BIOGRAPHICAL MEMOIRS

Ronald Thomson Grant, 5 November 1892 - 7 November 1989

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BY R. H. S. THOMPSON, F.R.S.

FAMILY BACKGROUND

RONALD GRANT was born on 5 November 1892, in Glasgow. He had an elder brother, George, who died in infancy, and a sister, Margaret Hogg Grant (1894–1939), who qualified in medicine at Glasgow.

His father, George McWillie Grant (1865–1925), was a journalist who for some years was in charge of the Glasgow office of *The Scotsman*, and was himself the son of Alexander Grant, a farmer of Inchgarth, Cults, Aberdeenshire.

His mother, Jean Hogg Thomson (1860–1927), was the daughter of James Kerr Thomson (1818–1907), a teacher, missionary and finally an ordained minister of the Free Church of Scotland. His obituary notice stated that 'he gave his leisure almost entirely to study, and even in his later years he entered with success into new fields of scholastic research'.

In his Personal Record Ronald has said that, so far as he knew, all his ancestors were country folk, mainly farmers: 'We lived simply, for we were not "well off", but happily in a flat in Glasgow which was situated a 10-minute walk to my school and the University.'

Of his father he has written that:

> he influenced me greatly. I have never met his like. He was a lovable character, always kindly and thoughtful for others. He was popular with his fellows, but was shy and avoided the limelight. A capable journalist, his interests were wide, and he knew something of many things. His judgement was sound. He always stimulated me to think for myself, often refusing to tell me his own views until I had made some exploration for myself. He encouraged me to attend the theatre and concerts. He himself sang, and put me to learn the piano from the age of six, holding me firmly to practise. Glad I am that he did so, for I have since had great pleasure from both listening to and playing music. He had a good library of general literature, which he encouraged me to use. From my later years at school and onwards he often gave me books to review, and sent me to report on meetings and carefully criticised what I wrote. He loved the country and its pursuits. On holiday we were much together, walking, trout fishing and playing golf.

In 1918, at Cannock Chase, Staffordshire, Ronald married Nancy, daughter of Robert A. Hill of Sydney, Australia. There was no issue of this marriage, and they were divorced in 1937. Later that year, in London, he married Marguerite, a daughter of Hermann Rastedt of Helsinki, formerly an engineer in St Petersburg. She and her

sister, Helen Rastedt, had arrived in this country in 1920 as 'refugees from Leningrad, walking or being given lifts, and accommodated by peasants for the nights'. They were forced to spend two weeks in Estonia while waiting to obtain a permit to enter Latvia, where they spent a further three months getting a visa to travel from Riga to England. Their father had business connections and friends in England, and with the Communist revolution in progress their lives were in danger, and so the escapes were planned. Their mother and father managed to get away in winter when the Gulf of Finland was frozen, so that they were able to drive from one coast to the other on sledges; they have recorded that while doing so they were 'terrified by the searchlights'.

Marguerite was a talented pianist, and had already two years of training in Leningrad before they were forced to leave Russia. On coming to England she entered the Royal College of Music in London, and was awarded her diploma after three years. She also paid several visits to Dresden where her aunt had a music school.

It was indeed music that brought Ronald and Marguerite together, and when they moved to their house in Farley Green two pianos were installed to enable them to play duets. She died tragically in 1939, four days after the birth of their daughter, Diana Marguerite.

His third wife, whom he married at Guildford in 1945, was Elsie Mary Whitehead, a widow, who was the daughter of Robert Buchanan, a marine engineer from Hull. There was no issue of this marriage, and she died in 1985.

SCHOOL AND UNIVERSITY DAYS

Ronald attended Hillhead High School, Glasgow, for both his primary and secondary education, from about the age of six, and went on to the University at the age of 17, in 1910. He enjoyed school, and he has recorded that he 'managed to do pretty well'. He was a keen member of the Cadet Corps from the age of 12 onwards. He played rugby football, and 'tried cricket but disliked it'.

He has mentioned that three of his teachers specially influenced him: these were Alexander Hadow, the English master, Hector McKenzie (classics) and in particular Peter McLeod, the science master. Ronald has written that 'he made things interesting; he insisted on the solution of problems by first principles rather than by formulae, and he demanded accuracy'. During his last year at school he was given the run of the school laboratory, which he said was well equipped, and he was therefore able to do more chemistry and physics than was required for the 1st M.B.

In 1910 he began his medical studies at the University of Glasgow. He clearly enjoyed his years in the Medical School, and was awarded prizes in embryology, physiology and pathology. Throughout his time there he took a full part in student activities, and was elected President of the Students Union. He served for four years in the Officers Training Corps. He has written:

> during this time at Glasgow the teachers of Medicine, particularly in the non-clinical subjects, were a first-rate group, most of them Fellows of the Royal Society – Gray in Physics, F.O. Brown in Botany, T.H. Bryce in Anatomy, James Gemmill in Embryology, Noel Paton and E.P. Cathcart in Physiology, and Robert Muir in Pathology. I have lively and grateful recollections of these

men, and owe them much. The only outstanding clinical personality was Sir William Macewen, Professor of Surgery.

While studying anatomy Grant began some undergraduate research, working in James Gemmill's laboratory until the outbreak of World War I, and helping him with his work on the development of the star fish, and at his suggestion studying the circulatory system of the brachiopod *Crania anomala*. He has commented on it by saying: 'This gave me valuable experience for later work. I enjoyed it.'

His last year in the Medical School was interrupted by war service. In August 1914 he joined the 4th Argyll & Sutherland Highlanders as a 2nd Lieutenant. He was wounded in Flanders in December 1914, and was invalided home in January 1915. In June of that year he was transferred to the R.A.M.C. and served with them until after the end of the war. From August 1918 to August 1919 he was attached to the North Russia Expeditionary Force at Archangel, serving as Medical Officer i/c Medical Division of No. 85 General Hospital. He was demobilized in September 1919, and in the same year was mentioned in Dispatches for services in North Russia.

University College Hospital Medical School

After returning in 1919 from war service overseas with the R.A.M.C. he was appointed Resident Medical Officer at Ruchill Fever Hospital, Glasgow. While holding this appointment he took the D.P.H. (Glasgow) in 1920, and was also in that year awarded the M.D. (Glasgow) on a thesis on 'The diphtherial infection in scarlet fever'.

In 1921, after a brief visit to Australia, he obtained a personal grant from the Medical Research Council to work with Sir Thomas Lewis and his group at University College Hospital Medical School, London. He remained with Lewis at University College Hospital until 1934, being appointed to the Scientific Staff of the Medical Research Council in 1928.

His first publication from University College Hospital in 1922 (2)* described a comparison of the action of quinidine with that of other Cinchona alkaloids in auricular fibrillation. He also made a study, jointly with Lewis, of subacute infective endocarditis (3, 5).

At about this time Lewis turned to a study of the small blood-vessels of the human skin, and in 1924 he and Grant published an important paper (6) on the vascular reactions of the skin to injury, in which they showed that there is a common reaction of the skin vessels to different types of injury to the skin; mechanical (scratching, stroking, pricking), burning, freezing, electrical stimulation or the application to the skin of a variety of noxious chemicals. This reaction closely resembles the effects produced by pricking histamine into the skin, and by careful and detailed work they concluded that these vascular changes are not a direct reaction to the injurious stimulus, but result from the local release of a substance having a histamine-like action

* Numbers in this form refers to entries in the bibliography at the end of the text.

on the skin vessels.

They also investigated the condition known as 'reactive hyperaemia' which had for long been familiar to all who have used a tourniquet to control haemorrhage, and which manifests itself on releasing the tourniquet as a bright flush of the skin. They showed that this hyperaemia of the skin distal to the obstruction occurs upon restoring the circulation, even though the nerves to the skin have been sectioned and allowed to degenerate, indicating that the reaction is a purely local one, and is independent both of the central nervous system and of local reflexes. They concluded that the vasodilatation results from 'the accumulation in the extravascular tissue fluids of slowly diffusible substances which are the products of metabolism during the period of circulatory disturbance'. They went on to point out that the reaction has much in common with that which controls the local tissue circulation in its response to a wide variety of injuries, as mentioned above.

In 1926 Lewis and Grant studied a patient who suffered from attacks of asthma and urticaria, the latter associated with the ingestion of or contact with fish. They showed that the skin of this patient reacted to a dilute aqueous extract of herring muscle, but was not abnormally susceptible to mechanical injury or histamine. The anaphylactic skin reaction was found to resemble precisely the skin reaction resulting from injuries of various kinds and from that produced by histamine. They concluded that the 'anaphylactic poison' acts on the skin by liberating in it a histamine-like substance (11).

While at University College Hospital Medical School, Grant worked at first closely with Sir Thomas Lewis, but from about 1928 onwards he became increasingly independent of him, working largely on his own with various visiting workers from abroad as collaborators, notably T.D. Jones, Edward Bland, Edwin Wood and P.D. Camp from the U.S.A., and Maurice Regnier from Brussels.

In addition to taking part in the work underlying the observations mentioned above on skin blood-vessels in man, Grant, being at heart a devoted experimentalist, felt more and more the need for a suitable animal preparation to further his work on man, and his observations on local arterial reactions in the albino rabbit's ear (23) led him to realize that here he had an ideal preparation for the direct observation of the behaviour of the smaller blood-vessels under the binocular microscope.

In a paper entitled 'Observations on direct communications between arteries and veins in the rabbit's ear' (24) he described, for the first time, *in vivo* evidence for the existence of arteriovenous anastomoses. He described their structure in detail, and showed that they react to mechanical stimulation, histamine, acetylcholine and cold by dilatation, although adrenaline causes constriction. They are particularly responsive to sympathetic stimulation, contracting vigorously and quickly. He concluded that 'the anastomoses serve two functions, local and general. It is mainly through their agency that the temperature of the ears is maintained when these are exposed to cold. They are also important factors in regulating body temperature since they can aid in the dissipation of heat by allowing an enormous blood-flow through the ears.'

In 1931 he and Bland (25) extended these observations to the arteriovenous anastomoses in human skin and in the bird's foot, with special reference to the reaction

to cold. In man they showed that the sole of the foot and the palm of the hand are richly supplied with these anastomoses, and they are particularly numerous at the tips of the digits. They described further evidence that in man they play an important part in the reaction to cold displayed by the human finger.

On a purely clinical level Grant was responsible for two lengthy and detailed papers dealing with the after-histories of two groups of men who had been under the care of Sir Thomas Lewis and his colleagues at the Hampstead and Colchester Military Hospitals during and after World War I. One group (8) comprised over 600 men suffering from the 'Effort syndrome', that is to say, men with reduced exercise tolerance but without definite signs of cardiovascular or other disease. They were followed up for a period of five years. The other group, followed up for ten years, consisted of 1000 men with definite signs of acquired cardiovascular disease. At the end of the War many ex-service men were living in London, and were receiving pensions for cardiac disability arising during service. It was realized that the opportunity for follow-up studies on a large scale was unique, and by arrangement with the Ministry of Pensions the opportunity was seized. The 1000 men were chosen from those sent by the Ministry for treatment at University College Hospital during the years 1919–1921 (29). No factors influenced the selection of patients other than those of residence in London, being a pensioner, and presenting definite physical signs of heart disease. The carefully recorded data and observations on this large group of cases provide us with a very complete picture of the course of a wide variety of cardiac conditions.

GUY'S HOSPITAL MEDICAL SCHOOL

In 1934 Grant left Lewis to become the Director of the newly established Medical Research Council's Clinical Research Unit at Guy's Hospital Medical School. He was also elected a Fellow of the Royal Society in that year.

At Guy's he continued his research into the physiology and pathology of the smaller blood vessels. His principal collaborators at Guy's were R.S. Bruce Pearson, H.E. Holling, E.B.G. Reeve, B. McArdle, D. Verel and John (now Lord) Butterfield. Although Holling and Reeve worked quite closely with him in his earlier years at Guy's, McArdle, Verel and Butterfield were engaged on research programmes that were, in the main, independent of Grant's chief interests.

His time at Guy's was interrupted by World War II (see later). On his return after completing his war service his chief helper and collaborator was John Armin. He had joined Grant as a Sergeant, R.A.M.C., during the War, and they continued to work together until Grant's retirement at the age of 65, in 1957, when the Unit was disbanded. Armin had no formal qualifications, but held the grade of Senior Experimental Officer of the MRC Grant has said 'I owe much to his friendly collaboration, his technical skill and his critical acumen.'

One of the earliest papers from the Guy's Unit appeared in 1936, and in this Grant, together with Bruce Pearson and Comeau (34), described detailed observations they had made of a group of six patients manifesting a well-defined type of urticaria which

had not hitherto been recognized and studied, although from time to time isolated instances had been reported. The urticarial attacks in these patients were regularly induced by emotion, exercise or warming the body, and were characterized by the development of numerous small flares and wheals, and were usually accompanied by itching. Grant and his colleagues were able to show that local whealing in these patients could also be produced by introducing pilocarpine or carbaminoylcholine electrophoretically into the skin. Acetylcholine, when introduced into the skin in this way, was uncertain in its effects, only occasionally producing whealing, but the addition of eserine, itself with no effects on the skin, regularly produced an urticarial response. They concluded that the urticaria in these patients is brought about by an abnormal reaction of the skin to normal amounts of acetylcholine released at nerve endings. The disorder has therefore been termed 'cholinogenic urticaria'. Later work supported these conclusions by showing that the cholinesterase activity of the skin is much reduced in patients suffering from this condition.

World War II. Studies on traumatic shock 1940–45

In the autumn of 1940 Grant's laboratory at Guy's Hospital was destroyed by a bomb, and at the request of the Committee on Traumatic Shock of the Medical Research Council, he and Reeve then embarked on a study of the systemic effects of severe and extensive injury in man. Their work on this problem began during the heavy air raids on London in 1940, and, when the large-scale air raids on London ceased, was continued at the Royal Victoria Infirmary, Newcastle upon Tyne, on patients injured in industrial and road accidents. The final stage of the work was done on the Italian battlefield in 1944–45.

In all, 230 patients were studied in detail, 120 in England and 110 in Italy at forward Casualty Clearing Stations or Field Dressing Stations. For the work in Italy, Grant was in command as a Lieutenant-Colonel, R.A.M.C., of the No. 1 Traumatic Shock Research Unit. He was mentioned in Dispatches, and was appointed O.B.E. in 1945. The main objective of the Unit was to learn how to recognize and treat the condition known as 'traumatic' or 'wound shock', which was reported to be occurring frequently in air-raid casualties. First, however, it was necessary to obtain enough facts to be able to define the condition of 'wound shock', which at that time was in a state of confusion, owing to different workers using the term to describe a variety of different conditions. The report of their five years' work (43) includes a full and most valuable description of the detailed clinical examination of their patients from the time they were first seen until death or recovery seemed certain. They found that the various signs following massive injury fell into several distinct patterns. It was early recognized that haemorrhage was a major factor contributing to the development of wound shock (39), and by correlating their clinical observations with measurements of blood volume and other clinical haematological investigations, they were able to assess the amount of blood lost, and so the amount of blood transfusion required. They also drew attention to the serious disturbances of water and electrolyte balance that may follow abdominal injuries. The final report of this work has provided us with a detailed and accurate

account of the generalized effects of severe injury, and of the reasons whereby these effects develop; it also stresses the need to give sufficient blood by vein sufficiently early and quickly.

Dr Basil Reeve, who had worked with Grant since the start of the War, has written of those times as follows:

> The Blitz was now increasing and many casualties of the bombing of the Port of London were being admitted to Guy's Hospital almost every night. We decided to study the clinical picture of these. As soon as a severely injured patient was admitted to the Casualty Ward we took up our position by his bedside with our clipboards and simple blood-pressure measuring devices, and followed him through his preliminary examination, his anaesthesia and surgery, and post-operative treatment until he was discharged to an outlying hospital or died. We followed or performed post-mortems, and collected tissues for histological examination. We recorded everything that happened to the patient in the greatest detail. We took part in the examinations and treatment of the patients if asked to do so, but rarely tried to influence treatment until much later in our studies. At first we were regarded as a nuisance, but Grant's tact and character, and the excitement and danger of the times, combined to make us acceptable.
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> When working we had supper at Guy's, and were joined at these times by senior members of the staff. One evening there appeared at supper a smallish man with fine eyes and an intelligent face, wearing a Burberry-style golf jacket, who seemed somehow quite out of place. I asked Reggie Waterfield, our haematologist, and an outstanding amateur astronomer, if he knew anything about him. 'That's Ludwig Wittgenstein, the famous Cambridge philosopher, who has come here to be a Dispensary porter' he told me. I was interested and started sitting next to him when I could. We soon became acquainted and friendly. We went on walks together and I told him a lot about our work on 'shock'. It turned out that Wittgenstein had decided that he could not grapple with, or teach, philosophy 'while the world was falling apart'. And so, with the help of Gilbert Ryle, the Oxford philosopher and a brother of John Ryle, who at that time was Professor of Social Medicine at Cambridge, he had become a porter at Guy's, but, later, after Grant's unit had moved to Newcastle he joined us as a technician.
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> By this time the German air-raids had almost ceased and we had very few patients to study. The British Army was too damaged by the course of the War in those early years to even consider setting up a Shock Unit, but through Grant's close ties with the Medical Research Council, his new interest in 'shock', and his natural tact, it was arranged that we should transfer our small unit to the Royal Victoria Infirmary in Newcastle where we could study the casualties occurring in the coal mines and heavy industries in Northern England. Our technician refused to come with us, but Wittgenstein asked if he might be considered for the job. Grant was in need of someone to prepare and cut sections for histological examination, and thus it was that Ludwig Wittgenstein, one of the famous philosophers of the time, joined our unit.
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> Our transfer to Newcastle allowed us time to review where we were in our studies. We had restricted our efforts to attempting to obtain a picture of the circulatory disturbances in the 48 hours or so following uncomplicated musculo-skeletal injuries. It was clear that blood loss played an important part, and we therefore improved our blood volume measurements. When Wittgenstein arrived we all lived together, and he became very involved in our studies. The next few months were, I believe, one of the happiest times in his life. Wittgenstein lived for discussion, and repeatedly there came up the problem of how to describe soft-tissue injury, its extent and the part it was playing in the overall clinical picture. One could describe the individual injuries of each patient, but this gave no basis for comparison. Wittgenstein suggested that wound size might be described as the volume of tissue damaged, using the hand or fist as a unit of volume. This pleased Grant, and provided us with a means of classifying the patients' soft-tissue injuries.
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> Towards the end of 1943, when the allied offensives had succeeded in N. Africa, Sicily and Italy

it became possible through the efforts of Grant and the Medical Research Council to move our studies to battle zones, and at the end of 1943 the 1st Traumatic Shock Research Unit was formed in the R.A.M.C. It consisted of Grant, R.P. Harbord, an anaesthetist with much experience of battle surgery, myself, two excellent Sergeant laboratory technicians, and a Private. We had a three-ton truck which R.E.M.E., using our plans, turned into a very effective mobile laboratory – in times of war anything is possible if you are near the front line!

In battles such as those occurring around Monte Cassino we could choose from an oversupply those patients that seemed best to answer our current research questions. We soon found that there was a relation between volume of musculo-skeletal injury and measured blood volume. Patients with five fistfuls or more of damage, seen when they had received little or no blood transfusion, had blood volumes that might be 65% or less of predicted normal. It became clear that if transfusions were received early enough after injury patients with the most massive injuries and continuing haemorrhage could be kept alive by massive transfusion, and that in these patients blood volume measurements were most helpful in guiding blood transfusion.

That our studies were successful depended on several special circumstances. First, Dunkirk and the Blitz were special times which allowed them to get started. Secondly, because of the excitement and dangers of the times our colleagues were prepared to give us much help and cooperation. Thirdly, Grant's organizing and persuasive abilities, and his care of the people that worked with him made us able to continue our studies, first in Newcastle and then in Italy. He was able to welcome and hold together many people of many different skills and talents. He was a demanding, very honest, very kindly, generous man – an honourable man, and, as Wittgenstein would have said, 'a very decent man'.

Dame Janet Vaughan, D.B.E., F.R.S., has recalled her contacts with Grant during those war-time years:

I knew him when I was a junior pathologist at University College Hospital, before the War, but, like many others, had a special reason to be grateful to him during the War.

After the first air-raid attacks Sir Edward Mellanby called a meeting of the Directors of the MRC blood supply depots, of which there were four, to discuss with expert physiologists what they had learnt about the treatment of casualties. We four directors described our findings with great hesitation to the obvious disagreement of the physiologists sitting opposite. Dr R.T. Grant, who was also present, said then that he too had been out on the streets with the Guy's team, and had found the same clinical picture as the blood-supply officers had described. As a result of this meeting competent young clinicians were appointed to each blood-supply depot to study shock and its treatment: Pat Mollison went to Sutton, and to me at Slough came a young man who later became a Professor of Medicine at a London medical school, and a young woman who became a physician at a South African medical school. We were all dependent on R.T. Grant for help and encouragement.

Clinical Research Unit, Guy's Hospital, 1945–1957

Grant returned to his unit at Guy's in 1945, and took up once more his work on the factors controlling the regional flow of blood in different parts of the body. Together with Bruce Pearson and Holling (35–37) he showed that significant differences exist between the vascular responses of the proximal and distal parts of the human limb. A chief difference is that although body warming produces a large increase in blood flow and skin temperature in the hand and foot it causes only a slight rise of forearm and leg blood flow. This difference between these different regions is largely due to the distribution of arteriovenous anastomoses, which are plentiful in the extremities but

virtually absent from the forearm and leg.

For many years Grant had been interested in the well-known finding that, after denervation, blood-vessels acquire a heightened reactivity to constrictor stimuli (32, 47). In 1953 he and his group described evidence (47) for the presence of a sympathetic cholinergic nerve mechanism in the central artery of the rabbit's ear. They suggested that normally acetylcholine is continuously synthesized and released, and tends to keep the artery in a state of dilatation. After nerve section, as the processes of degeneration extend distally, synthesis and release of acetylcholine diminish and finally cease, so that after about three days acetylcholine disappears from the arterial wall. They considered that this disappearance of acetylcholine is responsible, at least in part, for the heightened reactivity of the denervated vessel.

Dr Brian McArdle joined the Unit in 1948, and shortly after this was asked to investigate a young man who from childhood had developed pain, stiffness and 'cramps' in his muscles, brought on by very moderate exercise. He found that, in this patient, there was no increase in the blood lactate level after what was, for him, very exhaustive exercise. More specifically he showed that the blood coming from the forearm muscles after ischaemic exercise showed no rise in lactate, and that there was therefore a failure in glycogen breakdown. By using the plethysmographic method developed by Grant and Holling an abnormally high muscle blood flow was shown to follow ischaemic exercise. Further cases of this condition were described in America, and enzyme studies soon showed that McArdle's Disease, as it came to be called, was the result of a deficiency of myophosphorylase.

McArdle has recalled that:

> It was a good unit to work in, small but happy. While each of us was left to pursue his own problem we met Grant at lunch, at the weekly Out-patient Clinic and on his ward rounds. One's chief emotion in working alongside him was one of great respect – respect for his intellect, shrewd, penetrating and critical, and respect for his strong personality and the high standards he set himself and expected others to live up to. He was essentially 'serious-minded', but a more gentle side to his character appeared when he was away from his work, when he showed himself to be cheerful, kindly and helpful, with a pleasing dry sense of humour.

RETIREMENT

Grant retired at the age of 65 in 1957, when his Unit was disbanded. He continued working at the bench, however, with a personal grant from the Medical Research Council, until the age of 75, at which time the Wellcome Trust stepped in to provide support for him until he was 80. His main interest during these years of retirement developed from his earlier observations on the vessels and nerves of the rabbit's ear (32) which led him on to a study, jointly with Adams and Bayliss, of the distribution and types of cholinesterase activity in the peripheral nervous system. Most histochemical investigators at that time were in agreement that the motor axons in the peripheral nerves contain an acetylcholinesterase, but there was considerable diversity of opinion as to whether this enzyme is present in sensory and unmyelinated axons. Using histochemical methods they showed that motor axons (rat genitofemoral nerve) contain exclusively acetylcholinesterase, whereas sensory axons (rabbit great auricular

nerve) exhibit only occasional acetylcholinesterase activity and no non-specific cholinesterase activity. The unmyelinated fibres in sensory nerves appeared to contain only non-specific cholinesterase (61–63).

A further retirement interest developed out of his skill as an experimentalist and his experience with continuous intravenous infusion in small animals, which was put to good use by Dr Peter Wright who was at that time working in the Department of Chemical Pathology at Guy's Hospital Medical School, and had produced an anti-serum from guinea-pigs that had been treated with repeated subcutaneous injections of bovine insulin. Intravenous injection of this anti-serum into rabbits and rats was first shown to induce a transient hyperglycaemia (54) which was thought to be due to neutralization of the endogenously secreted insulin by the insulin antibodies. Intraperitoneal injection or slow intravenous infusion into rats induced a typical diabetic syndrome characterized by hyperglycaemia, glycosuria, polyuria, ketonuria and loss of appetite (55). From further work (56) it was concluded that injection of anti-insulin serum causes a rapid neutralization of active insulin in the blood stream. The active hormone becomes detectable again only when the injected serum has been saturated with insulin, following which the blood sugar concentration returns to normal levels.

When the time came for him to travel no more to London he was still active enough in mind and body to take up the study of Gaelic as well as to continue digging his garden with enjoyment.

R.T. Grant: the man

Ronald Grant became a member of the Physiological Society in 1926, and in 1986 was elected an Honorary Member; a long-overdue honour as Professor Greenfield has pointed out. As mentioned earlier he was elected a Fellow of the Royal Society in 1934.

He was one of the founding members of the Medical Research Society, and was its first Honorary Secretary. He was also a member of the Pathological Society, the Cardiac Society, the Association of Physicians, and the Royal Society of Medicine.

His chief interest and pleasure was in research work at the laboratory bench. The standards that he set himself in his work were demanding, and he expected the same standards and careful accuracy from all who worked with him. Administrative work had little appeal to him; neither was he interested in committee work unless it bore directly on the research activities of the institution to which he was attached.

His main pursuits, other than scientific, were first and foremost the cultivation of his garden at his home in Surrey. Here he grew, with skill and love, his roses, his soft fruit and his vegetables, and most excellent and generous were the bowls of raspberries and other fruits that appeared on his table when he was entertaining, as he loved to do, his friends to one of his splendid lunches.

He had an extensive and profound knowledge of natural history, and was always happy on country walks, seeking out and identifying wild flowers and birds. He was also a keen and accomplished trout fisherman, and I recall with pleasure a holiday that

I spent with him many years ago in Sutherland; to be not only north of the border but as far north as Kinlochbervie, with access to those innumerable small lochs and their many trout, was for him a perfect holiday. He also derived great pleasure from his piano and from his widely based library of books, mainly about Scotland and natural history.

With his grizzled sandy hair, his high cheek-bones and his craggy face he was unmistakably a Scot. Although he could be aloof and even forbidding when the occasion required it, he was a man of a warm and kindly nature, a good companion and a staunch friend.

Dr David Verel spent three years on Grant's unit as a Junior Beit Memorial Research Fellow, from October 1948 to September 1951. He has written to say: 'My initial impression of Grant was that it would have been very bad luck for any German whom he might have happened to meet in no-man's land when advancing with a rifle and fixed bayonet while he was a combatant in the First World War.' He was also surprised that his Glasgow accent had survived 30 years in England. But he goes on to relate how, on telling Grant that he was shortly going to be married, he was told to 'go away, get myself a house to live in and then report back'. Grant added that he would find doing research totally absorbing, but that 'I must always remember that however important and absorbing my research might become my marriage was the most important thing in my life'.

Verel has added: 'He was a most kindly man. Life with a wife and child on the £600 a year of a Beit Fellowship was not easy, and, hearing that one summer we could not afford a holiday, he gave us his house in Surrey for a holiday while he was away with his wife and daughter.'

His only enquiry while Verel was settling in to his research was a gentle question: 'Are you enjoying yourself?' Verel's enthusiastic reply, 'Yes, Sir' was followed by a quiet, 'That's all right then'. Verel concludes by saying: 'It was a happy time.'

Professor P.E. Polani, F.R.S., who knew Grant well over many years, has written:

> R.T. Grant was always modest about his achievements and reluctant to discuss them. Much of my knowledge of the personal details of his research has been pieced together from the many chats on research which we had, over the years, commuting from Clandon to London Bridge. For his work on traumatic shock alone he would have deserved great acknowledgment, but the quality of his earlier researches had already been recognized by his election to the Fellowship of the Royal Society in 1934. It was this recognition of his ability that pleased him above all else. Indeed, in 1984 he wrote to Sir Andrew Huxley, then President of the Royal Society, saying: 'I am proud of the Fellowship, and still remember the thrill I experienced when I learned of my election half a century ago.' But recognition, and pride in it, left R.T.G. always self-effacing and always ready to describe his approach to research as an almost playful adventure, and to ascribe his successes to good fortune rather than to his skill and dedication.

Dr Peter H. Wright has recalled how he came to know Grant:

> The Wright family first encountered Ronald T. Grant at University College Hospital Medical School in about 1923. At that time my father, Hedley D. Wright, was a lecturer in bacteriology, and for the next seven years cooperated with a team of physicians, led by Sir Thomas Lewis and including Dr Grant, in studying subacute bacterial endocarditis. When he was about to leave London in 1930 to take the Chair of Bacteriology in Sydney, my Father was presented with the

Diary of Samuel Pepys. Inside the cover of each volume was a gift label with the signatures of his colleagues at that Medical School, including that of Ronald T. Grant.

I, as a very small boy, was not to know all this until many years later when I joined the Department of Chemical Pathology at Guy's Hospital Medical School, in 1955. There I became interested in the idea of producing insulin deficiency in experimental animals by infusion of anti-insulin serum. It was suggested to me that I should approach Dr Grant who, I was told, had extensive experience with continuous intravenous infusion in small animals. He was, I was also told, a dour forbidding Scot with whom I would find it difficult to work. Nothing could have been further from the truth. As a young and inexperienced person I found him a good listener, speaking slowly with a gruff Scottish accent, and making clear, definite and helpful comments and suggestions. He and his assistant, J. Armin, were always helpful to me, and without them I doubt whether we would ever have succeeded in producing and defining that diabetic syndrome. In reporting the results of that study I found that he abhorred unnecessary verbosity. When I used the oft-quoted remark 'it is of interest to note...' I was gruffly told that its use was superfluous. If it had not been interesting I would not have mentioned it!

In the laboratory he was a stickler about work, but conversation was not restricted to work. He loved to talk about his fishing expeditions in the Highlands, about medicine in general, about books, and above all about his garden, which he managed with the same meticulous skill that he applied to his experiments in the lab. He had indeed a beautiful garden outside his country home containing everything from roses to fruit trees, all planted and grown with the tender loving care of a horticultural expert.

It was a joy to visit him then and in later years when the conversation ranged from fishing to wine and, above all, to us his visitors. It was fun to sit with him and his wife, Mary, in the enclosed porch, in the garden or inside the house, eating his home-grown strawberries and reminiscing about old times. Dr Grant, or R.T.G. as we all called him, was a man it was fun to be with, and I for one will miss his letters which have come to me regularly for the past 26 years.

Mr J.G. Duncan writes:

I knew Ronald Grant well, over 40 years. Soon after I joined the Medical Research Council's headquarters office, in 1945, I met him and found that we had much in common: we had been to the same university, our fathers had both been journalists, and I enjoyed and laughed at his crisp assessment of colleagues and others in the medical research world. I visited him many times at his fine home and large garden at Farley Green. On the first occasion, in the autumn of 1945, he met me with his old motor-bicycle and side-car at Clandon Station; and the last was about some five years ago when he was frail and was showing some despondency. I had arranged to see him again in November 1989 but he died a few weeks before the time of this visit.

His garden and country life were strong continuing interests, and he gave me good advice when I was creating my own. He was interested in Scottish affairs, collected a wide range of Scottish books and, after he had retired from research work in London, began to learn Gaelic but found that it was too difficult to retain vocabulary and the grammatical rules.

Mrs Jean Kirby, M.A. (Oxfordshire), a neighbour, has written:

In Farley Green, the village where he lived for more than 50 years, Dr Grant was little known, almost a legend. For the most part he divided his leisure time between his garden, his music and his books. But for those privileged to know him he was a delightful companion and a fascinating conversationalist; a well of information and wisdom, humour and concern.

Though a formidable intellect himself, he could be patient and very helpful to young people, and took a great interest in their progress, especially if they showed an inclination towards science. He was delighted to be able to tell my daughter, when perusing her Chemistry O level paper

that, but for a piece of research he had done some years previously, the examiners could not have asked her one of the questions!

It is, of course, common knowledge that his belief in science was profound, and that he appeared to accept nothing that could not be factually verified. But Dr Grant was full of surprises. He taught himself Gaelic so that he might read and understand the little-known poetry of that language; and would amaze anyone interested in philosophy by revealing, quite casually, that he had know Wittgenstein well, stunning his listener with anecdotes that may will be unique about that strange and brilliant man.

Although he enjoyed solitude (he claimed to have grown the high hedge that screened his vegetable garden so that he could neither be seen by chance visitors nor easily called to the telephone) I had the impression that he was sometimes a little lonely within his own austerity. Certainly, once he had assured himself that one was not going to waste his time in small talk, he became both charming and expansive, especially on a warm evening in his beautiful garden over a bottle of good wine!

If he was exacting over the work of others, he was no less severe with himself. When he surprised many by retiring, he said it was because he wanted to go while he knew himself to be at the height of his powers, and not wait to be told by someone else that he was no longer so.

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The portrait photograph was taken by Walter Bird in 1961.

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