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Science and Labour.

A FORTNIGHT ago the British Association was in session at Cardiff, and men of science were engaged in making and discussing contributions to the world's store of natural knowledge. This week the Trades Union Congress meets at Portsmouth, and representatives of manual labour are asserting their industrial and political claims with no uncertain voice. The spirits of the two bodies are as the poles apart. On one side we have the explorer, animated solely by zeal for discovery and eager to learn of new fields in which pioneers are prospecting: on the other we have workers seeking—no doubt reasonably in some cases—full rights and privileges for particular occupational interests, and aiming to use these interests for political power.

It is not within the province of NATURE to discuss these ambitions of manual labour, or to anticipate the effects of a policy which, to say the least, has little constructive work behind it. We may, however, deal appropriately with the relations of science to labour, especially as the activities of both are essential to human progress and prosperity. Schemes for securing greater pay for less labour occupy most of the attention of the public Press and social platform, while the vastly more important subject of the creation of wealth through scientific discovery and industrial application is almost unheeded by the very people who profit most by it.

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Labour alone may build pyramids to-day, as it did four thousand years ago, but it cannot create new industries without new knowledge, and this is obtained by scientific research, whether carried on in an academic laboratory or in the works. Without the aid of science and invention, this country would be in the condition of China, where four-fifths of the population are peasant cultivators of the soil, and the social condition of the people is far below that of any British working class. The fullest encouragement must, of course, be given to the greatest of our industries—agriculture—but it should also be remembered that there are only about as many acres of permanent pasture and arable land together, in the United Kingdom, as there are people in this kingdom, and that we must depend largely for our existence upon foreign trade. By the use of our knowledge and the development of our natural resources we have to be able to offer other countries what they are not yet in a position to produce for themselves, for the lack of either one or the other of these factors of prosperity. Resources can be exhausted, but scientific discovery can continually provide new openings for industry, and the nation which makes the best use of it can be assured of a leading position for its products in the markets of the world.

When, about the end of the eighteenth century, the home demand for corn exceeded the home supply, the population of England and Wales was about nine millions: now it is about forty millions, and we have to look to improved methods of cultivation, and to the production of new varieties of wheat, to enable us to provide more than a week-end supply of food. As a large and progressively increasing proportion of the world's inhabitants feed upon wheat, markets from which we now obtain supplies will also have the demands of other countries to meet, and it will be necessary for us to grow more of our own, as well as to produce goods which other countries will purchase from us.

We now export textile goods to the value of nearly three hundred million pounds annually, and we are able to do so, not because of any specific aptitude on the part of the British manual worker, but because of machinery and of chemical industry, which produces the dyes required for piece goods. Fifty years ago nearly all the cotton grown in the United States was exported to Europe: now, every year more and more raw cotton is being used in the mills of the New England States, and we have to seek fresh

sources of supply for our raw material. India is also developing its cotton industry to supply its own needs, and the tendency must always be in this direction when a country concerns itself with progressive industry. China has not yet reached this condition, and therefore it exports raw cotton, wool, and silk, and imports textiles made from them. We are able to send into China cottons and woollens to the value of about ten million pounds annually, solely because we are in advance of that country in science and invention.

We have reached our position as a great industrial nation by the use of scientific knowledge, and we cannot go back to the time when domestic manufactures and home markets were our only concern. China is rich in the very natural products to which our country largely owes its prosperity, and through which a large part of the population secures profitable employment. There is enough coal in the province of Shansi alone to last the world for several thousand years, yet China has not benefited from its riches because of its indifference to progressive knowledge. Two hundred years ago we were in much the same condition. At that time the total quantity of coal raised in Great Britain was not more than a few thousand tons, whereas now the annual output approaches three million tons. Our early coal mines were not more than about 180 ft. deep, and it was the invention of Newcomen's pumping engine that enabled the depth to be extended to about 300 ft. Now, thanks to Watt's steam-engine, and modern methods of ventilation and coal-getting, shafts can be sunk and coal seams worked at ten times this depth. Our buried treasure would have remained hidden in the bowels of the earth to this day, and the million or so miners who derive their living from them would be without an occupation which owes its growth entirely to the steam-engine and other machinery which science and ingenuity have provided.

These workers now number about 5 per cent. of the occupied persons in this country, and they threaten to hold up most of the nation's industries unless certain demands they make are granted. Whether their peremptory action can be justified or not we will not attempt to discuss, but we do ask them to remember that they owe their occupational existence to science, and that men of science really hold the key of power to all industrial positions. A few hundred chemists engaged in dye manufacture, or a few thousand in the production of sulphuric acid, could paralyse almost every industry if they adopted the action by

which the coal-miners now challenge the Government of this country.

The closing of the coal mines would mean the stoppage of our iron and steel trade, upon which our industrial greatness has been built, and here again the industry owes its modern development to such men of science as Sir Henry Bessemer, Dr. William Siemens, and Sir Robert Hadfield, to mention three only. Iron ore occurs in China almost as widely diffused as coal, but it is a talent buried in the ground, and the country derives little profit from it, either in employment or in power. The Chinese possess to a supreme degree the conservative spirit which opposes all advance or change, and we should have remained in their position if vested interests, either of employer or of employed, had been permitted to control national development, and industry had failed to take advantage of scientific discovery. Manganese and nickel, titanium, molybdenum, tungsten, vanadium, and other elements now used in steel-making were all products of scientific investigation, and from them wealth has been created and work provided.

It would be easy to show that science has been the source of development of our chief industries and that a single scientific discovery, like that of magneto-electricity by Faraday, for example, contributes far more to human progress than the action of all the politicians and labour leaders put together. The discovery of thorium and cerium made possible the manufacture of incandescent gas mantles, of which about four hundred millions are now produced annually, and from osmium and tungsten have developed the great production of metallic filament lamps. Aluminium, discovered in 1827, has risen from the position of a rare metal to a yearly tonnage exceeded only by iron, lead, copper, zinc, and tin, and it is manufactured exclusively by electrolytic methods, which would never have come into existence but for the investigation by men of science of the chemical effects of the electric current.

The workers are now strong enough to exact their fair share of the profits arising out of the applications of science, and no one wishes to dispute their just claims in this respect. In their deliberations, however, they should occasionally show that they realise the part which science plays in opening up new fields of work without itself sharing in the distribution of the wealth it creates. Probably, if there were a complete levelling of all incomes, wage-earners would not benefit by more than about 5 per cent., yet this is the subject

upon which attention is mostly concentrated, while the means of increasing the amount of wealth to divide by creating new industries or increasing the output of individual workers are given little consideration. It should be obvious that the greater the value of industrial production through science and labour, the more will be the profits to be shared, and that the curtailment of productive capacity must mean eventual disaster. The Labour Party has stated that it "has the duty of placing the advancement of science in the forefront of its political programme." We look to it to justify this claim by presenting to the workers in true proportion the relative values of participation in profits and the creation of wealth through science, as determining factors of social improvement and industrial progress.

Development of Higher Education in India.

THE fact that applications are now being invited for seven professorships and five readerships in the University of Dacca will perhaps direct increased attention to the latest development of higher education in India. It is certainly most desirable that the scientific world at home should take an interest in the subject, and do everything possible to help in a movement that is unquestionably of Imperial consequence. For this new university is intended to mark an important departure; it is to be of the residential and teaching type, and both in its government and in its ways is to embody, so it is hoped, what is best in our universities, old and new, at home. The standard of admission of students is to be what is customarily the intermediate examination.

All who have first-hand knowledge of Indian universities, and many of those who have only indirect knowledge, will know how urgent is the need for reform. The situation easily admits of scathing criticism, but it will be more profitable to assist to the extent of our opportunities in this new constructive effort. No more need be said here of the past than that we have in India exactly what we might expect from the attempt to implant in the East, under Government auspices, a system of universities modelled on the London University of early Victorian days. We know at home to what degree our statesmen have been gifted with educational insight and how far their training has qualified them to adjust educational policy to the needs of a new age or of a different race. Those who wish to read in detail the story of Indian university development will do well to refer to the

report of the Calcutta Commission, which was noticed at length in these columns on its publication last year (vol. civ., p. 357).

Dacca, as the ephemeral capital of Eastern Bengal, is well provided with all the material elements for making the university a success, and the Bengal Muslims declare themselves intent upon educational advance. If at the outset an academic staff can be assembled that will hold firm to the professed aims of the new university, it may succeed in conferring an incalculable boon upon India. The terms of the appointments will, it is to be hoped, prove sufficiently good to attract men of the necessary quality. A professorship at its best begins at about 1200*l.*, rising by annual increments of 60*l.* to 2160*l.*, and in addition there may be an allowance of 600*l.* a year. The normal age of retirement is to be fifty-five, when the benefits of a provident fund will accrue.

At the present time there will no doubt be more than the usual difficulty in recruiting first-rate university teachers for India. The abnormal demands of the home universities and the unsettled state of the world come into reckoning, in addition to the usual considerations of exile and climate. On the other hand, there is ground for expecting that in future those who take up educational service in India will not be penalised to the extent they have been in regard to promotion to appointments at home. It is to be hoped that the appointments at Dacca will be seen to afford a very special opportunity of national service and a true educational mission, and that they will appeal not so much to the spirit of adventure as to a real ardour for the advancement of learning by high and creative scholarship. The realisation of the aims of the new university, and the establishment of a compelling example that will lead others to mend their ways, will make a demand on the strength of character and fidelity to principle of its first professors not less than on their intellectual competence. There is surely much here to attract the best type of both character and talent.

As already announced, the first Vice-Chancellor of the new university is Mr. P. J. Hartog, lately Academic Registrar of the University of London. Distinguished in early days as a lecturer in chemistry at Manchester, and most recently by his leading part in the establishment of the School of Oriental Studies in London, Mr. Hartog will approach his task with ample breadth of intellectual sympathy. As a member of the Calcutta University Commission he gained direct knowledge of