tenth of a gram. They were then cut into halves and the seeds were taken out and weighed with the adhering pulp, after which the seeds were removed from the pulp, wiped as dry as possible on a towel and weighed. The percentage of seeds was computed by dividing the weight of the seeds by the weight of the melon. The diameter of the melon was then measured, also the thickness of the flesh and of the rind. The flesh was then tested for firmness, texture and flavor. The flavor was rated on the scale of five as best.

In five melons rated poorest in flavor, the weight of the seeds averaged 1.636 per cent. of that of the melon; in five rated of best quality, the weight of the seeds averaged 1.34 per cent. of that of the melon.

In five melons of 'coarse' texture, the weight of the seeds averaged 1.764 per cent. of that of the melon; in five of 'fine' texture, the weight of seeds averaged 1.364 per cent. of that of the melon.

In five melons having the thickest flesh, the weight of the seeds averaged 1.53 per cent. of that of the melon; in five having the thinnest flesh, the weight of seeds averaged 1.54 per cent. of that of the melon.

In five of the heaviest melons, the weight of the seeds averaged 1.34 per cent. of that of the melon; in five of the lightest, the weight of the seeds averaged 1.684 per cent. of that of the melon.

It appears that so far as texture of flesh and flavor are concerned, Dr. Sturtevant's conclusions were verified.

E. S. GOFF.

WISCONSIN AGRICULTURAL EXPERIMENT STATION.

PREDETERMINED EVOLUTION.

THE American Redstart (*Setophaga ruticilla*) is structurally very widely separated from the true Redstart (*Ruticilla phœnicurus*) of Europe, and yet outwardly resembles it to an extraordinary degree. This fact has caused Professor Alfred Newton (*Ency. Brit.*, XX., 318) to write as follows: "The wonderful likeness, coupled of course with many sharp distinctions, upon which it would be impossible to dwell, between the birds of these two genera of perfectly distinct origin, is a matter that must compel every evolutionist to admit that we are as yet very far from penetrating the action of creative power, and that especially we are wholly ignorant of the causes which in some instances produced analogy."

Cases of this sort may excite our wonder, but they are much more common than is often realized. In New Mexico and Arizona we have a series of numerous species of snails, which possess shells in no way distinguishable, except in a specific sense, from those of the genus *Polygyra*, which is dominant in the eastern States. During the last two years the anatomy of several of these species has become known, and it turns out that they are not even closely allied to *Polygyra*, but represent a peculiar genus which has been named *Ashmunella* (Pilsbry and Cockerell). In Arizona and southern New Mexico there is another series of snails, which has nearly the shell of *Epiphragmophora*, a genus of the Pacific coast. The species were always referred to the last-mentioned genus until Professor Pilsbry recently dissected one of them, *E. hachitana* of Dall. It then appeared that we had here another perfectly distinct genus, which was named *Sonorella* (Pilsbry). But not only do these interesting resemblances occur between species of our continent; they are seen equally between species of different continents. Some of the California species of *Epiphragmophora* so closely resemble the European *Arionta* that naturalists were for a long time deceived. I have recently had occasion to notice the extraordinary resemblance between certain Japanese snails and those of the United States. Thus, *Eulota connivens* (Pfr.) of Japan might easily be taken for *Sonorella hachitana* of Arizona; and *Eulota mercatoria* (Gray) is remarkably similar to *Epiphragmophora fidelis* (Gray), the first being from Japan, the second from Oregon.

Is it possible that we may find a real, if imperfect, parallel between this independent development of similar species and the development of diverse cells in the metazoa? A human being, for instance, contains innumerable cells of very diverse nature, all descended directly from the ovum or germ-cell. If these cells were not parts of an organic whole, but lived separate lives, we should speak of their descent

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?

T. D. A. COCKERELL.

EAST LAS VEGAS, N. M.,
January 29, 1901.

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-