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when it came to sharing his thoughts, ideas, and insights with colleagues and students," said Peter Olson, a colleague of Phillips' and a professor in the Department of Earth and Planetary Sciences.


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Paley Johnson 12 February 1917–11 February 2011; Fellow of Trinity 1962–2011

A tribute from Stephen Harding DSc (Oxon), Professor of Applied Biochemistry and Biophysics, University of Nottingham, delivered at the memorial service, 19 March, 2011.

Last month Paley Johnson died after a long and highly respected life and career of scientific research and teaching. He was just short of his 94th birthday. I had the privilege of being his last Research Assistant and I thank his family and the College for giving me the honour of delivering this address on behalf of his family, friends and colleagues.

Paley had been a Fellow of Trinity since 1962 and, in 1997, as is customary, he addressed the Fellows on the occasion of his 80th birthday. In 2007 everyone was back again as he addressed the College on the occasion of his 90th birthday.[1] In his concluding remarks he showed he'd lost none of his wit by saying that he looked forward to presenting the 3rd lecture in the series—and to receiving his telegram from the Queen 'if she also manages the extra ten years'.

Despite his distinguished academic career as a Colloid Scientist—where he became a world authority—Paley never forgot his roots in the North East of England. He was born and brought up in Durham, in the mining village of Middlestone, a few miles from Bishop Auckland. To his family's delight he passed his 11+ exam, to win a scholarship at Alderman Wraith grammar school in Spennymoor. Times were hard in the North East and the Headmaster of the school had told the boys that the cost of a school book was the equivalent of a night's wages for a miner. This impressed on young Paley the need to work hard at school; there he excelled and won a place at Trinity—without interview—to read Natural Sciences, supported by a State Scholarship. During tea-time

[1] http://www.trin.cam.ac.uk/show.php?dowid=731

discussions with us, half a century later, he would say how he rued the loss of the state grammar school system which he felt gave working-class children the best chance to gain places at the top universities.

He came up in 1935, studying Physics, Maths and Mineralogy, specialising in Physical Chemistry for his final year. He became particularly interested in the work of Dr. E.A. Moelwyn-Hughes, who subsequently recruited Paley as a PhD student, to investigate the effect of temperature on the activation energy of reactions between molecules in solution. In his memoirs Paley acknowledged what an important influence Moelwyn-Hughes had had on his subsequent career, and I quote: 'In the first year of my research I attended introductory classes in glass blowing as well as assembling thermostats—control to a few hundredths of a degree was essential. Equipment had to be checked and standardised against NPL calibrated instruments.... Looking back I can see clearly that such a period of supervision by a sound and demanding experimentalist as well as an accomplished writer of clear unambiguous English was as good an initial training period as one could have hoped for.'[2] These are precisely the skills that Paley himself would later pass on to many others.

However, one year into his PhD research the war intervened; Moelwyn-Hughes was called away by the Ministry, and the supervision of Paley's thesis switched to Professor Eric Rideal in the Department of Colloid Science on Free School Lane. Colloid Science was then a relatively new discipline at the interface between Physics, Chemistry, Mathematics and Biology. Paley had earlier been attracted by this fusion of disciplines and the great potential that physical science had in solving biological problems. He had caught this impression from Rideal's undergraduate lectures. Paley's research, however, had to be shifted around to accommodate the war effort and, under Rideal's guidance, he addressed issues as diverse as characterising the nature of sugar-type polymers called nitrocelluloses—for improved performance as cordite in rockets—to the extraction, purification, and analysis of groundnut proteins as a source of food. This gave him an introduction to the physical chemistry of linear polymers, which proved invaluable training for when he later moved to address the nature of asymmetric proteins such as muscle proteins—expertise later passed on to some of his own research students such as Arthur Rowe, who

[2] Johnson, P. (2010) *From an Ivory Tower*. Blurb Inc., San Francisco. This text was written in 1993 when he was 83 and was published in book form to mark the occasion of his 93rd birthday on 12th February 2010.

went on to become a leading authority in this area. It also provided material for Part II of his thesis, which he successfully defended.

After the war Paley followed Rideal who had taken up the Directorship of the Royal Institution in London, and whilst he was there Paley—along with Albert Alexander—produced a comprehensive two-volume Oxford University Press monograph on Colloid Science, which for nearly half a century remained the authoritative text in the field, and is still a valuable reference source, even today.[3] Primarily in recognition of this, along with other achievements, the University subsequently awarded Paley the distinction of an ScD degree. In 1950 he returned to Free School Lane to take up an academic post at the Colloid Science laboratory.

Paley was first and foremost an experimentalist, one of the best, and his attention turned to physical techniques for solving biological problems—to two techniques in particular, of which he became the master and a world authority. One was the analytical ultracentrifuge. This had been invented 25 years previously by Svedberg in Sweden. In essence, the very high centrifugal forces this machine created, by rotating dispersions of proteins or polymers in solution at up to 1000 revolutions per second, caused them to sediment and, from the sedimentation rate picked up by special optical systems, deductions could be made about polymer size, shape and interactions. Paley found a completely new application for this technique in the characterisation of gels, gelatine and other jelly-like materials[4].

One of the present world leaders in Colloid Science, Professor Helmut Cölfen at the University of Konstanz in Germany, comments on this work on gel analysis in the analytical ultracentrifuge. 'Paley did the first systematic analyses of gel systems in the centrifuge which was highly pioneering work since up to then, only solutions or dispersions of particles had been investigated. He found that the behaviour of a gel in the centrifuge was fundamentally different from a solution or dispersion and established the theory describing this. He was thus the first one to accurately describe the behaviour of gels in the centrifugal field and laid the foundations for the analysis and understanding of the important class of materials known as hydrogels, crucial for their application in food and biopharmaceuticals.'

[3] Alexander, A.E. and Johnson, P. (1950) *Colloid Science*. Clarendon Press, Oxford.

[4] Johnson, P. (1964) A sedimentation study on gel systems. *Proceedings of the Royal Society (London)*, A278, 527–542.

The other technique which became Paley's trademark was light scattering, the scattering of light by dispersions of polymers. Scattering of light is a well known phenomenon; it is why the sky is blue. If you shine light on a solution of polymers, the angular envelope of intensity of the scattered light will depend on the sizes and shapes of the polymers. But this technique required meticulous attention to detail and clarity of solutions from trace amounts of dust. Without that attention, as Paley would say, 'experiments were not useful'. In his own research and publications he did a lot to establish good practice, giving detailed procedures for achieving this, and was very critical of other studies where this attention to detail was not followed or shortcuts had been taken.

And this was it with Paley: he was an absolutely meticulous experimental scientist and an excellent teacher at undergraduate, postgraduate, and postdoctoral levels. He provided a platform and excellent grounding for many distinguished careers in science, and was highly respected by all researchers in the field.

Just a few testimonies:

Professor Vic Morris at the Institute of Food Research at Norwich: 'Paley Johnson was a really nice guy. He certainly helped me with advice and encouragement when I first started at IFR.'

David Sattelle, Professor of Molecular Neurobiology at Oxford: 'Retirement never stopped Paley and he was a great inspiration.'

Don Winzor, Professor of Physical Chemistry at the University of Queensland, describes Paley's death as 'the end of a very fine innings'.

Philip Wyatt, President of Wyatt Corporation in Santa Barbara, one of the world's premier light-scattering experts, a successful manufacturer of scientific instrumentation—and a Christ's College man: 'Yes, I well remember Paley and the wonderful informal meeting with him that included walking on the Trinity lawns with lots of Japanese tourists watching aghast. . . Then he took us to the special Trinity room associated with the first great chemist there, I think. I could never remember his name but I think he was a contemporary of Newton's and Italian [Vigani's room: ed.]. That special room either had port or brandy.and I think we each had a drop. It was a magical afternoon and a great honor to meet the great man whom I shall always remember!'

Colloid Science at Cambridge and Paley were almost synonymous. Indeed when Francis Roughton retired as head it seemed only a natural progression

that Paley would be the next Professor and Head of Department. Sadly, University politics conspired against him; the Department of Colloid Science was closed and fragmented. Paley's group moved, at the invitation of Sir Hans Kornberg, to the Department of Biochemistry where he continued to produce first-rate science until his retirement in 1984. From there he was given an emeritus position in the Cavendish Laboratory by Sir Sam Edwards—and for nine more years, with his centrifuges and light scattering, contributed to the establishment of the highly successful polymer physics group led by Athene Donald.

As to scientific instrumentation, Paley was wary of the increasing reliance, particularly in the biological sciences, on black boxes and button pushing, which reduced the opportunity for checking to see if an instrument was performing correctly; it also lessened the researcher's chances of interacting with the instrument and of fully understanding what was going on. In his memoirs he says, 'It is often felt by people of my generation that this basic type of checking up on relatively simple equipment is ignored in the "push button" age in which the modern research student finds himself; so often the "black box" hides the science involved and very recently the introduction of the microcomputer has added to these difficulties.' Paley would always impress on us the subtle distinction between a 'machine' and a scientific 'instrument'.

Paley's laboratories were a wonderful mix of commercial equipment purchased only when necessary—such as the latest laser for his light scattering—supplemented by in-house, sometimes ingeniously constructed, components. Examples included the use of a model aeroplane propeller, to ensure optimum circulation in the water baths used in one of his light scattering instruments; and a temperature control system for his viscometer water baths that involved a light bulb immersed in water which would flash on and off, holding the temperature constant to within a few hundredths of a degree. He was always supported by excellent glassblowers, workshops, and highly skilled technical support during his time in Colloid Science, the Department of Biochemistry and the Cavendish—for example, from David Read in Biochemistry and from Mr. Neville Buttress in Colloid Science, who joined him again at the Cavendish. Neville kept in touch with Paley right until his last days.

But Paley was more than an excellent scientist. He was a dedicated Christian, and at Cambridge he attended the Methodist Church on Castle Street for 75 years. It was here, and through the University Methodist Society. that he met

Margaret, a Homerton College girl who became his wife and companion for 35 years until, sadly, she died. They had two children: John, who is now an eminent lighting designer sought by top exhibitions in the country and abroad; and Helen, who is a communications consultant for the biopharmaceutical industry; and three grandchildren, Ben, Tom and Emily. Paley was very proud of his family, and in the last letter I got from him he pronounced his excitement that one of his grandsons was coming for lunch that day with his children: Paley was proud to say he was a great-grandfather three times over.

After Margaret's death in 1978 he was alone for a while; then he married again—to Muriel a retired school headmistress, who became his companion for 20 more years until, sadly, she was lost too.

Back in the laboratory, tea-time discussions were always something to look forward to. First of all, and most importantly Paley would often bring in the most splendid of cakes, made by Muriel, who would sometimes come in to join us. He would often speak very fondly of his family and of games of cricket in the garden with his grandchildren. He was keen on sports; we got the impression he was a bit of a Darlington FC fan, but subsequent discussions with his family suggested that he had a strong affection for Middlesborough. There was no mistaking that cricket was his great love and he would have been immensely proud when Durham were promoted from the Minor Counties to full County Championship status in 1992.

At these tea times we would sometimes chuckle at Paley's thriftiness. We were amazed at how many cups of afternoon tea he could extract from a single tea bag; and on mornings when the coffee jar was seemingly empty he would stop us putting it in the bin, to demonstrate his skills as an analytical chemist. He would take an aliquot of milk, pour it into the jar, and carefully dissolve all the coffee solids stuck on its glass sides, to steal an extra cup. We also learnt of an earlier occasion at tea when two denizens of the 'top floor' went down, apparently in error, to remove a fridge from Paley's laboratory. He happened to catch a glimpse them from the corner of his eye, and at great speed managed to stop the abduction half way up the stairs. The 'discussion', if that is the right word, that followed could be heard throughout the New Museums site!

My own time in Paley's laboratory was one of the most productive in my scientific career, and I will always be grateful for his masterly guidance. He also encouraged me to take the opportunity to interact with other groups at

the University; this included a very fruitful collaboration with John Rallison of DAMTP and Trinity. That work with Paley, and with John, underpins much of the work my own laboratory does, even today.

Paley was always very accommodating and helpful to people; here at Trinity one such person was Dr. Mary Archer, who had just been given a joint appointment as Fellow and College Lecturer in Chemistry at Newnham and Lector in Chemistry at Trinity, a position she was to hold for 10 years. Speaking with Sir John Bradfield last weekend, she recalled how particularly kind and helpful Paley was in introducing her and welcoming her to the College, making her feel at home.

Paley always had a huge affection for Trinity and was a splendid ambassador. Indeed, he has bequeathed a substantial sum to the College, to provide *Paley Johnson Supplementary Awards* to help 'United Kingdom graduate science students from modest financial backgrounds': this reflects his generosity, his affection for Trinity, and his desire to help those students, with backgrounds similar to his own, about to embark on their own scientific careers—just as he was able to do all those years ago.

So on behalf of all friends, family and colleagues we thank you, Paley, for everything, and say goodbye to this good man.

Sir William Rede Hawthorne, 22 May 1913–16 September 2011; Fellow of Trinity 1951–68

A tribute, by courtesy of the *Daily Telegraph*.

As a young engineer Hawthorne was sent, in 1940, on loan from the Royal Aircraft Establishment (RAE) to Power Jets, the company founded by Frank Whittle to develop the world's first operational jet engines. During testing of early prototypes, Whittle had run into difficulties with fuel combustion. Hawthorne was brought in to solve the problem.

Hawthorne arrived at Rugby station to be met by a battered car, which took him to the disused foundry at nearby Lutterworth which served as Whittle's works. There he set to work with a team in an old railway carriage which had been converted into an office.

The race to harness the new technology was crucial as the battle for the skies looked set to determine Britain's fate. Hawthorne decided that the answer