

Cambridge University – Department of Materials Science & Metallurgy

Teaching — 100 not out

In the beginning

The Lecture List in the *University Reporter* for 1909/10 advertises a course to be delivered in Chemistry (the old Chemistry building on Pembroke Street) by Heycock under the title "Metallurgy of Gold, Silver, Lead, Platinum, Copper, Tin and other metals". Part II teaching within Chemistry seems to have developed gently. By 1930 Dr D. Stockdale had taken over the lectures and gave courses on "Principles of Metallurgy", "Structure of Metals and Alloys" and "Assaying of Silver and Gold", one in each Term. Laboratory work was available from 10 – 1 daily. In parallel with this and presumably at a rather more elementary level a course was being given in "Metallurgy for the Ordinary B.A. Degree".

"Metallurgy" does not appear as the title of an independent subject in the Natural Sciences Tripos until Part II Metallurgy was introduced from October 1937, following a Report to the University in April 1937. Amongst other points, that report estimates that the additional annual cost to the University would be £300 – £350. The Lecture List for that year lists these courses:

5 OCTOBER 1937] CAMBRIDGE UNIVERSITY REPORTER 105		
Michaelmas Term, 1937	Lent Term, 1938	Easter Term, 1938
METALLURGY.		
NAT. SCI. TRIPOS, PART II (<i>continued</i>).		
At the Chemical Laboratory unless otherwise stated.		
Prof. Hutton. General Metallurgy. Tu. F. 9.	Continued.	Continued.
Dr D. Stockdale. Metallography. M. Th. 9.	Continued.	
Dr F. P. Bowden. General Physical Chemistry. M. F. 12.	Prof. Rideal. M. W. 12.	
Dr J. K. Roberts. Thermodynamics. S. 9.		
Dr R. C. Evans. X-rays and Crystal Structure. W. 9.		
Dr Evans and Dr T. P. Hoar.	Corrosion of Metals. Tu. 12.	
Mrs Tipper.	Plastic Deformation of Metals. Th. 12.	
Prof. Rideal. Surface Reactions. Tu. 12.		
<i>Practical work.</i>		
Laboratory Practice in Assaying and Metallurgy. Daily. Times to be arranged.	Continued.	Continued.
Special course in workshop practice. <i>Eng. Lab.</i> Times to be arranged.	Continued.	Continued.

Those lecturing were based in a number of Departments. The external examiner appointed for that year was Professor H.C.H. Carpenter of Imperial College.

Until 1942 Metallurgy was not represented in the two-year Part I of the Tripos but a "half-subject" (i.e. a one-year course) was introduced that year after a Report to the University in June.

1965 Reconstruction of the NST, introduction of first-year teaching in a joint course

Nothing stays the same for ever, even in Cambridge, and by the 1960s it was realised that the then current structure of the Natural Sciences Tripos needed thorough revision. After much deliberation involving three reports to the University it was agreed to make major revisions to the structure of the first two years of the Tripos, with the old Part I being split into Parts IA and IB. This removed the requirement for candidates for Part I having to revise and be tested on their first-year subjects as well as their second-year ones. The new format started in October

1965. That involved the introduction of a number of inter-departmental courses, one of which, "Crystalline State" involved our Department and the then Department of Mineralogy & Petrology (Min & Pet), which was absorbed into the Department of Earth Sciences on its creation some years later. Initially the marriage had its difficult moments, for example because, in a number of instances a phenomenon turned out to have one accepted name in Metallurgy and a different one in Min & Pet. "Precipitation" and "Ex-solution" spring to mind. Initially there was no lecture room big enough for the numbers taking the course and so the lectures were given simultaneously in the two Departments. With completion of the Babbage Lecture Theatre that ceased to be necessary, although it took significant effort and some years to solve basic problems with the Babbage. The course evolved over the years, overseen by an inter-departmental committee (the Committee of Ten, later becoming the Committee of N) and the name changed to "Crystalline Materials" and then to "Materials and Mineral Sciences". Finally, in Michaelmas 2010 the Department took on complete responsibility for the course and the name became "Materials Science".

With appropriate modification the old half-subject Metallurgy became a second year – Part IB – course. Its name has changed over the years in step with that of the Department and the content has evolved systematically.

Squeezing a quart into a litre pot – the Long Vac Term

The difficulty of covering the range of theoretical and practical content thought essential into a three-year (nine term) course was recognised in many scientific and other departments in the University before the Second World War and led to the introduction of what was loosely called the "Long Vac Term". Strictly speaking this was not a "term" but a period of eight or so weeks during the summer when undergraduates planning to take Part II of the Tripos in those subjects during the coming year returned to Cambridge. Initially in Metallurgy this just involved prospective Part II students being exhorted to take an analytical chemistry course run by Chemistry. This was joined in the summer of 1954 by the addition of a Metallurgy course (of unadvertised content) in the Goldsmiths' Laboratory. By the sixties Long Vac work involved a lot of practical and some lectures. Apart from making a useful start for Part II this period helped to develop social cohesion in the cohort. Long Vac Terms ended in the eighties because of a change in the rules governing student funding nationally.

Introduction of Part II Materials Science

By the early 1960s research interests in Metallurgy Departments internationally were broadening to include other materials, leading to the recognition of "Materials Science" as a distinguishable subject. In Cambridge a separate Part II in Materials Science was started in the Department in 1965/66, albeit sharing a significant proportion of the teaching with the established Metallurgy course as well as participation in the Long Vac Term.

Amalgamation of Part II Metallurgy and Part II Materials Science

Subsequently it was realised that running separate Metallurgy and Materials Science Part IIs, with some shared courses, was unnecessarily complicated and the courses were merged from 1975/76 as Metallurgy & Materials Science, with exchange to Materials Science & Metallurgy from 1986/87 (provoking some wry smiles around the University).

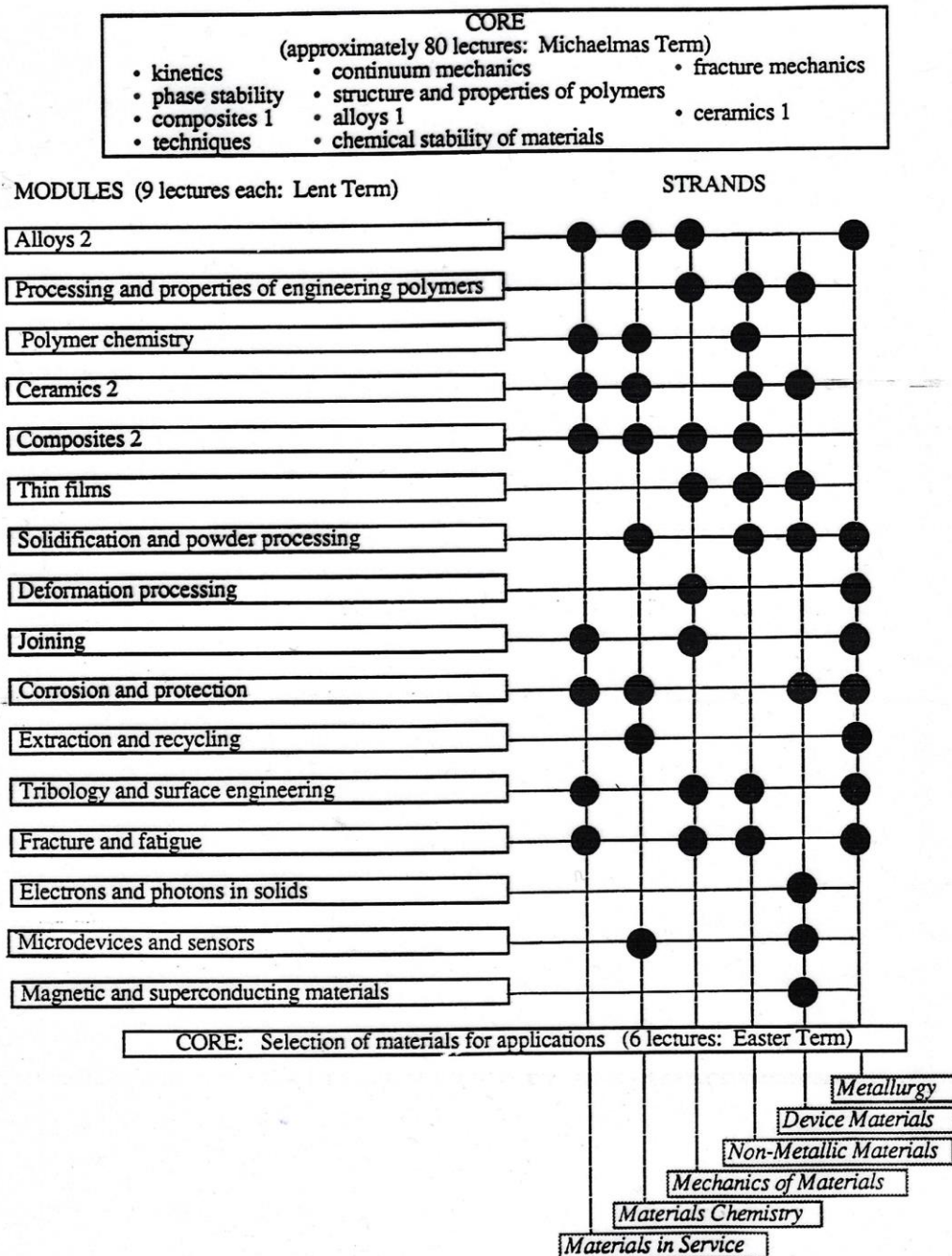
Evolution of course content

The content of the Department's courses has evolved continuously, sometimes, for example, in a minor way when a member of staff retired and at other times in a very substantial way. An important example of that was the introduction of "strands" into the Part II course beginning

in the year 1992/93 after very detailed deliberation by the Teaching Committee. These are illustrated below.

Lecture Courses

After completing the main part of the Core, approximately 80 lectures in the Michaelmas Term, each student will have to choose one from six strands of modules. Each strand contains eight modules, each of nine lectures, and builds on the core whilst allowing a measure of specialisation. The year is rounded off with a short Core course on the Selection of materials for applications.



Organisation: Teaching Committee Secretary

By 1978 it was recognised that a specific Member of Staff should be given responsibility for overseeing the organisation of teaching. The writer was the first to hold the resulting post of Teaching Committee Secretary. The formal organisational structure has evolved since then with the creation of specific posts to take on these (and more) responsibilities.

Accreditation

Following the Finniston report "*Engineering our future*" (published in 1980) it was gradually recognised that more attention should be given nationally to how well courses in science – and technology more broadly – matched up to the expectations of ... HE, industry, etc. These considerations led to two developments: accreditation by external professional bodies, the IoMMM (and its principal predecessor) carrying out the task for the Department, the first occasion being in 1982.

Student feedback – Questionnaires

In the early days formal feedback mechanisms for teaching did not exist in most higher education in the UK but that began to change in the era of student disturbances internationally in the 1970s and has now long become firmly established.

Teaching Quality Assessment (TQA)

Over the last three decades several national concerns have led to a rise of external assessments of the performance of universities in teaching and separately in research. This is not the place to discuss the assessment of research but the impact on teaching cannot be ignored. Initially this involved Teaching Quality Assessments of individual subject areas, later evolving into Quality Assurance Audits of whole institutions. In both cases the teams involved a majority of current academics and the writer found himself involved not only in overseeing the Department's preparations for TQA (ably assisted by Rosie Ward) 1997 but also with helping assess several other institutions. Comments on the Department's experience of TQA can be found in the editorial by Alan Windle, then Head of Department, in [Material Eyes Issue 4](#).

Introduction of Part III: the M.Sci. and M.A.St. degrees.

The pressures on course content arising from accreditation were further increased by changes in the typical specifications of A Level science subjects, which increased the difficulty of achieving the expected levels of attainment in physical science subjects and Engineering on completing a three-year degree course; this led to recognition that a fourth year was needed. For the Department the fourth-year course, Part III leading to the degree of M.Sci., was introduced for the academical year 1998/99, with an admission hurdle of a II(1) in Part II. (Success in Part II continues to be a sufficient qualification for the B.A. degree.) Since 2011 it has been possible for suitably qualified graduates from elsewhere to join the cohort of Cambridge undergraduates taking Part III. In their case they work for the postgraduate degree of M.A.St. (Master of Advanced Study). This option has seen a modest take-up but not every year and is currently suspended.

Teaching Fellows

For many years the University resisted anything that might seem to weaken the link between teaching and research. Essential though that linkage remains, pressures arising from external Research Assessment exercises and internal promotion processes have led to a recognition that some change was necessary. In Cambridge, the Department of Chemistry was the first to introduce "Teaching Fellows". Materials Science & Metallurgy followed in June 2006, the

first such Fellow being Noel Rutter, whose pioneering contribution to the Department's teaching was particularly noteworthy. His thoughts on his experiences are appended. Now he has been succeeded by Jess Gwynne, and more recently she has been assisted by Rob Thompson, sharing the task of maintaining the teaching programmes through the still continuing stages of the Covid-19 pandemic. An account of their experiences of that period is appended. There can be no doubt that the introduction of Teaching Fellows has had a substantial positive impact on the Department's teaching, not least in the students' responses.

Class Technicians

Teaching, especially practical teaching, would not be possible without the help of the Class Technicians. Over the years members of Staff have had good reason to be grateful for skilful help and suggestions when devising new practicals, which, once successful, then have to set up to run year after year. Likewise students in all years but most obviously in Part II have often benefitted from their guidance.

Teaching methods – 1. Lectures

Apart from the use of the human voice, many aspects of lecturing have changed over the century driven by technological developments. An account of changes experienced over the last 50 or so years appeared in the Centenary Supplement of *Material Eyes* Issue 37 and is appended.

Teaching methods – 2. Practicals, projects, industrial placements and foreign languages

The Department's courses have always included a significant amount of practical work but its nature has evolved over time. In the distant past there was much focus on analytical chemistry during each year followed by lengthy practical examinations for the Tripos. That steadily gave way to a broader range of topics and of teaching methods, particularly with the introduction of the inter-departmental Crystalline State course, which involved a twice weekly sequence of two-hour "demonstrations" closely linked to the lectures. A highlight of the practical work was provided by the hands-on use of very small X-ray generators, each one constructed inside a car wheel (!) to investigate elementary X-ray diffraction. Consideration of undergraduate travelling necessitated a re-think of the Part IA scheme as a result of the move to West Cambridge. The acquisition in the early seventies of a basic SEM for use by Part II students was very well received. A major recent change dramatically affecting the appearance of practical classes has been the requirement to wear lab coats – white for students, blue for demonstrators and staff.

Project work has also replaced some of the formal set practicals, initially in Part II and gradually spreading to earlier years, reaching the first year in the Lent Term 2004. Project work was an essential component of the fourth-year course from its beginning. These changes have also seen the method of assessment change from practical examinations to accumulation of credit for practical/project work during the year, the latter now including assessment of oral presentations.

In all the above components an essential feature is the invaluable contribution made by demonstrators, generally postgraduate students and postdocs. A long time ago they were simply thrown in at the deep end but as the subject broadened and the Department welcomed postgraduates and postdocs with ever wider academic and geographical origins, it was realised that regular briefing sessions for demonstrators in Part IA and (later) in Part IB had become necessary and these were introduced in the seventies. In Part II demonstrators are usually dealing with topics in their own areas of specialisation; even more so with Part III projects.

In addition to practical skills acquired through the Department's teaching, for many years students were strongly encouraged to take up an industrial placement during the summer following Part IB, the Department having built up a list of possibilities. This scheme has now expanded into the "Cambridge Materials Placements for Undergraduates in the Summer (CaMPUS)" scheme, which is available to undergraduates during the summer following Part IA or Part IB or Part II and includes scientific work in the Department as well as placements in Europe or in UK industry. For over two decades the Department has encouraged students to learn from the outset or to strengthen their skills in one of a number of important foreign languages using the facilities based in the Department of Engineering.

Teaching methods – 3. Supervisions

Although supervisions have evolved over centuries, they have long been an important feature of Cambridge education. A recognisable form of the present system has existed since soon after the Second World War, although the increase in numbers of students and the huge increase in numbers of postgraduate students and postdoctoral researchers has meant that members of those groups now undertake a higher proportion of the supervisions than was the case 60 years ago. In the Department supervision of groups, typically of two or three undergraduates, is long established but with ever-increasing specialisation individual students now experience many more supervisors in Parts II and III than was the case, albeit the number of sessions with an individual supervisor will generally be rather fewer.

Teaching methods – 4. Computer-based

The development of electronic computers had relatively little impact on teaching until the development of the PC since when the changes have been substantial although efforts are always made to ensure that human contacts are maintained! Following the initial development of the PC, IT began to play an ever increasing role in the Department, initially focused on research. However it was recognised that it also had a role to play in supporting teaching and a small group headed by Bill Clyne devised a series of on-line teaching units in materials science under the acronym [DoITPoMS](#) ("Dissemination of Information Technology for the Promotion of Materials Science") and made them freely available internationally, as they and their successors still are. A refreshed version has just been launched.

Textbooks emerging

There is a [YouTube presentation about books](#), including textbooks, that have emerged from the Department over the last 100 years so that information will not be repeated here.

Location, location, location

Over the century the locations of the Department's teaching have changed many times. In the early days lectures and practical work took place in the (then) Chemistry Department in Pembroke Street. Eventually the Chemistry Departments moved to their new building in Lensfield Road and Metallurgy took charge of some space (never enough!) in old Chemistry, including the Heycock Lecture Room, a seminar room and teaching laboratories. Indeed it may have been at that time that the Heycock Lecture Room received its name. As mentioned elsewhere, for several years from 1965/66 first-year lectures were run in parallel with half the students coming to the Heycock Room and half going to Mineralogy & Petrology. The Babbage Lecture Theatre in the Arup Building was used for many years before pressures of medical numbers saw their lectures moved to the Babbage and our Part IA lectures going to the Physiology Lecture Theatre. Part IB and Part II lectures were given in the seminar room, with Part IB later moving to the Babbage. When the Department moved into its section of the Arup

Building (mainly) in 1971 the Part II lectures were given in the lecture room created from offices on the lowest floor of the tower and many Part III lectures were slotted into the seminar room on the first floor of the Austin Building. With the move to West Cambridge, Parts II and III lectures and all practical teaching moved there but pressures from the rigidities of the six-day timetable in Parts IA and IB of the Natural Sciences Tripos required the lectures to continue to be given in central Cambridge (currently in the Department of Chemistry). For supervisions on the other hand, it must always have been the case that some supervisors supervised in the Department, some in their College.

Tripos Examinations

The form of Tripos examinations has changed over the years. Originally there were lengthy practical examinations, now practical skills are assessed during each year of the Tripos and the marks accumulated are submitted to the examiners. An external examiner or examiners have always been appointed for the Part II examinations (and now for Parts II and III). For many years candidates used their own names (not easily forgotten even under exam stress) on their scripts but anonymity has been assured since 1992 by the use of codes. Before the University centrally took charge of issuing the codes the Department used an ingenious system devised by Kevin Knowles to ease to ensure against amnesia on the part of candidates. Each code consisted of two letter and two digits but these were the chemical symbols and corresponding atomic numbers of elements (e.g. Fe 26)

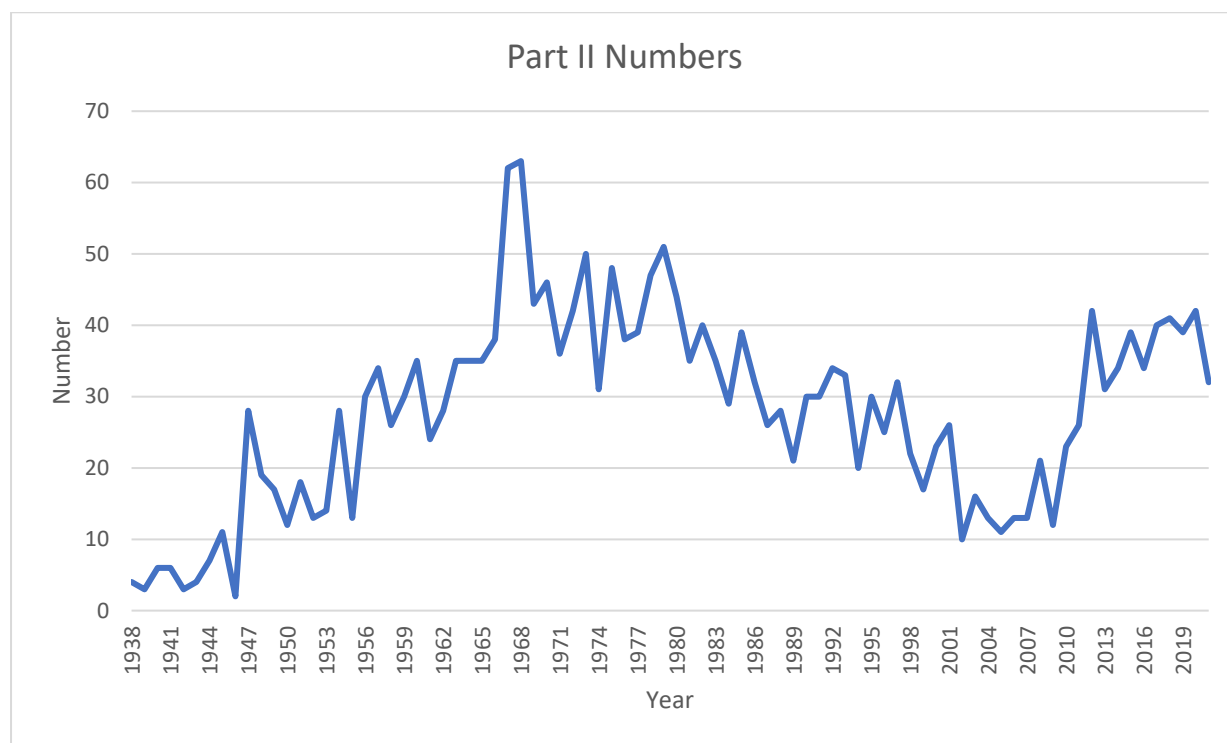
For very many years the results were published by posting the Class Lists outside the Senate House and in the Department. That has ceased to be the practice. First, no matter what their result individuals could opt for their name not to appear. Then the public posting of lists was agreed to be potentially problematical and so has very recently been terminated. Candidates themselves receive their results by electronic means.

Over the years the Department has been grateful to a number of external organisations and that have endowed or have regularly funded awards for excellent performances in the Tripos examination and associated work. These include the long-standing premier award, the Goldsmiths' Medal and Prize, now awarded to the most successful candidate in the examination for Part III. Others include the Armourers & Brasiers' Company (a range of awards), the Tin Plate Workers' Company, IoM3, Rolls-Royce, and CEGB, this last an endowment received in the distant past and which has outlived the donor organisation. A sum subscribed by many contributors on his seventieth birthday (in 1989) to mark the distinguished work of Sir Alan Cottrell formed the endowment for a prize awarded annually for the best performance in the subject in Part IB.

Numbers

An investigation of the Part II Class Lists from the initial one in 1938 has provided the data illustrated in the graph below. Over the years a very small number of candidates for Part II have failed to gain honours so the number shown for a particular year may be slightly smaller than the actual number in that year. In the other direction, from time to time the Part II Class has been augmented by a small number of candidates "not for honours", most notably in the early 2000s during the period of the exchanges with MIT. These numbers have also been excluded. All the exclusions do not significantly distort the trends shown above. In very recent years a small number of successful individuals have taken advantage of the new option of having their names omitted from the lists but Departmental records show the actual numbers and these have been used. At least partly, the ups and downs shown reflect national and even international fashions in subject choice by students but no doubt local factors have also played

a part from time to time. At present typically around 280 take Part IA Materials Science each year (roughly 45% of the Cambridge Natural Sciences intake) and around 10% of those come all the way through to Part III.



Graduate education, evolution of a formal structure and an examination

For many years from the foundation of the Department, postgraduates were few in number and learned their skills in the laboratory of their supervisor and in the Library, but gradually it became clear that some lecture courses, often with associated practical training were needed, usually focusing on specific experimental techniques, for example electron microscopy. With the steadily increasing numbers of postgraduates it became clear that some sort of formal assessment was needed and this led to the introduction of assessment for the CPGS (Certificate of Postgraduate Study) at the end of the first year, a pass being required in order to continue working towards a Ph.D. Then the increasing (international) demand for a formal course after a first degree led to the widespread introduction of one-year Master's courses, in Cambridge normally designated M.Phil. courses. The Department's first M.Phil. course – "Materials Modelling" – started in October 2000 and has now been succeeded by the interdepartmental taught M.Phil. in "Micro- & Nanotechnology Enterprise" generally led by this Department as well as a research-based M.Phil. in Materials Science. The courses in the taught M.Phil. are also attended by students in the four-year inter-departmental CDT (Centre for Doctoral Training) programme in "Computational Methods in Materials Science".

Teaching under Covid

Please read the appended account by the current Teaching Fellows Jess Gwynne and Rob Thompson of the Department's experiences during the Covid-19 pandemic.

Outreach

In addition to teaching undergraduates and postgraduates the Department has for many years been involved in outreach activities, mostly designed for schoolchildren, some for

schoolteachers. In the former category examples include a highly successful primary school outreach programme (SeeK – Science and Engineering Experiments for Kids) which ran for more than 10 years involving PhD researchers visiting local schools, activities created for Science Week (now the Cambridge Festival) with some also used in the inter-departmental "Physics at Work" weeks in September. These have included such memorable things as making ice-cream using liquid nitrogen alongside national curriculum-based activities. Since 2004, the Department has hosted residential summer courses for sixth form students in conjunction with the Engineering Development Trust, offering an insight into University and Materials Science in the context of the Natural Sciences Tripos. In the latter category were a series of inter-departmental courses for schoolteachers organised by the Institute of Physics run in Cambridge. As well as contributing a lecture, the Department provided hands-on experimental demonstrations based on some Part IA practicals transported to the Engineering Department. The Worshipful Company of Goldsmiths also supported courses for schoolteachers with the Department offering a Materials Science-based course for a few years. From time to time members of the Department have given lectures and practical demonstrations in schools around East Anglia.

External financial support

In addition to the notable series of benefactions made by the Goldsmiths' Company since their support of Heycock a century ago and summarised in [*Material Eyes Issue 33*](#), the Department has been grateful for other donations over the years, many of them in support of teaching. As mentioned already, sometimes these have created prizes awarded for outstanding performances in the Tripos; sometimes they have enabled the provision of new infrastructure. Most recently it was particularly pleasing that several benefactions towards the costs of teaching facilities in the West Cambridge building were received. In addition to the Goldsmiths' Company's support for lecture rooms other donations came from the Ann D Foundation for the teaching laboratory and Anne Glover for the computer suite.

Careers

This is not the place to attempt a review of the dramatically varied careers followed by graduates from the Department ranging from distinguished academic scientists and technologists to some impressively far distant from their first degree! Some were recorded in *Light Blue Materials* in 2005 and others have featured from time to time in *Material Eyes*.

Looking ahead

This autumn (2021) the University announced a completely new inter-departmental Tripos to start in October 2024. This four-year "Design Tripos", which will lead to the M.Des. degree, will have an emphasis on creativity in tackling societal and environmental issues. It will involve the Departments of Architecture and Engineering as well as Materials Science & Metallurgy. It is expected to attract students who have broad interests combining the arts, social and natural sciences and technology, at the same time helping to address the gender disparity in Engineering and the Physical Sciences in Cambridge. It will be complementary to the long-established courses in Materials Science & Metallurgy.

Acknowledgments and a request

This account would not have come into existence without help from a number of people. Lindsay Greer made the initial suggestion and provided informative details (along with references to *Light Blue Materials*). Noel Rutter contributed his thoughts on being the first Teaching Fellow. Jess Gwynne, in consultation with Rob Thompson, wrote the account of *Teaching under Covid*. Lianne Sallows unearthed extensive statistical data for numbers of

undergraduates in recent years, some of which underlie the section on "Numbers", provided up-to-date information about Outreach and dealt with website matters. James Elliott provided information about the "Design Tripos". Finally, invaluable inanimate guidance was found in the splendid collection of bound volumes of the *University Reporter* in the St John's College Library. If you spot any errors or can provide additional information please contact me at <jal2@cam.ac.uk>.

John Leake
December 2021

P.T.O.

Teaching Fellows - the first 15 years

Noel Rutter

The Department appointed its first Teaching Fellow, Noel Rutter, in 2006. The grade 9 post (equivalent to what was then the post of University Lecturer) was intended to have approximately 80% of its focus on teaching with a small opportunity for research activity. Lecturing assignments in the first year were very modest with just two courses, but teaching loads grew as it became clear that the Teaching Fellow was in a key position to be able to deliver multiple courses at Part IA and IB and another important part of the role was leading improvements and updates to Part I practicals.

It had not necessarily been envisaged from the outset that the Teaching Fellow would play a major part in the organisation and leadership of the Department's teaching activities, as the post of Director of Undergraduate Teaching (DUT) was a distinctly separate role. However from 2009 Noel became DUT and Secretary to the Teaching Committee, and hence the focus of the Teaching Fellow moved towards development of teaching in the Department more broadly and a key early aspect of that was helping to secure for the Department sole management and delivery of the Part IA Materials Science course.

In the early 2010s the key focus became planning for the relocation to West Cambridge. There was some trepidation from the teaching perspective as the initial building plans, constrained by budgets and the drive for efficiency, did not include provision for teaching labs in the new Materials Science building; rather it was envisaged that our undergraduate practicals could be allocated space in the Bragg building of the Cavendish. It is obvious now that this scenario did not transpire, but even with suitable facilities in place we were worried as to how students would adjust the new location. However such concerns were unfounded and the course would continue its steady increase in popularity in the years following the move.

Another key development which coincided with the move was the creation of an additional Teaching Fellow post, proof if needed that the model was considered by the Department to be a successful and effective one. Jess Gwynne was recruited to the role, the Teaching Fellows now becoming a team of two. When Noel left the Department in 2018, Jess took over the role of DUT and Rob Thompson was appointed as a new Teaching Fellow, with the Department retaining two such positions.

Looking back 15 years on from the creation of the first of these posts, it is certainly the case that more focused academic attention has helped the course develop and run more efficiently and enhance the broader student experience. At the same time all academic staff must continue to contribute significantly to the efforts - while the Teaching Fellows can organise and lead the teaching effort alongside a Head or Deputy Head (Teaching), they will only deliver a small minority of the course, even with significant individual teaching loads. With the pressures that arise from aiming to run world-class teaching alongside world-leading research there is a risk of removing responsibility for and awareness of the undergraduate programme from the broader academic staff and creating dependence on a small number of individuals.

While research was originally envisaged as being part of the role, the reality has been that to give full and proper focus to the teaching aspects has not left any substantial time for research activities. This has led the status of the Teaching Fellow posts within the structures of the University to be somewhat unclear and precarious with questions about the appropriate grading, whether they should be University Offices, and what the further career opportunities are for the role-holders all being important ongoing issues.

Teaching Under Covid

Jess Gwynne in consultation with Rob Thompson
(Teaching Fellows)

March 2020

With the challenges of Covid-19 fast approaching, we made it to the end of the Lent term before the University shut down, and then had five weeks to convert the Easter Term's lectures, practicals and exams to an online format. The lectures were pre-recorded by having the lecturers lecture to an empty lecture theatre (which was definitely an odd experience for those involved). For the practicals, we made some videos to show the students what they would have done during the practical sessions, and then produced some data to enable them to complete the exercises. However, exams were trickier. For the Natural Sciences Tripos as a whole, it was decided that the exams in both Parts IA and IB should provide a further contribution to the candidates' education rather than be a formal assessment, so we decided to produce papers based on past exam questions, which students completed in their own time and were then marked by supervisors. For Parts II and III, we decided that the only way to make the conditions the same for everyone was to convert the exams to a 24-hour online open-book format, so the already-prepared questions had to be adapted for this format by removing or reducing the bookwork parts.

Easter Term 2020

Jess went on maternity leave half way through May and left Rob and the rest of the Teaching Office to it, although she could not resist popping in (virtually!) now and then to see how things were going. Happily all went well in the Department – and for Jess (although maternity leave during a pandemic was a very different experience to the first time round).

Summer 2020

Planning for the 2020/21 academic year was difficult because the whole prospective situation was initially very uncertain. It did become easier once the decision had been made for all lectures to be online, because we could then start planning properly. The overall quality of the lectures produced by the Department's lecturers was very good given a standing start and the inability to collaborate and share experiences in person. Many of us found that recording lectures took much longer than delivering them in person, because the temptation to press stop when something didn't go quite right and have another go, was too strong! But it was not all doom and gloom: some things, such as not having to do the jigsaw puzzle of putting together the Parts II and III lecture timetables, were easier!

Michaelmas 2020

Lectures for all cohorts went ahead online. For Part IA, in-person Practical went ahead, but at a reduced capacity – rather than having classes of approximately 60 in at once, we split them in half, and had each group in for an hour at a time, to allow for social distancing, with time for cleaning etc. in between. We think this actually worked very well – the students were still able to complete the majority of the practical work that they would have otherwise done, and then complete the associated questions and data analysis at home. For Part IB, the practical sessions were similarly shorter but, because the lectures were online, we were able to have the students in the lab during the mornings, rather than at the same time as the Part IA for some of the sessions, so we could space them out around the lab, which worked well. We only ran one practical for Part II that term because the challenges of running the other practicals under the restrictions then in force made more impossible. Part III projects went ahead as normally as possible (subject to restrictions on space in research labs etc.)

Lent 2021

We found out with fairly little notice that we had to move the whole of the Lent term activities online. This was not a problem for lectures, because they were being pre-recorded anyway. We ran the Parts IA and IB practicals remotely, with pre-prepared data, videos etc. and used Zoom, splitting the students into breakout rooms to work together, and had demonstrators available. Perhaps unsurprisingly, the Part IB students engaged better than those in Part IA. Overall this worked reasonably and the main learning points were achieved, but it was a rather dry experience for everyone involved. The Part II practicals were converted to online format, which worked ok, but the cohort was a bit short of in-person contact throughout the year. Finally, Part III projects had to be hastily adapted to remote working. Some students took on more modelling work, whereas others had demonstrators in the lab collecting data for them, thus developing an unexpected transferable skill in a managerial role. Overall, they still achieved some excellent projects, despite the circumstances.

Easter 2021

The Part III poster session is usually held in the Tea Room over lunch but since that was not possible, we held it using Gather.town, which actually worked surprisingly well, and recreated some of the atmosphere of an in-person poster session. We had already made the decision for all our exams to be in an online open-book format, since we again felt that this was the only way to make conditions the same for everyone (for example, some subjects decided to go ahead with in person exams as usual, but this was difficult for students who had permission to work remotely, or who needed to self-isolate during the exams). We chose a three-hour format (plus time for scanning and uploading of their scripts to Moodle). One major advantage was receiving their scripts electronically, since this eliminated the need to transfer piles of scripts from one marker to another, and meant that there was no waiting for late scripts to come in from students sitting the exams in other locations, which made the whole marking process much smoother and more efficient. To achieve “Cohort equity” – the university’s way of trying to ensure that students were not disadvantaged by the pandemic – it was decided that the resulting grade distribution should be no less favourable than that for the three years preceding the pandemic.

Summer 2021

It was difficult to plan for the 2021/22 academic year, because everything was again still quite uncertain. What was clear was that the University was keen for the year to be as normal as possible.

Michaelmas 2021

For the large cohort in Part IA the lectures have continued to be delivered online in order to comply with the restrictions on numbers in the lecture theatre (the Bristol-Myers-Squibb [BMS] lecture theatre in Chemistry). All other lecture courses involve at least a significant in-person component. The Part IB lectures have been moved into the larger BMS lecture theatre to allow students to space out more. Most courses in Parts II and III are being delivered as normal, but some are happening in a flipped format, in which the students watch pre-recorded videos, and then attend in-person examples classes. Pedagogically this proves to be a good opportunity to try new things! For the IA practicals we have kept the split class format from Michaelmas 2020, because we think this worked really well. For Parts IB and II the practicals are back to normal timings but we are keeping a lot of electronic submission of (e.g.) practical notes, because it makes marking much easier. The Part III projects are happening as normally as possible. We are hoping to hold online open-book exams again, as last year for all cohorts;

we felt that we ended up with much better exam questions this way – less rote learning of lecture notes, and more testing of understanding.

Finally, stimulated by the experience of teaching through the pandemic, we are undertaking a complete course review. It seems a good opportunity to use some of the lessons learnt in the last 18 months; some changes we made had to be made at short notice but actually worked well and we want to keep. We are looking at the coverage of the lecture courses, with a view to identifying gaps and avoiding repetition, and at the practicals and assessment methods. There is no need to go back to exactly what we did before – just because we used to do things a certain way doesn't necessarily mean it's the best way of doing things!

November 2021

P.T.O.

Chalk, Moodle and Zoom

When I joined the Department as a Lecturer in January 1968 the normal method of conveying information in lectures was blackboard and chalk, mostly white but occasionally coloured, e.g, red for crystallographic symmetry elements. To display more as a lecture developed some lecture rooms had several boards, sometimes ones that slid up and down with a substantial heave‡. Use of (large clunky glass) slides was possible and 2"×2" slides were coming in but the projectors were primitive. Reproduced by prehistoric means, handouts were basic, with diagrams usually hand-drawn so students were expected to take full notes.



Brian Ralph lecturing Part 1A Crystalline Materials, Babbage Lecture Theatre, 1981

Over the years, blackboards and chalk gave way to (passive) whiteboards with wonderfully aromatic markers and projectors controlled by the lecturer. With the development of the PC, detailed word-processed handouts became the norm. In parallel with this came overhead projectors to display notes hand-written “live” by the lecturer onto a long scroll of clear plastic or on previously prepared viewfoils, initially written or drawn by hand, but later printed with word-processed text and diagrams, often identical to the handout. Next arrived applications such as *PowerPoint*, which provide for slick presentations – but do they get in the way of spontaneity? More recently (and after I retired) the University adopted *Moodle* to provide wide support for teaching; this proved its value when Covid-19 came along and teaching mostly went on line augmented by use of *Zoom* and such like. What will be the long-term impact of the past 18 months?

A wider view of the development of teaching, including practicals, projects, supervisions and DoITPoMS, over the past century will appear on the Departmental website.

John Leake

‡ After a mid-lecture tussle with one such board in the Pembroke Street Building the author ended up in A&E and still bears the scar!