

DUDLEY MAURICE NEWITT

1894—1980

Part III

**THE SCIENTIST IN THE PUBLIC DOMAIN
IMPERIAL COLLEGE , THE ROVING AMBASSADOR FOR
SCIENCE AND RETIREMENT**

(1945—1980)

by

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The first two volumes of this biography dealt with the period of Dudley's life which was dominated by the two world wars. This final volume focuses on the zenith of his academic career and his public life. It concludes with an account of his extensive travels to India, the Far East, Lebanon, the Caribbean, Russia, Nigeria and the United States – all in the cause of promoting Chemical Engineering. The objective of this biography is to 'show not tell'. It is not a hagiography nor even an *apologia pro vita sua*. There is no attempt at a final evaluation and it is for readers to form their own views. For this reason it has once again been decided to reproduce Dudley's own Memoirs *in extenso*. These are printed in italic.

From war to peace

In 1944 Dudley was 50 years old. He had acquired a reputation for organising an effective research and development operation and, with an eye for the post-war period, he was being 'head hunted'. In January 1944 he was approached by Sir Henry Tizard, a former Rector of Imperial College, to take up an appointment relating to research in industry. Dudley's reply gives a good idea about the way he viewed his own career at that time.

"Dear Tizard,

Thanks for your letter of the 24th instant. I should certainly like to have the opportunity of considering any industrial appointments such as you mention. It was quite clear from the Nuffield Conference that

great care will be needed to ensure that industry is not led astray in its efforts to embark on effective scientific research; and I received the impression from the general discussion that there was a real danger of this happening.

My own contact with industry extends over about twenty years and is briefly as follows:

With Imperial Chemical Industries -Technical matters relating to high pressure processes, plastics manufacture and the utilization of hydrocarbons (Consulting)

With the Distillers Company - Processes for the controlled oxidation of hydrocarbons (Consulting)

Reavell & Company - Design of High Pressure compressors (Consulting)

For various undertakings in the Textile, Metal Refining and Heavy Chemical industries - the design and erection of installations for the storage, distribution and handling of acids and other corrosive liquids.

My work at College has also kept me in touch with the Gas, Oil and Iron and Steel industries and I am a member of a number of committees set up by them.

I have recently visited America by invitation to inspect a number of Dupont's factories and the Plastic Section of the Monsanto Chemical Company to advise on scientific matters.

I am a founder member of the Institute of Chemical Engineers and a member of its Council. I have, as you know, always been interested in Chemical Engineering and particularly in that aspect of it which aims at improving plant design and lay-out and the proper scientific control of processes from the pilot plant stage. There is little doubt but that one of the big handicaps of Industry is the long delay between the completion of a laboratory investigation and the practical application of the

results - a delay due in large measure to lack of chemical engineering experience.

I hope the above will give the information you require, but, if not, I can easily expand it. Since you came to see us last at Welwyn we have embarked on a number of new projects which give promise of having useful applications; and if you can ever spare a few hours when you are in London I should like to show you some of them."

In May Dudley was appointed by the Government to be a member of a five man committee to review the structure and organisation of the Gas Industry. He takes up the story in his Memoirs. *Returning to England, I began to make arrangements for winding up the SOE activities and returning to College. I had already embarked on one or two civilian enterprises. The Minister of Fuel and Power, a son of Lloyd George, had appointed me a member of a committee to examine the structure of the Gas Industry and make recommendations as to its future. The Chairman of the Committee was Geoffrey Heyworth (later Lord Heyworth), then Chairman of Unilever, and other members included a director of the Metropolitan Water Board, an eminent Chartered Accountant and a Trade Unionist. We discovered the Industry to have a complicated structure - including municipal owned undertakings, others integrated and directed by powerful financial corporations, and large numbers of small works privately owned. There was no national grid and there was a great deal of uneconomic production in inefficient units.*

Although we were a Committee composed of members who, with one or two exceptions, were Conservative in politics, we had to admit that the only satisfactory solution was to nationalize the Industry and bring it under public ownership - and that was our final recommendation. It was accepted, and against strong opposition from the industry itself, was implemented by the next Labour government.

In October 1944 he was approached by A.V. Hill of the Royal Society who

wanted to have a “private talk with you some time about the possibility of your being willing, if invited, to undertake a rather important job in India.” His diary shows that he met Hill on 23 October. Whatever this “important job” was, he didn’t take it.

I was also asked by Courtaulds to investigate the technical aspects of a combined refinery and petrochemical complex, a majority shareholding in which had been offered them for some two million pounds. Their own chief chemist had reported favourably on its prospects but Samuel Courtauld, who had a remarkable intuitive judgement, was far from satisfied.

On inquiry, I found that a company had been formed to exploit an oil cracking process which had been patented by Dr Weissman, the great Jewish leader. The managing director was an Austrian emigré, Dr Kind, who had built up a successful business in Manchester refining oils. On the board was also Dr Tugenhat, a professional economist well known in the city. The company, which had no assets, was registered as Petrochemical Ltd.

Dr Kind was a man of great ability, a most persuasive speaker and with a strong personality. He entertained me royally at the Midland Hotel and spent a lot of time and effort in putting the influence on me. When I came to inquire into what he had to offer for two million pounds, I found an amazing state of affairs. The cracking process, which was the basis of the whole complex, had not even been developed to the pilot plant stage. The whole series of processes by which valuable chemicals were to be manufactured on a large scale, had been taken from a text book on organic chemistry. None of them had been tested on pilot plants and there was no technical know how.

In my report I advised Courtaulds not to touch it and they terminated the negotiations forthwith. Later Dr Kind persuaded Sir Robert Robinson, an eminent organic chemist but one without industrial experience, to recommend a government investment in the project through the Finance Corporation. In the course of the next few years they spent upwards of seven million pounds in

developing the various processes, and eventually sold the whole concern at a knock-out price to the Shell Oil Company.

Return to Imperial College

Dudley left SOE in May 1945 and in November the committee of inquiry into the Gas Industry reported. The same month Dudley was formally offered the newly created Courtaulds Chair of Chemical Engineering at Imperial College. There can be little doubt that Courtaulds endowed the chair specifically for Dudley. In his Memoirs he wrote *Courtauld's were very grateful to me for saving them from major financial disaster and to recognise my help, they endowed a Chair of Chemical Engineering at Imperial College – a Chair which I held until my retirement.* M.R.D. Foot, in the Foreword to *SOE the Scientific Secrets*, put it succinctly. “After the war Courtaulds looked after Newitt, funding a chair for him at Imperial College”. Courtaulds had been closely associated with the work of SOE from the start and Colonel Davis, who headed the branch of SOE of which Dudley's Stations formed a part, was a director. *The cost of endowing a Chair is about £150,000. Trustees were appointed to invest this sum and administer it. They included R.A. Butler, then Chancellor of the Exchequer, Sir George Schuster and Mr Samuel Garland. I used to lunch with the directors quarterly at the head office in St Martins le Grand, and make my report to the trustees in the afternoon. When the rebuilding of Imperial College began I found R.A. Butler a tower of strength in dealing with the Treasury, and my Department was the first of the new buildings to be authorised and completed.*

Dudley and his family

In 1945 Dudley's family returned from Wales and Nanny left, her vocation as she saw it being babies not growing children. Hilary was then seven and Malyn five. Nanny was succeeded by two young Swiss *au pairs* who brought youth and activity to what might otherwise have been a rather dull middle-aged establishment. One of these girls, Ursula, took up riding with enthusiasm

and even got Dudley back onto a horse for the first time since the First World War. Family holidays now became possible and in 1949 Dudley took the family by car to stay at an old mill at Merigny in central France, driving south in his old pre-war Humber through a shabby postwar France which seemed to have changed little since the early part of the century. The following year he hired a small cabin cruiser to go up the Thames from

Weybridge, regaling the family in the evening with extracts from *Two Men in a Boat*.

Then tragedy struck once again. Soon after this holiday Jane, then aged 45, began to suffer the first symptoms of cancer. She was soon seriously ill, spent time in hospital and became bed-ridden. Malyn had by this time been sent away to prep school at Edgeborough.

Dudley now decided that his establishment at Cobham could no

longer be sustained. In 1951 he sold the Fair House and bought a house further out of London near Farnham in Surrey. If the idea was to 'down size' and find

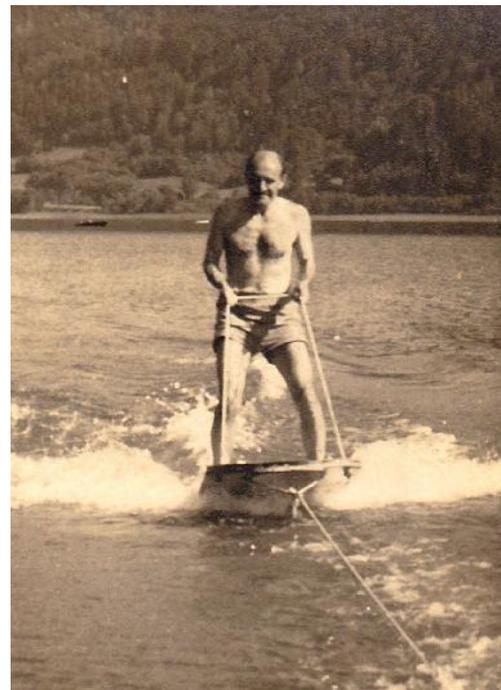


1949 Dudley, as President of the Institute of Chemical Engineers, and Jane receiving guests at the annual dinner.

a home easier to manage and more convenient for the seriously ill Jane, then Hollycot was an odd choice. It was certainly smaller than Fair House but still had five bedrooms and was old, inconvenient and in bad repair. Moreover it was three miles from the nearest town. Jane was more isolated in her illness than ever. Dudley had the house redecorated though nothing could cure its cottage-like darkness. He also threw himself into reorganising the large two acre garden which gradually became a show piece of ornamental trees, shrubs and lawns.

In 1951 Dudley's parents had celebrated their Diamond Wedding and had received a telegram from King George VI. However, shortly afterwards Dudley's mother, who for years had been confined to her one room apartment by crippling arthritis, died. Dudley's aged and very deaf father was now left on his own. For a short time he stayed alternately at Hollycot and with his other son, Eddie, before he himself died in May 1952. With the death of his father Dudley, now head of the family, devoted considerable effort to keeping in touch with distant relations and to establishing Hollycot as an open house for family members to visit.

In 1951, with Jane in hospital, Dudley took Hilary and Malyn on a long drive through Germany to stay in Austria. He maintained that he had secured an additional allowance of foreign currency by claiming that he was carrying out



Water skiing in Austria

research in the Austrian alps. On this visit Dudley stayed in Munich with old friends, the Kogels, who invited him and the children for an evening at the

Hofbrauhaus. The following year he took the children to stay in Stockholm where he attended a Conference.

Jane had experienced a year of remission when she was able to walk around but in 1952 she once again became seriously ill and in great pain. A bedroom was made up for her downstairs for the convenience of doctors and district nurses. With Dudley now busier than ever, and Hilary and Malyn at school, it became essential to find a house-keeper to manage the house. There were some unfortunate choices who did not stay long but eventually a young German woman, who had escaped from East Germany and found employment



Dudley's commentary on Hilary's school career

in Britain, was offered the job. Giesela soon established herself and brought order, efficiency and youthful energy to the house. She also provided care and companionship for Jane in the last months of her life. In April 1953 Jane died. Hilary and Malyn were both at home and had gone to the cinema. They were packed off immediately to the Isle of Wight to stay with their great aunt Daisy and returned to find all trace of Jane gone and their mother to all intents and purposes

forgotten. This was the second tragedy in Dudley's life and he faced it in the same way as the first. Jane, like Alix before her, was never mentioned and no photos of her were kept in the house. Dudley faced towards the future, his memories of his two wives were shut away and for him the past came to consist almost exclusively of his war memories and the doings of his paternal family.

Courtaulds Professor at Imperial College

In 1945 Dudley had returned to Imperial College to take up his academic career. Whereas before the war his work had been largely focussed on research, now he had to assume a wide range of administrative responsibilities to which he added involvement with the affairs of the Royal Society and industrial consultancy. Sir Alfred Egerton was still head of Department and Dudley, a close friend since before the war, became in effect his deputy. In his Memoirs Dudley recalled this period. *I left SOE and returned to College in 1945. The immediate post-war years were a testing period. A great expansion in University education was being planned, the Welfare State based upon the Beveridge Report was being set up, industry was in the throes of changing from a war to a peace time footing. There was a shortage of every kind of raw material and finished product; there was a serious housing shortage and food and clothing continued to be rationed. I had seen the same state of affairs in 1918 and was able to take it philosophically.*

On my appointment to the Courtaulds Chair of Chemical Engineering I began to re-organize the undergraduate courses and bring them more into line with modern requirements. Under Hinchley it had embraced far too wide a field and it was impossible in three years to cover in any detail the large number of subjects included in the syllabus. On my staff were Coulson, Richardson, Hasleden, Rowe and Smith – all of whom later obtained Chairs in various provincial universities.

Hannah Gay's *History of Imperial College London* explains that the undergraduate course in Chemical Engineering, which had been launched in 1937, was at first taught jointly with the Engineering Department and attracted only four students "but after the war it grew significantly, in tandem with the expansion of Britain's chemical industry". The result was "the relative rise in importance of chemical engineering with respect to chemical technology". Dudley was in overall charge of the course and in addition to Coulson and Richardson was

"much assisted by J.S. Oakley a technician who came to work in the department after working on bomb disposal during the war. His interest in explosives and other interesting devices was shared by Newitt and they worked well together. During the Cold War it was Oakley who brought a number of Ministry of Defence contracts to the Department, for things that might more properly have belonged to the mechanical engineering department, or perhaps in a James Bond film. They were jokingly referred to as 'hi-tech pocket tools and cutting keys for a certain sort of burglar' and a device 'for removing without trace seals on diplomatic bags.'" (Hannah Gay, *The History of Imperial College London 1907-2007* p.327)

Clearly Dudley had not forgotten SOE and his war time activities.

Dudley had already established close ties with certain industries before the war and these had been extended when various industries had been called upon to co-operate with the work of SOE. After the war Dudley made co-operation with industry part of his vision for the Chemical Engineering Department at Imperial College. *I also succeeded in establishing a vigorous research school which attracted students from all over the world and led to important industrial connections. To finance the various researches I had to depend largely on outside support which was generously given by many industrial organisations. I should mention ICI, Courtaulds, Shell Oil and the British Oxygen Company. Grants were also made from the Admiralty, the Department of Industrial Research, the Ministry of Fuel and Power and other government departments. In*

all these activities I was actively supported by Sir Alfred Egerton, Head of the Department, and by the Rector, Sir Roderick Hill, and later by Sir Patrick Linstead who succeeded Hill as Rector.

In 1952 Sir Alfred Egerton retired and Dudley became head of the Department. He was 58 years old but still very much in his prime and he remained head of the Department until his retirement nine years later. During this period he oversaw a great expansion of the Department and the planning of the new building to house it, named after Roderick Hill. In an address delivered at Dudley's memorial service, his successor as head of department, Professor A.R. Ubbelohde, emphasised the importance of this expansion of Chemical Engineering at Imperial College as Britain had been backward in this field and "not even fearsome British struggles and sacrifices during the War, which clearly were made worse owing to the technological superiority of her adversaries, had yet imparted very widespread support to corresponding university teaching".

Ubbelohde explained that Dudley managed his greatly enlarged workload by delegating. "Newitt was effective in delegation, where his good sense and kindness were tinged with a delicious irony, as well as a keen sense of quality in others." As the Department expanded so did the range of topics that came under the overall umbrella description of Chemical Engineering. Ubbelohde again – "the multidisciplinary impact from other leading branches of chemical technology was constantly operating within his department, for example, combustion science, nuclear technology, safety, thermodynamics and the properties of materials, and interface science." Could all this be taught to undergraduates and could it even be contained in a single department? "Newitt's leadership and wide general influence played a critical part in fostering healthy intradepartmental reactions. He once stated, in true Fen-man style, that he liked a mettlesome team to drive. However, the problem still remains to challenges us."

Dudley's own research had moved on from the exciting times when he was in

charge of the high pressure laboratory and now focussed on the drying of solids, the behaviour of vapour and gas bubbles and the conveying of solids in pipes. In 1947 he had been awarded the Osborne Reynolds Medal by the Institution of Chemical Engineers and in 1949 was elected its President. Between the end of the war and his retirement in 1961 he published 19 scientific papers, many of them in the *Transactions of the Institute of Chemical Engineers*. Peter Danckerts wrote of his work at this period:

“his physical insight was unerring as he showed in his work on the drying and suction potentials of porous materials, hydraulic and pneumatic conveying of particles, the pelleting of powders, as well as other topics. He had an idea that insecticides should be sprayed as bubbles rather than drops so that they might impinge on the lower surfaces of leaves. He sent some students with suitcases to stand still in busy passages of the Underground where the resulting disturbance of flow could be observed from above (until he was asked by the management to desist).”

Dudley seldom talked about his research at home but made an exception of a series of photographic stills of a bubble bursting, of which he was particularly proud.

In the conclusion of her *History of Imperial College London* (p.741), Hannah Gay singled out Dudley's achievement. "I have mentioned just a few of Imperial's more creative heads of department, but accomplishment comes in many forms. For example, in the form of outstanding inventive genius as demonstrated by Dennis Gabor and Dudley Newitt". However, she did point out that by the time he retired Dudley's apparatus had become dated and today, looking back, one has to remember that all his work was carried out in a pre-computer age.

In 1956 Dudley was appointed Pro-Rector of Imperial College. *Linstead and I had been students together, we had published jointly a number of papers on*



Dudley, Sir Patrick Linstead and the Queen Mother at the formal opening of the Roderick Hill building

high pressure synthesis, and when he became Administrative Head of the College, he appointed me Pro-Rector, a post I held until my retirement. I had to sit on numerous committees and on occasion to deputise for the Rector. I was Chairman of the Refectory Committee, of the Technicians Committee, a member of the governing body, and of the Board of Studies. At London University I was a member of the Board of the Faculty of Engineering and of the Board of Studies of Chemical Engineering. In his role as chairman of the Refectory Committee, Ubbelohde observed, “the kindly if closely watchful attention he received from students and colleagues must have reminded Dudley of much earlier problems of feeding his troops when in the army.” Dudley and the Linsteads were close friends. After Jane’s death Lady Linstead would on occasion take Hilary on a shopping expedition to London to buy suitable clothes and the Linsteads came frequently to stay with Dudley at Hollycot.

A notable feature of Dudley's work at Imperial College was the close links he established with India – inevitably one thinks of the influence which must have been exerted by Dudley's early years in the army in India. Indian students were encouraged to apply and a significant number graduated from the Department - when Dudley toured India in 1962 he was provided with a list of 92 former students from India and 13 from Pakistan. As late as 1974, when he was 80 years old, he was willing to act as external examiner for a doctoral thesis at Banaras Hindu University and to advise the University of the Punjab in Lahore on an appointment to a chair of chemical engineering. Danckwerts later observed:

“when I was at Imperial College one might have felt that the Raj had never been deposed. There were a great many diligent Indian students who could be found working there even on Christmas Day. Newitt was extremely sympathetic to them and I always persuaded him to be one of the examiners for an Indian PhD candidate. I think it would be fair to say that he recognised that the disaster of an Indian returning without the degree in which his family had invested so much was far more serious than any marginal erosion of the standards which might be attributed to London University.”

Later, when Malyn was first appointed as examiner of a PhD thesis, Dudley wrote to him, “remember when you are examining for the PhD to temper justice with mercy. It is a serious matter to fail a man unless you have a very good reason”.

In 1957 the new Roderick Hill Building was formally opened by the Queen Mother, a notable recognition of how far Chemical Engineering had travelled. Dudley had had close personal relations with Roderick Hill when he was Rector and Hill had written a letter of condolence on Jane's death in 1953. After the opening ceremony Hill's widow, Helen, wrote to Dudley thanking him “for looking after me this afternoon. It was a great help and gave me confidence. It was for us a wonderful occasion. I do think my dear Roderick would like to be

remembered in this way. And the Queen Mother, to whom he was devoted, spoke so sweetly of him.... Thank you again immensely. I don't in speaking of my own loss, forget yours".

During the 1950s, when he was head of the Department of Chemical Engineering and Pro-Rector of Imperial College, Dudley was constantly in demand as a speaker and sat on an ever growing number of committees. In 1958 he was invited to give one of the Royal Institution's evening Discourses. In 1959 he gave a formal address at the Distribution of Awards at Slough College of Further Education and in 1960 at the West Ham College of Technology. In 1961, at Brighton Technical College, he gave the Introductory lecture for a series of eight lectures entitled Unit Operations in the Chemical Industry. Dudley served on the Royal Society Council (1957-9) and was appointed one of the Society's auditors. He also sat on numerous Royal Society committees and sub-committees including the Library Committee (from 1958), the Publications Committee (from 1961), the Sectional Committee for Engineering Sciences and the Tyndal Mining Bequest Committee. He was a member of the Royal Society's National Committee for the History of Science, Medicine and Technology (1961-5), the British National Committee for Chemistry (1963) and the Committee on Data for Science and Technology and was representative of the Royal Society on the General Board of the National Physical Laboratory and the Science Advisory Committee of the British Council. In 1960 he was elected Fellow of the City and Guilds of London Institute.

Acting as Pro-Rector and head of department, carrying on his own research, supervising students, examining and sitting on a myriad of committees took their toll. In November 1959 Dudley wrote to Malyn at Oxford, "I am having a very busy time just now. I spent Friday in Newcastle inspecting the Railways – next week I go to Cambridge and dine at Emmanuel & then we have the Royal Society Anniversary Dinner. I am very tired of it all and would like to retire as soon as possible."

Dudley's work outside Imperial College

After the war Dudley's experience and contacts were much in demand. He wanted to link the academic work of Imperial College with the wider needs of the country and, as he was a skilled and tried committee man, he readily took on a wide variety of commitments in the public sphere. Dudley was an unrepentant heir of the Enlightenment. He saw no reason to confine himself to his own area of expertise for he believed that rational thought and the application of scientific method could be used to resolve problems of all kinds. He was soon actively involved with committees dealing with a wide range of public policy from fuel and energy, to water pollution, the railways and the eradication of tsetse fly, even though he was not an expert in any of these fields.

The cessation of hostilities in 1945 left the various Service Departments in a highly activated state. They set up numerous committees to formulate and direct research programmes of a most varied kind. I was a member of a number of Ministry of Supply Committees, Admiralty Committees and advisory bodies which, as time went on, gradually lost impetus and finally disappeared. Whilst they lasted, however, they occupied a lot of time including that of formal meetings, visits to research stations all over the country, digesting masses of reports and giving advice. In connection with one of the Admiralty assignments I organized and directed an extensive research programme into the removal of carbon dioxide from submarine exhausts. This led to the development of highly efficient scrubbing devices which later had important industrial applications.

With the cessation of these service commitments, others in the field of civil research assumed a growing importance and continued to occupy much of my time. I can here only mention a few typical examples. As a

member of the Scientific Advisory Council of the Ministry of Fuel and Power, I was involved in the planning of Fuel Policy and of long term developments in the Gas, Coal and Electricity industries. I expended a great deal of effort in trying to obtain an integrated policy based on forecasts of future energy demands – as distinct from allowing the three energy producing industries to compete with one another irrespective of the national interest. Since those days I have constantly emphasised, to a succession of ministers, the importance of recognising that forecasts of the national energy demand and supply form the basis of all other forecasts and determine future economic growth. I have also endeavoured to show that forecasting should not be considered as a series of inspired guesses but requires expertise of a high order to determine the various interactions upon which the final conclusions can be reached. There are signs now, in the late sixties, that the Government is beginning to realize that its long term planning must depend on reliable figures of growth and that some central department should be given the responsibility for producing and keeping up to date the necessary statistics.

The Scientific Advisory Council was set up by Hugh Gaitskell when he was Minister of Fuel. It had 12 members and was chaired by Sir Alfred Egerton. It was to “advise the Minister in developing coal, petrol and other fuel sources in Britain and in promoting economy and efficiency in fuel supply, distribution and consumption”. Later Dudley was to chair another advisory group for Gaitskell’s successor, Harold Wilson (see appendix).

I was also asked by the old Colonial Office to act as Chairman of a Committee to enquire into means of controlling the tsetse fly in Africa and to suggest a research programme which might be put into effect in the field. The tsetse fly is found in many large wooded areas but little was then known as to its habits and density distribution. Three lines of action resulted from our preliminary studies, namely –

- a. To carry out a fly census in a particular area*
- b. To then spray the area with insecticide from low-flying aircraft and redetermine the fly population*
- c. To repeat (b) a number of times to determine whether a total extermination of the fly was feasible*

On more general lines, I was anxious to inaugurate a long term research into the possibility of discovering attractants which would concentrate the fly population in a very small area and so facilitate the effective use of insecticide. Extensive spraying operations were carried out and demonstrated that complete extermination of the fly was possible, though at a rather heavy cost. The work of the committee was terminated before the 'attractant' programme had been completed.

I later became a member, and for five years was Chairman, of the Water Pollution Board. The water pollution research station had recently been moved to new quarters near Stevenage and, under its Director, Dr Southgate, was engaged in setting up standards of purity for effluents discharging into rivers. These formed the basis for regulations imposed by the newly created River Boards and have since been responsible for a major improvement in the state of many of our rivers. A major task of the station was to examine the state of the Thames estuary, which for long stretches was completely polluted. I was a member of the Thames Survey Committee set up by the Port of London Authority to recommend measures for a progressive improvement in the river and a general tightening up of controls. The report of this committee is a comprehensive and authoritative volume, many of its findings being applicable to other highly polluted estuaries. In the course of our investigations, we frequently had the use of the Port of London launch and had many pleasant days cruising up and down the river inspecting various reaches below Tower Bridge.

When his five years as chairman of the Water Pollution Research Board ended in May 1956, Lord Salisbury wrote a letter of thanks, recognising that "this is only one of the many ways in which you have in the past, and still are helping

in the application of scientific knowledge to the public good". However, Dudley remained a member of the Thames Survey Committee until at least 1963. In his Memoirs Dudley recalled that Salisbury "*used to tell amusing stories about the American occupation of Hatfield House during the war. When they requisitioned the house, they had the water tested and reported that it was so polluted that it could not safely be used even for washing floors. Salisbury remarked rather sourly that he and his ancestors had been drinking it for several hundred years without any ill effect*".

In 1947 Dudley wrote to Professor Simons, "the Department of Scientific and Industrial Research have set up a Mechanical Engineering Research Board to advise generally on research to be undertaken in the field of mechanical engineering. The Board will be setting up in its turn a number of sub-committees to deal with various aspects of the subject and one of these, to be known as the Thermodynamics Committee will be under my Chairmanship. The function of the Committee will be to review the present situation in regard to data upon the Thermodynamic properties of gases and vapours" He invited Professor Simons to become a member.

Another sphere of activity with which I was concerned was the re-organization of our railway system, the introduction of diesel locomotives and the electrification of the main line. I was elected member and later became Chairman of the Scientific Advisory Council set up by the Railway Board. Joined with me were Sir William Stanier – the doyen of railway engineers, and at eighty years of age, alert and vigorous, Sir Thomas Merton, for many years Treasurer of the Royal Society, Sir Charles Goodeve, and Professor Jones. Sir Brian Robertson, Chairman of the Board usually attended our meetings. We soon found that senior officials of the railway, brought up on the tradition of steam, accustomed to regard the railways as having a monopoly position, and generally ignorant of modern engineering and technological advances, were actually resistant to all

change. The railway research laboratories were starved of funds, inadequately staffed and poorly equipped.

We were faced with the task of identifying problems which called urgently for solution, with enlarging facilities, enlisting research engineers and scientists of standing and framing programmes designed to increase efficiency in all branches of the service. Amongst items to which particular attention was given was the design and operation of marshalling yards, improvement in the braking systems of good trains, the riding qualities of passenger coaches, vibration and noise, the re-design of couplings, automatic signalling and ventilation and air conditioning. Our interests extended also to the docks and methods of handling cargoes; and at Hull we initiated a programme of research into the silting up of the Humber and the techniques of dredging. Generally speaking, we gave the railways a good shaking up and radically changed the attitude of the senior officials to innovation.

The Advisory Council was eventually wound up by Beeching who explained in a letter to Dudley that “the requirements for research must spring directly from recognition of the technical problems emerging from the Board’s own commercial operating objectives”. Beeching was clearing away the obstacles to implementing his massive closure programme. Although he says nothing about this in his Memoirs, Dudley always thought Dr Beeching, whose period as chairman of the British Railways Board saw the wholesale massacre of large parts of the rail network, was essentially sound as he was a scientist by training - and an Imperial College man.

My connection with the coal industry dates from the time when the mines were nationalised and I acted as expert in various claims for compensation by the owners. Later I became a member of the Awards Tribunal, a body set up to make monetary awards to miners and mine officials – for inventions leading to greater safety and improved productivity. This Tribunal

was first under the Chairmanship of Sir Ernest Gower and later Sir Andrew Ryan. Since the inception it has made numerous awards, some which run into thousands of pounds. It has aroused at all levels in the industry, a spirit of initiative and inventiveness which cannot but react favourably upon the efficiency of its operations. Dudley remained a member of the Awards Tribunal until well into his 80s. In 1956 he had been awarded the Fifth Coal Science Medal by the British Coal Utilisation Research Association

After the war a large part of Dudley's time was taken up with his membership of the numerous committees to which he was appointed. On many of these committees he sat as representative of the Royal Society but to others he was appointed by various governments in view of his scientific standing and his reputation for having run SOE's Station IX during the war. On those Committees where Dudley acted as Chairman, he presumably played a significant role in their work and in formulating their decisions. However, one wonders why he was so willing to sit on so many of these bodies when he was head of the department at Imperial College and when he was still involved in active research programmes. Was it that he felt he had something definite to contribute or was it simply so that he could remain informed and fully up to date on the ways in which science impinged on public affairs?

Reina del Pacifico

In 1948 Dudley appeared as an expert witness before the Public Inquiry into the explosion on board the liner *Reina del Pacifico*. This catastrophe, in which 28 people were killed, is still very much alive in the corporate memories of marine engine builders. The *Reina del Pacifico* had been built by Harland and Wolff in 1931 as a luxury passenger liner of the

Pacific Navigation Company. It had first hit the headlines in 1936 when Ramsay Macdonald, the former British prime minister, died on board during a cruise. The ship had been requisitioned during the war and had served as a troop carrier in the Mediterranean and the Indian Ocean, surviving attacks by Italian and German war planes. So it was already famous when in 1947, while still undergoing trials after a refit, a massive explosion and fire occurred in the engine room. Dudley recorded his experiences of this case in his Memoirs.

During the period 1945-60 I was involved, as expert witness in numerous legal actions. On many of these my old colleague Townend was joined with me although on occasion we acted in opposition. As an example of the latter was the celebrated case of the Reina del Pacifico. This fine passenger liner had been undergoing a complete refit in the Belfast yards of Harland and Wolff, and had then to pass acceptance trials. During these trials the engine room was manned not only by the crew but by a number of experts who had been involved in the refit. Soon after the trials commenced, a disastrous explosion occurred in the engine room resulting in most of the staff being either killed or badly injured. When I inspected the ship some days later, I found the engine room a complete wreck and every evidence that an explosion, originating on one of the crank cases of the diesels, had spread with increasing speed and violence through all the remaining crank cases, forcing open all the crank case doors. After an extensive examination of the damage, I was able to locate the source of the explosion and arrive at a satisfactory explanation of the reason why it had spread with such disastrous results. This, however, did not end the matter – large sums of money were involved, both for compensation and for reconditioning the ship, and I was not clear whether liability rested with Harland and Wolff or with the ship owners. I was acting for the owners, Townend for the Ministry of Transport, who had set up a Court of Inquiry.

The Court met in Belfast [in 1948] and the hearing lasted some three weeks. Eminent counsel from London and Belfast were briefed, numerous witnesses were examined and cross-examined, and the expert witnesses underwent a

cross examination unexampled in its severity and duration. I was myself under attack for nearly two days, and my evidence was admitted to have been decisive and to have fully satisfied the Tribunal.

Dudley's private papers contain his own notes on the disaster as well as press reports. Among the latter is a lengthy account of his cross examination which appeared in the *Daily Telegraph*.

“the first witness [Dudley] called by the Pacific Navigation Co., Liverpool, owners of the vessel ... was again cross-examined to-day on his theory that the explosion originated in port outer No 2 crank case, the pressure wave then travelling to the starboard side of the engine-room. He stated that he had tried for years to measure the weight of such waves and had not yet succeeded. Accordingly he was unable to estimate the weight of the pressure as it emerged from the crank case or as it was deflected off the doors of the other crank cases. He refuted the suggestion of Mr W.W.B. Topping KC (for Harland and Wolff) that his opinion had been coloured on earning at the outset of his inspection of the engine-room that the explosions had started there. He also expressed the opinion that the starboard outer engine casing was fractured by vibration and not by blast....”

Expert witness

As a by-product of this case, I was asked to investigate the causes of crank case explosions by the Shipbuilding Research Association, and to make recommendations for safety precautions in the event of their occurring whilst ships were at sea. One of my colleagues, J. Bergoyne, was associated with me in his work and as a result of the paper we read before the Institute of Marine Engineers, we were presented with its medal.

One of our recommendations related to the fitting of 'bursting disc' relief valves. The theory of bursting discs was then but imperfectly understood; they were coming into widespread use in all kinds of industrial plant, and I was

asked by the British Standards Institute to draw up specifications for their design and use.

In collaboration with one of my students, A. Munday, I carried out an extensive investigation into the mechanism of the rupture of thin discs subjected to sudden compression waves, and was able to formulate a satisfactory theory – details of which we later published in the Philosophical Transactions of the Royal Society.

For several years, Townend and I were retained by the British Oxygen Company as expert witnesses in cases where damage was caused by the explosion of acetylene cylinders. These explosions, which usually occurred in confined premises, caused an immense amount of damage and the question of liability was hotly contested and often difficult to determine.

Our reputations as expert witnesses grew rapidly and we began to be employed by Insurance Companies in all cases of unexplained fires and explosions. The enquiries were often involved and time consuming and eventually I had to take a firm stand and refuse to act any longer.

Sometimes these cases verged on the absurd. In November 1964, Dudley wrote in a letter to Malyn, “I have just returned from a short visit to Ireland where I had to give evidence in a legal case. All the witnesses on my side were habitual criminals and one was arrested immediately he left the witness box. Our key witness was kidnapped on the night before the trial so we were severely handicapped at the very start.”

Consultant for Shell in the Caribbean

In February 1955 Dudley was guest at the annual dinner of the Institute of Refrigeration, replying to the toast ‘Science and Industry’ proposed by A.I. Anderson of the Orient Steam Navigation Company. The same year he travelled to Venezuela as a consultant for Shell. He described this visit in some detail in his Memoirs. *One interesting tour I made was to Venezuela at the invitation of the Shell Oil Company, to inspect their oil fields and refineries. I was joined by*

Professor Bawn of Liverpool University. I travelled to the Caribbean by sea, accompanied by Hilary and Malyn whom I left at Barbados, whilst I went on to Caracas. Dudley had known Cecil Bawn during the war when Bawn was head of the Physio-Chemical section in the Armament Research Department of the Ministry of Supply.

Venezuela is a country economically based upon oil, the capital is a luxury town with modern hotels, country clubs and magnificent shops. It has recently built an impressive new University which, although short of students, has well equipped laboratories and workshops and large, beautifully designed, lecture theatres. It was tantalizing to see all these facilities available and only partly in use, whilst at home, our Universities were overcrowded and, in many cases, sadly out of date.

Bawn and I toured the country, generally travelling by air, but sometimes by road. We spent sometime at Maracaibo inspecting the off-shore drilling and visiting neighbouring refineries. The oil companies have to assume responsibility for providing many social services including hospitals, schools and housing for the staff. They are committed to employing a large proportion of Venezuelans at all levels, and are very closely controlled in all their activities by government inspectors. The principal language is Spanish. The native Indian population has not, in general, profited by the immense wealth derived from the exploitation of the oil resources. They continue to lead a primitive life in shanty towns and show no desire to improve their standard of living or change their habits. Bawn and I had some good sea fishing some miles off shore and landed some outsize specimens of unknown species.

From Venezuela I went by air to Trinidad where Hilary and Malyn joined me. We toured the island, visiting the famous asphalt lake and some of the oil fields in the interior. Trinidad is becoming a favoured holiday resort, there are good hotels, race courses and other amenities, and the climate is agreeable and not too hot. It is noted for the quality of its rum and the great variety of rum based short and long drinks.

Congress informed of scientific and technological change likely to affect the worker and the security of his employment. Here I met many of the outstanding figures in the Labour movement – George Woodcock, the General Secretary, Frank Cousins, Ted Hill, Lord Lewis and Lord Carron.

Congress is much concerned about the implications of automation, the impact of the human sciences and the part trades unions should play in management. I find that congress has enlightened views, is not blinded by prejudices inherited from the past, and genuinely wishes to support all measures designed to remove restrictive practices and introduce a greater degree of discipline amongst the working population. It realizes, however, that its powers are limited and that a considerable time must elapse before, through higher education and improved conditions of living, a more co-operative attitude between labour and management can be achieved. It has given strong support to my recommendations regarding a national energy policy and a central forecasting organisation. I am myself a member of the Association of Scientific Workers and served for a term as President.

*Whilst in opposition, the Labour Party, first under Gaitskell and later under Wilson, set up a committee to advise them on aspects of scientific policy. Its members included C.P. Snow, P. Blackett, Bronowski, Ben Lockspeiser and myself. Amongst politicians who attended our meetings were Robens, Greenway, Jim Callaghan and Dick Crossman. We used to meet at the National Liberal Club or in a private room at the Savoy Hotel, dine and hold our discussions in a relaxed atmosphere over cigars and brandy. Hannah Gay in her *History of Imperial College London*, describes what must be the same committee, but with slight variation as “an informal group of scientists and engineers which met under the auspices of the Labour Party, often at the Reform Club. Their aim was to develop a scientific and technical H. Florey, J. Huxley and Imperial’s D.M. Newitt. Harold Wilson attended as representative of the party leader, Hugh Gaitskell”. This was distinguished company.*

The return voyage on board the French liner *Antilles* was brought forward so that the ship could run safely before the hurricane that was imminent.

Dudley's links with the Labour Party and the Trades Unions

After the war Dudley formed close links with the Labour Party. In his younger days he had been a member of the Fabian Society and was a lifelong admirer of Bernard Shaw. His wife, Jane, was an active member of the Labour Party and worked for a trades union during the war. In a letter to Hilary, Jane's old school friend, Ruth Payne, remembered that they always used to tease Jane for being a "red". His close friendship with Sir Alfred Egerton brought him into contact with Ruth Egerton and her brother Sir Stafford Cripps, the Labour Chancellor. Dudley, along with many others, hoped that the Labour Party would be a modernising influence in Britain, applying what today would be called 'evidence based criteria' to a range of technical and social issues in the post-war period. In 1948 Hugh Gaitskell, who Dudley had known during the war when Gaitskell was Hugh Dalton's assistant, appointed Dudley as a member of the Scientific Advisory Council attached to the Ministry of Fuel and Power. In 1950 Dudley, as a member of the Chemical Engineering Subcommittee of the Technical Personnel Committee, submitted a report to the Ministry of Labour and National Service. In 1951 Philip Noel Baker, then Minister of Fuel and Power, wrote to Dudley that a Fuel Efficiency Advisory Committee had been set up and asked if he would be willing to serve as a "member in a position to report the view of the Trades Union Council". Dudley's name had been put forward by Sir Vincent Tewson, president of the TUC. In 1951 Labour lost the election to the Conservatives but Dudley remained closely in touch with the Labour Party in opposition and with the Trades Union Congress.

In his Memoirs Dudley described his involvement with the Trades Unions and the Labour Party. *I have, for many years, been a member of the Scientific Advisory Committee of the Trade Union Congress – a body which keeps*

re-capturing and maintaining technological initiative after the war. Also drew attention to the importance of Science and Technology in relation to economies and policy making”. Privately, on the long walks which he took with Hilary and myself, he expressed other, more global, concerns. I remember in particular discussions about the world population growth and his stark warnings about the dangers of nuclear power generation. He was convinced that the dangers that this would present to the very survival of the planet far outweighed any temporary economic or political advantages nuclear power might have.

Nevertheless, it was obvious to me and my sister, being brought up in close contact with him, that, although he regularly read the *Daily Telegraph* (he did its crossword on his daily commute) he had deep general sympathy for many of Labour’s ideals. Although he enjoyed the good life of dining, wine tasting and foreign travel, cultivated many ‘establishment’ tastes, ranging from antique collecting to fishing and sent me to the most prestigious private school in the country, he himself was firmly rooted in his own past which had included an education at Wandsworth Technical College (not Eton like Sir Alfred Eger-ton) and service as a private in the East Surrey Regiment in India. He had worked himself up to a position in which he could enjoy many of the privileges of the ‘establishment’ but without ever forgetting or ignoring his roots. As Courtauld’s Professor of Chemical Engineering and Pro-Rector of Imperial College he had many speaking engagements and it is significant that among the invitations he kept were those from ordinary Technical Colleges and schools, though he declined an invitation to become a governor of Hatfield College of Technology on the grounds that Hatfield was too far away for him to attend meetings. Danckwerts recalled that “his philosophy, as he told me several times, was ‘It’s not money or titles that count, but privilege’”. This is an enigmatic, even Delphic, utterance. Did he mean that it was privilege that counted for him, or that it was privilege that counted more than money or titles in the wider English society? In a letter to Malyn, written in June 1963, Dudley reflected on a broadcast by A.J.P. Taylor – “He is extremely good as a lecturer

In 1963 Crossman invited Dudley to attend a “week-end conference...which Harold Wilson and James Callaghan have said they will attend” to discuss the conclusions of various groups dealing with science policy. “This is to be a private conference, limited to a small number of people, to enable discussion to be frank and useful”. In a letter to Malyn dated 29 June, Dudley wrote, “I have had a political week – dining with Harold Wilson on Monday, Dick Crossman who is I believe an old Wykehamist and also a ceremonial dinner at B’ham Palace. The pictures in the palace are really superb and there is a lot of chinoiserie collected by George IV and very attractive”.

Shortly before Labour came into power in 1966, Wilson asked me to take the Chair at a Committee to draw up a fuel policy statement. There had, in the previous ten years, been numerous committees with much the same terms of reference and several long reports had been published which dealt mainly with detailed programmes of research for the coal, gas and electricity industries, but also produced forecasts of future supply and demand. Even in the course of a few years these forecasts had been shown to be wildly out and this circumstance had led to the belief that forecasting was, at best an unreliable basis for the formulation of long term plans. Our report differed from all previous ones in that it was based upon an integrated policy, in the short term covering the period 1965-80, and in the long term 1980-2000; and furthermore it recognised that a national energy policy must take into account the global growth of energy demand. (See appendix).

Dudley seldom commented directly on party political matters and certainly did not subscribe to any political ideology. His publicly expressed views were always on scientific matters or on questions where scientific evidence needed to be brought into play. He was firmly of the view that ‘evidence based’ policies were essential whichever party was in power. This is made clear in the Personal Record that he wrote for the Royal Society, where he summed up his work in the public sphere – “Did much to arouse Industry to the importance of

but he seems to have a bee in his bonnet about class distinctions at Oxford and at the public schools. I believe class distinctions only exist when you are looking for them or have an inferiority complex of some kind. In any case life is too interesting to bother about such trivialities”.

Over a twenty year period from the end of the war to the mid-1960s Dudley worked closely with leading figures in the Labour Party and in an appendix to his Memoirs he summed up his experience of two of them. *Gaitskell was one of the most intelligent politicians I ever met and he handled the committee firmly and wisely. I recall when Bronowski and Snow presented a document which was a characteristic hotch potch of science and economics, Gaitskell told them firmly to confine themselves to science and leave economics to the politicians. Wilson on the other hand, was less convincing. He seemed to come under the spell of fluent speakers like Bronowski. He did not seem able to weigh evidence and make his own decisions. This led him into grave difficulties in his first term of office. One of these was due to his handling of fuel policy. He had appointed me Chairman of a Fuel Policy Committee, which consisted of scientists and economists. We produced a report which forecasted a grave situation when the oil producing countries realized the stranglehold they had on the developed countries of Europe and America. We concluded that by 1980 they would have raised the price of oil to such an extent that coal would again become fully competitive as a source of energy. In the interval we recommended that the coal industry should not be run down but should, if necessary, be subsidised so that it could be rapidly expanded should the necessity arise.*

I had several talks with Wilson and Richard Crossman on this matter but they were then in the hands of economists who could only see the short term advantage of cheap oil supplies on rapid industrial growth. Wilson has since admitted publicly that he made a wrong decision. Between 1950 and 1965 I constantly maintained to a succession of Ministers, the vital importance of energy supply and the need to create a strong Ministry of Energy – including all

branches of the energy producing industries. It has taken the oil supply crisis of 1973 to bring about the desirable change.

In 1956 Dudley served as President of the Association of Scientific Workers, one of the unions that later formed ASTMS. His address to the Council was published in full in the *Association of Scientific Workers Journal* (July 1956) and shows clearly where he stood with respect to the political issues of the day and how he thought science related to Britain's future. He starts by a general reflection on the government's inability to deal with inflation which has "led to another series of those hastily improvised measures which governments always adopt when their strategic planning is at fault". First and foremost the country needed "greater scientific manpower. We have to provide facilities for training all grades of scientists, technologists and technicians in much greater numbers than ever contemplated in the past". He contrasted the Soviet Union's training of 78,000 technicians a year with the 9,000 trained in Britain. The solution had to lie with schools and the training of teachers and with parents allowing their children to continue at school. Pay of teachers needed to increase and the funding spent on research also needed to grow. It is a long address that covers all the fields of interest to the Association but there was always a strong element of consistency in Dudley's thinking which focussed his address to the union on issues of strategic planning, the training of scientists and engineers and on the marriage of academic research to the needs of industry.

In 1969, when the Association of Scientific Workers was about to amalgamate with ASTMS Dudley was one of the Honoured Guests at the Golden Jubilee dinner, alongside Lord Penney and Ian Mikardo.

Retirement

In 1961, having reached the age of 67, Dudley retired from his academic position. He was given a magnificent Chinese cloissone table as a leaving gift and Courtaulds had the leading silversmith of the age, Gerald Benney, make a rose

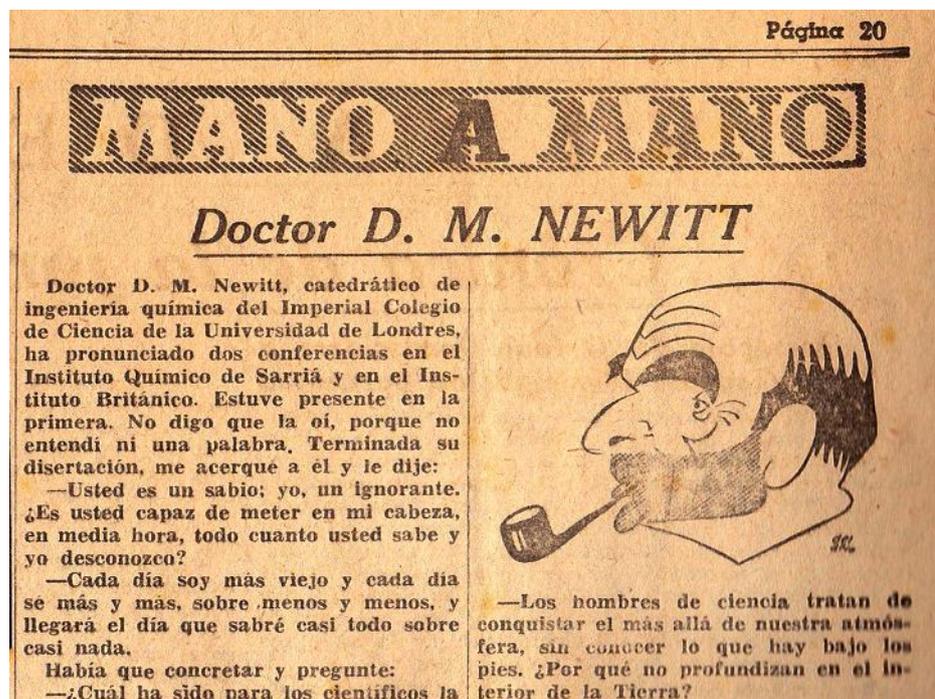
bowl as a token of their gratitude and long association. Dudley was elected Fellow of Imperial College and in September 1961 was awarded an honorary degree by the University of Toulouse. In 1969 he received an honorary doctorate from the University of Bradford in the company, among others, of Tony Benn who was honoured on the same occasion.



*Dudley receives an Honorary Doctorate from the University of Bradford.
Tony Benn stands immediately next to him*

However, one aspect of Dudley's life did not end with retirement – his advisory role on numerous committees. In 1962 he was invited by the Foreign Office to serve as a member of the British side of the Mixed Commission set up under the Anglo-Spanish Cultural Convention. In 1963 Dudley's membership of the Advisory Council on Research and Develop-

ment, Standing Committee on Fuel Technology, came to an end. Lord Fleck of the Ministry of Power wrote, "As Chairman of the Council I fully share the views of my colleagues on the high value they attach to the advice and help we have received from you and other members of the Committee." Edward Boyle, Minister of Education,



Cartoon of Dudley in a Spanish newspaper

also wrote a letter of thanks as Dudley's term as member of the Science Museum Advisory Council came to an end. However, as he ended his membership of one body, he took membership of others.

Dudley's retirement was marked by his being appointed to the Board of Albright and Wilson. He wrote of this in his Memoirs. *My old friend, Sydney Barrett, Managing Director of Albright & Wilson Ltd., invited me to join this Board and I remained a Director for some four years and later was retained as a consultant. This was, for me, an unusual and fascinating experience, giving an insight into the top management of a large industrial concern with branches in India, Australia and Canada. My services as director coincided with the period of 'take overs' by which many large organisations, based*

upon a monopoly position, sought to diversify their interests. Amongst my colleagues on the Board were Dr Schon, later Lord Schon, the founder of the firm of Maichin Ltd., Reeve Angel, Wansbrough Marchon Jones, Threlfall, Nevil Wilson and Arthur Albright. I must confess that the glimpses I obtained of the stresses and strains of industrial life made me thankful that I had adopted an academic career.

In 1962 Dudley was awarded the Royal Society's Rumford Medal "for distinguished contribution to Chemical Engineering", and received scores of congratulatory messages from academic colleagues and research institutions.

In his Memoirs Dudley reflected on his retirement.

At the time of my retirement, the Department of Chemical Engineering was in a flourishing state, all vacancies in our undergraduate school were filled from a long waiting list, we had a large post-graduate school, and we had established a number of short courses in advanced technology open to qualified persons from industry. Amongst our researchers, Professor Gayden and Dr Cullis directed work in the field of combustion, Bett and Weale the work on high pressure technology, Fraser and Eisenblaum work on fluid mechanics, and Ubbelohde on solid state physics. In addition, I had a staff of young and enthusiastic scientists and engineers, many of whom have since obtained Chairs in this country and abroad.

I was, in terms of service, the senior member of staff of the College, having spent the whole of my active career, either at the Royal College of Science or the City and Guild College. I was appointed Emeritus Professor of Chemical Engineering in the University of London, Fellow of Imperial College and Fellow of the City and Guilds Institute. In order to retain my connection with the College I was appointed a research fellow with accommodation in my old Department.

Looking back, I feel that I have had a most satisfying career – indeed, in many ways beyond my deserts. Whilst not financially lucrative, it has given

me opportunities for carrying out work in which I have been keenly interested, I have made numerous friends amongst my colleagues and many of the most eminent scientists of the day, and I have taken part in many of the great events which have marked the first half of this turbulent century. And so I come to the last phase which must now in the natural course of events be drawing to a close.

Dudley's opinion that the "*Department of Chemical Engineering was in a flourishing state*" was not universally shared. Hannah Gay sums up the situation when she wrote, "it is probably fair to say that by 1960 the department had lost its reputation as the leading chemical engineering department in the country". If this was indeed the case, it was in part due to the radically different ideas of Dudley and his successor as head of Department, Paul Ubbelohde, who had been head of the department of Chemistry at Queens University Belfast. According to Hannah Gay "the problems between Ubbelohde and Newitt had almost led to the splitting of the department". Whereas Dudley was a chemical engineer who believed that the teaching and research of the Department should be closely linked to the industry and its needs, Ubbelohde was a Chemical Technologist who thought that the Department should concentrate on pure research. If professional relations between the two were "strained", as Hannah Gay asserts, in private they remained good friends. Ubbelohde was a frequent visitor to Dudley's home at Hollycot, arriving in his Bentley, and he and Dudley shared a common taste for wining, dining and antique collecting. In September 1964 Dudley wrote to Malyn, "I have just been spending two days with Ubbelohde. We had one sea bathe at Winchelsea & another at Bexhill – the water cold but very bracing. Then we did a round of the junk shops driving up in his superb Rolls Royce [actually a Bentley]... His farm is now quite interesting with vast numbers of pedigree pigs and sheep". Gardening was a topic on which Ubbelohde deferred to Dudley's superior knowledge and as late as 1978, when they were both well into retirement, Dudley was arranging for trees to be sent from a nursery to Ubbelohde's country house at

Burwash. In 1978 Ubbelohde wrote a letter of protest to Dudley to when Professor Sargent, the new head of Department, refused to renew his Senior Research Fellowship.

Dudley also got on well with Ubbelohde's dazzling and formidable secretary Georgina Greene, who became a dominating influence in the Department. Georgina had a two-way mirror connecting her office with that of Ubbelohde and vetted all those who wanted to speak to the head of Department. She worked with Dudley on the design and decoration of the Senior Common Room in the Roderick Hill building. In February 1968 Dudley wrote to Malyn, "we have bought several fine pictures for an SCR at College – a good Bonnington – a Brangwyn and a fine Sultanabad Persian plate – 16th century". A card from Georgina, written in November 1975, is typical of the friendship that long outlasted retirement from the College.

"Sunday is quite convenient and I very much hope you will stay for luncheon here, after all the chores are finished. Should you by happy chance see some wall flowers and bulbs, they would be so welcome too, but only if it's utterly no trouble to you. I look forward to seeing you, With love Georgina."

Another letter in May 1976 again invited Dudley to lunch and "I will try to get hold of Paul [Ubbelohde] and Ruth [Egerton] too". As well as maintaining social contact Georgina tried to enlist Dudley's help when she applied for the post of General Secretary of the Institution of Chemical Engineers, stating in her letter of application that she had been presented at Court, had attended



Dudley and Paul Ubbelohde

functions at Buckingham Palace, knew two former prime ministers and had designed and built stables for Thoroughbreds!

When Dudley retired he had been working at Imperial College for 42 years and he was to remain actively involved in research, examining and supervising students until his death 19 years later. Few people spent more than sixty years of their life at Imperial and in many ways Dudley embodied the qualities that made the College unique. Hannah Gay, in the conclusion to her *History of Imperial College London*, sought to explain the ethos of the College. She emphasised how tradition, embodied in the constituent colleges which had come together to form Imperial, and in the long established Departments gave a strength and solidity to its achievements. Dudley always identified strongly with the Chemical Engineering Department which was in many ways the community where he felt most at home and whose students became a sort of extended family. Hannah Gay also laid great stress on the independence enjoyed by Departments and on the tradition of teamwork rooted in the ethos of the College, to illustrate which she singled out Professor Bone and his team, of which Dudley had been a leading member. For Dudley the Department was the port of embarkation for his numerous enterprises in the world of science, consultancy and education which took him literally all over the world – but always to return to the Department which he believed held the secret of how the chemical engineers that were needed around the world could best be educated.

Dudley in retirement

Since Jane's death in 1953 Dudley's life, off duty, had settled into a pattern that admirably suited his personality. He never remarried but always seemed able to find women to manage the domestic side of his life. He had long cultivated a kind of helplessness where household matters were concerned and was never seen to so much as boil a kettle to make a cup of tea. His young German housekeeper remained until 1956 and she was succeeded by a diminutive but sweet tempered and very efficient Swiss woman called Frieda Gruneisen. In

spite of her isolation in the dark woods around Hollycot, Frieda looked after Dudley for the best part of seven years, once again bringing an element of



Hilary

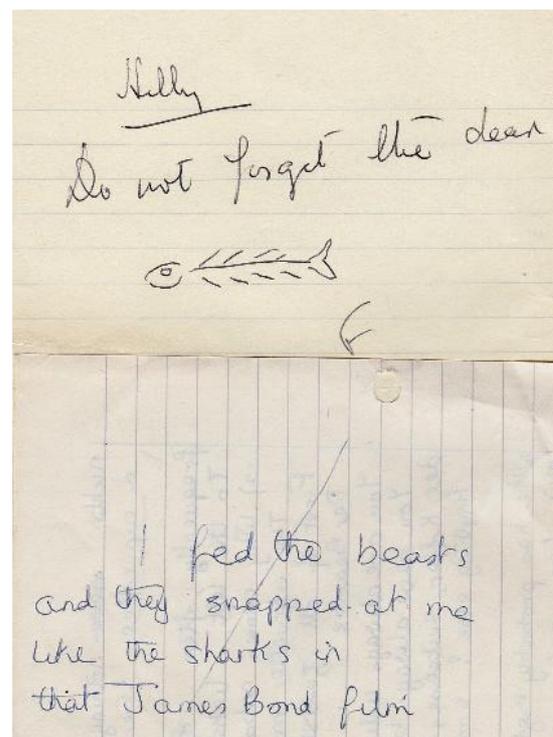
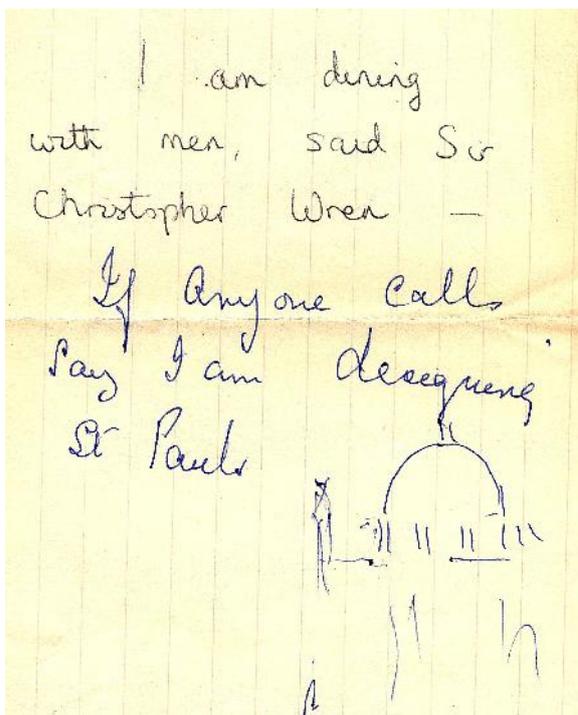
Germanic order to his daily life. Frieda took an old fashioned pleasure in such things as home cooking, making Christmas biscuits and polishing antique furniture, which suited Dudley's increasingly old fashioned tastes. The house was always clean and tidy, and sometimes even warm, when the professor was at home spending his weekends working in his garden and sitting in his favourite chair by the fire, hand resting on the head of a bronze French maiden which in time was burnished into a glistening yellow.

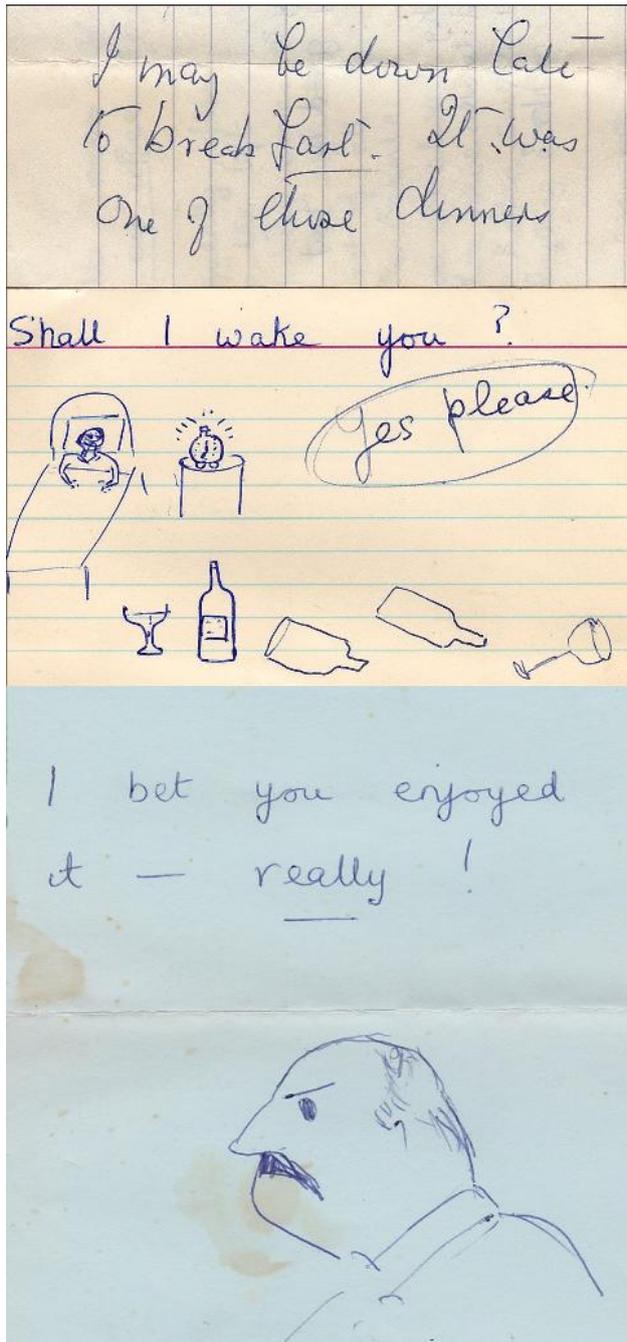
Dudley's appearance had not changed much for thirty years, and generations of students and colleagues instantly recognised the large bald crown, the shortish stocky build and the pipe. Always the pipe. Dudley was never to be seen without his pipe and the scent of Players Navy Cut in the air always gave away his whereabouts in the garden, while the house was richly perfumed in tobacco smoke. Smoking, however, took its toll in winter when heavy colds turned into bronchitis and breathing difficulties, which sometimes kept him housebound. Otherwise Dudley remained remarkably healthy and active until well into his eighties.



Dudley and Hilary

Hilary was also resident at Hollycot. She had studied at Imperial College and had enrolled for a PhD in the Chemistry Department where Dudley's nephew, Jimmy taught. However, Hilary did not achieve much success in experimental work and left with an MSc rather than a PhD. She then worked for the Leather Institute and for ICI as a chemist until in 1976 she met and married Nick Earl and finally moved out of her room in Hollycot. Although Hilary and Dudley were deeply attached and shared many values in common – not least a 'left wing' orientation in their thinking and an admiration for the plays of Bernard Shaw. Hilary always felt that she was in some ways a failure in his eyes, a failure socially as her dislike of social occasions and lack of small talk meant that she was not the ideal companion for the many social occasions Dudley attended, and a failure academically. On the eve of the viva for her thesis Dudley sent Hilary a good luck message which consisted of a pencil sketch showing a road ahead leading to the Royal Society with a question mark. On either side were Woolworths and Marks and Spencers. In the event this proved to be an unnecessarily cruel gesture. Malyn, meanwhile had not entered the world of





science at all. From Winchester he had gone to Balliol College Oxford where he read History and then had briefly taught at Gordonstoun before taking up an academic position at the University of Rhodesia and Nyasaland in 1962.

While Hilary was resident at Hollycot she and Dudley kept different hours. She went to bed and rose early in order to get to work, while Dudley frequently returned late from College or from some evening function. They communicated by notes left on the kitchen table, frequently illustrated with little cartoons.

Dudley had kept in touch with his old commanding officer, Brigadier Gardner, and in 1952 was asked to become godfather to his granddaughter Carina. As Carina grew

Dudley not only dutifully sent birthday and Christmas presents but began to treat her as a sort of surrogate daughter, taking her to Royal Society and other functions, enjoying the company of an accomplished and attractive young lady - the socially adept daughter he never had. Dudley always kept the different sides of his life in separate compartments and Carina knew nothing about his family or even knew that he had children of his own.

When Frieda finally left in 1962, to get married, Dudley was dependant for some time on Hilary and his sister Phyllis who had come to live in Farnham. He eventually employed a young woman with a six year old daughter and a dog but not surprisingly she left after less than a year, having experienced Hollycot through the notoriously hard winter of 1963. Dudley wrote to Malyn in Africa, “I am not altogether sorry. I find a child and a dog a little much”. In November 1963 Dudley underwent an operation – “I am back



Carina aged 7

home but am still rather weak after the carving up I have had from the saw-bones”, he wrote to Malyn, “however all the bits and pieces are back in place and I hope to be quite fit by the time you get home.” He then went on to described his life without a housekeeper – typifying the character of the helpless male which he had assumed. ”At present Aunt Phil gets my breakfast – the old gardener gives me morning tea, Mrs Court [the daily help] does my lunch and one of the painters my afternoon tea. It is a complicated routine but with plenty of goodwill all round”. Eventually the housekeeper problem was solved when a cousin, Connie, daughter of his uncle Charles, moved in as his housekeeper, a position she retained until Dudley’s death in 1980.

Phyllis was not the only family member to move to be near Dudley in Farnham. After Dudley’s uncle Charles died in 1952, his wife, Daisy, also moved to Farnham. A pattern of family activity evolved with coffee at the Lion and Lamb cafe in Farnham where Dudley held court and visits to the little Castle Theatre where an old fashioned repertory company performed a different

play every week. In 1965 Malyn had married Joan Board. Dudley was a witness at the Registry Office ceremony and, after signing the register, characteristically asked the Registrar if divorce papers could also be obtained at his office. Later that year, with the situation in Rhodesia deteriorating, Malyn and Joan returned to Britain, Malyn to take a lecturing post at the University of Exeter. Soon after their first child, Bernie, was born. Dudley was now a grandparent, a role he sustained during university vacations when the family came on visits supplemented on occasions when Dudley himself travelled to Devon.

The strength and richness of Dudley's personality, a personality that brought him eminence in his academic career, renown as a scientist and success in many areas of public life, meant that he was dependent on others to see that his domestic life ran smoothly. A succession of housekeepers and then female relatives looked after his home and his every need. The life at Hollycot was built entirely round his tastes, his values and his habits. As he grew older these came to reflect a by-gone era where the spheres inhabited by the different sexes were kept separate in ways which the twenty-first century would find difficult to understand or to accept. Dudley never lifted a finger to help in the kitchen or the house (except on Christmas Day when he would himself do the washing up – a hangover from the carnival traditions in some regiments of the British army where officers would wait on the men at table on Christmas Day). Although Dudley continued to fill the house with antiques to stand alongside the French pictures and furniture inherited from his first wife, all other decisions on domestic matters were left to women. The garden was Dudley's kingdom and there he ruled supreme.

When at home Dudley needed to relax but that often meant sitting silently reading and smoking. He made little attempt at conversation either with his housekeepers or his family, and the formal breakfasts were often conducted in complete silence with a 'lazy suzy' in the middle of the table obviating the need even to ask for someone to pass the marmalade. There was a deep self-

centredness at work here which could sometimes become insensitivity to the needs of others. Dudley himself had dealt with personal stress (the dangers and horrors of war, the tragic deaths of his two wives) by internalising the problems, by ‘battening down the hatches’ and devoting himself to hard work. And he expected others to do the same. This lack of sensitivity to the needs of others was most obvious in his dealings with his daughter. Although she was devoted to him and, in his way, he was to her, he failed to notice her growing problems – her deep sense of failure, and a shyness that soon became obsessional, making it almost impossible for her to interact socially with other people and leading to a reclusiveness that made her increasingly isolated and lonely. Dudley did not provide any response to these problems from which Hilary was, wholly unexpectedly, rescued, by meeting Nick Earl who not only shared her values and tastes but was able to give her a normal domestic life, fun, happiness – and a family.

Some of the men in Dudley’s family, notably his father, had been renowned for their strong views and aggressive manner towards others. Dudley had early learned to curb this tendency, no doubt reflecting on the consequences of the abrasiveness of Professor Bone, but as he grew older he became more like his father in this respect. He would often express uncompromising opinions, particularly about people he disliked, and took pleasure in shocking his listeners with deliberately outrageous political incorrectness. For example, he would tell the traditional conservative monarchists in his family that, “What the royal family needed was a good dose of black blood”. If he saw signs of a wedding being celebrated he would often exclaim, “Another good man gone!”, and if a child was mentioned, or was present on a visit, he would come out with “ill weeds grow apace”. He maintained that the best way to get a newly planted tree to grow was to bury a dead dog in the hole before planting. He maintained that he had a drawer in his desk at College into which he put the gifts of Wedding Cake that students who married dutifully sent to him. If a student came to tell him that he was about to get

married, the drawer was opened and Dudley would point ominously at the silver boxes of cake and say “these men never completed their doctorates”. When in 1978 Malyn told him that he was making a research trip to India and would be stopping over in Abu Dhabi, Dudley’s comment was to wish him a successful journey, saying that he had been in Abu Dhabi with his regiment in 1915 when they had hanged the father of the present ruler.

Dudley regularly sent letters on a variety of topics to the *Farnham Herald*. A letter he wrote in 1978 on the control of deer, which he complained were eating his roses, was typical of the wicked pleasure he took in shocking people. He concluded the correspondence by reflecting that “all your correspondents unite in condemning the use of crude methods such, for example, as an ounce of buck shot, which I am assured constitutes a singularly effective and permanent remedy”.



A watercolour painted by Dudley on holiday in Greece

Bizarre also were his relations with his Coal Merchant. All his life Dudley had lived in houses where heating was provided by solid fuel. It was his only domestic chore to riddle the stoves and remove the ash. He was in the habit of sifting through the ash pans and taking out pieces of shale or unburnt coal. These were placed in a bag and at weekends he would go down to the Coal Merchant and plant the bag on the counter demanding an explanation for the poor quality of the fuel. In 1975 he even wrote to the Solid Fuel Advisory Service with his complaints.

After his retirement Dudley bought a Jaguar. He always left it unlocked, with the key in the ignition, until one night it was taken and used in a bank raid. Next morning the police recovered it abandoned and undamaged. In the same way Dudley never locked the door of his house when he went out on the grounds that, if thieves wanted to break in, this way they would cause much less damage.

In his final years Dudley became a governor of West Surrey College of Art in Farnham and had his portrait painted by the principal. He had no interest in music and used to quote with approval the alleged saying of W.S. Gilbert that he only knew two tunes - one was God Save the Queen and the other wasn't. In painting he was rather more knowledgeable and on one occasion took Malyn to listen to a lunch time lecture at the National Gallery. When on holiday he used to spend time painting in watercolours. Although not an artist of the ability of Alfred Egerton he produced neat little landscapes and flower paintings.

The Fisherman and the Yachtsman

Although Dudley appeared to the world as someone who was very sure of his own identity and his own values, it is possible to look more closely at how this personality was constructed. Dudley formed some close friend-

ships among his colleagues and these friendships involved strong elements of imitation. For example, it is not difficult to see in the deliberately contrived ‘rows’ he seemed to enjoy, a conscious or unconscious attempt to emulate his mentor Professor Bone, and it was possibly his friendship with Sir Alfred Egerton, an accomplished artist, that led Dudley to take up watercolour painting, while Paul Ubbelohde, an expert in Chinese porcelain and oriental carpets, may have been the influence that led to Dudley himself to start to collect fine oriental antiques.

Not all was imitation, however, and Dudley was in many respects the author of his own legend. For example, he acquired a reputation for being a keen fisherman and certainly the silent and contemplative side of the fly fishing was suited to his personality. An oft repeated story, which Dudley himself helped to spread abroad, was that during the First World War he had landed the largest fish ever caught in the Tigris and that the march of the expeditionary force had been held up while he played the fish and brought it ashore. Danckwerts recalled that Dudley “was a keen fisherman but [that he] complained that when he went out for a quiet day’s fishing in India his former students used to line the bank and applaud every catch”. Dudley did indeed join the exclusive fly-fishing club, The Piscatorial Society, which had been founded in 1837 and met at the Junior Carlton Club. In 1959 he was the guest of honour at the society’s annual dinner. The speech he made on this occasion is typical of his style, injecting a trace of scientific content and serious purpose into a light hearted social occasion.

“In proposing the toast of the Society, Professor Newitt said that he was sure that all anglers would pay tribute to the high standard of craftsmanship that went towards the making of their equipment. To him, as an engineer, the fishing rod was a beautiful thing and he would give much to be able to express in rigorous mathematical terms those of its properties which enabled the angler to cast a fly of negligible

weight an incredible distance with great precision.

But in addition to traditional craftsmanship the angler was now beginning to invoke the aid of science. He would like to sound a note of warning. Scientific research could and often did lead to the most unexpected and disconcerting consequences; and it was as well to let the scientist know from the very beginning that he would be expected to adhere closely to his terms of reference and not give rein to his imagination.

Up to the present he thought no great harm had been done. The glass fibre rod and the nylon line were useful innovations, but what would they think of an electronically controlled reel and a radar directed 'homing' fly.

One direction in which scientists could be of considerable practical assistance was in connection with water pollution. They could provide the necessary data upon which the River Boards could frame standards of effluent purity and they could give advice on economic methods of purifying industrial effluents.

Angling was, of course, a great leveller and deflater, for a season's fishing undoubtedly removed any sense of adequacy which one might possess.

In conclusion, the speaker said that the Society had during its long history experienced its full share of ups and downs of fortune. It had survived two World Wars, it had helped to combat the dangers of river pollution and it had added greatly to the knowledge of river management. Its prestige was never higher than today and this it owed to the devoted labours of a succession of distinguished Presidents, aided by generation after generation of its members. He asked members and guests to rise and drink to the future prosperity of the Piscatorial Society."

However, for the most part, Dudley was an armchair fisherman. In February 1962 he had written to Paul Ubbelohde about a successful fishing

expedition in India. Ubbelohde's reply is at the same time tongue-in-cheek and slightly barbed. "Your piscatorial triumphs as described in a letter dated Feb 7th are subject to photographic and ponderometric evidence of unimpeachable quality. How you are to obtain such evidence is a problem. A large stuffed fish brought back would be a waste of space best reserved for more interesting luggage – and even a stuffed fish can be purchased."

Dudley certainly owned a rod, a reel and a net and assiduously kept up the pretence that he was a keen fisherman. In 1967 he wrote to Malyn that he would be coming to Devon and "shall bring my fishing rod & see if I cannot land a trout or two" - but I do not remember him ever actually going fishing.

The same goes for Dudley the yachtsman. Dudley certainly liked the *idea* of yachting and for years was a member of the Royal Thames Yacht Club when its premises were in Knightsbridge and he could go there from Imperial College for lunch. Danckwerts wrote of him that

"he was also a keen sailor and once startled me with a proposal that he and I might form a syndicate to buy the latest British loser of the America's Cup race. 'She'll be going for a song. Best materials. Shorten the mast and turn her into a cruiser'. I must have been unconsciously signalling indications of wealth. His next idea was to build a yacht in the Mediterranean and man it during the summer with relays of undergraduates".

In 1956 it seems Dudley came to near to realising his idea of himself as a yachtsman. He heard of land being offered for sale on the Beaulieu river in Hampshire. He even sent his cousin Jo to bid unsuccessfully for it at auction. He apparently had the idea of building his own house and having his yacht moored at the end of the garden. Yet, although Dudley hugely

enjoyed sea voyages, I never knew him to sail even a small dinghy. Yachting and fishing were activities that were important to him largely in constructing the personality he imagined for himself.

Dudley on tour

After his retirement Dudley continued to be active in research and between 1961 and his death in 1980 he published six research papers. He also remained actively involved in the IUPAC Thermodynamic Tables Project. However, this was now a less important part of his life. Relieved of routine teaching and administration, he was able to devote time to overseas consultancy. He had always enjoyed travel, though he seldom flew and preferred always to go by sea. He now accepted invitations to advise a number of governments on technical education and the establishment of research centres and for ten years travelled ceaselessly to all parts of the world. In some ways, although he was officially retired, the 1960s became the busiest decade of his life.

Dudley wrote at greater length about these journeys than about any other aspect of his life and they are the main examples of descriptive writing that he attempted. The account he wrote of his journeys have been given in full, supplemented by extracts from letters he wrote to the family. They show a different side to his life and his personality, one that was no longer restricted by the disciplines of the academic year, the writing of research papers and the relentless rounds of committees.

Dudley dealt with these journeys in the concluding part of his Memoirs which he headed *The Last Phase*.

Perhaps the most dangerous period of a man's life is the first few years following his retirement. Up to the last moment he is fully extended with responsibilities stretching in all directions. Then everything stops; his telephone ceases to ring, his engagement book is empty, he has no train to catch in the morning and no engagements in the evening. Life becomes a blank and unless he takes vigorous avoiding action, he shares the fate of old soldiers and fades away.

I have always maintained that after the age of fifty years, a man should begin to plan his retirement, and might even attend a course of instruction on how to grow old. He must retain some of his old interests and discover new ones – but at the same time he should cultivate a relaxed approach to any tasks he undertakes, should avoid irksome responsibilities, and above all should recognise that his physical resources are running out and that the tempo of his activities must slow down. There is nothing tragic about this; indeed there is a great pleasure to be derived from sitting on the side lines and watching the younger generation trying to cope with the ever increasing complexities of modern life. The question is, do I practise what I preach? I will try in the next few pages to give an answer.

I was sixty-seven years of age when I retired, in good health and both physically and mentally active. Some years earlier I had accepted a number of invitations to visit universities and industrial installations abroad and I had become an active member of the International Union of Pure and Applied Chemistry (IUPAC). (He chaired the Task Group of the IUPAC Thermodynamic Tables Project which reported in July 1965). I had also become a member of the International Conference on the Properties of Steam and, in collaboration with my colleague S. Angus, had carried out measurements on the enthalpy of steam over a wide range of temperatures and pressures. These activities involved travelling abroad to attend conferences, carry out inspections, and generally foster international relations. Before my retirement I could not afford to absent myself too long from my College duties and I had to be rather selective about which invitations I should accept and which conferences I should attend. After my retirement there were no restrictions on my time and I travelled frequently and extensively in many parts of the world.

Back to India

Throughout 1961, in anticipation of his retirement, Dudley received a flood of invitations to visit Canada, India, Egypt, Australia, the West Indies, Iran and New Zealand. In the end he seems only to have undertaken a two month tour

of India which was postponed until 1962. Once it became known that he was definitely coming to India numbers of invitations arrived for him to visit research laboratories and Colleges and to give lectures, while the Royal Society tried to get him to act as its delegate at the Annual All Pakistan Science Conference in Peshawar. He was also asked by G.D. Birla “whether it would be possible for you to come to India and take charge of a new institution which I propose to set up in Madhya Pradesh for teaching Mechanical, Electrical and Chemical Engineering”.

In his Memoirs Dudley gave a detailed account of this visit. *After the lapse of more than forty years, I again passed through the Mediterranean and Suez Canal and again felt the thrill of approaching Bombay at dawn and landing on its busy quays. The noise, the dust and the smells came back to me in nostalgic waves. I began to remember phrases of Urdu that I thought I had long forgotten. All seemed the same on a superficial view and yet there was a subtle difference. I was no longer a representative of the Raj but merely a distinguished visitor. I was, however, heartened by notices which read ‘treat the stranger as a brother and a friend’. A noticeable change in Bombay and other large towns I visited subsequently, was the air of cheerful optimism. The inhabitants, and particularly the children, were well dressed and looked well fed. One was no longer pestered by beggars and the streets were clean.*

I stayed several days in Bombay, visiting the University and driving out to what we now term the trading estate, an area well outside the town and reserved for factory development. Unilever, Glaxo and other large European combines had established modern factories which were staffed largely by Indians and were models of advanced technology in design and lay out. It was a heartening sight and yet somehow not quite convincing. Underlying these examples of Western progress were vestiges of the old oriental disorder. The approaches from Bombay were by ill paved roads along which wandered the sacred cows, slow moving native bullock carts and dilapidated motor lorries; the villages along the route had not changed much in forty years; the shops, the

endless chatter of customers, the litter and the tumble down dwellings were much as I remember them in my youth. As my travels progressed I was struck, again and again, by the contrast between the large towns with their air conditioned modern offices and shops, and the villages with no water supply, no public services and no amenities. There were still the same mud walled hovels and the crowds of children scrabbling about in the dust and litter.

Leaving Bombay by train I travelled across the great central plain to Delhi where I was met by one of my former students, Dr Kane, who then held an important administrative post in the Planning Department. I stayed in the Ashoka Hotel, a large modern hotel situated amongst the embassies and legations on the outskirts of the town.

Delhi, being the centre of government, was swarming with civil servants who occupied handsome bungalows on an estate in the vicinity of the main government offices and House of Representatives. I had to visit many of them including Dr Thacker who was head of the Department controlling National Laboratories and had responsibility for the Government scientific policy. Pandit Nehru took an active interest in this Department and I had a long discussion with him at his home, which was the residence of the former Commander in Chief during the last days of the Raj. He was a man of singularly equable temperament, insulated from any great enthusiasms and I believe without any close friends. His remoteness, great integrity and statesmanlike approach to the many problems facing his country, placed him far above the crowd of sycophants, intriguers and trouble makers who made up the majority of members of the Suba Lok, the counterpart of our House of Commons. I attended one of their sessions and could not fail to notice that Nehru had complete authority over the house and that no question was regarded as settled until he had spoken on it. I had met his sister, Mrs Pandit, in London, a most able woman of wide culture and mature judgement. She was greatly respected both in the United Nations Assembly and in diplomatic circles in London.

Some time prior to my visit, the Federation of British Industries had donated a large sum of money for establishing in Delhi a College of Technology of University status. I was a member of the Committee entrusted with administering the fund and I had, therefore an interest in noting the progress made in building and equipping the various Departments of the College. The administration of the College was in the hands of a Board of Governors of which Dr Thacker was Chairman, Dr Dogra the first Principal.

In order to assist in setting up and equipping the Departments and in establishing high academic standards amongst the undergraduates, a number of senior staff from British universities were seconded to the College for a period of two or three years, and a special relationship was established with the Imperial College of Science, whereby selected members of the Indian staff were given a course of training at Kensington. This relationship, which still exists, has proved of immense value to both parties.

When I first visited the College site, which is some miles from Delhi, it had only been partly developed. Many of the buildings, however, were completed and in occupation and work on others was in an advanced state. Halls of residence, sports grounds and other amenities are to be provided and when completed, the College should be one of the best equipped in India.

Whilst in India I also visited the National Physical Laboratory. This proved to be a great disappointment. The Laboratory had been for some years without a Director, the lack of leadership was evident in all sections, and there was a want of purpose in many of the researches in progress. The difficulty in finding Directors and senior staff of the requisite standing for the many national laboratories is one of the serious problems facing India today; and until it is solved, the great potential of these laboratories will not be realised.

In the intervals of work, I paid many visits to places of historic interest

including the Red Fort, the Taj Mahal at Agra and some of the ruins of the palaces of the Mogul Emperors.

There is another side to Delhi, in marked contrast to the prosperous civil service quarter. The old city continues to be overcrowded, some parts resembling a shanty town built of corrugated iron, scraps of wooden planking and old kerosene tins. The streets are narrow, ill paved and littered with refuse, but even here, the children look clean and well fed and there is great activity amongst the traders and shop keepers.

Leaving Delhi, I travelled by train to Kharagpur where I spent some time with my old friend Bhattacharya, head of the Chemistry Department of the Institute of Technology. Returning to Calcutta, I stayed with one of my old students, Dr Lamont, a senior official of ICI which had a large factory in the neighbourhood. It was sad to see in Calcutta the remains of our old dominion in India, the race-course, the Governor's residence, the Officers Club and the Statue of Queen Victoria – all falling into decay, whilst on the perimeter are rising ranks of modern office blocks, shops and hotels.

The bazaars remain unchanged, crowded, noisy and colourful. Carts and barrows, donkeys and human beings mill about in the humid heat, interrupted from time to time by a motor vehicle trying to force its way through the prevailing confusion with blasts on its hooter and loud shouts from its driver. The problems posed by this vast concentration of human beings are formidable. The hospital service, for example, is totally inadequate to meet the demands of a rapidly increasing population. Patients requiring treatment are laid out in rows in the hospital courtyards; and they lie hour after hour suffering in silence and without any attention or immediate prospect of treatment.

On arriving in Madras, Dudley wrote to Hilary, "Occasionally on this trip I have been glad you were not with me. I don't think you would have appreciated some of the more primitive ways of life and the hazards one meets with. A few nights ago I woke up and saw a large animal inside my mosquito net staring at me with green eyes. As I sat up it sprang through the net carrying my

night table with it and out through the window,. I thought that was rather much.” To Malyn he described seeing the Taj Mahal by moonlight. “It is wonderful spectacle as the dim light makes it look delicate and almost transparent”. He went to hear Nehru speak at an election rally and said he had been promised a “night in the jungle to watch the tigers coming to drink at a water hole. We are not going to shoot them as that is now considered non-U”.

The next stage of my tour was to Madras where I was engaged to give a series of lectures at the Aleargh College. I had not before visited southern India and like all newcomers, I fell under the enchantment of its beautiful cities with their lovely vistas of flowers and palm trees, the Hindu temples with their fantastic carvings, and the sea shores fringed with palms and with white stretches of sand. I was met at Madras by Dr Laddha, Principal of the College and a number of his staff, and during the whole of my stay, I enjoyed their hospitality and made many friendships which have lasted to the present day.

Most of the senior staff were American trained and, under the direction of Dr Laddha, were engaged in research, mainly in the field of chemical engineering. One section of the College was devoted to leather technology and – particularly to improving the methods of tanning as practised in the numerous small tanneries in the surrounding villages. It was a good example of the policy of encouraging village industries which I had advocated in my talks to the planners in Delhi.

Madras, situated on the sea shore, is an attractive city, its fine buildings are surrounded by carefully tended gardens, the streets are clean and the population looks prosperous. Dr Laddha took me on several motor drives in the surrounding country. We would stop at times and buy green coconuts – the vendors would cut off the top with blows of a heavy knife and we would drink the milk, which was cool and refreshing. On one evening he arranged a concert of music, dancing and singing in my honour. I find the formal Indian dancing with its many conventions and symbolism, difficult to understand and to me at any rate, not particularly attractive.

In Madras Dudley delivered four lectures (1) The Origin and Growth of Chemical Engineering (2) The training of a Chemical Engineer (3) Chemical Engineering Research (4) Problems of Industrial Research and Development.

On leaving Madras I went by car to Bangalore along a picturesque but somewhat dangerous mountain road. It passed through tea and coffee plantations which seemed to be well maintained and prosperous. At Bangalore I was entertained by one of my old students, Professor Kuloo, who was head of the Chemistry section and was directing a number of researches in the field of thermodynamics. He and his students presented me with a nice bronze of the goddess Ashoke and a number of attractive wood panels of local manufacture.

From Bangalore we crossed mountainous country, through Mysore with its vast plains of a deep red sand stone to Mangalore on the west coast. We broke our journey at a large game reserve where we spent the night. At dawn the next day we embarked on a large lake which formed part of the reserve, and cruising along the banks, had a good view of a herd of wild elephants, wild buffaloes and other smaller game. Although there were said to be tigers in large numbers, we saw none on this occasion. Continuing our journey westward, we stopped at a country club which was evidently a centre for the European managers of the surrounding tea gardens. It had a well stocked bar and the walls of the smoking room were hung with rows of signed topees, left behind by the owners on retirement.

The mountain road on which we were driving presented many hazards, in places partly blocked by landslides and in others, carried over ravines by rickety bamboo bridges which swayed and bent under the weight of the car. On several occasions we traversed the bridge on foot, leaving our driver to follow with the car.

At Mangalore I had to inspect a new fertiliser factory which was then getting into production and was having a number of teething troubles. Mangalore was once the centre of a Dutch settlement and many fine old Dutch houses built by

merchants remain as a memorial of their old colony. Mangalore still has a sizeable coastal traffic and the crowded bazaars testify to its prosperity. Here I visited an old Jewish synagogue, the walls and floors of which were lined with old blue and white Dutch tiles, now worth a King's ransom on the antique market. They are being carefully preserved as a tourist attraction.

From Mangalore I followed the coast northward to Poona where is located the National Chemical Laboratory. There is a fine and well equipped laboratory which should be able to make a valuable contribution to Indian industry. Its Chemical Engineering section was directed by one of my old students, Dr Pai, who is a man of great energy but unfortunately, not much initiative. I was disappointed with the research programme which seemed to me to have little relevance to the urgent problems of a developing country. The staff held a reception for me and I had a number of discussions with its senior members.

In a letter to Hilary dated 3 February, he wrote "I arrived just after a big dam had burst and caused the most disastrous flood. There was at one time 25ft of water in the main street travelling at a high speed". *Returning to Bombay, I attended a dinner given by members of the Old Centralians and then, exhausted by my lengthy tours, embarked for home.*

The detail of Dudley's itinerary after his departure from Delhi gives a good idea of the intensity of this visit.

" Feb 19th Leave Delhi Howrah Mill 8-45 am

20th Arr. Calcutta 10-05 am. Will be met by Mr Foster, ICI and will be the guest of Mr Lamonde. Afternoon – visit to Glass and Ceramics Institute, Jadavpur College on behalf of the UK Institute of Chemical Engineers. Dr Atma Ram will arrange to take Professor Newitt from Mr Lamonde's residence.

21st Visit to Alkali Factory of ICI in the morning and ICI Research Laboratory in the afternoon.

22nd Morning – Visit to the Calcutta University. Afternoon - Leaves for

Dhanbad by train – 16.40 hours – Coal Field Express – 1st class, not Air-conditioned. Arr. Dhanbad 21.48 hours. Director, Central Fuel Research Institute will meet Professor Newitt at Dhanbad. Professor Newitt will be the Institute's Guest.

23rd Visit to Fuel Research Institute

24th Visit to the Central Mining Research Institute Dhanbad and Sindri Fertilizers

25th Morning – Leaves by car (National Metallurgical Laboratories car) for Jamshedpur. Arr. Jamshedpur before lunch. Professor Newitt will be the Laboratory's guest at Jamshedpur.

26th Visits to The National Metallurgical Laboratory and Tuta Iron & Steel Works.

27th Leave Tatanagar by train 9.44am. Arr. Kharagpur 13.00 hours. Professor Newitt will be met by the Director Dr Sen Gupta. Lunch with the director, Indian Institute of Technology, Kharagpur. He will be the Institute's Guest.

27th Afternoon and

28th morning with the Institute. Evening. Leave by train (Madras Mail) from Kharagpur

March 2nd Arrival – Madras. Accommodation to be arranged by the Ministry of Commerce and Industry in hotel Connemara

2nd – 5th Stay in Madras. Lectures by Professor Newitt at the Madras University. Visit to central Leather Research Institute, Madras.

5th Departure for Bangalore in the morning.

6th Arrival in Bangalore in the morning. He will be met by Director, Indian Institute of Science and will be guest of the Institute. Stay in Bangalore on the 6th and 7th. Visit to HMT to be arranged by Dr Bhagwantham.

8th Leave Bangalore at 8.00 am by car to be provided by Fertilizer & Chemicals Travancore Limited. Officer of FACT will accompany Professor Newitt from Bangalore. Packet lunch to be carried. Proceed via

Tumkur, Avisekere & Halebad. Visit to Belur. Arrival in the evening at Krishna-rajasaagar Hotel at Mysore. Visit to Chamandi Temple.

9th Departure from Mysore 8.30 am. Arrival Coimbatore for lunch en route Ooty or Conoor. Night at Coimbatore.

10th Departure Coimbatore at 8.30am to Tekkar via Pollachi. Spend night at Tekkar. 11th early morning visit to Game Reserve and departure 8.30 am for Cochin. Arrival at FACT Guest House at 1.30 pm for lunch. March 11th and 12th stay in Cochin. Attend meeting of the Inorganic Chemical Industries Development Council on the 12th and visit FACT and Travancore-Cochin Chemicals.

12th Departure Madras by Cochin *Express*

13th Arrival Madras 8.10 am. Departure Madras at 12.00 noon by grand Trunk Express

15th Arrival Delhi. 15th and 16th stay in New Delhi.

17th Leave Delhi by train for Lahore (Pakistan). Arrival Lahore in the morning. Stay in Lahore 18th, 19th, and 20th

20th Leave Lahore in the evening for Delhi.

21st Arrival Delhi in the morning. Stay in New Delhi on the 21st.

22nd Leave Delhi in the morning by Frontier Mail for Bombay.

23rd Arrival in Bombay in the morning. 23rd and 24th stay in Bombay.

25th Leave Bombay for UK by ORONSAY

This itinerary, which reads almost like a royal progress, in many ways reflects Dudley's position as a scientist and public personality. He was clearly not an expert in all the industries and sciences whose institutions he visited, but he was concerned with the organisation of research institutions and with public policy towards science and the way in which science could inform the approach to difficult political problems. He was also sufficiently well known internationally for a visit to be of importance to any Indian institution struggling in the competitive world of newly independent India.

Lebanon - November 1962

A year or so later I was invited to visit the Lebanon by another old student who held an important Government appointment and was Director of an Institute of Scientific Research. Dudley had been invited by the Lebanese Industry Institute and the visit was arranged through the Department of Technical Co-operation. He was to give lectures in Beirut on "The Role of Government in Scientific Research" and at the University of Damascus.

After the lapse of more than forty years, I landed in Beirut, which in the interval had expanded and now presented the usual phenomena of modern apartment houses, hotels and shops imposed upon a background of narrow streets, bazaars and native dwellings. The traffic jams recalled those of our English towns.

I was told that much of the prosperity of modern Beirut derived from the oil sheikhs who were investing large sums of money in real estate and were the main customers for jewellery and other luxury goods.

I found the old established American College still flourishing and much increased in size. It gives a good modern education with satisfactory academic standards and provision for student amenities.

My hosts took me on many excursions to places I knew in 1918. We visited the famous temple at Baalbek, coming to it across a vast plain on the perimeter of which one sees, from a long distance, the columns of the main building standing out on the skyline. From Baalbek we drove across country to Damascus where I was engaged to give a lecture at the University. The unsettled state of the Lebanon and surrounding countries was impressed upon us by the constant hold ups at military check points, with checking passports and a thorough searching of cars for contraband.

The approach to Damascus through a fertile country clothed in fruit orchards and intersected by streams is one that once seen is never forgotten. The town is now prosperous, with modern shops and hotels, and with its bazaars displaying brocades and silks, jewellery and leather goods of native workman-

ship. At the University I found several of my old students on the staff, but my impression was that, on the science side, there was a lack of adequate financial provision resulting in a low morale and dull and impaired teaching.

Returning to Beirut, I went on several excursions along the coast, visiting some of the ruins of Crusader castles and other places of historic interest. A bold attempt is being made to attract tourists and make provision for their comfort; hotels in the larger towns are adapted to European standards, there are good roads and transport facilities and the climate is temperate.

Two letters sent to Malyn supplement the *Memoirs*.

“I had a most delightful cruise up the Mediterranean and spent yesterday wandering about Alexandria. It is a fairly typical eastern town with crowded native bazaars, mosques and a few Roman ruins. Mixed up with all this are modern apartment houses of conventional design; the streets are crowded with mules, horses and decrepit old motor cars. I arrived in Beirut this morning on SS Exeter a small American passenger vessel. It is a great comfort travelling on Govt. Business. At Beirut I was met by an Embassy official, whisked through the customs and deposited in this hotel all without delay or trouble of any kind. I shall have a busy week here inspecting and lecturing. If I have time I want to revisit Baalbek, Carchemesh and Damascus and I shall try and pick up some good rugs and silverware”.

On his return to Britain he wrote:

“I had a most interesting time in the Lebanon and Syria but with too much entertainment by the foreign office boys. They have so little to do that any visitor is welcome. Also the ambassador turned out to be an old friend of mine [Sir Ponsonby Moore Crosthwaite] and I knew several of the Councillors. I was able to visit Byblos, Sidon and Baalbek and see something of the excavations going on. They are finding the most beautiful little bronze figures, jewellery and gold mounted daggers. The whole country is

sprinkled with old temples, burial grounds and Roman villas. A real paradise for the archaeologist.”

Trinidad – 1963

In February 1963 Dudley escaped the bitter English winter and made a second visit to Trinidad. “I travelled out here on a small Dutch boat which had a tremendous buffeting in the Bay of Biscay but otherwise the journey was very pleasant”, Dudley wrote to Malyn in Africa. “Trinidad is now self-governing and I am discussing with some of the new management the long term planning of the island’s industries. It is a difficult problem since oil and sugar are almost the only valuable products. And the population is quite small.”

Writing to Hilary he gave a vivid description of one of his fellow passengers.

“One of the chief characters is old Sir James Baird. He is very like Uncle Matthew in Nancy Mitford’s books. He grinds his teeth when he sees the coloured people and his language is awful. As he is rather deaf he shouts such remarks as ‘Look at that black b...rd. I could strangle him.’ There is also a young girl on board ... I heard her trying to explain communism to old Sir James who was purple in the face. She knew all about Karl Marx and far more about political affairs that he would ever know. ‘Do you mean to say you admire the b...dy fellow Kruschew’ asked Sir James. ‘Yes’, sez she. He then comes over to me and roared ‘Did you hear what that little b...ch said?’ It is all most awkward.”

In his Memoirs Dudley wrote: *I again visited Trinidad to report on the organisation of the University and in particular on the engineering course. With the granting of independence, the head quarters of the University has remained situated in Jamaica and only the Engineering Faculty is located in Trinidad, some thousand miles away. It is an awkward arrangement and productive of much delay and inconvenience. There is a great difficulty in obtaining European staff although the pay and living conditions are not unreasonable; and as a consequence, the standards are not all that could be desired. The students are,*

on the whole, intelligent and adaptable and when qualified, find many suitable openings in the expanding industries of Jamaica and the other islands.”

IUPAC and Moscow

During the last ten years or so I have paid several visits to the United States and Canada in connection with my work for the Steam Conference and for IUPAC. As a member of the Thermodynamics Commission of IUPAC, I initiated a project for the preparation and publication of Tables of the Thermodynamic Properties of Gases. This involved setting up a permanent centre staffed by a senior scientist with the necessary secretarial assistance. The project is now housed at Imperial College and is under the direction of Dr Selby Angus, one of my old students. Dr Angus is also connected with the Steam Conference and was for some eight years engaged in experimental determination of the enthalpy of steam at Imperial College.

The Steam Conference and its various committees have met on numerous occasions in Munich, London, New York, New Hampshire, Frankfurt and Paris. It also held one meeting in Moscow to which I travelled by train across East Germany and Poland. This was a testing experience, the trains were long, slow and often without refreshment cars. The one thing always available was tea which the attendant supplied from samovars at intervals of an hour or so throughout the day.

Moscow in summer is not unpleasant, although the city itself has a certain dreary uniformity. Large rectangular blocks of flats are springing up in all directions, the modern University, a spectacular concentration of buildings on a prominent site, appears to be more adapted to propaganda than to higher education. There are lavish student amenities, sports grounds, halls of residence and concert halls. Students come from all over the world and a great effort is made to ensure that they leave with a good impression of Russian efficiency and friendliness. The academic standard appeared so-so. The same did not apply to the various research institutes we visited. Here the atmosphere was serious and purposeful. Research programmes were well

planned, the facilities for experimental work excellent, and the quality of the work of a very high standard.

Whilst in Moscow I visited the British Embassy where I met several old friends. The Embassy is situated under the walls of the Kremlin and the comings and goings of the staff are severely circumscribed; there seemed to be little social intercourse with Russian diplomats and government officials.

The shopping centre of Moscow is incredibly drab. There are no luxury shops and the big stores display goods of a strictly utilitarian quality and design. The bookshops are an exception, they are attractive and well stocked, and the books are cheap and well produced. We made a few excursions into the surrounding countryside which, however, is flat and without great interest.

In marked contrast is Leningrad with its Winter Palace, handsome churches and fine buildings. There is humanity about Leningrad which is conspicuously absent in Moscow. Even the people seem more cheerful and less dedicated to technological efficiency. We received the impression that this somewhat care-free approach to life was not regarded with favour by the authorities of the Kremlin. Our Russian hosts entertained us well. Every day concluded with a banquet at which we all made speeches extolling the international character of science, the friendly relations which exist between scientists of all nations and the singular proposition that no 'iron curtain' exists in science. Numerous toasts were drunk in vodka and I, for one, got rather tired of caviar which appeared on all occasions.

On 3 August Dudley had written to Hilary:

“The Russians have a strange craving for vodka, caviar and sturgeon and the limit is reached when they serve boiled sturgeon for breakfast and cold sturgeon for lunch.... Whilst Moscow is very modern, Leningrad belongs to the old regime. It is like a mixture of Paris, Vienna and Budapest. All the old palaces are now museums, or picture galleries, swarming with the proletariat. At one dinner I attended I addressed the assembly as Comrades and

this created a sensational impression. I now expect to be made an honorary member of the party.”

Dudley always maintained that one of the principal objectives of the IUPAC meetings was to find some attractive part of the world for each gathering and that this came to be of more importance than any outcome of the meetings themselves.

United States - 1966

Dudley went to the United States on numerous occasions and in his Memoirs wrote in detail about one such visit.

In February 1966, I made an extensive tour of the United States on behalf of the Thermodynamics Tables Project. Leaving Southampton on February 11th on HMS Queen Mary, I arrived in New York on February 16th where I was met by my sister Rita, and spent the night at her house in Cresskill, New Jersey. On February 17th I left New York for Washington where I stayed at the Lafayette Hotel until February 22nd. I visited Dr Beckett at the National Bureau of Standards. Dr Brady and other members of the staff. I also called at the Carnegie Institution and the University of Maryland. Leaving Washington on February 22nd, I passed through Chicago to Laramie and thence by motor coach to Santa Fe. Here I visited Dr Heller at the Los Alamos Scientific Laboratory and went with him on some picturesque rides in the surrounding country.

Dudley wrote to Malyn from Los Alamos:

“I am, as of now, buried in the hell of Colorado about 50 miles from the nearest railway station. This is a part of the country with a strong Spanish background and all the houses in Santa Fe & its surroundings are definitely Spanish in type. There is a fair amount of snow on the ground with temperatures about freezing but brilliant sunshine. It would be grand weather for walking. Unfortunately I am shut up all day at meetings and when I do get out it is in a car.”

From Santa Fe I proceeded by coach through La Junta to Denver, and then by private car to Boulder where I visited the Laboratory and had discussions with its director, Dr Johnson.

From Boulder I proceeded by train to Bartelsville where I was met by Dr Douslin and spent a day in his laboratory (Bureau of Mines – Petroleum Research Centre). Leaving Bartelsville on March 2nd, I passed through Chicago to Painesville where I stayed two days with my brother Lewis and his wife.

From Painesville I proceeded by train to Buffalo where I visited the Linde Air Products Laboratories and had discussions with members of the research staff. Thence back to New York where I embarked on the SS United States and reached Southampton on March 13th.

Far East - 1968

Dudley's visit to the Far East led him to write the most detailed of all his travel narratives. *The purpose of this visit was primarily to attend a meeting of the Steam Conference in Japan; just before leaving England, however, I was asked to visit Ceylon by the British Council, and advise the education authorities on setting up a course of training in Chemical Engineering. I also planned to visit Bombay and Delhi and to pay a long promised visit to some of my old students in Pakistan; this made up a fairly full programme which would occupy me for several months.*

I embarked at King George V dock on the P&O cargo ship SS Sunda on July 12th, bound for Yokohama. The Sunda is some 9000 tons with accommodation for twelve passengers on the boat deck. There were, however, only five passengers on board. Mr and Mrs Parker, Mrs Newman, Mr Smith and myself. We arrived in Rotterdam on 13th July where we stayed until the 17th loading cargo. During this time we visited the Hague, Delft and Amsterdam.

In a letter to Hilary dated 18 July Dudley adds more colour. Mr and Mrs Parker are “quiet and pleasant”; Mrs Newman turns out to be a psychiatrist with the

gift of laying on of hands.... Fortunately she has a sense of humour and takes our leg pulling in good part”; Mr Smith is “a dour Yorkshireman very much concerned with keeping down his weight but nevertheless with a very hearty appetite and a more than adequate thirst.” Mrs Newman, Dudley reported, “is in an agitated state because we convinced her last night that she would have to be ‘tarred and feathered’ on crossing the line. She has spent all the morning questioning junior officers and sailors and they have played up well by showing her some drums of tar and an old feather mattress”. When they crossed the Line she locked herself all day in her cabin. “The captain in particular is like the Ancient Mariner. He holds you with his glittering eye. He does not want you to talk only to listen whilst he pours out the dullest stories I have ever had to listen to. We are trying to work out a technique for countering him. After dinner one of us is chosen by lot to hold him in conversation.... It was my turn last night and I retired to bed at 11pm completely exhausted”. Mrs Newman “wanted to know what would happen if she had an acute attack of appendicitis. The Captain told her it was the Chief Officer’s job to carry out any emergency operations. He had to admit that he had received no medical training and had never yet had to carry out an operation – but he had a book on surgery and a knife which he usually used for sharpening pencils – he was quite prepared to ‘have a go’.... The Captain interjected that this was of no importance since he was authorised to read the burial service on anyone who died at sea”. Mrs N. subsequently hit her head on her bath and was laid up. “We persuaded the Chief Officer to visit her in his capacity as doctor. He took a bag of tools with him including a large monkey wrench, a hammer and saw and an empty whiskey bottle labelled castor oil. This alarmed Mrs N. and when ... he asked where she felt pain, she decided to get up.”

Since the Suez Canal was still closed, our course involved rounding the Cape of Good Hope and crossing the Indian Ocean to Malaysia. The voyage down the coast of Africa took us past the Canary Islands, the Dakar coast and Sierre Leone. We crossed the equator on July 25th in fine weather, sighted

Table Mountain on the 31st, and reached Durban on August 2nd, where we stayed for some twelve hours, taking oil. We were able to tour the town by taxi and see something of its suburbs and shopping centre. The town is situated on a hill side overlooking the port and there are numerous panoramic views from the high ground. Although it was mid winter, the temperature was that of a summer day in England and the gardens of the suburban houses were full of flowers and exotic climbing plants.

Leaving Durban on the 2nd, we passed south of Madagascar and Mauritius, and across the Indian Ocean to Port Swettenham where we anchored on August 14th. Here we remained discharging cargo until Friday 16th. Ships unloading at Port Swettenham usually anchor off shore and discharge into lighters; if, however, there are any free berths they may tie up alongside and discharge directly onto the quayside. No shore based cranes are available and everything is manhandled. Port Swettenham is approached by several channels, a mile wide, and bordered by mangrove swamps. There are numerous warehouses, shops and houses and the streets are lined with stalls selling fruit, sugar cane, mineral waters and textile products. All about is a colourful crowd, strolling the sunshine or doing the daily shopping. One is in no doubt about being in the East. The coconut palms, banana plants, paw paw and mangoes, all spell a tropical climate, whilst the curious penetrating smell compounded of rotting fruit, stagnant water and flowers, reminds one of the bazaars of India and the villages of Lebanon.

We drove along a modern motor way to Kuala Lumpur, the capital of Malaysia, a distance of some twenty miles. The traffic along the road, lorries, private cars and bicycles, was reminiscent of Europe. The road was bordered by coconut groves and rubber plantations with here and there a native village composed of wooden huts in various stages of disintegration. Approaching the town, we branched off the main road to visit an open cast tin mine. The tin bearing soil is chalk white and the tin is extracted by washing over long wooden sluices. The outskirts of the town are occupied by modern factories, many of European ownership and all looking prosperous. The town itself lies at the foot

of a range of hills, and with its gardens and palm groves, presents a most pleasing picture. The architecture is a happy blend of eastern and western; there are numerous good hotels and modern shops and the roads are clean and well maintained. One gains the impression of a prosperous and contented community; there are no beggars and no signs of poverty.

I visited the British Council Headquarters which houses a large library and provides space for concerts and exhibitions and reading rooms. I also paid a short visit to the Rubber Research Institute and saw something of the important technological developments which form part of its activities. As a fitting conclusion to my visit, I spent an hour in the lounge of the Federal Hotel, a rotating structure on the 18th floor, providing a splendid panoramic view of the town and surroundings.

A letter to Malyn dated 14 August adds to Dudley's impressions:

"I am spending a few days in Kuala Lumpur and its environs. It is a most charming town surrounded by hills and palm groves. I called at the University and found the following sad state of affairs.

Total Students 4,500 of which

Studying Arts 3,200

Science 600

Engineering 300

Odds and ends 400

There is of course a large demand for engineers and none for artists, historians and the like. From here we go to Cebu and Manilla. It has been a lovely voyage so far – crossing the Indian Ocean and going down the Malacca Straits. The weather has been hot and sunny and apart from some pitching and rolling quite agreeable. I hope to arrive in Japan by the end of the month and then I shall have to start working in earnest. So far I have not discovered any old ivories or works of vertu but I may pick up something of interest in Hong Kong."

Leaving Port Swettenham on August 16th we passed through Singapore Straits and along the north Borneo coast to the Sulu sea. Here we struck heavy rain storms and high winds.

Arrived at Cebu on Tuesday August 20th and berthed alongside. Cebu is a comparatively large town founded by the Spaniards but now showing a marked American influence. It has a large shopping area, the shops being built under arcades – they are generally shabby and the pavements ill kept and dirty, a vague smell of drains pervades the town. There are some fine schools and the children look well fed and are clean and well dressed. There is, as in most towns, a difficult traffic problem. The streets are crowded and the cars sound their horns almost continuously.

The suburbs of the towns, occupied by government officials and Europeans, create a very agreeable impression. The houses are large and adapted to tropical conditions, and the gardens, full of exotic shrubs and flowers, give colour to the scene. I lunched with the acting President of the San Carlos University, the Rev. R.Kolk SVD, in the Spanish Club within a setting of tropical trees and shrubs. It offers a notable gin and lime drink well suited to the climate.

The San Carlos University is maintained by the Catholic Church without government assistance. It differs in pattern from American and European Universities in that it includes all levels of education from elementary school to graduate levels. It is housed in fine modern buildings set in well kept gardens. The class rooms, laboratories and lecture halls are spacious and cool. The Engineering School is situated some six miles from the town at the foot of a range of low hills overlooking the bay and port. The general impression I received was that whilst at school level the teaching was good and the standards adequate, at undergraduate level, the equipment was poor and the teaching far below the level desirable in a degree course. The chemical engineering course extended over five years, the first two years being common to all engineering students. The University receives some financial support from West Germany and from the Ford Foundation in America. There were a

number of Europeans on the staff, seconded from America and Europe for short periods.

We left Cebu at 5am on Thursday 22nd, and taking a tortuous course between numerous islands, reached Manilla on February 23rd, berthing alongside.

Manilla was occupied by the Japanese during the war and fierce fighting took place in the suburbs and surrounding country before they were driven back into the hills. The American war memorial, a wonderful monument situated on a lovely site in the suburb of Bonifacio, testifies to the heavy fighting that took place. The luxurious residences and gardens in Bonifacio are reminiscent of Beverley Hills and the film star standard of living. There is a fine golf course and polo ground.

The business district of Manilla is representative of the finest modern architecture – the roads are well paved, the buildings graceful and well laid out in a spacious setting, a marked contrast to the dull and uninspired buildings of modern London. August is the rainy season and we experienced heavy thunder showers and high gusty winds.

The Sunda delivered a cargo of flour mainly, and took on a cargo of hemp. The stevedores in Manilla have a reputation of being the biggest thieves in the Far East, and during our stay in port we had to have a body of security police on board.

The passage from Manilla to Hong Kong was stormy with heavy rain and high winds. The Sunda berthed about 10am and passengers had one day ashore. On arrival we were boarded by a score or so of merchants, mainly tailors and bookmakers, soliciting orders. They could produce a made to measure suit in 24 hours at about one half the price charged in London. Hong Kong is an excellent example of how to exploit the tourist trade. Close to the port is a co-operative shopping centre containing several hundred shops, a restaurant, tea-rooms and a bar. The shops contain high quality goods – cameras, jewellery, pictures, furniture, ivory and silk goods in great variety. This is in marked contrast to Manilla where it is difficult to find anything of interest to buy.

During our stay it was hot and humid, temperatures reaching 33 degrees Centigrade. The town has a lovely setting, surrounded by hills and built near the water's edge, large rectangular buildings in the modern idiom rising to twenty stories on congested sites, are reminiscent of New York. The main streets are well paved and have an international character, but the side streets bring home to one the essential Chinese background of the settlement.

We left on the last stage of the voyage at midnight. A magnificent sunset followed by the lighting up of the city was a spectacle not easily forgotten. Activity in the port area continued far into the night with constant coming and going of crowded ferries and Chinese craft.

Between Hong Kong and Yokohama we were dodging a series of typhoons which were moving erratically amongst the islands. We berthed in Yokohama on August 31st, one of the busiest ports we have met since Rotterdam. It rained heavily all day.

In a letter to Hilary he described dodging typhoons. “ ‘Wendy’ was coming directly towards us so we dodged behind some islands for shelter – but then ‘Shirley’ crept on us during the night and we only just escaped her – to be caught by ‘Anna’. For a time it was quite exciting”.

I left the SS Sunda on September 1st. The passengers gave me a farewell dinner and the Captain and Chief Officer piped me overside.

From Yokohama by taxi to Tokyo and then by Takado Railway to Kyoto where I was met by Professor Osingo and taken to the Kyoto Hotel. This is a typical American luxury hotel with all the usual trimmings. Kyoto is a strange mixture of East and West. The main shopping centre might be any modern western city, neon lights, department stores, banks, office blocks and a continuous traffic jam. But turning into some of the narrow side streets one steps into the Orient. With Professor Osingo, I visited numerous bars and Japanese restaurants, all scrupulously clean but built of wood with paper windows – the whole structure light and fragile. In the restaurants, one takes off one's shoes

on entering and sits on cushions at low tables on which the food is cooked. The waitresses in kimonos, kneel at the table and keep one's plate filled, I may add, one's glass as well; the favourite drink being warm saki served in shallow china cups. The food is often unrecognisable – shredded vegetables, synthetic proteins, mushrooms, prawns and other sea food. They have also a way of serving meat and fish together – a repulsive combination to western tastes. At one restaurant, the Geishas danced a formal Japanese dance whilst we ate. An unusual but pleasant custom on entering an eating house or bar is that of presenting one with a flannel dipped in hot water, with which one wipes one's face and hands before eating or drinking.

Kyoto is well provided with Temples, Shrines, an Imperial Palace and an old so-called castle, museums and art galleries. I was not allowed to miss one of them. All the temples and shrines are built of wood, often with thatched roofs, and practically all of them have been burned down more than once.

Generally the Buddhist temples are surrounded by pleasant gardens with one or more lakes teeming with carp. They are in good repair and all of much the same design. Japan is a country of tourists and unfortunately many of the temples and shrines are now approached through a line of shops selling cheap souvenirs - the illusions of mystery and tranquillity are lost for ever. One cannot help being impressed, however, by the famous stone garden of the Ryoanjo Temple with its wonderful background of time weathered walls and its white sand.

The gardens in Japan are designed for Spring and Autumn when the colourings from cherry trees, camelias and azaleas in Spring and from maples in Autumn are dramatic. In summer there is only green foliage, grass patches and large rocks – no attempt is made to grow annuals to bloom in August and September.

Nijo Castle, which was a residence for visiting Shoguns is an interesting example of an official residence with large reception rooms decorated with wall paintings, no windows and no furniture, but large sliding doors leading into open corridors.

We visited Lake Biwa, which is a holiday resort as large as Lake Geneva and surrounded by hills and forests. Some fifty miles from Kyoto is Nara, where I visited a

fish farm devoted to rare types of oriental fish, and also the temple housing one of the largest bronze Buddhas in the world. The dimensions of this gigantic figure are unbelievable, the fingers of



Dudley with two geishas

the hands being some four feet long and everything in proportion.

In a letter to Hilary he wrote, “I am having a most exhausting time... it is only large draughts of saki that keep me going. I have visited innumerable imperial palaces and Buddhist shrines & walked miles through stone gardens and climbed hundreds of steps up to tea-gardens and other places of refreshment.” Of all his experience of Japanese culture it was the ornamental fish – and the geishas – that most appealed and he seems to have tried to arrange for some fish to be air-freighted to London.

From Kyoto I returned to Tokyo, staying at the New Otani hotel, which provides on the premises everything a traveller could want – hairdresser, steam baths, dentists, doctors and about ten different dining rooms.

Tokyo has all the characteristics of large towns such as London, New York and Paris. The poorer quarters are sordid, the business section palatial and non descript. The streets during the rush hour are one long traffic jam and the

commuters, crowded into trams and trains, have that 'dead-pan', weary look characteristic of their species. There is nothing of the east until one dines in a Japanese Geisha house – when the waitresses dressed in kimonos, kneel round the table serving food and keeping the guests cups full of saki, a colourful, graceful and attractive picture. I visited several of the Universities in Tokyo, much like Western Universities – the students on strike, the professors dull and dedicated men. Few talk English and communication with them is both difficult and tiring.

The Japanese have retained their racial characteristics in a remarkable way. They are generally short in stature, 5ft to 5ft 6ins, they all have jet black hair and brown eyes, they are often disfigured by a mouthful of gold filled teeth, and they all have the same sallow complexion. When young they are graceful, with good colouring and cheerful, smiling faces – but they age quickly and, in the towns, the daily rush of modern life has given them the typical hard faced look which we see so frequently in Europe.

Before leaving Kyoto I gave a special lecture to the Conference on High Pressure and was presented with a fine lacquer tray. I was also guest at a dinner at which numerous speeches were made and vast quantities of saki drunk.

I strolled one evening through the food, vegetable and fish market and was astonished at the variety of food I could not recognise and had never tasted. The Japanese are great fish eaters – vast quantities of prawns at nearly every meal, and other sea food including dry jelly fish, squids, octopus and eels form favourite dishes. The habit of mixing fish with meat on one dish is rather distasteful to the European as is also the habit of eating quails eggs. Apples and peaches seem to grow well but I saw no plums or soft fruit. The market was remarkably clean and although food was freely exposed, there were no flies.

Returning to Tokyo, I stayed several days at the New Otani before embarking at Yokohama for Hong Kong. My last impressions of Tokyo were the infernal noises in the main streets, the vast net-work of fly-over roads and a number of steel towers that suggested that the Eiffel Tower had littered.

I embarked on SS Arcadia on September 27th, leaving Yokohama at 1300 hrs. The departure followed the usual cruising pattern. Paper streamers formed a lacework between ship and shore – a Japanese brass band played 'There is no place like home' and 'Auld Lang Syne' and tropical rain drove everyone to shelter.

The ship stopped at Hong Kong where Dudley reported that “one of my old students who, I think, has made a fortune pearl smuggling is waiting to entertain me” which apparently included a visit to an opium den. October 7 Dudley wrote, “My old student Zau captured me on arrival and we have been doing some rather spectacular explorations along the Communist Chinese border – what they call the Bamboo Curtain. It is an important Chinese anniversary this week & the town is plastered with pictures of Chairman Mao. Each evening there is a riot and the streets remind me of a picture of the storming of the Bastille.... I am going out with Mr Zau on his junk tomorrow to do a bit of smuggling – it should be quite exciting.”

The entrance to Singapore is less dramatic but more beautiful than to Hong Kong. A number of rocky islands thickly covered with tropical trees and shrubs give colour to the scene and numerous small craft give it life. We anchored at Keppel Harbour some four miles from the town.

Singapore is disappointing in nearly every respect, the population Chinese, Indian and Malaysian is unattractive, the streets are dirty with deep, open drains along the sidewalks. The native shops are stucco faced, the paint peeling from the walls, the general effect one of dilapidation, the general smell, one of drains.

It is said that over 50% of the population are under twenty one years old, and if this is correct, there looms ahead a serious employment problem.

In the centre of the town, King George V Park forms a small green patch pleasing to the eye in contrast to the surrounding slums. It houses the Van Klief Aquarium – a very fine collection of fresh and salt water fish well displayed.

We arrived at Penang at noon on October 16th – the approach to the harbour is picturesque, with tree clad islands and small fishing craft busy near shore. The town (George Town) is a pleasing contrast to Singapore being clean, with many fine buildings and good shops. The pavements are in good order, the shops clean and the roads well maintained. Unfortunately, the shopkeepers have the oriental habit of bargaining to an extent that shakes ones confidence in the quality of the goods.

At Port Swettenham, where we stayed one day after leaving Singapore, the Cathay took on a heavy load of rubber and military stores, and at Penang, a quantity of ingots (tin).

From Penang we sailed due west across the Bay of Bengal to Colombo – a smooth passage, marked each evening by dramatic sunsets. There are vast quantities of flying fish – shoals of a hundred or more in flight at one time – also dolphins in large numbers making spectacular leaps.

The purpose of my visit to Ceylon was to examine its industrial structure, educational system and plans for expansion, and from this background, to advise the Government as to whether there was a need for the training of chemical engineers.

On arriving at Colombo I was met by the British Council representative and dispatched by road to Kandy. It is a journey of some seventy miles through lovely, tropical scenery, paddy fields on either side of the road, rubber trees, palms, bread fruit, pepper vines, mangoes and the universal banana. There are numerous villages on the route, primitive but colourful, and the road is, at times, blocked by an elephant or water buffalo. At this time of the year the temperature is around 80 degrees F, the humidity high and there are nearly every day short, but heavy, thunderstorms. To Hilary he wrote that an “elephant nearly dropped a huge tree trunk on top of our car.”

At Kandy I stayed for a week at the Suisse Hotel bordering a picturesque lake. It was a typical Victorian colonial building with doubtful plumbing, indifferent cooking, but cool and airy. The place swarmed with native servants, mainly standing about in picturesque attitudes, willing, but incredibly inefficient.

I was met by Professor Peira, Dean of the Faculty of Engineering at the University of Ceylon. The University is situated some five miles from the town on a site surrounded by low hills. The campus is one of the most lovely I have seen, planted with flowering tropical trees and with wide stretches of lawn, neatly kept up. It has about 400 students over half of whom are housed in hostels on the campus.

Most of my time at Kandy was spent in company with members of the staff but I had one or two days touring the district, the centre of the tea growing industry. The tea gardens cover a vast area in hilly country – the planting being done on steep terraced slopes, the tea processing factories being situated at the higher altitudes. The processing consists mainly of withering the leaves, rolling them into the familiar form, removing dust and fibres and drying and packing. Whilst some attempt has been made to modernise the process, there seemed to be plenty of scope for further improvement. The present yield is about 1lb of tea from 5lbs of leaves.

Through the gardens wind narrow mountain roads with countless hairpin bends; there are few signposts and none of the labourers seem to know where they are or how to get to villages which cannot be more than two or three miles away.

Kandy is a large town with good shops. It presents always an enchanting spectacle. The women, with their many coloured saris and graceful carriage, add colour to the picture; everyone seems cheerful and one sees little evidence of any urge to work. Wandering through the crowd are always to be seen a sprinkling of Buddhist priests dressed in saffron coloured gowns and with shaved heads. Buddhism is a powerful and aggressive force in Ceylon – the priests dominate at least two of the Universities and they exert a powerful political influence.

Lunching with the Vice Chancellor after a meeting of the Board of Regents of the University, I met again one of my old students, George Ponaperuma who is now a powerful force in government circles. I returned with him to

Colombo where a formidable programme of visits and conferences had been prepared for me.

From information obtained from these activities I was able to prepare a report on the desirability of training a substantial number of chemical engineers at the University and to outline a suitable four year course.

“The newspapers here keep referring to my visit and finally the representative of the World Bank ran me to earth and asked ‘What’s all this’ in aid of. I told him.”

Leaving Colombo by air, I spent a few days in Bombay, during which I was entertained by a party of my old students and visited the University and the new industrial complex.

From Bombay I went by air to Karachi, where I was met by Dr Ahmed Khan, another of my old students. Since my previous visit in 1916 the town had grown out of all recognition and presented that unique mixture of opulence and extreme poverty which characterises so many of the towns of India and Pakistan.

From Karachi to Lahore by train and was met and entertained by Professor Saluhaddin who had worked with me at Imperial College. Lahore had for me many old memories. The gun Zam Zammah and the Ajaib Gher, the Grand Trunk Road and the bazaar, were all reminders of Kipling and the last days of the Raj. In spite of my protests, my programme was overloaded with works visits, receptions, conferences and talks with old students – their hospitality was overwhelming and I left loaded with presents and wreaths of flowers.

Writing to Hilary he proposed making a “quick dash up to the Khyber Pass to see the old Piffers” and said that he would “sit on Zam Zammah in memory of old times”.

Returning to Karachi I left by air for London where I arrived on time for our usual Christmas celebrations.

Ceylon, India and Pakistan under the stimulus of independence and with the aid of massive grants from the International Monetary Fund, are centres of tremendous activity – but in some respects the results do not measure up to expectations. The rich have become richer and the poor poorer. The priorities



Dudley and Zam Zammah, the gun that features at the start of Kipling's novel Kim

are wrong. One sees in Delhi, Bombay, Calcutta and Karachi, palatial offices of banks, insurance companies and travel bureaux, luxury hotels, state subsidised, new universities and government research institutes with modern equipment, housed in spacious new buildings – cheek by jowl with mass poverty on a scale undreamed of in Europe. Economically, none of these countries is viable and all three base their long term plans upon a continuance of the large subsidies they receive from the West.

Nigeria – 1971

In 1971 Dudley was invited by the Inter-Universities Council to visit Nigeria. Apparently Imperial College had been approached about the possibility of seconding some staff to start a course of Chemical Engineering at the University

of Lagos but, as Professor Sparkes wrote to Dudley in August 1970, “I thought that it would be better for a senior academic to go out and assess the situation”. Dudley agreed to go. As he wrote in his final report, “The Faculty of Engineering at Lagos University is now planning the addition of Chemical Engineering to its other Schools of Engineering and I have been invited by the Vice-Chancellor and the Dean of the Faculty to visit Lagos, acquaint myself with the existing facilities and make recommendations covering space requirements, equipment, syllabuses, staffing and other relevant matters for the new School”.

My last overseas tour took place in 1971 (February – April) when I visited Nigeria at the invitation of the Vice Chancellor of the University of Lagos to advise on the training and employment of chemical engineers in the new industrial developments.

I went by air to Lagos traversing the Sahara desert and the hinterland of Nigeria. My cousin, Madge Wilson-Jones (nee Finn) accompanied me and we had our headquarters in a modern hotel situated in the old cantonment area of Lagos.

Nigeria was just recovering from several years of civil wars and the armed forces were still much in evidence. A beginning was being made in ambitious plans for industrialization. Foreign aid and the revenue from oil were being spent in the erection of modern office blocks, government offices, motorways, universities and expensive motor cars. As in all other developing countries I have visited, the priorities were wrong. An army of government officials and civil servants were living in comparative luxury, whilst large areas of Lagos were given over to shanty town – huts built of corrugated iron, old kerosene tins and wooden planks, open drains, and only the most elementary sanitation. The population was increasing explosively as people crowded in from the countryside. The attempt to westernize the economy by a crash programme of industrial development, was meeting with the usual results. Frustrating delays due to the inefficiency of the civil service, complete chaos in the ports and

frequent break-downs in the public services, made the implementation of government planning abortive.

In our hotel, for example, although there were modern showers and baths, the water supply was frequently cut off and we had to make do with buckets of water drawn from a well.

The plans for education and training exemplified the difficulties inherent in attempting to change the economy too rapidly and in giving priority to 'prestige' developments. In the Lagos area, for example, there were three large and well equipped Universities, but a woeful shortage of qualified staff. The Vice Chancellors were intriguing amongst themselves and making bids for foreign aid irrespective of their real needs. Whilst the output of semi-trained graduates was increasing, I tried to convince the educational authorities that for every graduate there should be a body of at least twenty trained technicians. At the time of my visit there was only one poorly equipped school for the training of these men; and this was reflected in the difficulty experienced by industry in the efficient maintenance of plant and equipment.

The insistence of the government in the nigerianisation of labour in the foreign owned factories put up labour costs to an uneconomic level and, save for oil, effectively prevented the growth of exports.

I made several journeys to Ibadan, Ife and Port Harcourt. Away from the towns the roads were in a deplorable state and the villages primitive and devoid of public services. The sides of the roads were littered with rubbish dumped from factories and workshops, public transport was overcrowded and there were no amenities.

All this may sound depressing, but it is the inevitable result of trying to go too fast. There is another side to the picture. The country is rich in natural resources, the people intelligent, and the climate pleasant. If they can be brought to understand that their true interest is to develop their natural resources, mainly agriculture and forestry, by planned improvements in husbandry, to slow down industrialisation, and above all, to avoid the euphoria attached to the exploitation of their oil reserves; there is every prospect of

raising their standard of living and establishing a viable and stable economy.

I may add that they have had plenty of good advice contained in the reports of numerous international commissions and plenty of bad advice from unscrupulous entrepreneurs who see the opportunities for getting rich quick.

In attempting to aid developing countries, the well meaning international organisations generally fail to understand the mentality of the peoples of tropical and sub-tropical countries. They appear to assume that Western ideals and objectives can be grafted onto races which do not necessarily regard industry, hard work and sophisticated living as virtues. If one of the aims of organised society is the 'pursuit of happiness', then Western methods, even in the West, have singularly failed. Surely we can do better for those who look to us for help and advice.



*Dudley and, his cousin, Madge Wilson-Jones,
in Lagos*

In a letter to Hilary he reflects, no doubt with some relief, that “there are no cathedrals, castles or picture galleries. The hotel has a changing population of commercial types from UK, USA, USSR and Japan 'Where the carcass is there will the vultures be gathered'.... The Govt here receives so much advice that they must be thoroughly bewildered”. For some reason Dudley deeply resented being asked to show his passport and during his visit to the Far East had on more than one occasion caused major problems when he refused to produce it when all the other passengers had to present theirs. In Nigeria the

problem arose again, as he wrote to Hilary. “There has been a slight contretemps. I paid a courtesy call at the High Commissioner’s Office and was received by a hoity-toity young miss who asked to see my passport and to fill in a form. I am afraid I exploded with loud crackles and red hot cinders. Eventually peace was restored. Doors opened and important officials came out like ants from an anthill. I paid a second visit a few days later and the red carpet was out and no one wanted my passport.”

Dudley’s invitation to Madge to accompany him had not been entirely successful. While Dudley was visiting various institutions and travelling round the country, Madge was stuck in the hotel in Lagos. The dull routine, however, was somewhat enlivened by the “old bachelors who have taken her under their wing and I see groups of them telling her risky stories or explaining to her how lonely they are far from home. She seems to enjoy it.” Dudley was planning to visit Sierra Leone once he left Nigeria but, as he wrote to Hilary, “there appears to be some sort of war going on in the capital – not due to anything I have done – but I am advised to keep out.... I have decided firmly that this shall be my last trip abroad... I am too old to go ‘roughing it’ in the under developed countries. If you ever hear me mention any other trip have me examined by a psychologist and put away”.

Final thoughts on Chemical Engineering in a University setting: Report on Chemical Engineering at the University of Lagos

When Dudley wrote his report on Chemical Engineering for the University of Lagos he was already 77 years old. The report sets out recommendations for a degree course in Chemical Engineering but in the Introduction Dudley reflects more widely on the nature of Chemical Engineering education. In some respects this reads like his final thoughts on this topic after fifty years involved in the education of chemical engineers.

Before considering the demand for chemical engineers in Nigeria, “I should like to remove certain misconceptions which exist as to the precise role of the

chemical engineer in Industry. The oldest and most persistent of these is that the provision of chemical engineering services can well be met by industrial chemists and mechanical engineers working in collaboration. This has long since proved to be a fallacy and it is hardly worthwhile at this late stage to stir up the dust of an old controversy. The second is related to the distinction between chemical engineers and chemical technologists.”

Does Nigeria need chemical engineers?

“If we consider the need rather than the demand for chemical engineers it must be obvious to anyone with experience of the teething troubles inseparable from the commissioning of new plant and processes and the use of unskilled or semi-skilled labour, that a still larger force of chemical engineers will be required in the future.”

In Nigeria, he says, chemical engineers will have

“from the outset to assume responsibilities greater than would normally be expected of their counterparts in more highly industrialised communities. This circumstance should be reflected in their training which must be of such a nature as to develop self-confidence, a readiness to assume responsibility in making important decisions and the ability to deal effectively with unexpected difficulties and emergencies. It also highlights perhaps one of the most important roles of a University – that of character building”.

Dudley’s report proved to be controversial and a point by point criticism, running to 12 pages, was published by Pranscop Technological Services which was part of the Institute of Computer Sciences. This in turn was strongly rebutted by Dr Awojobi of the Faculty of Engineering with copies to the vice-chancellor. It is not entirely clear why Dudley’s report caused such an upset but there were clearly internal politics at work and a barely disguised resentment that Dudley should have recommended that Lagos form links with a single overseas institution and that the chemical engineering course should be accredited by one of the professional institutes.

Finale

Dudley had a long life closely involved in public affairs. In his Memoirs he ventured some reflections on politics, the world and on life in general.

When I began to write this story I was in my 70th year – I now conclude it in my 80th year [1974]. In the intervening years I have still kept in touch with my old department at Imperial College and continued to supervise a group of scientists engaged in the production of international tables of the thermodynamic properties of fluids. This project has received widespread support and is now established as a continuing activity of the International Union of Pure and Applied Chemistry.

At the time of writing the ‘developed’ world is in a state of crisis which is likely to continue and grow more serious as we approach the end of this turbulent century. In the early sixties Mr Harold Wilson, leader of the Labour Party, then in opposition, asked me to prepare a report on a future fuel policy. I think he had in mind a policy based on forecasts of energy requirements – such forecasts being arrived at from simple extrapolations of existing trends.

In my report and in further discussions with Wilson and Richard Crossman, I tried to convince them of the danger being incurred by all European Countries and the USA in basing their economy on oil, the main source of which lay in the Middle East, and the supplies of which were controlled by the Arab states. As soon as the Arab leaders appreciated the stranglehold they had on the West, there would be trouble. I predicted that this would happen at the latest by 1980 and that we should, therefore, re-consider the policy of closing mines and adapting our power stations and industry to the use of fuel oil.

Neither would take this warning seriously; the oil lobby was very powerful and played down any suggestion that oil would ever be in short supply. There was also the alternative offered by atomic energy to meet any short-fall.

The situation I predicted has, through the Arab Israeli war, come about a few years earlier than I expected and the present (1973) crisis is likely to have alarming consequences. I doubt yet if the Government fully appreciate our

dependence on the internal combustion engine and the chaos which would result from a break-down of oil supplies. Even if, by conceding the Arab demands, we obtain adequate supplies, the cost will be such as profoundly to affect the whole economy, to make coal again competitive, and to stimulate research into alternative methods of energy production. There will have to be a return to rail transport, a stop to the building of (probably) redundant motorways, the return of the horse and bicycle, and a change in all our habits.

Much of this involves long term planning with little time to spare and will make great calls on our adaptability. This situation is full of interest to the historian and the economist and I regret that I shall not live to see the consequences.

At my age one often reflects on life and death. Death is a curious phenomenon, inevitable and marking the end of a long period in which past, present and future run into one another. Present is in fact an interface between past and future, and when one no longer has an assurance of future, one is thrown back on the past. Living more and more in the past, one is led to examine all the mistakes one has made, and to arrive at an understanding of what are the real values which make for a full and satisfying life.

I have never, at any time of my life, regarded my character and behaviour as anywhere approaching what I could have wished. The one important quality without which all others are stultified, is integrity – integrity in thought and action; and it is a quality which is rare and difficult to achieve. In our society, indeed, complete integrity would be frowned upon as inimical to social intercourse, and to some extent this is true.

I am also sceptical of the exhortation 'love your neighbour as yourself'. I do not love myself; I see much in my character to deplore and little to imitate. I am prepared to respect my neighbour, to overlook many of his foibles and superstitions, and to help him if necessary; but I do not love him and I don't want to.

I am also against fraternisation with people of different backgrounds. I do not consider I am better or worse than they are; I am different; nor, by and

large, do they wish to fraternise with me. At a very early age, this was forcibly brought home to me. It was early in the 1914-18 war when I was a private in a territorial battalion; some of the young officers, infected with the socialist dogma of equality, used to come into our mess and try to establish friendly relations. We had to tell them, as gently as possible, that the essential structure of the army depended upon the recognition of two classes, the one providing leadership and the other unquestioned obedience to orders, any attempt to blur this distinction must inevitably weaken the whole structure.

At the present time, a similar situation has arisen in respect of race relations. The policy of attempting fully to integrate peoples of different cultures and different backgrounds is not only absurd, but wicked. Actually they do not wish to be integrated; they wish to preserve their religions and cultures whilst, at the same time, participating in all the benefits of our particular social structure. In saying this I am in no way prejudiced. I have always had many friends in India, Pakistan, China and the Middle East, and I have, as far as lay in my power, done everything possible to assist them in raising the standards of living in their own countries; but I do not wish to live with them, persuade them to abandon their religions and cultures and adopt my way of life. Nor, on their side, do they wish me to do so. The question we have to resolve is – can two widely differing cultures exist side by side without friction and conflict? I have serious doubts as to the possibility.

Human nature is such that it finds equality repugnant. Equality of opportunity – yes, but equality of achievement – no. There are those who are born leaders and those who cannot face responsibility; those who are original thinkers and those who can never break away from conventions. Both are indispensable in any community but they cannot expect to mix in any social sense.

A great deal of nonsense is now being talked about education and the desirability of ensuring that it is not divisive. We should all talk in the same way with the same accents and all attend the same schools. If this should ever come about there would be a levelling down resulting in a dreary and

uninspiring uniformity. A strong case can be made out for separating children according to their intellectual potential, and giving to each category the kind of education by which they can benefit. The fault of the present system is that separation is largely dependent on the financial status of the parents and not the capacity of the children. In short, any educational system should be divisive, the criterion being merit and not wealth.

This leads me to a final reflection. Until we have learned how to control the world's population, there is little hope of world peace. The technologically based societies of Europe and America are inherently unstable and pose problems of conservation, pollution control, social unrest and class warfare, which so far have been unresolved.

It is curious to reflect on the failure of economists and politicians to give weight to the very elementary proposition that income and expenditure must be balanced. In this country, and indeed in most western countries, we are aiming at standards of living which go far beyond what we can afford. This may be called the 'hire-purchase' economy; and as any householder knows, there is a limit to hire-purchase set by his income. Our politicians and economists search about for all kinds of subterfuges to circumvent this very obvious fact, and the result is 'inflation' which at the time of writing (1974) has assumed alarming proportions.

"But in the days that are now passing over us, even fools are arrested to ask the meaning of them; few of the generations of men have seen more impressive days. Days of endless calamity, disruption, dislocation, confusion worse confounded"

(Thomas Carlyle 1850)

Dudley and the family

Dudley had a large family. He had two surviving brothers and three sisters who remained very important to him throughout his life – assuming an added importance after the death of his two wives. In the end they also

became more important than any of the friends he made during his career. Beyond the six siblings was a wider penumbra made up of nephews and nieces, uncles, aunts and cousins. Beyond that again was an outer ring made up of descendants of earlier Newitts. Dudley kept in regular touch with most of these and organised a number of gatherings when a wide variety of family members congregated for a formal dinner in Farnham, or at Frensham

Ponds Hotel on the occasion of Hilary's wedding in 1976. In between there was a continuous procession of visiting Americans

(siblings, nephews, nieces, cousins) who all came to pay court at Hollycot, having tea on the lawn and being shown the garden or staying for a few days before

moving on with

their European tour. But all those who visited Hollycot did so on Dudley's terms. It was not uncommon for Dudley to receive a guest, provide a glass of sherry or a cup of tea (depending on the time of day) and then to disappear into his garden to get on with some task.



Dudley, Eddie and Lewis 1961

After his own retirement Lewis came on a number of visits with his wife Julia, Rita came with her husband Eddie Byrne and Bonnie was also a frequent visitor. Sibling relationships always have hidden subtexts which the outside observer cannot fully appreciate. Lewis and Dudley were only separated in age by two years and had spent much of their youth together in Wandsworth and in Scotland. Both had enlisted and fought in the First World War. Lewis had then emigrated to the US where he pursued a successful career as an industrial chemist. For a decade or so the two brothers' lives followed different tracks and it was not until late in the 1930s that they began to reconnect. Letters became more frequent and Lewis paid a number of visits to England. Although Lewis became very deaf, he and Dudley remained able to communicate and their relationship was very much one of equals.

With Eddie it was different. Eddie was four years younger than Dudley and six years younger than Lewis, a big enough gap for him to be cast from the start as the younger brother. He had enlisted in the air force during the First World War but was under age and never served. After a brief spell in East Africa he also emigrated to the USA but never established himself in any career and was overtaken by the Depression. During this time he suffered considerable hardship and Dudley from time to time sent him some money. Eventually Eddie returned to England, retrained and made a successful career as an accountant. Eddie also married twice and his second wife, Hilda, became crippled with arthritis. She and Eddie lived near New Malden, a 45 minutes drive from Hollycot. Eddie and Hilda were regular visitors for Sunday tea and always came to Hollycot for Christmas. But it was Eddie and his severely disabled wife who came to Hollycot. Dudley seldom visited them. This was a relationship very different from that between the two elder brothers. Eddie always remained the younger brother, moreover the younger brother who had messed up the early part of his life and had had to return from the US a failure. Dudley had little sympathy for failures. Eddie's son, Jimmy, recalls that

“Dudley clearly did not tolerate incompetence or lack of dedication to the task in hand and when my passes in the intermediate BSc exam were not all As, Dudley told my father that I was ‘useless’”. When Jimmy went on to study at Imperial College, Jane took him aside and warned him “not to disgrace the professor”. Dudley’s attitude towards his younger brother and his nephew



Hollycot and its garden

clearly owed something to the relationships established earlier in life and were not all positive. Jimmy later recalled that “Dudley always seemed stuffy and excessively professorial ... [with] an inability to socialize in an open and friendly manner”.

Dudley’s relations with his sisters were in some ways more and in some ways less complicated. Bonnie, the eldest, was highly intelligent and amusing, with a sharp wit that was frequently employed against members of the family. Dudley enjoyed her witticisms levelled against Lewis’s wife, and the husbands of the other two sisters. He liked her company and she in turn worshipped him.

However, Bonnie had always led a ‘colourful’ life and began to turn up at Hollycot with young men in tow. Moreover she became increasingly addicted to alcohol. Dudley proved surprisingly tolerant of this behaviour but increasingly Bonnie’s visits became a trial and she began to stay more frequently at Phyllis’s cottage rather than at Hollycot. Rita came to England less often. She also was a witty and amusing person but remained slightly more distant from Dudley than her elder sister. Phyllis, the youngest sister, had been Dudley’s ward until she came of age in 1936 and Dudley had overseen and paid for her education. After a number of false starts Phyllis settled at Sunfield, a Rudolph Steiner home for Downs Syndrome children. Dudley was never very sympathetic towards this work as he believed that educating backward children was a waste of resources. A letter to Phyllis, written shortly after the war, survives in which he clearly sets out his views.

“I am not entirely hard hearted over your problems but if you had seen as much as I have of the conditions under which normal children are being brought up not only in devastated Europe but in England – you would appreciate that priorities are necessary – there is not enough of accommodation, staff, furniture and other essentials to go round. Who is to be dealt with first? We say get the healthy children properly accommodated and fed. The future of the country depends on their efforts. When their wants have been met we can give attention to those unfortunate categories which are bound to be a permanent liability.”

However, although there was no meeting of minds on this issue, the two remained very close. Dudley found time to go to help establish a garden when Phyllis and her partner, Fried Geuter, established their own children’s home at Ravenswood in Crowthorne. When Fried died Phyllis came to live in Farnham, looking after Dudley whenever there was a hiatus between housekeepers and always ‘being there’ to help out with visitors, or to manage the increasingly erratic behaviour of Bonnie. Phyllis maintained also very close relations with

Eddie with whom she had much greater sympathy and spent a whole year providing nursing care for Hilda in the final stage of her life.

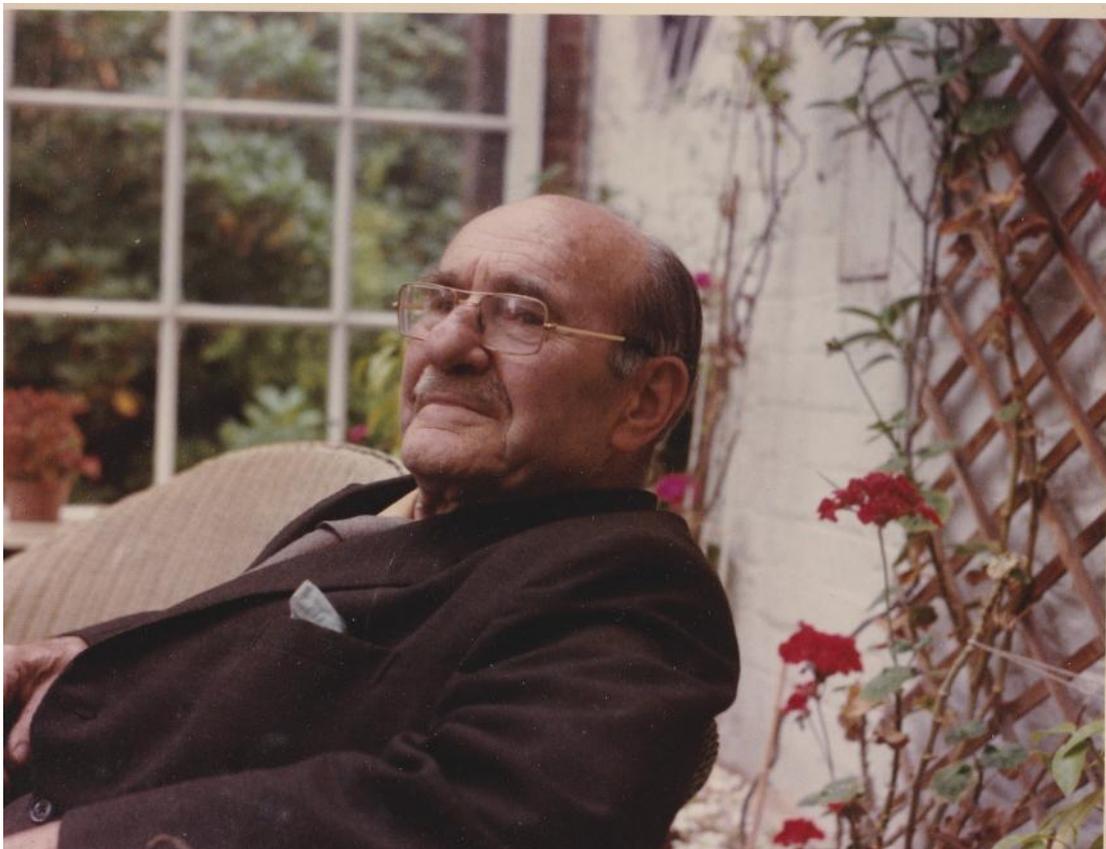
Dudley also came to take pleasure in the younger family members. This had not always been the case and Jimmy remembered going at the age of 5 (1932?) to visit Dudley at Coombefield Close to find him abrupt and cross – an impression that remained with him until Dudley eventually mellowed when Jimmy obtained a first in Chemistry. After retirement, however, Dudley became much more accessible towards the young. When his cousin Angela's daughter Heloise was barely one year old he wrote her a slightly tongue-in-cheek letter. "You have now come to the age when a first introduction to mathematics should interest you" and he enclosed a book *Multiplication Made Easy*. Later he wrote to her drawing attention to the scientific nonsense of going up a hill to fetch a pail of water as in the 'Jack and Jill' nursery jingle. Of course, he knew little Heloise was not really of an appropriate age but he believed that children should not be treated as babies and fed nursery nonsense.

Growing up with Dudley

Although I was sent away to boarding school at the age of eight and was home only for the school holidays, and although Dudley was extremely busy during the 1940s and 1950s when I was growing up, he was a major formative influence on my life. This might not appear obvious at first sight. Although he wrote regular letters these were rather stiff and formal, full of promises to come down to watch cricket matches (which he seldom did) or making arrangements for holidays or days out. During the holidays I spent much of my time on my own as Dudley left early in the morning for his London commute. I was urged to do jobs in the garden – mowing lawns, digging out tree stumps, and endless weeding. At weekends we walked round the garden discussing jobs that had to be done before making the ritual visit to the Lion and Lamb cafe in Farnham or to the little Castle Theatre

in the evenings. After lunch Dudley would retire with a book to his favourite arm chair to ‘meditate’ which was the accepted euphemism for an afternoon nap.

As he grew older Dudley appeared increasingly and unashamedly old fashioned. He was among the last of the generation of men who had short clipped moustaches, wore tweed suits and smoked pipes. He had little small talk and never really tried to discuss my schooling or my interests, except in the most perfunctory manner. Although he professed to be a keen fisherman and yachts-



The last photo taken of Dudley in the conservatory at Hollycot.

man, he never made any attempt to indulge these pursuits with me. Only when we were taken on country walks was there some discussion of pressing world problems. All this sounds like a cold relationship, verging on neglect. However, this was not how it seemed at the time and not how I remember it. Living close to Dudley meant absorbing his values, his tastes and his way of life.

Working in the garden, taking country walks, meeting regularly with members of the family, reading quietly at home – boring as this sounds it was a powerful cocktail of habits and values. Dudley gave the impression of strength and certainty. He seemed always to be confident and in control. He never lost his temper or became confused. Even his studied domestic helplessness seemed not a weakness but a kind of strength. Also, almost unnoticed, I learnt that saying nothing was often better than saying something trivial or irrelevant, and definitely better than chatter. Dudley had learned the merits of ‘holding his peace’ during the stresses of war. In its own way life at boarding school could be very stressful for a young boy and the virtues of ‘laying low and saying nothing’ were lessons well learnt.

Living close to someone invariably means that you get to know their weaknesses and vulnerabilities – but this was not the case with Dudley. There were no apparent chinks in the armour of his strength and self-confidence. At least none that were ever visible to me. It is often said of the children of prominent persons that ‘nothing grows under a big tree’ – and this seems to some extent to have been true of Hilary who lived at home with Dudley until she was 38 years old. But I was away at boarding school or university much of the time and the ‘big tree’ offered security and shelter rather than stunted growth.

If Dudley’s persona was to a certain extent deliberately constructed, it was a good illustration of Shakespeare’s metaphor that “all the world’s a stage”. You have first to put on the costume and the make-up before you can become the person you desire - another lesson well learnt.

Family letters

Dudley was not a great letter writer. Of all the many letters of his that survive there is only one which seems to express deep feelings. It is worth quoting at length. It was written, probably in 1944, to his sister Rita when he had just returned from a visit to the US.

“My dearest Rita,

I have now been home for some weeks and my visit to the US is becoming nothing but a pleasant memory. I cannot begin to tell you how much I enjoyed meeting you and Bonnie again and seeing your delightful young family. In some ways it is most unsettling when two or three of our family foregather. It carries one back to old days and our old home. I get a most extraordinary feeling that my present existence, my home and family, are only a transient manifestation and that at any moment I may be transported into the past and see you and Phyllis come home from school and Ma serving an enormous dinner to an enormous family.

I do hope that you are considering very seriously a visit to England as soon as the war is over. You must come and see the old folk and you must not put it off one moment longer than necessary. As Ma gets older she lives more and more in the letters she gets from you girls and in her recollections of the past.”

Nevertheless, reading his slight and often rather dull letters, one can feel very close to the writer – they are honest and true to his character, as for him communication was a matter of providing practical information not expressing feelings or describing experiences. The exceptions are the letters he wrote during his Asian tour of 1968 when he had long empty hours on board ship and his letters become more descriptive. The letters Dudley wrote to Malyn are all very similar. He wrote frequently while Malyn was at boarding school and seventy of his letters survive, covering the period 1962 to his death, half of them written between 1962 and 1965 when Malyn was in Africa. After exchanging information about various travel arrangements and the movements of members of the family, there is the routine mention of the weather and developments in the garden. There are short references to political reports in the press and exhortations to finish the thesis and publish the book. Occasionally Dudley would offer advice on building plans (which he was going to finance) or on possible career moves for Malyn or Hilary.

Many of these letters observe what was at one time considered a necessary convention, that the writing should continue, however briefly, onto a second page. Only occasionally are they illuminated with a spark of wit or an arresting turn of phrase which remind one of the sense of humour that Dudley brought to his personal relationships.

Hilary also kept all the letters and notes he wrote to her including fourteen which were written while she was in the Netherlands doing an internship at a gas plant. In spite of their brevity, Dudley's personality and his relations with his family come through.

1958 to Hilary in the Netherlands: "I have heard nothing from Holland about a breakdown in gas supplies so I presume your analyses are not too wildly out. I went up to London yesterday and found such a pile of letters that I became disheartened and came home again."

1960 (March) to Malyn: "I cannot think what you people were about to elect Macmillan as Chancellor [of Oxford University]. You might as well have elected Jimmy Edwards or Danny Kaye." and (June) Hilary "seems to think the gardens at Blenheim are rather better than ours. I doubt it."

March 1965 to Malyn: "Last Tuesday we celebrated Hilary's birthday by a little dinner at the Bush hotel. Hilary was in good form but how she does it on tomato juice I don't know."

Nov 7 1962: "the Indo-Chinese situation looks ugly. If India could only send the Piffers up to the frontier they would soon clear up the situation."

August 1965 on hearing about Malyn's production of the *Carmelites* at the University of Rhodesia: "I suppose there is some fascination about producing a play which has no plot, no message and no recognisable characters - but why not stick to the old maestro [Bernard Shaw]?"

July 1968 at sea: "Our Yorkshireman tells me he has put on 7lbs in weight during the last week and a simple extrapolation to his weight when we reach Japan has thoroughly frightened him. This morning he started dieting cutting

down on cornflakes and only eating three fried eggs and two rashers of bacon with toast and marmalade."

Sometimes Dudley would abandon the formula and offer urgent advice. In 1968 he heard that Malyn had been chosen as prospective parliamentary candidate for the Labour Party in Honiton.

"I hope you will not get embroiled in politics – working up a constituency and fighting an election is time consuming – and if you win it spells the end of your academic work with no compensating advantage. MPs now have a full time job – not only in the house but also dealing with endless local trivia. The pay is poor – rather less than a garbage collector earns in New York and the future prospects are precarious; I expect you will think this is what RLS calls 'prudential and cowardly' advice from the old to the young but it is based upon my contacts with many MPs in London."

More revealing are the little cameo sketches of Dudley in Hilary's voluminous correspondence with Malyn. These capture the essential Dudley as he was known to members of the family and to those who met him in retirement.

September 1970: "Your comments... remind me of father complaining because we weren't being taught the integral calculus at the age of five. Father is embattled with British Rail, who sent him from Edinburgh to King's Cross in a train without a restaurant car. He says in passing that Scotland was wet, cold and windy, just like here in fact."

December 1971: "Father says he is surrounded by the moribund, but seems to be keeping pretty well himself in spite of days spent in the freezing garden picking stones out of the flower-beds. When gardening is really impossible he hounds Kay out into Farnham to help with his Christmas shopping".

August 1972 with family arrivals in the offing: – "Father was sent out to

buy drinks for the parties we expect, told to get beer as well, and came back with three half pint cans. He also produced from the back of the drinks cupboard a tin of cocktail biscuits he got in 1964, and a bottle of whisky that he says is too good to be offered to anybody.”

November 1973: “I told Father the other day that I thought of growing my hair long, and he said ‘Well think again and grow it short’ ”.

April 1974: “I thought I had persuaded Father to let me help with the mowing. Well, I did it once, with the motor mower, father watching every move – then we had delaying tactics for a fortnight. If I offered to do it in the mornings – too early, in the afternoons, too late. Finally, all right, I could do the bit by the garage. Blowed if he hadn’t got the hand mower out for me. I sweated round for half an hour, stopped 15 sec to blow my nose – father appeared round the tool shed & said ‘What are you slacking for?’ ”

August 1974: “Father looked [at Malyn’s book on the Comoros] and said you should write more like Charles Montagu Doughty – what a fearful idea”.

November 1975: “Father is fine; at the Lion and Lamb [cafe in Farnham] the waitresses, at sight of an arriving Newitt, say ‘Sir is in the inner room’ or ‘Sir hasn’t arrived yet’. In short he’s an established Farnham character.”

Unknown date: ”Father is reading Galsworthy and says ‘sugary’. He is upset too, because no one thinks Francis Chichester as marvellous as he does... opposition view point – why cross the Atlantic six times single handed or rather, why wouldn’t once do?”

Closing the book

Dudley had had a minor stroke in his eighties which left him with a slight limp. The stroke slowed him down somewhat but did not radically alter

the pattern of his life. He continued to make regular visits to Imperial College where he maintained certain research interests. He also continued to serve on various committees. He accepted Robert Maxwell's invitation to serve on the honorary editorial advisory board for the Pergamon International Library. In 1975 Robert Maxwell wrote a letter of thanks and invitation to select some volumes from the list. "From time to time we shall, of course, be replacing old editions with new titles in the library and I should be grateful if you would let me have any suggestions about possible authors and topics". In 1976 Dudley was a member of the Executive Committee of the Laboratoire des Interactions Moleculaires et des Hautes Pressions run by Boris Vodar, and in 1979 (at the age of 85) he eventually retired from the Awards Tribunal of the National Coal Board. He had been a founder member 27 years earlier. He even undertook a final consultancy *January 1978 I was invited to go to Algiers on the Methane Progress - a tanker carrying liquid methane from Algiers to Canvey Island. It was a very pleasant voyage although very rough in the Bay of Biscay.*

Otherwise his life became increasingly focused on his family, his garden and his home where he was devotedly looked after by his cousin Kay (who had changed her name from Connie which she detested). Work in the garden was concentrated on simplification, with many of the flower beds being grassed over. Early in 1980 he was ill with bronchitis but recovered somewhat before his sister Bonnie came on a visit from America. Then during the night of 13 April he had a heart attack and died.

His brother Lewis, aged 88, came from Ohio to pay his last respects and, after the cremation, Dudley's ashes were buried in the town cemetery of Chatteris in the Fenland.

There was an obituary in *The Times* and his death was noted in the local papers. On 22 May 1980 there was a memorial service at Holy Trinity Church,

Brompton Road – a sort of parish church for Imperial College. Flowers were brought from Dudley’s garden where the rhododendrons were in full bloom and the eulogy was delivered by Professor Ubbelohde. Hilary and Malyn received a large numbers of letters, among them a few that deserve special notice. Dudley’s former secretary, Pamela Johnson, had married Kenneth Bett, one of the lecturers in the Department. She wrote,

“I am glad I had the opportunity of seeing him [Dudley] at the lecture just before Christmas but thought then that he had become frailer; although the wicked gleam in his eye was still very much in evidence. I have so many memories of the years I worked for him. I amuse my family by recounting some of the comments he made about things, and quoting examples of his wry wit and sense of humour. I also remember various outrageous expeditions I embarked on at his instigation, particularly once, when parts of Baker Street were being demolished, I was sent to find 221B and to bring back a brick therefrom. This had to be parcelled up and sent to the US Sherlock Holmes Society”.

She might also have remembered being detailed to take Malyn, Hilary and their American cousin Debbie for a holiday at St Cast in Brittany – beyond the normal course of duty for a secretary in the early 1950s!

Recalling a visit to Moscow as part of the IUPAC project, Selby Angus wrote that the Russians “revered him so much that they did tend to give him caviar at every meal – but I remember one memorable breakfast when communication broke down and it consisted of caviar, chocolate éclairs and tea”. Dudley’s old Indian friend and associate, G.P. Kane, summed up what was the theme of many of the letters: “Ever since I joined the Imperial College forty-five years ago, Prof Newitt was my Philosopher Guide and Friend, and he was very generous to me with his affection and support. Whenever I visited England, a meeting with Prof. Newitt was a

fixture in my programme.” A former student, Amalendu Sen, wrote a lengthy series of reminiscences. What most impressed him was an occasion when

“on hearing that Professor Newitt had arrived [in] Delhi, I rushed to see him at his Hotel’s suite...[the] Hotel’s receptionist informed him over internal telephone line that one of his ex-students named ‘SEN’ has come to see him. What astonished me most was that instead of calling me to meet him at his reception room of his suite, he came down within few minutes to meet me at the ground floor... and then to take me to his suite.”

When Dudley’s desk at Imperial College was cleared, a loaded revolver was found among his effects!

APPENDIX 1

In April 1949 Dudley had written a long letter to the *Daily Telegraph* drawing attention to the lack of a national fuel policy. This remained a matter of major concern and in 1963 Dudley was asked to act as chairman of a group of scientists to advise Harold Wilson of fuel policy. In May Dudley, produced a report entitled FUEL AND POWER. The following extracts from the report give a good idea of his thinking in this important area of economic planning and of the way he believed scientists might contribute to the formulation of public policy.

Introduction. The need for a Long-Term Fuel and Power Policy

I The Minister of Power has the statutory duty of providing for the energy requirements of the country in the appropriate forms and quantities and at the cheapest rate consistent with certain political, economic and social obligations.

We believe that a Labour minister of Power has an unique opportunity of planning and developing the total energy producing potential of our country, by following the Socialist principle of a planned integration of all separate fuel and power industries, in the interests of the community as a whole.

In our view this implies that he must frame and implement a policy which will enable the various energy producing industries to prepare and carry out long-term plans and to

promote activities designed to maintain their existing operations at a high level of technical industrial and commercial efficiency. In this connection, he has also the responsibility for “Securing the effective and co-ordinated development of coal, petroleum and other minerals and sources of fuel and power...” He must also take account of the social costs of his policy and not interpret costs in the narrow economic sense alone.

II In order to assist him he requires, inter alia, the best possible projections of total energy requirement over comparatively long periods and a pattern of energy use which will take into account the estimated availability of primary and secondary fuel and the impact of technological and economic development in industry as a whole.

In this country the contributions from ‘income’ sources of energy may be regarded as of minor importance and attention may, therefore, be focused upon coal, oil (including natural gas) and fissile material as the basic sources of energy.

III At the present time perhaps the greatest uncertainty with respect to policy making, attaches to the position of oil in the economy. Various current estimates suggest that before the end of the century the rising world demand will result in a hardening of prices of oil so that coal and fissile material may find themselves in a much more favourable competitive position than today. In this country they may well have to provide a substantial proportion of the increasing energy load if a future fuel crisis is to be avoided.

IV There are other considerations which enter into the formulation of policy which require a close and continuous study of the pattern of technological development in industry as a whole and of the impact on the fuel industries of industrial and social changes resulting from the National Economic Policy.

V It is clear that a wide range of skills and extensive research are required to assemble and appraise the information upon which policy decisions may have to be made and we shall suggest later in this Memorandum a form of organisation suitable for the purpose.

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The Basis for a Policy

I The immediate future and long-term plans of the coal industry. We recommend that coal should be assigned the task of supplying the ‘base load’ of UK energy needs. To this end it should be maintained at around 200 million tons during the current period of energy surplus, with the prospect of expanding in the longer run. A healthy coal industry, capable of expansion, is in our view the keystone of a rational fuel policy for this country, and we have recommended appropriate action.

II The secondary fuels, electricity and gas, have choices open to them of the primary sources of energy to be used. We recommend that their development plans should be geared to the objective for coal given above and to the longer-run projections of energy needs.

III The administrative structure and present policies of the gas industry. We recommend that the structure should be changed to provide a central organisation capable of operating the industry on a national basis.

IV The development plans of the nuclear energy industry. We recommend that the nuclear energy programme should be framed in the light of two objectives:

- a) To make a significant contribution to electricity supply by 1980
- b) To develop a safe and economical system of electricity generation. Efforts should preferably be concentrated on developing a limited range of nuclear station types, capable of competing economically with fossil fuel systems and, if necessary, of being multiplied rapidly.

V Research Development. We recommend that a review of the research and development programmes of the fuel and power industries be undertaken in the light of the policy decided upon, having regard especially to collaborative work implied by our recommendations on the gas industry, and to the extension of research into atmospheric pollution and fuel use efficiency.

VI To assist in the detailed application of policy and to provide a continuing advisory service on all aspects of fuel and power affecting the UK, we recommend the formation of a policy planning group within the Ministry.

Finally, we should like to refer briefly to two matters of principle which are frequently cited as important elements in policy making, namely free competition between the fuel industries and freedom of choice on the part of the consumer.

This report makes an emphatic recommendation that there should be a co-ordinated comprehensive Fuel & Power Policy; the interests of individual industries should not be allowed to override the national interest and where there is a danger of this happening the minister should not hesitate to exercise his judicial and co-ordinating functions. There will still be a degree of competition between the industries and this doubtless will have a stimulating effect on their commercial activities and may suggest useful and rewarding research and development products. But we feel strongly that there should be a much greater emphasis on collaboration than on competition.

Short of absolute prohibitions the consumer will always have freedom of choice to decide between different products on price and acceptability. There is nothing to prevent the minister using price as a means of stimulating or damping down demand for one fuel as against another. This may well be one of the principal elements in the control machinery used to put a national policy into effect. But we regard freedom of choice by the consumer as an ideal that sounds well on paper but can never be realised in practice. It has little or no bearing on policy, since consumers will, if left to themselves, follow normal commercial practice in satisfying their requirements.

APPENDIX II

On his travels to Asia, the Middle East and the Americas Dudley was called on to give a large number of lectures. In the file relating to his visit to the Lebanon and Syria in 1962 are the drafts of a number of these lectures. Below are the notes for a lecture given on 28 November 1962 to The Order of

Engineers in Beirut. This lecture shows clearly how Dudley drew on his experience of running Station IX during the War and why he attached such importance to the pro-science direction adopted by the Labour Party under Harold Wilson.

The Govt. Role in Research

The Govt. is responsible nowadays for creating conditions favourable for the growth and expansion of industry by either direct or indirect action. It has a Minister for Science and an Advisory Council on Scientific Policy – “to advise the minister in the execution of his responsibility for the formulation and execution of Gvt. Scientific policy”. It will recognise that in highly competitive markets industry can only survive if can operate at high technical efficiency and keeps abreast of modern technological trends. And this is only to be done by research.

Big industries may usually be expected to look after themselves – they have the financial resources, the scientific manpower and the incentive to keep themselves up to date. They only require that the Govt. should provide them with trained personnel and should give them incentives for incurring the financial risks associated with large research & development projects.

A much more difficult problem is concerned with the medium sized and small industries. These cannot afford to employ many highly trained scientists & technologists or to devote any considerable sums to research. Nor are they in a position to keep themselves informed of modern progress and take advantage of new discoveries and new techniques. Usually they operate inefficiently and only keep going by virtue of low overheads, unskilled labour and bad working conditions. They are reluctant to abandon traditional methods and do not understand which help can be given to them. Nearly all countries face this problem and Govts deal with it in various ways. There is, however, one method common to them all. All Govts now find it necessary to create and maintain a certain number of National Laboratories in the interests of industry. Standard Laboratories, NPL, NCL, Fuel Research, Hydrodynamics. Each of these is run by Advisory Councils and their programmes are largely determined by National Science Policy. They provide some services to industry, particularly the large industries, on a payment basis but are not intended to be self-supporting. In UK they are financed by DSIR, MRC, ARC who are controlled by the Treasury.

They do not provide a solution to the problem of the small manufacturer since they have no machinery for making contact with him, or for ascertaining his needs.

Between the two world wars the DSIR established the system of Research Associations in which a voluntary levy was made on firms engaged in particular industries eg Paper making, Iron and Steel, Paint, Leather. The levy was based upon turn-over and the Govt. made a grant depending upon the total subscribed by industry.

The Research Associations have their own research stations under a Director of Research and are controlled by a Council elected from member firms.

The Council usually appoint a Research Committee to advise the Director of Research and to approve the budget and programme of research. The Govt. Appoints 2

visitors to the Association – usually eminent scientists who periodically visit the station, are co-opted members of the Research Council and generally report to the DSIR when the Association comes up for a renewal of its grant.

The Association have well equipped and well staffed laboratories. Their programme usually includes

- (a) A substantial amount of fundamental research of high quality bearing upon the technology of the industry
- (b) Ad hoc applied research carried out for member firms
- (c) Providing an information service to member firms
- (d) Making sure by personal contact & otherwise that the smaller member firms are able to appreciate and take advantage of the work of the Asscn. – Mobile laboratories
- (e) Open Days – Conferences

Generally they have been very successful. Contrary to early fears big organisations which have their own research facilities join & become active members.

The DSIR encourages industrial research in another way. It provides grants to qualified individuals (usually university teachers) or in some cases to industry to initiate and carry out research which is considered as timely and of promise – these may be considerable grants

Jodrell Bank Telescope

Computers

Machine Tools

It would contribute to channels by which recommendation for the Advisory Council for Scientific Policy in regards to neglected fields would be financed.

...

Govt. Expenditure on Research

£320 millions – Defence 49% Civil 14.2% Research Councils 3/7%

Private Industry 28.5%

Universities 0.3%

£480 millions

The system I have outlined relates to a highly developed country in which there are many industries represented by manufacturing units of all sizes and in which the total of subscriptions is sufficient to finance research on a comparatively large scale.

How would this apply to a country in which there are few industries and these consist of relatively small units. It is doubtful whether they could in the early stages of industrialisation support research associations. And certainly there would be a number of industries without any representation.

In this case it is probably best to start with a General Industrial Research Association combining many functions of a National Laboratory with those of a Research Association. It will have to perform an educational function.