which weathers rapidly into rounded grains. About 1 per cent. of these grains were found to be conodonts. This is the highest known stratigraphic occurrence of the conodont group.

The Phosphoria types are peculiar and are apparently senile specializations of a rapidly declining group. They seem to bear the same relationship to other conodonts that the late Cretaceous ammonites do to other ammonoids and that Silurian and Devonian trilobites do to other trilobites. There are at least two types of ribbed spoon-like teeth and one type of plate-like tooth with longitudinal lines of denticles. Simple conical forms are abundant. The species will be described and figured in a later paper.

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ACADEMIC FREEDOM IN ITALY

NEXT summer the International Physiological Congress is scheduled to meet in Rome. In this connection I wish to call the attention of the members of the Federation of American Biological Societies, who are members of this congress, to the official edict issued by the Italian government on October 8, 1931, compelling all professors in Italian universities to swear allegiance to the Fascist régime. As announced in *School and Society* for January 9, eleven university professors out of 1,225 have refused to take this oath of allegiance.

I wish to propose to the members of the Federation of American Biological Societies for the coming meeting in Philadelphia in April the consideration of refusing to attend the International Congress of Physiology in Rome August next unless this brutal and defiant attack on academic freedom on the part of the Italian government is rescinded.

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SCIENTIFIC BOOKS

The Universe of Modern Physics. By MAX PLANCK. W. W. Norton and Company, Inc., 1931.

THE revolution of thought which had its inception in two physical theories, relativity and quantum mechanics, has swept over larger and larger fields of human concern. It has drawn into scientific controversy, and caused a revision of, some of the concepts that were considered to lie at the very basis of philosophical and physical thought. In the midst of the multifarious and conflicting attempts of reformulation we hear the voice of Planck, the man whose work was largely responsible for the abandonment of classical reasoning in physics. He addresses not the comparatively few who work in the special fields of theoretical physics, but all those who have an interest in the basic problems of physical reality. And his message is certain to be received with greatest attention.

Physicists are entirely too prone to forget the relations between their science and the fundamental issues of epistemology; indeed they frequently neglect to apply the test of logical consistency to the concepts which compose their theories. Planck's aim is to clarify these matters. He starts by stating the goal of physics, which he defines as the apprehension of true reality, a goal which is admittedly unattainable but acts as a guiding ideal in scientific investigations. Reality, in Planck's analysis, is more than the mere phrase it appears to be in many similar treatises: the world of reality is definitely set aside as one of three, the other two being the world of sense and that of physics. The latter is a deliberate hypothesis and is subject to change, while the world of reality is immutable.

The discussion of these metaphysical matters is followed by a lucid exposition of relativity and the quantum theory, particular emphasis being placed upon those points at which they break away from the more common habits of thought. Planck's comments on Heisenberg's principle of uncertainty are very noteworthy indeed, for he makes a point which is too often overlooked in the numerous illustrations of this principle: It "has nothing whatever to do with any measurement," but derives its validity only from the wave nature of matter. Determinism is redefined, and its premises are then shown to apply to wave mechanics, so that uncertainty can not be said to be contradictory to determinism. Nevertheless, there is an important distinction between determinism in classical physics and in quantum physics. Classically, the configuration of objects was governed by definite laws; in quantum mechanics complete determination fixes the state of material waves. This situation is not opposed to strict determinism; it merely renders considerably looser the relation between the physical world and the world of sense.

Causality, complete physical lawfulness are in Planck's opinion the bases of physical science. He regards causality as a category which is given *a priori*, much in the Kantian sense. The definiteness of his statements on this controversial point is truly pleasing, and it is to be hoped that the soundness of the author's view will penetrate the mist which still be-

clouds this important problem. On the basis of the supposition of lawfulness the physicist proceeds to erect his science, and his efforts are governed very largely by working hypotheses, whose rôle and importance are discussed. Interesting examples taken from the history of physical thought illustrate the making of physical theories. After discussing the genesis of physical laws Planck examines their contents. He finds that, from this point of view, all laws can be divided into two main groups: those governing reversible and those governing irreversible processes. While it is impossible on logical or empirical grounds to decide whether one type of law is derivable from the other, Planck wishes to uphold the postulate that all laws are ultimately of a dynamical character, this being essential for the healthy development of physics.

Attempts have frequently been made to establish freedom of will on the basis of physical uncertainty. Planck shows convincingly how unnecessary such endeavors are, for he proves with his usual clarity that "human free will is perfectly compatible with the universal law of strict causality." In concluding he discusses some of the difficulties with which modern theories are still confronted, and points out the value which might arise from a coordination of scientific and philosophic endeavors.

The book contains in its 114 pages not only a considerable amount of valuable information accessible to those not specifically versed in science but it presents the views of a man who has left his permanent imprint upon the subject of which he speaks. Minor technical errors are only too likely to appear in a book of such broad perspective; there seems to be one on page 31 where the author, speaking of points at which the potential energy exceeds the total energy, is apparently referring to states where the total energy is negative. Some might find, too, that space should have been given to Dirac's more recent theories—but all such criticisms would seem pedantic.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A MODIFICATION OF THE OSBORNE-MENDEL SALT MIXTURE CONTAINING ONLY INORGANIC CONSTITUENTS

IN a salt mixture used in compounding synthetic diets for experimental animals, it has seemed to us to be desirable to use purely inorganic salts because of the possibility that the citrates and lactates, commonly used in salt mixtures, may contain unsuspected vitamins. The salt mixture given below, in addition to fulfilling the requirement as to purely inorganic sources, is easily prepared from readily available C. P. chemicals with very little grinding and does not cake on standing. Moreover, it contains the inorganic radicals of Osborne and Mendel's milk salts to give in 1 kilogram of completed ration essentially similar amounts of the necessary constituents that this last would give in the proportion recommended, and thus should be equivalent for feeding purposes.

For convenience in comparing the present salt mixture with that of Osborne and Mendel,[1] as well as with McCollum's No. 185,[2] and Hawk and Oser's[3] recently suggested mixture, the 4 mixtures have been calculated to a 1 kilogram finished salt basis (Table I). As different proportions of salt mixtures in the

TABLE I

INGREDIENTS TO GIVE 1 KILOGRAM SALT MIXTURE

	O. and M.[1] grams	McC. No. 185[2] grams	H. and O.[3] grams	Suggested grams
NaCl		46.7	77.41	105.0
KCl			125.29	120.0
KH_2PO_4				310.0
$Ca_3(PO_4)_2$				149.0
$CaCO_3$	310.2		68.90	210.0
$MgSO_4$ (anhydr.)		72.0	38.50	90.0
$FePO_4 + 4H_2O$				14.7
$MnSO_4$ (anhydr.)	0.182		0.161	0.20
$K_2Al_2(SO_4)_4 + 24H_2O$	0.0564		0.0925	0.09
$CuSO_4 + 5H_2O$				0.39
NaF	0.571		0.508	0.57
KI	0.0460		0.0414	0.05
$NaH_2PO_4 + H_2O$		93.8		
K_2HPO_4		257.7	219.72	
$CaH_4(PO_4)_2 + H_2O$		146.0	113.25	
Ferric citrate + $1\frac{1}{2}H_2O$	14.59	32.0	13.00	
Ca lactate		351.8		
Ca citrate			309.67	
$MgCO_3$	55.67		33.43	
Na_2CO_3	78.78			
K_2CO_3	325.1			
H_3PO_4	237.4			
HCl	122.8			
H_2SO_4	21.16			
Citric acid + H_2O	255.4			

[1] T. B. Osborne and L. B. Mendel, *J. Biol. Chem.*, 37, 557, 1919.

[2] E. V. McCollum, O. S. Rask and J. E. Becker, *J. Biol. Chem.*, 77, 753, 1928.

[3] P. B. Hawk and B. L. Oser, SCIENCE, 74, 369, 1931.