vital statistics quoted by Sir James Barrett prove the efficient work of the medical services rather than the absence of climatic influence on life and habits.

In a thoughtful and well-documented study[5], A. Grenfell Price, of the University of Adelaide, has reviewed the attempts to settle and establish agricultural or other industries in the Northern Territory. The thorough work of this geographer has been recognised by the award to him of the Commandership of the Order of St. Michael and St. George and the doctorate of the University of Adelaide in 1933. He has summarised his views on the major problem in a paper entitled "Pioneer Reactions to a Poor Tropical Environment"[6], and concludes that "there is little hope for anything more than a sparse pastoral population in the greater part of the Australian tropics and that this population will show strong reactions to a poor and difficult tropical environment. There is, however, some possibility that Australians may permanently establish close settlement by white agriculturists in small and favourable areas, particularly on the east coast of Queensland".

Dr. Isaiah Bowman[7] suggests that, so far as the Northern Territory is concerned, it would be better to "give up this painful experiment on an incorrigible frontier and let the land revert to wilderness".

If the land has now been properly assessed, the real danger of 'an empty north' to the 'White Australia' policy disappears. Sir James Barrett points out the accessibility of the Northern Territory from densely peopled areas, such as Java, and argues that had conditions been suitable it would long ago have been colonised by Malays or Javanese. On the other hand, there was not, perhaps, sufficient economic pressure to necessitate the inhabitants of the East Indies seeking settlement in lands less attractive. The position to-day is somewhat different. There is a close correlation between climatic and soil conditions in the region around Darwin and in some of the poorer parts of peninsular India. Will the future alter the value of tropical Australia in the eyes of overcrowded India? Darwin is clearly destined to remain on a major world aerial route, and in this connexion at least the Northern Territory cannot remain entirely empty.

[1] See *inter alia*, "Australia, Physiographic and Economic", Oxford. Third edition, 1923, pp. 262–3.

[2] "Tropical Australia", *Aust. Quart.*, No. 21, 64–72, March 1934.

[3] Quoted by A. G. Price, *Amer. Geog. Rev.*, **23**, 371, July 1933.

[4] D. B. Dill and others, "Physical Performance in Relation to External Temperatures". Fatigue Laboratory, Harvard University, 1931.

[5] "The History and Problems of the Northern Territory, Australia". Adelaide, 1930.

[6] *Amer. Geog. Rev.*, **23**, 353–371, July 1933.

[7] "The Pioneer Fringe". New York, 1932, p. 186.

Obituary

SIR ALFRED EWING, K.C.B., F.R.S.

JAMES ALFRED EWING, like many Scots who have become distinguished in the fields of literature and science, was a son of the manse. He was born on March 27, 1855, in Dundee, where his father was a minister of what was then called the 'Free Church of Scotland', his father having 'come out' in the Disruption of 1843. In the autobiographical section of "An Engineer's Outlook", Sir Alfred described his father as a man who, with a superb physique, never missed a day's duty through illness, or shirked one for any reason; the same words might be applied to Sir Alfred himself. He seems to have owed much of his early education to his mother. As he so happily phrased it, "She gave us much of what other boys got at school, and did it in a way that made us associate a love of learning with our love of her".

From Dundee High School, Ewing proceeded in the early '70's to the University of Edinburgh, the first holder of an engineering scholarship in the gift of Dundee High School, and his career as a student was prophetic of the distinction he was to acquire in later life—the records of the Engineering Department show that during the session 1871–72 the prizeman in the class of engineering was James Alfred Ewing. It was his good fortune to be a student during the time when Tait and Fleeming Jenkin were at the zenith of their powers, and undoubtedly Ewing owed much of his zest for research to the inspiring influence of these two teachers. Through Jenkin he was brought into contact with Sir William Thomson (afterwards Lord Kelvin), and he took an active share in the early development of submarine telegraph cables, making in connexion with this work three cable-laying voyages to Brazil and the River Plate.

In 1878, on the nomination of Fleeming Jenkin, Ewing went to Japan as professor of mechanical engineering in the University of Tokyo, and there spent what he termed "five educative years". In the latter part of this service one of his duties was to undertake teaching in physics, and he there began his classical experiments on magnetism.

It was while in Tokyo that Ewing married his first wife, Miss Washington, a great-great-grand-niece of the first president of the American Republic. He had two children, born in Japan, by his first wife, who reached mature years before their mother's death. In 1911, shortly before he was appointed to the principalship of the University of Edinburgh, he married as his second wife a daughter of the late Prof. John Hopkinson, a past-president of the Institution of Electrical Engineers, by whom he had a son.

After five years service in Japan, Ewing decided

to return home, although the Japanese authorities were anxious to retain his services for another two years. He had been offered, however, the professorship of engineering in University College, Dundee, and there he had seven years of further experience in teaching and research.

In 1890 Ewing was appointed to the chair of mechanism and applied mechanics in the University of Cambridge as successor to James Stuart. The last years of Stuart's occupancy of the chair had not been happy ones, as his attention had been largely diverted from engineering to politics and journalism, and the University was disinclined to continue the engineering department, if that were possible; fortunately, a wiser decision was taken. By the generosity of donors, Ewing soon acquired a laboratory, where research work could be carried on and ordinary laboratory instruction given. The school flourished, the number of students increased rapidly, and, in 1899, a generous gift in memory of Prof. John Hopkinson from his widow and children provided the funds for a much-needed enlargement of the laboratory buildings. By 1903, when Ewing severed his connexion with the University of Cambridge, the Engineering School was one of the largest in the country, and its output of research testified to Ewing's great influence upon those working with him.

In 1903, the Admiralty was about to introduce what was known as the New Scheme of Naval Education. After an interview with Lord Selborne and Sir John Fisher, Ewing was offered the post of Director of Naval Education on very generous terms. This opened up for him an entirely new sphere of work. It meant that he had for the time being to abandon his researches and to drop his professional practice. That this new scheme became a complete success was largely due to Ewing's extraordinary gift for administrative work, as there was opposition to some of the changes which had to be introduced.

When the War broke out in 1914, Ewing was still Director of Naval Education, but almost at once he was asked to undertake an entirely new and onerous duty, namely, the problem of dealing with enemy cipher. This led to the creation of a department which came to be known as "Room 40". The work carried out in Room 40 was strictly secret, and no section of our defence work was more unknown to the general public and to the enemy. The secrets of Room 40 have never been divulged, though Ewing himself removed the veil slightly in a lecture he gave before the Edinburgh Philosophical Institution in 1927. Prior to this, the late Lord Balfour, then Chancellor of the University of Edinburgh, disclosed the fact that Ewing had been the head of the organisation in Room 40.

It was while carrying on this work that Ewing was invited in 1916 to fill the dual office of principal and vice-chancellor of the University of Edinburgh. He was somewhat averse to undertaking this fresh burden, but was persuaded by the late Lord Balfour to accept office, while still continuing his work at Room 40, and it was not until May 1917, when he handed over the control to Admiral Sir Reginald Hall, that he was able to devote himself unreservedly to his University duties.

When he accepted office at Edinburgh, Ewing was sixty-two years of age, and it is a striking testimony to his extraordinary capacity for work and to his bodily vigour that, starting at that late age in an entirely new sphere of work, he was able in the twelve years of his principalship to accomplish such great and far-reaching changes in the development of the various departments of University life. He realised that the War had brought many new problems in education and industry, and that the great universities would have to play a very important part in the necessary solving of these problems. Rapid developments in specialised study made it essential to found new chairs and lectureships, and during his term of office at Edinburgh no less than thirteen new chairs were established—six in the Faculty of Arts, four in the Faculty of Medicine, and three in the Faculty of Science—besides a number of lectureships in new subjects or in some of the older subjects where the teaching had to be extended. A new degree in commerce was established; and the degree of Ph.D. was instituted in the hope of encouraging post-graduate work and research. The increase in the number of the teaching staff involved as a corollary an extensive scheme of new buildings. It was impossible to find a site for the necessary new buildings in the immediate vicinity of the Old College, and Ewing decided to recommend the purchase of a large area of ground about a mile and a half south of the Old College, where during his principalship independent blocks were erected for chemistry, zoology and animal genetics; while plans were prepared and finances provided for new blocks for geology and engineering, built, however, after he had retired. These blocks of buildings, known as King's Buildings, will remain as a permanent memorial to Ewing's term of office as principal of the University of Edinburgh.

Needless to say, such an extensive increase in the number of teaching staff and the erection of these buildings involved very heavy expenditure. Fortunately, Sir Alfred had a very persuasive tongue, and he was able to secure handsome gifts from private benefactors and public trusts, running into a total of more than three-quarters of a million sterling, and was thus able to carry through his improvement schemes without laying any serious burden upon general University finances.

During his twelve years of office, crowded as they were with administrative and social duties, Ewing was still able to find time to carry on research work, which had been his chief pleasure and object in life. He was an active member of many of the special committees of the Department of Scientific and Industrial Research, being chairman of the Bridge Stress Research Committee, which issued a valuable report in 1928. The necessary experiments on railway bridges throughout the country had to be carried out usually during week-ends, week-ends which an ordinary man at Ewing's age would have given over to rest and recreation, especially after he had

spent the previous five days in strenuous University work. He was also chairman of the Timber Mechanics Committee, and so recently as July 1934 that Committee issued a report, largely the work of Ewing himself. There can be little doubt that Ewing habitually overworked himself during the last three or four years of his life—work was his passion, especially research work, and it was to research work that he devoted his main energies during his last years.

It is interesting to remember that, as Ewing began his university career and his life's work more than sixty years ago in the engineering class-room of the University of Edinburgh, so he made his last public appearance in the lecture room of the engineering department only last October, when he delivered an address entitled "For Better or Worse" to the members of the Associated Science Societies of the University. How much he was beloved by the students of the University was attested by the fact that he was known to them by the affectionate nick-name of "Alfy", and, at the conclusion of his last address, after the formal vote of thanks had been proposed and carried, the student audience rose to its feet and gave, as only students can, three rousing cheers for "Alfy".

Ewing's last years were largely occupied by the thought that man's ethical development had not kept pace with the advance of science, that science and engineering had placed in the hands of mankind tools which man had not yet learned to use wisely. This formed the main theme of his remarkable presidential address to the British Association for the Advancement of Science at York in 1932. In "An Engineer's Outlook", published two years ago, one of the reprinted lectures was the Hibbert Lecture, delivered at the University of Cambridge in February 1933, on "Science and some Modern Problems". This lecture summed up Ewing's creed; after sixty years of active life in the service of education and science, he could find no better principle to urge on his listeners than the old gospel of goodwill—"*Thou* shalt love thy neighbour"—this, he said, is not a mere general injunction, it is an individual message.

Ewing was the recipient of many honours. He held honorary degrees of the Universities of Oxford, Cambridge, Durham and St. Andrews. He was elected a fellow of the Royal Society in 1887, and in 1895 received a Royal Medal for his researches on magnetism. He was elected an honorary member of the Institution of Civil Engineers in 1929, and of the Institution of Mechanical Engineers in 1932. He was made a Companion of the Bath in 1907, and Knight Commander of the same order in 1911. He was the author of many papers on scientific subjects, published in the *Transactions of the Royal Society* and other scientific societies. His textbooks include "Magnetic Induction in Iron and Other Metals"; "The Steam Engine and Other Heat Engines", of which many editions have been issued, and which has been translated into many languages; "The Mechanical Production of Cold", "Thermodynamics for Engineers" and "The Strength of Materials".

T. HUDSON BEARE.

Sir Alfred Ewing and his Cambridge Chair

The Jacksonian professorship of natural and experimental philosophy at Cambridge is an old foundation dating from 1783. It was the duty of the professor to give experimental lectures on "Natural Experimental Philosophy and Chymistry", and the chair had been held by a succession of distinguished men. In 1875 it was vacant through the death of Prof. Willis, who had been its occupant for nearly forty years. His predecessors had been chemists.

By 1875 it was recognised that the study of the natural sciences deserved fuller encouragement. Maxwell, a few years previously, had been appointed to the chair of physics. Foster was lecturing as a Trinity prælector, Frank Balfour was beginning his work on comparative anatomy, and Liveing was teaching chemistry to an ever-increasing number of students. It was clear that he needed help; the Jacksonian professorship again became a chemical chair and Dewar was invited to fill it.

At the same time, it was felt that mechanism and applied mechanics should still have a place in the University course; there was a man in Cambridge who could carry on some part at least of Willis's work, and so a professorship of mechanism and applied mechanics, to "terminate with the tenure of office of the professor first elected" unless the University should determine otherwise, was established, and James Stuart became professor. There were some, Coutts Trotter for example, who, even then, sixty years ago, realised that the scientific study of engineering was a fitting subject for inclusion in the scheme of an ancient university. It was a long step from this appointment to a professorship of engineering. It was to be the duty of the professor to lecture on the principles of mechanism; the theory of structures; the theory of machines including the steam engine and other prime movers.

There was an ordinary degree in mechanism and applied science, for which students were advised to read parts of Weale's Rudimentary Series, Balfour Stewart's "Heat", Bird and Brooke's "Elements of Natural Philosophy", and Ganot's "Physics". There was no laboratory, no provision for experimental work. But the professor started his work He raised funds for a certain amount of apparatus, some tools and workshop appliances, which ultimately were taken over by the University. A shed was erected to hold these, and by slow degrees the work grew.

Some ten years later (1886–87), there was much controversy as to the place workshops should hold in a scheme for an honours degree in engineering then under discussion. A syndicate appointed to investigate among other things the "whole question of the workshops" was granted, in 1890, "further powers to enquire whether it be desirable to develop further the Engineering School in the University on the lines suggested" in a memorandum it had issued, and as a result, on November 10, 1892, the Mechanical Sciences Tripos was established. The Tripos was to be in two parts covering the usual subjects of examination for an honours degree in engineering, together

with—an addition of 1895—a paper of essays having "reference to the fundamental principles, history, philosophy or applications of the Mechanical Sciences".

Meanwhile, Prof. Stuart had resigned and, to quote the "University Calendar", in "1890 J. A. Ewing, B.Sc. Edinb." had been appointed professor. He came, personally unknown to us, but with a distinguished career as a teacher at Tokyo and Dundee, a pupil of Lord Kelvin, the author of papers on magnetism of outstanding merit. In 1881 he had described the effects which follow the application of a cyclical process of magnetisation to iron and other material, that tendency of the magnetisation to lag behind the application of the magnetising force, to which he gave the name of *hysteresis*, and in 1885 had contributed a striking paper to the Royal Society entitled "Experimental Researches in Magnetism".

Ewing established himself at once as a *persona grata* to the University, a colleague, soon to be our leader, whom some of us who had been active in urging that engineering should receive full recognition from the University welcomed whole-heartedly among our ranks. To his wise judgment and sane advice are due the general acceptance of the scheme of education proposed. The debt due to him by the University may perhaps be measured by the success of that scheme which, aided by his staff, Peace and Dalby and Lamb, he developed for the next thirteen years.

A committee was set up in Cambridge to obtain funds for the establishment of an adequate laboratory for the teaching of engineering in the University. Sir J. J. Thomson, Prof. Newall, Sir Napier Shaw and myself are the sole survivors. Ewing was the treasurer. We had the help of a large and distinguished general committee which contained the names of all the great engineers of the day. We stated that £20,000 would be required for the complete design, but that much could be done for £4,000 or £5,000, and with the money so raised the Engineering Laboratory made its start. What it has now become engineers are well aware.

The first Tripos examination was held in 1896, Ewing, Osborne Reynolds, and Shaw were the examiners; seven candidates passed, of whom three were placed in the first class. Now the Engineering Tripos list is among the largest in the University.

Since those days, Sir Alfred has done more great work for his country. In Cambridge he will ever be remembered as the founder of the Engineering School, the man who taught the University what science, so long at home there, might do for industry and how that task might be achieved.

R. T. GLAZEBROOK.

Sir Alfred Ewing and Naval Education

THE connexion of Sir Alfred Ewing with naval education came about through the decision of the Admiralty, in 1902, to carry out a root and branch reform of the training of officers and men in all sections of the Navy. The reform was long overdue, for even up to 1901, junior officers spent a part of their time in learning to manœuvre ships under sail, although for all practical purposes sails in warships had been obsolete for thirty years. Then, too, there was the urgent problem of the staffing of the engine rooms of the steadily increasing fleet, a problem rendered difficult by the failure of successive Boards of Admiralty to adjust the status of naval engineers in accordance with their responsibilities.

Though at the beginning of the century, naval training was discussed in many quarters, the credit for the re-organisation of naval education in 1903 to meet modern requirements belongs in the first place to Lord Fisher (then Admiral Sir John Fisher), who had recently become First Sea Lord. The first step in the reform was the publication in December 1902, over the signature of Lord Selborne, of the famous "Memorandum dealing with the Entry, Training and Employment of Officers and Men of the Royal Navy and of the Royal Marines". That memorandum stated that "In the old days it sufficed if a naval officer were a seaman; now he must be a seaman, a gunner, a soldier, an engineer, and a man of science as well"; and that "the three branches of the Service which are essential to the fighting efficiency of the Fleet—the Executive, the Engineer and the Marine" were to be recruited by one system and all officers were to be trained alike up to a certain age.

These were ideas entirely new to the Service and to carry them into effect it was obvious that the Admiralty would require a man of outstanding reputation. Their choice fell on Sir Alfred Ewing, who in the preface to his book, "An Engineer's Outlook", tells of his first visit to the Admiralty, when he met Lord Fisher, "that volcanic personality whom, later, I was to see often in quiescence and in eruption, and to learn something of his greatness". This visit led to Lord Selborne offering Sir Alfred the appointment of Director of Naval Education.

To a civilian, the task Sir Alfred undertook might well have appeared a complex one, for in the course of a few months he found himself responsible for the training given in the Royal Naval College, Greenwich, H.M.S. *Britannia*, the new Royal Naval College at Osborne, the Royal Naval Engineering College at Keyham, the Dockyard Schools at Portsmouth, Chatham and Devonport, various training establishments for seamen, stokers and artificers, together with the supervision of the work of some eighty naval instructors of university standing, many of whom were serving on distant stations. The Selborne-Fisher scheme naturally cut across many traditions and found not a few critics; while from the members of the Board of Admiralty Sir Alfred received every assistance, among those below them he was sometimes conscious of cross-currents.

From the beginning it was realised that the new system of training would have to be modified in the light of experience, and many changes have been made. It may, however, safely be said that naval education to-day owes more to the work done by Sir Alfred Ewing between 1903 and the War than to any other single individual.

EDGAR C. SMITH.