Two Centuries of Change: Physics Degrees at the University of Aberdeen

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This is a draft, written during the Covid-19 outbreak. It is likely to be months before I can return to the library and produce a final version but it is sufficiently complete that I thought it worth sharing.

It’s easy to pause in King’s quadrangle, look at the ancient chapel or the fairly ancient Cromwell Tower and imagine that students centuries ago had a recognisably similar academic experience to those of today: lectures, study exercises, exams and eventually letters after their name. In fact a lot more than academic content has changed. I wanted to look at how the structure and teaching of one subject that has been part of the academic portfolio of the University of Aberdeen has evolved over the past two centuries. Of course, there have been huge social changes too but I’m not really qualified to cover those and this is not a book, just a survey of how teaching of Natural Philosophy (Physics in the 21st century) has evolved over the past two centuries. Footnotes provide further details in places.

In the beginning

There were no Physics degrees as such two centuries and more ago (I’m writing this in 2020). First, for the academic reason that the Physics of the day was called Natural Philosophy; secondly, because there were no subject specific degrees. Two centuries ago in Aberdeen there were two independent Universities: King’s College and Marischal College. They each offered just one first degree, the Artium Magister (AM). By 1820, King’s College was more than 300 years old and Marischal College more than 200 years old. Natural Philosophy had been taught as a third-year or fourth-year subject in both Universities since their foundation. The universities had distinctly different histories but by 1820 their AM courses were converging in general outline, if not in detail. All AM students (in round numbers about 200 in either establishment¹) would spend much of their 3rd year of the 4-year AM degree syllabus studying Natural Philosophy. Physics was, then, a bigger component of every Aberdeen graduate’s experience than it is now or has been for most of the past century. No physics degree, but students of all persuasions were more knowledgeable about the physical ideas of the times than many are today.

¹ In addition to AM students there were ‘private students’
There was another more social difference two centuries ago. The prime motivation to attend University for many students, at the expense of their often poorly off parents, was to learn – learn enough to take them out of the social and working class that their parents, grand-parents and great-grand-parents had found a living in. Obtaining the letters AM after their name was incidental for many. ‘Final Exams’ were pretty nominal. In fact, graduating was expensive and a significant fraction of the class did not graduate even after completing 4 years of education. They went to University to acquire knowledge that would take them from farming and the trades into a profession. Of course I’m generalising here but to emphasise the point that knowledge was the commodity sought, a significant number of enrolled students were ‘private’ students, taking the classes of one year or even of one professor only. The weakness of the system was already recognised in that the professions of law, divinity and medicine offered post-graduate degrees, although they were not a pre-requisite for entering these professions.

With the growing professionalisation that evolved in Victorian society and the re-structuring of Universities in Scotland, the eventual offering of subject-specific first degrees was inevitable. The first salvo came in 1858 with the Universities (Scotland) Act and an accompanying Scottish Universities Commission 1858-1863. They introduced the basis of the system still in place: the University Court as the supervisory body, the General Council of all graduates and staff as a monitoring body, and a well-structured examination system with external examiners. One set of Commissioners oversaw the merger of King’s College and Marischal College in 1860 into the ‘University of Aberdeen’, decreeing that its foundation should date from that of King’s College in 1495.

1863 – 1900

The degree student of 1860 enrolled in a 4-year Master of Arts (MA) course, as had his predecessors. Honours were now available in selected areas, one being Mathematics-Natural Philosophy. Over and above the need to pass the regular MA exams, this involved extra study and additional specialised exams but no extra year. The academic session ran from early October through until March, with final-year exams in March. Lectures were generally in the mornings, with the afternoons available for study and attempting the substantial number of questions given out by the professors\(^2\). In Natural Philosophy, the staff consisted of the Professor and one graduate Assistant, who was appointed a year at a time. The first cohort to appear in the record books were 45 students who sat two Maths exams and two Natural Philosophy exams in March 1862 at the end of their 3\(^{rd}\) year. 28 passed, the pass being

\(^2\) Changing student life is the main topic of R D Anderson “The Student Community at Aberdeen 1860 – 1939” [AUP, 1988]
determined by the aggregate mark. A pass was necessary to be awarded an MA in the following year. 15 students entered for assessment in November 1862; two failed to appear, 8 passed and went on to receive their MA. In March 1863 only two were flagged for Honours. One was deemed ineligible for not having a pass in Mental Philosophy\(^3\), which left the first award of Honours Mathematics-Natural Philosophy to Charles Niven (First Class), a seriously bright student from a bright Peterhead family. Charles was no mean student, for he went on to become Senior Wrangler\(^4\) at Cambridge, Professor of Mathematics at Queens College Cork for 12 years before returning to Aberdeen in 1880 as an FRS to take the Chair of Natural Philosophy. A low-key but auspicious start to Natural Philosophy degrees at the University of Aberdeen.

What happened next? After the fusion of the two Universities, Natural Philosophy was located at King’s College in rooms in the Cromwell Tower that had been used earlier by the Professor David Thomson\(^5\), who had kept his job. At least there was some stability there as King’s quad became a building site for much of the 1860s with the demolition and rebuilding of the East and South sides. Exam marks in the spring and autumn diets quickly became marks out of 1000, strongly suggesting a significant amount of continuous assessment for work throughout the session, though that is a surmise on my part. It’s worth saying again that all students wishing to graduate with an MA had to pass Natural Philosophy\(^6\). Whereas over a hundred students in King’s College and Marischal College together had taken Natural Philosophy in

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\(^3\) Mental Philosophy involved compulsory courses for Arts students in Logic in 3\(^{rd}\) year and Moral Philosophy in 4\(^{th}\) year.

\(^4\) Four students from Aberdeen within a decade were Senior Wranglers. The first was George M Slessor. See https://homepages.abdn.ac.uk/npmuseum/article/GeorgeSlesser.pdf for his story.

\(^5\) See https://homepages.abdn.ac.uk/j.s.reid/pages/Profs/ThomsonUni.shtml

\(^6\) The compulsory subjects were Humanity, Greek, English, Mathematics, Natural History, Natural Philosophy, Logic and Moral Philosophy.
their third year, now numbers taking the annual exams were typically in the sixties. By the end of the 1860s half of the March candidates were described as 4th year students, as were all of the autumn candidates. Honours Mathematics-Natural Philosophy numbers never reached double figures in the 19th century. This can be seen in the graph shown later. Aberdeen was perceived as a ‘classics’ university and, more and more as the century progressed, as a place for medical education. By 1890 medical students exceeded the number of all the Arts students put together, though that is jumping ahead a bit.

1870 saw the widening of the distinction between Honours degrees and Ordinary degrees in that the requirement for Honours students to have passed the Ordinary exams in their discipline was removed. The final-year class in Natural Philosophy was an optional course for Arts students. Separate Honours exams were introduced. The first results appeared in 1871. Students had 7 assessments, 2 in Maths and 5 in Natural Philosophy with a total number of marks adding to 2700. First that year was Aberdeenshire lad George Chrystal, with the phenomenal score of more than twice that needed for a first-class degree. That achievement has probably not been equalled in the succeeding century and a half. Chrystal\(^7\) went to Cambridge to study under Maxwell and before the decade was out was Professor of Mathematics at Edinburgh, having relinquished the Regius Chair at St Andrews. In 1872, another first-class graduate was Peter J Anderson who for 5 years from 1876 to 1881 acted as Natural Philosophy Assistant before making a career for himself as University Librarian. In that role he was an outstanding promoter of University and local history. Few historians likely know he was a first-class Mathematics-Natural Philosophy graduate.

As the 70s merged into the 80s, not a lot changed conspicuously in terms of numbers and requirements, though changes behind the scenes were taking place. David Thomson, the Professor of Natural Philosophy since 1845 who was seen as an effective teacher, died in post in 1880 after bouts of weakening health. Charles Niven\(^8\) succeeded him. After 1886 the requirement to pass Mental Philosophy to obtain an Honours degree was dropped. Numbers sitting Maths and Natural Philosophy exams were increasing so that the 4th year exams in October now had over 60 students.

The secondary school educational system that fed the University was becoming stronger and secondary schooling more widely available. One consequence was that the typical age of entry into first year was creeping up from 15 or so in the first half of the century towards 18 towards by end of the century. The

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\(^{7}\) See https://homepages.abdn.ac.uk/npmuseum/Scitour/Chrystal.pdf

\(^{8}\) See https://homepages.abdn.ac.uk/j.s.reid/pages/Profs/Niven.shtml
Scottish Education Department introduced the school leaving certificate in 1888, typically taken by 17- to 18-year olds, and when the University introduced entrance qualifications in 1892 they were tied to the same standards.

Although Honours numbers were small, it was not uncommon to find outstanding students, often academically head-and-shoulders above their contemporaries. Charles Chree⁹ was a notable graduate of 1879, earning an international reputation in his career for his work on geomagnetism, for his 32-year tenure as Superintendent of the Kew Observatory and for his Presidency of the Royal Meteorological Society and the Physical Society of London. The Institute of Physics award the Chree Medal, named after him. Two years later William Cassie¹⁰ was the first graduate. Like Chree, he followed his Aberdeen degree by going to Cambridge and after graduating became either the first or one of the first Maxwell post-graduate scholars at Cambridge. He secured the Professorship of Natural Philosophy in Royal Holloway College in 1893, effectively their first professor of the subject. The University of Aberdeen award the Cassie Prize in Physics. Another example from a few years later of a top graduate in his year was Hector Munro Macdonald who graduated with a strong First in 1886. Like the others, he went on to Cambridge. A career of distinction as an applied mathematician followed that led to him coming back to Aberdeen in 1905 as FRS and Professor of Mathematics, a post he occupied until 1935.

It was common practice to seek the advice of a private tutor for those who wished to ensure a good result or, for some, just to ensure a pass. The ‘go to man’ for Maths-Natural Philosophy in the second half of the 19th century was David Rennet¹¹, Aberdeen’s version of William Hopkins in Cambridge. The University now award the Rennet medal for the best performance in mathematical problem solving for a Joint Honours Mathematics-Natural Philosophy student. There have been tutors since, but Rennet was the last of his kind.

Returning to the nature of the Honours degree, the decade of conspicuous change was the 1890s. ‘New Regulations’ were implemented; the BSc degree was introduced¹² (though not with Honours); medical physics teaching was initiated by Natural Philosophy; women were allowed (welcomed?) as undergraduates; third-class Honours were introduced; the first PhD in Natural Philosophy was awarded to Alexander Ogg in 1899.

I haven’t investigated the details of the New Regulations (there are better ways to spend one’s life) but much of the change was initiated by the Universities (Scotland) Act of 1889. A central idea of the Scottish MA degree, and the AM before it, was that all students were given a broad education in classics, philosophy and science. The uniform MA syllabus was

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⁹ See https://homepages.abdn.ac.uk/npmuseum/Scitour/Chree.pdf
¹⁰ See https://homepages.abdn.ac.uk/npmuseum/Scitour/Cassie.pdf
¹¹ See https://homepages.abdn.ac.uk/npmuseum/article/DavidRennet.pdf
¹² Indeed, the Faculty of Science was created here (and also in other Scottish Universities) in 1894 consisting of the Professors of Natural Philosophy, Mathematics, Chemistry, Natural History (Zoology & Geology), Botany and Physiology.
abandoned in the 1890s so that students had a wider choice with more Honours options, though still with obligations to include the broad range of subjects13. A second-year Natural Philosophy course was introduced for those who were planning to devote their 3rd and 4th years to Honours in another subject and, moreover, the Ordinary MA was now awarded as a 3-year degree. 46 people took the first lower level Natural Philosophy exam in March 1896; 12 failed. The first woman’s name (Nellie Badenoch) appears the following year among 47 students; 25 failed, though quite a few of these resat the exam in October. Professor Niven and his one Assistant were now giving classes in years 2, 3 and 4 with no technical or secretarial support. Teaching Natural Philosophy with the aid of class-room demonstrations had been promoted in a big way in Aberdeen a century before by Professor Copland at Marischal College and continued by his successors. Although Niven was an FRS with a reputation in mathematical physics, it is hardly surprising that he had little time for any other University activity besides teaching.

To make matters even more stressful for Niven and his assistant, Natural Philosophy launched a medical physics course in the summer term in 1893 consisting of 5 lectures a week plus some practical work14. One of the pioneers who emphasised the use of physics in understanding the workings of the body was Neil Arnott15, a graduate of Marischal College in 1804. His book ‘Elements of Physics’ ran to 6 editions and was popular for at least half a century. Arnott became a Physician to the Queen and benefactor to the University. On the Honours front, Honours marks dropped to a total of 2400 in 1895, which still included 600 for Maths problems and 600 for Physics problems. The first women Honours MA Mathematics-Natural Philosophy were Eliza Barron & Emily Riddoch, two in a class of just 4 in 1899. The Assistant in these times of change was James Taggart, son of a leading Aberdeen granite merchant, first-class graduate of 1896 and one of my second cousins once removed. Small place, Aberdeen.

1900 - 1946

If you’ve jumped into this section, then you’ll find that by 1900 degrees had moved a lot nearer to the ones we recognise today. The Honours course was 4 years long, the Ordinary MA, 3 years. It might appear that the standard of the MA had dropped but the argument was that effectively the first year had been cut out, for the entrance qualifications were said to be now at a level consistent with that formerly achieved by first-year students. The corollary, of course, was that the Honours Degree was now of higher standard. One relic of the past was that the session was still virtually one term, with a short break at the end of

13 The Batchelor of Law degree (BL) was introduced at the same time. The Batchelor of Divinity (BD) dated from 1873.
14 Presumably as part of the restructuring of the medical degree that increased from 4 to 5 years.
15 See https://homepages.abdn.ac.uk/npmuseum/Scitour/Arnott.pdf

The 1890s was an appropriate decade to introduce the BSc, for it was also the decade of the discovery of X-rays, radioactivity and the potential of radio waves. This 1890s X-ray tube is part of our historical teaching collection.
each calendar year. This changed in the session 1909-1910 with the introduction of the three-term year starting in early October and ending in early June. That said, exams were still in March and October. The only Physics Honours degree awarded was still the MA Maths-Nat Phil and would remain so until 1940.

Women were accepted as students, though to begin with only a sprinkling took Natural Philosophy. That changed as the century got underway, as can be seen in the graph shown later. Perhaps the award of the Nobel Prize to Marie Curie in 1903 was an inspiration. The number of male graduates reached double figures in 1904. The annual number of women graduates increased over the next decade but in fact it has not reached double figures yet (2020). What increased dramatically in the early 20th century was the number of women enrolling in Arts and hence in the non-Honours Natural Philosophy classes. In 1900, the Arts faculty had about 100 women students and 280 men; by 1910, 250 women and about 300 men. With the advent of WWI, Niven was lecturing to many women. The 1915 March exam roll of almost 60 students was about 50% women; the 1916 roll of over 50 students contained just 16 men. Changed days for a professor who had graduated in 1863 and spent most of his first 40 University years in a male only institution. Niven, though, was well-liked by students and one of the few Professors regularly known by his nickname, ‘Charlie’. Since 1904 he had been granted two Assistants, one being the popular William Fyvie who would become the first assistant to be given the title of Lecturer (in Mechanics, 1911). A second long-term Assistant was AEM Geddes, appointed in 1909, snatched away during WWI but returning in 1919 to be appointed Lecturer. It is interesting to see in passing that during the WWI years the Professors of Natural Philosophy, Mathematics and Chemistry were all FRSs. It hasn’t happened since!

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16 There had been teaching in a summer term beforehand, such as the medical physics course, but the 1909 decision extended the session for all students from 20 weeks to 25 weeks.
17 See [https://homepages.abdn.ac.uk/npmuseum/article/Biogs/Fyvie.pdf](https://homepages.abdn.ac.uk/npmuseum/article/Biogs/Fyvie.pdf)
18 See [https://homepages.abdn.ac.uk/npmuseum/article/Biogs/AEMGeddes.pdf](https://homepages.abdn.ac.uk/npmuseum/article/Biogs/AEMGeddes.pdf)
Another change early in the 20th century was the rise of practical physics in the curriculum and into the examinations. With the major rebuild and expansion of Marischal College in the 1890s and early 1900s came the move of Natural Philosophy from the King’s College campus to Marischal College. Natural Philosophy was allocated the mid-right section of the quadrangle. The rooms included the ‘Advanced Laboratory’, seen in the accompanying photograph above taken in 1905. From 1903, the department began to offer the Arnott Prize paper to Honours students as a means of making good the bequest from Neil Arnott for the best performance in experimental physics. Performance in this paper didn’t count towards the class of Honours awarded and it would seem that the highest marks didn’t always receive the prize. The Greig Prize for the best overall performance clearly trumped it and two prizes were not awarded to the same person. Sometimes the Arnott Prize was split. In 1912, a practical mark was added to the Arnott Prize score; in 1923 the practical component increased in value and from 1924 G P Thomson included a practical mark in the overall Honours assessment for the first time. The Arnott Prize paper, though, continued until 1941, usually with an accompanying practical.

In Charles Niven’s final year, the leading First was Winifred M Deans. She too went to Cambridge, obtaining a BA at Newnham College before beginning a teaching career. She left after two years to work for Blackie & Sons publishers in Glasgow. I have on my shelves three books translated from the German by her. Her translations, mainly undertaken in the 1930s, include works by leading physicists Schrödinger, Debye, Born, Brillouin, Ewald, de Broglie and Pohl. After WWII she came back to Aberdeen and worked at the Rowett Institute for 20 years.

Like a few others (including my relative) Winifred Margaret Deans added a BSc to her name at Aberdeen. Although the BSc was introduced in the early 1890s, it took a long time to garner many students, particularly among women. According to the statistics, by 1900 there were just 42 Science students in the University of which just 1 was female. This compares with 377 Arts students, 330 Medical students and also students in Law and Divinity, making a total of 800. By the mid-twenties, take 1925-26 as an example, the numbers had changed to 229 Science students of which 58 were women, 726 Arts students of which 439 were women. Medical numbers had dropped a bit in a total University roll of 1399. Since Natural Philosophy was a core subject in the Arts curriculum, Natural Philosophy classes were now well populated with women. The core MA class in the March 1926 exam shows 120 candidates of which 62 were women. 20 other students sat the first BSc exams, that also included a practical mark. Other exam marks in Natural Philosophy recorded in March 1926 were for MA (Advanced) 16 candidates, BSc (Subsid), BSc (Engineering), BSc (Agriculture) and BSc (Forestry), the last option newly established. All this was in addition to a dozen Honours
students that included Alexander Reid, who would become G P Thomson’s research student who was the first to obtain electron diffraction images. 21 BSc students also had degree exams in June. I haven’t seen the records of the Medical Physics class, taught by Harry Griffith. All this was achieved by 1 Professor (engaged in research that would lead to a Nobel Prize), 2 Lecturers and 1 Assistant, with Harry Griffith, although based at Marischal College, also taking care of Health & Safety in X-ray and radiotherapy treatments in a large hospital. The lecturer William Fyvie died of pneumonia in January 1828 and was replaced by an Assistant.

Re-reading the previous paragraph I see I have missed out Owen F T Roberts, who was appointed Cruickshank Lecturer in Astronomy, Meteorology and Navigation in 1924. At least I presume that was the title since I also had that title from 2002. The appointment was paid for by the Cruickshank Trust. In Roberts’ time the emphasis was on Meteorology research and teaching and Roberts lectured to the Forestry students. Latterly it became more or less an Honorary title for a lecturer in Astronomy, with outreach obligations.

One development from the late twenties was the introduction of the ‘Combined Course’, half Natural Philosophy, half Mathematics for MA students. This was a weakening of earlier regulations that required all Arts students to take a full course of Mathematics and one of Natural Philosophy as part of the breadth of a Scottish university degree. The combined course arrangement lasted a few years but was superseded by Arts regulations dividing the spectrum of University subjects into divisions with obligations to take courses in more than one division. It wasn’t just Arts that wanted to maintain the spread of subjects in a degree. Post war, the BSc regulations insisted that all Science students take at least one of Mathematics, Natural Philosophy or Chemistry in first year. We were all also enrolled in a short non-examinable course in the History & Philosophy of Science. As the century wore on, there was increasing pressure particularly from the biological sciences to allow greater specialisation in a degree and the regulations were changed so that Science students took only 3 first-year subjects, dropping the Maths/Physics/Chemistry requirement. I think this was in the early 1990s. A few years later, the concept of a combined course was re-introduced in the form of ‘Tools for Science’, the combination now being Mathematics/Physics/Computing for those who did not bring qualifications with them in these subjects. Tools for Science lasted about a decade from the late 90s. The requirement to take 4 subjects at first year was restored to Science in this century and the breadth of the Scottish Degree maintained in part by obligations to take 60 credits worth of the wide-ranging ‘Enhanced Study’ courses. Breadth is still a distinctive feature of Aberdeen’s core degrees.

Returning the story to around 1930, as earlier some years were marked with an outstanding student. The names of Charles Strachan and G K T Conn caught my eye, Strachan in 1929 and Conn in 1933. Both went on to Cambridge (I am beginning to think I personally missed a trick, though opportunities were greater at Aberdeen a few decades later!), Strachan took an accelerated Tripos and then a PhD with R H Fowler and J E Lennard-Jones. He came back to Aberdeen then worked with Max Born in Edinburgh for a year and spent WWII in Liverpool as acting Head of Department before returning again to Aberdeen where he was the departmental specialist in quantum mechanics and theoretical nuclear physics. Conn spent five years in the Cavendish Laboratory working on infra-red spectroscopy before going to

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19 See [https://homepages.abdn.ac.uk/j.s.reid/pages/Profs/GPThomson.shtml](https://homepages.abdn.ac.uk/j.s.reid/pages/Profs/GPThomson.shtml)

20 See [https://homepages.abdn.ac.uk/npmuseum/article/Biogs/cs.pdf](https://homepages.abdn.ac.uk/npmuseum/article/Biogs/cs.pdf)
Sheffield and then becoming Professor of Physics at Exeter in 1956. His topical books on *The Nature of the Atom*, *The Wave Nature of the Electron*, 6 volumes of *Essays in Physics* and other titles became well-known.

*The Natural Philosophy Department supplied radium needles for cancer treatment to hospitals along the East Coast in the 1930s*. Left, a teaching slide from the 1930s highlighting radiation safety. Right, a 'Baird Televisor' photocell from our collection (Ref: ABDNP:200575a) harks back to the early days of broadcast television in the 1930s.

John Carroll (later Sir John Carroll) took over from G P Thomson in 1930 for a decade during which student numbers declined. Arts student numbers fell from about 650 to 400; Science numbers remained at around 250. The Universities total roll fluctuated between about 1300 and 1200, sustained by an increase in Medical students to almost 500. I remember that in the 60s Medical students took 6 years to complete their degree and it may have been the same then. Honours student numbers in Maths-Nat Phil crashed in 1938 and 1939 to just one student in each year, recovering a bit in 1940.

1940 notably saw the first appearance of Honours BSc in June, with two students Flora Black and Charles Burns, both earning Firsts. So might have begun a thriving era but WWII was underway. Roberts and Professor Carroll were seconded to the services. An intensive Radio-Physics course was begun to train future radar officers and, for a time, another course to train future RAF officers. These courses entailed hiring some 8 Temporary Assistants. Geddes took over the Head of Department duties from Carroll. Honours, both MA and BSc, ground to a halt in 1944 and 1945 with all potential students being drafted before reaching Honours. Carroll returned from the Admiralty briefly at the end of the war but resigned, making way for R V Jones.

1946 – 2020

Jones has described the experience of his first class in Aberdeen as being awash with ex-servicemen (not quite his words). It would take some time for some of them to work their

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21 For more on this and the consequences of WWII, see [https://homepages.abdn.ac.uk/npmuseum/article//Radium/Radium.html](https://homepages.abdn.ac.uk/npmuseum/article//Radium/Radium.html)
22 See [https://homepages.abdn.ac.uk/npmuseum/article/Profs/Carroll.shtml](https://homepages.abdn.ac.uk/npmuseum/article/Profs/Carroll.shtml)
23 See [https://homepages.abdn.ac.uk/npmuseum/article/Radio-Physics.pdf](https://homepages.abdn.ac.uk/npmuseum/article/Radio-Physics.pdf)
24 See for example the tribute to him at the King’s College memorial service: [https://homepages.abdn.ac.uk/npmuseum/article/Biogs/rvjmap.pdf](https://homepages.abdn.ac.uk/npmuseum/article/Biogs/rvjmap.pdf)
way to Honours. A special Honours exam diet in September 1946 overseen by Geddes saw 3 MA candidates all receive Firsts (not the only time this has happened). Jones’ first Honours experience was in 1947 when all finals, MA and BSc, were held in June, setting the precedent from then on. There were 6 MA candidates (still Maths-Nat Phil) of which 4 were women, and 3 male BSc candidates, one of whom was John C S Richards25 who would become in due course Jones’ right-hand electronics expert in the Department. Jones would never see as many as 4 women again in a year’s Honours exams in his 35 years as Professor. In half of

Number of Honours Physics graduates by year (male, blue; female, red): 1863-2019

*Number of Natural Philosophy/Physics Hons graduates at Aberdeen University including Single Hons, Joint Hons and Combined Hons. This time series covering 157 years shows both random changes and oscillations. Fluctuations over 7 and 15 year periods are the most conspicuous.*

those years he would have no women at all in Honours. Post war women did not want to study Physics, with few exceptions. Was Physics tainted with the image of nuclear bombs? Jones himself probably didn’t help convince undecided first-year students with his frequent reminiscing about war-time technological achievements but the lack of women in professional physics was a national if not an international meme. I spent several months at Gdansk University in the 1970s. There, the physics classes were full of women. Here, it was not until the 1980s when those born in the 60s were reaching University age that numbers began to increase, slowly.

1948 was the final fling of the old Maths-Natural Philosophy as the leading Physics degree. 9 students graduated, each having 10 assessments: 5 in Maths and 5 in Physics. Charles McCombie26 was the leading First, much liked as a lecturer in later years before he left to become Professor of Physics at the University of Reading. In 1948 there were also 6 Honours BSc students who sat 5 papers and two practical exams. This was the regime that characterised most of Jones’ years. One of Jones’ innovations was to introduce ‘paper V’, a paper inspired by his Oxford experiences in which absolutely any subject might come up. One of his early questions was ‘What are our reasons for believing that the moon is not made of cheese?’ In my year one of the questions was ‘What is the common volume of 3 cylinders

25 See https://homepages.abdn.ac.uk/npmuseum/article/Biogs/jcsr.pdf
26 See https://homepages.abdn.ac.uk/npmuseum/article/Biogs/cm.pdf
that intersect each other at right angles?” I think only one person in the class got the correct answer in the exam by 3D integration that the volume was a sphere of the same radius as the cylinders. Apparently, one was supposed to ‘see’ that this must be so, not thrash out the maths. Paper V was not liked by students, partly because there was never any preparatory practice for it by staff and partly because it was a lottery in exams that could determine the rest of one’s life.

Jones strongly supported laboratory physics. The scheme that became established was that in first-year, students had one 3-hour practical per week throughout the session; in second-year, two 3-hour practicals per week; in third and fourth-years, three 3-hour practicals per week. All the experiments were scripted but there was freedom to go beyond the script in later years. All practicals were assessed and none of the marks counted towards one’s Honours class. The two practical marks in the finals were determined by two, one-day unseen experimental tests. In my time in the 60s, one was in electronics, set by Richards, and the other could be on any subject27.

Returning to Honours trends, 1948 was almost the last year in which there were more MA candidates than BSc. In 1949 there were 8 BSc students and no MA students at all. 1950 saw the splitting of the MA degree into ‘Option A’ and ‘Option B’. Option A was the Joint Honours degree under new regulations. Option B was Honours Natural Philosophy. In Arts in general, Joint degrees were the most common. Dipping into the 1952 Calendar, you will find that by then there were 35 Arts Honours options of which 25 were Joint subject degrees. In Arts one took 3 subjects in the first year; in Science, 4 subjects. In second year, there were two Natural Philosophy courses: Advanced and Intermediate Honours. Intermediate Honours had to be passed for those intending any kind of Honours Degree in Natural Philosophy. The same applied in Mathematics. The regulations were getting involved. [The University Calendars of the early 50s run to over 1000 pages, though they do contain the names and addresses of over 10,000 members of the General Council]. Since students took only two subjects in second year, the class choice was already fixed for those wishing to keep open the option of an Honours degree in either of these subjects. This was true in Arts or Science. Few people opted for either option A or option B after 1954. In both Science and Arts there were no degree exams for 3rd year students in Natural Philosophy and Mathematics, unlike some other sciences. There were, though, class exams.

I should make a digression on the huge expansion of Physics during Jones’ tenure. Pre-war, the Department had one Professor and at most two lecturers. Fyvie had been replaced by the ill-fated Alan Baxter who was promoted to Lecturer in 1938 after three years as Assistant. His misfortune did not come in the war but in 1947, by which time he had resigned. He was killed in a plane crash in West Africa while transporting equipment to observe an eclipse of the sun in South America. Four new lecturers were appointed by Jones in the 1940s and as many as 14 in the 1950s28. Not all stayed long and the water is muddied because some had responsibility only for Medical Physics that still fell under the Department of Natural

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27 For reasons I have forgotten, I have the 1955 Practical Examination papers on hand. They are for 9th June at 10 am and 13th June at 9 am. The papers read:  
Paper I: 1. Plot a cooling curve for naphthalene and deduce the melting point, using a calibrated thermocouple 2. Determine the size, in amperes, of the current in an ionisation chamber.  
Paper II: Assemble the Mach interferometer provide, and use it to measure the stress optical coefficients of commercial plate glass.

28 A spreadsheet listing all academic staff in Natural Philosophy from 1860 – circa 1990 can be found at https://homepages.abdn.ac.uk/opmuseum/article/Biogs/NatPhilStaffb.pdf
Philosophy. Medical Physics did not become a separate department in the University Calendar until 1965 when Professor John Mallard was appointed. Strangely enough, when University expansion was a hot political topic in the 1960s and Jones had worked hard to secure funding for a modern purpose-built Natural Philosophy building at King’s College that was opened in 1963 by G P Thomson, he became a strong opponent of University expansion, both on the local stage and nationally.

Nonetheless expansion came about, which had the effect of widening the areas of expertise of the staff to whom students were exposed. By the second half of the 60s these areas included at least solid-state properties, radio astronomy, upper atmosphere physics, geomagnetism, Mossbauer scattering, diffuse X-ray scattering, mathematical physics, nuclear structure theory, mechanical, electronic and optical instrument design. The diversity was a brilliant model for a teaching department and created a nice atmosphere to work in but it was not the way that research was going to be funded in the future. Contraction began in the late 60s and early 70s. For political reasons, no new lecturers were appointed between 1972 and 1982 and the consolidation needed to grow small centres of excellence into large centres did not happen. Jones retired in 1981 shortly before his 70th birthday, along with several senior staff who were encouraged to leave due to the University’s financial difficulties.

Not much had changed in the last two decades of Jones’ tenure in terms of Honours degrees. There were still only 3 options: Honours BSc (Natural Philosophy) and the two MA options, one of which was Joint Honours. Jones was succeeded by Geoffrey Marr29 in 1981. (Marr

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29 See https://homepages.abdn.ac.uk/npmuseum/article/Biogs/gvm.pdf
was the first Head of Department with a BSc and PhD). The practical exams gave way to assessment in laboratory work undertaken during the Honours years. One Honours project from the 80’s was almost certainly the first in Britain to develop experiments that were flown in space\textsuperscript{30}. Later in the decade Honours projects were introduced for all Hons students.

The 80s, though, was the beginning of an irreversible change of student experiences brought on by the advent of microcomputers. We had taught our 3\textsuperscript{rd} year students programming since the 1970s – structured programming in Fortran. I know, I used to teach it. Initially students created programs on punched cards and then, with the advent of terminals (video display units) in the last years of the 70s, programs and operating instructions were typed into the mainframe computer directly at the ‘the undergraduate computing cafeteria’ – no drinks, no food there. Microprocessors were a different pitch. The mix of low-level programming, hardware knowledge and computer interfacing was the kind of skill set that Natural Philosophy students should be able to learn well and take into future careers. Indeed, microprocessor instrument design research was a blossoming field in Aberdeen and elsewhere. Electronics labs were already a feature of Honours teaching so it was a small conceptual step in the early 1980s to provide microprocessor literacy. We began with Commodore Vic-20s and the Hektor boards favoured by the Open University. Outside the lab, the office was an early user of word processing. Linked microprocessor classrooms replaced the VDU cafeteria from 1983. Before the advent of Microsoft, staff used WordStar and SuperCalc to prepare teaching material that was better structured and more legible than earlier duplicated handwritten notes. By the end of the 80s most of the lecturers had an IBM PC clone on their desks. Lecture demonstrations, popular for some two centuries, faded away in the 1980s. Computer simulations began to appear but they did not become a big part of the new teaching. Looking back, it’s clear that the 1980s was the decade a lot changed as far as delivery of coursework was concerned. It wouldn’t stop there, with the early 90s seeing the introduction of web-based information access and dissemination and PowerPoint. I’m in danger of jumping ahead.

Far-reaching changes in the 1980s did not come just from departmental or university wide innovation but from national political changes. Mrs Thatcher and the Conservative

\textsuperscript{30} See https://homepages.abdn.ac.uk/npmuseum/article/StudentsSpace1984.pdf
Government came into power in 1979 and did not take long to decide that Universities should be run on a ‘business model’. Uneven cuts in government funding were handed out through the University Grants Committee, which had been established in 1918 to act as a buffer between government and Universities. Its defences were severely breached in the 1980s and before the decade was out it was demolished.

Aberdeen was particularly unfairly affected and within the University, Natural Philosophy was singled out by management under Principal George McNicol as a target where substantial savings could be made. McNicol had a reputation for ‘never courting popularity’ and in that he was highly successful, particularly with Aberdeen’s Natural Philosophers.

Staff were transferred to other departments or encouraged to leave; laboratories were taken over by Engineering and facilities wound up. Not surprisingly Honours student numbers declined in spite of attempts to widen the options available such as adding ‘Physics with Industrial Physics’. A management committee was set up to decide ‘the future of physics’, headed by Zoologist Professor William Mordue who was a newcomer to the University in the 1980s. Their conclusion in 1989 was that Honours Physics should be discontinued after the existing cohort of students had passed through, which would be in 1992. Physics was subsumed into the Department of Engineering. Geoffrey Marr was one of the casualties. In retrospect, the exercise achieved little other than dismantling a largely successful and highly relevant department, and the loss of a substantial amount of credibility to the University’s reputation.
It looks as if this story is about to hit the buffers but McNicol retired in 1991 and the new Principal, Maxwell Irvine, grasped the lever just in time and diverted the crash. Roger Clark, who had been moved to Mathematics, managed to offer the degree ‘Mathematics with Theoretical Physics’ that at least kept some Honours Physics on the books. Physics itself sat in the siding for two years while the MacRobert Trust funded a professorship for David Hukins to undertake research in Medical Physics and act as Physics Department Chairman with the remit to re-start Honours Physics. The first students were enrolled in 1994; new lecturers were appointed and the Honours class began again in 1996. The degree options on offer were markedly different from those of previous decades.

Looking back through some of the post-war graduates before going on to the later 90s, names that caught my eye were Ian R Young from 1954, subsequently Professor of Radiology and FRS; Bill (W J L) Buyers, graduate of 1959, the first PhD in the X-ray scattering group who became Assistant for three years before launching into a distinguished research career in neutron scattering at Chalk River in Canada. He was awarded the Gold Medal of the Canadian Association of Physicists and the prestigious national honour of the Order of Canada; Jim (J A D) Matthew, graduate of 1960 who was appointed Assistant for two years in 1962 followed by a post-doc year at Cornell, settled into a life-long career at the University of York where he was admired for his teaching and as a theoretical solid state physicist. He became Professor, Head of Department and Deputy Vice-Chancellor. Looking on a few years, I see Patricia Langhorne (1975) who went to the Scott Polar Research Institute in Cambridge after graduating but was unable to work in Antarctica, since women were excluded. Following that she went to New Zealand to the University of Otago, in due course was appointed Professor of Physics and has been able to make numerous trips to Antarctica as part of her research. George W Fraser (1977) became a highly respected and popular Professor of Detector Physics in Leicester University and Director of their prestigious University Space Research Centre. David Lurie (1979) is Professor of Medical Physics in Aberdeen and heads the MRI research group. Equally close to home, Norval Strachan (1986) and Jan Skakle (1989) are Professors of Physics here. My selection of graduates has highlighted some of those who went on to an academic career. Many others did too, and even more have made a wide choice of careers.

In the late 80s and early 90s modularisation came to the University of Aberdeen. The academic year was divided into two teaching halves rather than three terms. Most courses that used to run for a year were divided into two modules. Honours degree programs included a sequence of modules that had to be taken as a student progressed but there was much more freedom to mix modules. Joint Honours options became easier to set up and Physics responded with new inter-disciplinary offerings of Physics-Geology, Physics-Chemistry, Physics-Philosophy, Physics-Computing as well as a range of ‘Combined Honours’ with a major/minor flavour including Physics with French or German or Gaelic or Spanish and Physics with Education that shaved a year off Physics teacher training. In total 11 Physics degrees were available. Not all have survived to 2020. The MA Natural Philosophy was revised to include courses in Philosophy. The BSc Physical Science was introduced to allow people to take mixed modules at Honours level, with the Honours classification being decided on level 4 courses only. The cross-disciplinary nature of Physics degrees was also reflected in the interdisciplinary interests of new staff appointed. All had strong associations with other departments and most were indeed located ‘elsewhere’.

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Honours degree choice was just one aspect of the changes. The Institute of Physics issued a detailed overview document on the pre-requisites for an Honours course that would receive their accreditation. Staff had been thinking along the same lines and were in complete agreement with its proposals. Students taking the ‘new physics’ syllabus (we didn’t call it that) found a strong emphasis on transferrable skills in their course. These skills were continuously assessed. Exercises included writing web pages, giving presentations, preparing conference style posters (with an element of monitored peer assessment), working in small teams, writing a magazine article.

Compared with a century before when much of a student’s learning experience involved absorbing a professorial monologue, it now had rich variety. As in earlier years, the class of Honours degree was assessed on both 3rd and 4th year work but the change was that exams were at the end of each module. A project running the whole length of the 4th year included two presentations and an assessment of the final thesis. Some courses were 100% continually assessed. The net result was that about 50% of the Honours grade was determined by continuous assessment. This was considered a much better preparation for a work environment or an academic future in research than the one week of Final exams that had characterised most of the preceding decades. The Institute of Physics accredited our new Physics degrees from the beginning.

The luxury of having Honours classes usually less than two dozen was that students got to know each other and there were opportunities for staff and students to socialise in a manner that would not have happened a century earlier. The away weekend for Honours students was initiated in the 1970s by Roger Clark. It was occasionally at Edzell, then regularly at Tarradale House on the Black Isle in February until the University sold the property and then, until recently, at the Braemar Youth Hostel in November. The staff-student cricket match went back to R V Jones’ early days and later Departmental hill walks organised by Cyril Henderson for many years and golf matches that included Honours students were a feature of the social scene.

Another aspect that Physics was keen on was to put all our coursework on open access on the web. We almost achieved this by the end of the 1990s. Personally, I thought open access was a positive incentive for making sure the coursework was clear, accurate, well-structured and appropriate, given that the world could see it. Potential oversees students could see what we offered and whether it matched their own interests or was appropriate for a year abroad. Students of later years could look back on courses they had taken and reference information that they found was interesting or useful. We had some favourable comments from outwith
the University but the University decided, around 2005 I think, that coursework should be private to the students who had enrolled on that course – a retrograde step.

There have been changes in the 21st century. Physics was shunted from the purpose-built Natural Philosophy building in 2007 to the 3rd floor of the Meston Building, the undergraduate laboratories excepted. As I write this, there are 6 personal Physics professorships, surely a sign of very active research, but a Professor of Natural Philosophy has not been re-appointed since Professor Marr resigned. Honours numbers have exceeded all historical figures and included some outstanding students but I sense that the memory that we have risen from the ashes is still present. One can only hope that the lessons of the past have been learnt.

Honours Physics wasn’t all about exams. Celebrating five centuries of the University during which Natural Philosophy has been taught, some of the party on our 1995 reunion hill walk on a circuit that included Lochnagar, Carn an t-Sagairt Mór.

*JSR*

*Thanks*

*This account is drawn from a large amount of data held by the University’s Natural Philosophy Collection and the University archives. The images were created by myself or are held by the University's Natural Philosophy Collection.*