impossible to believe that improvement is in one necessary component only.

With such evidence before us, the way is clear: selfishly, to care for our cattle as much as we care for ourselves: in fact, through them really to care for ourselves, particularly for our children. Housing is of no importance compared with proper feeding.

The supreme value of milk is beyond all question —particularly to the pregnant mother, to the child from the moment of conception, throughout infancy and early youth. Our task now is to make the general supply of such quality that it may serve as a defence against all disease arising in any way from a lowered vitality in ourselves or in farm animals generally from imperfect feeding.

Our cry should be not merely: 'Back to the Land' but 'Honour the Land', by raising its fertility to its fullest extent and enjoying the fruits thereof.

The Indian Institute of Science, Bangalore

THE retirement of Dr. M. O. Forster last month from the directorship of the Indian Institute of Science, Bangalore, after ten years service, and the appointment of Sir C. V. Raman to succeed him, afford an appropriate opportunity to give a general account of this remarkable Institute and its work. In recent years the number of workers in the various departments has greatly increased, and many of the researches carried out by them are of high scientific value, while others have a direct bearing upon the development of the country's natural resources and industrial expansion. There are four scientific departments in the Institute, concerned respectively with general chemistry, organic chemistry, biochemistry and electrical technology, and the range of investigations carried on in each of them is very wide.

Dr. Forster himself is to be congratulated upon the continued progress of the Institute during his directorship and the maintenance of the object for which it was established, namely, to promote original investigations and their use for the benefit of India. His services to the cause of higher scientific education and research in India are widely known and highly appreciated. A remarkable testimony to the regard in which he is held at Bangalore, and a tribute of gratitude from the staff and students of the Institute, were afforded by a large and distinguished company which assembled at the Institute on March 14 to express regret at his departure and convey the best wishes to him and Mrs. Forster. Dr. Forster was presented with an address and a silver casket of exquisite workmanship, and Sir Mirza Ismail, Prime Minister of Mysore, who presided, referred in glowing terms to his zeal and devotion to the Institute. In the course of his speech, Sir Mirza said: "Dr. and Mrs. Forster have come to love this State as much as we do. They have identified themselves with us completely. I need not tell them, for I am sure they know it well enough, that their decision to continue to live amongst us, after retirement, is a source of the utmost gratification to their friends and even to those who are not privileged to know them personally. We feel that we shall be enriched by their presence in our midst. . . ." As Dr. Forster is retiring to the beautiful garden city of Mysore, which is only a couple of hours journey from Bangalore, he will be able to continue in touch with the Institute and its activities.

The Institute originated in the munificence and foresight of Mr. Jamsetji Nusserwanji Tata who, about the year 1896, proposed to place in trust Bombay properties with a capital value of Rs. 30 lakhs (£225,000) to endow a research institute for India. During the development of a scheme for implementing this benefaction, the Government of Mysore allocated 371 acres of suitable property about three miles from the outskirts of Bangalore, contributed Rs. 5 lakhs (£37,500) towards the buildings and promised a subsidy of Rs. 50,000 (£3,750) per annum without limit of time; while the Government of India agreed to make an annual grant of Rs. 1·5 lakhs (£11,250).

On the death of Mr. J. N. Tata, his two sons, the late Sir Dorabji and Sir Ruttonji Tata, announced their intention of giving effect to the wishes of Mr. J. N. Tata, and transferred the Bombay properties to the Treasurer of Charitable Endowments. The vesting order having been signed in May 1909, the Council appointed thereunder authorised the construction and equipment of the buildings already planned by Dr. M. W. Travers, who had been appointed director in August, 1906. The first students were admitted to the departments of general chemistry, applied chemistry and electrical technology in July 1911, the department of organic chemistry being opened in September of the same year.

It was hoped by Sir Dorabji Tata that the Institute would become an all-India institution, and this intention is to some extent realised by the students in it being drawn from all parts of the sub-continent, though for geographical reasons those from Mysore and Madras predominate. On the financial side, however, it cannot be said that the support to the Institute is of an all-India character. Excepting Mysore and Hyderabad, which have uniformly and generously supported the Institute, contributions from other States and Provinces have been altogether disproportionate to the benefits received by their students. Bombay has approximately the same number of students in the Institute as Mysore and Madras, yet it contributes nothing to the finances. The absence of support from Bombay and Bengal is much to be regretted, for it means that other regions are influenced by it and neglect to afford the aid

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which would make the revenue of the Institute an all-India responsibility.

The following analysis of applications and admissions for the five years 1926–30 shows the geographical distribution, and the considerable excess of applications over admissions from all parts of the country:

	Mysore	Madras	Bombay	Bengal	Rest of India
Applications ..	151	239	244	72	148
Admissions ..	73	88	91	26	51

It was pointed out in an article in *Current Science* of October last that those responsible for developing the resources of the Institute, while placing in the foreground the requirement to impart advanced knowledge, and instruct in the methods of research, have consistently kept in mind any possible bearing which the results may have on the inception of new industries and the improvement of existing ones. Ample evidence of this recurs each year in the appendix to the Council's annual report, showing in abridged form the current subjects of investigation; but although the technological application of the work at the Institute has been wide, and in several cases valuable, there is doubtless room for expansion in this field.

One example of an economic application latterly engaging the attention of the Institute is the systematic inquiry into the cause of spike-disease in sandal. This has now continued during the past five years in co-operation with the Government of Madras and the Coorg Commission, the results being summarised in periodical reports published separately from the *Journal* of the Institute. The latter publication contains a description of the various inquiries, academic and economic, which have been pursued in the laboratories, and in the past fifteen years has comprised about two hundred issues. The range of subjects is wide, and includes many that might be turned to an industrial utilisation of principles or materials. This aspect of the work is reflected in the fact that the major proportion of the Institute's former students have been absorbed into non-academic occupations, particularly in the field of electrical technology.

An estimate of the factors contributing to the growth of the Institute may properly include the following considerations. The original organisation was planned by Dr. M. W. Travers, who served as director from 1906 until 1914, being succeeded in the following year by Sir Alfred Bourne until 1921. On Dr. Travers leaving India after constituting the chemistry laboratories, Prof. J. J. Sudborough became head of the departments of general and organic chemistry, terminating in 1925 his fourteen years' association with the Institute, and having developed a highly efficient department of organic chemistry dealing principally with indigenous natural products. He was ably followed by Prof. J. L. Simonsen, who remained only two years and is now professor of chemistry in the University College of North Wales, Bangor. In 1916, Prof. H. E. Watson, who had rendered excellent service as assistant professor of general and inorganic chemistry since 1910, was appointed professor and is now head of that department, which he has raised to a very high level. On retirement of the late Prof. Rudolf from the chair of applied chemistry in 1914, the duties of that office were assumed in 1916 by Prof. G. J. Fowler, whose reputation in the field of chemical bacteriology led the Council in 1921 to convert the chair into that of biochemistry: this branch he developed in several directions advantageous to India until 1924, when Prof. R. V. Norris was appointed and remained until 1929, making valuable contributions to its activities. Since August of that year Prof. V. Subrahmanyan has been in charge.

Dr. Alfred Hay (who died in April 1932) was appointed as the first professor of electrical technology in January 1908, retiring at the end of 1922. During his fifteen years' tenure he organised an admirable system of training by which engineering graduates of Indian universities are fitted to assume positions of responsibility as electrical engineers. His successor, Prof. J. K. Catterson-Smith (1923–1930), now professor of electrical engineering at King's College, London, greatly extended the premises and equipment of the department, and established a section of electrical communication engineering designed to meet the rapidly expanding interest in wireless telegraphy and telephony. He also founded the Institute Engineering Society, and a journal entitled *Electrotechnics*. In 1931 he was succeeded by Prof. F. N. Mowdawalla.

The *Journal of the Indian Institute of Science* describes the research work issuing from the laboratories, and embraces about two hundred original communications. A preliminary account of these is usually presented at the Indian Science Congress, which has received warm support from the Council by deputations of many students and members of the teaching staff to attend the annual meetings.

An important auxiliary to the work of the departments is the Library, which has been maintained in a state of increasing efficiency by Mr. K. Amrita Row. The library contains 21,000 volumes, principally research journals, and is the best of its kind in India. Research students at Bangalore have thus available for reference the published results of investigations carried on almost anywhere in the world. It is easy to understand, however, that notwithstanding the facilities which the Institute affords for advanced study and research, many students in universities in other parts of India hesitate to undertake post-graduate training there. Even if such an Institute were established in Great Britain, where the distances are not of the same continental order, it may be doubted if it would attract so many science graduates taking courses of advanced study and training for research as are now at Bangalore. Since the Institute was founded there has been

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a notable increase in the amount of research work carried on in many of the Indian universities, and there is a natural tendency for each such institution to retain its most promising research students instead of letting them go elsewhere.

This and other difficulties in the way of expansion were surveyed by a committee of inquiry, of which Sir William Pope was chairman, appointed in 1921, and helpful suggestions for overcoming them were made in the report of the committee published in the following year. Dr. Forster was appointed director of the Institute shortly after the publication of the report, as a scientific man of eminence with proved administrative capacity, and he has in every way justified his appointment. The committee contemplated the institution of a department of physics as a link between existing activities in physical chemistry and electrical technology, but sufficient financial support has not been afforded to carry out this recommendation. It may be hoped that the new director, Sir Venkata Raman, will by his enthusiasm and untiring energy be able to increase the financial resources sufficiently to establish a new department of physics on a scale worthy of the Institute and of the high expectations of its founder.

Trevithick Centenary Commemorations

DURING the past week, many tributes have been paid to the memory of Trevithick, the great Cornish inventor and engineer. On April 24 Prof. C. E. Inglis delivered the memorial lecture, at the invitation of the Trevithick Centenary Commemoration Committee, in the theatre of the Institution of Civil Engineers, by kind permission of the council. Sir Murdoch MacDonald, the president of the Institution and the chairman of the Committee, was in the chair.

In beginning his lecture, which is being published in full, with illustrations, in this week's *Engineer*, Prof. Inglis said that when Trevithick died on April 22, 1833, no obituary notices proclaimed that the nation had lost a mechanical genius of the first order of magnitude, and his memory passed into an oblivion which for many years was almost complete. But the greatness of the man, and the impetus he had given to engineering science, was such that his fame could not suffer permanent eclipse. Slowly, but with an ever-increasing luminosity, his genius shone forth, and with the passage of time he seems to rise higher and yet higher above his contemporaries.

Fifty years ago, the name of Richard Trevithick had won an honoured position throughout the engineering world, and now posterity, more discerning than his own generation, deems him not unworthy to be enthroned alongside and on the same exalted plane with his predecessor and one-time rival, the illustrious James Watt.

Trevithick was born at the foot of Carn Brea in the parish of Illogan not far from Camborne on April 13, 1771. Up to about the age of twenty-six years, he was connected with Cornish mining engineering and was familiar with all sides of engineering practice. A man of fine physique, forceful, energetic, self-confident, decisive and independent, he was yet of a kindly, generous disposition and though when goaded by opposition he would flare out, he cherished no animosities and there was a singular absence of anything approaching meanness in his character. The overwhelming vitality and driving force of the man, said Prof. Inglis, is strikingly portrayed in the bronze statue erected in Camborne last year.

Trevithick's great work began with his experiments with steam-driven locomotive models in 1797, and from then until in 1816 he left England for the Peruvian mines, was the period when his constructive genius flared forth with a brilliance which was almost continuous. To those years belonged his construction of the Camborne steam road carriage of 1801, his great patent of 1802 for stationary and locomotive high-pressure engines, his London steam road carriage of 1803, his historic rail locomotive, which he built at Penydarren in South Wales in 1804, his London rail locomotive of 1808, his application of steam engines to pumping, winding, dredging and agriculture, his invention of the Cornish boiler, his attempt to drive a tunnel beneath the Thames between Rotherhithe and Limehouse, and his patents for iron ships, iron docks and iron tanks. During the years 1797–1816 he was, in Prof. Inglis's words, "a veritable volcano of inventions". Some of these, because they ante-dated engineering progress by many years, failed to come to fruition, but others, notably the high-pressure semi-portable steam engine, gave an impetus to mechanical science which gathered momentum with the passage of time, and for which his successors mainly reaped the honour and financial reward.

One of Trevithick's inventions of this time was the water-pressure pumping engine, and speaking of a large engine of this type erected in Derbyshire, Prof. Inglis remarked: "This simple and powerful type of engine was verily the mechanical embodiment of its creator's mental and physical characteristics, and Trevithick's creations invariably inherited his own personal attributes—strength and exuberance of energy almost amounting to rashness." In comparison with Trevithick, Watt was a timorous spirit; steam in his mental vision was merely an agent for forming a vacuum, and the potentialities of danger he envisaged from the use of high-pressure steam outweighed any possible advantages which could be gained thereby. Trevithick, on the other hand, never counted that particular cost; he never permitted potentialities of danger to obscure his horizon, and it was this entire absence of fear which, perhaps more than

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