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.

ration are recommended by these investigators, a comparison is also given (Table II) of the percentage of the inorganic radicals in a diet prepared with the prescribed proportions of salt mixture to ration.

TABLE II

PERCENTAGE OF RATION

	O. and M.[1] per cent.	McC. No. 185[2] per cent.	H. and O.[3] per cent.	Suggested per cent.
Salt mixture	4.0	3.7	4.4	3.5
Na	0.137	0.126	0.134	0.145
K	0.737	0.427	0.721	0.533
Ca	0.496	0.256	0.489	0.500
Mg	0.064	0.054	0.0766	0.0636
Fe	0.0120	0.0243	0.0118	0.0129
Mn	0.000265		0.000258	0.000255
Cu				0.000348
Al	0.000013		0.000023	0.000018
PO_4	0.920	1.169	0.906	1.098
SO_4	0.083	0.212	0.135	0.251
Cl	0.478	0.105	0.468	0.423
F	0.00103		0.00101	0.000903
I	0.000144	*	0.000144	0.000134

* Iodine in drinking water.

The suggested mixture has been used in essentially the present form for several years in this laboratory. Copper has added recently in accordance with the findings of Waddell, Steenbock and Hart[4] and Elvehjem and Hart.[5]

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A NEW KAHN ANTIGEN MIXER

THE proper mixing of the Kahn antigen with salt solution in order to obtain a stable and uniform emulsion is still something of a problem, notwithstanding the improved mixers available on the market.

In this laboratory and in that of Agnew State Hospital we have used a mixer which possesses definite advantages over all others and which is inexpensive to make. It is nothing more than a Hatschek emulsifier in miniature. Its operation is simple.

The materials used are as follows:

(1) A specimen vial ⅝ inch inside diam. by 2⅝ inches long .

(2) 1 rubber stopper No. 3 with 2 holes.

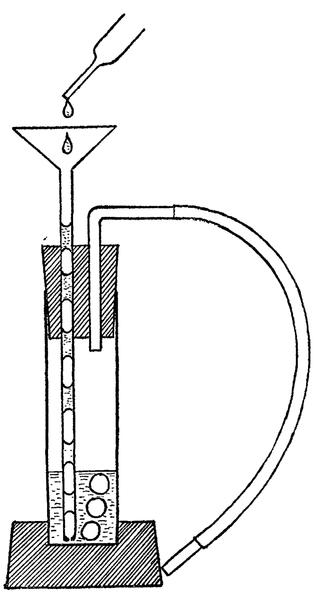
(3) A 1 inch funnel with a stem 4 inches long.

(4) A 1½ inch right angle glass tube, ⅛ inch inside diam.

(5) A piece of rubber tubing 9 inches long by ⅜ inch diam. with glass tubing mouth-piece.

The end of the funnel is heated until the hole is ½ mm. in diameter. When inserted through the rubber stopper and the vial closed the funnel stem should almost touch the bottom. For greater stability the base of the vial can be held in a No. 9 rubber stopper.

The antigen is put into the vial first. After the stopper is replaced, gentle suction by mouth or otherwise is applied by means of the rubber tube connected with the right angle glass tube. This causes bubbling through the antigen. Now the salt solution is poured into the funnel one drop at a time—say 2 or 3 drops per second. The entrapped air between the drops does the mixing of the salt solution with the antigen in the vial. If mechanical suction is used and also a dropping funnel it is possible to reproduce the mixing exactly each time and standardize the emulsion with great accuracy; something almost impossible with the mixers in general use. Since this mixer has been in use, a marked decrease in doubtful determinations has taken place.



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[4] J. Waddell, H. Steenbock and E. B. Hart, *J. Biol. Chem.*, 84, 115, 1929.

[5] C. A. Elvehjem and E. B. Hart, *J. Biol. Chem.*, 84, 131, 1929.