Professor Albert Edward Green (1912 – 1999)

Albert Green, who has died aged 86, was Sedleian professor of natural philosophy at Oxford university from 1968 to 1977, and one of the most distinguished and prolific British applied mathematicians of the 20th century. He made great contributions to

theoretical and applied mechanics, and his contributions to elasticity theory alone would justify placing him among the most outstanding workers in theoretical mechanics.

Yet he also wrote highly original papers on fluid mechanics, thermodynamics, diffusion theory, and on the mechanics of continua in general. His books, Theoretical Elasticity (written with W Zerna) and Large Elastic Deformations (with the late JE Adkins), remain standard reference texts four decades after they were written.

Green was a partner in two outstanding collaborations. In the 50s and early 60s, he and Ronald Rivlin, who was then at Brown University in the United States, formed a formidable duo that led, among other things, to the establishment of the theory of non-linear viscoelasticity.

Then, in 1964, as a visiting professor at the University of California at Berkeley he began a partnership with Paul Naghdi which was only broken by Naghdi's death in 1994, and resulted in remarkably fine research papers on continuum mechanics.

Green was born in London and graduated with a first in mathematics from Jesus College Cambridge in 1934, receiving a doctorate three years later. From 1936 to 1939 he was a research fellow at Jesus College.

In 1939, Green became a lecturer at Durham university and from 1949 until 1968 he was professor of applied mathematics at King's College, Newcastle-upon-Tyne (which became the University of Newcastle in 1963). At Newcastle, he chaired and co-chaired the mathematics department and served as dean of the science faculty. Under his leadership, Newcastle's applied mathematics group became one of the liveliest in the country.

Green had an ability to create a stimulating environment, and inspire by his own research. He was particularly successful in recruiting talented young mathematicians who have since become distinguished scholars.

In 1968, Green accepted Oxford University's Sedleian chair, which he held until his retirement in 1977. He chaired Oxford's Mathematical Institute from 1974-76, was a fellow of the Queen's College, and a visiting professor at Brown and Berkeley. He was even more active in research after his retirement, publishing papers well beyond his 80th birthday.

Green served on several journals' editorial boards and supervised many research students and postdoctoral researchers. Generous, infectiously enthusiastic and passionate about his research, he inspired generations of research students and all who had the good fortune to work with him.

Green was elected a fellow of the Royal Society in 1958. Other honours included a Smith's Prize and an ScD from Cambridge, honorary doctorates from the Durham, Glasgow and the National University of Ireland, the Timoshenko Medal - the highest

honour for theoretical mechanics awarded by the American Society of Mechanical Engineers, and the von Karman Medal from the American Society of Civil Engineers.

Modest, friendly, warm-hearted and unpretentious, he was always willing to take a stand on matters that were important to him. Discussions with him were always conducted with great good humour. Everyone who came under his influence remained a friend and admirer for life. He was an accomplished organist and enjoyed gardening and walking.

In 1939, he married Gwendoline May Rudston, who survives him.

---by AH England and AJM Spencer, The Guardian, Tuesday 31 August 1999

1974 ASME Timoshenko Medal Acceptance Speech by Albert E. Green

Reflections on 40 Years in Mechanics

Thanks to the Society through the President for the presentation of the medal.

Thanks to Dick Shield.

There is one serious disadvantage to receiving the medal - the tradition that the recipient gives an acceptance talk.

Owing to the influence of men like Professor Timoshenko, work in applied mechanics in the U.S. has mostly been centred in engineering schools but sometimes in mathematics, applied mathematics departments or institutes. In Britain theoretical work in applied mechanics has mainly been in departments of mathematics and applied mathematics, but a few departments of engineering have also been concerned with such work. My own experience in Britain has been entirely in departments of mathematics in which there were close links with pure mathematicians. In the United States I have been fortunate to be associated with colleagues at Brown University and at Berkeley, as well as visiting other universities. Although I am in a department of mathematics, both pure and applied, at Oxford, my own title is Sedleian Professor of Natural Philosophy. The Sedleian Chair was founded by Sir William Sedley who by his Will dated October 20, 1618, bequeathed the sum of §2,000 to the University, to be laid out in the purchase of lands for its endowment; this bequest took effect in 1621. It is regarded as the oldest of the scientific Chairs even though the Savilian Professorships of Geometry and Astronomy were endowed in 1619, and the first of them actually filled in that year. My immediate predecessors were Professor George Temple, Professor Sydney Chapman and Professor A.E.H. Love, and you will be aware that they dealt with very different aspects of natural philosophy. Professor Love held the Chair for 41 years, from 1899, and his work is well known in the present company. The fourth holder of the Chair who was appointed in 1660 was Thomas Willis. A list of some of the treatises which he wrote makes interesting reading: (1) _Of the accession of the blood _; (2) _Of musculary motion _; (3) _Of urines _; (4) _The anatomy of the brain _; (5) _The description and use of the nerves _.

He also wrote about convulsive diseases, scurvy, and the comparative anatomy of some dozen species ranging from the earthworm and lobster to sheep and man. He is regarded as the founder of neurology. In his last writings on rational therapeutics he presented a vast and sometimes horrific pharmacopoeia in which, however, are buried useful descriptions of the anatomy of the blood vessels, the muscular layers of the stomach, and the detailed structure of the lungs. Perhaps we can discern the beginnings of the present fashionable subject of biomechanics in the description of the probang, an ingenious machine for treating a very rare case of a certain man of Oxford who was probably suffering from stricture of the oesophagus.

Willis had as pupils or assistants men who later became well known. They included Robert Hooke, the great inventive physicist and microscopist, John Locke, the physician-philosopher, Edmund King who, with Richard Lower, performed the first blood transfusion, and finally, Thomas Millington and Christopher Wren _ who later became Savilian Professor. This set were some of the extraordinarily versatile scientists who, after their _Invisible College _ as Robert Boyle termed it, eventually went on from Oxford to found the Royal Society in London _ Willis was one of the original Fellows (1663).

At Oxford applied mechanics is studied in the Department of Engineering as well as in Mathematics. In this connection, Sir Richard Southwell, who received the Timoshenko Medal in 1959, held the Chair at Oxford in Engineering.

The term natural philosophy takes me back to early days in Cambridge as some of the papers in the Mathematical Tripos Examination were headed natural philosophy. On looking through the list of those who received the Timoshenko Medal I see four names associated with Cambridge. Professor Lighthill who is there at present, Professor James Goodier who was somewhat before my own time, and I did not know him in those days. Although we corresponded occasionally I only met him in recent years in California. Then there was Professor Sydney Goldstein. I attended many of his lectures both as an undergraduate and as a graduate student and I still have some excellent notes in Electromagnetism and Fluid Dynamics from him. He always packed a tremendous amount into lectures. One habit was to finish a lecture at 10am on one day in the middle of a sentence and then to begin his lecture the next day promptly at 9am continuing the same sentence as he walked in the door! He also disregarded physical disabilities. Occasionally he suffered from gout and would lecture seated on a bench with both feet and legs wrapped in bandages, using the board above as far as he could reach.

The fourth person on the list is Sir Geoffrey Taylor, or more usually known as G.I. I had the good fortune to be one of his research students and am sad to know that he is now incapacitated by illness after a long and very active life in applied mathematics and mechanics. G.I. had a room in the Cavendish Laboratory in Cambridge and he did experiments with the help of a superb technician named Thompson. Many of you will be aware of his classic work on the stability of Couette flow of a viscous fluid between rotating cylinders, which is an excellent combination of theory and experiment. The apparatus which he used for the experiment was still in the laboratory when I was a

student. G.I. was an enthusiastic yachtsman and was very interested in developing an anchor which was much lighter than the conventional type and which had more efficient properties. He used to experiment with a model anchor by throwing it into a large box of sand in the laboratory with obvious enjoyment. The anchor was eventually patented and has, I believe, been widely used. Although it may now be surprising to some of my listeners I once did an experiment under his guidance _ but not since then!

I recall that when I started with G.I. he suggested an area of work and discussed this with the help of rather illegible scribblings on a sheet of paper. At the end of the discussion I took the treasured paper away in the somewhat vain hope of deciphering some of the main points. Of course, G.I. really knew what answers he expected from an investigation by his somewhat unusual physical insight. I had to seek out appropriate mathematics myself and after about 9 months I was almost in despair as I had made absolutely no progress.

Before I actually started postgraduate study in 1934, G.I. sent me to the International Conference of Applied Mechanics which was held on that occasion in Cambridge. I remember being somewhat overawed by the people at the conference and I understood very little of the technical papers. Of course, being a beginner, I thought that I ought to go to every lecture! I read Professor Eric Reissner _s speech in mechanical engineering which was delivered at this gathering last year and I can endorse his remarks about _the memory of my feelings and impressions of insecurity as an early participant in technical meetings _. At the Cambridge conference I saw _ at a distance _ some of the well-known workers of that era in mechanics including Timoshenko, von Karman, Prandtl, Beizeno, Burgers and H. Reissner, father of Eric Reissner. For some reason I think I remember correctly that H. Reissner lectured on viscous flow between rotating non-concentric circular cylinders.

The lectures in applied mathematics for both undergraduate and graduate students in Cambridge dealt with a wide variety of subjects. It is interesting to note that many of the things we were taught in Geometry, Algebra, Analysis and Mechanics have now disappeared entirely from syllabuses in most universities! In addition to Sydney Goldstein, I attended lectures by W.R. Dean, L.A. Pars (who was my undergraduate supervisor and a superb mathematician), Eddington, Harold Jeffreys and others. I recall one lecturer who wrote very clear books and papers but was very bad at lecturing. He started with a class of ten. Very soon this was reduced to two _ myself and a friend. I then dropped out but my friend persisted only to find that the lecturer did not turn up. My friend went up to the lecturer _s room in one of the colleges to find him still in bed. However, he was then given a good set of notes and went away quite content for the rest of the term.

Later when I had a Fellowship at Jesus College, I got to know people in other disciplines. One interesting person is Sir Arthur Quiller Couch _ or Q as he was called _ who was Professor of English and a writer of distinction. He compiled the Oxford Book of English verse and wrote many stories about Cornwall, and was once the Mayor of Fowey, a village in Cornwall. In those good old days Q would announce in the University Gazette

that he would lecture on Wednesdays in this term (February 14 and March 14) _ and then he cancelled one of these and hurried back to Fowey.

Another Fellow, Dr. Brittain, acted as chronicler of Q _s activities. He had two clocks in his room, one at the current time and one at God _s time, which in the summer was not the same.

After leaving Cambridge I spent some years in the Durham Colleges in the University of Durham where the department of mathematics consisted of 3 staff and I was expected to lecture on any topic of the undergraduate course in either pure or applied mathematics _ something which I could not do today. If present-day staff were required to do the number of lectures per week that we had to do there would be some sort of sit-down strike or walk-out. It was many years before this situation changed. In Durham I had my first research students. One of these students worked on problems of holes in wooden materials and when he obtained his degree a friend sent him a telegram which aptly read _holes in wood wins scarlet hood _.

From Durham I went to the other, and larger, part of the University, which was at Newcastle upon Tyne (now the University of Newcastle upon Tyne) and first met Professor Shield. In those days he always seemed to be an incredibly young student. I followed two well-known applied mathematicians who had been at Newcastle for many years _ Professor Havelock of water wave fame and Professor Goldsbrough who worked on tides and problems concerned with Saturn _s rings. Although they retired when I arrived I had the good fortune to know them for many years. As we know, different languages often cause many problems. I remember Havelock, who was a modest and rather shy man, being very pleased when he received a letter which said _Dear Professor Havelock, the odour of your name pervades the world _. This reminds me of a letter I received after the war from a Japanese colleague saying that he regretted the absence of correspondence owing to the prevailing darkness of the abominable days.

I had a charming pure mathematical colleague, Professor Rogosinski who hated any administrative work. He occasionally had language difficulties and after one meeting in which the future of the University was discussed he emerged and said _well, it is all a dream pipe _.
One of the great advantages of working in a scientific subject is that one gets to know many people from all over the world. I have been very fortunate in being able to work with a number of colleagues which I always find much more satisfactory than working entirely alone. It is interesting to find that similar ideas about a topic in science seem to appear in quite different parts of the world simultaneously. Having said this I am reminded that someone in the United States once remarked that no British Applied Mathematician ever believes anything has been discovered unless he re-discovers it himself!

Years ago, partly because of teaching loads in universities, there was little pressure on staff to engage in research or scholarly activity. Although this sometimes led to very dead departments or individuals, it did mean that work could be undertaken without the

continual pressure of the need for publication. After the 1939-45 war interest in research in university departments greatly increased and the pressure on staff, particularly younger members, is tremendous _ publish or perish has almost become the watchword. I am afraid that this tends to lead to bad standards. I particularly regret that often due recognition is not given to the type of person in a university who is a true scholar but is not one to produce a large number of papers. Such a person, who often had wide knowledge and understanding, can be invaluable in a department but gets left behind in the promotion stakes. The output of scientific papers in every subject is enormous and in recent years there has been a tremendous increase in the number of journals published. It is practically impossible to keep track of every paper in a particular area of interest, let alone in a variety of topics. As a result some duplication of effort is inevitable. Also I guess that only a small fraction of work is ever read in a thorough way.

In closing I may reflect that in mechanics, as well as in other sciences, there are fashions both in the type of work studied and in the way it is presented _ the pendulum tends to swing from one extreme to the other. We all suffer from prejudices in our every day life and it is not surprising that this spills over into science. Some regard highly abstract mathematical presentations of work as being divorced from physics while others regard some aspects of physics as mere hand-waving. I believe that there is something of value in the whole range of scientific thought. Of course, intensive discussion and argument with colleagues is sometimes a very profitable _ or at least a very enjoyable exercise. On looking back over the history of science one realizes that most of us can only hope to place one small brick _ if that _ in the edifice _ and even that may get knocked out by following generations. The more one learns over the years the more one realizes how little is really known: This is always the challenge to future generations.