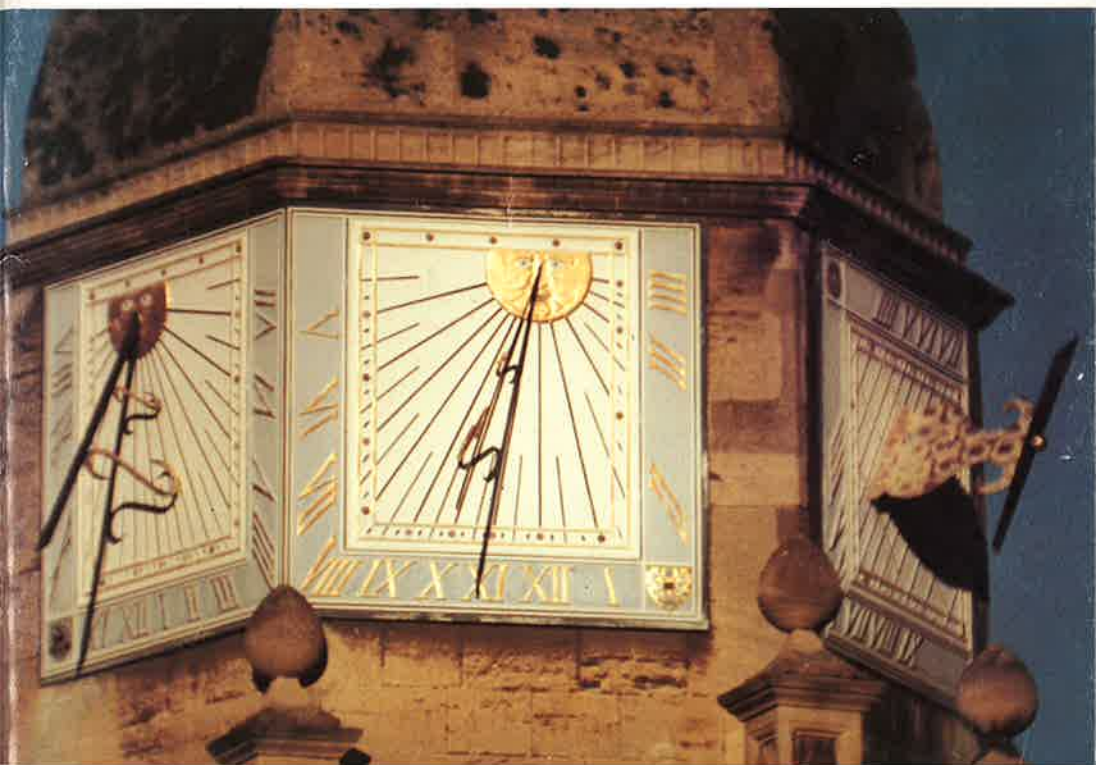


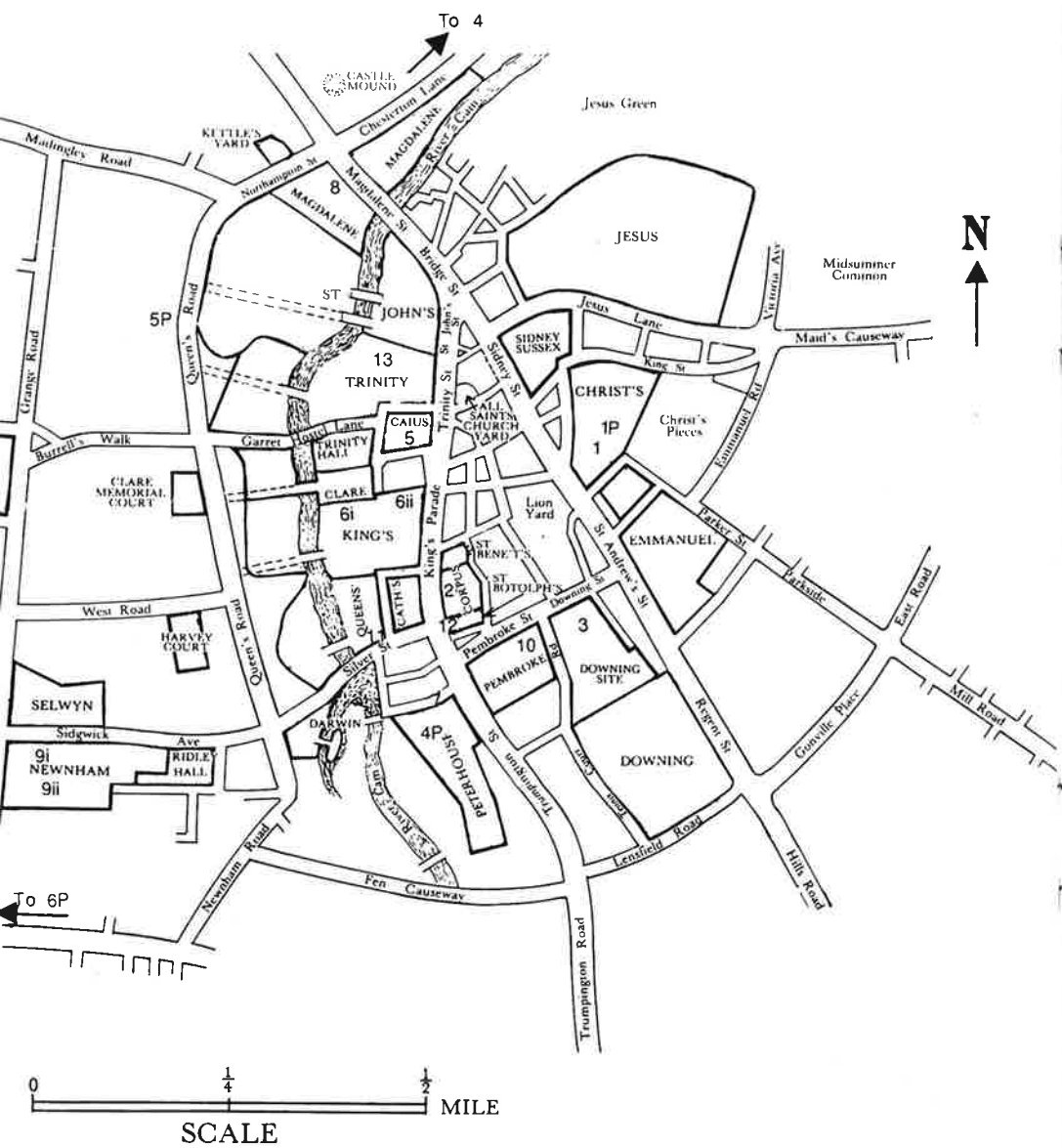
CAMBRIDGE SUNDIALS



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LC 3299

CAMBRIDGE SUNDIALS



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INTRODUCTION

The use of sundials

In the simplest life man needed no daily timekeeping other than sunrise and nightfall. But when people began to meet together by pre-arrangement at a particular time and place - whether for work, pleasure, worship or eating - an indicator of intermediate times became useful. The signal of time for foregathering may be a sound: the church bell, the factory hooter, the umpire's whistle, the dinner-gong. But the giver of the signal must know when to give it, and thus came the invention of timepieces; hour-glasses, waterclocks, calibrated candles, sundials, and finally clocks and watches.

In western Europe the clergy were among the first users of sundials, for timing the daily offices of the Church: matins, none, vespers, compline; and a primitive but beautifully fashioned portable sundial dividing daylight time into 3-"hour" intervals was found in the tomb of St. Alphage of Canterbury who died in A.D. 1012. Travellers were also sundial users; in the Middle Ages a journey would have to be timed to reach the next town before the gates were shut at nightfall, and in some parts of Britain an association has been found between medieval public sundials and medieval main roads. Even when in the sixteenth century mechanical clocks could be made with some precision and had the advantage of use at night and in cloudy weather, portable sundials were still used. Watches could not be made to keep good time until well into the nineteenth century, and watch-users frequently checked their timepiece against a clock, or sundial.

The commonest designs for sundials are the horizontal dial (a typical rose-garden centre-piece); and the vertical dial, adorning the wall of a building or garden. In each case the shadow-casting object is a straight-edged piece of metal, usually brass, bronze or iron. This is called the gnomon, (or style, or spike). It is mounted to slope in such a way that the upper end points at the celestial pole, close to the position of the Pole Star, and the edge is then parallel with the earth's axis. The angle between the sloping edge and the horizontal plane is the latitude angle of the place where the sundial is situated. From the point of attachment of the gnomon to the dial-face, straight hour lines radiate to the edge of the dial where the hour numbers appear. Other lines, inscriptions, decorations or mottoes appearing on the dial face are known collectively as dial furniture. Much rarer designs for sundials are the Armillary Sphere, and the Analemmatic Dial. An example of each of these designs appears in this book.

Sundials in Cambridge

Cambridge is rich in sundials. The number and variety of sundials to be seen on an afternoon's walk through the city must surely be unsurpassed in any place in Britain. Since the eighteenth century if not earlier, the Colleges have been using sundials as architectural adornment on south-facing walls, as ornamental features for the courts, and as centre-pieces for garden plantings. To the pleasure of sundial enthusiasts, this long tradition is continuing unbroken, and some of the most interesting sundials of Cambridge have been constructed or restored in the last 30 years.

Sundials as timepieces were gradually superseded in the early seventeenth century when mechanical clocks of sufficient accuracy could be installed in public places.

Thereafter, sundials, while retaining their existing function as garden ornaments, have increasingly taken on a role as memorials. Many of the Cambridge sundials commemorate a person, an event or an occasion. A well-designed wall dial catches the eye and retains the onlooker's attention for longer than a eulogistic inscription on a marble tablet. Or a benefactor wishing to make a presentation to college or university will know that the gift of a sundial will be seen by more people and "used" on more occasions than (say) a piece of table silver.

The dials of Cambridge give ample scope to students of sundial mottoes and other dial furniture. The literary-minded can enjoy the epigram at King's College, the morality at Corpus Christi, the merry doggerel of East Chesterton's gnomon-base, the erudite word-play of the inscription at Peterhouse. Colour as well as literary interest can be included in dial furniture; besides the traditional zodiac signs at Queens' College several dial faces include coats-of-arms, and scrutiny of dials at Peterhouse or Christ's will reward students of heraldry.

The use of sundials as timepieces continued after the invention of mechanical clocks. Indeed there is evidence that the Queens' College dial (predecessor to the present one) and an early sundial in the Old Court at Peterhouse were used to calibrate or adjust a nearby clock or bell timepiece. The present-day dial reader, however, wishes to deduce from the position of the gnomon-shadow on the dial the "time-by-the-clock" or GMT. This deduction requires two corrections: the longitude correction and the equation-of-time correction. The sundial marks what is called local apparent time: when the sun is at its zenith in Cambridge the shadow is at the 12 hour-line and the local apparent time is noon. Cambridge lies only a short distance east of the Greenwich meridian, and the sun reaches zenith at Greenwich only 30 seconds later than at Cambridge so for Cambridge the longitude correction is negligible. The equation-of-time correction allows for the discrepancy between time-by-the-sun and the time-by-the-clock, a discrepancy which varies at different times of the year. During summer months it is quite small: never more than 4 minutes, from early April till early September. In winter months it is larger: in mid-February the sundial is 14 minutes "slow" by the clock, and in mid-November it is 16 minutes "fast". On small sundials the close lines on the dial face permit reading to an accuracy of only about ten minutes at best and a correction factor is superfluous. But for larger dial faces, correction to clock time is justified, and several Cambridge dials (Trinity, Peterhouse, Magdalene) embody such equation-of-time corrections, which will be mentioned in descriptions of these dials.

Cambridge sundials, then, give us something more than aesthetic enjoyment and literary and historical interest. The computer-based design of the curved hour-lines of the Benson Court sundial at Magdalene College is an illustration of the best of modern scientific dialling and is a reminder that the 21st century may yet have something to offer to dialling enthusiasts.

In the table of contents, the sundials are listed numerically in alphabetical order of the names of their sites. The corresponding numbers appear on the map. Most of the interesting dials may be seen on a south-to-north walk through the city, starting, say, with Little St. Mary's and St. Botolph, and finishing with Magdalene. The Newnham College dials would require a 15-minute side trip; and the East Chesterton Playground dial, nearly 2 miles from the city centre, would form a separate expedition.

Each list entry includes the letter "O" (Open Access; may be seen from a public road or path); or "R" (Restricted Access: may be seen only at such times as the garden, court or college is open to the public).

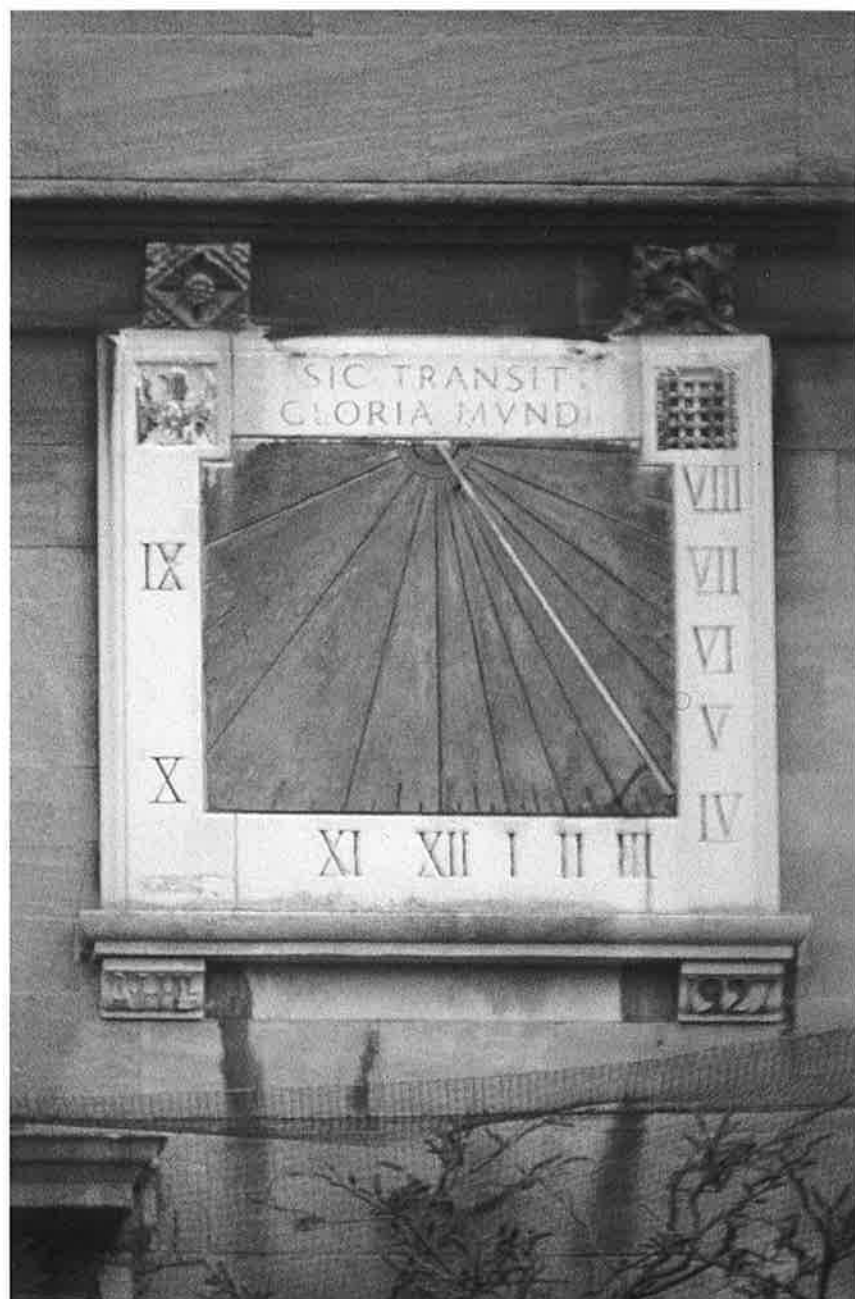
A separate numerical list (1P, 2P.....) is given for sundials in private gardens. To see these dials, permission would have to be obtained from the owners. These dials are included in this book so that people unable to see the actual dials may enjoy the photographs. The Wolfson College sundial, 6P, is an armillary sphere, the sight of which is well worth the 20-minute walk westward from St. Botolph's Church. (Visitors are asked to call at Wolfson College Porters' Lodge for permission to view the dial, which will readily be obtained.)

Finally a short list is given (1N, 2N---) of some sundials, all with open access, to be seen within a five-mile radius of Cambridge.

CHRIST'S COLLEGE

A sundial may be seen in Christ's College high on the wall of the Hall, beside a large bay window, and almost opposite the gateway entrance from St. Andrew's Street. As the aspect of this wall is south-declining-west, the dial face shows more afternoon hours than morning hours. The motto SIC TRANSIT GLORIA MUNDI ("So departs the glory of the world") is a favourite of sundial designers. In the upper right corner there appears the portcullis, an emblem of the Beaufort family. Lady Margaret Beaufort re-founded the College in 1505 as Christ's College, from its small beginnings as "God's house" in 1442 on a site near Clare College. Lady Margaret's son became King Henry VII, and united the Houses of Lancaster and York after the Wars of the Roses. The portcullis was thus adopted as a royal symbol. (It is much used in the Houses of Parliament, the royal palace of Westminster, and by various departments of Her Majesty's Government.) The portcullis is also prominently displayed in Lady Margaret's other Cambridge foundation, St. John's College. The symbol in the upper left corner of the dial may possibly be a carved marguerite, Lady Margaret's floral emblem; this flower is also part of the adornment of the gates of St. John's College car-park.

The present sundial dates from 1927. The College possessed a wall dial somewhere near this position in the seventeenth century: it shows clearly in a print published by Loggan in *Cantabrigia Illustrata* in the 1680's. But this earlier dial was demolished during alterations to the Hall in the late nineteenth century. The erection of the present dial was due to the generosity of A.H. Lloyd, a member and notable benefactor of the College, whose initials, with the date 1927, are inscribed on the base of the stonework surround. The calculations for the gnomon angle were carried out by Professor Hutchinson a member of the College and an expert on sundials. The stonework was constructed by the local building firm Ratee & Kett. The inner part of the dial was repainted in 1939.



CORPUS CHRISTI COLLEGE

A wall dial is to be seen on the south-facing wall of Old Court at Corpus Christi. It replaces an earlier dial on the same site, which was "rediscovered" in 1919 when the ivy was stripped off the walls of Old Court. The date of this earlier dial is unknown but it is probably eighteenth century; all the nineteenth and early twentieth century pictures of the Old Court show this whole wall as ivy-covered.

The Governing Body's minute book at the time of the "rediscovery" records that the wall below the ivy was of clunch, a local soft stone, and that figures incised directly into this would soon deteriorate by weathering. So blocks of Portland stone were fixed in front of the clunch stone, cut, figured and coloured. The design dated 1920 is the work of T.H. Lyon, architect and fellow-commoner of the College, who restored the Old Court including the sundial at this date. The design includes a sunburst above the gnomon, and a motto MUNDUS TRANSIT ET CONCUPISCIETIA EJUS ("The World and its desires pass away"). Obviously the division of the hour lines into Winter/Summer must also date from this period (c. 1920) since it was in 1916 that the use of "summer time" was established. The lower (gold) numerals relate to summer hours, the upper black numerals to winter hours.



DOWNING SITE

An unusual 17-face sundial stands on a lawn on the University's Downing Site (entered from Downing Street by a gateway under an arch). This sundial is in the form of a spherical stone from which portions of the surface have been cut to form 17 plane surfaces, each with its own gnomon. On the upper (horizontal) surface Roman numerals mark the hour lines; on the eight vertical and 8 sloping surfaces the numerals are arabic.

The dial stone stands on a low stone plinth, round the base of which is the inscription: SOLI HORISQUE WILELMUS ET UXOR LUCIA RIDGEWAY POSUERUNT A(nno) S(alvationis) MCMXIII ("For the sun and the hours, William Ridgeway and his wife Lucy placed this in the year of our salvation 1913"). The support of the uppermost gnomon is in the form of a seated camel; the same inscription with the omission of the first two words is engraved on this gnomon.

The sun rarely strikes this sundial in the winter months as there are now high buildings to the south and west of it. It has a function in garden conservation however: its presence has saved this portion of lawn from becoming a car-park or the site for a temporary laboratory. It is unique in having protection by university ordinance: the first charge on the Ridgeway-Venn Travel Fund of the University is the upkeep of this dial.

Professor Sir William Ridgeway was Disney Professor of Archeology in the University of Cambridge, from 1892 until his death in 1926. He had wide interests in archeology mainly of the eastern Mediterranean countries. He was instrumental in obtaining recognition by the University of the study of Anthropology as an academic subject.



EAST CHESTERTON PLAYGROUND

The sundial forming the centre-piece of the "Playground of Planetary Proportions" at East Chesterton Green is unique among Cambridge sundials in being of the analemmatic type. In a sundial of this design, the gnomon stands vertically, and hour lines are replaced by hour points, which lie on the circumference of an ellipse drawn on a horizontal surface. In the most accurate analemmatic dials, provision is made for the movement of the vertical gnomon according to time of year: closer to the 12-noon hour point in summer, further in winter. This design can readily be adapted to construct a "human" sundial: the gnomon is a person standing upright on a marked spot on the ground, and looking at his own shadow; the position of his head's shadow among the hour points indicates apparent time of day.

The playground sundial is designed for use by children, the required height of the gnomon being that of a junior school child of "average age, average size". The dial is intended for summertime use, so the hour points around the incomplete ellipse run from 10 a.m. until 6 p.m., B.S.T.; and there is a single gnomon-base in a position appropriate for the summer months.

The inscription on the gnomon base; "Stand here tall....as the world spins round....see times shadow fall....show the hour on the ground" was supplied by a local resident, Mrs Derry Earnshaw. The stonework was designed and inscribed by Mr Harry Gray of The Carving Workshop, Cambridge. The gnomon base is of Portland Stone, with green Westmorland slate insert.

The design of the playground, in which the various pieces of play equipment and ornamental plantings are named after celestial bodies in the solar system, was a joint venture of landscape architects of Cambridge City Council led by Mr Douglas Rule, and the City Housing Department, particularly Mr Andy Buckley, the Housing Estates Project Officer. The children of the nearby St. Andrew's Community Junior School were consulted as to the theme of the play area, and some of them helped in the construction of the sundial.



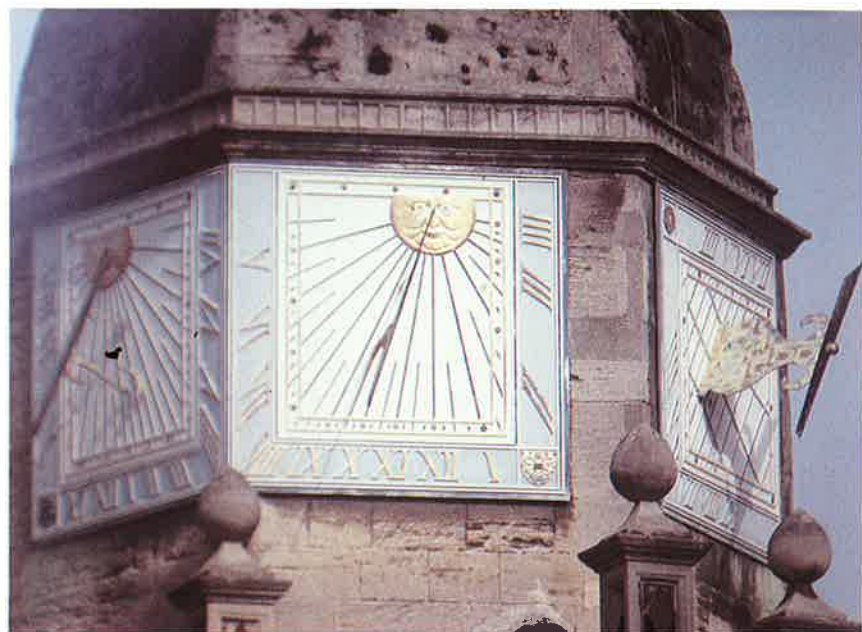
GONVILLE & CAIUS GATE OF HONOUR

The six-faced vertical dial above the gateway between Gonville & Caius and the Senate House Passage is perhaps the most elegantly beautiful of all sundials in Cambridge. The precision of its lines, the restrained colouring, and the clarity and simplicity of the dial faces make it a delight to see and to read. Four of the dial-faces (E, SE, SW, and W) can be seen from Senate House Passage: the NW and NE faces are visible from within Caius Court. It is pleasing and perhaps surprising that despite the nearby presence of several tall buildings all six dial-faces catch the sun at least in June.

This dial, though in the position of a much earlier one, dates only from 1963. It was constructed soon after the extensive restoration of the Gate of Honour itself, undertaken by the College as part of a series of restorations marking the 4th centenary of the re-founding of the College by Dr Caius in 1557. Dr Frank Powell, then Junior Bursar, made the first sketches for the design, taking as a guide an engraving dated 1688 from Loggan's *Cantabrigia Illustrata*, which shows the earlier Gate sundial. Measurements were undertaken by Dr P.J. Message (Fellow and Astronomer) of the exact corner angles of the hexagonal stone superstructure to which the dial faces are attached, and also of the orientation of the eastward and westward facing sides, which are not precisely parallel with meridians. These measurements allowed great accuracy in the drawing of the hour lines and design of gnomon angles for each face.

The dial faces are of bronze, painted with vitreous enamel. The working drawings were made by the Ancient Monuments branch of the Ministry of Works, and the dial faces were made by Birmingham Guild Ltd.

A set of sundials was inscribed in the stone of the Gate when (or soon after) it was built in 1575. The designer may have been Theodore Haveus of Cleves, who is known to have designed another sundial, no longer extant, which stood in Caius Court. The hour-lines for this earlier Gate sundial were incised and painted directly on the stone, and the gnomons were mounted on iron brackets inserted into the stonework. This set of dials needed frequent repair and restoration, and gradually fell into decay. When the thorough restoration of the stonework of the Gate was carried out in 1958-59, it was still possible to see traces of some of the hour-lines, and the fixing holes for the gnomon brackets. The present dial faces will be more durable than their predecessors. They are a handsome adornment to the Gate and a pleasure to passers-by.



KING'S COLLEGE

(i) Chapel Dial

A wall dial can be seen on King's College Chapel just to the east of the south porch. The hour lines and numerals are painted in black directly onto the stone. The gold sunburst at the base of the gnomon, the heraldic lions at the lower corners and the gold inscription J.C. 1578 make this dial face a handsome spectacle. The black-letter motto along the top UT HORA SIC FUGIT VITA ("Life flies away like an hour") is rather hard to read.

The significance of the initials and date is uncertain. Dr Caius, second founder of Gonville & Caius College, died in 1573, but there seems no reason why King's should commemorate him. A former Provost of King's was named Sir John Cheke, and other Fellows and benefactors of the College have the initials J.C. but none are specifically associated with this date.

(ii) Sorley Dial

A two-faced vertical sundial stands on a low column of square cross-section in the NE corner of the court at King's College. The SW and SE faces each bear an iron gnomon: (that on the SW face is badly distorted). The hour lines and Roman numerals are incised directly into the stone.

The NW face carries the inscription WATCH FOR YE KNO NOT THE HOURE 1649. The NE face carries the inscription: "As one that doeth truth cometh to light so he living sought light diligently and dying could say now I see that great light".

WRS 1855-1935.

The first inscription is based on Math. 25, 13 and the second on John 3, 21, but the precise sources, and the significance of the date 1649 have not been discovered. This date may perhaps refer to the time of the original placing of the sundial at the Church of St. Anne on the Sands, Dunbar, Scotland.

The dial was erected here in 1938, the gift to the College of Mrs Sorley the widow of Professor W.R. Sorley, Professor of Moral Philosophy and Professorial Fellow of King's College.



LITTLE ST. MARY'S CHURCH

A scratch dial is to be found on the SW buttress of the nave of Little St. Mary's Church; this buttress is approached by a path through the garden round the west end of the church. The dial takes the form of white incised lines on a blackened surface: a circle about 16 cms in diameter with radii from a central hole where the gnomon originally projected. Because of the orientation of the long axis of the church, this surface of the buttress faces almost due south.

Scratch dials are not uncommon on the south walls of medieval churches. In most of them the gnomon which would have projected from the central hole perpendicular to the wall's surface is now missing. The dial would have recorded "seasonal" or "canonical" hours: the period of daylight, sunrise to sunset, divided into twelve equal parts; obviously seasonal hours were longer in summer than in winter. Scratch dials were usually placed where they could be seen by passers-by, and were used by the clergy for timing the daily offices of the Church. Scratch dials can be seen on the south walls of several Cambridgeshire churches, including the church in Hauxton, 5 miles S.W. from Cambridge, where there are two such dials one each side of the church door.



MAGDALENE COLLEGE

The sundial high on a south-facing wall in Benson Court, Magdalene College (on the west side of Magdalene Street) is of a handsome modern design. It is unique among Cambridge sundials in being directly readable for G.M.T., as the equation-of-time correction is incorporated into the design. The hour lines, instead of being straight as on most dials, are curved as an elongated S-shape on the January-to-June dial face, and as a reversed S on the July-to-December face. These two sets of lines if superimposed would give the characteristic analemma (elongated figure-of-eight) as seen on many dial-faces (the dial at Peterhouse for instance) for use as the equation-of-time correction. But the lines if superimposed here would have become difficult to read: hence the pair of dial faces.

The time marker is a spot of light appearing at the centre of a "sunburst" shadow. The shadow and light spot are formed by the metallic ray-edged disc with central hole, held above each dial face on the end of a bracket projecting from the wall above. During the year advancing from January, as the sun's altitude increases the light spot is cast daily at a lower and lower point on each hour line; and conversely in the latter half of the year the light spot would be found each day higher up on each hour-line. The curvature of each line and the position of the light spot along its length thus make allowance for the times when, on an ordinary straight-line/straight-gnomon dial, the dial is either ahead of or behind clock time.*

The design of this unusual sundial arose from the Annual Design Competition run by Magdalene College for its first-year engineering students. The subject for the 1986-87 competition was a sundial, and the prize-winner was a student from Hong Kong, Mr W-F. Ng. The Governing Body of the College met the expense of realisation of the design. The stonework was carried out by Mr Will Carter O.B.E. an Honorary Fellow of the College, and the metalwork (stainless steel) was made in the University Engineering Department.

The motto FACILIS INTER PHILOSOPHOS QUAM INTER HOROLOGIA CONVENIET ("It is easier to gain agreement among philosophers than among timepieces") is a line from a satirical work by Seneca.

*The origin of the discrepancy between apparent (solar) time and mean (clock) time lies in the fact that the speed of movement of the earth along its orbit, and consequently its speed of rotation, is not precisely the same throughout the year: slightly slower than average in late December, slightly faster in mid-September. For human convenience, we have divided the orbit time (year) into 365 exactly equal periods of time, called "Mean days". These are the periods of time which are measured off on an accurate mechanical, electrical or atomic clock.

The slightly slower rotation time in late December (30 seconds per day) leads to a gradually accumulating discrepancy as the weeks pass, so that by mid-February solar time has come to be more than 14 minutes later than mean (clock) time. The speeding up of the rotation in mid-September (20 seconds per day) has the result that by mid-November solar time has come to be 16 minutes ahead of clock time. Many sundials include a graph giving minutes above or below zero plotted against month of the year, to show the user how many minutes must be added or subtracted in order to obtain clock time from solar time.



NEWNHAM COLLEGE

(i) Hopkinson Dial

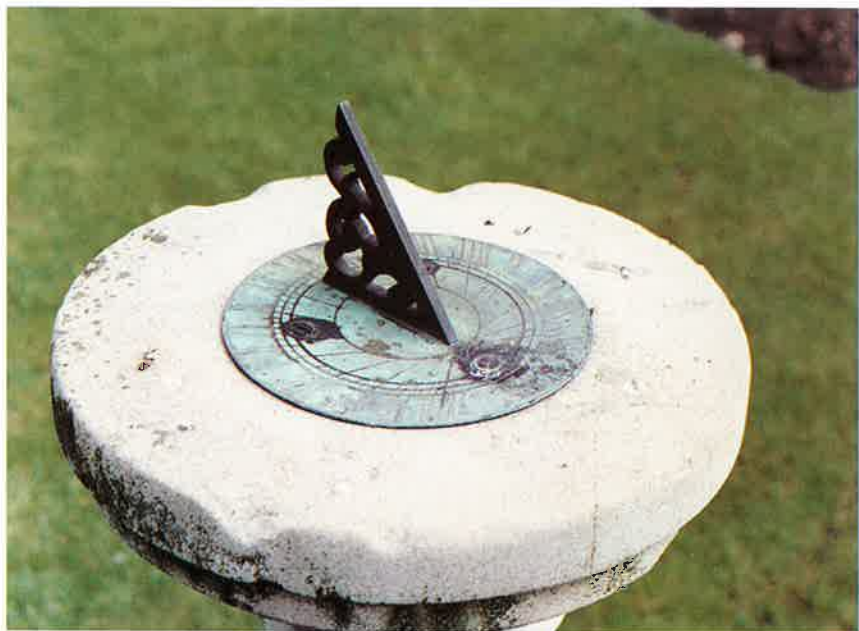
A small horizontal sundial on a handsomely wrought stone plinth stands as the centre-piece of a group of flower beds near the north-west corner of Newnham College garden. The brass dial face was made (according to the inscription) by T. Bailey. The original gnomon was broken off, and was replaced in 1984 by a gnomon designed and made by Alexis Brookes of St. Johns' College, who based the design on that of an eighteenth century sundial in the Whipple Museum of the History of Science.

The sundial was given to the College in 1898 as a memorial to Alice Hopkinson, who graduated from the College in 1895. She, with her father and brother, were killed in a climbing accident in the Alps. The Hopkinsons were a notable Cambridge family, the father having been a Cambridge scientist.

(ii) Sidgwick Dial

A four-faced sundial surmounts a cylindrical stone pillar situated on the Mound, a raised lawn near the west end of Newnham garden. Four stone seats are placed round the base of the pillar, and the whole arrangement of column and seats forms a pleasant piece of garden architecture. The sundial at the top is not entirely successful. The dial faces are too small to be read with ease at that height, and drips from the brass gnomons have badly discoloured the stonework. All the faces, particularly the south face, are so badly weathered that it is almost impossible to decipher the hour lines and numerals.

The date of the sundial is 1914. The column and surrounding area of the garden were laid out as a commemoration of the Principalship (1892-1911) of Eleanor Mildred Sidgwick, second Principal of Newnham College.



PEMBROKE COLLEGE

A horizontal sundial with octagonal dial face stands on a cylindrical stone plinth under a magnolia tree at the eastern end of Pembroke College garden. It is somewhat weather-beaten and the gnomon seems to have undergone repair or replacement at some time. An engraving on a brass plate on the plinth reads: MEMOR AMICI J.V.S.W. HOC SOLARIUM POSUIT A.J.A. ("AJA placed this sundial here as a remembrance of his friend JVSW").

This inscription is the most interesting feature of the dial. It records the gift to the College made in 1957 by Professor Arthur J. Arberry (Fellow of Pembroke 1931-32 and 1947-69), in memory of his friend James Vere Stewart Wilkinson, who died that year. The gift was made to pay for the re-siting of the sundial, a change made necessary by the completion that year of the Orchard Building, with consequent realignment of garden paths and walls. James Wilkinson was a distinguished orientalist, keeper of oriental manuscripts at the British Museum and later in Dublin. It is fitting that the initials of these scholars should appear on the sundial of "a College which has traditionally sheltered and promoted orientlists".

Though the dial itself is of no great interest it is situated in a charming garden.



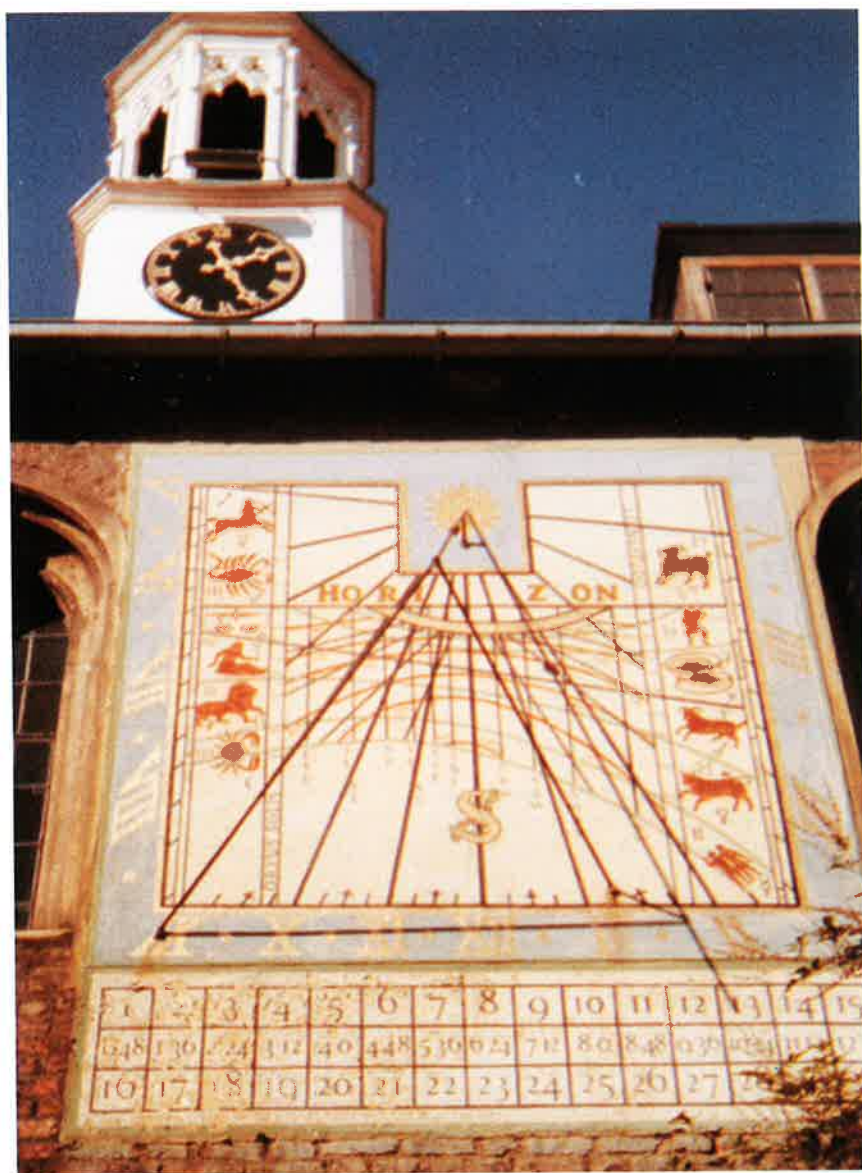
QUEENS' COLLEGE

The sun-and-moon dial adorning the south-facing wall of the Old Court at Queens' College is one of the most remarkable wall dials in Britain, well known among gnomologists for the intricacy and interest of its dial furniture. When the reading of the heavens was an important part of the philosopher's skill, and dials functioned both as clocks of the day and calendars of the year, dial faces often became a complicated series of criss-crossing lines showing the sun's position on the ecliptic, azimuth and altitude and so on. Though many brass astrolabes and portable dials of this type have survived in museums, few outdoor dials of such intricacy as the Queens' dial are known.

The wall faces south declining slightly east. The hour lines are clearly marked, numbered by Roman numerals in gold on a blue border. The scale just inside the blue border divides the hours into halves and quarters, and the apparent (solar) time can be read with considerable accuracy. On a narrow border to left and right just within the hour scale, there are written the (Latin) names of the months, starting with Januarius just above the Roman numeral III, descending right, ascending left, "Junius" and "Decem-ber" being split left and right. Within this comes a border showing planetary and zodiac signs and pictorial constellations associated with each month. On the left just inside the pictures of the constellations is a narrow vertical column labelled "Ortus Solis" (Sunrise), with a set of numbers (time of day) above, starting 4.40 below, 8.7 at the top. The shadow of the gold-painted wooden ball fixed to the gnomon about $\frac{1}{3}$ of the distance along its length acts as a marker. If this shadow lies on one of the curved green lines on the dial face and this line is followed to the left towards the "Sunrise" column, the time of sunrise on that day can be read off. (Interpolation can be used to give an estimate of the time of sunrise on days when the ball's shadow lies between lines.) The column on the right, labelled "Longitudo" may give the angle of the sun, in hours and minutes, from its position at the autumn equinox. Another interpretation of the numbers in this column is that they denote day length at the corresponding time of year.

The green lines, and also the black line lying almost horizontally across the dial face, are date-curves. The lowest green curve, the ends of which reach the month "Ju-nius", is the date-line of the summer solstice, June 22nd; the shadow of the ball precisely follows this green curve throughout the hours on that date. At the equinoxes, Sept 21st and March 21st, the shadow of the ball traces out the straight black line, the ends of which touch "September" on the left, "Martius" on the right. (Sadly, there is no winter solstice date-curve, because of the ornamental gold arc at the top of the dial face.)

The set of black lines radiating from the point where the vertical line marked "S" would intersect the line marked "Horizon" denote "temporary hours", also called "seasonal hours", a time scale in use until the eighteenth century; the day between sunrise and sunset was divided into twelve equal parts, which would obviously be of varying length according to the time of year. It may be surmised that this system was useful when many people worked, and were paid, as day-labourers, perhaps for a 12-"hour" day from 7 o'clock until 7 o'clock all the year round. The system might be appropriate when paid employment was mainly outdoor farm-work, but would not survive into an era of factory employment when daylight was not essential for the work.



When the shadow of the ball falls on one of the black vertical lines on the dial face, the compass direction at the base of that line denotes the direction (azimuth) of the sun: (SWBS - south-west by south, and so on). The red curved lines labelled with numbers in degrees give the altitude of the sun in degrees above the horizon, when the shadow of the ball lies on any one of them.

The numbers below the dial face refer to its use as a moon dial. For this purpose it is necessary to know the moon's hour angle (angle between sun and moon) as shown in the middle of the three rows of figures for each corresponding day of the lunar cycle. The angle is measured in hours and minutes; (1 hour = 15°). It is only between first and last quarters of the lunar cycle that moonlight is bright enough to show a readable shadow; and for accuracy in computation it is necessary to know the precise time (day, hour and minute) of the previous phase of the moon, (First Quarter or Full). But ".....the moon's motion is so irregular that no moondial can possibly be accurate, and is to be regarded as providing an exercise in mental arithmetic rather than being an instrument of any practical value" (Shepherd, 1948).

The first wall dial in Old Court was put up in 1642. It was painted directly onto a stone surface, stone blocks being sunk into the brick-work of the wall for this purpose. It was probably used to set a clock bell. The present clock tower above the dial face is modern but the bell within it is dated 1637, so this may have been the time-keeping bell checked by the original sundial. The appearance of the 1642 sundial is unknown. A manuscript of 1733 reads: ".....lately painted, a very elegant Sun-Dial, with all the signs....." but it is not clear whether this is a fresh painting to a new design or a re-painting of an original design. Certainly by 1753 there was a Dial "....counted as a Curiosity, being beautifully ornamented with a variety of useful Furniture...." It fell into decay, and by 1860 had no gnomon or ironwork of any kind. The present gnomon must be a restoration made soon after that date. There have been 5 re-paintings since 1911, the most recent being in 1971. Since 1968, the dial has been painted onto plaster fixed to the underlying stone. There is already available a computer-programme (King, 1981) for correcting small errors in the lines, and it is to be hoped that such corrections will be incorporated into the next re-painting.

Queens' College is rightly proud of its wall dial, so the dial is unlikely to fall again into disrepair. It is not perhaps the most beautiful of the Cambridge sundials, but it retains the attention and repays minutes and hours of study on a sunny day.



ST. BOTOLPH'S CHURCH

High on the hexagonal buttress at the S.W. corner of the tower of St. Botolph's Church in Trumpington Street, a fine two-face vertical dial overlooks the street. One face is due south, the other south-west. The large faces and clear numerals make it easy to read from street level.

The date of this dial is unknown. It is recorded as having been restored in 1913. It replaces a much earlier dial on St. Botolph's Church, which was designed by a Mr Butterfield, and repainted in 1614 at a cost of 18 pence. The appearance and precise position of this earlier dial are unknown.

St. Botolph is a patron-saint of travellers, who were among the first sundial users. It is appropriate that a church dedicated to this saint, standing close to the position of the old city gateway on the main road south out of Cambridge, should possess this fine readable public sundial.



TRINITY COLLEGE

In the Great Court of Trinity College near the Chapel door there stands a horizontal sundial on a large stone plinth. The dial face is engraved on thick copper and includes the 16 compass points surrounding the gnomon. Within the circle of hour lines labelled with Roman numerals, there lies a ring bearing the abbreviated names of the months; there is another ring divided into segments labelled "Watch Faster" "Watch Slower" indicating the direction of the discrepancy between solar and mean time, in the appropriate month. To the south of the gnomon, the words "Troughton, London" and "Lat. 52° 15'" are just discernible. The dial face is now badly pitted and weathered. (It is very similar in style and dimensions to a better-preserved sundial at Wandlebury on the Gog-magog Hills about 5 miles south of Cambridge.)

The Trinity College sundial was erected in 1704, according to the College bursar's accounts showing the cost of making the stone steps. However the existing dial face must be of a somewhat later date: the instrument makers Troughton, (of Surrey Street, Strand, London) flourished in the period 1740-1780.



CHRIST'S COLLEGE

Fellows' Garden

An equatorial dial of unusual design stands on an elaborately carved stone plinth in the Fellows' Garden at Christ's College. The dial consists of an equatorial and a meridian semicircle of brass, and a brass rod as gnomon. The shadow of the rod falls on the equatorial circle where (sadly) the numerals and hour-lines have become obliterated through weathering.

The dial is mounted on a handsomely inscribed brass base plate about 250 mm square. At the corners are the maker's name and date: "Bryan London, Anno Dom. 1640". In the centre is a compass rose, and an ornamental scroll carrying the motto I STAND AMID ye SUMMER FLOWERS TO TELL ye PASSINGE OF ye HOURES. At the upper end of the meridian circle is a heraldic fish or whale. On the base of the stone plinth the 4 main points of the compass are marked. Some badly weathered lettering is also visible: it may have given the mythological names of the winds associated with the compass points: "Boreus" is just visible at the north point.

This quaint seventeenth century dial is a pleasing sight in an exceptionally beautiful garden. By restoration of the numerals it could become of even greater interest.



CORPUS CHRISTI COLLEGE

Garden of Master's Lodge

A horizontal sundial stands in the garden of the Master's Lodge on an elaborately carved stone plinth. The brass dial face is in good condition, and bears the maker's name to south of the gnomon, "John Jones, Bristol". A compass rose of 8 points is engraved below the gnomon.

The sundial was part of a generous bequest made to the College in the 1940's by Mr Aubrey Bateman, then the Mayor of Bath, who had graduated from the College in 1899. Mr Bateman had bought the sundial in or near Bath, where it had stood for many years in the grounds of a house belonging to one of the sons of George III, probably the Duke of York. The dial was placed in the Master's garden in the 1980's.



MAGDALENE COLLEGE

Garden of Master's Lodge

A charming horizontal sundial with circle-in-square dial face and clear Roman numerals stands in the S.E. corner of the Master's Garden at Magdalene College. It was inherited by the College in 1974 from the estate of a member and benefactor of the College, Mr G.H. Macfarlane-Grieve. The dial was made for a latitude of $51^{\circ} 29'$, somewhat south of its present position and also of Mr Macfarlane-Grieve's home, Toft Manor. There is indirect evidence that the sundial was made before 1702, but its original site and the maker's name are unknown.

Soon after the dial came into possession of the College, it was set up in the Fellows' Garden; but it was unfortunately vandalised and the dial and plinth languished in a College cellar until restored and re-established in its present position by Dr Richard Luckett, a Fellow of the College, in 1987.



PETERHOUSE

Fellows' Garden

The elegant sundial in the south-facing wall of the Perne Library at Peterhouse was erected in 1984, the seventh centenary of the foundation of the College. It was a gift to the College to commemorate this occasion, from the Peterhouse Society and Friends of Peterhouse, including Petreans of many generations all over the world.

Much thought went into the design, which is largely the work of Dr Philip Pattenden, a Fellow of the College. The hours are marked by Roman numerals of gold on a blue border; each numeral, following the design of an earlier Peterhouse sundial, is placed in the same sense as the direction of its hour-line. The noon-line is surrounded by an elongated figure-of-eight or analemma,* which is marked with the names of months of the year. This device allows the observer to read G.M.T. (clock-time) at noon in any month. When the shadow of the marker on the gnomon is astride the date on which the dial is being read, the time will be noon G.M.T. For clarity the other hours are shown by simple straight hour-lines; but by looking at the dates on the analemma the observer may see how fast or slow solar time is, in relation to G.M.T., on the day of observation, and may thus find G.M.T. at any hour on the given date.

The execution of this interesting and intricate design is the work of a local firm of masons, Rattee & Kett. The dial face is made on a panel of "Coade Stone" an artificial stone which weathers to resemble natural stone. The gnomon is of phosphor bronze.

The memorial aspect of the sundial is shown in two ways. The first is heraldic. At the upper central point from which hour lines and gnomon radiate, the arms of the College appear. Of the four coats of arms at the corners of the dial face, the upper left is associated with the date 1284, and the lower pair with 1984; the upper right shield showing the crossed keys of St. Peter was in use as the arms of the College before the sixteenth century. At the top left corner appear the arms of Hugo de Balsham, Bishop of Ely, Founder and first Visitor of the College, 1284. The lower left corner shows the arms of the See of Ely, placed on the dial by permission of Peter Walker, Bishop of Ely and Visitor to the College in the year 1984; and lower ~~left~~ ^{right}, the arms of Lord Dacre, Master of the College in 1984.

The commemorative function of the sundial is made more explicit in the inscription along the top. Certain letters of the inscription are enlarged and coloured red; these letters have numerical value as Roman numerals (M-1000, D-500, and so on). The sum of the numerical value of all the red letters is 1984. The inscription reads:

STRUCTA SUPER PETRAM STABIT DOMUS: UT FUGIT HORA CRESCIT
HONOS: SEPTEM SAECULA CERTA FIDES. This has been translated "On Peter's rock
our house stands sure. Its fame, hourly increased, seven centuries proclaim".

Peterhouse possesses an exquisite memorial to its past seven centuries, which will be admired and enjoyed for many centuries to come.

* "Analemma" meant originally the plinth or pedestal on which a sundial stands; hence, later, the sundial itself. The word was also used to denote the projection of a hemisphere onto the plane of the meridian; later, it came to mean a scale of the sun's daily declination inscribed on the surface of a terrestrial globe; such a scale took the form of parallel lines, or an ellipse, or an elongated figure-of-eight. The word now retains only the last of these meanings.

The description of the Magdalene sundial includes a note on the basis of the discrepancy between solar and clock time.



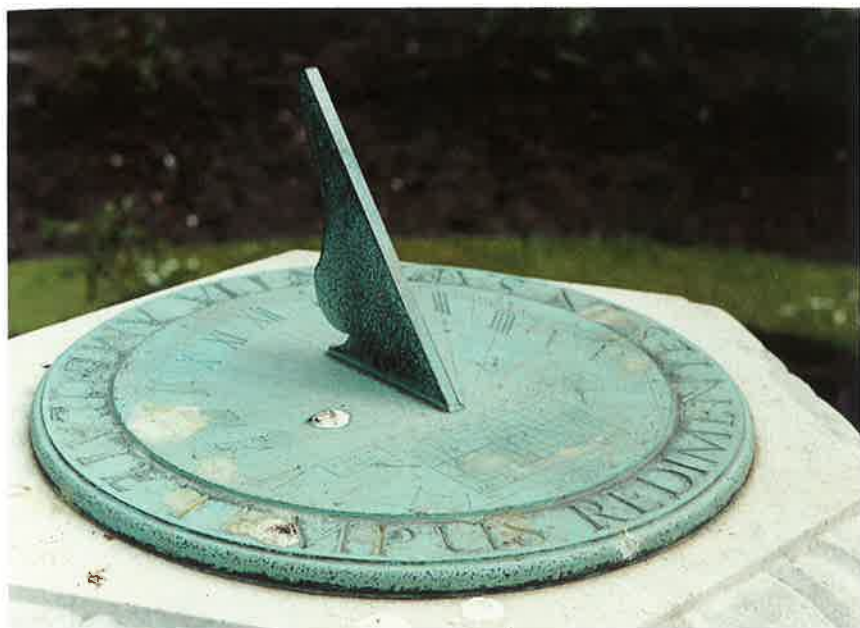
TRINITY COLLEGE

Fellows' Garden

A horizontal sundial forms the centrepiece of a group of rose beds in the Fellows' Garden at Trinity College (west of Queens' Road). On the large dial face, in addition to the hour lines and numerals, there is an equation-of-time graph, indicating the minutes, at different times of the year, to be added to or subtracted from solar time, to obtain clock time. There is also the trade-mark (Wheatstone bridge) of the Cambridge Instrument Company. Around the circumference of the dial is the motto: IN SAPIENTIA AMBULATE TEMPUS REDIMENTES ("Walk in wisdom....redeeming the time") from Colossians, IV 5, Authorized Version.

The sundial was designed by the sculptor Ernest Gillick. It was set up in 1919, and moved to its present position in 1930. It commemorates three Fellows of the College, all of whom were members of the College Garden Committee, who were killed in the First World War, and whose initials are inscribed on the stone of the plinth: Keith Lucas, G.B. Tatham and C.E. Stuart.

The complete design of the sundial, including the motto, was "seen in a dream" by another Fellow of the College, (and also a Garden committee member) Walter Morley Fletcher. In 1918, soon after the end of the War, Fletcher dreamt that he was walking in the Fellows' Garden and saw the sundial there, with the names of his friends on the base. Fletcher told his friend Ernest Gillick about the dream, describing the dial in detail. Gillick offered to make the dial for the College, an offer gratefully accepted by Trinity College Council.



WOLFSON COLLEGE

Fellows' Garden

A beautiful armillary sphere of three concentric brass rings stands on an octagonal stone plinth near the south side of the Fellows' Garden at Wolfson College. The gnomon takes the form of an arrow. The vertical and polar rings are narrower than the equatorial ring bearing the hour numbers; the period of the obscuring of the shadow of the gnomon by that of the vertical ring is therefore brief.

The sundial was designed and made by Bruce Green (Stonework Development Ltd, Market Harborough, Leics). It was the gift of the Fellows of the College in recognition of the Presidency of John Morrison, first President of Wolfson College.



WANDLEBURY

At Wandlebury on the Gog Magog Hills about 4 miles SE from Cambridge, a raised lawn marks the site of the old Gogmagog House, demolished in the 1950's. On this lawn stands a remarkable sundial, transferred from a nearby lawn and placed here shortly after the demolition when Wandlebury was acquired by the Cambridge Preservation Society.

The dial face and gnomon of heavy brass are mounted on a plinth of Venetian stone. The dial face, a masterpiece of the engraver's skill, shows a series of concentric circles. The outermost circle marks minutes, with small arabic numerals giving 10-minute intervals. Within this is the circle marking hours in large Roman numerals. Next come circles reading "Watch Faster---Watch Slower" and a circle of arabic numerals giving minutes (faster or slower) for adjustment of dial time to calculate "watch" time; then a circle of dates (of each month) and abbreviated names of the months.* The next circle in each half of the face reads "Aequation of Natural Days". Within this, the angular degrees of each quadrant are inscribed. Directly below the gnomon is a 16-point compass rose, each point marked: SSW around to SSE.

To the south of the gnomon the Godolphin arms are shown; (the Godolphin family owned the Gogmagog estate for several generations). Close to the arms there are the words "Latitude 53 D 15 M". At the north of the gnomon the maker's name is just discernible: "Jos Jackson London". Joseph Jackson was a member of a family of instrument makers which flourished in the mid-eighteenth century. The exact date of the dial is not known, but the fact that the arms include a ducal coronet imply a date after 1740, the year in which a Godolphin daughter married the Duke of Leeds.

Considering its age this sundial is in remarkably good condition. The amount of information obtainable from it, and the clarity and precision of the engraving, make it one of the most exquisite horizontal dials of the Cambridge neighbourhood. We may hope that, of the thousands of visitors who come each year to enjoy the glorious natural beauties of Wandlebury, many may also appreciate and admire the splendour of this man-made object.

*See description of Magdalene Sundial for a note on the basis of the discrepancy between "time by sun" and "time by watch".



HAUXTON

At the church of Hauxton village (off the A 10, south of Cambridge) there are two scratch dials, one each side of the south door. Each is a circle with radial lines and a central hole. Scratch dials of this general type, either circles or semi-circles, mark "canonical hours"; (see Little St. Mary's Church). Such dials are not uncommon on walls of medieval churches all over the country and there are at least a dozen examples in Cambridgeshire. They are frequently called Anglo-Saxon dials but their use continued beyond the Anglo-Saxon period. The Hauxton dials are unusually large and clearly-marked. The doorway, and the chancel arch within the church, are pure Norman.





OAKINGTON

At Oakington church about 5 miles N.W. of Cambridge, a reclining sundial is painted directly onto the stone of the SE diagonal buttress at the end of the south aisle. The hour lines and numerals (4 a.m. to 1 p.m.) are incised, and painted black; the dial face is deep red, and the motto GOD ALWAYS CARES appears in gold letters along the top.

Like everything else in and around this church, the sundial is in excellent condition. Surprisingly in a village which takes a pride in its history, nobody seems to know the date or origin of this dial.



GREAT SHELFORD

A vertical dial is to be found high above the door of the south porch on the church at Great Shelford, about 4 miles south of Cambridge (by A 10 and A 130). The date in gold numerals above the dial is 1789. This date does not appear to commemorate any particular event or person, but extensive repairs to the church were being undertaken in the late eighteenth century. The numerals on the dial face are inscribed directly onto the stone, and some show bad weathering.

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AFTERWORD

This small book does not aim at completeness, and there are probably many beautiful and interesting sundials unknown to the authors, scattered among the gardens and walls and grounds of Cambridge. The fascination with sundials does not diminish and we may look forward to seeing more dials, not fewer, as the years pass. One Cambridge College, for instance, is considering the erection of a replica of an Anglo-Saxon sundial to adorn its Anglo-Saxon herb garden. Furthermore, a fine large reclining-equatorial sundial built to commemorate the tercentenary of the Royal Greenwich Observatory was moved with the R.G.O. from Herstmonceux to Cambridge some years ago; but sadly it still awaits a suitable site for erection. If this book ever reaches a second edition we hope to add some more sundials to our list.

ACKNOWLEDGEMENTS

Permission was kindly given by the persons and institutions named below, for the photographing and recording of sundials. This permission is gratefully acknowledged.

Bursar of Christ's College
Master, Fellows and Scholars of Corpus Christi College
Master and Fellows of the College of St. Mary Magdalene
The Council of Gonville and Caius College
The Council of Newnham College
The Governing Body of Peterhouse
Secretary to the Garden Committee, Trinity College
Bursar of Wolfson College

Help and information given by the people named below is gratefully acknowledged.

Mrs W. Clark, Ms J. Ringrose, Messrs A. Buckley, H.G. Button, P. Date, N. Durkin, Drs A.V. Grimstone, F. King, R. Luckett, P. Pattenden, D.W. Phillipson, F.C. Powell, R. Robson, J.R. Seagrave, C. Taylor, R.D.H. Walker.