

SCIENCE.—SUPPLEMENT.

FRIDAY, NOVEMBER 6, 1885.

RECENT PROGRESS IN POLITICAL ECONOMY.

IT has long been evident to close observers of current thought and discussion that the so-called science of political economy is in a state of transition. The old authorities have begun to lose their hold on general regard and esteem. Ricardo, Malthus, and Mill no longer hold the pre-eminent position once accorded to them. Until within a few years of Mill's death, the statement might have been truthfully made that nearly every prominent thinker in the field of economics in England, France, and Germany, was an adherent of the so-called orthodox school of political economy. Economics was regarded as one of the most exact and severe of sciences, and as having reached a most advanced stage of its development.

The reaction began in Germany early in the fifties by the rise of the historical school, and increased so rapidly that German thought was soon completely emancipated from the domination of English authority in this field. The movement was slower in England; but it had made such progress before Mill's death, that even Mill himself had begun to be influenced by it, and was convinced that many of his views were untenable. He openly confessed his conviction that one of his fundamental doctrines, that of the wage-fund theory, was false, and adopted a very different theorem in its place.

So steady and general was the defection in the ranks of the orthodox, and so vigorous were the attacks on the stronghold of the faithful, that the public soon lost all confidence in the scientific character of political economy. This was strikingly manifested, a few years ago, when a movement was started in the British association for the advancement of science, to abolish the economic section of that body on the ground that there was no such thing as a science of political economy. This movement was met, on that occasion, by the memorable address of Professor Ingram, which revealed, for the first time, how completely the later thinkers had broken with the old views. The growing influence of the writings of such men as Cliffe Leslie shows how ripe the time is for a new start in this field, while the recent publication of the work of the lamented Toynbee indicates the existence of a school of

thinkers in the very centre of Oxford and Cambridge, who are in hearty sympathy with the new movement.

The same tendency to break away from the old moorings is plainly seen among the younger men in this country. It is to be clearly discerned in the tone of newspaper writing done by those who have come under the influence of this new movement. It is evident at all the centres of learning where the modern scientific spirit has been allowed access to this field. It came plainly to light in the organization of the new American economic association formed at Saratoga in September last, where it was clear that the men interested in the enterprise believe that political economy is still in a rudimentary state, and that, if it is ever to attain to the rank of a universally acknowledged science, it must leave the purely abstract and *a priori* methods of the early economists, and have recourse to the same general methods of investigation which have achieved so much in modern natural science.

Perhaps the most striking evidence, however, of the untenableness of the old system, and the imperative necessity for a new, is to be found, not in the attacks of the opponents of 'orthodoxy' in the economic field, but in the present attitude of its defenders. For a time they took almost no notice of the defection from their ranks, or of the growing numbers of their opponents, or, if they did notice it, it was done in that supercilious way which is universally characteristic of conscious infallibility. But a great change has come over the spirit of their dreams. They are now finally aroused, and the result of their awakening is to be found in a series of attempts 'to restate the fundamental doctrines of the science in a less objectionable form.' As a matter of fact, when they get the doctrines fairly 'restated, so as to correspond more closely to the actual conditions of our modern industrial life,' the restatement is so different from the original theory that the latter is scarcely any longer to be recognized in it.

This is eminently true of the little work by Mr. Bagehot.¹ The author examines in the two essays of which the book consists, and which were originally published in the *Fortnightly review*, two of the postulates of the English orthodox school of economics, with the idea of restating them with such modifications as he thought they needed in

¹ *The postulates of English political economy.* By WALTER BAGEHOT. New York, Putnam, 1885. 8°.

order to bring them into harmony with the facts of modern society. The postulates selected are those referring to the transferability of labor and capital respectively.

After a short discussion of the reasons for the general neglect into which English political economy has of late fallen, in which he gives nearly all reasons except the right one, viz., that it is an outlived theory, the author proceeds to show that the Ricardian assumption of the easy and rapid transferability of labor and capital among various industries never has been true, and is not true now, though it may be true in the distant future. A more complete vindication of the justice of the attacks on Ricardo's system, so far as it is claimed to be a satisfactory explanation of our modern industrial economy, could scarcely be desired. Had Mr. Bagehot lived to finish the great work of which these essays were to form a part, it can scarcely be doubted that he would have followed out his premises to their legitimate conclusions, and finally have been found where he belonged,—among the opponents, instead of among the restaters, of 'orthodoxy.'

C. R.

TEMPERATURE OF THE MOON'S SURFACE.

PROFESSOR LANGLEY'S two most important discoveries—1°, that the greater part of the energy in the solar spectrum is way below the visible red; and, 2°, that our atmosphere is more and more transparent to radiant energy the greater its wavelength—promise to bear fruit in many directions. In his paper on the temperature of the surface of the moon,¹ one of their applications is shown in the complete upsetting of the long-cherished idea that the temperature of the moon's surface rises to 200° or 300° F. during the lunar day, and falls about as far below zero in the lunar night. First enunciated as a theory by Sir John Herschel, the only experimental evidence upon which it has rested has been the observations of lunar radiation by the present Earl of Rosse, to which Professor Langley takes no exception, so far as the experimental results are concerned, but from their interpretation by Lord Rosse, he entirely dissents. This interpretation rests upon the assumptions, 1°, that solar radiation is principally confined to luminous vibrations; 2°, that about 92 per cent of these are transmitted by glass; and, 3°, that only 1.6 per cent of the obscure rays are transmitted by glass. The first has already been shown

to be entirely wrong, and, when it is remembered that Professor Langley found over two-thirds of the total energy in the solar spectrum, from a glass prism, to lie below the visible red, nothing further need be said as to the non-conclusiveness of any deductions from the above assumptions.

Professor Langley's observations on Mt. Whitney lead him to the conclusion that, were it not for our atmosphere, the surface of the earth, even under continuous direct sunshine, would be at a temperature of only about 48° C. above that of surrounding space (whatever that may be), at any rate low enough to freeze every thing up solid, perhaps even the gases; and he concludes that the moon is in this condition unless it has an appreciably absorbing atmosphere, of which there are only some uncertain suggestions at present.

Attacking the problem entirely anew, he speaks of its importance as follows:—

"The amount of heat received from the moon, and the dependent question as to the temperature of the lunar surface, are subjects of greater interest to us than might at first appear. They are even ones in which we may be said to have a material concern, for, until we know the temperature which an airless planet would attain in the sun's rays, we can have no accurate knowledge of the extent to which the atmosphere of our own planet contributes to its heat, nor of some of the most important conditions of our own existence."

Professor Langley describes important improvements in the galvanometer used with his bolometer, so that with the combination of the two he is now able, when the needle is damped to a period of 10s., to make 1mm. on the scale correspond to a current of only 0.000,000,001,3 of an ampère, or indicate a difference of temperature of only 0°.000,016 C. As regards precision of measurement, the probable error of a single observation is only about 2 per cent of the total amount of lunar radiation, while in Lord Rosse's work the probable error of the mean of a series of 10 observations was 19 per cent, thus giving one of the former a weight equal to several hundred of the latter, to say nothing of its far greater freedom from constant errors.

With this apparatus, and with all the other refinements and precautions against error which invariably accompany all of Professor Langley's work, he has been making the following investigations:—

1°. Direct measurement of lunar heat compared with solar. 2°. Comparison of moon's heat with that of Leslie cube (hot water). 3°. Transmission of lunar heat by the earth's atmosphere. 4°. Comparative transmission of glass for lunar and

¹ Memoirs of the National academy of sciences, vol. iii, pt. i., 2d memoir. On the temperature of the surface of the moon. By S. P. LANGLEY. Washington, Government, 1885. 4°.