

Setting Patterns: The Atypical Choices That Shaped the Career of Sir Frank Macfarlane Burnet in Twentieth-Century Australia*

Neeraja SANKARAN
Yonsei University

Introduction

Changing Patterns: An Atypical Autobiography is the title that the Australian biologist Sir Frank Macfarlane Burnet (1899-1985) gave to the memoirs that he published (Burnet, 1968) upon his retirement from a long and fruitful career at the Walter and Eliza Hall Institute for Medical Research (WEHI) in Melbourne, Australia. As Burnet explained, he had characterized his autobiography atypical “because I should like to see it be something more than an account of my own experiences and ideas and at the same time, much less than a comprehensive autobiography.”¹ While it is not an unusual practice for scientists to include scientific details in their autobiographies these details are almost always presented against the wider landscape of the authors’ life. Burnet’s personal life, however, was almost entirely missing from *Changing Patterns*, which gave his claim of atypicality considerable weight. Indeed, as one reviewer remarked, “the one most

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¹ Frank Macfarlane Burnet, *Changing Patterns: An Atypical Autobiography* (Melbourne: Heinemann, 1968), p. 1.

personal chapter of the book [...] is the least interesting in the book which is otherwise highly successful.”²

The reason for invoking Burnet’s memoirs at the outset of this essay is to provide the context for the title which replaces the “changing” of the original with “setting.” The “change” in the original title refers to the author’s angle on “the way in which scientific aspects of medicine [had] changed [and] how new concepts of human biology emerged” in relation to his own scientific activities.³ By writing his memoirs, Burnet was in many ways following a path of atypicality that he had begun to tread from the very outset of his career by making choices that were unusual for Australians of his generation. As a result of these choices he both seeded the patterns of his own career and set a pattern that many other Australians began to follow. These actions were instrumental in forging an independent scientific identity for their newly-formed nation, which had only achieved the status of a federation in 1901. In this paper I examine Burnet’s career against the backdrop of the changing landscape of the Australian biomedical sciences during the twentieth century and give voice to various factors that played a role in its shaping.

Science Down Under

The quality and abundance of its world-class scientists and research institutions bears testimony to Australia’s standing in the international biomedical research scene today. But this prominence was a relatively late development in its history and one that only really gained momentum after World War II.⁴ At the dawn of the twentieth century, Australia presented quite a different face to the scientific world. A young nation, only newly independent, it still relied heavily on its ties to Great Britain. Except for a political right to self government, it remained in many respects still a part of the British Empire and subservient to it in all matters of defense and foreign policy for some years. Even after it broke away from these political ties, in other spheres such as science and technology, this dependency on Great Britain, both as an intellectual resource and for institutional support, continued for some decades to come. As late as 1939, “Australian scientists tended to see themselves and their work very much within the context of a larger British scientific network.”⁵

² J. Oppenheimer, “Book Review: Changing Patterns: An Atypical Autobiography By Sir Macfarlane Burnet,” *The Quarterly Review of Biology* 45-4 (1970), 381.

³ Burnet, *Changing Patterns*, p.1.

⁴ F. C. Courtice, “Research in the medical sciences: The road to national independence,” R. W. Home, ed., *Australian Science in the Making* (Cambridge: Cambridge University Press, 1988), pp. 277–307.

⁵ Roderick W. Home, “Introduction,” R. W. Home, ed., *Australian Science in the Making*, p. xiii.

By the 1960s, however, there was a clear shift in this perception both at home and abroad. As Burnet remarked at the time of his retirement:

Somewhere between 1920 and 1960 Australia developed from a colonial to an independent status. Politically it might have been its own master for the whole period, but culturally, scientifically and industrially in 1920 it was a dependency of Great Britain. By 1960, and even more so in 1970, that was not the case. Australia would now take its place, at a standard in line with its population, as part of the world of Western art and scholarship, science and medicine as well as that other world of technological progress [...]. Our contribution to medicine and to the sciences related to medicine has been and continues to be a significant one.⁶

Burnet was certainly in a vantage position to render this verdict on Australian medical research, having served as an eyewitness to and effector of the changes he was talking about. Indeed his career runs almost parallel with the scientific status of his homeland through most of the twentieth century. Born in 1899, he had been part of those generations of Australians who had needed to travel a long way, typically Great Britain, to gain research credentials and experience. Although cities such as Melbourne, Sydney, and Adelaide had already established their universities and medical schools in the nineteenth century, these schools were “staffed basically for teaching” and did not offer opportunities for students to undertake any original research.⁷ In 1923, for instance, when Burnet was finishing his medical studies in Melbourne, “Medical research in Australia was essentially a part-time activity.”⁸ Most of the research that was undertaken in Australia at the time was “piecemeal, part-time and lacking the approbation of the centers in which they were conducted.”⁹ Not until the advent of World War II could Australians even enroll in doctoral programs at home. Dr. Margaret Holmes, a longtime researcher at WEHI, can recall that in the 1940s she was part of the first batch of students to enroll in the state of Victoria in a Ph.D. program.¹⁰ The first Ph.D. degree in biomedical science in Australia was not awarded until 1947.¹¹ Before then, students interested in medical research had to travel abroad to gain practical experience and sustained mentorship.

⁶ Frank Macfarlane Burnet, *Walter and Eliza Hall Institute 1915-1965* (Melbourne: Melbourne University Press, 1971), p. 20.

⁷ Courtice, *op. cit.*, p. 288.

⁸ Burnet, *Walter and Eliza Hall Institute 1915-1965*, p. 21.

⁹ Peter G. Hobbins, “‘Outside the Institute there is a Desert’: The Tenuous Trajectories of Medical Research in Interwar Australia,” *Medical History* 54:1 (2010), 1-28, on 1-2.

¹⁰ Margaret Holmes, Interview with author (4 August 2009).

¹¹ Frank Fenner, “Medicine and medical science,” T. B. Millar, eds., *The Australian Contribution to Britain: Papers of a Conference at the Royal Society 7-8 June 1988* (Australian Studies Centre, Institute of Commonwealth Studies, University of London, 1988), 20-40, on 21.

Howard Florey, one of the winners of the 1945 Nobel Prize in Physiology or Medicine for his role in discovering penicillin and initiating the antibiotic revolution, is a notable example of a Burnet contemporary who followed what was at the time a more traditional path for an Australian interested in medical research. Born in 1898, Florey left his hometown of Adelaide for England after completing his medical degree in 1921 and spent the bulk of his career in England, conducting all his Nobel prize-winning work there. Although he did return to Australia on sporadic research visits later in his life, he never made it his primary intellectual home.

In contrast to Florey, Burnet, who went to England in 1925, also after obtaining his medical degree, returned to Melbourne in 1928 upon completing his doctoral research. With the exception of one more two-year visit to England, he thereafter worked in Melbourne until his death in 1985, despite offers from such prestigious institutions as National Institute of Medical Research in England and Harvard University in the U.S. Consequently, when he won the Nobel Prize for Physiology or Medicine in 1960, he was the first Australian to be thus recognized for research conducted in his home country. Just a few years later in 1963, Sir John Eccles, who like Burnet had returned to Australia to pursue his career (first in Sydney, and then later in Canberra), won his Nobel prize, also in Physiology or Medicine. By following Burnet's career from the mid-1920s to the 1960s, this paper argues that not only does his career reflect Australia's path to scientific independence, but also that it played a significant role in effecting the transition.

It is difficult to read Burnet's assessment of Australia's scientific progress quoted earlier without calling to mind the three-step model for "the spread of Western science" proposed by the historian George Basalla.¹² Based on a survey of literature concerning the way in which Western European scientific knowledge was disseminated, Basalla discerned a pattern of diffusion from the place of origins to parts of the world such as Australia, Africa, India, and South America, which had not encountered European science or culture. According to him this process took place in three overlapping stages: first, of exploration (by the European country), followed by a "colonial" phase in the lands explored, and finally the achievement of scientific independence by the distant location.¹³ He identified several criteria as necessary for the achievement of the third phase including: a respect for the scientists' work in their own society, the ability of a country to train its scholars at home, a local intellectual community, an ease in professional communication at home and abroad, the work of the scientists gaining recognition both at home and internationally as well as a reciprocal exchange of intellectual resources between the parent and colonized country.¹⁴

Basalla's ideas have since fallen into disrepute, justly criticized by various scholars for the oversimplification of the concepts of Western and colonial

¹² George Basalla, "The spread of western science," *Science* 156-3775 (1967), 611-622.

¹³ *Ibid.*, 611.

¹⁴ *Ibid.*, 617.

science¹⁵ or for its treatment of a nation's scientific progress in a synoptic fashion.¹⁶ In addition, the theory falters because of its Eurocentrism¹⁷ and because "Basalla failed to recognize the problematic status of the diffusion of so-called modern science even within Europe."¹⁸ Nevertheless his analysis figures as "the first modern 'big picture' history of science [that] was an attempt to say something about science on the global stage and, for a while at least, encouraged others to think 'big' as well."¹⁹ Also worth noting is that criticisms notwithstanding, Basalla himself still defended the essential elements of his analysis a quarter of a century after he had first proposed it, on the basis of certain features of science that were tied to its diffusion:

Obviously, more needs to be done to show the relationship between the nature of science and the diffusion patterns it generates, [but] until I am presented with a full alternative to my model of the spread of science I will stand by the 3-phase explanation.²⁰

In the current analysis, Basalla's description is worth mentioning as an entry point at least, because Burnet's previously quoted statement on the status of Australian science closely conforms to Basalla's characterization of the third phase in the spread of modern Western science from a European center to a remote location. Given the recurrence of Australia as an example in different phases of the diffusion model,²¹ it is, on the one hand, almost a shock to find Burnet's contributions missing from Basalla's article. On the other hand, we should realize that Burnet and Basalla were contemporaries and that their remarks were made within a few years of each other. In fact, the overall similarity in assessment of Australian science in the 1960s, from these two scholars in different disciplines from different parts of the world (USA and Australia), shows us that there was a widespread idea about the nature of Western science, and what success in that endeavor entailed. This consensus enabled both Basalla and Burnet to draw similar conclusions about the status of Australian medical science. Though Burnet did not explicitly cite

¹⁵ Roy MacLeod, "On visiting the "Moving Metropolis": Reflections on the architecture of imperial science," *Historical records of Australian science* 5-3 (1982), 1-16.

¹⁶ Ian Inkster, "Scientific Enterprise and the Colonial 'Model': Observations on Australian Experience in Historical Context," *Social Studies of Science* 15-4 (1985), 677-704.

¹⁷ Dhruv Raina, "From West to Non-west? Basalla's Three-Stage Model Revisited," *Science as Culture* 8-4 (1999), 497-516, on 501-504.

¹⁸ *Ibid.*, p. 500.

¹⁹ Worboys, "Epilogue," B. M. M. Bennett and J. M. M. Hodge, eds., *Science and Empire: Knowledge and Networks of Science across the British Empire, 1800-1970* (Palgrave Macmillan, First edition, 2011), p. 324.

²⁰ George Basalla, "The spread of Western science revisited," *Mundialización de la ciencia y la cultura nacional: actas del Congreso Internacional Ciencia, Descubrimiento y Mundo Colonial*, Presented at the Congreso Internacional Ciencia, Descubrimiento y Mundo Colonial, (1993), p. 603.

²¹ Basalla, "The spread of western science," 612, 613, 618, and 620.

Basalla in his book, his remarks about Australia's international contributions to science²² implies a tacit acceptance of such hallmarks of scientific independence and achievement spelt out by Basalla in his description of phase 3 science, as the ability to earn a living as a scientist in the country under discussion and communicate ideas as equals both at home and abroad.²³

It is virtually impossible for a historian of science today to talk about the spread of scientific knowledge without at least a nod to Bruno Latour's provocative model for following "science in action."²⁴ First applied in an analysis of Pasteur's study of microbes²⁵ and then expanded in 1988 into a broader argument for understanding the workings of science in society, Latour's thesis is that the history of technoscience should be treated as "the history of the resources scattered along networks to accelerate the mobility, faithfulness, combination and cohesion of traces that make action at a distance possible."²⁶ Latour's notion of a technoscience – a neologism he coined to denote the combination of science, technology, and society as one entity²⁷ – resonates rather well with Roy MacLeod's thesis that science should be treated *as* imperial history rather than in it,²⁸ which makes it all the more attractive in considering the Australian case.

Stripped of jargon Latour's model is simply saying that a technoscience depends on the "progressive extension of a network" for its success.²⁹ These networks are facilitated by different "actants" – yet another term he invented to represent both humans and things – which he believes have equal agency in this role. Actants then act (what else?) at different "centers of calculation," venues where "knowledge production builds upon the accumulation of resources" through circulation to other places.³⁰ In the context of our analysis, Burnet, the institutions he was affiliated to, and the material objects he worked with, feature among the actants in the development of Australia as a center of calculation of biomedical science, in much the same way not only Pasteur but also microbes, railways and vaccinations were part of the networks that were forged in late nineteenth-century France.³¹

Latour's model begins with the premise that "knowledge is not something that could be described by itself [...] but only by considering a whole cycle of accumulation: how to bring things back to a place for someone to see it for the first

²² Burnet, *Walter and Eliza Hall Institute 1915-1965*, p. 20.

²³ Basalla, "The spread of western science," p. 617.

²⁴ Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge, MA: Harvard University Press, 1988).

²⁵ Latour, *Les microbes, Guerre et paix*, (Paris: Métailié, 1984). Translated in 1988 as *The Pasteurization of France* (A. Sheridan & J. Law, Trans.) (Cambridge, MA: Harvard University Press, 1988).

²⁶ Latour, *Science in Action*, p. 259.

²⁷ Ian Hacking, "Book review," *Philosophy of Science* 59-3 (1992), 510–512, on 510.

²⁸ MacLeod, *op. cit.*, p. 2, emphasis added.

²⁹ Latour, *Science in Action*, p. 249.

³⁰ Heike Jöns, "Centre of Calculation," *The SAGE Handbook of Geographical Knowledge* (2011), pp. 158-170, on p. 158.

³¹ Latour, *Les microbes, Guerre et paix*.

time so that others might be sent again to bring other things back.”³² A cycle of accumulation results in one point becoming a center by acting at a distance on unfamiliar events, places, or people:

... by *somehow* bringing [them] home. By inventing means that (a) render them *mobile* so that they can be brought back; (b) keep them *stable* so that they can be moved back and forth without additional distortion, corruption or decay, and (c) are *combinable* so that whatever stuff they are made of, they can be accumulated, aggregated, or shuffled like a pack of cards. If those conditions are met, then [many places] that were at first as weak as any other place will become centers dominating at a distance many other places.³³

Latour’s utilization of the French captain Lapérouse’s first landing in 1787 on the land of “Sakhalin” in his project to map the Pacific as the beginning of a cycle of accumulation³⁴ bear a striking resemblance to Basalla’s description of Sir Joseph Banks’s Australian encounter as the ship’s botanist on Captain Cook’s first exploratory voyage in 1768 in terms of a phase 1 activity in the spread of Western science.³⁵ Perhaps less directly, it is also possible to map the various Phase 3 activities from Basalla’s model for scientific autonomy³⁶ onto the different “transformation of inscriptions” that Latour describes as occurring within a center.³⁷

Despite its usefulness in picturing twentieth century Australian bioscience in action, Latour’s model also has its limitations as an analytical tool. One major drawback is admittedly a product of personal style. Latour’s edict to strip events of their particulars (e.g. personalities and scientific details) and consider them only in terms of the strengths and weaknesses of network formation is not appealing to a historian when the main subject is the scientific life of an individual. In fact, as this paper will go on to show, some of the specifics of Burnet’s story – the Bundaberg tragedy for example, and to a lesser extent, WEHI’s institutional trajectory – would appear to serve as counter-examples to the usefulness of the type of stripping that Latour advocates. But in history as in various other crafts, no single tool can or should be used to execute all functions, and it is up to the historian to wield Latour when expedient and move beyond to other heuristic tools as needed.

Institutional and Intellectual Influences: WEHI and Kellaway

Where Burnet at an individual level provides an exemplar of and window into Australian science in the early twentieth century, the Walter and Eliza Hall

³² Latour, *Science in Action*, p. 220.

³³ *Ibid.*, p. 223.

³⁴ Latour, *Science in Action*, pp. 215-221.

³⁵ Basalla, “The spread of western science,” 612.

³⁶ *Ibid.*, p. 617.

³⁷ Latour, *Science in Action*, p. 235.

Institute of Medical Research (henceforth WEHI) takes a center stage as an institutional exemplar of the same. One of the first medical research institutes to be established and have flourished in Australia, WEHI's place in Burnet's career cannot be overstated. It was here as a medical resident in the 1920s that he made his first forays into independent laboratory research and also where he spent the majority of his career until his retirement in 1965. As Burnet would acknowledge toward the end of his career there, "it is certain that, as one reviewer of my autobiography hinted, if you take away from my life the Hall Institute and what it implies, there is just nothing left."³⁸

But WEHI looms larger in Australia's scientific landscape than just as Burnet's intellectual home. "I should not be writing this book if I did not feel it has contributed something notable to Australia – something that was more than a long list of competent scientific papers," he remarked.³⁹ Its reputation lives on into the modern day, making it Australia's most enduring dedicated medical research establishment. Burnet played a pivotal role in establishing WEHI's international reputation, both through his individual research contributions and more importantly, through his activities as director from 1944 to 1965.

WEHI was founded in 1915 by Sir Henry Allen, then the Dean of Medicine at the University of Melbourne, so named for the founders of the charitable trust that provided the funds.⁴⁰ Although it was the expressed vision of the founders to establish an institute that could "above all things devote itself to medical research"⁴¹ in its early years WEHI served as laboratory support to the Melbourne Hospital for conducting post mortems and experimental pathology. It was in the context of this latter function that Burnet as a medical resident in pathology entered its doors in 1924.

Within a few months of Burnet's filling his post as resident pathologist in 1924, the administration at WEHI underwent a change that was to prove very influential, both for Burnet personally and institutionally, in setting WEHI on the path it was originally meant for: Charles Halliley Kellaway (1889-1952) was appointed as the new director. The Australian-born, British-trained Kellaway, who would hold the reins at WEHI for the next two decades, "set in motion a tradition of full-time research in the biomedical sciences."⁴² He achieved this tradition not so much by his significant research achievements as with his astute management skills.⁴³ Not only was he able to successfully enlist government support for medical research – for example, he was a pioneer in helping to secure Commonwealth funding for

³⁸ Burnet, *Walter and Eliza Hall Institute 1915-1965*, p. v.

³⁹ *Ibid.*, p. 21.

⁴⁰ Vivianne de Vahl Davis, "Sir Harry Allen and the Foundation of the Walter and Eliza Hall Institute of Medical Research," *Historical Records of Australian Science*, 5-4 (1983), 31-38.

⁴¹ "The Beginning" (2012). Retrieved May 18, 2013, from http://www.wehi.edu.au/about_us/history/the_beginning/.

⁴² Burnet, *Walter and Eliza Hall Institute 1915-1965*, p. 21.

⁴³ Peter Hobbins and Ken D. Winkel, "The Forgotten Successes and Sacrifices of Charles Kellaway, Director of the Walter and Eliza Hall Institute, 1923-1944," *Medical Journal of Australia*, 187-11/12 (2007), 645-648.

research endeavors within Australia⁴⁴ – he also proved very adept at identifying local talent to serve as colleagues, collaborators and later, successors.⁴⁵ Through these actions, Kellaway became a powerful force in changing various “local economic imperatives,” which, as Inkster has argued, conditioned the nature of the Australian scientific enterprise.⁴⁶

One of the first tasks Kellaway accomplished as the new director of WEHI was to reorganize the institute into three main departments – physiology, microbiology and biochemistry – with the idea that a different researcher would head each unit. It is no small indication of his ability to recognize potential that he chose the young pathology resident to head the bacteriology department. As Burnet would recount later,

By the end of 1924 [Kellaway] had planned my immediate future. I must go to England and work for two years, either with Boycott at University College Hospital or in the Lister Institute. Then, assuming I did reasonably well, Kellaway wanted me back at the Hall Institute as his assistant director. It seemed to be exactly the pattern that I wanted myself.⁴⁷

Kellaway’s *modus operandi* of selecting promising local talent and sending them abroad for training with an open offer to return set foundations for a strong research base in Australia within the next generation, and mitigated – though it did not entirely prevent – a complete brain drain of the type that so disadvantaged other countries in the twentieth century.

Frequent references to Kellaway in the young Burnet’s diary show the extent to which the latter depended on his mentor at this early stage of his career. The earliest mention, which must have been entered soon after the Kellaway’s arrival in Melbourne, reads:

Kellaway had a talk with me this morning in which he seemed very keen over my little bit of work and was insistent on my going on with it. Also he gave me the very distinct impression that he wanted me to sooner or later join forces with him in more immunological stuff.⁴⁸

This initial rapport solidified over the next month and by November Burnet recorded that:

⁴⁴ Peter Hobbins, “Serpentine Science: Charles Kellaway and the Fluctuating Fortunes of Venom Research in Interwar Australia,” *Historical Records of Australian Science* 21-1 (2010), 1–34, on 29.

⁴⁵ Courtice, *op. cit.*, p. 293.

⁴⁶ Inkster, *op. cit.*, p. 677.

⁴⁷ Burnet, *Changing Patterns*, p. 37.

⁴⁸ Frank Macfarlane Burnet, Personal diary, 9 January 1922–17 April 1924, Burnet Collection, University of Melbourne Archives, Series 2, file 7, 24 August 1923.

Kellaway had a fairly long yarn with me today about prospects and so on. I know that he has a fairly high idea of my potentialities and seems keen to make a first class research man out of me in which process I shall do my best to assist him.⁴⁹

It is evident from these remarks that Burnet appreciated the advantages of his mentor's experience and looked to him for his opinions and advice on his research as well as writing. "Kellaway has given me much criticism in the manner of writing scientific English and has above all impressed me with the necessity of simplicity and of saying always what I want to say and no more," Burnet remarked on one occasion,⁵⁰ and a few weeks later, on receiving some feedback on his writing, noted that "Kellaway at least did not sneer at it."⁵¹

Kellaway's personal influence aside, Burnet's remarks are noteworthy because they mark an unprecedented moment in Australian history of science, a new level of the local student-teacher interaction. With four years of cutting-edge research work behind him, Kellaway was, at the time, unique in Australia, and his presence offered for the first time the possibility for an aspiring Australian medical scientist to contemplate a local career under a local mentor. In the Latourian sense, Kellaway is an early actant in the development of Australia as a center of calculation remote from Great Britain, which mediated the long shift from colonial to independent science.⁵²

Although, as mentioned earlier, Burnet had left for England in 1925 reasonably assured of a position at WEHI waiting for him after his return with a completed doctorate, his plans were by no means set in stone. Had he decided to remain in England, Burnet would certainly not have been unique; as mentioned earlier there was a precedent for Australians traveling abroad to not return home, Kellaway being a notable, if temporary (until 1944), exception. Others besides Howard Florey had succumbed to the lure of the better research opportunities abroad, including Gordon Cameron, Burnet's successor as pathology resident at WEHI, who arrived in Europe about the time Burnet was getting ready to return,⁵³ and Neil Fairley, another WEHI graduate who had done research with Kellaway.⁵⁴ Some of Burnet's letters to his fiancée written around the time he was completing

⁴⁹ Ibid., 22 November 1923.

⁵⁰ Ibid., 9 January 1924.

⁵¹ Ibid., 4 February 1924.

⁵² Basalla, "The spread of western science," 617.

⁵³ Patricia Morison, "Martin, Sir Charles James (1866–1955)," *Australian Dictionary of Biography Volume 10* (National Centre of Biography, Australian National University, 1986), <http://adb.anu.edu.au/biography/martin-sir-charles-james-7501/text13077> (Accessed on 17 May 2013).

⁵⁴ Frank Fenner, "Fairley, Sir Neil Hamilton (1891–1966)," *Australian Dictionary of Biography Volume 14* (National Centre of Biography, Australian National University, 1996), <http://adb.anu.edu.au/biography/fairley-sir-neil-hamilton-10145/text17915> (Accessed on 17 May 2013).

his Ph.D. show him, too, toying with the idea of following the example of his peers and possibly delaying his return by some years:

My problem is whether to return to Australia at the end of this one [year]. [...] You see a London PhD would increase my standing considerably, there will be difficulties about my bacteriophage monograph if I'm in Australia during the period of its publication (early next year probably) and it's not quite fair to the Beit people to throw that up after only a single year. However they don't weigh very heavily against not getting a job in Australia at all and having to wait 4 or 5 years for you. And if Melbourne wants me back at all badly I shall come in November or December.⁵⁵

A second letter written a few weeks later reveal more about factors that weighed in on his eventual decision:

Someday I may be a distinguished scientist but I'm far from that yet and I can't feel sure that anyone will want to give me a job when the Beit is finished should I decline the Melbourne job. On the other hand there is certainly a better chance of doing good work and obtaining a European-American reputation in England than in Australia. [...] England has advantages over Australia from the point of view of facilities for work but they are not overwhelming advantages.⁵⁶

In terms of securing his future Burnet was indeed right to consider these issues for, at the time, Australia offered virtually no avenues besides WEHI for advancing a career in biomedical research. To return at this early stage in his career, then, meant that the 28-year-old Burnet needed to face the prospect of becoming a fish of indeterminate size in a decidedly small pond, and also the possibility that the pond could dry up in the future. Notwithstanding the risks, however, January 1928 saw Burnet back in Melbourne as assistant director of the microbiology at WEHI just as he and Kellaway had planned. That he chose to make the calculated risk to return to Australia is certainly a measure of his confidence, not only in his abilities as a researcher but also in his belief that his gamble would ultimately offer immense paybacks. But the fact that he had a position waiting for him at all is an indicator of the important role of Kellaway and WEHI in determining Burnet's career. Although considerably less material – personal papers, memoirs, etc. – are available on other contemporaries to make definitive statements about their career choices to remain in England, it is certain that Florey for instance did not have the same opportunities in Australia as Burnet did at WEHI.

⁵⁵ Frank Macfarlane Burnet, "Letter to Linda Druce," 15 January 1927. F. M. Burnet Collection, University of Melbourne Archives, Series 2, File 10.

⁵⁶ *Ibid.*, 25 February 1927.

At Home and Abroad

Burnet's return to Melbourne in 1928 marked a new phase in his scientific development from student to independent researcher, who was not only in charge of his own investigative program but also, as head of the bacteriology unit and Kellaway's assistant director at WEHI, responsible for overseeing the agendas of an entire institution. He was yet to prove his actual mettle of course, but opportunity knocked almost immediately upon his return, offering him chances to demonstrate his capabilities as a scientific investigator and to show the relevance of his expertise in local and national contexts.

The opportunity occurred in the guise of medical tragedy in the small town of Bundaberg in the state of Queensland, triggered by a federal health initiative to immunize children against diphtheria. On the evening of 27 January 1928, eighteen children in Bundaberg, who had received the vaccine (an antitoxin against the diphtheria toxin) earlier that day from the local Medical Officer of Health, took violently ill, beginning with symptoms of vomiting and diarrhea, which quickly turned even more serious with cyanosis, delirium and unconsciousness. By the next evening, twelve of these children had died, leaving behind six, of whom only three actually recovered eventually.⁵⁷ While the common denominator in all cases had been the vaccine, the exact cause of the deaths was as mystifying as it was unprecedented. Obviously, the tragedy, which made international headlines, needed a swift resolution, not only to prevent more children from getting ill or dying, but also because it had severely compromised the status of mass anti-diphtheria vaccination programs all over Australia and abroad in New Zealand and South Africa.⁵⁸ There was an overwhelming outcry from the frightened public "for a rapid, open and decisive explanation of the events"⁵⁹ from the medical establishment "to soothe public feeling and to restore popular confidence in themselves."⁶⁰ As the leading medical researcher in Australia at the time, Kellaway was appointed as chairman of a Royal Commission set up to investigate and resolve the cause of the tragedy. Kellaway ensured that the Commission took complete ownership of the problem and promptly assigned the microbiological part of the laboratory investigations to Burnet. Working with another WEHI bacteriologist Mavis Freeman, Burnet pinpointed the culprit in short order, which alleviated public fears that the problem was one of contamination and not an inherent fault in the process of immunization itself.⁶¹

⁵⁷ Hobbins, "'Immunisation is as Popular as a Death Adder': The Bundaberg Tragedy and the Politics of Medical Science in Interwar Australia," *Social History of Medicine* 24-2 (2011), 426-444, on 428.

⁵⁸ *Ibid.*, 430.

⁵⁹ *Ibid.*, 432.

⁶⁰ *Bundaberg Daily News and Mail*, 30 January 1928, p. 6, (as quoted in *Ibid.*, 428).

⁶¹ Claire Hooker, "Diphtheria, Immunisation and the Bundaberg Tragedy: A Study of Public Health in Australia," *Health and History* 2-1 (2000), 52-78, on 69.

The Bundaberg culprit had turned out be *Staphylococcus aureus*, a usually harmless bacterial species that commonly causes boils and carbuncles in the skin. Based on their investigations Burnet and Freeman determined that the organisms had been introduced accidentally into the vaccine fluid and multiplied to such an extent that “some tens of millions of staphylococci were injected under the skin of those children.”⁶² The deposition of large concentrations of the bacteria and their toxins into the bloodstream and tissues in what Burnet characterized as “a wholly unnatural fashion,” overwhelmed the children’s systems, causing severe septicemia and associated effects such as toxic shock and death.⁶³

Due to the worldwide media coverage of the tragedy, its swift resolution by the Commission’s team was also widely publicized and thus went a long way toward enhancing the reputations of all concerned. For Burnet, personally, the rapidity of getting to the root of the problem helped set the standing that he had begun to gain while a student in England as a solid and creative researcher and problem-solver. At a broad level, as Hobbins has argued, such swift action and resolution was also important in advancing (or at times regaining) the public’s acceptance of medical expertise and gained a stronger foothold for directed medical research in the otherwise do-it-yourself Australian culture.⁶⁴ The incident also considerably strengthened Kellaway’s, and therefore WEHI’s, relationship with the federal Department of Health, which doubtless had positive payoffs during the leaner years of the Depression through which WEHI survived even though many other research institutes floundered.

The Bundaberg tragedy functions at multiple levels as yet another actant in the formation of Australia and WEHI as centers of calculation in biomedicine. At the same time, however, it is worth noting that the incident also provides a counter-argument for the validity of Latour’s model. This contradiction arises because the formation of the networks in question was dependent on the scientific results. Had the Commission not been successful in their scientific task they would not have been able to establish the networks deemed important in the success of a scientific establishment. Indeed, the failure to find the culprit (the staphylococci) would have resulted in quite the opposite effects: a loss of credibility for Kellaway, Burnet and others, and a destruction of existing networks rather than the extension of existing connections and the creation of new ones.

As had been the case with bacteriophage a decade earlier, it was the novelty of the phenomenon under investigation rather than any major technical achievement that put Burnet in the spotlight in the Bundaberg incident. Neither the bacteriophages nor *Staphylococci* were particularly difficult to work with in the laboratory, but in the early 1920s the phages had been a very new discovery and

⁶² Frank Macfarlane Burnet & Mavis Freeman, “A comparative study of the inactivation of a bacteriophage by immune serum and by bacterial polysaccharide,” *Australian Journal of Experimental Biology and Medical Science* 15 (1937), 49–61.

⁶³ Burnet, *Changing Patterns*, p. 64.

⁶⁴ Hobbins, “‘Immunisation is as Popular as a Death Adder’: The Bundaberg Tragedy and the Politics of Medical Science in Interwar Australia,” 73.

Burnet had been the first person in Australia to work with them. While the staphylococci responsible for the Bundaberg tragedy were common enough bacteria, their involvement in human mortality was unprecedented and Burnet's role in the discovery of this new capacity again put him at the frontiers of medical research.⁶⁵ The fact that a relatively harmless bacterial species could change into a virulent pathogen prompted Burnet to expand his thinking about the general nature of host-parasite infections, and specifically, to think about the role of the host's body during the course of an infectious disease.⁶⁶ These considerations, in turn, directed him toward studies of antigen-antibody interactions in greater depth, and to eventually focus exclusively in immunology, his contributions to which earned him Nobel Prize.

From an institutional perspective Burnet's interest in such subjects brought novel and hot research topics to WEHI, at a time when Kellaway had begun to retreat more into his research on Australian snake venoms, a topic more local in its scope and of less international interest than infectious diseases.⁶⁷ Meanwhile, the appearance of an epidemic of poliomyelitis in 1929 in the state of Victoria introduced Burnet and WEHI to yet another new topic of research of widespread interest the world over: the poliovirus. The epidemic pushed Burnet firmly into the world of animal viruses, which became the subject to which he made his first internationally acclaimed contributions and claimed an undisputed place in biomedicine for Australia and the Australians.

Also during this period, Burnet helped to lay the foundations for a robust publication tradition within Australia, by distributing his publications on these subjects between international (largely British) journals of long-standing repute, and newer Australian journals which were yet to be known beyond national boundaries. True, the fact that local publication standards were perhaps not as stringent or exacting as the international peer reviewed publications made it easier for Burnet to publish more frequently. But it is worth noting that his practice of publishing his papers both in Australia and abroad gained a broader visibility for the local journals and helped establish their reputations because they got cited in those papers that he published internationally.

Three years after his return to Melbourne, Burnet arrived at crossroads that would once again lure him away from home and affect his career in such a way as to have a lasting impact on the progress of research in Australia. The major reason for this turn of events was financial. In the late 1920s and early 1930s, Australia along with much of the Western world was in the throes of the Great Depression, and in order to ensure that the institute stayed afloat, the entire staff of WEHI was to have taken a 25 percent pay-cut in 1931.⁶⁸ In the meantime, thanks to the financial backing of the Rockefeller Foundation, Henry Dale had initiated a new

⁶⁵ Hooker, op. cit., 69.

⁶⁶ H. F. Akers and S. A. T. Porter, "Bundaberg's Gethsemane: the Tragedy of the Inoculated Children," *Royal Historical Society of Queensland Journal* 20-7 (2008), 261-278.

⁶⁷ Hobbins, "Serpentine Science," 10.

⁶⁸ C. Sexton, *Burnet: A Life* (Melbourne: Oxford University Press, 1999), p. 71.

research program on viral diseases at the National Institutes of Medical Research in Hampstead Heath back in England. As part of this program, he created two fellowships to recruit and train promising young scientists in the new techniques of handling viruses. Evidently impressed by what he had seen a few years earlier at the Lister, he wrote to Kellaway asking for permission to offer one of these positions to Burnet for a couple of years. Recognizing the advantages of such a fellowship for Burnet, the future of the Hall Institute, and also, doubtless relieved from having to pay a salary for two years, Kellaway supported this move.⁶⁹ On Burnet's end, the prospects of a better salary and a chance to interact with some of England's leading researchers, as well as a job waiting for him at the end of two years presented a win-win situation: "no one really had any doubts whatever on the matter" of whether he would accept the position.⁷⁰

Upon arriving at Hampstead Heath, Burnet needed to find a specific topic on which to conduct research. This was no easy task at first, for as he has recounted:

There was already a large group of workers in the virus department and it soon became clear to me that all the viruses which were then available for study in relatively unspecialized laboratories, were under investigation by one or more members of the staff. No matter where I started, it seemed I should be poaching on someone's preserve.⁷¹

Luck was ever on Burnet's side, however, for very soon an acute infection of some canaries from an investigation on malaria provided him with untested material to work with. Besides performing the set task of defining the nature of the canary infection, he used the material from the tissue samples to initiate a new project to develop and refine the then brand-new techniques of cultivating viruses.⁷² He was also able to continue his bacteriophage work, which he would later describe as "undoubtedly far ahead of anything else in the world."⁷³ But the "crowning discovery" during this time in his estimation was the isolation of the influenza virus by NIMR scientists Wilson Smith, P.P. Laidlaw and Christopher Andrewes. Although not a member of the influenza team, Burnet was friends with all three men and in fact, in collaboration with Andrewes on bacteriophage work. His informal association with this group during this period thus helped him maintain a keen interest in their work, to his enormous future benefit. Burnet would later describe his second stint in England in glowing terms:

⁶⁹ Ibid.

⁷⁰ Burnet, *Changing Patterns*, p. 41.

⁷¹ Ibid., p. 89.

⁷² Alice M. Woodruff and Ernest W. Goodpasture, "The susceptibility of the chorio-allantoic membrane of chick embryos to infection with the fowl-pox virus," *The American Journal of Pathology* 7-3 (1931), 209-222; Burnet, *Changing Patterns*, pp. 89-90.

⁷³ Burnet, *Changing Patterns*, p. 53.

I lived in a glorious rush of ideas and discoveries many of which were real. It was the right time and the right place. [...] My notebook was crammed full of ideas for experiments and the days were not long enough for the work we wanted to do. It was the great, golden age of the dawn of virology – a word, by the way, that we never used.⁷⁴

At the end of the two years at NIMR, Dale offered Burnet a permanent post there. The offer must have been tempting to Burnet as the financial situation in Australia had scarcely improved but he decided in favor of returning to Melbourne and WEHI. In part, Burnet wanted to return because he and his wife missed home, but there were compensations at work as well. During his absence Kellaway, on Burnet's advice, had successfully approached the Rockefeller Foundation in the United States for the funds to set up a new virus laboratory at WEHI. The money from the foundation would not only cover the costs of setting up and running the laboratory but also pay the salary of the head, which position naturally fell to Burnet with his newly acquired expertise.⁷⁵ This position offered him opportunities for advancement and autonomy that may not have been realistic at NIMR where he would have been much lower in the pecking order than at WEHI. So, in 1933 armed with a cache of standard strains of various poxviruses from NIMR's collection, Burnet headed home again, this time for good, as it turned out.

Once back in Melbourne Burnet's star continued to rise, and with it, the stars of WEHI and by extension, Australia. By the second year of his return, the virus research carried out in his laboratory was deemed by WEHI as "the most important advance in our work."⁷⁶ The achievements of the virus laboratory were given precedence over all other activities. Not only did the lab at WEHI provide a local node of expertise on viruses, but also because the work there was at the cutting edge, scientists from other countries began to turn their attention to Australia for Burnet's expertise. The presence of this lab also meant that young Australians interested in medical virus research were not compelled to travel abroad for their training, although it was still not possible to work towards doctoral degrees at home. In the context of the burgeoning field of animal virology, it is evident that Australia was fast outgrowing any dependency on England. Scientists such as Dora Lush and Bill Keogh, who became quite famous within Australia, answered the roll call of people trained in the virus laboratory at WEHI in those early years.

While at Hampstead, Burnet had deliberately *not* worked on the influenza viruses so as to avoid stepping on anyone's toes. But a local outbreak in the Nurses Homes of the Melbourne Hospital in 1935 brought these viruses back to the forefront of his attention where they remained for many years.⁷⁷ Between 1935

⁷⁴ Ibid., p. 41.

⁷⁵ Sexton, op. cit., 77.

⁷⁶ Charles H. Kellaway, *Director's Sixteenth Annual Report: Walter and Eliza Hall Institute of Research in Pathology and Medicine (1934-1935)* (Melbourne: The Walter and Eliza Hall Institute, 1935), p. 7.

⁷⁷ Burnet, *Changing Patterns*, p. 125.

and 1958 Burnet published a total of 98 original articles on various aspects of the activity and genetics of the influenza virus.⁷⁸ By 1943 he had come to be recognized as one of the world's leading authorities on the influenza viruses, and as an eminent immunologist remarked at Burnet's centenary celebrations, "It would not have surprised anyone if [Burnet] had shared a Nobel Prize for his influenza work."⁷⁹

While virus research at WEHI garnered acclaim for Kellaway, Burnet and the institute worldwide, it also confirmed, at the federal cabinet level, the potential worth of medical research at a time when Parliament was considering the creation of a National Health and Medical Research Council (NHMRC).⁸⁰ This development turned out to be crucial for the continuation of the virus lab and indeed, WEHI itself, because the Rockefeller Foundation funds that had helped set up the virus laboratory were on the verge of running out. Luckily by 1938 the NHMRC had committed funds towards supporting WEHI, with a specific sum directed towards Burnet's virus department allowing research in his laboratory to proceed without interruption. The involvement of NHMRC signaled a lessening of Australia's reliance on foreign funding sources for medical research and an increased support from within, taking it yet another step toward the transition from colonial to independent science.⁸¹

The outbreak of World War II in 1939 coincided, somewhat ironically, with what has been identified as "a peak of prosperity" for WEHI.⁸² Part of the reason for WEHI's wartime prosperity was due to its staff's close association with the Army: First Kellaway (1939 - 1941) and then Keogh (from 1941 until the end of the war) served as Director of Hygiene and Pathology at the Army headquarters in Melbourne. This continued association meant that many of the infectious disease problems associated with war were referred to and handled at WEHI. A large share of this effort fell to Burnet's lab, specifically in the context of attempting to find adequate immunization against influenza as a precaution against repeating the experience of the 1919 pandemic that claimed more lives during World War I than any battlefield.

By the early 1940s the institute had grown sufficiently large to warrant its own space and Kellaway had secured approval for custom-built laboratories for WEHI.⁸³ As it happened, Burnet oversaw the move of the virus laboratories to the new facility because he was standing in as acting director of WEHI while Kellaway

⁷⁸ Ibid., p. 5.

⁷⁹ Peter Doherty, "Burnet Oration: Living in the Burnet lineage," *Immunology and Cell Biology* 77-2 (1999), 167-176.

⁸⁰ Hobbins, "Serpentine Science," 25.

⁸¹ Basalla, "The spread of western science," 617.

⁸² Sexton, op. cit., 97.

⁸³ Charles H. Kellaway, *Director's Twenty Third Annual Report: Walter and Eliza Hall Institute of Research in Pathology and Medicine (1941-1942)* (Melbourne: The Walter and Eliza Hall Institute, 1942), p. 9.

was visiting England and America on army matters.⁸⁴ His short stint as head evidently gave Burnet a taste for the feeling of being in charge, for when in 1944 Kellaway made known his decision to resign from WEHI and move to England to take up the directorship of the Wellcome Research Institute, Burnet announced his intentions of making a bid for the director's position.

The personal impact on Burnet of the news of his decades-long mentor's decision to leave Australia is impossible to gauge from the available written records, but it is clear that he felt more than ready to assert his independence by this time. In fact, even though he would have been a strong contender as Kellaway's replacement as director of WEHI, having served as assistant director since the early 1930s, there appears to have been some difference of opinion about his suitability for the position. From the institutional perspective, Kellaway may have worried that the administrative duties of the directorship would take Burnet away from the bench and hence, compromise his research. He also had concerns relating to his astute reading of Burnet's personality, which in contrast to his own gregariousness was shy and introverted. While Burnet shared some of Kellaway's reservations, he felt that he had earned the directorship anyway and that he possessed the "fundamental vision and drive" to succeed at the post without sacrificing his research. No longer the youngster willing to let his seniors make decisions for him, Burnet went ahead with his application and was approved for the position.⁸⁵

Conclusion: Directing the Spotlight on WEHI and Australia

Burnet is the person who is widely credited with taking WEHI "onto the world stage" during his directorship.⁸⁶ At first glance this fact might seem paradoxical in that it was Burnet, the loner, who turned out to play a larger role in bringing WEHI to international renown than his more outgoing predecessor and mentor. But timing more than any other factor seems to have been responsible for this development. Kellaway came to WEHI in its infancy, at a time when survival and the very justification for its existence were the key challenges facing the institute. By the time Burnet came to the helm, the infant had already been through its growing pains and was a young adult whom he helped guide to maturity. Burnet's success in gaining international exposure for WEHI depended directly on the contributions of his laboratory to research. Unlike Kellaway, he no longer had to sell the idea of

⁸⁴ Frank Macfarlane Burnet, *The Director's Twenty Fifth Annual Report to the Board of the Walter and Eliza Hall Institute of Research in Pathology and Medicine (1943-1944)* (Melbourne: The Walter and Eliza Hall Institute, 1944), p. 7.

⁸⁵ Sexton, op. cit., p. 113.

⁸⁶ WEHI, "Sir Frank Macfarlane Burnet," (2012). (Retrieved August 26, 2013, from http://www.wehi.edu.au/about_us/history/directors/frank_macfarlane_burnet/); Gustav J. Nossal, "The Walter and Eliza Hall Institute of Medical Research 1965-1995: from basic research to clinical triumphs," *Medical Journal of Australia* 163:11-12 (1995), 599-603.

research or its importance; what counted more was performance within the idea. By maintaining a steady output of quality research, then, his lab ensured its own and WEHI's continued visibility to the world.

Yet another change WEHI experienced during the change of guard from Kellaway to Burnet was in its organizational structure, although this switch may reflect the adaptability of the institute to the changing research environment in Australia, rather than say much about the management styles of the two men. In WEHI's early years, Kellaway's strategy was to establish different departments and promote diversity in the research pursuits of his staff. This multiplicity of disciplines enhanced the institute's appeal among Australians wishing to engage in medical research, which served to attract people and thus, kept the institute going in its early years.⁸⁷ Other near contemporary institutes such as the Australian Institute for Tropical Medicine and the Sydney Cancer Research Committee – analyzed by such historians as Warwick Anderson and Hugh Hammersley respectively⁸⁸ – were necessarily but unfortunately constrained by budgetary concerns to pursue fewer research streams, which ultimately resulted in their demise. As we know from the work of Burnet, Fairley and others at WEHI in the 1930s and 1940s, Kellaway's strategy won great returns, establishing a reputable institution that would attract locals to obtain further training.⁸⁹

By the end of Kellaway's tenure as director, however, the Australian research landscape was undergoing a major transformation. While WEHI was still way ahead of the pack in terms of research productivity, new research institutes were springing up on the horizon in different parts of the country.⁹⁰ Thus, a specialized institute excelling at a few areas rather than spreading itself thin over too many began to present a more attractive option during the Burnet era at WEHI, by which time there were more demands for expertise and depth rather than options and breadth. Furthermore, the outbreak of war and the possibility of an influenza epidemic imposed different priorities, leading to the predominance of virus research over other topics at WEHI, as evidenced in the change in the annual reports from 1935 onward, when the institute began to privilege the virus laboratory over all other topics.

With Kellaway's departure in 1944, the annual reports show that the physiology department, already on a decline since the cessation of venom research in 1939, evaporated altogether. Although biochemistry continued to maintain a presence, infectious disease research, both in Burnet's own lab as well as in the clinical research unit that he set up soon after taking over as director, became the dominant focus at WEHI. This status prevailed until 1957 when, "Almost overnight,

⁸⁷ Hobbins, "Serpentine Science," 14.

⁸⁸ Warwick Anderson, *The Cultivation of Whiteness: Science, Health, and Racial Destiny in Australia* (Durham: Duke University Press, 2003), pp. 145-164; Hugh Hammersley, "Cancer, Physics and Society: Interactions between the Wars," R. W. Home, ed., *Australian Science in the Making* (Cambridge: Cambridge University Press, 1988), p. 215.

⁸⁹ Courtice, op. cit., pp. 293-296.

⁹⁰ Courtice, op. cit., pp. 296-302.

immunology became the major preoccupation of the institute and over the next 10 years.”⁹¹ Burnet’s decision regarding WEHI’s shift of focus meant a drastic change for many talented colleagues, such as the virologist Frank Fenner and microbiologist Gordon Ada who spent the rest of their career at the Australian National University in Canberra. Whatever the difficulties and resentments at the time, however, history delivers a positive verdict on the astuteness of Burnet’s actions in redirecting WEHI’s disciplinary identity. More than a decade after his death, the institute was still enjoying the reputation as “the world’s best known research center devoted to immunology,” which he had helped it achieve.⁹²

In October 1943, shortly before he was to take up his directorship, Burnet was invited to the United States to deliver the famous Dunham lectures at Harvard University. For an Australian to be invited to deliver this prestigious lecture series was high recognition indeed, and the invitation speaks directly to the issue of the status of Australian science at the time. Admittedly still subject to the brain drain of many of its fine minds, the fact that it had these minds to offer to what was arguably the world’s most prestigious and well-regarded research university demonstrates how far Australia, or at least WEHI, by this time had come in its way to distinct and reputable scientific identity of its own. The aforementioned brain drain was very much at stake at these lectures, for following them Burnet was offered a position at Harvard. An extremely attractive offer, the position would, as Cecil Drinker, then dean of the medical school later described in a letter to a friend, “have given [Burnet] complete freedom in research, and by the accident of numerous gifts, a very liberal budget. I think it is fair to say that he liked us here at Harvard and would have been very happy in the position.”⁹³ Although Harvard, according to Drinker, was prepared to do a great deal for him and he knew it, Burnet refused the offer. As flattering as the offer was, it was one that he could afford to turn down because of what awaited him at the other end. With stable funding, public support, an international reputation and the autonomy to direct not only his own research but to shape an entire institute, and even possibly a country’s science, to his will, he had more advantages at home than possibly even at Harvard. Furthermore his decision resonated with his national pride, perhaps best and most eloquently articulated thus in his memoirs:

In a curiously illogical fashion I have a deep emotional attachment to Australia [...]. I have been treated with extraordinary generosity by the academic worlds of England and America but I am an Australian and through all my work there was a little extra drive which might be expressed in our idiom ‘that I’d bloody well show them that we can do as well in this country as anywhere else!’⁹⁴

⁹¹ WEHI, op. cit.

⁹² John J. Marchalonis, “Burnet and Nossal: the Impact on Immunology of the Walter and Eliza Hall Institute,” *The Quarterly Review of Biology* 69-1 (1994), 53–67, on 53.

⁹³ Sexton, op. cit., p. 109.

⁹⁴ Burnet, *Changing Patterns*, p. 43.

“Show them” he did, as is made evident by tracking Burnet’s career within his institutional and national contexts. While it would be a gross exaggeration to credit any single person, even one as famous as Burnet, with a national identity, it is certainly possible to see in him a very prominent and influential actant in Australian biomedical science, achieving many “firsts” for his country, his institute and himself.

Both through his own achievements and through the careers of scientists who trained at WEHI, Burnet and the institute continued to maintain Australia’s visibility in the international biomedical research community. His Dunham lectures were developed into a highly influential monograph on the nature of viruses.⁹⁵ A few years later he published *The Production of Antibodies*, which was recognized worldwide as a breakthrough in immunology.⁹⁶ The American immunologist David Talmage, who independently of Burnet had arrived at similar conclusions about clonal selection around the same time,⁹⁷ recounted the impact of this book on the discipline and on himself:

The little book played a large role in changing the conceptual framework through which antibody formation was viewed. I know it made a large impression on me, because it was published just as I was starting out in immunology.⁹⁸

Meanwhile because of the presence of a top class institution like WEHI at home, travel abroad for such notable Australians as Fenner, Gordon Ada, Donald Metcalf and Gustav Nossal became a perk rather than an essential for a meaningful career in research as it had been for aspiring researchers of earlier generations. Fenner’s *vitae*, for example, reveals that he received his research training at WEHI first, and only later went abroad for a training fellowship abroad.⁹⁹ Thanks to the quality of work, WEHI could begin to host visiting scholars, underscoring the fact that the international intellectual exchange was now of a reciprocal nature. For example, Joshua Lederberg came as a Fulbright scholar to study with Burnet in 1957, just one year shy of winning his Nobel Prize in Physiology or Medicine for contributions toward microbial genetics. Three years later in 1960, when Burnet won his Nobel Prize, he was the first Australian to have done so for work done on home soil, a definitive way of “showing them!” that Australia was now a full fledged member of the international biomedical community in its own right.

⁹⁵ Sir Frank Macfarlane Burnet, *Virus as Organism: Evolutionary and Ecological Aspects of Some Human Virus Diseases* (Cambridge, MA: Harvard University Press, 1945).

⁹⁶ Frank Macfarlane Burnet and Frank Fenner, *The Production of Antibodies*, 2nd ed., (Melbourne: Macmillan, 1949).

⁹⁷ David Talmage, “Allergy and immunology,” *Annual Review of Medicine* 8-1 (1957), 239-256.

⁹⁸ D. W. Talmage, “The acceptance and rejection of immunological concepts,” *Annual review of immunology* (1986), 1–12, on 4.

⁹⁹ Gavan McCarthy, “Fenner, Frank John-Biographical entry,” *Encyclopedia of Australian Science* (1993).

Abstract

The scientific life of the Australian biologist Sir Frank Macfarlane Burnet is examined against the context of the development of an independent Australian scientific identity over the course of the twentieth century. Born in 1899 Burnet was part of a generation of Australians who needed to travel abroad to gain research credentials, but is atypical in that he became one of the first to deliberately return after obtaining his PhD to pursue an active research career. He played a pivotal role in putting Australian medical research on the world's map, both through his own significant research in the fields of animal virology and immunology, and as director of the Walter and Eliza Hall Institute for Medical Research (WEHI), which under his leadership gained an international reputation for excellence. This paper attempts to tease out the relationships between Burnet, WEHI, and Australia and to place Burnet's life and work in their institutional and national contexts.

Key words: Frank Macfarlane Burnet, twentieth-Century Australian science, Walter and Eliza Hall Institute (WEHI), scientific career, intellectual influences, institutional contexts