SCIENTIFIC RESEARCH AND THE FUTURE OF INDIAN INDUSTRY

THIS is the title of an interesting address delivered by Prof. S. S. Bhatnagar as "The Third J. C. Bose Memorial Lecture" at Calcutta on 30th November 1940. It will be a commonplace to enumerate the many examples of what scientific research has done to industry in the world. Still a few topical illustrations may be given in order to convince the hasty capitalist who wishes to apply science to industry immediately, that a certain amount of fundamental research is essential before a discovery or invention can be exploited to its best advantage. The Society of Chemical Industry of England awarded its Perkin Medal for 1937 to Thomas Midgely for his researches which culminated in the discovery of tetraethyl lead and freon. The discovery of tetraethyl lead was the result of a series of fundamental investigations based on the original observation that elemental iodine dissolved in motor fuel in very small quantities greatly enhanced the anti-knock character of the fuel. Similarly in the development of non-toxic non-flammable refrigerents in the form of organic fluorides a logical study according to the properties of the Periodical Table was a main factor.

Not all the honours of discovery useful to industry go to chemistry. Physics shares a good many of them and occasionally with a rapidity and beauty which bewilder the chemist. One example of physics contributing to the creation of a new industry is that of the production of cold, resulting in the liquefaction of the permanent gases. The pioneering researches of Sir J. C. Bose himself on the properties of electric waves would have been commercialised immediately had only India been an industrially developed country.

If Indian researches have not been employed on a large scale, it is not because they are of no importance. This neglect is largely due to the lukewarm interest of our Government in the past in these activities, an utter lack of appreciation on the part of our industrial magnates as to the possibilities of scientific research in relation to industry and the sophisticated and too philosophical a view which the scientists themselves have taken of their discoveries. Still some progress has been made. The inspiring genius of Sir P. C. Ray enabled him to sow the seeds of Indian industry which have now blossomed forth in the shape of the Bengal Chemical and Pharmaceutical Works, Ltd., one of our largest chemical factories in India. Further industrial programmes are afoot under the ægis of the Tatas, the Governments of Mysore, Baroda and Kashmir, and others. These developments which are in the process of materialising in the near future will give a fillip to scientific research which no other movement has yet been able to impart.

As an example of what the more wide-awake nations of the world are doing for their industries, may be taken the progress which Japan has made in this direction after the China incident. The address recently delivered by Dr. K. G. Kita, Chairman of the Society of Chemical Industry of Japan, should be an eye-opener to Britain and to India. In India, several new plants are in the process of being erected and several others have already come into existence. For example, we have now in the country a plant for the manufacture of chlorine and bleaching powder, and a plant for the production of nitric acid from synthetic ammonia. A big plant for the manufacture of benzene and toluene from coal is being put up at Tatanagar, and orders have been placed for a plant for the production of aviation lubricants in N. India. However, the greatest scope for India lies in her ability to make good by indigenous production what now constitutes a shortage in industry owing to restricted imports, and this presents a vast field of investigation for the technical man and the universities. The Board of Scientific and Industrial Research and workers in the field of Industrial Research are alive to this and many investigations have been undertaken with a view to introducing the manufacture of auxiliaries in industries which have become already firmly established, as the most immediate service which research can render is to make the existing organisations equal to an emergency. Such research schemes on Scientific Instruments, Graphite, Fertilisers, Glass and Refractories, Vegetable Dyes, Cellulose, Metallurgy, etc., are being carried out under fifteen different committees. The Indian investor should also investigate the possibilities of developing uses for the raw materials whose exports were so large from the country that their disposal now constitutes

a serious problem. In this category may be mentioned the vegetable oil-seeds, bones, and skins, and leather wastes.

Scientific research in India has already achieved notable success. These cover the fields of neutral glass industry, production of large quantities of pectin at extraordinarily low prices, luminous paints of non-radioactive origin, wood treating process utilising the impregnation of naturally occurring resins, preparations of chlorinated rubber, manufacture of paints and varnishes from Bhilwan nuts, etc.

One should not forget, however, that scientific and industrial research in this country has its handicaps. We are overburdened with all sorts of tariffs and duties. Our trade and our laws are occasionally not quite helpful nor can it be said that political considerations do not come in the way of some of the investigators.

CENTENARIES

Horrocks, Jeremiah (1617–1641)

JEREMIAH HORROCKS, 'the pride and boast of British astronomy' in the words of Sir John Herschel, was born of a poor schoolmaster at Toxteth near Liverpool in 1617. He matriculated in his thirteenth year and entered the Emmanuel College, Cambridge, as a sizar. He had to leave the university before qualifying himself for a degree. Yet he determined "that the tediousness of study should be overcome by industry, my poverty by patience and that instead of a master I would use astronomical books". Having found Lansberg's *Tables* untrustworthy, he studied the works of Kepler, and Tycho Brahe, and Galileo's *Astronomical dialogues*. Finding that Kepler's numbers were incorrect, he set them right from his observations. In May 1638, he bought a telescope for half-a-crown and used it to observe the solar eclipse of 22 May 1639.

Venus in Sole visa is the title of the book in which Horrocks described his observation of the transit of Venus, thereby earning unquestioned priority for his motherland. It was published posthumously in 1672. In the course of his studies, he became convinced that a transit of Venus across the Sun, overlooked by Kepler, would actually occur in the afternoon of 24 November 1639. He announced the approaching phenomenon to his friend Crabtree and prepared to observe it by throwing upon a screen in a darkened room the image of the Sun formed by his little telescope. At 3-15 p.m. he saw with rapture the disc of Venus already entered upon the Sun. He and Crabtree were the sole observers of this unprecedented spectacle. Among the results secured by Horrock's rough measurements were corrections to the orbital elements and apparent diameter of Venus, but he hardly guessed how fundamental his observations would prove to be in the determination of the parallax of the Sun and planets.

Horrocks was also the first to conjecture that the lunar orbit should be an ellipse with the earth in one of the foci and with a varying eccentricity and an oscillating major axis. Newton afterwards showed that both the conjectures were right and were really corollaries of his theory of gravitation.

The works of Horrocks were caused to be published by the Royal Society under the editorship of Dr. Wallis. They came out in 1879 with title *Angli opera postuma*.

Horrocks died prematurely 3 January 1641.

Godfrey, Ambrose (*d.* 1741)

AMBROSE GODFREY was employed in the laboratory of Robert Boyle. He later established an independent laboratory in Southampton Street, Covent Garden. He was deputed to analyse the water of the medicinal spring at Nottington. He was elected F.R.S. in 1730. He contributed two papers to the *Phil. Trans.*, one entitled *An account of some experiments upon the phosphorus uninæ* and the other *An examination of Westashton well-waters.*

Godfrey invented and took a patent for a fire extinguisher. Godfrey's method of "suffocation and explosion" was tried 19 May 1761 in a house erected for the purpose by the Royal Society of Arts in Marlybone Fields. It is said to have proved an entire success.

Godfrey died 15 January 1741.

Huddart, Joseph (1741–1816)

JOSEPH HUDDART, a British hydrographer, was born 11 January 1741, at Allenby in Cumberland. He was educated at his parish school. Even as a boy he showed aptitude for mathematics and mechanics and constructed the model of a mill.

In 1778 Huddart entered the service of the East India Company through the good offices of his cousins who were both shipowners and holders of East India stock. As commander of the Ship "Royal Admiral" he made four voyages to the East. Meanwhile he interested himself in the survey of the coasts and ports that came under his notice, and constructed charts of Sumetra and the Indian coast from Bombay to Cocanada.

Huddart retired from the service of the East India Company in 1788. In 1791 he was elected F.R.S. Several years before, the accident of a cable parting had turned his attention to the problem of making ropes with an equal distribution of strain on the yarns. He now entered into business for the manufacture of cordage on this principle and made a handsome fortune.

Huddart died at London 19 August 1816.

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