

# Journal and Proceedings of The Royal Society of New South Wales

Volume 118 Parts 3 and 4 [*Issued March, 1986*]

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## Tribute to Sir Frank Macfarlane Burnet

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*Sir Macfarlane Burnet was one of the Royal Society of N.S.W.'s most distinguished Honorary Members. He died 31st August, 1985, in his 86th year. Unquestionably one of the fathers of Australian medical science and one this century's greatest biologists, he was awarded the James Cook Medal by the Society in 1954 for his outstanding achievements. We are indebted to Professor Sir Gustav Nossal, Director of the Walter and Eliza Hall Institute of Medical Research, for permitting us to publish the following tribute to Sir Macfarlane which was originally given on ABC Radio on 4th September, 1985.*



As Sir Macfarlane Burnet is being royally farewelled in the City of Melbourne, where he did all his important work, it is worth pausing to consider what were the qualities of intellect and spirit that made him such an outstanding and substantially different kind of scientific thinker. To attempt this analysis, we must recall the circumstances that prevailed in Australian science when Burnet made his start. Over 60 years ago, when he first entered the laboratory as a humble pathology registrar at the Melbourne Hospital, biomedical science was hardly stirring in Australia. The universities were good trade schools, the art of medicine being passed on largely by part-time clinical teachers with Collins Street practices. Rivett and C.S.I.R. were years away; The Walter and Eliza Hall Institute had made a faltering beginning and had just appointed Charles Kellaway as its second Director; in short, no serious person would contemplate learning medical research in Melbourne. For that, you had to go to London! This news, however, had not reached our shy young beetle-collector. Schooled by nothing other than the scientific literature, he began to study the bacterial viruses which later became the vehicles for the birth of the new genetics. Burnet was soon publishing in international journals. He did indeed go to London, at about the same time as his classmate Roy Cameron and his South Australian contemporary Howard Florey, but, unlike them, he quickly came back and with the exception of a second two-year British stint in his early thirties, the whole of the rest of his career was back at home. He built the Hall Institute into a formidable international force in virology and immunology. He made Melbourne a Mecca of medical research. This entirely committed Australian deserves to be recognized as the father of Australian medical science.

How, then, was he so successful, right from the beginning of his research career? Burnet's was a contemplative, almost a solitary, kind of genius. The majority of his papers were single-author works, using simple, elegant techniques, frequently of his own devising and requiring little more than a Pasteur pipette, a test tube, a fertile hen's egg and a microscope. Yet his studies differed

sharply from the then current image of Paul de Kruif-style microbe hunting. Burnet's work did not end with the isolation and characterization of some new virus, it *began* there. The virus, important though it might be in its own right, was just the beginning of a rounded journey into biology. A particular finding made in the classical reductionist mode of normal science was never left alone. It became a springboard for speculation on the nature of life processes, a tool in the synthesis of a peculiarly holistic view, that drew microbiology, genetics, epidemiology, immunology and ecology into an intricate web of interlocking concepts. For the forging of these constructs, Burnet needed quiet and isolation. Not for him the thrust and parry of a vigorous discussion with a peer or gifted student. How many times have I seen him struggle to accommodate a new finding, his or someone else's, into the constantly changing pattern of his speculative framework. He would observe or listen, eyes half-shut, brow puckered in concentration. Then out would come pen and paper, and a doodle of simple images marginally annotated in his small, neat handwriting would emerge. And then, so often, "I'll have to think about this!" in the quiet of his study, that night (never next week, never after the next committee meeting or trip) the problem would be attacked again, and the next morning, with quiet certainty: "Nossal, I've found the answer!"

For Burnet, there was never a failed experiment. Most of us, when the fruit of a week's work emerges from our complex array of instruments – the gamma counters, the spectrophotometers, the protein sequencers – cope badly when the results appear confusing. We grind our teeth, we curse, "The bally thing didn't work. I'll have to set it all up again in the morning!" Burnet believed totally that nature was always trying to tell him something. So he would take the unexpected, uninterpretable results and turn them this way and that, add and subtract figures in various simple ways, play with the data until they were forced into some kind of order. Somewhat mischievously, he would say: "Nossal, I never repeat an experiment". He didn't mean it literally, of course. What he meant was that each experiment, no matter how small, would suggest some extra step, an extra control, an extra slight experimental variation, making the confirmatory experiment always into an elaboration, a broadened learning experience. It was true that Burnet published very quickly, some felt prematurely. He wrote freely, correctly as he went. Many papers did not see a draft before being sent off. His critics accused him of sloppy work, yet in truth he was a gifted experimentalist. But he was never interested in dotting i's or crossing t's. When he was convinced that he was right, he would publish and move on to the next problem, leaving the details to be sorted out by someone else. This capacity to skim the cream off the top certainly did not endear him to his competitors, particularly in the U.S.A.

Today, we live in an age of technology. The era of the big battalions has arrived in research. Yet science is primarily about ideas. Advanced techniques serve as essential tools, but the logical and imaginative constructs that human minds produce when the tools have done their work are the essence of science, and that which distinguishes it from technology. Burnet believed passionately in ideas. His extraordinary gift was to take apparently unconnected observations and fit them, almost force them, into whatever theoretical framework was his current obsession. Nowhere was this more evident than in his two lasting contributions to immunology, the definition of tolerance and the creation of the clonal selection hypothesis. He was fascinated by the need for the immune system to have some way of distinguishing self from not self, the simultaneous capacity to mount a vigorous antibody response to any foreign substance that enters the body, but to avoid a destructive attack on the body's own tissues. He was equally intrigued by the immense diversity of antibodies, the seemingly endless array of specificities that could be generated as infections or vaccines hit the body. The problems were on his mind for 15 years. To address them, he drew on knowledge accruing in virology, zoology, embryology, haematology, enzymology and molecular biology instead of just conventional immunology. The technical details of the theories need not concern us here. Suffice it to say that he puzzled out the correct

solution to these two central issues of immunology. This represents his greatest and most lasting achievement, richly meriting his 1960 Nobel Prize for Medicine.

The originality was fed by wide and disciplined reading. His sheer industry in keeping up with literature over a broad front was prodigious. He had zestful, ready willingness to accept the probable truth of new findings or incompletely proven claims. Most scientists, when their comfortable preconceptions are challenged, are so ready to shout: "I don't believe it", or "I'll wait till it's confirmed". Not so Burnet. He embraced new data as just more grist to the mill, ready for integration into his scientific *Weltanschauung*. As his reputation grew, he was prepared to admit to a human weakness. He was interested in other people's data, not in their theories. The only theories that mattered were his own. As a young man, I suffered greatly because of my perception of this egocentricity. I admired and respected Burnet so much but could not understand this single flaw. But as I have matured, I recognize that he could have worked no other way. The shyness, the single-minded preoccupation with his field of work, the almost obsessional desire to generalize, the joyful devotion to scientific truth, all this added up to a unique blend. He *did* perceive the universe distilled through a curiously personal filter, and what went on in his mind had greater reality, clearer *Gestalt*, for him than did anything else. Though the recognition from all round the globe and his happy, secure family life mellowed him a great deal over the last 30 years, the self-absorption never quite disappeared. Rather, it gradually became an amiable, comfortable boundary condition for all dealings with him, almost irrelevant once recognized.

Unlike many pure scientists, Burnet was an able leader, commanding the loyalty of his staff at the Hall Institute which he directed for 21 years. He ensured that the Institute worked on a single main theme of his own choosing, but, that much being said, he left his colleagues a great deal of latitude and never sought to claim credit for one of their discoveries. He was always eminently accessible and ready for scientific discussion. For years, the first thought of most Hall Institute workers when an interesting result came through was: "I wonder what the boss will think of this?" And there simply was no way to gain his approval, so important to all of us, other than through first-rate, honest scientific work. His extraordinary ability to evoke respect and loyalty owed much to his own uncompromising scientific honesty and commitment. The full measure of Burnet's gifts as a leader and teacher can be gauged by looking at the careers of his students and disciples. Such scrutiny will reveal his immense influence on Australian science.

Never afraid to speak out on public issues, Burnet devoted himself entirely to writing and lecturing after his retirement 20 years ago. A surprising harvest of 16 books, roughly one a year, came from this period. The blend of popular science, history, sociology and philosophy bore the complete stamp of the master. To this work, as to his science, Burnet brought the unique spectrum of his gifts: originality, imagination, intuition, naive honesty, conceptual breadth and daring, and, yes, wisdom of an almost spiritual kind. No one who has known him will lightly apply the adjective "great" to another. No one who loves Australian science will ever forget his example.

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