

Australian astronomers: what made them great?

Ragbir Bhathal examines the life and times of Australia's eminent astronomers and finds that the personal contacts made in a nomadic research career in turn foster success in international research.

A few years ago, as part of a national oral history project, interviews were conducted with 18 of Australia's top astronomers to find out what contributed to their success in both the Australian and international world of astronomy. Are there special qualities of personality, background or upbringing that mark a person for this calling, or did they become astronomers by chance or even by force of circumstances? Did they muck around with telescopes or things of a scientific nature when young, and were they always interested in astronomy? What kind of socialization process did they undergo in becoming significant astronomers? Were linkages and mentors important in their rise?

This paper examines their early experiences, formative years and their rise to eminence; I have discussed their astronomical achievements elsewhere (Bhathal 1996). When interviewed, all the astronomers were over 40 years of age. Five of them (Bart Bok, Ronald Giovanelli, John Bolton, Robert Hanbury Brown and Harry Minnett) have passed away, some have retired and five of them remain actively engaged in major astronomical projects and exert an influence on Australian and international astronomy.

Socio-economic backgrounds

The majority came from middle-class backgrounds or professional homes where money, although not plentiful, was enough for a comfortable life and a good education. A couple came from low socio-economic backgrounds, but this did not stop them from succeeding in this essentially meritocratic field. Slightly less than half went to private schools. A couple attended both private and government schools. According to Ken Freeman: "My family were relatively well to do; there was enough money to send my sister and myself to private schools, with some sacrifice. We always had a car and most of the time there was no serious shortage of money. I mean we certainly had to watch what we spent."

In the case of Ronald Brown: "My father and mother were not particularly well off. My maternal grandparents, my grandfather, had run a small business and so he would be described, I guess, as middle class, but my parents you would've said were standard working-

ABSTRACT

Australia's strong position in international astronomy arises from the work of a few brilliant astronomers whose contributions have been recognized by their peers. They are Fellows of the Royal Society of London, the US National Academy of Science, the Australian Academy of Science, the Australian Academy of Technological Sciences and Engineering and are or were heads of major scientific and astronomical institutions or projects in Australia and overseas. Who are these astronomers and how did they become so eminent?

class parents."

All the astronomers had in common being either top students or among the top students in their schools. Jeremy Mould said: "I put a lot of emphasis on schoolwork and the results showed up; I collected quite a lot of prizes over my school career. I was dux of Xavier."

According to Robert Hanbury Brown: "I was in the top form of my prep school and I got a scholarship. Yes, I have always been good at schoolwork. One of the reasons for that is I had an extremely good memory."

The occupations of their fathers were varied. No single profession held the monopoly for producing an environment conducive to the development of a world-class astronomer. The fathers included teachers, an accountant, a nurseryman, an architect, a farmer, a postman, a soldier, a company director, a congregational minister, a banker, a manager, a cutlery manufacturer, and an electrical engineer. Mothers were teachers or housewives, except for one who trained as a lawyer.

Some of this group were born in Australia while others came to live there. Some, although born in Australia, spent a considerable amount of time in overseas organizations. Most viewed such international experience as essential for their development as top scientists. In the process of their nomadic research careers, they built up their international network of scientific colleagues and became members of the visible and invisible colleges of science. Others spent

much of their career in one country, but eventually returned to the land of their forefathers or to a newly adopted homeland. For example, Ron Ekers worked overseas for almost 23 years before returning to take up the directorship of the Australia Telescope National Facility. On the other hand, Robert Hanbury Brown, who was born in India, represents the classic example of the scientific nomad. Bernard Lovell (1990) remarked at the 70th birthday conference to honour Hanbury Brown: "Maybe there are a few who might remember that he once worked at Jodrell Bank. Whether he is to be regarded as an Australian now visiting England or an expatriate Englishman whom we are glad to welcome back to this country, or as a national of India, who has spent his research career in England, America and Australia, I must leave you to elucidate."

Ben Gascoigne and Richard Manchester came from New Zealand to study astronomy in Australia and they have stayed. Bart Bok was born in Holland and came to Australia for 10 years before returning to the United States – exactly as he set out to do beforehand. Russell Cannon, John Bolton, Jeremy Mould and Paul Wild were born in England but made Australia their home. However, Jeremy Mould has moved again, to the United States. Australia opened up unlimited opportunities for each of them. According to Wild: "I have absolutely no doubt whatsoever that I would never have had the opportunity that I did, in Britain."

Ten of the astronomers were born in Australia: Ken Freeman in Perth, Donald Melrose in Hobart, Harry Minnett, Bob Frater and Bernie Mills in Sydney, Ron Ekers in Victor Harbor near Adelaide, Chris Christiansen in Melbourne and Don Mathewson in Brisbane.

Family backgrounds and early life

There seems to be nothing remarkable about the family backgrounds of this group of astronomers. Most of them developed a very strong interest in things mechanical rather than in natural history when they were young. They came from families with between two and four children. In slightly more than half of the cases they were the eldest child in the family and in a couple of cases they were the only child. Most of the astronomers spent a happy childhood

although there seem to have been a few exceptions. In the case of Ronald Brown: “On balance I’d say I was tending towards unhappiness rather than happiness as a child. My mother, unfortunately, discouraged me making friends and having friends to play.”

And Don Melrose said: “I don’t recall being a particularly happy child. I enjoyed a lot of things but I also was, I think, rather serious and contemplative – I don’t know why.”

The more usual experience matched Ken Freeman’s recollection: “I think I was happy enough. I had a fairly normal time through primary school and no particular hassles at high school that I can recall.”

Except for Freeman, Giovanelli, Bok and Christiansen, who came from continental European backgrounds, the rest of the astronomers came from Anglo-Celtic protestant backgrounds. Only a couple came from a Catholic background. Unlike the American scientific elite (Zuckerman 1977), there were no astronomers from Jewish backgrounds. This is partly due to the fact that most prominent Jewish scientists and intellectuals from Europe settled in the USA; very few ventured to Australia.

The majority of the astronomers came from families that were not religious in the formal institutional sense. A couple of those interviewed have a serious interest in the church and believe that God intervenes in the affairs of human beings. Some, however, see religion in terms of providing an ethics for morality. The fact that their parents subscribed to less rigid religious doctrines meant that the majority of the astronomers came from homes that tolerated a greater diversity of opinion. Most of the astronomers have adopted a non-religious philosophy of life, a couple see religion as having an adverse impact on science, while a couple see the hand of God in the affairs of human beings.

Don Mathewson, a former director of the Mount Stromlo Observatory, sees religion as an adverse influence: “I think religion has set back science enormously. It has been a bad impact. I think the dogmatic teachings show that the church is restrictive on free thinking.”

Bernie Mills remarked: “I can see no evidence whatsoever for the religious God of any religion. In fact, I can see no evidence at all for any God whatsoever, so I always class myself as an atheist.”

Ron Ekers takes a different view: “At the time, I thought of myself as a pantheist, and I think this is still my view.”

The homes of potential creative talents usually have intellectually and culturally stimulating materials (Zuckerman 1977). These astronomers came from homes where they were encouraged to read and they were all avid and voracious readers in their childhood. It was evident from the interviews that their parents did not push them to be the best in whatever they did; they were

encouraged but not pushed. In most cases their parents did not influence their choice to become scientists. Where there was any influence it came from the mother or father, not necessarily just from the mother. The decision to take up science was entirely theirs and they seemed to be driven by an inner desire. A common thread running through all their backgrounds is they were influenced by a good teacher at school and were avid readers of science magazines or messed around with technical things. Their early extracurricular interests mostly involved physical gadgets, such as Meccano kits, radio sets and experimenting rather than accepting things stated in books. In short, they were curious about things electrical and mechanical.

According to Hanbury Brown: “I had a guardian, a legal guardian, whose name was Eric de Hoghton. He had a laboratory in his house in Hove, so that from about the age 10 onwards I’d been accustomed to being in the house of a man who had a working laboratory and he was a consulting radio engineer, so I had radio and I decided quite early on that radio engineering was what I wanted to do.”

Richard Manchester recalled: “As far as toys go, I certainly had a Meccano set when I was 12 or thereabouts, I used to mess around with electromagnets and motors and that sort of thing.”

Scientific heroes did not appear to have a strong influence on the early life of the astronomers. Only a couple of them mentioned Isaac Newton or Albert Einstein as scientific heroes in their youth. If they had any heroes they were more likely to be sportsmen and in a country fanatical about sports it was cricketers or footballers (Australian rules) rather than scientists.

For Donald Mathewson: “I guess Donald Bradman. Science was taught very badly and I guess although I was good at physics and maths, I never developed any real heroes in that subject.”

Only in one case was it a famous engineer, for Paul Wild: “I suppose Newton became a hero in a way but my specific hero I think was an engineer with the splendid name of Isambard Kingdom Brunel who built the Great Western Railway and a number of famous ships – the *Great Western*, the *Great Britain* and the *Great Eastern* – which were far beyond their time. He became a hero for life I think; one or two others like Einstein and Beethoven joined later on.”

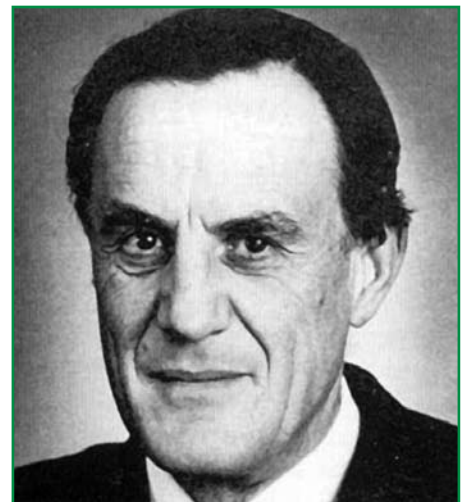
It is rather surprising that, for almost all these astronomers, neither the activities or exhibitions of science museums nor popular science programmes on radio played any part in inspiring them to take up careers in science. Books, science magazines and mucking around with technical things seemed to have far more influence.

The path to astronomy

It is interesting to note that most of the astronomers did not show any particular interest in astronomy in their secondary school years.

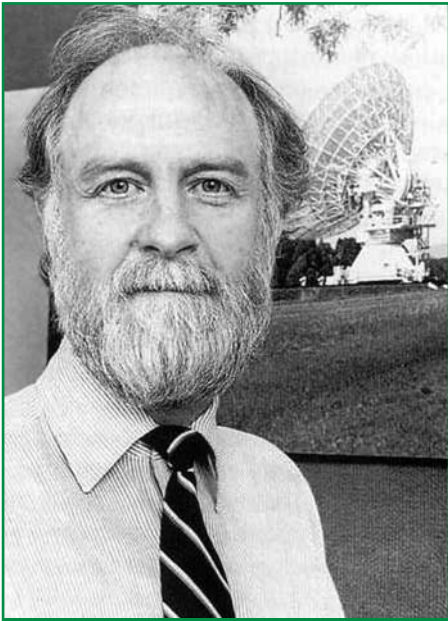


1: Chris Christiansen.



2: Robert Hanbury Brown, whose papers have been archived and were deposited recently at the Royal Society by Dr Anna Mayer of NCUACS, University of Bath. The archive is available in printed form from Dr Meyer at NCUACS, and free on request in electronic form.

Their decision to become professional astronomers was usually not made until they were in their third or fourth year at university. They became astronomers by chance, force of circumstances or as a result of attending a summer science school or a summer vacation course. In a couple of cases, they made the choice after completing a PhD in a different area of physics. As Bart Bok said: “At the present time, for example, a large number of the best astrophysicists are people who start out as physicists, who become good physicists and look for a bigger and better laboratory. What they do is, they look at the heavens and say, ‘Good Lord, there is the whole Milky Way, there are the large nebula for studying the physical processes’. We all come in by different routes.”



3: Ron Ekers.



4: Bernie Mills.

Bernard Mills was confronted with a choice. “Pawsey [the founder of radio astronomy in Australia, see Robertson 1992] gave me the choice of either continuing with the computer or doing astronomy. And at that time Bolton had made his first discovery of point radio sources, a class of point sources, and this really intrigued me. So, as far as I was concerned, there was no choice. I went into that, although I was by no means an astronomer.”

John Bolton was also to play a role in Richard Manchester’s entry into astronomy. According to Manchester: “Toward the end of my PhD, I started thinking about what I would do having achieved this. We had arranged to meet John Bolton. He said they were about to take delivery of the first computer at Parkes. So the deal was

that, as I had a bit of computing experience he said, ‘if you come and program this computer and write programs to make it useful for astronomy, we will teach you astronomy.’”

There are variations in the formal training that each of the astronomers underwent. The era of “big science” has changed the pattern of recruitment into research positions in government, university or industrial laboratories. It is thus easy to assume that there is a correlation between earning a PhD and creativity in science, but this is not borne out in practice. Take Einstein, for example (Pais 1983). He did not get his doctorate by attending research seminars or working in white-hot research laboratories but did his most creative work while working as a clerk in a Swiss patent office. He once complained to a friend: “I shall not become a PhD... The whole comedy has become a bore to me.” Yet in 1905 Einstein wrote four papers and sent the least important to the University of Zurich for his PhD. When one considers that those 1905 papers included his revolutionary papers on the special theory of relativity and the photoelectric effect, one must surmise that obtaining a PhD did not contribute to Einstein’s capacity for doing creative work in physics.

Einstein is not atypical of the creative scientist. Studies have shown that top scientists generally begin contributing to the store of knowledge before obtaining their doctorate, or in some cases even before doing their PhDs (Zuckerman 1977). This is amply demonstrated here by Mills, Christiansen, Wild and Hanbury Brown.

Hanbury Brown said: “I went to Manchester University as an ICI research fellow in 1949, with the specific purpose of taking a PhD and applying this great dish to the new science of radio astronomy. This we did successfully, and eventually I never took the PhD again, of course, because it turned out I was an examiner for the PhD and the registrar said it was not proper to be an examiner and a candidate for the same exam.”

In the case of Mills, he had invented the Mills Cross and made significant contributions to radio astronomy. “This work also led to my submitting a thesis for a Doctor of Science in Engineering, based largely on the work of this instrument, a description of the instrument and the basic theory of the instrument. My Doctor of Science in Engineering was awarded in 1959. Also in 1959 I was elected a Fellow of the Australian Academy of Science.”

Paul Wild had a similar experience. After 10 years of research he collected some of his papers and sent them to Cambridge University and they awarded him a Doctor of Science.

Christiansen invented the “Christiansen or grating interferometer” and submitted his research papers for the award of the Doctor of Science degree. Robert Frater, who went on to build the Australia Telescope (Frater 1984) as a major Australian bicentennial project, began

publishing significant papers even before obtaining his PhD from the University of Sydney. The astronomers obtained their PhDs between the ages of 24 and 31.

Fellowships of scientific academies

A fellowship of an academy of science is a mark of recognition of the work of a scientist by his peers – it signals to the scientist that he or she has arrived. These astronomers were elected Fellows of the Australian Academy of Science at an average age of 47, with a wide variation. The fellowship was awarded to Ronald Brown at the age of 38 and to Harry Minnett at 59. It is interesting to note that the astronomers who had Pawsey as their mentor (Wild, Bolton, Mills and Christiansen) were elected to the fellowship of the Australian Academy of Science before or at the average age of 47. Pawsey was a foundation Fellow of the Australian Academy of Science when it was founded in 1954.

Bolton, Mills, Wild and Pawsey were elected Fellows of the Royal Society of London. Hanbury Brown was already a Fellow of the Royal Society of London before he came to Australia. Frater, Minnett and Wild are not only Fellows of the Australian Academy of Science but also Fellows of the Australian Academy of Technological Sciences and Engineering. Only Wild has the honour of being a Fellow of the Australian Academy of Science, the Australian Academy of Technological Sciences and Engineering and the Royal Society of London. Bok was a Corresponding Member of the Australian Academy of Science and a Fellow of the US National Academy of Sciences. At the moment Ken Freeman and Ron Ekers are the only working astronomers in Australia who are Fellows of the Royal Society of London. Ekers was a past president of the IAU.

Socialization of astronomers

The socialization of astronomers is an important aspect of their apprenticeship. It is a process through which they are inducted into the culture of astronomy or science. Early exposure to top scientists or working at prestigious institutions is important in the socialization process and the building up of national and international networks (Zuckerman 1977).

Ken Freeman did his PhD at Cambridge University and Don Matthewson had Hanbury Brown as his PhD supervisor at Jodrell Bank in Manchester. Bolton had an international reputation and because of this many of the top astronomers would visit Parkes where Bolton was based (Robertson 1992). Ekers recalled: “So as a student I had contact with some of the world’s top scientists. I later discovered that my fellow students at other institutions never had this kind of exposure. John [Bolton] would invite us to his home for dinner, for example. The atmosphere was great because it was very

hands-on research, lots of discussion of problems.” This benefited Ekers when he was looking for a post-doctoral fellowship in an overseas country. He was also able to use Bolton’s networks to further his astronomical career. In the ensuing years he built up his own network in the international world of astronomy. The presence of overseas experts also created an exciting and interesting research environment at the Parkes Radio Observatory.

Like Ekers, Mould spent a large part of his working life in prestigious overseas institutions. This helped him tremendously in making the contacts with the right people and in forming an international network of astronomers. “I’d say Kitt Peak was a place where I made a lot of contacts in astronomy. The tendency of astronomical institutes to encourage international visitors and to organize meetings, both formal and informal, is the kind of thing that builds up a large network.”

Linkages and mentors

Apart from having done their PhDs at prestigious institutions or working with productive groups or under internationally well-known supervisors, these astronomers spent some years on postdoctoral research. The nomadic existence of the postdoctoral years provided them with long-term links with other active astronomers for future collaborative projects across national borders and the writing of joint papers in international publications. The linkages also meant that the astronomers are represented as members or leaders on international committees or forums and serve as gatekeepers in the field of astronomy.

All the astronomers interviewed had highly productive mentors, from whom they learned not so much substantive knowledge but a style. Cannon, a former director of the Anglo-Australian Observatory, spoke for many of them: “In my case I would say that what I got out of my ‘mentors’ was mostly the general way of doing research, much more than any specific education on how to proceed in particular directions.”

Almost all the astronomers (Bolton, Christiansen, Mathewson, Mills, Minnett and Wild) who were born before 1930 owe their pre-eminence to Joseph Pawsey, the deputy-chief of the Division of Radiophysics at the CSIRO. Pawsey, who trained in the Cavendish Laboratory at Cambridge University under the watchful eye of Nobel Prize winner Ernest Rutherford, introduced the Cavendish “string and sealing wax” (Home 1988) tradition into the Radiophysics Division. This had tremendous spin-offs in the first 10 years of the development of radio astronomy in Australia. Improvisation and a spirit of “can-do” allowed the physicists and engineers to push forward the frontiers of radio astronomy.

According to Christiansen: “The field work had a pioneering appearance. At the field stations,

the atmosphere was completely informal and egalitarian, with the dirty jobs shared by all. Thermionic valves were in frequent need of replacement and old and well-used coaxial connectors were a constant source of troubles.”

Pawsey can truly be called the father of radio astronomy in Australia and the scientist who led Australia’s resurgence in astronomy after the Second World War. Being an extremely creative person he gathered around him a group of brilliant physicists and engineers who were to dominate the development of astronomy in Australia for several decades. The group included Christiansen, Wild, Minnett, Mills and Bolton.

Bolton in turn was to serve as a mentor to Ekers and Manchester. Christiansen came under the influence of Cambridge-trained Thomas Laby, the professor of physics at Melbourne University, and Pawsey. Christiansen in turn served as a mentor for Frater who went on to design, develop and build the Australia Telescope, the southern hemisphere’s largest radio synthesis telescope (Frater 1984). Both Richard Woolley and Bart Bok played an important role in the scientific development of several of the astronomers mentioned in this paper. Woolley was director of the Mount Stromlo Observatory after the Second World War. He was responsible for the acquisition in 1955 of the 74 inch reflecting telescope for the observatory and changing the direction of the observatory from solar and geophysical research to stellar and galactic astronomy. He left the observatory in December 1955 to become the 11th Astronomer Royal and the director of the Royal Greenwich Observatory in England. Bart Bok was the director of the Mount Stromlo Observatory from 1957 to 1966. He was the first astronomer in Australia to address a meeting of parliamentarians from both houses of Parliament in Canberra – on the implications of the Russian Sputnik. He was one of the ardent advocates for the establishment of the Anglo-Australian Observatory at Siding Spring Mountain (Gascoigne *et al.* 1990, Levy 1993).

Bok and Bolton served as mentors for Ekers, while Woolley was a mentor for Cannon. Freeman, Cannon, Melrose and Ronald Brown did their PhDs in top overseas institutions and in the course of their careers their paths crossed. Both Freeman and Cannon trained under Donald Lynden-Bell, an accomplished English astronomer and a prolific publisher of research papers. Mount Wilson Observatories’ Alan Sandage, who at one time was an assistant to Edwin Hubble (of expansion of the universe fame), also served as a mentor to Freeman. According to Freeman: “Contact with Sandage was very good for my career. Sandage became a mentor and a patron and has really helped my career greatly through his support and I think I got tenure fairly swiftly after finishing my Queen Elizabeth Fellowship and I’m sure that Sandage’s support was very significant in all that and

I’m very grateful to him for it.”

The 18 astronomers who were interviewed for the National Project established linkages not only among themselves but also with the international world of astronomers. They are a small group of elite astronomers in Australia with international links. Intellectual isolation and the tyranny of distance are a thing of the past. These astronomers are plugged into the international electronic grid and have become international astronomical users of the worldwide internet and telecommunications systems. They also belong to the international “invisible college” of elite scientists. They are the gatekeepers and high priests of Australian astronomy.

Over the past 10 years, a new generation of elite Australian astronomers has emerged and they are making waves in Australian and international astronomy. Led by Brian Boyle, Matthew Colless, Rachel Webster, Brian Schmidt, Lister-Stavelly Smith, Warrick Couch and Brian Ganesler, they are taking Australia into the 21st century. ●

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Note: The full transcripts and tapes of the interviews on which this article is based are held in the Oral History Section of the National Library of Australia in Canberra for use by scholars and historians of science.

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