

branch of service under the administration of the Imperial Government including the Army, the Navy and the Church,—provided they possess the requisite qualifications,—and recruitment elsewhere for these services does not stop, it is feared that the canker of unemployment will slowly undermine the very structure of the body politic, tending towards extremely undesirable manifestations. The Indianization of railways is a matter of extreme urgency and will provide employment to a large body of

duly qualified Indians. To a very great extent, the solution of the problem in India is bound up with prejudice and vested interests, which have promoted its acuteness. The tools and the labourers to which Sir Ross Barker referred in his Convocation address are there, and are not unworthy; but the expansion of the field for the employment of both is the province of statesmen, the great industrial and commercial magnates, the landed aristocracy and business corporations.

Chemistry and Currency.

By Dr. Gilbert J. Fowler, D.Sc., F.I.C.

TO the Biochemist the phenomena of life present a wonderful picture of energy transformations, controlled by marvellous mechanism, and in all their complexity conforming to fundamental quantitative law.

Thus, for every intake of food there is a definite output of energy, either in the form of physical or mental work, or of heat.

This is becoming well recognized by up-to-date food vendors and manufacturers, and the careful housewife, especially if she is American, calculates and adjusts her menus in calories. On the door of the weigh-house, at the entrance to the Mysore City sewage farm, is a list of the vegetables sold, and their corresponding energy values, expressed in calories.

In the last annual Memoirs and Proceedings of the Manchester Literary and Philosophical Society, which has just come to hand, there is an interesting reprint of a short autobiography of Dr. J. P. Joule, which has recently come into possession of the Society, in which he states that in 1841 he found that, "the quantities of heat evolved by the combustion of the chemical equivalents of bodies are proportional to the intensities of their affinities for oxygen." Thus Joule may be said to be the father of modern quantitative dietetics.

Long before the date of Joule's discovery Adam Smith wrote as follows in "The Wealth of Nations":—

"Labour alone, therefore, never varying in its own value, is the ultimate and

real standard by which the value of all commodities can at all times and places be estimated and compared. It is their real price; money is their nominal price only.....

"The real value of all the different component parts of price, it must be observed, is measured by the quantity of labour which they can, each of them, purchase or command. Labour measures the value not only of that part of price which resolves itself into labour, but of that which resolves itself into rent, and of that which resolves itself into profit.....

"Food is in this manner not only the original source of rent, but every other part of the produce of land which afterwards affords rent derives that part of its value from the improvement of the powers of labour in producing food by means of the improvement and cultivation of land."

Have we not in the work of Joule a means of measuring exactly the labour which Adam Smith declares is the only true basis of value?

Here let us at once guard against a misconception. Adam Smith never intended to say that the *value* of each man's labour was the same, but that it constitutes a *standard* by which the value of other commodities can be measured. Adam Smith sensed the fundamental fact which the work of Joule put into scientific form that

every adult individual requires a certain minimum amount of food in order to be able to expend an equivalent amount of *energy*. How that energy may be applied is another question; a dynamo may turn out so many units of electrical energy per hour, which may be expended in lighting a room or in firing a mine, the amount of energy may be the same in both cases, the effects are different. Therefore, both "Poet and Peasant" require, within certain limits, the same amount of daily food, but the energy set free may be expended in the one case in writing poems on the delights of a rural existence, and in the other in actually digging potatoes for the poet's sustenance.

Considerations such as the above have led to the idea of a fixed datum for currency, based, not on metal, but on *Energy*, combined with the most constant element in the human food ration, *viz.*, *Nitrogen*. This datum has been termed the ERN, from "Erg" the unit of energy and N the symbol for nitrogen.

The daily nitrogen ration, according to Professor Rose of the University of Illinois, (*Dietary Facts and Fads, Ind. and Eng. Chem.*, June, 1931) is 10 grams, and the equivalent energy 300 calories. The actual value of one ERN on this basis is therefore 300 calories multiplied by 10 grams of nitrogen.

Nitrogen is chosen as a basis because, of all the constituents of the total food ration, its consumption fluctuates within the narrowest limits, 10 grams per capita per day representing a fair average.

An obvious criticism is that all kinds of nitrogen compounds are not of the same nutritive value, but in actual practice, nitrogen as a commodity has its average price, which is controlled by the quantity available and the demands of agriculture. The elemental nitrogen, as it originally exists in the atmosphere, may properly be taken as a basis, since it passes during its cycle from the air to the nitrogen-fixing bacteria in the soil, from them to the plant, from the plant to the animal, and back again to the soil, whence by reason of sundry

denitrification changes, it again assumes its elemental condition, and passes back into the atmosphere. During this cycle it has entered into countless different combinations, the resultant energy of which, liberated as they pass through the human body, averages some 300 calories per day.

Having once decided upon the value of this basic datum, the ERN, in terms of normal currency in a year of average prosperity (1928 has been suggested), the value of all other commodities can readily be calculated in terms of ERNS. In a recent speech, Mr. Winston Churchill states that the prices of thousands of commodities have kept in step with one another, gold alone has broken the ranks.

With the ERN as our standard we should have a constant basis for our commodity prices.

The ERN does more than this. Owing to the two interdependent factors, energy and nitrogen, it provides a means for equating mechanical power and agriculture. The machine is only an extension of a man's hand. One man, kept alive by food purchased by so many ERNS, can operate a machine liberating units of energy in abundance. The labour and intelligence of man can harness the Cauvery Falls and light up the towns and villages of the Mysore State. The energy thus utilized represents so many ERNS. On the other hand, without the nitrogen, provided by the labour of the agriculturist, the man at the machine cannot function. The combined value of the food and of the energy which this sets free, either immediately or ultimately, constitutes the *real* wealth of the State. This is living wealth. Gold is *dead*. What can it do in "its long, indirect and solemnly idiotic journey to be sterilized in the vaults of the hoarding powers"? (H. G. Wells, "*The Work, Wealth and Happiness of Mankind*," p. 381.)

With the ERN as our standard of currency there would ultimately be no need to hoard. So long, as the sun shines and the sea endures and the intelligence of man has free scope, he has wealth and to spare in the forces which he has at his disposal.

As Professor Soddy reminds us—"with the doctrine of energy, the real capitalist proves to be a plant" ("Wealth, Virtual Wealth and Debt," p. 30.)

The practical measures necessary to introduce an ERN currency, and the social and political results which would follow, may well provide subject-matter for further articles.

The Future of Agriculture in India.

THE importance of Agriculture to India has been realized to a greater extent during recent years than at any other time in the history of the country. The report of the Royal Commission (1928) presents a searching enquiry into the various problems at issue and the best means of solving them: the Imperial Council of Agricultural Research constituted on their recommendation has continued their good work and has already rendered valuable service to the country. Various new schemes have been sanctioned and researches leading not only to increased yield but also to improved quality undertaken. The provincial agricultural departments, as also those of the Native States, have also redoubled their activities and chiefly as the result of their efforts combined with those of the irrigation departments, larger areas are coming under cultivation, more valuable crops are displacing the cheaper ones and superior and high-yielding varieties are taking the place of the inferior strains. All these would augur well for the prosperity of the country—richer harvests and larger returns for the farming classes, cheaper and more plentiful food and clothing for the others and increased trade and wealth for the nation. Is such really the case? If not, what is our present position and what are we heading towards?

A study of the trade returns* for the past few years would show that the prices of agricultural produce have been steadily falling and that the exports made up chiefly of textile fibres, food grains and oil seeds have already shrunk by nearly 50 per cent. There is financial distress all around and the suffering, particularly among the agricultural classes, who constitute 75 per cent of the total population, more acute

than ever before. Is the present depression a momentary one caused by fluctuations in currency and political troubles or is it a more serious condition likely to lead to further distress unless new remedies are found?

The position would be clarified when it is realized that the present agricultural awakening is not confined to India alone; in fact, other countries had started long before India began. Starting with Sir William Crookes,* a succession of authorities had predicted food shortage in the World unless more is produced; even recently, Sir Daniel Hall† has expressed profound uneasiness at the inadequacy of the present supply to meet the growing needs of Western countries. The experiences of the War have also taught many a country to be independent of the others for their food and clothing. As the result of the above we find almost every country in the World producing more than it ever did before.‡ Export trade in agricultural crop has shrunk and countries like India which have subsisted mainly on the produce of the land have been seriously hit. There is yet no suggestion of acute over-production except in the cases of rubber and tea but such a condition is bound to extend, before long, to other crops as well.

Before considering any remedial measure, it would be essential to determine whether there is any real cause to fear shortage of food supplies at least in the near future. Taking merely the cultivable lands into consideration, we find that only a small fraction of the World's extensive areas have so far been brought under the plough. Thus, Canada has still over 350 million

* *Review of Trade in India*, 1928, 54; 1929, 55; 1930, 56; 1931, 57.

* *Repts. Brit. Assocn.*, 1898 (Bristol), 3.

† *Repts. Brit. Assocn.*, 1926 (Oxford), 255.

‡ *Int. Rev. Agric.*, 1928, 19; 1929, 20; 1930, 21.