

standards are conservative but appropriate. He expresses concern, however, about the distorted perspectives and the regulatory overkill of US government agencies regarding radioactive waste deposits. Many millions or even billions of dollars may be spent to avert a single radiation-related 'health effect' while society neglects less expensive public measures that would be of much greater benefit to health.

W. J. Schull — a statistical geneticist — and Neel studied the effect on child health of the relatively frequent consanguineous matings in Japan. They found a small but definite effect on the frequency of physical defects and mortality as well as on stature, psychometric measurements and development of offspring, indicating the role of so far undefined recessive genes. Schull wrote a charming nontechnical view of his impressions of Japan (*Song Among the Ruins*, Harvard University Press, 1990).

In the 1960s, Neel and a multidisciplinary team ventured repeatedly into the rainforest of Brazil to study human evolution. They investigated the Yanomami, a remote Indian tribe that in Neel's judgement came close to having the lifestyle of early humans. Of adult males, 25 per cent were killed in violent encounters, infanticide was practised for birth defects and for 20–25 per cent of female births, and inbreeding was intense. There were marked genetic differences between Yanomami villages, a striking example of Sewell Wright's evolutionary model of random drift. The headmen in each village had more wives than other men and twice as many children. Neel thinks that genes may be involved in achieving headman status.

Assessing the future, Neel deplores the increasing political power of the aged in the United States and assigns a low priority to research into ageing that might lead to an extension of the human lifespan. His overriding concern, however, is global overpopulation and the prospect of epidemics, malnutrition and an impoverished ecosystem. He believes that all countries should treat this issue as the "social equivalent of a military emergency" and strive to achieve an egalitarian worldwide two-child policy.

His recommendations for eugenics (optimization of genotype expression) as well as wide use of genetic screening and counselling are in agreement with the opinions of most human geneticists, but his assessment of today's research trends is more controversial. He rejects current emphasis on gene therapy for genetic disease, which he feels requires more long-term assessment and is inappropriately popular because it uses high technology, does not challenge religious beliefs and does not require self-discipline. Similarly, he downgrades the Human Genome

Project as contributing little to the solution of the main genetic problems facing humankind. He believes that our concern with molecular genetics is diverting attention from the important problems affecting the human gene pool. Before the First World War, geneticists knew little about genes but worried about the future, whereas today's geneticists know much more about genes but largely ignore the broad issues facing humankind. Human geneticists are becoming mere "gene mechanics" and "DNA jockeys".

Neel has led an interesting life. He writes and explains well and shares many interesting and amusing episodes with the

reader. Although there will be disagreement with some of his judgements, his arguments command attention. Here is a highly respected human geneticist giving a somewhat different view of human genetics from that usually presented in the scientific and public media. The book is strongly recommended to geneticists, biologists and medical professionals as well as the intelligent public and policy-makers. □

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Preparing the ground for airwaves

Willem Hackmann

The Early History of Radio from Faraday to Marconi. By G. R. M. Garratt. *Institution of Electrical Engineers/Science Museum, London: 1994. Pp. 93. £19.*

GERALD Garratt, who died in 1989, spent most of his career at the Science Museum in London, where he was for many years in charge of the communications collections. This slim posthumous volume is based on his interest in the early history of telecommunications. Seven brief chapters review in chronological order the parts played by Michael Faraday, James Clerk Maxwell, Heinrich Hertz, Oliver Lodge, Aleksander Stepanovich Popov and Guglielmo Marconi in preparing the ground for radio broadcasting. The final chapter on Marconi was prepared, after the author's death, by his daughter, Susan, and is based on papers published by the Institution of Electrical Engineers and elsewhere in the early 1970s. The work of Joseph Henry, David Edward Hughes and George Francis FitzGerald is also dealt with in passing.

The author starts with the genesis of the electromagnetic theory beginning with Hans Christian Oersted's epochal experiment of 1820. This turned Newtonian science on its head, for Oersted demonstrated not only the relationship between electricity and magnetism, but also that there were forces that appeared to operate in circles. André-Marie Ampère gave these discoveries their mathematical foundation, but this did not satisfy a natural philosopher of the stature of Faraday. It was precisely the consequences of Ampère's mathematical ideas on the physical nature of matter that started Faraday on his quest. On 24 June 1937, Sir William Bragg, the then president of the Royal Society, broke the seal of a document Faraday had deposited there on 12 March 1832. In this fascinating manuscript Faraday refers to wave propagation,

which he saw as a consequence of his concept of lines of force in motion of a magnetic field. Maxwell produced his mathematical synthesis in the 1860s, although, as the author points out, the often stated claim that Maxwell predicted the existence of radio waves is at most a half-truth. FitzGerald, however, was convinced of their existence, but it was Hertz who confirmed this experimentally in 1887–88.

Lodge, as Henry before him, demonstrated the oscillatory nature of the Leyden-jar discharge. In the case of Lodge, this was in the context of improving the lightning conductor, but his investigations also prepared the ground for Marconi. One of the author's objectives was to demonstrate how essential Lodge was to the development of radio. Far in advance of any other, he appreciated the need for resonance between transmitter and receiver. The chapter on Marconi deals only with his introduction to the scientific fraternity in England in 1896, his relationship with Sir William H. Reece, chief engineer to the Post Office, and the successful English Channel trials of May 1897. These started the Post Office's interest in wireless telegraphy.

So what of Popov? The author agrees with the harsh judgement made by Charles Susskind in 1962, that at the time Marconi demonstrated his system, Popov did not possess a practicable method of radio-communication.

This is not intended to be an original book; most of the conclusions are well known. Nor does it deal with more recent scholarship. But it is a very readable account, most useful to non-historians who want a brief survey of the subject, and to students. □

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