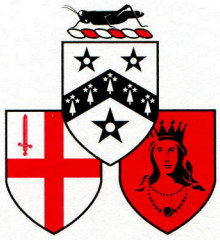

GRESHAM COLLEGE

Founded 1597

GEOMETRY

400 YEARS OF GEOMETRY AT GRESHAM COLLEGE

by

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The Oldest Mathematical Chair in Britain

Robin Wilson

The Gresham Professorship of Geometry was founded in 1596 to provide free public lectures in the City of London, predating the mathematical chairs in both Oxford (1619) and Cambridge (1663). Here we outline its 400-year history and describe some of the distinguished people who have held this position. All those before 1740 are well documented in John Ward's Lives of the Professors of Gresham College [1]*, while others, especially during the later 18th and 19th centuries, remain obscure. Further details can be found in the College's informal account* [2].

Gresham Professors of Geometry

1597	Henry Briggs
1620	Peter Turner
1631	John Greaves
1643	Ralph Button
1648	Daniel Whistler
1657	Lawrence Rooke
1662	Isaac Barrow
1664	Arthur Dacres
1665	Robert Hooke
1704	Andrew Tooke
1729	Thomas Tomlinson
1732	George Newland
1749	William Roman
1759	Wilfred Clarke
1765	Samuel Kettleby
1808	Samuel Birch
1848	Robert Edkins
1854	Morgan Cowie
1890	Karl Pearson
1894	Henry Wagstaff
[1939	Lectures in abeyance]
1946	Louis Milne-Thompson
1956	Alan Broadbent
1969	Sir Bryan Thwaites
1972	Clive Kilmister
1988	Sir Christopher Zeeman
1994	Ian Stewart
1998	Sir Roger Penrose
2001	Harold Thimbleby
2004	Robin Wilson

The founding of Gresham College

The Gresham professorships arose from the will of Sir Thomas Gresham. Born in 1519, he was admitted to the Mercers' Company in 1543. Edward VI appointed him Royal Agent in Antwerp, one of the major commercial centres of Europe, where he amassed a vast fortune. Impressed by the Antwerp Exchange, Gresham offered to pay for a similar one in London if the City Corporation would provide the site. This Exchange – the centre of commerce in the City of London – was opened in 1566 and proclaimed *The Royal Exchange* when Queen Elizabeth I visited it around 1570.

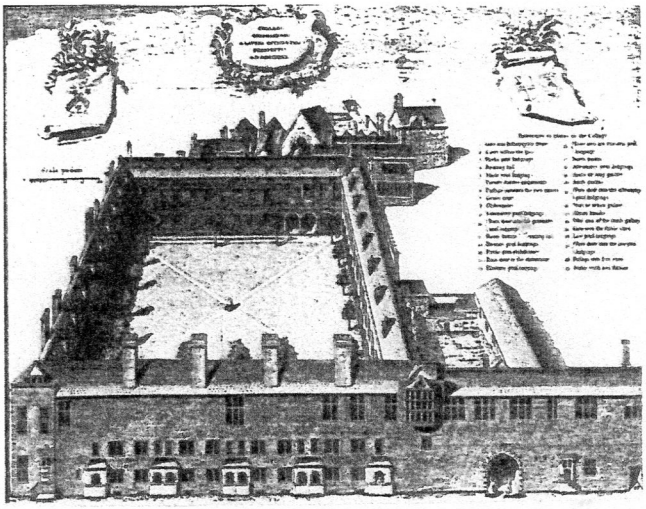
Thomas Gresham

In 1575, Sir Thomas made a will, giving half of the Royal Exchange to the Mayor and citizens of London and the other half to the Mercers' Company. These groups were to provide £50 per year for each of seven professors to give free public lectures in Geometry, Divinity, Astronomy, Music, Law, Physic and Rhetoric, within his dwelling house in Bishopsgate Street; these seven professorships exist to this day, and an eighth one, in Commerce, was added recently.

Sir Thomas Gresham died in 1579, but his wife survived him for a further 17 years. So it was not until 1596 that the Corporation and the Mercers' Company came into possession of Gresham's house, which became known as *Gresham College*. As the *Ballad of Gresham College* later described it:

> *If to be rich and to be learn'd*
> *Be every Nation's cheifest glory,*
> How much are English men concern'd,
> Gresham to celebrate thy story
> *Who built th'Exchange t'enrich the Citty*
> *And a Colledge founded for the witty.*

From the beginning Gresham College encouraged the practical sciences of navigation, trade, commerce, manufacturing and medicine, rather than the Aristotelian studies still pursued at the ancient universities. The professors were required to be unmarried, and a suite of apartments was provided for each one. It was laid down that the geometry lectures were to be read twice every



The original Gresham College

400 years of Gresham professors: Sir Roger Penrose with Henry Briggs

week, on Thursdays at 8 a.m. (in Latin) and 2 p.m. (in English):

> *The geometrician is to read as followeth, viz. every Trinity term arithmetique, in Michaelmas and Hilary terms theoretical geometry, in Easter term practical geometry.*

Henry Briggs

The first Gresham Professor of Geometry was **Henry Briggs**, who was installed in early 1597 and occupied his College rooms at the far right-hand of the quadrangle. There he worked on navigation and on tables for finding the height of the pole star. By 1610 he was studying eclipses, and five years later was wholly taken up with logarithms, lately discovered by John Napier of Edinburgh who, in Briggs's words:

> *set my Head and Hands a Work with his new and remarkable logarithms. I never saw a Book which pleased me better or made me more wonder.*

Unfortunately, Napier's logarithms were cumbersome – in particular, log 1 was not equal to 0, and log *ab* was equal to log *a* + log *b* – log 1. As Briggs continued:

> *I myself, when expounding this doctrine publicly in London to my auditors in Gresham College, remarked that it would be much more convenient that 0 should be kept for the logarithm of the whole sine.*

Briggs made two extended visits to Napier in Edinburgh to discuss such matters. The result of these deliberations was that, while still at Gresham College, he devised his new base 10 logarithms, with log 1 = 0, in which to multiply two numbers together one simply adds their logarithms. His *Arithmetica Logarithmica* of 1624, completed after he had left Gresham College to become the first Savilian Professor of Geometry in Oxford, contains his extensive hand-calculations of the logarithms of 30,000 numbers to 14 decimal places, which proved to be an invaluable aid for mariners and navigators.

Gresham College and the Royal Society

In 1657, Christopher Wren was appointed Gresham Professor of Astronomy, while Lawrence Rooke, the previous holder of that post, became Professor of Geometry. In his inaugural address, Wren praised Henry Briggs, describing the useful invention of logarithms as 'wholly a British art which at Gresham College received great additions'.

Rooke had earlier spent some years at Wadham College, Oxford, assisting Robert Boyle in his 'chymical operations' and attending meetings of 'learned and curious gentlemen' in the rooms of Dr Wilkins, Warden of Wadham. When Rooke moved to Gresham College, many of his Oxford associates – Robert Boyle, Robert Hooke, John Wallis and others – visited London to attend his lectures and discourse afterwards in his rooms. On 28 November 1660, following a Gresham lecture by Christopher Wren, the Oxford group proposed the formation of a society. This new society, later the *Royal Society*, met weekly in Rooke's rooms at Gresham College.

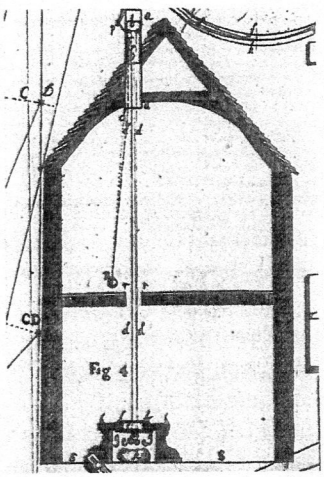
In 1662, Rooke died, and was succeeded by the Cambridge mathematician **Isaac Barrow**. Barrow had been one of the earliest to investigate what is now known as the fundamental theorem of calculus. He held the Gresham Geometry Chair for two years, before returning to Cambridge as the first Lucasian Professor of Mathematics, the post later held by Isaac Newton, and currently by Stephen Hawking.

Robert Hooke

The ninth Gresham professor was a remarkable person, best remembered for his work with Boyle on the air pump, for his invention of the microscope, as described in his *Micrographia* of 1665, and for 'Hooke's law' on the extension of springs. As Curator of Experiments for the Royal Society, he was required to design and present experiments to the public on a regular basis.

In his diary, Samuel Pepys wrote of 'Mr Hooke who is the most and promises the least of any man in the world that I ever saw'; Hooke had 'a meagre aspect' and there were bitter disputes with Isaac Newton and others. But he seems to have carried out his Gresham responsibili-

ties conscientiously for over thirty-five years, making the College an important centre for scientific research and debate. The Royal Society appreciated 'the conveniency of making their experiments in the place where their curator dwells and the apparatus is at hand', and in 1674 the Gresham authorities gave Hooke £40 to erect a turret from which he could make astronomical observations.



Robert Hooke's turret at Gresham College

Shortly after Hooke's appointment, most of the City of London was destroyed in the Great Fire of 1666, including Gresham's Royal Exchange. The College narrowly escaped and became a temporary exchange, with the Lord Mayor living in the Divinity professor's lodgings, the Mercers' Company displacing the Law professor, and so on.

It was not a good time for the College. Several professors (though not Hooke) regularly failed to give their lectures, or presented them badly. The citizens of London lost interest in the lectures, which were frequently cancelled because no-one turned up. Matters came to a head in 1699. Rebuilding the Royal Exchange had been costly, and proposals were made to save money by rebuilding the College on a smaller scale. Parliament was petitioned for approval, with only Robert Hooke, now frail and the only professor resident in the College, holding out against the plans. The bill failed, but further attempts were made after Hooke's death in 1703. Isaac Newton, who became President of the Royal Society in that year, also joined in the fray, petitioning Queen Anne for land on which the Society could build. Around 1710 the Royal Society moved to Crane Court and the Gresham residence survived for a further 60 years before being demolished.

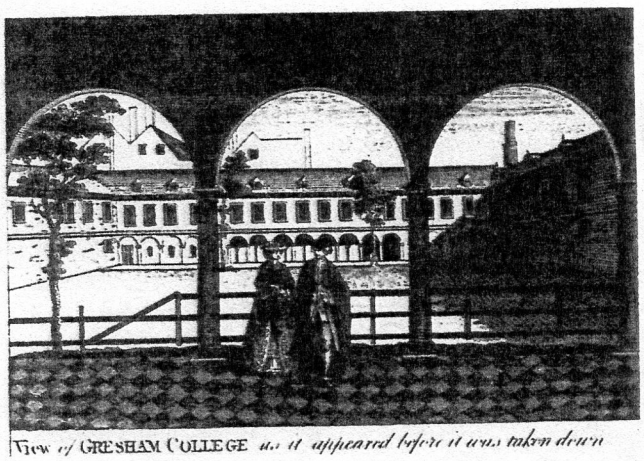
The 18th and 19th centuries

The next two centuries were largely a time of inaction when, in the words of W. W. Rouse Ball, 'an appointment at Gresham College ceases to be a mark of scientific distinction'. Few Gresham Professors from this period are now remembered, and it is remarkable that the College survived through this difficult time.

A constant problem for the Gresham authorities was the letting of rooms by the professors in order to increase their income – even the righteous Hooke had let out his stable. The salary of one Geometry Professor, **Andrew Tooke**, was withheld when he let out his lodgings for £20 per year and his coach house and stable for £7 per year; once he removed his lodgers, his salary was restored. Another Geometry professor, **George Newland**, had a different problem, arising from continued complaints by the Law professor, Mr Mace:

The Gentlemen visited the Stables belonging to Dr Newland under part of Mr Maces Appartment and are of the Opinion that the Stench arising from the Horse dung is a Nusance to those who inhabit the said Appartment.

In 1768, the Gresham College Bill finally passed through Parliament, and the College, Sir Thomas Gresham's house, was pulled down. The lectures were transferred to the Royal Exchange, where they were presented for the next 70 years.



View of GRESHAM COLLEGE as it appeared before it was taken down

An 18th-century view of Gresham College, shortly before its demolition

The years at the Royal Exchange proved to be another low period in the history of the Gresham lectures. Attendances continued to decline, and several of the professors were less than conscientious about their lectures, while also proving to be generally uncooperative, unwilling to change their ways and frequently causing difficulties for the Gresham committee who were trying to improve the situation.

On 10 January 1838, the Second Royal Exchange was destroyed by fire, with the total destruction of the lecture room. It was high time that a new Gresham College was built, and this opened on 2 November 1843. Built at a cost of £7000 in the enriched Roman style, with its entrance on Basinghall Street in the City of London, its lecture room was capable of holding 500 people.

Karl Pearson

Although most Geometry professors from the 19th century are largely forgotten, the 19th professor was one of the most distinguished: the applied mathematician, later statistician and biologist, **Karl Pearson**. Third Wrangler from Cambridge, he studied in Germany before returning to London, where he was called to the Inner Temple. In 1884 he abandoned law, becoming professor of applied mathematics and mechanics at University College, London, where he spent the rest of his working life. Later, he co-founded the journal *Biometrika* and was its principal editor for 36 years.

We are fortunate in knowing much about his Gresham lectures. A highly effective teacher, his lectures were beautifully presented with graphics, models and slides. From his first highly successful series of Gresham lectures, on applied mathematics, grew his popular book *The Grammar of Science* (1892) which was influential for many years.

Pearson was greatly influenced by Francis Galton's 1889 book *Natural Inheritance* and he soon turned to

statistics. His second series of Gresham lectures, on the *Geometry of statistics*, was a comprehensive treatment of the graphical presentation of statistical data from the biological, physical and social sciences. His third series, *Laws of chance*, discussed probability theory and correlation, and his Gresham lecture on 31 January 1893 introduced the term 'standard deviation' to the world for the first time; the word 'histogram' also made its first appearance at a Gresham lecture.

Perason's final series was on *Normal curves, skew curves and compound curves*. With his lectures at Gresham College, the Royal Society and UCL, he firmly established statistics as a discipline in its own right – especially in its applications to problems of heredity and evolution.

The 20th century

In 1894 Pearson resigned the Gresham Chair due to ill health, and was replaced by **Henry Wagstaff**, who held the post for 45 years until the outbreak of the Second World War. He was later granted the title of Emeritus Professor of Gresham College in view of his long service, over 500 lectures.

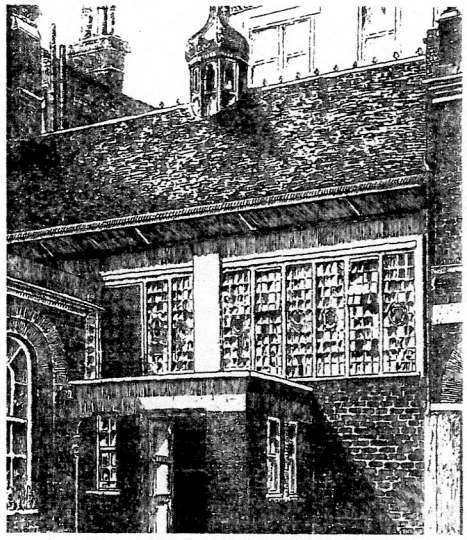
In December 1939, shortly after the outbreak of the Second World War, the lectures were suspended, resuming in Autumn 1946. The new professor was the applied mathematician **L. M. Milne-Thompson**, who was well known for his books on theoretical applied mathematics, and for his *Standard 4-figure Mathematical Tables*. At Gresham College he lectured for ten years on such topics as the geometry of configurations, and aesthetic values and their measurement. His successor, **T. A. A. (Alan) Broadbent**, had been President of the Mathematical Association and editor of the Mathematical Gazette for 25 years. He was Gresham Professor for 13 years, giving around 150 lectures on a wide range of topics.

Broadbent's successor, **Sir Bryan Thwaites**, was the Founding Director of the School Mathematics Project (SMP), and his lectures on 'Ways ahead in school mathematics' attracted audiences of over 100, mainly from the general public. Thwaites was a great enthusiast for the use of computers in applied mathematics, many years before his time, and computers featured in several of his Gresham lectures.

The next Gresham Professor was the applied mathematician and historian of mathematics **Clive Kilmister**, who held the position for 16 years. A bold experiment to link Gresham College with the new City University in London was tried, with the aim of attracting audiences from both the University and the general public. This arrangement eventually broke down, and Kilmister found himself lecturing in an unsuitable cinema in the Barbican and, more pleasantly, at the new City of London School buildings by the river. His successor, **Sir Christopher Zeeman**, also lectured at the School on a number of occasions during his six years with the College, and his lectures regularly attracted hundreds of young people.

Barnard's Inn Hall

Finally, in 1991, everything changed yet again to what is essentially the current arrangement. Gresham College moved to Barnard's Inn Hall, for 60 years the home of the Mercers' School, and since then most of the geometry lectures have been given in its fine hall.



Barnard's Inn Hall

The professors are now elected for a fixed term, usually of three or four years, and give six lectures per year. Recent Geometry professors have included well-known popularisers of mathematics: Sir Christopher Zeeman and **Ian Stewart** presented the Royal Institution Christmas series of lectures, while **Sir Roger Penrose** has written several best-selling books. His successor, **Harold Thimbleby**, focused on the role of computers in the modern world. As the current holder, my lectures concentrate mainly on topics in pure mathematics and the history of mathematics.

Audiences have recently increased, and all geometry lectures now have to be given twice in order to accommodate everyone. Each lecture can be viewed on the web [*www.gresham.ac.uk*] and transcripts can be downloaded. The number of 'hits' on the Gresham College website has increased from about 200 per month two years ago to over 20,000 per month, and many thousands of Gresham College lectures have been downloaded. It is probable that the state of the Gresham College Professorship of Geometry has never been as strong as it is has been in recent years.

References

1. John Ward, *Lives of the Professors of Gresham College*, London, 1740.
2. R. Chartres and D. Vermont, A Brief History of *Gresham College, 1597–1997*, Gresham College, 1997.

Robin Wilson is Professor of Pure Mathematics at the Open University, UK, and a fellow of Keble College, Oxford University. He is the current holder of the Gresham Chair of Geometry. On the photo he is dressed as Leonhard Euler.

GRESHAM COLLEGE

Policy and Objectives

An independently-funded institution, Gresham College exists

to continue the free public lectures which have been given for over 400 years, and to reinterpret the 'new learning' of Sir Thomas Gresham's day in contemporary terms;

to engage in study, teaching and research, particularly in those disciplines represented by the Gresham Professors;

to foster academic consideration of contemporary problems;

to challenge those who live or work in the City of London to engage in intellectual debate on those subjects in which the City has a proper concern, and

to provide a window on the City for learned societies, both national and international.

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The City of London Corporation is committed to promoting learning and development, and to ensuring equality of opportunity for all. The free public lectures provided by Gresham College professors and the seminars, conferences and webcasts the college hosts play an important part in it achieving these aims. The City of London Corporation is proud of its association with Gresham College and with the Mercers' Company which also provides essential support, enabling the College to thrive and flourish.