

Paul Ivan Korner 1925–2012

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Paul Korner's life's work centered on unraveling the sympatho-adrenal control of the circulation and applying this knowledge to understanding the pathogenesis of hypertension and to improving the management of cardiovascular diseases. He made major contributions as Foundation Professor of Physiology at the University of New South Wales (1960–8), as the first Scandrett Professor of Cardiology at the University of Sydney and the Royal Prince Alfred Hospital (1968–74), and as Director of the Baker Institute for Medical Research (1975–90). After retirement in 1990, he undertook his last major work, writing an influential single-author text, *Essential Hypertension and its Causes*.

Early Years and Family Life

Paul Korner was born on 18 November 1925 in Ostrava in the Moravian region of the then Republic of Czechoslovakia, only a few years after its creation from parts of Habsburg Austria and parts of Habsburg Hungary. His father Ernst was a successful architect who had studied in Vienna in the early 1900s and had a thriving practice by the time Paul was born. Ernst came from a Jewish family that in his generation produced several talented professionals, being the first generation of Jews admitted to the professions within the Habsburg Empire. Paul Korner came from a close extended family, some in Vienna, many in Ostrava. His mother Edith Korner née Singer was also a highly educated person and her father's refusal to let her attend university only increased the emphasis she placed on education. In his working life, Paul Korner sought out and valued women scientists entirely on their merits.

Paul Korner grew up with his younger brother Nils in an elegant inner-city apartment, surrounded by art works and antique furniture, speaking Czech and German. With his parents he spoke German because, with his father being Czech and his mother Hungarian, this was the



common language. The Korner apartment was close to the then predominantly German Sudetenland, which Neville Chamberlain in effect ceded to Hitler in the notorious Munich Agreement of 30 September 1938. Parts of the family history are reflected in the Germanic-sounding family name, Korner, which was adopted by the extended family around 1905 in place of the very obviously Jewish family name, Kohn. Despite the absence of religious belief and practice, at least within the immediate family, there remained a definite sense of being Jewish. In many ways, Paul Korner embodied the Jewish ethic that one should aim in a selfless way to

leave the world a better place than one found it. In any case, being Jewish was something that could not be ignored in the Nazi period when the family fled Central Europe for the British Empire.

As German aggression loomed from May 1938, Ernst wanted to stay in Ostrava and fight the Germans. Edith insisted that at least she and the children must leave Czechoslovakia urgently, by air. Ultimately they all left, initially for Switzerland and then for England, on 9 September 1938, three weeks before the Munich agreement was imposed on Czechoslovakia. The escape of the family from the Nazis was forever in Paul Korner's mind. Ostrava was two hours away from Auschwitz on the main railway line between Czechoslovakia and Krakow in Poland. In the early 1940s the Ostrava Jewish community was a pilot group for deportation to ghettos like Lodz in Poland, then Auschwitz. Quite a few members of both the Korner family and Edith's branch of the Singer family were deported and died there. In recent years Paul Korner believed strongly in the need for Australia to adopt a more generous policy towards refugees. When the balance of Czechoslovakia was annexed by Germany in March 1939, Edith decided that England was not far enough away. They decided upon Australia rather than the United States or Israel, partly because of its distance and Britishness but mainly because Australia had been the only country willing to give Edith's brother and family immigrant visas. In August 1939 Paul's family embarked for Australia aboard the Dutch liner *Marnix van St Aldegonde*. The ship was requisitioned for immediate war service while in Colombo and the discharged passengers spent some weeks there, with Paul serving, at the age of 13, as secretary to a committee formed to look after the less fortunate members of the stranded passenger complement. The passengers included the later Nobel Prize-winning medical scientist Bernard Katz, and discussions with him were probably part of the impetus that led Paul Korner to pursue medical science, even though there was no family tradition in medicine.

Paul Korner was always an earnest and good student—his primary schooling was in Czech, his initial high schooling at the central Ostrava Gymnasium in German, another year in England, then the remaining three years at Barker College in the Sydney suburb of Hornsby. The family had



Figure 1. Paul Korner and Jennifer, ca. 1949.

an Anglophile aspect well before it emigrated, and in 1936 his school compositions included a play about the abdication of the English king, Edward VIII. At Barker College Paul was a good student but confirmed that he had no aptitude for sport, least of all for contact sports such as rugby or boxing! Paul began his medical studies in 1943 and was only 19 when he met his future wife, then Jennifer Woods, aged 16 and very beautiful, while they were both holidaying in the Burragarang Valley that is now under Warragamba Dam. Paul was with two other Jewish medical students of Middle European origin, and for some time Jennifer was courted by all three. Eventually he won through, and he and Jennifer were inseparable thereafter (Fig. 1). Jennifer graduated in Arts with Honours in Anthropology while Paul was completing the medical course, and she then worked with Professor A. P. Elkin in the Anthropology Museum at the University of Sydney as a research assistant and tutor.

Paul and Jennifer were married on 21 December 1950, immediately after he completed his course, and there are unconfirmed rumours that he began work on his MSc thesis during their honeymoon! Jennifer placed great emphasis on supporting and working with Paul as he pursued his goals as a medical scientist. She was devoted

to this throughout their married life, quite apart from being the first-line carer for their three children and the manager of their household. Among other things, she helped him with tasks such as proof-reading his manuscripts and reviewing his English expression. Jennifer was a most vivacious and engaging woman, with a lovely smile and a very warm personality. She provided warm and willing hospitality not only to Paul's friends and colleagues but also to the numerous visitors to his laboratory and to the institutions that he led. It was very cruel that she should later suffer from deep and recurrent bouts of depression that began in 1983 and continued to the time of Paul's death in 2012. None the less, there were good periods during which they could continue to travel overseas, take long hiking trips, and enjoy the wealth of cultural activity they both loved. Paul was her constant and assiduous if at times impatient companion and carer, right up until his own final illness that then deprived her of his support.

Paul Korner was a man of prodigious talents and energies. His involvements ranged from his work as a medical scientist, through all forms of medical practice, into all areas of modern history and most areas of literature and cultural endeavour. There was also his dedication to his family, both immediate and extended, genetic and in substance, including several close friendships extending over many years if not a lifetime. He was a great and affectionate father and friend and a constant source of wise counsel on careers, business affairs and more personal issues. He worked very hard to help his three children and six grandchildren find a good path in life, in medicine, law, drama or wherever. For many years he was the family GP, and until his death he retained his medical registration and gave valuable and well informed advice as background to medical consultations for all members of both the immediate and extended family. Paul was predominantly a serious person, but he had a good and varied sense of humour, ranging from the Marx Brothers through the plays of Oscar Wilde and into more modern forms of humour and satire. For instance, he returned from his six months in Boston in the first half of 1956 with a record of songs written and performed by the trenchantly satirical Tom Lehrer, and he also loved *At the Drop of a Hat* by Flanders and Swan. There is much more that could be

said about Paul as lover of Shakespeare, Oscar Wilde, Bernard Shaw and the theatre generally, as a voracious and wide-ranging reader of literature in several languages, or as a historian, bushwalker, swimmer, household improver, even gardener, youthful skier, music lover and audiophile, as well as an inveterately keen traveller within Australia (from Kakadu to the Snowy Mountains) and across most other continents. Among his many enthusiasms, he had an abiding love for the great Mozart operas, often playing them while he wrote.

Despite or because of his experimental work with animals, Paul Korner was a great animal lover, especially a dog lover. In the years of his so-called 'retirement' he valued his flourishing membership of the Woolwich and Hunter's Hill fraternity and sorority of dog walkers. This reflected his dedication to regular serious exercise and also his conviviality, born of a deep interest and insight into other people as well as his abilities as a raconteur and a lively polemicist in relation to Australian and international politics. Paul maintained many close friendships, drawn from the ranks of his former students and colleagues, as well as from other walks of life, over many decades. His expectations and demands of friends and family members were often considerable. While patient up to a point, reasonableness was not always what determined the limits of his patience. He championed the Australian values of equal opportunity, teamwork and social justice, and the aspects of the Australian national character embodied in some of his most-admired medical science predecessors such as Sir Macfarlane Burnet and Sir John Eccles. Paul had a deep knowledge of and love for most eras of history and was astonishingly well read and retentive, most notably and passionately about the era of Weimar and Nazi Germany.

Paul was proud of his achievements and derived fulfilment from the various international and national honours and recognitions bestowed on him, for instance his Order of Australia award and the International Society of Hypertension Distinguished Membership conferred on his very last day. He was brave through 2012 as health problems with cancer secondaries in the spine increased and he was fearless in the face of the death that loomed. In his last weeks and days, Paul was demonstrative and affectionate,

and his human qualities were much in evidence. He was truly delighted on his second last (and last conscious) day, when Peter Friberg from Sweden, Paul's erstwhile student of some two or so decades earlier, came from the International Hypertension Society conference to let Paul know that his main plan for the conference had been fully implemented. This involved the distribution to the leading young investigators among the conference delegates of around one hundred copies of Paul's last great work, his book *Essential Hypertension and its Causes*. This was in many ways the completion of Paul's last unfinished business. He died not only courageously but with satisfaction and fulfilment.

Early Career: Medicine, Doctoral and Post-doctoral Years

Having finished his schooling at Barker College as Dux of the School in 1942, Paul was awarded an exhibition to enter Medicine at the University of Sydney in 1943. At the end of his second year he approached Professor Frank Cotton, head of Physiology, to ask if he might join a research project in the summer vacation. Cotton was developing a method for frequent measurement and recording of blood pressure and suggested that Paul work on this and apply it to studies during and after physical exercise. Paul succeeded in getting the apparatus to work and by the end of the vacation had a stationary bicycle ergometer used to record blood pressure during graded exercise in departmental volunteers. This was the start of Paul's research career, and with encouragement from Professor Sir Harold Dew, the then Dean of Medicine, he was allowed to interrupt his medical course and do a BSc Honours year, followed by an MSc course. He was joined in this excursion by another student, Geoffrey Kellerman, who was top student in their year and who went on to a stellar career in Biochemistry. Together they explored other scientific disciplines and ventured to complete courses in statistics.

Paul Korner's work on exercise confirmed that the trough in blood pressure following a sprint was a normal phenomenon and due to pooling of blood in previously active lower-limb muscles. This was abolished by applying air pressure to the leggings using a 'G-suit'—available because one of Professor Cotton's other interests

was in the development of anti-gravity suits to combat 'blackout' in fighter pilots. But to everyone's surprise, blood pressure rose and remained elevated during limb occlusion, and this was attributed to the so-called muscle chemoreflex, first described by Alam and Smirk. These studies formed the basis for Paul Korner's MSc thesis on 'Studies on human vasomotor responses to exercise'. He and Geoffrey Kellerman resumed the medical course in 1948 but Paul found it very boring compared to the excitement of making new discoveries. He did notice, however, that malignant hypertension was common, with a few such patients in every medical ward and with no effective treatment available.

Upon graduation in December 1950 and his marriage to Jennifer, Korner became a Junior Resident Medical Officer at the Royal Prince Alfred Hospital, despite its discouragement of marriage among its resident staff which he circumvented by the simple stratagem of not consulting the hospital authorities! Possibly the most important events in his professional life during 1951 were the visits to Sydney of two great clinical investigators in the field of hypertension, Professor John (later Sir John) McMichael from the Royal Postgraduate Medical School in London and Professor George (later Sir George) Pickering from Oxford, both of whom were en route to New Zealand to visit Horace (later Sir Horace) Smirk, to find out about his revolutionary new treatment for malignant hypertension using ganglion-blocking drugs such as pentolinium and hexamethonium. At the end of his year as a junior resident, Paul had many options to pursue research but accepted an offer from Professor Colin Courtice to work as a Junior Research Fellow at the Kanematsu Research Institute at Sydney Hospital, funded by the National Health and Medical Research Council (NHMRC). His choice was possibly influenced by the Institute's having had some remarkable scientists work there, including Eccles, Kuffler and Katz whom Paul remembered fondly from the voyage to Australia in 1939. Courtice became a very influential mentor and he prodded Paul to write up the work from his MSc thesis, leading to three papers in the *Australian Journal of Experimental Biology and Medical Science* (1, 3, 5) and to the lesson that good research material serves little purpose if not published! During his two years at the Kanematsu Institute, Korner

worked with a group of very bright students, destined to be leaders in their own fields—Ian Darian-Smith, Bede Morris and Bernard Lake. He worked on the role of arterial hypoxia in the development of pulmonary oedema and the shift of fluid between plasma and lymph, studies that led to six papers (2, 4, 6, 9–11) and later became part of his University of Sydney MD thesis on ‘The actions of anoxia and noradrenaline on the experimental production of pulmonary oedema’.

As a result of this work, Korner was awarded the inaugural Overseas Research Fellowship of the newly established Life Insurance Medical Research Fund of Australia and New Zealand. He and Jennifer and their first born son Nicholas set sail at the start of 1954 for England, where Paul worked at the Royal Postgraduate Medical School under Sir John McMichael and Dr John Shillingford on the haemodynamics of valvular heart disease in humans. He and Shillingford developed the first method for the estimation of backflow in patients with valvular incompetence, using the degree of dispersion of indicator in indicator dilution curves (12–14). The method created much interest but proved to be insufficiently robust for clinical use. However their time in London was wonderful for Paul and Jennifer from a cultural point of view, and they enjoyed life at the theatre, opera, galleries and on the music scene—all the more as Jennifer’s mother joined them and provided a resident baby sitter! And their second son, Tony, was born there.

After London, Jennifer, the children and Jennifer’s mother returned to Sydney while Paul went on to spend seven months at the Harvard Medical School with Professor Cliff Barger in the Department of Physiology. Barger had developed a model for heart failure by creating tricuspid incompetence in dogs—a model of clear interest to Paul. But Korner’s two greatest lessons from Harvard were the capacity to perform complex experiments in conscious animals, which he used in most of his subsequent work, and the possibility of teaching medical students in a very different way from what he had experienced at the University of Sydney, with magnificent facilities and courses that incorporated mammalian practical work in a most enlightened manner. He was also struck by the high level of scholarship, not only among staff but also among the graduate students, and by their capacity to relate the basic sciences to clinical medicine. These lessons

were very influential at later stages in Korner’s career.

Return to University of Sydney, 1956–60

While Paul Korner was in London and then Boston, Colin Courtice had moved to the Australian National University as Professor of Experimental Pathology and Frank Cotton had retired from his chair at the University of Sydney. However, Cotton’s successor, Peter Bishop, a visual neurophysiologist, offered Paul a Senior Lectureship with promise of strong technical support, a post Paul accepted. While he was there, two medical graduates came to work with him as PhD students, Tony Edwards and Geoff Thorburn, and he also attracted several BSc(Med) students—the first two being John Chalmers and John Uther. Paul and his group worked on two themes, the use of the indicator dispersion method for estimation of valvular incompetence and the investigation of neural and humoral mechanisms regulating the circulation in the conscious animal. The work on indicator dispersion was performed in dogs with pulmonary valve incompetence induced by Rowan Nicks, the new cardiac surgeon appointed to the Royal Prince Alfred Hospital. Unfortunately the method did not prove accurate enough for use in humans with clinical valve incompetence (15, 18, 19, 23), but the experience of developing this methodology was invaluable some years later at the University of New South Wales when Paul began to use the thermal dilution method to measure cardiac output in conscious rabbits. The work on circulatory control was performed using stimuli such as graded arterial hypoxia, tissue hypoxia induced using carbon monoxide and haemorrhage. In each case, the roles and contribution of both the afferent and the efferent connections of reflex autonomic mechanism were studied—both baroreflex and chemoreflex mechanisms on the afferent side and both neural and hormonal mechanisms for the efferent limb, with particular focus on the sympatho-adrenal system (20–22).

During this period at the University of Sydney, Paul Korner was visited by both John Eccles (before his Nobel Prize and before becoming Sir John) and Bernard Katz. Both visits were very influential for Korner’s career. Eccles invited him to write a much acclaimed

review on ‘Circulatory Adaptations in Hypoxia’ for *Physiological Reviews* (17), for which Eccles was a member of the Editorial Board, while Katz asked him to write a review for *Progress in Biophysics*, which Korner did with a paper on ‘Some Factors influencing the Dispersion of Indicator Substances in the Mammalian Circulation’ (24). This work marked Paul Korner as an emerging leader on the international stage and in further recognition of his work he was awarded the Edgeworth David Medal of the Royal Society of New South Wales in 1959. On another front, Paul was very disappointed with the University’s medical course, for which he and the other staff lectured to vast numbers of medical students—as many as 400–500—herded into large lecture theatres, in great contrast to the superb course that had so impressed him at Harvard.

Foundation Chair of Physiology, University of New South Wales, 1960–8

Around this time, the educational reforms of Australia’s Menzies Government led to the expansion of the University of New South Wales (UNSW) and the establishment of Monash University. The foundation Chairs of the Faculty of Medicine at UNSW were formally established late in 1958 and advertised internationally early in 1960. Paul Korner did not apply but, after informal contacts from Colin Courtice and the Vice-Chancellor of UNSW, Professor J. P. Baxter, he received a formal letter from Baxter in April, offering him ‘on the unanimous recommendation of the Medical Selection Committee’ the University’s Foundation Chair of Physiology, which he accepted. He was encouraged by Baxter’s promise that there would be sufficient funds for student teaching to permit the establishment of the ‘Harvard-style’ course in Physiology to which he was committed. And, indeed, the student laboratories were splendidly equipped with modern, multi-channel ‘Grass’ pen-recorders and transducers, as well as oscilloscopes, all of which the academic staff frequently ‘borrowed’ for their own research.

Paul Korner was joined by Ian Darian-Smith to be the two ‘founding fathers’ of UNSW Physiology, immediately making it a well balanced school that was soon richly complemented by such people as Tony Edwards (by then a respiratory physiologist with Herman Rahn in

Buffalo), Robert Holland (from Robert Forster’s laboratory in Philadelphia), Geoff Thorburn (from a post with Cliff Barger at Harvard), and later Mary Scott (who was a protégée of Michael de Burgh Daly in London). The initial accommodation was in the Chemistry building where Korner and Darian-Smith did their course planning and research, to the extent that each afternoon, before leaving, they fed the experimental animals and cleaned out the cages themselves. It was one of Paul Korner’s great qualities that he never asked anyone else to do something that he was not prepared to do (or had done) himself.

The Physiology course that they introduced had fewer lectures than the traditional course offered at the University of Sydney, with weekly small-group tutorials and a very comprehensive programme of practical classes for small groups of students to use the excellent equipment during the second and third years of the medical course. All staff—junior and senior, including Paul Korner and Ian Darian-Smith—took an active part in these classes, which ran virtually as long as was necessary to achieve good results, irrespective of the specified timetables. Paul had no idea how much the students feared his offers of help with difficult preparations, though all grew to love his deep involvement in their course. One of his former students from this era, Professor Robert Graham, recalled those experiences at Paul’s memorial service at the University of Sydney:

My association with Paul goes back to . . . when I was a second year medical student at the University of NSW, and Paul was the Foundation Professor of Physiology. My colleagues and I were very uneasy about meeting the Professor, as we had only recently learned that he and then Associate Professor Darian-Smith had failed about one third of the year ahead of us. So to say that we were scared of the great man is an understatement, but we weren’t disappointed—my first meeting with Paul was during our first week of physiology at a prac class. We were trying to learn how to use what at that time were brand new Grass Polygraphs with hundreds of dials, toggles and switches and we were making an absolute mess of it. Paul strolled up and without holding back dressed us down right royally—reflecting in his loud heavily accented voice: ‘You’ve been playing with this simple apparatus for the past 30 minutes. Don’t you know how to use it yet?’. But, this inauspicious

beginning, nay fear, of the Great Professor did have a good effect on us for we all studied our tails off as we didn't want to fail like our colleagues in the year ahead and, indeed, most of us did pass physiology and many of us fell in love with it. Not long after that initial—what should I say, 'introduction'?—to Professor Korner, I recall him strolling into a heavily packed lecture room and the first words he uttered, in his characteristically booming voice, were: 'Can you hear me up the back?' Well, I can assure you, had Helen Keller been there sitting in the back row, even she wouldn't have had any trouble hearing him!!! But from these fearful beginnings, I rapidly became very fond of Paul, and we became good friends, a friendship that grew and grew over the years.

In 1964, to extend that personal experience of experimentation, the new school began its BSc(Med) programme, an intercalated year in the medical course that allowed students to pursue a programme of full-time research. This was complemented by the introduction of the first Physiology courses into the BSc degree programme and ultimately an Honours degree in Physiology (and later, Pharmacology).

Paul Korner's personal research activities at this time focused on neuro-endocrine control of the circulation in the conscious animal, initially using different types of hypoxia and later haemorrhage to dissect input-output relationships. The work encompassed arterial baro- and chemoreceptor reflexes and both neural and hormonal elements of the efferent limbs. His decision to publish in 'high-impact' international journals and not, as previously, in the *Australian Journal of Experimental Biology and Medical Science* was a major policy change and thereafter most of the work from his laboratory at UNSW was published in either the London-based *Journal of Physiology* or in *Circulation Research* (25, 26, 28, 29–40, 42, 43, 48). This helped him greatly in achieving recognition in wider scientific circles and he was soon established as a leading figure in international cardiovascular physiology. Indeed he was an invited speaker at the 23rd Congress of the International Union of Physiological Sciences, held in Tokyo in 1965, to talk on 'Control of the systemic circulation in hypoxia'. After that meeting he took the opportunity to undertake a short period of sabbatical leave, visiting two leading scientists—Björn

Folkow in Göteborg, Sweden, and Arthur Guyton in Jackson, Mississippi. Folkow became a firm friend and major influence on Paul's research for many years, foreshadowing his work on the 'vascular structural amplifier'; and while Guyton initially exerted considerable influence on Paul's views regarding circulatory control and the pathogenesis of hypertension, he later proved a major disappointment owing to what Paul saw as his refusal to acknowledge the important role of neural mechanisms.

Importantly, while Ian Darian-Smith was on sabbatical leave at Johns Hopkins University in 1966, Korner took over the teaching of medical neurophysiology. This increased his determination to explore the role of higher brain circuits in regulating the circulation, work that he began when he was at UNSW and carried on for the rest of his life (49).

Things went seriously wrong in 1967 when the Dean of Medicine (Professor F. F. Rundle) attempted to force the Faculty Examinations Committee to reduce what he considered an unacceptably high failure rate in third-year medicine. When this did not succeed he attempted to force the Deputy Registrar to advise the failing students that their marks would be reviewed. This enraged Paul Korner and Ian Darian-Smith. They sought an urgent meeting with the Vice-Chancellor, Professor Baxter, who could not or would not see them: rather, 'if the matter was urgent', they should discuss it with the Dean (UNSW Archives file CN 647). Shortly thereafter Baxter wrote a seemingly emollient but misleading letter to Korner. In fact the real failure rate was not unduly high: in 1966 the Faculty had, for the first time allowed second-year students who had 'failed' their examination to proceed into the third year. Korner pointed this out to Baxter and presented data in an unsuccessful attempt to convince him that, overall, in 1967 the failure rate was quite comparable to previous years and that the essence of Baxter's case (including his assertion that, in the unexpected absence of the external examiner, the standards had been set unrealistically high) was baseless (UNSW Archives file CN 647). Korner and Darian-Smith felt that the pressure from the University was excessive, financially motivated and likely to be repeated in subsequent years and both resigned in writing, just before the University withdrew its objections. Too

late!—they felt neither able nor willing to withdraw their resignations (Korner, 'Autobiographical Notes', 2008).

Though he subsequently conceded that, as a relatively young professor, he might have reacted impetuously (UNSW Archive file CN 647), Paul Korner never resiled from the integrity of his and Ian Darian-Smith's decision, notwithstanding that it cost the intellectual life of the UNSW Medical School dearly. Darian-Smith was promptly offered a senior post in Baltimore by Professor Vernon Mountcastle, though he had to wait several months before a visa could be issued and was, for that period, offered a lifeline by Peter Bishop, by now Professor of Physiology in the John Curtin School in Canberra. Korner and his wife were reluctant to go to the USA, being concerned that, with the Vietnam war raging, their two sons might be subjected to the Draft. Korner was considering a position at McMaster University in Canada when possibilities opened up closer to home, at the University of Sydney.

The Scandrett Chair of Cardiology, University of Sydney and Royal Prince Alfred Hospital, 1968–74

An Australian philanthropist, Mr Lance Scandrett, had just endowed a Chair of Cardiology that was to be within the Department of Medicine at the University of Sydney and located at Sydney's Royal Prince Alfred (RPA) Hospital. Ruthven Blackburn, the then Professor and Head of the Department of Medicine, convinced Paul Korner to apply—saying it provided a good opportunity to improve and build clinical research in cardiovascular medicine at the RPA Hospital. And so Paul Korner became the Scandrett Professor of Cardiology and took up the post in May 1968. As Professor of Cardiology he reported directly to Blackburn as Head of the Department of Medicine; he was also head of the Department of Cardiology at RPA but not at the other teaching hospitals of the University of Sydney. Korner was most appreciative of Blackburn's role in securing his appointment and in supporting him throughout his tenure of the Scandrett Chair.

The appointment of a basic scientist to a clinical chair was unusual in Australia at that time

and it had a mixed reception among Australian cardiologists. Fortunately for Paul, the two most senior and influential cardiologists at RPA Hospital, E. H. Halliday and J. G. Richards, were very supportive and helped pave the way. Paul got down to learning about clinical cardiology and clinical research, and to identifying the major challenges of the époque. The clinical laboratories and beds of the cardiology department were located in 'The Hallstrom Institute', named after Sir Edward Hallstrom, a Sydney businessman and philanthropist, and occupied the top two floors of the Page Chest Pavillion. Laboratory space was very tight but Paul was successful in working with the hospital management to refurbish and modernize some of the clinical (catheter) laboratories, while the University provided funds for animal facilities within the hospital. The diagnostic catheter services were provided by young full-time hospital specialists, with a Director. As this group had little focus on research, there was always tension between the honorary and the full-time staff, related to perceived status and rights of private practice. Directors turned over regularly and the then Director, Dr Anthony Jose, left soon after Paul was appointed, to take up a post at Johns Hopkins University in Baltimore.

Possibly the most important aspect of Paul Korner's move to a chair of cardiology was that it caused him to re-focus his work so as to bring the science more directly to bear on the major clinical problems of the day—hypertension, vascular disease and heart disease (51, 56, 62, 65). For the rest of his career, he continued to pursue the most fundamental aspects of cardiovascular science, but always with a direct link and relevance to major clinical problems. And he gradually moved to very direct involvement in clinical research. One of the most rewarding aspects of the move to a clinical chair in a major teaching hospital was the very large number of top-flight medical graduates who sought to work with him and pursue a doctorate or obtain post-doctoral experience. Among those who did this at RPA Hospital were Stephen Hunyor, John Shaw, Malcolm West, Peter Fletcher, Peter Blombury, Andrew Tonkin and Bob McRitchie. John Uther came with Paul from UNSW. He was also joined by two science graduates, Jim Angus from Pharmacology at the University of Sydney and Warwick Anderson who had done his

doctorate in Adelaide with John Ludbrook and then done post-doctoral work with Cliff Barger at Harvard. All went on to outstanding careers in medical research in Australia. Paul also gave much support and encouragement at that time to other young cardiovascular researchers in Sydney, including Ian McCloskey, Roger Dampney and Elspeth McLachlan. Indeed, throughout his career Paul went out of his way to support and encourage young scientists. Such support has been of lasting benefit to many Australian cardiovascular researchers, not just those who worked directly with him.

The research on hypoxia at UNSW, which figured prominently in Paul's second review for *Physiological Reviews*, 'Integrative Neural Cardiovascular Control' (57), paved the way for new endeavours at the Hallstrom Institute. This model was useful in elucidating the sites of action in the central nervous system of clonidine, a centrally acting anti-hypertensive drug (59, 60, 69, 73, 80, 83, 84). Saxon White returned from a post-doctoral post at La Jolla, California to a Chapman Fellowship in Cardiology and brought with him the Doppler flowmeter technology that he and Paul, and later Bob McRitchie, put to good use in studying the nasopharyngeal ('smoke') reflex in conscious rabbits (86). The inhalation of noxious vapours (such as cigarette smoke) evokes instant apnoea and a bradycardia, with marked redistribution of blood to the brain and heart, reminiscent of the changes induced by hypoxia and seen in the 'diving reflex'. Having observed that baroreflexes played a significant role in virtually all circulatory perturbations, Korner turned to studying these reflexes in both animals and humans (63). He developed a logistic function curve to describe the relationship between changes in blood pressure and the evoked changes in heart rate (63, 66, 67, 69, 74, 76, 79) and demonstrated an attenuation of this reflex not only in humans with hypertension but also in rabbits with experimental renal hypertension. This work was boosted by the arrival from Oxford of Professor Peter Sleight, one of the very early pioneers of studies on baroreflexes in human hypertension, to spend a sabbatical year with Korner.

Korner also investigated the role of autonomic and non-autonomic factors on resting heart rate and on haemodynamics in people with essential hypertension, and reported that, as

generalized autonomic blockade did not abolish the difference between patients with and those without hypertension, non-autonomic factors must play a major role (62, 65, 77, 85, 87). It was only much later, when techniques for direct measurement of sympathetic activity became available through Murray Esler's work at the Baker Institute, that he came back to appreciating the major role of sympathetic activity (123, 124, 145–147).

Paul Korner's initial enthusiasm for Arthur Guyton's work waned over the next few years, as his attempts to confirm some of Guyton's assertions revealed some flaws. Guyton had suggested that all hypertension began with salt-induced overload, exceeding renal excretory capacity and leading to excessive tissue perfusion or high cardiac output. Guyton did not believe the sympathetic system had any role in long-term circulatory control and suggested that the initial tissue overperfusion and raised cardiac output triggered a local autoregulatory response to adjust blood flow to the tissues. But Paul and colleagues found that the phenomenon of high output followed by increased vascular resistance did not occur in renal hypertension in animals, and in a study with Barry McGrath (106) found that salt overload in humans with renal impairment raised the blood pressure entirely through raised cardiac output without any elevation of peripheral vascular resistance. This led to much debate but, to Paul's chagrin, Guyton did not change his position.

Paul Korner's tenure of the Scandrett Chair coincided with major developments in clinical cardiology. This was the era of the new coronary care units but the full-time cardiologists at the Hallstrom Institute felt that their work was already state-of-the-art and that a coronary care unit was unnecessary. However, an extensive literature and accumulating evidence convinced Paul that a coronary care unit might save many lives by facilitating the immediate treatment of life-threatening arrhythmias and he went ahead with its establishment. Results were dramatic—after one year of operation, the mortality at two weeks after myocardial infarction fell from 12% to 3%. Another field crying out for development was hypertension, a field that had been left fallow for many years despite advocacy from Sir Horace Smirk, who had visited the hospital and given a lecture on his results with

gangion-blocking drugs, and despite the development of many new and more effective anti-hypertensive drugs. With Paul Korner's encouragement, John Chalmers worked with David Tiller (Head of Nephrology) and John Horvath to establish a hypertension clinic and service, as a joint activity of Cardiology and Nephrology. Many clinical physiological and pharmacological studies followed, including elegant randomized factorial clinical trials with new anti-hypertensive agents (89, 90).

Paul had learned the importance of personal contact with other leading scientists from his experience with the Tokyo IUPS Congress while at UNSW, and soon after taking the Scandrett Chair he attended the International Congress of Cardiology in Jerusalem in 1968 followed immediately by the European Congress of Cardiology in Athens. In Jerusalem Paul gave a paper on the role of hypothalamic and fore-brain mechanisms on the autonomic responses to hypoxia. He did not yet have any clinical data and his long-term sparring partner, Austin Doyle, remarked 'It was like Arthur Schnabel playing in a nightclub!', which Paul took as a compliment. Sir Kempson Maddox, the grand old man of cardiology in Australia and still a major figure on the world stage, nominated Paul to be a member of the Council of Clinical Science of the International Society of Cardiology. At the first meeting Paul attended, he met Alberto Zanchetti, Deputy Director of the Istituto di Ricerc Cardiovascolari in Milan, which led to a strong connection with the Milan group—a leading group in the world of hypertension—and participation in several key meetings and workshops with the leading players in Europe and North America (58, 61, 69). Paul then helped Ralph Reader, Director of Australia's National Heart Foundation, to organize a series of similar elite scientific meetings in Australia with the major figures from overseas participating, including one on 'Hypertensive mechanisms' in 1970 and another on 'Present concepts about the myocardium' in 1973. Paul Korner's morale received a major boost with his election to Fellowship of the Australian Academy of Science in 1974.

Around this time, Paul Korner was approached by Tom Lowe, who was about to retire as director of the Baker Medical Research Institute in Melbourne, to ask if he might be interested

in that position, which was also linked to the directorship of the Clinical Research Unit of the Alfred Hospital. The Baker Institute had been founded in 1925 by Thomas Baker and Edgar Rouse, pioneers of the film and photographic industry in Australia, who had been bought out by Kodak. Under Tom Lowe's directorship from 1946, the Institute had become very diverse in its activities, and had recently moved into a new building with excellent facilities. Jennifer and the family were somewhat reluctant to leave Sydney and it was clear that their two sons, Nicky and Tony, would have to remain there to complete their university courses in arts/law and medicine respectively. However, it was also clear that this was an opportunity too good to miss, though Paul was also sad to disappoint Ruthven Blackburn and his cardiac colleagues at the Hallstrom Institute. He took up his new post on 1 January 1975.

Director of the Baker Medical Research Institute, 1975–90

Paul Korner was warmly met in Melbourne by the members of the Institute's Board, who introduced him to Melbourne's cardiologist, academic and business leaders. The Board was chaired by John Habersberger, formerly the Managing Director of Kodak Australia, and had three other members, Dr H. B. Hay, a cardiologist at the Alfred Hospital, Professor Rod Andrew, Dean of Medicine at Monash University, and Darren Baillieu, a retired scion of a leading Melbourne family. All had agreed to Paul Korner's proposal to develop the Baker as a multidisciplinary cardiovascular research institute, and all gave him unstinted support. The Institute was very soon affiliated with Monash University, with Paul being appointed to a personal chair in Medicine. He was gratified by the good relationships between Monash University and the University of Melbourne—a marked contrast to university relationships in Sydney. The Baker at that time had many empty laboratories as all Lowe's staff had left and only two small research groups were still in residence, one doing research on cancer and the other working on developmental biology in relation to SIDS (the Sudden Infant Death Syndrome). Both left within two years. Very soon after his arrival, Korner was joined by a little band of émigrés from Sydney—two post-docs in Jim Angus and Warwick Anderson,

two doctoral students in Peter Blombery and Peter Fletcher, and Korner's personal laboratory assistant of many years, Judy Oliver. Their introduction to Melbourne was facilitated by the help Monash University gave them to find accommodation and by the warm and consistent hospitality offered to them by Jennifer. One reason Jennifer was happy to come to Melbourne was the prospect of her working professionally again and she soon became a research assistant in Basil Hetzel's Department of Public Health at Monash.

Korner established several research groups at the Baker. His own small group from Sydney formed the nucleus of his 'Hypertension and Circulatory Control Group', and to strengthen the Clinical Research Unit he recruited the Institute's present Director, Garry Jennings, a Monash graduate pursuing postgraduate training in cardiology in the UK, who arrived at the end of 1975 (149–152). Korner established a successful on-going collaboration with Colin Johnson (107, 112, 114, 116–118), Professor of Medicine at the nearby Prince Henry's Hospital, to strengthen the endocrine capacity, and he recruited Jennifer Angell-James from the UK to start a neurophysiological laboratory, working with Pat Dorward and Professor Masami Iriki, a visiting scientist from Japan (102, 103, 109–111, 125, 126, 133). He also attracted Professor Paul Nestel to be the Deputy Director of the Institute and head of a new 'Cardiovascular Metabolism and Nutrition Research Unit' from early 1976, accompanied by other members of his group, including Noel Fidge. Other laboratories were established in time, including a 'Catecholamine Laboratory' headed by Murray Esler, a 'Cell Biology and Morphology' laboratory headed by Julie Campbell, a 'Pharmacology' laboratory headed by Jim Angus, returning from his C. J. Martin Fellowship after working in London with Nobel laureate Sir James Black, a 'Clinical Pharmacology' laboratory headed by Allan McLean and a Cardiac Surgery laboratory with Frank Rosenfeld. John Ludbrook later established an 'Experimental Cardiac Surgery' laboratory.

This rapid growth exceeded the growth in necessary research funding and placed very great pressures on the Institute, which struggled to make ends meet. 1975 was a horror year for the Australian economy, the Federal Government and the budget of the National Health and Medical Research Council, and things took a long

time to improve. Some useful temporary respite came from renting out empty laboratory space to the Australian Antarctic Division for two years but it was not until the award of an NHMRC Block Grant, commencing in 1983, along similar lines to those supporting the Walter and Eliza Hall and Florey Institutes, that finances began to be on an even keel. During these early years, Paul also reorganized the Institute's governance and management structure. The Board was expanded to twelve members chaired by Sir Laurence Muir, with a new Business and Advisory Committee and also a new International Scientific Research Advisory Committee with outstanding membership from the USA, Europe and Japan. Paul appointed a Finance Director, Michael Downes, in 1978, helping to lighten his own administrative load and at the same time improving the Institute's fund-raising activities. In 1980 the Institute was incorporated under the 'Baker Medical Research Institute Act' of the Victorian Parliament.

Much high quality research was accomplished over the next few years and one of Paul Korner's greatest achievements was his success in remaining a 'hands-on scientist' working in his own laboratory for a considerable time each week (Fig. 2), as well as collaborating closely with many of the other groups working in closely related fields. Outstanding results were achieved in the field of circulatory control, including the discovery that the arterial baroreceptor threshold is rapidly reset whenever there is a sustained change in blood pressure, and description of the complex interactions between renal, arterial and cardiac baroreceptors (154–156, 175–178). This led to the concept that 'whole organism' baroreflexes in the intact organism actually integrate input from arterial, renal, cardiac and pulmonary baroreceptors (190, 273, 274). Work with Head, Angus and Bobik in experimental animals demonstrated that tonic input from cardiac and pulmonary baroreceptors was mediated through central noradrenergic and serotonergic neurons and clarified the role of these central neurons in mediating the effects of antihypertensive drugs such as methyldopa and clonidine on blood pressure and heart rate (178–181, 188–191, 193, 196, 200, 205, 216, 217, 241, 244, 254, 255, 261, 287, 308).

There was international acclaim for the work of Murray Esler and his colleagues using



Figure 2. Paul Korner in his laboratory at the Baker Institute with his long-time laboratory assistant, Judy Oliver.

the noradrenaline spillover technique that Esler had developed to measure sympathetic activity in hypertensive subjects, and to demonstrate increases in activity in a variety of vascular beds and of physiological and pathological conditions (123, 124, 145–147, 167–170). For example, they showed that the elevation of noradrenaline spillover was similar in mild and severe hypertension in humans, suggesting that the progressive elevation of blood pressure seen over time is caused by other mechanisms (145–147, 167).

Paul Korner appreciated the importance of the relationship between the Baker Institute and the Alfred Hospital and enthusiastically supported the development and activities of the Clinical Research Unit under the leadership of Garry Jennings. (This was renamed the Alfred Baker Medical Unit in 1989.) Throughout Korner's tenure at the Baker, he keenly fostered the interaction and 'back and forth' interplay between basic research teams and clinicians and clinical research teams. Amongst the achievements of the Clinical Research Unit were the studies with Jennings and Esler focusing on the effects of exercise and of exercise training, which demonstrated that the anti-hypertensive effects are achieved in part through dilatation of resistance vessels in active skeletal muscle, and that stress-related increases in blood pressure in members of the Australian Antarctic Expedition could be reduced by exercise training (210, 229, 242, 271, 281, 292, 293, 303). They also showed that prolonged control of raised blood pressure in hypertensive subjects reduced peripheral resistance

both before and after total autonomic blockade (208, 209, 211). This suggested that it might be structural rather than neurally mediated, but the very rapid re-development of hypertension when treatment was stopped made this unlikely. Extensive studies were also completed on the vascular amplifier in experimental hypertension, particularly on the relationship of left ventricular hypertrophy with sympathetic activity and with vascular hypertrophy and on its effects on myocardial contractility and on distribution of coronary blood flow.

Around the time Paul Korner retired in 1990, there were twelve laboratories at the Institute including Basic Cardiology (Broughton), Cardiac Surgical Research (Rosenfeld), Cell Biology (Campbell), Cellular Biochemistry (Woodcock), Circulatory Control and Neuropharmacology (Korner), Electron Microscopy and Morphology (Luff), Human Autonomic Function (Esler), Lipoprotein Structure, Function and Molecular Biology (Fidge), Lipoprotein Metabolism (Barter), Pharmacology (Angus), Renal (Anderson), and the Alfred Baker Medical Unit (Jennings).

When the NHMRC Block Grant was reviewed by an independent international committee in 1987, it concluded that 'The Baker Institute is one of the very few institutes in the world conducting research on cardiovascular function and disease over a broad front from basic biomedical science to applied clinical research. The standards are very high and it has an excellent international reputation. In

particular, the work on hypertension is outstanding. The Clinical Research Unit offers the Institute important opportunities to apply its basic work in prevention and treatment and to draw on clinical findings as the starting point for more fundamental studies.’ Paul Korner had led the Baker Medical Research Institute from being a little backwater of no consequence to a commanding position as an internationally respected institute specializing in multi-dimensional cardiovascular research, with very high quality work spanning the whole range from fundamental science to applied clinical research and what would today be called ‘translation and implementation research’. His personal scientific standing remained at the top of the tree and he was much loved and respected by staff at all levels at the Institute and widely respected beyond its walls.

Broader Activities in Science and Health

Paul Korner was actively involved in national and international research management and organization throughout his career. In his early years he was heavily involved with the National Heart Foundation of Australia, and he remained a member of its National Medical and Scientific Advisory Committee from 1966 to 1986. Around this time he was also a member of the Research Committee for the Life Assurance Medical Research Fund of Australia and a member of the Council of Clinical Science of the International Society of Cardiology. He also became a member of the management committee for the Heart Foundation’s ‘First Australian National Blood Pressure Study’ from 1970 to 1978. The trial (also known as the ‘Australian Therapeutic Trial in Mild Hypertension’) was led by Ralph Reader, and Korner was active in its planning, analysis and publication. This landmark trial was the first to establish clearly that lowering blood pressure was beneficial in the prevention of major vascular complications, even in patients with mild hypertension. Hypertension research was strong in Australia but most active researchers in this field only met overseas, at the meetings of the International Society of Hypertension. Accordingly Austin Doyle and Korner acted to found the ‘High Blood Pressure Research Council of Australia’, which held its inaugural meeting in December 1978 and has

met annually in December ever since. Austin Doyle was the first President and Paul the first Secretary. He later became President, from 1987 to 1989, and also accepted Presidency of the Australian Physiological and Pharmacological Society, a society in which he had long been very active, in 1986–7. Having been elected to the Australian Academy of Science in 1974, Paul was active on many of the Academy’s committees. He was a member of the Academy’s Council from 1979 to 1982 and was Vice-President in 1981–2. Through the Academy, he became Chair of the organizing committee for the 29th Congress of the International Union of Physiological Sciences, held at UNSW in 1983, and President of the Congress. This attracted over 3,000 international delegates—the largest medical conference yet held in Australia—and made a profit that was invested in a trust fund of the Australian Physiological and Pharmacological Society. Korner was very active in the International Society of Hypertension and received that Society’s Volhard Award and Lecture in 1982; he was later made a ‘Distinguished Member’. He was also honoured by the European Society of Hypertension, which gave him the Björn Folkow Award and Lecture in 1995.

In his last three years in Melbourne, from 1988 to 1990, Paul Korner became President of the newly amalgamated Alfred, Caulfield and Royal Southern Memorial Hospital, a coalition that was not welcomed by any of the constituent hospitals. The Government was seeking a ‘neutral chairman’, which Korner was, but it was a thankless task and he grew to regret accepting the role. However, he came to respect the new CEO, Dr Bill Kricker, a systems engineer with extensive business experience, who managed to improve the hospital’s financial situation very considerably.

Continuing in Science: the Years in ‘Retirement’, 1990–2012

On Paul’s retirement from the Baker Institute at the end of 1990, he and Jennifer returned to Sydney, to their lovely old home at Woolwich (Hunter’s Hill), overlooking Sydney Harbour. Their first grandchild was born on the day of their return! Very soon, Paul Korner was made Emeritus Director of the Baker Medical Research Institute and Emeritus Professor of Medicine,

Monash University, as well as Visiting Professor in the School of Physiology and Pharmacology at UNSW. Shortly afterwards, he became a Visiting Professor in Physiology and an Honorary Member of the Faculty of Medicine at the University of Sydney, where he interacted with Roger Dampney. He also established a close relationship with Bob Graham and the Victor Chang Cardiac Research Institute.

Paul was soon in demand for numerous national and State Government committees. One such was the Life Science Panel for establishing Cooperative Research Centres (CRCs) involving partnerships between academia and industry, an Australian Government initiative to capitalize and commercialize some of the fruits of research. For this Panel, he served for six years as the visitor to new CRCs such as the ones on Eye Research and Vaccine Technology—his main tasks being to facilitate the interaction between the CRC and the Canberra bureaucracy, to help with submissions and reports, and to provide advice. He was once again appointed to the Council of the NHMRC, from 1991 to 1993. He also served on State Government committees in New South Wales and Western Australia, to review the support of medical research institutes through the funding of infrastructure along lines long established in Victoria.

In the first few years, Korner returned to Melbourne from time to time for periods of three to six weeks to complete experiments on a variety of themes, including further analysis of the structural determinants of vascular resistance and investigation of the release of endothelial relaxing factors in hypertension. Many papers resulted in this period (with Jim Angus, Garry Jennings and others), many of them on the importance of ‘vascular amplifiers’ for the development of hypertension (291, 296, 297, 301, 304–306, 319, 322, 324–326). Two of these papers demonstrated that the sympatho-adrenal system played an obligatory role in the development of hypertension in the Spontaneous Hypertensive Rat (SHR)—a finding that had eluded other investigators, as most had underestimated the compensatory capacity of the adrenal medulla after destruction of the sympathetic nerves (306, 309). This stimulated Paul to return to his long-cherished ambition to write a definitive text on the pathogenesis of hypertension from a holistic, integrated, whole-system view. His first plan was

to write this book together with his close friend and scientific soul-mate, Björn Folkow from Göteborg. Eventually, after three or four years of voluminous but unproductive correspondence and difficulties in communication exacerbated by the tyrannies of distance, Paul decided he had to write as sole author. Finally, after much toil and a vast amount of study in fields where he was a novice, including molecular biology and genomics, Paul’s book was born, *Essential Hypertension and Its Causes: Neural and Non-Neural Mechanisms*, published in 2007 by Oxford University Press.

Essential Hypertension and Its Causes: Neural and Non-Neural Mechanisms

This book, written in the years after Paul Korner left the Baker Institute and ‘retired’, represents one of his greatest achievements in the realms of science. In it, he examines the nature of the circulatory control system and argues that it is an adaptive, non-linear system in which regulatory parameters are actively altered when operating conditions exceed certain limits. Such systems have been used extensively to explain somatic motor control and Korner argues that they apply equally to control of the circulation and do so through both the central nervous system and peripheral control mechanisms. In the central nervous system, ‘slow’ neurons releasing monoamine transmitters and neuropeptide co-transmitters act to adjust the parameters of the control system by modulating the responsiveness of target neurons and leading to constant ‘resetting’. Korner presents evidence that both genes and environmental factors are necessary for developing ‘essential hypertension’ (as the common or garden variety of hypertension is known). The main environmental causes are mental stress, high salt intake and obesity. The process is initiated by chronic mental stress, which is perceived through hypothalamic-cortical neuronal connections. In particular, mental stress raises the activity of dopaminergic neurons linking the cortex and hypothalamus and initiates the ‘get ready for action’ variant of the defence response or the ‘fight or flight’ response. The resulting increase in sympatho-adrenal activity leads to the initial elevation of blood pressure and to mild hypertension. Once the episode of stress is over, the response rapidly subsides in

normal people but in susceptible individuals, the dopaminergic neurons and synapses become sensitized or strengthened so that in time, the autonomic response is activated at lower levels of stress, and in effect these synapses behave like ‘memory neurons’.

Subsequently, non-neural functional and structural changes progressively enhance the vasoconstriction, causing vascular rarefaction in vital target organs including the heart, kidney and brain. In Paul Korner’s view, the kidney is the victim of the neural changes and not its source—this representing the fundamental difference in the views of Korner and Guyton. Korner believed that in many individuals with essential hypertension, maybe 60% of them, the stress-induced changes in neural activity increase the blood pressure responsiveness to high salt intake, which further accentuates the hypothalamic defence response and enhances the non-neural structural vascular changes. In another large group, possibly close to 40% of subjects with essential hypertension, the sympathetic activity pattern induces eating and weight gain, causing hypertensive obesity, with an increased tendency to develop non-insulin-dependent diabetes and atherosclerosis. The book is a lasting monument to Paul Korner’s contribution to circulatory control and to our understanding of the causes and pathogenesis of hypertension.

Paul Korner—the Man, the Colleague and the Mentor

Paul Korner was a true polymath with a wide range of interests outside his science. He had a lifelong love of music and was steeped in both classical music and opera, with deep knowledge of both. He read widely, devouring the latest books, and in earlier years he and Jennifer were regulars at the theatre, at concerts and at the opera. He loved to walk and loved the wilderness, including that of the Australian bush, and often took the family on long walks at weekends, through national parks or along harbour foreshores. In later years, he and Jennifer went hiking along some of Europe’s best trails and passes. He was also a great raconteur with a quite disarming sense of humour. Paul was a devoted family man, very proud of his three children, Nicholas the lawyer, Tony the psychiatrist and Harriet the occupational therapist. As a scientist he had

many great qualities. One was his insatiable scientific curiosity: he always asked questions at scientific meetings, often to the discomfort of the unfortunate speaker who might well have to listen to some sound advice! Another was his insistence on gathering the evidence through well planned and rigorous experiments, and he was once heard advising a junior colleague with a tendency to theorize, ‘why don’t you stop having all those great thoughts and do some experiments for a change’. Indeed, another Korner characteristic was his quite devastating turn of phrase. As an example, after fighting a losing battle against the appointment of an inadequate candidate for a chair of Medicine, he was heard to say ‘Caligula’s horse could do a better job!’

Behind his imposing facade, Korner was remarkably sensitive to the struggles and issues confronting his students, research fellows and colleagues and a great source of support, understanding and comfort to many. One of his greatest contributions and legacies came through his role as supervisor, mentor and supporter of countless early and mid-career researchers who are now leaders of cardiovascular science and of academic and research institutions across Australia. Following his return to Sydney in 1990, he became a regular figure at the Victor Chang Institute seminars and the Director, Bob Graham, decided to name a lecture series in his honour, ‘The Paul Korner Lecture Series’ given weekly by early-career researchers at the Chang Institute. Paul became a regular figure at these lectures and interacted with ease with young scientists and trainees, giving advice and encouragement. One early-career researcher who benefited from this association, Chris Blair, asked that the tribute below, entitled ‘A memory of Professor Korner’, be read at Korner’s memorial service in the Great Hall at the University of Sydney, which Bob Graham did:

Professor Korner unfailingly arrived at VCCRI in good time each Wednesday morning to attend the seminar series that will always bear his name. For at least half an hour before the seminar commenced he was often to be found sitting in the lobby, happy to chat with anyone who approached him, whether it was a senior Faculty member or a PhD student. With an hour of vigorous scientific discussion to come, it seemed to a young scientist that these prior exchanges were by convention reserved for salutations and

cordial catching-up, before battle commenced and the conversations became 'all business'.

One morning, I decided to push my luck. I headed for the lobby, somewhat uncertainly, with a laptop containing a considerable amount of data, hopeful that I might be lucky enough to get a few words of advice (of the analytical kind) before the seminar began. Fortunately, Professor Korner wasn't in conversation when I arrived. As I approached him he spied the laptop, partly ajar, and immediately had the measure of me. But my timidity was misplaced. Before I'd said a word he invited me to sit down, and without hesitation spent the next 40 minutes unhurriedly scrutinizing my designs, listening to my methods, and offering useful new perspectives on the findings I described to him. The work concerned a rather involved investigation of a particular type of stem cell therapy for the heart, yet it didn't for a second seem that this was 'not his area'. As a vastly experienced scientific director, his analytical mind effortlessly straddled the ages and fads of scientific vogue, and he discussed my findings like he'd been thinking about such details for years (and he may well have been!). And of course, detecting my trepidation, he engaged me with the congenial air of an experienced supervisor, making suggestions rather than criticisms, and hinting at alternative interpretations upon which he then encouraged me to hang my own ideas. We at the Victor Chang, and numerous others beyond, felt Professor Korner's warmth and humanity for ourselves, and are the richer for it.

Concluding Comments

Paul Korner was a passionate man and a fighter for good causes, with a piercing intellect and a disarming sense of humour coupled to a devastating turn of phrase and a caring heart behind an imposing façade. But, above all, he was a man of science. Paul Korner died unexpectedly after a short period of acute illness, against a long background of protracted struggles with his health. Up until his last few weeks, he was still fully engaged in life and science, with all his faculties intact and in high gear. By a cruel turn of fate, he died on 3 October while the International Society of Hypertension was meeting in Sydney, and on the day the Society honoured him through the award of 'Distinguished Membership'.

On the death of Max Planck, Albert Einstein wrote a moving eulogy of Planck that applies equally well to Paul Korner and we have quoted

it below, replacing the name of Planck with that of Korner:

Many kinds of men devote themselves to science, and not all for the sake of science herself. There are some who come into the temple because it offers them opportunity to display their particular talents. To this class of men science is a kind of sport in the practice of which they exult, just as an athlete exults in the exercise of his muscular prowess. There is another class of men who come into the temple to make an offering of their brain pulp in the hope of securing a profitable return. These men are scientists only by chance of some circumstance, which offered itself when making a choice of career. If the attending circumstances had been different, they might have become politicians or captains of business. Should an angel of God descend and drive from the temple of science all those belonging to the categories I have mentioned, I fear the temple would be early emptied. But a few worshippers would still remain—some from former times and some from ours. To these latter belongs our Korner. And that is why we love him.

The death of Paul Korner leaves a big gap in the field of hypertension and cardiovascular disease. He was not only a remarkable scientist but also a passionate fighter for the support of science and medical research. He will be sorely missed, for he was without doubt one of the great figures of Australian science in the second half of the twentieth century and a major presence in the wider world of international cardiovascular science. Those in this field of science are fortunate that he chose to devote his life to understanding and managing hypertension and disorders of the heart and circulation.

Acknowledgements

Much of the material included in this record was based on 'Autobiographical Notes: My Life in Science', written by Paul Korner in 2008 in preparation for the interview with John Chalmers about his life and scientific career made for the Australian Academy of Science. We are also indebted to Professor Robert Holland for his contribution to the section dealing with Paul Korner's time at UNSW and to Professors Geoffrey Head and Alex Bobik for their contributions to the descriptions of Paul Korner's scientific work while he was Director of the Baker Medical Research Institute.

Awards and Honours

- 1946 BSc, University of Sydney
 1947 MSc, University of Sydney
 1951 MBBS, University of Sydney
 1952–3 NHMRC Junior Research Fellowship
 1954–6 Overseas Research Fellowship of the Life Insurance Medical Research Fund of Australia and New Zealand
 1956 MD, University of Sydney
 1958 Edgeworth David Medal, Royal Society of New South Wales, for Distinguished Research in Science amongst younger workers
 1970 R. T. Hall Prize, Cardiac Society of Australia and New Zealand
 1974 Elected FAHA (Fellow of American Heart Association)
 1974 Elected FAA (Fellow of the Australian Academy of Science)
 1982 Franz Volhard Award and Lectureship, International Society of Hypertension
 1987 DSc (honoris causa) University of New South Wales
 1988 Advance Australia Award for Services to Medical Research
 1989 MD (honoris causa), University of Melbourne
 1990 Appointed an Officer in the General Division of the Order of Australia (AO)
 1990 Life Membership of High Blood Pressure Research Council of Australia
 1991 Life Membership of Australian Physiological and Pharmacological Society
 1991 The Paul Korner Medal for Outstanding Achievement established by the Baker Institute for Medical Research to recognize the contributions of graduate students; awarded annually, along with a cash prize
 1993 The Paul Korner Lecture Series established by the Victor Chang Cardiac Research Institute – for the weekly seminars presented by early career researchers
 1994 Scientific Patron of 15th Scientific Meeting of the International Society of Hypertension, held in Melbourne
 1995 Björn Folkow Award and Lectureship, European Society of Hypertension (Milan, Italy)

- 2000 Tony Sjostrand Lecture, Swedish Society of Medicine (Göteborg, Sweden)
 2012 Distinguished Membership of the International Society of Hypertension, conferred at its General Meeting, held during the 23rd Biennial Scientific Meeting, in Sydney
 2013 The Paul Korner Award for Hypertension and Neuroscience established by the International Society of Hypertension for award at its biennial scientific meetings, with the Award to include a sum of money from a corpus of donations collected by the High Blood Pressure Council of Australia for this purpose

Appointments

- 1951 Resident Medical Officer, Royal Prince Alfred Hospital, Camperdown, Sydney
 1952–3 Junior Research Fellow, Kanematsu Memorial Institute of Pathology (with Professor Colin Courtice)
 1954–5 Research Fellow, Royal Postgraduate Medical School, Hammersmith Hospital, London (with Sir John McMichael)
 1955–6 Research Fellow, Department of Physiology, Harvard Medical School, Boston (with Professor Cliff Barger)
 1956–9 Senior Lecturer, Department of Physiology, University of Sydney
 1959–60 Associate Professor of Cardiopulmonary Physiology, University of Sydney
 1960–8 Foundation Professor and Head, School of Physiology and Pharmacology, University of New South Wales
 1963–7 National Secretary, Australian Physiological and Pharmacological Society
 1968–74 Foundation Scandrett Professor of Cardiology, Department of Medicine, University of Sydney and Head, Hallstrom Institute of Cardiology, Royal Prince Alfred Hospital, Camperdown, Sydney

- 1975–90 Director, Baker Medical Research Institute and Director, Clinical Research Unit, Alfred Hospital, Melbourne
- 1975–90 Professor of Medicine, Monash University, Melbourne
- 1976–84 Chairman, National Committee of Physiology, Australian Academy of Science
- 1977 Chairman, Organising Committee for 29th Congress of IUPS (International Union of Physiological Sciences)
- 1978–83 Secretary, High Blood Pressure Research Council of Australia
- 1980 Chairman, Organising Committee for National Heart Foundation Conference on Cardiovascular Receptors, Molecular, Pharmacological and Therapeutics Aspects
- 1980–6 Deputy Chairman of National Medical and Scientific Advisory Committee of National Heart Foundation of Australia
- 1983 President, 29th IUPS Congress, Sydney
- 1986–7 President, Australian Physiological and Pharmacological Society
- 1987–9 Chairman, High Blood Pressure Research Council of Australia
- 1987–90 President and Chairman of Board of Management of Amalgamated Alfred, Caulfield and Royal Southern Memorial Hospitals
- 1988 Chairman of Review Committee of John Curtin School of Medical Research, Australian National University
- 1990 Emeritus Director of Baker Medical Research Institute
- 1990 Emeritus Professor of Medicine, Monash University
- 1990 Visiting Professor, School of Physiology and Pharmacology, UNSW
- 1991 Visiting Professor, Department of Physiology, University of Sydney
- 1993 Chairman, Review Committee for Department of Anesthesia, University of Sydney

- 1993–4 Visitor, Cooperative Research Centres for Eye Research and Technology, for Vaccine Technology, for Biopharmaceuticals, and for Diagnostic Technologies

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