

from a primitive common ancestor (the germ-cell) and their evolution in the course of countless generations into distinct genera and species. Coues, in fact, has gone so far, in writing of bird-anatomy, as to treat the different kinds of cells as pertaining to several genera and species, which he names.

But we are here met by the extraordinary fact that all this complicated development and evolution is repeated anew in every individual, and that, speaking broadly, the course of cellular evolution is predetermined in the germ. This fact is so commonplace to us that we have ceased to realize the wonder of it, or its possible significance as a hint of the method of evolution among species.

Why may it not be that the evolution of species, to a greater or less extent, is similarly predetermined, and that here is to be found the explanation of the phenomena described in the beginning of this note? If life exists in Mars, a knowledge of it would go far toward answering such a question. How much similarity would there be between creatures evolved on two planets, with all the diversity of conditions which this implies?

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NOTES ON PHYSICS.

NON-PERMANENCE OF WEIGHT.

EXPERIMENTS by Heydweiller (*Phys. Zeitschr.* Aug. 25, 1900), similar to those of Landolt (*Zeit. für Phys. Chem.*, 12, p. 1, 1893), seem to show that a slight change of total weight accompanies some chemical reactions. These experiments have been interpreted by some reviewers as throwing doubt upon the axiom of the conservation of matter. This axiom is not, however, incompatible with variation of total weight in chemical or even in physical changes. If it should be found, for example, that the weight of a given amount of lead and of a given amount of oxygen varied with physical and chemical conditions, a *standard state* of lead and a *standard state* of oxygen would have to be adopted in which state these substances would always have to be weighed, and the principle of the conservation of matter would

have to be stated thus: Given so much lead and so much oxygen, measured by weighing under standard conditions, then, whatever changes these substances undergo, the amount of each is found to be unchanged if both are brought back to standard conditions and weighed.

Variation of weight with physical and chemical conditions would, no doubt, throw light upon the nature of gravitation, but if such a variation becomes established it will have but little disturbing influence upon the notion of the indestructibility of matter.

In the light of Professor Fessenden's electrical theory of gravitation, it would seem that the change of state most likely to produce a change of weight would be the dissolving of an electrolytic salt in water. For, assuming electrolytic dissociation to be a separating of positively and negatively charged atoms or *ions*, the region throughout which the electric force of the atom is exerted would be greatly extended by the dissociation.

THE ELECTRO-MAGNETIC THEORY OF RADIATION.

PROFESSOR M. PLANCK, of Berlin, published some months ago a derivation of the formula connecting energy and wave-length in the spectrum of a black body at a given temperature, the derivation being based upon the notion of an electrical resonator enclosed in a space surrounded by perfectly reflecting walls. It is remarkable that this formula should agree with the formula of Stefan obtained by thermodynamical considerations. In the *Verhandlungen d. Deutschen Phys. Gesellschaft*, for December 1900, Professor Planck has given an outline of some work, soon to be published in full, in which he applies the method of probabilities to the determination of the partition of energy among a vast number of electrical resonators enclosed within a reflecting boundary. A consequence of the theory developed by Professor Planck, which gives some check upon its legitimacy, is a formula which permits the calculation of the number of actual molecules of any salt in a gram-molecule (the number of atoms in a gram of hydrogen), the basis of the calculation being the energy curve of the spec-

trum of a black body as determined by Lummer and Pringsheim and by Kurlbaum. It is thus found that an atom of hydrogen weighs 1.64×10^{-24} grams. Professor Planck compares this result, together with other results depending upon it, with previous approximate determinations of this quantity, and he remarks that the values determined by his formula are *not approximations*, but that the calculations are absolutely valid, provided that his theory is true.

W. S. F.

NOTES ON INORGANIC CHEMISTRY.

In an article by Berthelot in the *Annales de Chimie et de Physique* on Egyptian gold, it appears that in the earliest epochs, argentiferous alluvial gold was used for coins and other articles. Only later, from the time of Croesus down, was the gold refined. The period of manufacture can be approximately told by analysis, owing to the rarity of minerals which yield gold free from silver. Specimens of gold from the fifth and twelfth dynasties show about four per cent. of silver, but those from the Persian epoch consist of almost pure gold.

In a recent number of the *Chemical News*, Dr. J. H. Gladstone gives an account of analyses made of specimens of gold leaf from Egyptian mummies, supplementing the work of Berthelot spoken of above. Down to the time of the eighteenth dynasty the foil is evidently made from the native alloy, containing from four to eighteen per cent. of silver, the latter alloy closely approaching electrum. The specimens from the first dynasty show a similarity of composition, coming from a single source, but those from the later dynasties differ among themselves, and evidently had different origins. Little copper is found in any of the foils. A very thin superficial crust of chlorid of silver is found in some of the foil, indicating a slow diffusion of one part of the alloy—the silver—till it reaches the outside surface, where it meets with the chloride that exists in the sands of the desert. That the Egyptians were acquainted with different qualities of gold is evidenced by the Harris papyrus, containing the annals of Rameses III., about B. C. 1200, where mention is made of gold, pure gold, good gold, white gold, best gold,

gold of the second quality, fine gold of the land, gold of the land of Koebti, and of Kush.

THE recent cases of poisoning in England from arsenic contained in beer, and the differing results obtained by the chemists who have analyzed the beer in question, have given rise to an extended discussion in the *Chemical News* and elsewhere, as to the value of the tests for arsenic which are commonly relied upon to detect and estimate the amount of arsenic in suspected substances. This discussion is well timed, for, in the whole field of toxicology, no substance is more frequently to be tested for than arsenic. The test most generally depended on is Marsh's, and this is taught in almost every laboratory, of college and medical school. As a matter of fact, while this test is thoroughly reliable in the hands of a skilled analyst, it is beset with so many difficulties, which interfere with its accuracy, that it is of little value except when carried out by a chemist who has had long experience with it; indeed in the hands of a neophyte it is often wholly misleading. This is well shown in the recent cases, where the results obtained by the different analysts were very conflicting. On the other hand, even with unskilled chemists, Reinsch's test, when properly carried out, is thoroughly to be depended on, and is under ordinary circumstances more delicate than that of Marsh. Not the least of its advantages is the fact that it requires but a short time and the simplest apparatus only. Its value is well brought out by no less an authority than A. H. Allen, writing in the *Chemical News*. It is greatly to be hoped that the present agitation will result in placing the tests for arsenic on their proper relative basis.

SOMETIME since attention was called in this column to the fact that in the examination of quite a number of canned goods, tin was found present in every instance. A paper on the same subject by F. Wirthle has appeared in the *Chemiker Zeitung*, dealing with canned meat, mostly beef. The goods were from one to five years old, and in each case tin was found, and, as was also true of the experiments above referred to by Cowan and the writer, only the