

germ of the theory of evolution. But they all presupposed the action or intervention of supernatural forces, and as such had no real scientific basis. Purely metaphysical speculation leads nowhere, and the unsubstantial subtleties of dialecticians leave us cold. We seek to elucidate what has been for countless ages an inscrutable problem in the light of the lessons of physical science. We reason from the facts of astronomy, geology, physics, chemistry, and biology as we know and understand them, and as each new development arises we apply its teaching to the solution of the mystery. It has already been pointed out that the application of the mechanical theory of heat, spectrum analysis, thermal radiation, radiation pressure, and radio-activity to cosmogonic phenomena has done more to elucidate these problems than all the speculative theories and systems of former ages put together.

The lecture<sup>1</sup> which Prof. Nernst reprints in the little brochure before us is, we believe, the latest attempt to focus the outcome of modern research upon this question of the origin and mode of formation of the world. He applies to it the knowledge with which his study and training as a worker and expositor of chemical physics has equipped him. Furthermore, he has sought the aid of students in fields of inquiry other than his own when these have any direct relation to his subject. The lecture was originally delivered in Berlin as one of a series of popular discourses arranged by the Prussian Academy of Sciences about a year ago, and has been repeated in parts of mid-Europe, notably in Vienna and in Prague. As published it has been considerably enlarged. It is prefaced by a short introductory statement defining the problem and explaining its limitations, and the methods by which it may be attacked. It is furnished with a long appendix, practically as extensive as the lecture itself, in which details are developed which would be out of place in a purely popular exposition. As may be anticipated, the whole is instructive and highly suggestive, and we have read it with interest and pleasure. Nevertheless we rise from its perusal with a humbling sense of the inadequacy of our present means to grapple with so stupendous a problem. More than ten years ago the same theme was handled by Prof. Svante Arrhenius in his "Werden der Welten" and afterwards in "The Life of the Universe," and it may be doubted whether in reality Prof. Nernst has succeeded in carrying the matter any further. How partial and inadequate is the basis on which even the latest cosmogony rests was well brought out in the discussion last year at the Edinburgh meeting of the British Association on the age of the earth. The work of one epoch does little more than upset that of

its predecessor. Premises in regard to the earth's heat are vitiated by the discovery of radio-active materials. We are still in ignorance as to the true source of solar energy. Secular contraction apparently is not enough to account for it. We have absolutely no definite knowledge on so fundamental a matter. The more we learn the greater seems our ignorance. We can but go on groping for the light, testing our surmises as best we may in the feeble glimmer that our present knowledge sheds.

Negligible as is the scientific merit of the old cosmogonies, they had at least the charms of imagery and fancy—charms at which the cold, unsympathetic eye of a passionless science looks askance. Even the imagination of a Tyndall would find it difficult to invest our modern cosmogony with the vestiges of such attributes.

### Textile Research Fellowships.

THE British Research Association for the Woollen and Worsted Industries represents the culmination of a movement which was started at the University of Leeds during the early days of the war. Two objectives were then in view, research specially applied to the elucidation of problems presented by the textile industries, and a deeper and more extensive education with the object of promoting the introduction of the sciences and scientific method into industry whenever and wherever possible. It was perhaps natural that the first of these objectives should dominate when, in what it conceived to be the larger interest of the community, the University handed over its missionary work to the newly constituted Research Association, which included representatives from the whole of the woollen and worsted industries of Great Britain and Ireland.

The experience of this association is now tending to emphasise the need for well-trained, sympathetic men actually placed in the works if the achievements in research—which already are by no means inconsiderable—are to be used at all: still more is this necessary if anything like full value is to be drawn from research results.

It is therefore not surprising that the research association should consider it not only expedient but also absolutely necessary that well-trained University and other students should be encouraged to resist the more direct call of industry and to prepare themselves for the difficult but very necessary work of introducing more science into industry. Whether this appeal will achieve the desired result depends not only upon the fellows and scholars which the association is now selecting, but also upon the sympathetic consideration given to their work and its possibilities by the controllers of industry. In addition to ability, there must

<sup>1</sup> "Das Weltgebäude im Lichte der Neueren Forschung." Von Prof. Dr. W. Nernst. Pp. iv+63. (Berlin: Julius Springer, 1921.) In Germany, 12 marks; in Great Britain, 48 marks.

be opportunity, and only the combers, spinners, and manufacturers can give this.

We have confidence that the necessary opportunity will be given to the well-trained man, and we therefore specially direct the attention of those eligible for the fellowships and scholarships offered by the British Research Association for the Woollen and Worsted Industries. In each case awards are tenable in the first place for one year, and maintenance grants are offered, the maximum value of the fellowships being fixed at 200*l.* per annum. Applications for fellowships, which should reach the secretary of the association at Torridon, Headingley, Leeds, before June 30, should contain full particulars of the candidates' training and an outline of the research which it is proposed to undertake. It should be realised, however, that if success is to be achieved a type of "researcher" different from any yet produced is necessary. The man of science has as yet made little or no direct impression upon the woollen and worsted industries; all the advances made—and these have been more considerable than most people realise at the present moment—have been at the hands of the technologist. Indeed, it is still a moot point as to whether the technologist should be encouraged to obtain a training in pure science, or whether the man of science should become a technologist. Possibly both these lines of action are promising, but from the scientific point of view it is very desirable that prospective candidates should have a sound knowledge of the industry, for with this knowledge and deeper insight will undoubtedly come a profound respect for an industry which has already achieved so much, and further an earnest desire to help towards increasing its usefulness in the service of humanity.

Possibly the textile industries offer most promising fields of research in the direction of physical chemistry; but applied mathematics, chemistry, zoology, and other of the sciences have also claims which will certainly not be ignored.

### A Manual of Tides.

*Tides and Tidal Streams: A Manual compiled for the Use of Seamen.* By Comdr. H. D. Warburg, R.N. Pp. vii+95. (Cambridge: At the University Press, 1922.) 8*s.* 6*d.* net.

THE author of this manual is convinced, and not without cause, that the non-harmonic methods of giving and using tidal information at ports not served by complete predictions are obsolete and not trustworthy. These methods assume the simple phenomenon of semi-diurnal tides only and came into prominence because the original workers on tides were

most familiar with the tides in European waters. But in most parts of the world the diurnal tides cannot be neglected, even if they are not of greater importance than the semi-diurnal tides, and at present navigators are not provided with information suitable for the calculation of tidal heights in such places. Commander Warburg suggests that the tides should be represented universally by a few harmonic constituents, and that navigators should be taught suitable methods for getting approximate values of the height of tide at any time by the use of harmonic methods.

The author gives an explanation of the generation of tides and tidal currents as an introduction to the harmonic methods proposed, and he also explains various tidal phenomena such as the double high-waters experienced on the south coast of England, but these explanations cannot always be commended from the scientific point of view. The phenomenon of double high-waters, incorrectly explained in the manual, has often been explained correctly from Airy onwards (*e.g.* Sir W. Thomson, *NATURE*, Dec. 19, 1878), but the wrong explanation is curiously persistent. It is alleged that the cause is in the reflection of the tide wave from the north coast of France and that this "reflected wave" arrives on the south coast of England some six hours later than the "primary wave"; we thus get, it is said, two waves with their maxima some six hours apart and therefore two high-waters within six hours of one another. But obviously, or at least from simple trigonometry, two semi-diurnal oscillations, whatever be their relative phases, can only combine to give a semi-diurnal oscillation; that is, the part played by reflection is to make the resultant phase of the actual oscillation at a given place different from what it would have been if no reflection had taken place. The true cause is the presence of quarter-diurnal oscillations in the primary wave. These are due chiefly to shallow water, and with a free unreflected progressive wave the phases of the semi-diurnal and quarter-diurnal oscillations are such that double high-waters cannot occur; but if reflection takes place then it is possible to disturb this phase relationship so that the minimum of the resultant quarter-diurnal tide occurs about the time of maximum of the semi-diurnal tide; we may then get a "double-headed tide," or a very long "stand." The importance of the shallow-water constituent is, however, not limited to double high-water phenomena, which are only extreme cases.

A brief explanation of the mechanical harmonic method of calculating predictions is given, but the diagram of a tide-predicting machine, however, illustrates motions which are not strictly harmonic. The