Our History

The fourth edition of the pictorial history of the college has been published: ***The World of UCL,* by Negley Hart, John North and Georgina Brewis.** UCL Press. It costs £30, but is available through the College Shop for £20, but, what is more, is Open Access and can be downloaded for free from ucl.ac.uk/ucl-press.

A few copies of the history of the Chemistry Department are still available: ***UCL Chemistry Department 1828-1937,* by Alwyn Davies and Peter Garratt.** It is available through the college shop, free of postage, for £12 or through the authors (a.g.davies@ucl.ac.uk; p.g.garratt@ucl.ac.uk).

Sir William Ramsay and the fatal addiction

By Alwyn Davies

In the four years from 1894 to 1898, in a spectacular burst of research, William Ramsay discovered five new gases, helium, neon, argon, krypton, and xenon, and added a whole new group, Group VIII, to the seven in Mendeleev's Periodic Table. This provided a keystone to our understanding of atomic structure, and for this work, in 1904, he was awarded the first Nobel Prize in chemistry to come to a British subject.

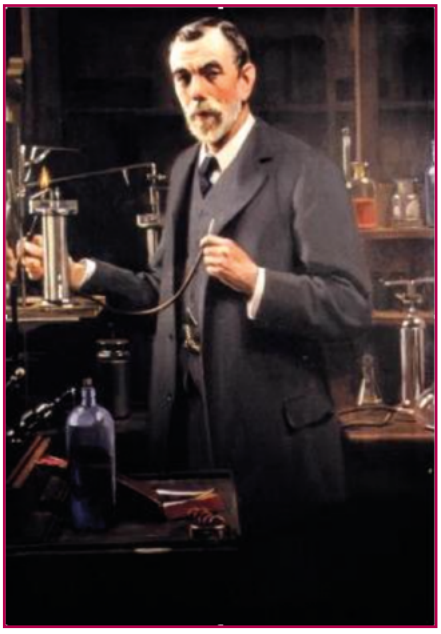

Figure 1 William Ramsay

The key to his success is apparent in his portrait painted in 1905, which we have in the Department (Figure 1). Most academics in that period would be painted sitting at a desk writing or reading. Ramsay had himself painted in his favourite place, in the laboratory, at the bench, doing glass-blowing repairs to a glass vacuum line. He was never happier than when doing experimental work. He had learned glass-blowing from his assistant, Sydney Young, when he was in Bristol, and he worked on the equilibria between gases and liquids. He became expert in designing and constructing apparatus, largely in glass, and in manipulating small amounts of gases.

He carried through this love of experimental work into his lectures. We have the note book of one of his students, and in the front he has written: "Practically every laboratory preparation described was carried out on the lecture bench, and a sample of every substance mentioned was to be seen, Any unusual properties were demonstrated". Figure 2 shows him lecturing, with the bench covered with apparatus. He isolated argon in August 1884, and already in the November, when the academic year had started, he demonstrated the isolation in an undergraduate lecture.

He tried to go round the teaching labs every day, and carried on his watch chain a platinum spatula for poking the students' precipitates. He smoked, and rolled his own cigarettes, scorning the machine-made ones as being unworthy of an experimentalist. He modestly ascribed his own success in isolating the noble gases, to having a large flat thumb for closing the ends of tubes of gases when he removed them from the mercury troughs.

This love of experimental work is also shown in the song overleaf, which he wrote and sang at the Lab Dinner in 1898:

The Atmospheric Gases, O! (Air - Green grow the rushes, O!)

There' nought but air on every han',
In every breeze that passes O;
What guides the windmill or a fan,
An' 'twere na for the gases O.

Chorus: Here's tae their masses O,
Their atomic masses O,
The happiest hours that ere I spend
Are spent among the gases O.

The wardly race may riches chase
And riches still may fly them O
And tho' at last they catch them fast
Their hearts can ne'er enjoy them O.

Gie me a cannie hour at e'en,
A pint o' liquid airie O,
A tube or twa 'o impure Neon,
I'll never ha'e a carie O.

In liquid sate, I'll fractionate
Wi' Travers and wi' Baly O,
And we are sure we'll make it pure
And weigh it on the scalie O.

And Xenon tae, we'll catch and weigh
And find its refractivity,
And now it's done, we' ripe for fun
To join you in festivity.

Sae lads o' mine, pour out the wine,
Fill bumpers in your glasses O.
Wi' three times three, come join wi' me,
"The atmospheric gases O".

When the opportunity arose, his superb experimental skill gave him the edge over other possible competitors, and enabled him to isolate the noble gases. In the long run his dedication was to be the cause of his untimely death. On April 19th 1894, Lord Rayleigh lectured at the Royal Society on his work on measuring the atomic weights of gases by determining their densities, and Ramsay was in the audience. Rayleigh said that he found that the density of nitrogen, which he had obtained from the air, was greater than that of nitrogen, which he had prepared in the laboratory. The difference was small, about half of one percent, but the result was reproducible: atmospheric nitrogen was denser than what he called laboratory nitrogen. After the lecture Ramsay and Rayeigh discussed the problem. They agreed that it implied that nitrogen from the atmosphere contained an unrecognised, heavy, unreactive, gas. They set out, independently, but in communication, in an attempt to isolate this supposed gas, and their different methods are shown in Figure 2, the physicist, Rayleigh's, on the left and the chemist, Ramsay's, on the right.

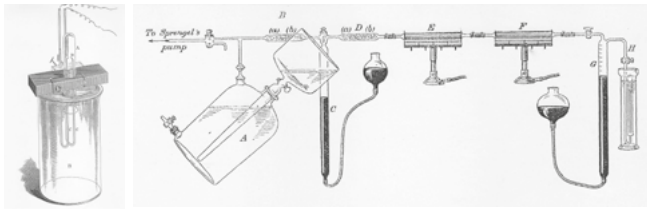

Figure 2 Rayeigh's and Ramsay's apparatus for isolating argon

Rayleigh generated a spark in air, which caused the nitrogen to be removed as oxides of nitrogen. With his experience in constructing apparatus, Ramsay could be more ambitious and he constructed the gas train in which atmospheric nitrogen was passed over red hot magnesium where it reacted to form solid magnesium nitride. Ramsay's advantage is obvious: From 50 cm^3 of air, Rayleigh obtained 0.3 cm^3 of gas – a small bubble with which he could do nothing further. From 10 or 11 L of nitrogen, Ramsay obtained 104 cm^3 of a new gas on which he was able to determine the density, atomicity, discharge spectrum, and chemical properties, and together they were able to announce the discovery of the first of the noble gases, argon, with an atomic weight of about 40.

In 1895 he obtained helium, with an atomic weight of 4, from the gas occluded in a uranium mineral.

These two gases could find no place in Mendeleef's original Periodic Table, but they could fill the first and third places of a new Group VIII if it were added to the original seven. Ramsay thus set out to find the missing gas with an atomic weight of about 20 to fill the second place in Group VIII. In 1898 he decided that this new element was hiding in his argon, but to fractionally evaporate the liquefied argon using liquid air which had become available, he would need a large volume of argon. He obtained 18 litres by converting the batch-wise process shown in Figure 3 into an ingenious semi-continuous one in which a Sprengel pump was used to circulate the nitrogen over the magnesium until absorption was complete. From this impure argon he isolated neon, with A.W. 20, and from the liquid air resides he isolated krypton, A.W. 84 and xenon, A.W. 130.

From 1900 onwards, Ramsay's research was mainly on radioactivity, and again it is characterised by ingenious design of apparatus and its meticulous manipulation. Here are two examples.

In 1902 with Soddy, he showed that helium, was the product of radioactive decay of radon.

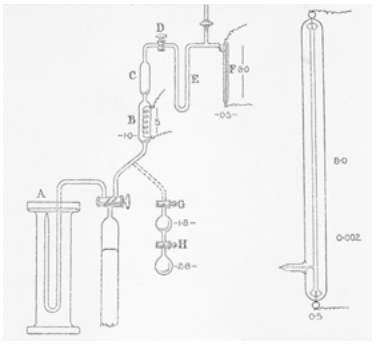

Figure 3 Apparatus used to show that helium was a decay product of radon

Their apparatus is shown in Figure 3. Radon was contained in a thin-walled capillary which was enclosed in a wider evacuated tube. Radon has a half-life of 3.8 days and alpha particles from its decay passed through the capillary walls and the outer tube developed the characteristic yellow discharge spectrum of helium.

And in 1910, Ramsay and Whitlaw-Gray, built the balance shown in Figure 5 and showed that 6.58 $x10^{-5}$ ml of radon weighed 6.55 x 10^{-7}g, giving it the atomic weight of 222 and confirming its position as the sixth noble gas.

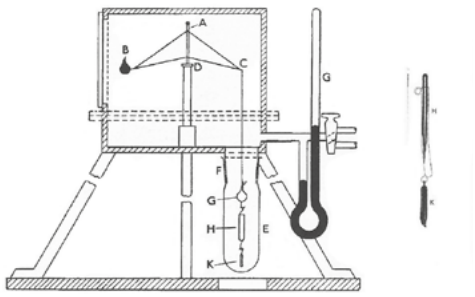

Figure 4 Apparatus for determining the density of radon

The dangers associated with radioactivity were not appreciated and throughout this work, Ramsay was handling the radioactive compounds with no precautions: His notebook from that period is still radioactive. He developed cancer of the jaw and after two operations he died on July 23 1916 at the age of 64. His love of experimentation, which had marked his whole career, ultimately proved fatal.

UCL Chemistry **NEWSLETTER**

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Introduction

Many thanks go to Louise McSeveny, for organising this year's newsletter and to Tracy Hankey at UCL Digital Media Services for her help.

We hope this newsletter gives a flavour of the exciting chemistry and family atmosphere achieved in the department. It is not an exhaustive document but can provide a number of contact points to the wide variety of activity that occurs in the department.

Introduction by Head of Department

As I sit here writing this welcome the UK basks in temperatures over 25 degrees, the government has published its long awaited Brexit White paper and Donald Trump is visiting the UK! Fortunately we keep our minds busy in the chemistry department with lots of exciting science and activities, which you can read about in this newsletter.

We have had a number of retirements this summer – Mr Jim Stevenson, Mr Phil Hayes and Professor Derek Tocher all of whom have been at UCL over 30 years (53 years for Phil!). We are grateful to Jim and Phil who both contributed greatly to the technical team in the department over the years in the workshop and teaching labs, respectively. Thanks also go to Professor Tocher who has taken on many key roles over the years including Pro-Provost for East and South-East Asia, Departmental Tutor, Admissions Tutor, Deputy Safety Officer, Affiliate Student Tutor and for the past 6 years Deputy Head of Department. We were delighted when Professor Tocher was awarded a special Lifetime Achievement Award, as part of the MAPS Faculty Education Awards. Indeed, chemistry did extremely well with awards going to Dr Katherine Holt (Teaching Staff category), Dr Anna Roffey and Dr Daren Caruana (Continuing Professional Development Category) and Emre Sener (Postgraduate Teaching Assistant Category).

This year Dr Hugo Bronstein moved to the University of Cambridge after 4 years here at UCL. We welcomed Dr Bob Schroeder from the University of Queen Mary as a Lecturer in Organic Chemistry and Dr Kerstin Sander as a Lecturer in Radiochemistry and PET Pharmacology (joint appointment with medicine). Dr Clare Blakewell and Dr Antoine Maruani will both start Ramsay Trust Fellowships in October 2018 and Dr Rachel Dickman has been awarded an EPSRC Doctoral Prize Fellowship. We also welcomed Louise McSeveny as acting EA and Dr Richard Fiztmaurice as acting Laboratory Manager for the organic section, while Nicola Phillips and Dr Helen Allan are on maternity leave.

There have been many new initiatives and grants awarded within the department. A few highlights include Professor Giuseppe Battaglia who was awarded an ERC Consolidator Grant for €2m entitled CheSSTaG (Chemotactic Super-Selective Targeting of Gliomas) and Dr David Scanlon an ERC starting grant for €1.5m for a project called DISCOVER (Design of Mixed Anion Inorganic Semiconductor for Energy Conversion). Professor Jawwad Darr is leading an EPSRC JUICED (Joint University-Industry consortium for energy materials and devices) Hub grant for £1.8m (with Professor Ivan Parkin, Professor Furio Cora and Dr Rob Palgrave). Well done also to Dr Rob Palgrave who co-led a bid between UCL and University of Cardiff for the National XPS facility to be located at Harwell. UCL's bid was worth £1.2m and UCL will own one instrument on completion.

Yet again the department had a record intake with over 100 students taking one year MSc and MRes degrees in the department. Undergraduate and PhD admissions were also very strong which presented challenges with respect to space and research project allocations.

However, we had two enjoyable away days this year – one for academic staff and one for Professional services/support staff from which many ideas have emerged. We are currently in the process of having new fumehoods fitted in the 3rd floor laboratories and apparently our toilets are going to be refurbished in the department!

I wish you all the best for the 2018-19 academic year.

Professor Claire Carmalt