Sir Christopher Wren (1632-1723)

Our series of profiles of the mathematicians who have lent their names to the CSAR systems continues with a look at the life of Christopher Wren - mathematician, astronomer, scientist and architect.

Although these days he is most widely known as an architect and designer, Sir Christopher Wren’s career did not begin with training in these disciplines. Before the age of 17 he had invented an instrument that wrote in the dark, a pneumatic engine and a new deaf and dumb language. Among his first contributions to the world was the perfection of a working barometer. His talents were extraordinarily diverse.

Born in 1632 in East Knoyle, Wiltshire, to the Dean of Windsor and his wife, the young Christopher led a privileged early life, despite the death of his mother when he was very young, with the young Prince Charles being one of his playmates.

![Figure 1: Portrait of Christopher Wren by Sir Geoffrey Kneller](image)

Physically Christopher was a rather frail child who was quite small in stature. He loved drawing from a young age and he developed this markedly as he grew older. Science fascinated him; he showed a natural curiosity in everything around him and loved to conduct little experiments which he devised himself. Christopher had a private tutor during his early years, then when he was nine years old he was sent to Westminster School in London. This school was run by Dr Busby who was noted both for the exceptionally strict discipline he maintained and for his considerable ability which led to great success for many of his pupils. At this school Christopher quickly became proficient in Latin and this is shown by letters he wrote in Latin to his father which still survive.

The Wren family, obviously much favoured by the King, were staunch Royalists. This led to difficulties when, not long after Christopher began his schooling at Westminster, the English Civil War broke out between King and Parliament. Matthew Wren, who was by this time the Bishop of Ely, was imprisoned in the Tower of London for eighteen years. The deanery at Windsor was attacked and Christopher’s father was forced to move out. At first he went to Bristol but, when Christopher was eleven years old his sister married William Holder and shortly after this Christopher Wren senior went to live in the rectory in Bletchingham, Oxfordshire, the home of his daughter and son-in-law. William Holder was a mathematician and was to have a very strong influence on Christopher who spent much time at Bletchingham. Holder essentially took on the role of mathematics tutor to Wren and also encouraged him to experiment with astronomy.

In 1646 Wren left Westminster school but he did not enter university immediately. During the next three years he built up a broad knowledge of science. He was employed as an assistant to Dr Charles Scarburgh, helping him with various anatomical experiments. Wren created pasteboard models to illustrate how muscles worked which Scarburgh used for demonstrations during his course of anatomy lectures. The work Wren carried out for Scarburgh was his first significant scientific contribution. After this, and still before entering university, Wren was recommended to William Oughtred, a leading mathematician of the time, as an appropriate person to translate into Latin his work on the mathematics of sundials.
Wren entered Wadham College, Oxford on 25 June 1649, received a B.A degree on 18 March 1651 and his M.A. from Oxford in 1653. He was elected a Fellow of All Souls, Oxford, in 1653 and lived in the College until 1657. At Oxford Wren carried out many scientific experiments. He worked on anatomy, making drawings of the human brain for Willis's Cerebri anatome. He devised a blood transfusion method which he demonstrated by transfusing blood from one dog to another. Perhaps what was most remarkable about the years Wren spent in Oxford was the breadth of his interests. His mind leapt from one topic to another as he came up with ideas such as: an instrument to measure angles, instruments for surveying, machines to lift water, ways to find longitude and distance at sea, military devices for defending cities, and means for fortifying ports.

In 1657 he became Professor of Astronomy at Gresham College, London. He had been making observations of the planet Saturn from around 1652 with the aim of explaining its appearance. His hypothesis was written up in De corpore saturni but before the work was published Huygens presented his theory of the rings of Saturn. Immediately Wren recognised this as a better hypothesis than his own and De corpore saturni was never published.

Wren was part of a scientific discussion group at Gresham College London that, in 1660, initiated formal weekly meetings. He undoubtedly played a major role in the early life of what would become the Royal Society, his great breadth of interests and his expertise in so many different subjects helping in the exchange of ideas between the various scientists. His lectures at Gresham also provided a focal point for meetings of the scientists prior to the formal inauguration of the Royal Society. In fact the report of the meeting at which the Royal Society was founded reads:-

“Memorandum November 28 1660. These persons following according to the usual custom of most of them, met together at Gresham College to hear Mr Wren’s lecture, viz. The Lord Brouncker, Mr Boyle, Mr Bruce, Sir Robert Moray, Sir Paule Neile, Dr Wilkins, Dr Goddard, Dr Petty, Mr Ball, Mr Rooke, Mr Wren, Mr Hill. And after the lecture was ended they did according to the usual manner, withdraw for mutual converse."

In 1662 this body received its Royal Charter from Charles II and ‘The Royal Society of London for the Promotion of Natural Knowledge’ was formed. In addition to being a founder member of the Society, Wren was president of the Royal Society from 1680 to 1682.

Wren became Savilian Professor of Astronomy at Oxford in 1661 and held this post until 1673. It was after this appointment that he made his important contributions to mathematics. Isaac Newton, never one to give excessive praise to others, states in the Principia that he ranks Wren together with Wallis and Huygens as the leading mathematicians of the day.

Wren’s fame in mathematics resulted from results he obtained in 1658. He found the length of an arc of the cycloid using an exhaustion proof based on dissections to reduce the problem to summing segments of chords of a circle which are in geometric progression. He was the first to resolve Kepler’s Problem on cutting a semicircle in a given ratio by a line through a given point on its diameter. This problem had a basis in astronomy for it had arisen in Kepler’s work on elliptical orbits. Kepler reduced finding the mean motion of a planet to that of cutting an ellipse in a given ratio with a line through a focus. In addition to solving Kepler’s Problem, Wren independently proved Kepler’s third law and, as we noted above, formulated the inverse-square law of gravitational attraction.

Another topic to which Wren contributed was optics. He published a description of a machine to create perspective drawings and he discussed the grinding of conical lenses and mirrors. Out of this work came another of Wren’s important mathematical results, namely that the hyperboloid of revolution is a ruled surface. These results were published in 1669. Work on the logarithmic spiral, which had been rectified by Wallis in the late 1650s, led Wren to note that it was possible to consider an area preserving transformation which would transform a cone into a solid logarithmic spiral. This, he remarked, resembled snail shapes and sea shell shapes, ideas which D’Arcy Thompson was to examine 250 years later.

It is not quite clear where Wren’s interest in architecture first arose; certainly he read On Architecture by Vitruvius, written in the first century BC, while he was a student in Oxford. In 1661 he was invited to work on the fortifications of the harbour at Tangiers and, although he turned down this request, it is interesting to realise that even at the age of 29 Wren was considered someone who might take on a major architectural project. In 1663 Wren visited Rome where he made a thorough study of the Theatre of Marcellus, examining both the ruins of the theatre...
and drawings that showed its original form. This was important in Wren’s development as an architect and the influence of the Theatre of Marcellus is clearly evident in his early designs. A visit to Paris in 1665 was also influential, particularly the impression that the church of the Sorbonne and the church of Les Invalides made on him.

In 1663 he designed the chapel at Pembroke College, Cambridge, commissioned by his uncle the Bishop of Ely. In the same year he submitted a model of his design of the Sheldonian Theatre, Oxford, to the Royal Society. This project, with its construction beginning in 1664, was the first of his projects to include the design of a dome.

In 1668 building work began on Wren’s designs for the Emmanuel College Chapel, Cambridge and the Garden Quadrangle, Trinity College, Oxford.

Wren’s greatest opportunity in architecture came with the rebuilding that followed the fire of London of 1666. Appointed Commissioner for Rebuilding the City of London in that year he carried out a survey of the area destroyed by the fire with the help of three surveyors. Wren replanned the entire city and supervised the rebuilding of 51 churches.

It is worth noting that despite the remarkable number of designs Wren was working on at this time, he still held the Savilian Chair of Astronomy at Oxford. Clearly his love of the academic world made him reluctant to cut his links with it despite his position by this time of Britain’s leading architect.

In 1669 Wren was appointed as Surveyor of St Paul’s Cathedral. He had been involved in repairs of the old cathedral in 1663 and he was a natural choice to take over this role when, in 1669, he was appointed Surveyor-General of the King’s Works.

Wren is best known today as the architect for St Paul’s Cathedral. His first design for the new cathedral was rejected by London City Council as not sufficiently grand and Wren produced a second plan together with a model in 1674. This second plan was based on a Greek design which was rejected by the clergy as not in keeping with the proper form of a Christian church. Wren, despite his great disappointment at the reaction to his plans for St Paul’s, set to work again and produced a third design based on a Latin Cross with a large dome.

This third design would form the basis for the plans for the Cathedral that stands today but Wren modified them as the work progressed over a period of 35 years. As Wren was already 43 years old when the project began, he might not have been expected to live to see its completion. However, he lived to the age of 90, and St Paul’s Cathedral was completed 12 years before his death.

In 1675, the year in which Wren’s plans for St Paul’s were accepted, he received a commission from Charles II to build a Royal Observatory for Flamsteed who had been appointed as Astronomer Royal in that year. As is so often the case the King was short of money so Wren had to design a building to be constructed ‘on the cheap’. Of course Charles II was not having an observatory built to push forward scientific research, rather he wanted a solution to the longitude problem which would give England a huge advantage over its competitors as a sea-faring nation.

Christopher Wren died after catching a chill while travelling to his London home in February 1723 and was buried in St Paul’s Cathedral on 5 March under the south aisle of the choir at the east end. Fittingly, he was the first person to be buried at St. Paul’s.

I am indebted to a biographical article on Sir Christopher Wren published by the School of Mathematics and Science, University of StAndrew’s, Scotland for most of the information in this article. The rest has come from a variety of sources, including the online BBC History – Society and Culture web page with their biographical overview of Sir Christopher Wren. This may be accessed at: http://www.bbc.co.uk/history/society_culture/art/wren_christopher.shtml