKINLEY, J. I. (eds) 2004. Guidelines to the Standards for Recording Human Remains, IFA Paper, 7, Reading: Institute for Archaeologists.

BROOKS, S. AND SUCHEY, J. 1990. Skeletal age determination based on the os pubis: a comparison of the Acsádi and Neméškeri and Suchey–Brooks methods, Human Evolution, 5, 227–38.

BROTHWELL, D. 1981. Digging Up Bones, 3rd edition, Oxford: Oxford University Press.

BROWN, W. A. B. 1985. Identification of Human Teeth, Dorking, Adlard and Son.

BUCK, C. E., CHRISTEN, J. A. AND JAMES, G. N. 1999. BCal: an on-line Bayesian radiocarbon calibration tool, Internet Archaeol., 7, http://intarch.ac.uk/journal/issue7/buck/.

BUkKRA, J. E. AND UBELAKER, D. H. (eds) 1994. Standards for the Collection from Human Skeletal Remains, Arkansas Archaeol. Survey Res. Ser., 44, Fayetteville: Arkansas Archaeological Survey.

CAM, H. 1959. The city of Cambridge, in J. P. C. Roach (ed.) A History of the County of Cambridge and the Isle of Ely Volume III The City and University of Cambridge, 1–149, Oxford: Oxford University Press.

CESSFORD, C. 2006. St. John’s Triangle, Cambridge: An Archaeological Excavation, Cambridge Archaeological Unit, Rep., No. 729.

CESSFORD, C. 2007. Grand Arcade, Cambridge: An Archaeological Excavation. Cambridge Archaeological Unit, Rep., No. 800.

CESSFORD, C. 2009. The Old Divinity School, St. John’s College, Cambridge: An Archaeological Evaluation and Watching Brief, Cambridge Archaeological Unit, Rep., No. 861.

CESSFORD, C. 2012. The Old Divinity School, Cambridge: An Archaeological Excavation, Cambridge Archaeological Unit, Rep., No. 1094.

CESSFORD, C. WITH ALEXANDER, M. AND DICKENS, A. 2006. Between Broad Street and the Great Ouse: Waterfront Archaeology in Ely, East Anglian Archaeol., 114. Cambridge: Cambridge Archaeological Unit.

CESSFORD, C. WITH DICKENS, A. 2007. Ely Cathedral and environs: recent excavations, Proc. Cambridge Antiq. Soc., 96, 161–74.

CESSFORD, C. AND DICKENS, A. 2011. An urban hospital cemetery and adjacent occupation, Medieval Archaeol., 55, 306–11.

CESSFORD, C. AND DICKENS, A. in prep. From King’s Ditch to Department Store: investigations of an 11th–20th Century Suburb and the Town Ditch of Cambridge.

CESSFORD, C., WITH DICKENS, A., DOWDOWELL, N. AND REYNOLDS, A. 2007. Middle Anglo-Saxon justice: the Chesterton Lane Corner execution cemetery and related sequence, Cambridge, Archaeol. J., 164, 197–226.

CESSFORD, C. AND NEwMAN, R. WITH ALLEN, M. AND HINTON, D. 2011. The Dolphin Inn Hoard: re-examining the early nineteenth-century discovery of a mid-thirteenth-century hoard from Cambridge, Archaeol. J., 168, 272–84.

CHERRY, J. 2013a. The jet crucifix, in M. R. McCarthy, Excavations at Carlisle Cathedral in 1988: Roman, Medieval and Post-Medieval Data, 87–91, York: Archaeology Data Service. doi:10.5284/1019911.

CHERRY, J. 2013b. Jet crucifix, in K. Kolls and W. Mitchell, A Cycle of Recession and Recovery AD 1200–1900: Archaeological Investigations at Much Park Street, Coventry 2007 to 2010, 77–78, Oxford: Brit. Archaeol. Rep. Brit. Ser., 582.
118 ST. JOHN’S HOSPITAL CEMETERY AND ENVIRONS, CAMBRIDGE

Cherryson, A., Crossland, Z. and Tarlow, S. 2012. A Fine and Private Place: the Archaeology of Death and Burial in Post-medieval Britain and Ireland, Leicester Archaeol. Monogr., 22, Leicester: University of Leicester School of Archaeology and Ancient History

Connell, B., Jones, A. G., Redfern, R. and Walker, D. 2012. A Bioarchaeological Study of Medieval Burials on the Site of St. Mary Spital: Excavations at Spitalfields Market, London E1, 1991–2007, MoLA Monogr. 60, London, Museum of London Archaeology

Coppock, G. 1984. Two jet crucifixes from North Lincolnshire: their use, date and significance, in N. Field and A. White (eds), A Prospect of Lincolnshire: Being Collected Articles on the History and Traditions of Lincolnshire in Honour of Ethel H. Rudkin, 61–63, Lincoln, Privately Printed

Daniel, G. 1939. A note on finds of archaeological interest recently made in the College, The Eagle, 51, 144–47

Dickens, A. 1996. Archaeological Excavations at St. John’s College, Cambridge, Cambridge Archaeological Unit, Rep., No. 175

Evans, G. R. 2010. The University of Cambridge: A New History, I. B. Tauris, London

Falks, C. G. and Lewis, M. E. 2011. Proposing a way forward: a review of standardisation in the use of age categories and ageing techniques in osteological analysis (2004–2009), Int. J. Osteoarchaeol., 21, 704–16

Ferrante Di Ruffano, L. and Waldron, T. 2006. The Skeletal Analysis of an Anglo-Saxon Population from Cherry Hinton, Cambridgeshire, Unpubl. Rep., Cambridgeshire Historic Environment Record

Galloway, A. (ed.) 1999. Broken Bones: Anthropological Analysis of Blunt Force Trauma, Springfield: Charles C. Thomas

Gilchrist, R. 2003. ‘Dust to dust’: revealing the reformation dead, in D. Gaimster, and R. Gilchrist (eds), The Archaeology of Reformation 1480–1580, 399–414, Soc. Post Medieval Archaeol. Monogr. 1, Leeds: Maney

Gilchrist, R. 2008. Magic for the dead? The archaeology of magic in later medieval burials, Medieval Archaeol., 52, 119–175

Gilchrist, R. and Sloane, B. 2005. Requiem. The Medieval Monastic Cemetery in Britain, London, MoLAS

Grainger, I., Hawkins, D., Cowal, L. and Mikulski, R. 2008. The Black Death Cemetery, East Smithfield, London, MoLA Monogr., 43. London: Museum of London Archaeology

Griffiths, N. 1986. Horse Harness Pendants, Datasheet, 5. London: The Finds Research Group AD 700–1700

Griffiths, N. 1995. Harness pendants and associated fittings, in J. Clark (ed.), The Medieval Horse and its Equipment, c. 1150 – c. 1450, Medieval Finds from Excavations in London, 5. London: HMSO

Gummer, B. 2010. The Scourging Angel. The Black Death in the British Isles, London, Vintage Books

Hall, A. and Dickens, A. 2005. St. John’s Triangle, Cambridge: An Archaeological Watching Brief, Cambridge Archaeological Unit, Rep., No. 695

Hall, M. A. 2001. An ivory knife handle from the High Street, Perth, Scotland: consuming ritual in a medievalburgh, Medieval Archaeol., 45, 169–88

Harde, K. W. 1984. A Field Guide in Colour to Beetles, London: Octopus

Heighway, C. M. and Bryant, R. 1999. The Golden Minster: the Anglo-Saxon Minster and Later Medieval Priory of St. Oswald at Gloucester, Counc. British Archaeol. Res. Rep., 117, York: Council for British Archaeology

Hillary, J. 2003. Jewish colonisation in the twelfth century, in P. Skinner (ed.), The Jews in Medieval Britain: Historical, Literary and Archaeological Perspectives, 14–40, Woodbridge: Boydell Press

Hillson, S. 1996. Dental Anthropology, Cambridge, Cambridge University Press

Hinton, D. A. 1900. Pendants, in Biddle 1990, 643–46

Howe, M. D. 1983. A medieval knife handle from Crowland, Lincolnshire, Medieval Archaeol., 28, 146–50

Hodgson, J. F. 1902. On low side windows, Arch. Adina, Second Ser., 23, 43–200

Hughes, T. Mck. 1898. Further observations on the ditches round Cambridge with special reference to the adjoining ground, Proc. Cambridge Antiq. Soc., 9, 370–84

Karn, M. 2013. English Episcopal Acta: Ely, 1198–1256, Oxford: Oxford University Press
Kenward, K. 2005. Cambridge and its Economic Region, 1450-1560, Stud. Regional and Local Hist. 3, Hatfield: University of Hertfordshire Press.

Lovejoy, C., Meindl R., Pryzbeck, T. and Mensforth, R. 1985. Chronological metamorphosis of the auricular surface of the ilium: a new method for the determination of adult skeletal age at death, *Am. J. Phys. Anthropol.*, 68, 15–28

Lucht, W. H. 1987. *Die Käfer Mitteleuropas*, Krefeld: Goecke and Evers

Macgregor, A. 1985. Bone, Antler, Ivory and Horn: The Technology of Skeletal Materials since the Roman Period, London: Croom Helm

Macgregor, A. 2000. Objects of bone, antler and ivory, in P. Ellis (ed.), *Ludgershall Castle: Excavations by Peter Addyman 1964–1972*, 160–68, Wiltshire Archaeol. Nat. Hist. Soc. Monogr. 2, Devizes, Wiltshire Archaeological and Natural History Society

Mann, R.W., Bass, W.M. and Meadows L. 1989. Time since death and decomposition of the human body: variables and observations in case and experimental field studies, *J. Forensic Sci.*, 35, 103–11

Mayor, J. E. B. (ed.) 1869. *History of the College of St. John the Evangelist, Cambridge, Part I* by Thomas Baker, Cambridge: Cambridge University Press

Mays, S. 2007. The human remains, in S. Mays, C. Harding, and C. Heighway. *The Churchyard: Wharram. A Study of Settlement on the Yorkshire Wolds XI*, 77–192, York University Archaeological Publications, 13, York: York University Department of Archaeology

Mays, S., Vincent, S. and Campbell, G. 2012. The value of sieving of grave soil in the recovery of human remains: an experimental study of poorly preserved archaeological inhumations, *J. Archaeol. Sci.*, 39, 3248–54

McDonald, T., and Doel, P. 2000. *Land at 69 to 115 Church End, Cherry Hinton, Camb: Interim Report*, Hertfordshire Archaeological Trust Rep. No. 722

Miller, J. 1991. *Archaeological Investigations at St. John’s College Front*, Cambridge, Cambridge Archaeological Unit Rep. No. 39

Miller, J. 1993. *Archaeological Investigations at Chapel Court, St. John’s College*, Cambridge. The Courtyard Site Cambridge Archaeological Unit Rep. No. 89

Newman, R. 2008. *St. John’s Triangle, Cambridge: An Archaeological Excavation*, Cambridge Archaeological Unit Rep. No. 851

Newman, R. 2010. *Archaeological Test Pits at First Court, St. John’s College*, Cambridge, Cambridge Archaeological Unit Rep. No. 968

Newman, R. 2011. *First Court, St. John’s College*, Cambridge: an archaeological investigation, Cambridge Archaeological Unit Rep. No. 1057

Peacock, E. R. 1977. *Coleoptera Rhizophagidae. Handbooks for the identification of British Insects. Vol. 5 Part 5a*, London: Royal Entomological Society of London

Pierce, E. 2013. Jet cross pendants from the British Isles and beyond: forms, distribution and use, *Medieval Archaeol. 57*, 198–211

Price, M. 2013. *How Did the Social Changes of the Fourteenth Century Affect the Everyday Lives of English People? A Case Study from St. John’s Divinity School, Cambridge*, unpublished undergraduate dissertation, University of Cambridge

Purcell, D. 1969. *Cambridge Stone*, London: Faber

Reynolds, S. 1959. Almshouses, in K. C. Roach (ed.), *A History of the County of Cambridge and the Isle of Ely*, Volume III, *The City and University of Cambridge*, 446–47, Oxford, Oxford University Press

Riley, H. T. 1867. *Gesta Abbatum Monasterii Sancti Albani A Thoma Walsingham, regnante Ricardo Secundo, compilata. Volume 1: AD 793-1290*, London: Longmans, Green, Reader and Dyer

Roberts, C. 2002. Trauma in biological perspective: past, present and future work in Britain, in M. Cox and S. Mays (eds), *Human Osteology in Archaeology and Forensic Science*, 337–56, London, Greenwich Medical Media

Roberts, C. and Cox, M. 2003. *Health and Disease in Britain from Prehistory to the Present Day*, Stroud: Sutton

Roberts, C. and Manchester, K. 1995. *The Archaeology of Disease*, 2nd edition, Stroud: Sutton
Rogers, J. 2000. The palaeopathology of joint disease, in M. Cox and S. Mays (eds), Human Osteology in Archaeology and Forensic Science, 163–82, London: Greenwich Medical Media

Rogers, J. and Waldron, T. 1995. A Field Guide to Joint Disease in Archaeology, Chichester: John Wiley and Sons

Rubin, M. 1987. Charity and Community in Medieval Cambridge, Cambridge: Cambridge University Press

Samuel, M. 1989. The fifteenth-century garner at Leadenhall, London, Antiq. J., 69, 119–53

Saxby, D. and Miller, P. (eds), 2007. The Augustinian Priory of St. Mary Merton, Surrey. Excavations 1976–1990, MoLAS Monogr. 34. London: Museum of London Archaeology

Schafer, M., Black, S. and Scheuer, L. 2009. Juvenile Osteology: A Laboratory and Field Manual, London: Academic Press

Sidell, J., Thomas, C. and Baylis, A. 2007. Validating and improving archaeological phasing at St. Mary Spital, London, Radiocarbon, 49, 593–610

Spoerry, P. forthcoming. The Production and Distribution of Medieval Pottery in Cambridgeshire, East Anglian Archaeol.

Stace, C. 2010. New Flora of the British Isles, 3rd edition, Cambridge: Cambridge University Press

Tarlow, S. 2000. Emotion in archaeology, Curr. Anthropol., 41, 713–46

Tarlow, S. 2011. Ritual, Belief, and the Dead Body in Early Modern Britain and Ireland, Cambridge: Cambridge University Press

Thomas, C., Sloane, B. and Philpotts, C. 1997. Excavations at the Priory and Hospital of St. Mary Spital, London, MoLAS Monogr., 1, London, Museum of London Archaeological Service

Trotter, M. 1970. Estimation of stature from intact limb bones, in T. D. Stewart (ed.), Personal Identification in Mass Disasters, 71–83, Washington, Smithsonian Institution

Ubelaker, D. H. 1989. Human Skeletal Remains, 2nd edition, Washington: Taraxacum Press

Underwood, M. G. 2008. The Cartulary of the Hospital of St. John the Evangelist, Cambridge, Cambridgeshire Records Soc., 18, Cambridge: Cambridge Records Society

Villotte, S. and Knüsel, C. J. 2013. Understanding entheseal changes: definitions and life course changes, Int. J. Osteoarchaeol., 23, 135–46

Waldron, T. 1994. Counting the Dead. The Epidemiology of Skeletal Populations, Chichester: John Wiley and Sons

Waldron, T. 2005. The human remains, in J. Murray. Excavation of a medieval cemetery at Crowland Road, Haverhill, 26–39, Proc. Suffolk Inst. Archaeol., 41, 5–42

Walker, D. 2012. Disease in London, 1st–19th Centuries. An Illustrated Guide to Diagnosis, MoLAS Monogr. 56. London, Museum of London Archaeological Service

Walker, P. L., Bathurst, R. R., Richman R., Gjerdrum, T. and Andrushko, V. A. 2009. The causes of porotic hyperostosis and cribra orbitalia: a reappraisal of the iron-deficiency-anemia hypothesis, Am. J. Phys. Anthropol., 139, 109–25

Wang, M., Van Houten, J. N., Nasiri, A. R., Johnson, R. L. and Broadus, A. E. 2013. PTHrP regulates the modeling of cortical bone surfaces at fibrous insertion sites during growth, J. Bone Mineral Res., 28, 598–607

Williamson, R. 1957. The plague in Cambridge, Medical Hist., 1, 51–64

Willis, R. and Clark, J. W. 1886. The Architectural History of the University of Cambridge and of the Colleges of Cambridge and Eton (3 volumes), Cambridge: Cambridge University Press

Wood, J. W., Milner, G. R., Harpending, H. C. and Weiss, K. M. 1992. The osteological paradox: problems of inferring prehistoric health from skeletal samples, Curr. Anthropol., 33, 343–70

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