

Nick Woodhouse



Mathematical
Institute

The Andrew Wiles Building: A short history

Oxford
Mathematics

“The opening of this fantastic building is great news for Oxford’s staff and students, who will soon be learning together in a stunning new space.”

Rt Hon David Willets MP
Minister of State for
Universities and Science

Below: Charles L. Dodgson
(Lewis Carroll) aged 24 at his
desk [Wakeling Collection]

A short time in the life of the University

The earliest ‘mathematical institute’ in Oxford may have been the School of Geometry and Arithmetic in the main Quadrangle of the Bodleian Library (completed in 1620). But it was clearly insufficient to provide space for everyone. In 1649, a giant of Oxford mathematics, John Wallis, was elected to the Savilian Chair of Geometry. As a married man, he could not hold a college fellowship and he had no college rooms. He had to work from rented lodgings in New College Lane.

In the 19th century, lectures were mainly given in colleges, prompting Charles Dodgson (Lewis Carroll) to write a whimsical letter to the Senior Censor of Christ Church. After commenting on the unwholesome nature of lobster sauce and the accompanying nightmares it can produce, he remarked: ‘This naturally brings me on to the subject of Mathematics, and of the accommodation provided by the University for carrying on the calculations necessary in that important branch of science.’

He continued with a detailed set of specifications, not all of which have been met even now. There was no room for the “narrow strip of ground, railed off and carefully levelled, for investigating the properties of Asymptotes, and testing practically whether Parallel Lines meet or not: for this purpose it should reach, to use the expressive language of Euclid, ‘ever so far’”. This last process, he remarked, “may require centuries or more: but such a period, though long in the life of an individual, is as nothing in the life of the University”. Predictably, Dodgson’s approach did not produce results. More serious moves to provide Oxford mathematicians with appropriate accommodation had to wait until the next century.

In 1930, G. H. Hardy, another Savilian Professor, wrote an article in the Oxford Magazine. He argued for the founding of an Institute where faculty members and graduate students could meet and lectures could be given: ‘Why should a professor have to grovel



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before a College Bursar when he wants a room and a decent blackboard?'. At first, the response was modest. All that was granted for the new 'Institute' was a temporary foothold in the newly constructed extension to the Radcliffe Science Library (built in 1934); this consisted of a room for each of the four professors, one for a secretary, and one for lecturers.

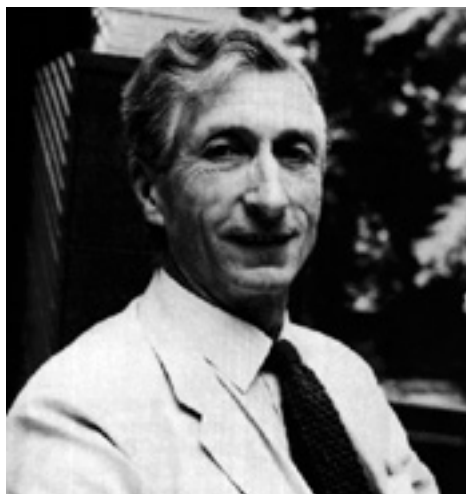
In the 1950s, Oxford's mathematical community expanded rapidly with the arrival of the topologist Henry Whitehead as Waynflete Professor, and in 1953 the Institute moved into a Victorian house on the corner of Parks Road and Museum Road.

Eventually, in 1966, a purpose-built Mathematical Institute was constructed in St Giles'. Its detailed design was overseen by Charles Coulson, Rouse Ball Professor of Mathematics, who insisted that pure and applied mathematics should be under the same roof, unlike at Cambridge at the time. In 1966, its large lecture theatres could easily hold an entire year-group and provided acres of blackboard, enough for even the most enthusiastic of lecturers.

Space, however, rapidly became a problem. Funding constraints had not allowed a vision of future growth, and nor had they allowed for the construction of enough space to tempt tutors away from their college rooms. The building was barely large enough to house the professors, university lecturers, visitors and graduate students, and before long it was overflowing into a house in St Giles', and then into one floor after another of Dartington House, a utilitarian block in Little Clarendon Street, where OCIAM and the Centre for Mathematical Biology found their home. More recently, a redundant medical laboratory, the Gibson building, was spared demolition and pressed into service.

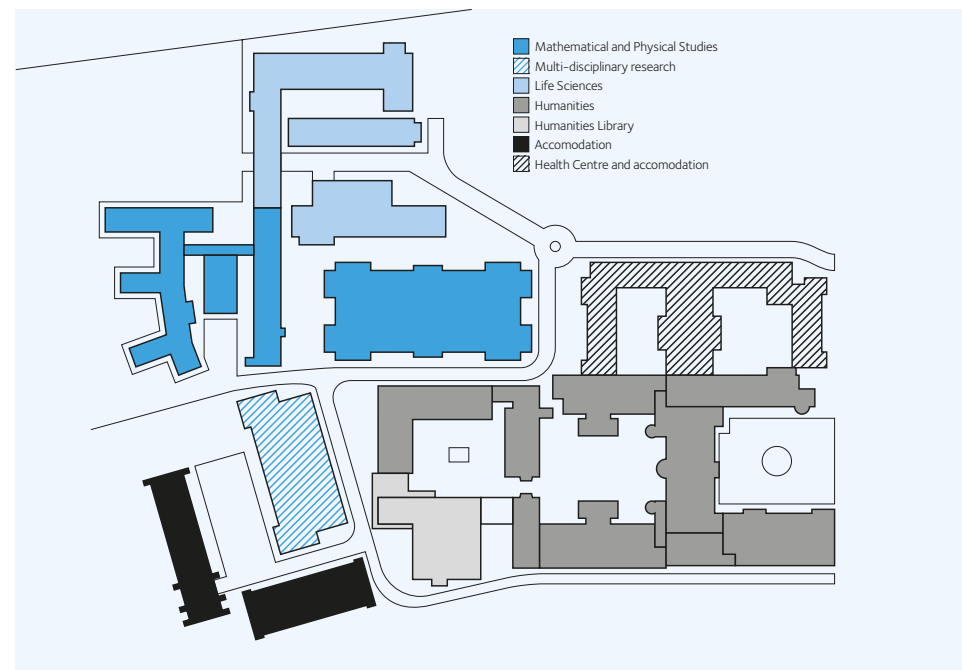
Other pressures were coming to bear by the 1990s. Research groups made up of faculty members, post-doctoral researchers, and graduate students were becoming a common organisational unit, and it was proving difficult to support them when their senior members were housed in colleges across the City.

Below: Charles Coulson, Rouse Ball Professor of Mathematics
Right: Plans from the University's 'vision document'



There was also increasing awareness that the mathematics undergraduates lacked central facilities. They did not have an intellectual home where they could mingle and exchange ideas with others with similar specialist interests. Neither the dismal underground reading room in the Radcliffe Science Library nor the lecture theatre in the Museum, where most of the first- and second-year lectures took place, could provide this.

The problems had been recognised in a General Board report in 1992, and in 1997 a University Working Party on Sites, chaired by Sir Colin Lucas, recommended that 'Mathematics, preferably including Statistics, but not the Computing Laboratory, should be consolidated onto a single site in the general area between the present Science Area and the Radcliffe Infirmary.' He had in mind the site of the Acland Hospital. A new avenue was opened in 2000, however, when the development of the Radcliffe Infirmary site (now the 'Radcliffe Observatory Quarter' or 'ROQ') became a serious possibility.



Early plans for the ROQ

In its earliest form, the plan for the ROQ was to refurbish many of the old hospital buildings, only demolishing those that were clearly unfit for purpose. The University drafted a 'vision document', which was to guide development over the next 25 years. It divided the site into four (unequal) quarters: Humanities, Science, the 'Graduate Quarter' (graduate housing in the old nurses' home) and the 'Press Quarter'. The former maternity hospital on Walton Street was to be refurbished for mathematics.

While the 'vision' was useful in focusing on what could be achieved with this huge space in the centre of Oxford and served its purpose in driving planning for the site, it underestimated the difficulty and cost of refurbishing pre-war buildings. Moreover University policy moved against providing laboratories and student housing on very costly city-centre land in favour of a more dense development of libraries and academic offices.

In 2002, following discussions in the wake

of the vision document, the Mathematical Institute began planning for its new building. It engaged David Heslop, of the Architects Design Partnership (ADP), to work with the department on a brief. ADP also produced an outline design for a new mathematics building to the south of the maternity hospital, opposite the University Press.

David Heslop's brief and outline design were taken to various University bodies for approval over the next two years. Early in 2003, the University announced the purchase of the site, with possession set for July 2007, when the remaining NHS departments would migrate to Headington. In the meantime a further external review of the mathematics department (in 2004) reiterated in strong terms the conclusion of the 1992 review on the need for a new building.

In February 2004, Landon and Lavinia Clay visited Oxford for the opening of the new Chemistry Research Laboratory, and their subsequent very generous support for the mathematics project had a transformational

effect. The dream of a new building was now more than a distant aspiration: it was time to focus in detail on plans that had a real chance of coming to fruition over the coming years.

During the spring and summer of 2004, the SLAM Collaborative of Cambridge MA developed a feasibility study for the whole site. For the first time, at the suggestion of Lavinia Clay, consideration was given to the wholesale demolition of all the unlisted buildings and to opening up of views of the Radcliffe Observatory (the Tower of the Winds).

The Mathematics building itself was to be at the end of a wide tree-lined avenue running due south, diagonally across the site from the Tower. An elegant classical treatment was proposed for the facade facing OUP across Walton Street.

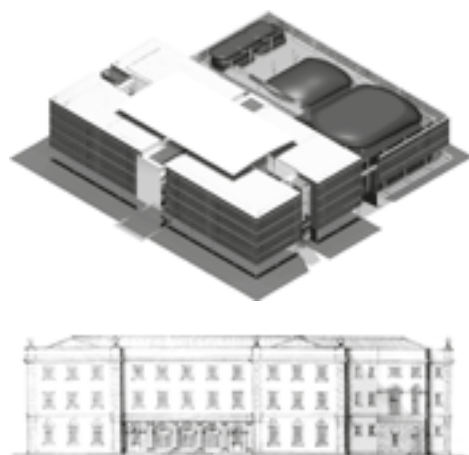
The RVA masterplan

In Michaelmas Term 2004, the plans were looked at afresh, under the guidance of the new Vice-Chancellor, John Hood. It had become clear from the early work that to treat the site as a collection of independent building lots, as in the vision document, would be to miss a rare opportunity to make a spectacular architectural contribution to Oxford. Greater coherence was needed, together with careful attention to the views of the historic buildings, as in the SLAM proposal. There was also an economic imperative to make optimum use of the space. City policy did not permit building above the height of the Carfax Tower, so it was necessary to make the best possible use of levels below ground.

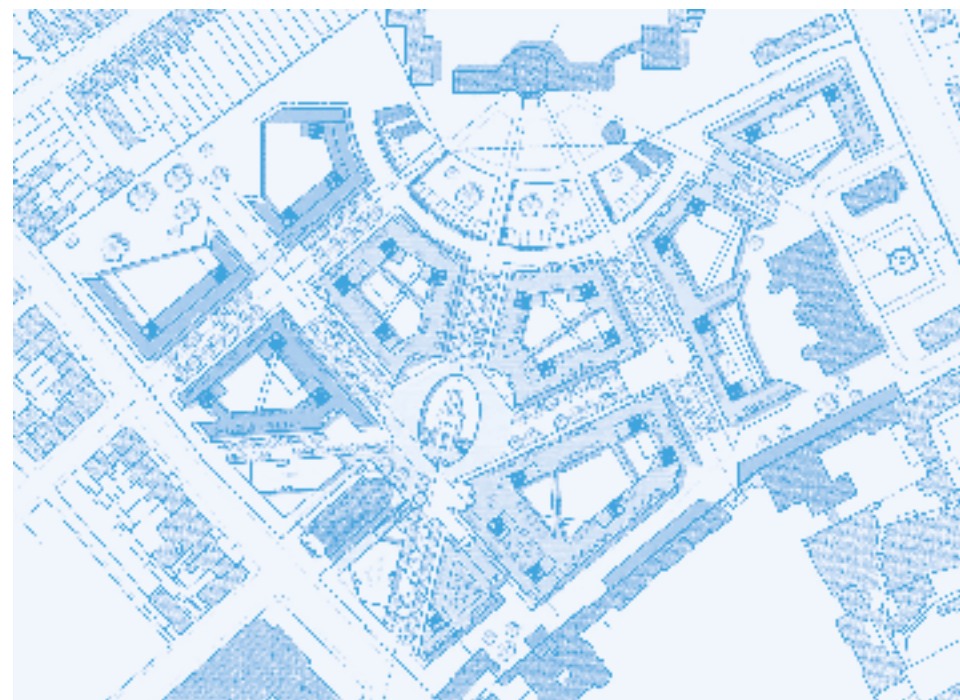
A RIBA competition was launched in November 2004 for a site-wide masterplan and for the design of the mathematics building. In January 2005, four firms were shortlisted and in April 2005, Rafael Viñoly Architects (RVA) emerged as winners of the competition and began work on the masterplan.

By November 2005, the outlines of the masterplan were clear. The whole development was conceived as a single building, with the different components connected at two

Below: David Heslop's 2002 outline design
Bottom: SLAM Collaborative's 2004 feasibility study, including the proposed classical treatment for the facade facing across Walton Street



Right: Rafael Viñoly's initial napkin sketches
Below: Outlines of the 2005 RVA masterplan



underground levels: by a huge mezzanine floor and lower basement stretching across most of the site. Above ground, there were to be avenues radiating from the Tower of the Winds and exploiting the views that had been central to the SLAM plan. A key feature, which survived the subsequent revisions, was an avenue running from the Tower to an opening into Somerville's into main quadrangle, giving the college a view to the north and mitigating the dense development of the university buildings by capturing views of Somerville's lawns to the south. A sunken garden in front of the Tower would bring natural light to the humanities library, which was to extend under the central buildings.

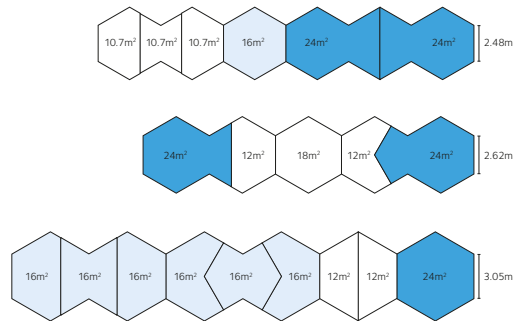
David Heslop's draft brief was developed by Keith Gillow, PDCM and RVA, and the mathematics building was assigned what proved to be its final location on a plot on the east of the site, wrapping around the back of the eighteenth century infirmary building, which is now Radcliffe Humanities. The teaching area below was to be connected to the new subterranean library, where the mathematics books from the Radcliffe Science Library and from the Whitehead Library in St Giles' would be housed as a single collection. Design work began in earnest in 2006, with the initial sketches being made by Rafael Viñoly on a napkin over dinner at Branca in Walton Street.

A brief interlude

The following five years, up to the point at which construction finally began in the summer of 2011, were dominated by uncertainty. It was a time of financial turmoil and large shifts in the approach to the public funding of universities. The ROQ project was conceived on a grand scale, and its success depended on reconciling many competing considerations. The site is bordered by important historic buildings and its development would have a significant impact on the City. English Heritage and the City conservation officers had a strong interest. The neighbouring colleges had legitimate concerns about the scale of the development and about access. There was tension between the requirement to unite the mathematics department in a single building and the desire to open a view across its plot to the Tower of the Winds. Within the University, there were competing claims on limited capital resources and diverse views on priorities, not just between the departments and faculties that were in urgent need of new space, but also between spending on buildings and preserving endowment to support academic posts. It was also difficult to plan a new library at a time when the electronic revolution was provoking fundamental debate about the very nature of academic libraries.

The timing of the project required the masterplan, with all the intricacies of site-wide infrastructure and service provision, to be developed in parallel with the design of individual buildings. The 'single building' concept blurred the boundary between the two processes and the UK's planning regime does not cope well with such a dual approach. As people came and went in leading positions, opinions on key questions shifted. The grand views along the radial avenues, which were initially welcomed, were displaced by a new emphasis on intimate spaces and 'discovered views'. In 2009, Niall McLaughlin Architects, who designed the successful Somerville extension on the southern boundary of

Below: RVA's initial plan produced in 2006, based on a hexagonal grid
Bottom: The 2008 scheme of five connected pavilions



the site, revised the masterplan, keeping the avenue between Somerville and the Tower, but abandoning the sunken garden and the other long views across the site from the south.

In the meantime, the University took possession of the site in February 2007 and Bennetts Associates were appointed in May 2008 to design the humanities building. Demolition of the condemned hospital buildings began, and was completed by the end of 2008.

The three phases of the Mathematics Plan

RVA's initial plan, produced in the summer of 2006, was based on a hexagonal grid. Conceptually exciting, and geometrically pleasing, it was likely to be costly and difficult to build, and would not have achieved the targets set for the efficient use of the plot. Thereafter the plans went through three major

Below: Render of the scheme which evolved into the now completed building



phases as different practical and aesthetic considerations came to the fore. During 2007 and the first part of the following year, RVA developed in detail a plan for a single undivided building stretching uniformly up to the 'Carfax limit' across the whole plot. Its impressive central atrium was covered with a dramatic inverted glass roof (the 'impluvium'). There was a second sunken garden on the south side of the entrance.

This design was considered to be too massive by the City officers and English Heritage. They suggested that the building should be broken up into smaller units. A roofscape that varied in height, occasionally piercing the Carfax limit would be acceptable.

In response, RVA produced a new scheme, based on five connected pavilions. At first the City planners supported the new direction in informal discussions, but in early 2009 their

written comments made it impossible to proceed.

The pavilions were abandoned, and work began on a new scheme which evolved into the now completed building. There were to be two wings, connected at ground-floor level by an entrance lobby and at the first-floor by a glass-walled common room facing the Tower of the Winds. This arrangement allowed a view of the of the Tower from the courtyard in front of the refurbished Infirmery building. The roofscape varied in height, as had been suggested in 2008, building up from a low point on the Woodstock Road towards the central divide. Initially there were to be courtyards in the centre of each wing, but these were covered over as the plan progressed to form the two magnificent atria in the final design. Below ground, there was generous circulation space around the teaching rooms, where undergraduates and others could meet, work and drink coffee between lectures.





Construction of the Andrew Wiles Building

It was worth the wait. In May 2010, the City Council approved RVA's design and also Bennetts' design for the neighbouring humanities building. The construction firm Laing O'Rourke, which was already working on the Somerville project on the southern boundary of the site, was appointed as the main contractor, working with RVA and with PDCM as project manager.

It remained unclear whether enough funding would be available, with the financial outlook still looking bleak. It was not until the summer of 2011 that, with the strong support of Alex Halliday as head of the MPLS division and an inspired presentation by Sam Howison at its meeting in May, the University Council finally made the bold decision to proceed.

Construction began with a ground-breaking ceremony on August 2nd 2011. By the end of the following winter, the 'big dig' was complete. Secant piles had been sunk to form the outer wall of the double basement. Some 47,000m³ of soil had been removed, pipes for the ground-source heat pumps had been installed, and the department had become the proud owner of the largest hole in all Oxford. Huge horizontal yellow steel props prevented the sides from collapsing inwards until the floor slabs could provide permanent stability.

By May, the slabs for the mezzanine level were complete and the building began to rise above ground level. Two massive white tower cranes appeared above the dreaming spires, and interest in the project within and outside the department quickened.

Progress over the following months was rapid. Laing O'Rourke had brought with them a number of innovative techniques that allowed the mass of the floor plates to be reduced and which avoided the traditional time-consuming process of pouring concrete into plywood shuttering. Concrete planks were manufactured off-site, under factory conditions, and were then topped up on site with a layer of poured concrete. Not only did this allow for speedy construction, it also gave

Right: Stairways at the entrance of the new building
Below: Pre-construction render of the project
Bottom: The 2011 ground breaking ceremony





Left: Interior view of the 'crystal' covering the light well in the south atrium
 Below: The 2012 topping out ceremony
 Right: The graph $K_{3,3}$ which inspires the design of the 'crystal' covering the light well in the north atrium

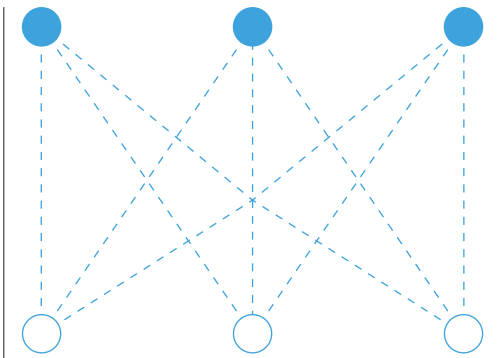


a very high-quality finish to the undersides of the slabs, which could be painted directly.

In August 2012 the North wing reached its full height, and a topping out ceremony was held on the 31st. Work began on the cladding and the interior spaces. In August 2013, the building was completed, nearly £2m under budget. It was an impressive performance by Laing O'Rourke and their sub-contractors.

Throughout the detailed design and construction phase, the project was overseen by a Project Sponsor Group, drawn from the MPLS division, the Mathematical Institute, PDCM and the Estates Directorate, and advised by RVA and external consultants. Enormous credit must go to Keith Gillow, who acted as departmental project manager and guardian of the brief.

Members of the department ensured that mathematics is well represented in the fabric. Following a departmental competition,



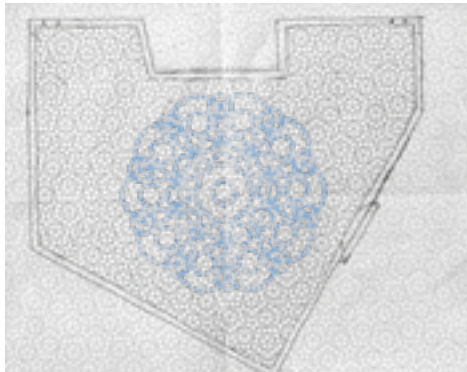
the design of the two 'crystals' covering the light wells in the north and south atria were based, respectively, on the graph $K_{3,3}$ and on a surface plot of the solution of an eigenfunction problem for the two-dimensional Laplacian. For the area in front of the main entrance, Sir Roger Penrose designed a new realisation of his non-periodic tiling, to be laid in granite slabs inset with stainless steel bands.

A century and a half before John Radcliffe's bequest was used to build the Radcliffe Observatory, and twelve years before John Wallis's election to the Savilian chair, Pierre de Fermat claimed to have proved his celebrated 'last theorem' in a marginal note in a copy of Diophantus's *Arithmetica*.

In tribute to Sir Andrew Wiles, who finally published the completed proof of the theorem in 1995, the latest building to rise on the Radcliffe Observatory Quarter is named in his honour.



Above: The final paving in front of the main entrance
Right: The tiles being carefully laid outside the building
Below: Sketch of Sir Roger Penrose's design







Design
williamjoseph.co.uk
Photography
Alain Goriely: Covers, 10, 17, 18a, 19, 20
Rafael Viñoly Architects: 13, 14, 18b
John Cairns: 16a

Andrew Wiles Building
Radcliffe Observatory Quarter
Woodstock Road
Oxford OX2 6GG
United Kingdom

+44 (0)1865 273525
enquiries@maths.ox.ac.uk
www.maths.ox.ac.uk

