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The Dyson Perrins Laboratory at Oxford

Jeremy Knowles, the Amory Houghton Professor of Chemistry and Biochemistry at Harvard University, looks at the end of almost 90 years of organic chemistry research in the Dyson Perrins Laboratory, as all its current academic staff move across South Parks Road to a new purpose-built laboratory

Just over ninety years ago, William Odling, the second incumbent of the Waynflete Professorship of Chemistry at Oxford, decided to retire at the age of eighty-three after forty rather undistinguished years in the Chair. The electors turned to W. H. Perkin, Junior, who accepted the position on condition that a new laboratory be built. By February of 1913, the University had voted £15,000 and Charles William Dyson Perrins had given £5,000 towards a structure that — with its hard-glazed bricks and "public lavatory" style — would serve Organic Chemistry at Oxford for nearly a century.

William H. Perkin, Jnr.
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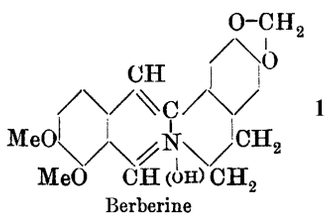
Inevitably, the First World War led to delays and rising costs, and Dyson Perrins was invited to lunch in Magdalen, at the end of which he offered another £25,000 (later observing, it is said, that this was the most expensive lunch he had ever eaten).[1] The Dyson Perrins fortune largely derived, of course, from the manufacture of Lea and Perrins Worcestershire sauce. But the family evidently also had an interest in organic chemistry, for Dyson Perrins' father (the original partner in Lea and Perrins) had worked on the alkaloid berberine, and had established its empirical formula in 1862.[2] How satisfying that it turned out to be Perkin himself (in a paper co-authored with his student Robert Robinson) who published the structure of berberine (**1**) in 1910![3]



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Berberine
From ref. 3.

Perkin and his colleagues moved into the new laboratory in the spring of 1916, "without doubt the finest in the kingdom, and not inaptly termed 'a palace of chemistry'; of it, Perkin was equally fond and proud." [4] Thus began the four eras of successive Waynflete professors: W. H. Perkin until his death in 1929, Robert Robinson until 1955, E. R. H. Jones until 1978, and Jack Baldwin until today.

Perkin's reputation at the time of his appointment came largely from his work on the structure and synthesis of terpenes, on the formation of carbocycles, and on a host of synthetic reactions. His interest in the alkaloids had already begun, and this field dominated the later decades of his career at Oxford. He transformed the Oxford undergraduate curriculum by introducing the Part II (candidates for honours being now required to spend a fourth year, to present "records of experimental investigations"),[4] and the research productivity of the Department increased dramatically.[5] Perkin lectured mainly to advanced students, and he left most of the elementary teaching to his assistants. Yet he could evidently be a compelling lecturer, even on seemingly banal subjects. Thus Robinson recalled: "[I] first became cognizant of Perkin when [he] took a first year lecture at Manchester as a substitute. The subject was sulfuric acid and from the moment when Perkin began to speak . . . there was a new atmosphere of expectancy . . . it was felt that sulfuric acid was a vastly interesting substance . . . because of the applications one might have to make [of its derivatives] . . . one day in organic research with the Professor." [4]

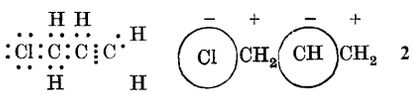
Perkin died in 1929 (some suspecting that his health had been affected by mercury inhalation from many Emde reductions of methyl strychninium methosulfate, always on a massive scale involving *kilograms* of sodium amalgam), and — with unsurprising if unusual speed — the Electors invited Robert Robinson to Oxford.

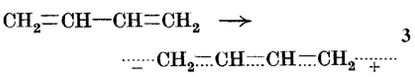
Robert Robinson.
(Reproduced courtesy of the Library and Information Centre, Royal Society of Chemistry)

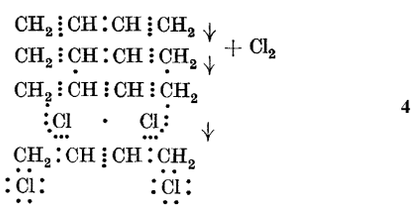
Robinson arrived in 1930, and for the next twenty-five years he dominated the Oxford organic scene. The original plan for the Dyson Perrins had been completed in 1920 (though by that time the last third, the east wing, cost more to construct than had the whole of the rest of the building), and Robinson steadily displaced several not-purely-organic activities, as the number of research collaborators rose. His career-long interest in the structure and synthesis of alkaloids and natural pigments continued at Oxford, and steroids were added to the mix as he arrived. Perhaps the greatest change he wrought was to embrace mechanistic 'theory' in synthesis. He accepted the relevance of such concepts as polarity (**2**),[6] conjugation (**3**),[6] radicals (**4**),[6] and the aromatic sextet (**5**),[7] well before these had become part of every chemist's lexicon, and — aside from a formidable flow of publications — he distilled his understanding of the whole range of

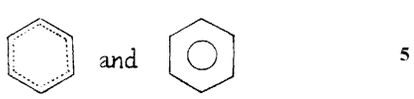
DOI: 10.1039/b309390p

natural product chemistry into the engaging little volume: *The structural relations of natural products*,[8] which was published as he retired from the Waynflete chair.









From refs. 6 (**2**, **3** and **4**) and 7 (**5**).

Robinson never tried to resolve the tension between the Department and the Colleges. In 1931, only four of the seventeen college chemistry fellows could be described as 'organic', and this proportion rose little in his time. He led by the force of his science rather than by academic political maneuvering (for example, he called only three staff meetings in his twenty-five years as Head of Department).

In 1955, the Electors looked north for a third time to Manchester (whence had come Perkin, and — even if briefly *via* University College London — Robinson), and appointed E. R. H. Jones. In Manchester, Jones was leading a thriving operation in excellent surroundings, and — having inspected the decaying Oxford laboratory — made his acceptance conditional upon a major renovation and extension of the Dyson Perrins. With considerable initial (and some continuing) reluctance, Oxford agreed, and Jones brought several colleagues from Manchester to help shape a more modern laboratory with up-to-date instrumentation and services. Scientifically, he continued to pursue his work on terpenes which had its roots in his Ph.D. with Simonsen, and on steroids and acetylenes to which he'd been introduced in his time with Heilbron. (For example, in his acetylene work he had laid the ground (**6**)[9] for the first industrial synthesis of vitamin A, by Isler.)[10] These interests, to which was later added a survey of the products of microbiological hydroxylation of steroids, maintained a flow of significant contributions to the literature even as his involvement in the affairs of the University and the chemical profession took him increasingly away from the laboratory. Unlike his predecessors, Jones felt that teaching students was one of the responsibilities of the Head of Department, and for many years he gave clear and polished (if not especially passionate) lectures to introduce first year students to the delights of organic chemistry. He ran the Department with diplomatic resolve, and "the autocracy was very benevolent."[11]

E. R. H. Jones.
(Reproduced courtesy of the Library and Information Centre, Royal Society of Chemistry)

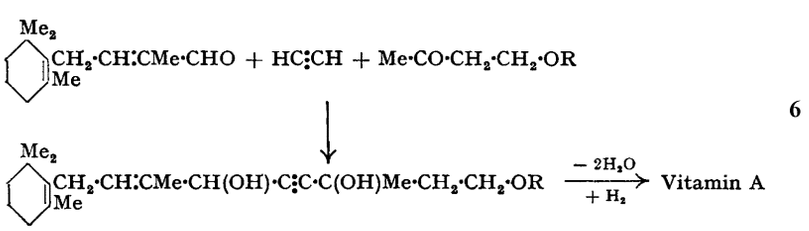
Like Robinson, he wrestled — sometimes unhappily — with the relationship between the Department and the Colleges, but while Robinson had simply looked the other way, Jones worked more positively with the system to make the best for the Department that he led. In his time, organic chemistry was brought up to a level (in resources, in University posts, and in College fellowships) commensurate with physical and inorganic. It was still true that University Demonstrators who were not also College fellows worked mostly as part of the Professor's team, but Jones generously (indeed, selflessly) supported the independent research of his colleagues, as the Dyson Perrins grew. Jones retired from the Waynflete chair in 1978, but he went on to seal the merger of the two national chemical societies, becoming the first President of the Royal Society of Chemistry in 1980.

Jack Baldwin succeeded Jones in 1978. Baldwin had worked with Derek Barton at Imperial, and was by then at MIT, having discovered 2,3-sigmatropic reactions, formulated his 'rules for ring closure', and moved towards the interface of organic chemistry and biology. His interest in the biosynthesis of β-lactams took immediate root in Oxford, where collaboration with E. P. Abraham led to the isolation, cloning, and ultimately the structure of the enzyme isopenicillin N synthase, which catalyzes the formation of the penam nucleus from its tripeptide precursor (**7**).[12]

Jack Baldwin.

This success spawned two decades of research into the biosynthesis of the three clinically-important classes: the penams, the clavams, and the cephems, and the unravelling of the mechanisms of their synthases by the use of substrate analogues combined with structural data from a variety of enzyme–substrate intermediates. Concurrently, much impressive work (as well as some helpful entrepreneurship) has flowed from many of the other research groups in the Department.

During the 1980s and 1990s, the inadequacy of Oxford's chemistry buildings became increasingly painful, and the formal separation (both physical and intellectual) of the sub-disciplines was seen to be inappropriately constraining. In most fields, these days, fewer fences divide the intellectual landscape, and chemistry is no exception. [As R. B. Woodward once remarked: "If it's *interesting*, it's chemistry."] So, at last, the largest chemistry school in the western world has been unified, urged on by the diplomatic energy of Graham Richards, its first overall Head of Department. A splendid, large, new



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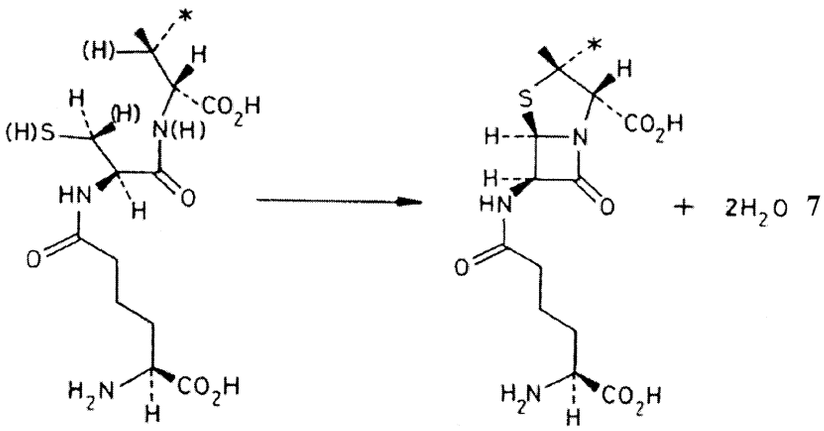

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laboratory, directly opposite to the Dyson Perrins across South Parks Road, will soon be occupied. Those of us who were brought up with the D.P.'s unique combination of smells, its extravagantly high ceilings, the staircase that millions of undergraduate feet could never wear away, the horrors of Room 33, and the open drains that made minor explosions in the teaching labs so much more interesting, will be nostalgic but not truly sorry. The Dyson Perrins has served Oxford well, but a bright new era begins.

Jeremy Knowles
August 2003

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5 In the six years from 1901 to 1906, a mere 18 publications in chemistry had emerged from Oxford (compared with 101 from Imperial College). From 1919 to 1924, Oxford produced 140 publications (commensurate with what was then flowing from Cambridge and Imperial).[4]

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