Western mine distributed, as one of the products of their 'Holy Terror,' specimens which they denominated metallic cobalt. The substance looked metallic enough, and local assayers being unable to deny their statement the shares found ready sale for a while. But after a time one doubting Thomas brought his specimen to a museum to see if by comparison with anything there he could establish its cobaltic character. A little comparison showed him that his specimen was carborundum, and carborundum he learned was not made by the reduction of cobalt ore. Whether he imparted this information to others who thought of purchasing shares I do not know, but it is likely that the output of carborundum from cobalt (?) mines received a serious set-back after his discovery.

A Canadian prospector working in a little-explored region found a deposit which for some reason he believed to be zinc ore. He was so well convinced of this that he made his way to a large city for the purpose of obtaining means to work the ore. Visiting a museum where specimens of zinc ore were exhibited, he compared them with his own and at first concluded that the two were identical. On looking further, however, he saw specimens of septaria, which he at once recognized as representing his own specimens. His dreams of a zinc mine were dissipated, but that the awakening had come before he had expended his own and other's means was due to his improving an opportunity to consult an accurately classified and identified, in other words, a scientific collection.

Oliver C. Farrington.
Field Columbian Museum.

SCIENTIFIC LITERATURE.

Darwin, and After Darwin. III. Post-Darwinian Questions, Isolation and Physiological Selection. By the late G. J. Romanes. Chicago, Open Court Pub. Co. 1897.

The writings of the late Dr. Romanes are always interesting, whether one agrees with his conclusions or not. The present volume deserves to be widely read by naturalists, not only as a clear exposition of its author's views on evolution, but as an admirable stimulus to thought and observation. Dr. Romanes, in the closing years of his life, did all he could to bring about the foundation of an establishment for testing experimentally the various hypotheses concerning evolution, but without much success. A few observers have been doing excellent work, but the great majority of working naturalists appear to pay little attention to theoretical considerations, and so lose the opportunity of contributing valuable evidence to throw light on controverted questions.

Under the heading of Isolation it is set forth that this may be of two kinds. In *Apogamy*, or indiscriminate isolation, certain individuals are isolated from their fellows without regard for any peculiarities they may possess; in *Homogamy*, on the other hand, the isolated individuals are isolated because they differ from the rest. Natural selection gives rise to *Homogamy* by preserving certain individuals having desirable peculiarities, thus isolating them from those which, lacking those characters, perish. Any form of *Homogamy* must cause a change of type, and thus constitutes a step in evolution. *Apogamy*, strictly speaking, would not cause any change; but as no two portions of a species are entirely alike, in practice it becomes converted into a slight form of *Homogamy* and in time change results. This is most likely to occur when the separated portion is very small, as the average of a few individuals is less likely to resemble that of the whole species than the average of, say, half the species.

It is set forth that there are two forms of evolution, the *monotypic* and the *polytypic*. Natural selection, it is stated, can only cause monotypic evolution; therefore to explain the multiplication of species in space we must call in the aid of other forms of isolation. One potent cause of isolation is said to be *Physiological Selection, i. e.*, the segregation of sets of individuals which are fertile with one another, but wholly or partly sterile with the rest of the species.

All these matters are discussed in detail, with many quotations from previous writings. On p. 41 it is remarked that "against the view that natural selection is a sufficient explanation of the origin of species there are two fatal difficulties: one, the contrast between natural

species and domesticated varieties in respect of cross-sterility: the other, the fact that natural selection cannot possibly give rise to polytypic as distinguished from monotypic evolution." The author adds: "Now it is my belief that the theory of physiological selection fully meets these difficulties."

To the present writer, these objections to the sufficiency of natural selection seem not to carry weight, but the matter can only be suitably tested by observation. In the first place, it remains to be shown that polytypic evolution, in the sense intended by Romanes, occurs commonly in nature. Cases are cited in which different species of plants appear to be originating in the same area, but it is by no means proven that they did not originate in different localities and have since intermingled. And even if they have been confined from the beginning to an apparently uniform environment, it will be very hard to prove that the uniformity is real, so that there is no opportunity for natural selection to act differently on the different parts of the original species. It seems to me that, given diverse conditions of life within a limited area, natural selection may operate not only to bring about the division of a species into two or more, but also sterility between them. Let us take the case of such grasshoppers as are found on the sandhills of New Mexico. Some are green and live on the herbage; others are light brown, the color of the ground on which they commonly rest. Each kind will gain some advantage from its color, combined with its habits. Suppose that these are still mutually fertile varieties of one species, the greenish and brownish specimens will cross, and the formation of two races will be hindered.* But there will be variations in fertility, and those which are most fertile together, and at the same time of identical colors, will have an advantage. Hence the correlation of, say, greenness with certain variations of the reproductive organs, will be seized upon by natural selection and perpetuated. Even in ordinary monotypic evolution those individuals which are specially fertile *inter se*, or infertile with those unlike them, and *at the same time possess beneficial characters*, will have an advantage, and the peculiarites of the reproductive organs will be increased through natural selection. Another case is that in which two varieties, mutually fertile, have originated in different localities, but afterwards occupy the same territory. When they meet (as has been actually observed in some cases) hybrids, or mongrels, will be formed all along the line, and it appears as if the peculiarities of each form will eventually be lost. But any small percentage of either variety which has in common some variation of the reproductive organs, leading to physiological isolation, will be left alone to represent the original variety; and as that variety is fitter to survive than the mongrel it will supplant it, and we shall have a species which is infertile with its allies. That it will be infertile with all, or nearly all, its allies is probable because the variations of the reproductive organs are so numerous and so diverse that it is not likely that exactly the same sort of variation will be selected in any two cases.

Thus, while natural selection might employ physiological (more properly, sexual) isolation in the formation of species, it is not quite apparent to me that such isolation would of itself cause divergence. For while sexual isolation would be homogamy as regards that variation —which is by itself the reverse of beneficial—it would be apogamy as regards other variations, since it is not shown that it is correlated with any particular modifications of other kinds. So the isolated individuals, having no advantage, but some disadvantages from their isolation, would tend to be eliminated rather than to increase, owing to the operation of natural selection.

As telling against the necessity for natural selection in the formation of species, Mr. Gulick's statements regarding the land-shells (Achatinellidæ) of the Sandwich Islands are quoted. In these islands it appears that almost every valley has a distinct variety or species, and yet the conditions of existence are apparently the same in at least many of the localities.* Mr. Gulick considers

* Unless there arises a green and brown dichroism within specific limits, as in one species known.

* I have never been to the Sandwich Islands, but can testify that in Jamaica, which also has a remarkably varied molluscan fauna, there are many different conditions of soil, moisture, vegetation, etc., consti-

the distinctions to be due to isolation, without any reference to utility. Suppose a variable type to occupy a valley, A. A few examples wander to valley B and start a colony. Their average is not the same as that of the whole population of the place whence they came; hence the colony will differ more or less, from the start, from the parent race. If this difference is not harmful it will be perpetuated.

The proposition that natural selection can have nothing to do with these changes seems to need examination. It is possible, for example, that when birds have got used to eating variety A in valley A they will not so readily observe and attack a different variety in the neighboring valley B. On crossing into B they might certainly be expected to look for and first attack examples similar to those they had before eaten; hence the new variations would be neglected and get some advantage. Another point is that in a variable species certain individuals will be selected by reason of characters which are, perhaps, not visible externally, *e. g.*, the ability to digest a new sort of food. When these individuals are selected out of many, in the home of the species, they will probably be of diverse varieties, and so no special color-strain, for example, will arise. But let a few examples migrate, and of these only a few survive, it is probable that these survivors will have correlated with their useful characters certain others which are not in themselves valuable.

Much more might be said, but these few criticisms will serve to indicate the problems discussed in the work; and, it is hoped, to suggest lines of observation to those who can help to give us knowledge in place of hypotheses.

T. D. A. Cockerell.

Mesilla Park, New Mexico,
March 25, 1898.

tuting different environments for the snails. The Sandwich Islands are elevated, and it is quite certain that the greatest precipitation of moisture must occur at the higher levels, and on the side of the islands first reached by the prevalent winds. On sloping ground there must also be marked differences of sunlight; and, in short, it may be regarded as certain that the Sandwich Islands valleys do not offer identical conditions.

Penikese; a Reminiscence by One of Its Pupils. Albion, N. Y. 1895. Pp. 95. Price, $3.00.

This is a work dedicated by an unknown author 'To all to whom the memory of Penikese and its Master is dear.' We note in the preface that 'the material of which this little volume is composed furnishes the apology which its author would make for its appearance,' and that 'it seems best no longer to withhold its pages from the public.' The material does not furnish an apology; what the public has done to provoke its publication is not stated, and unsuspecting librarians who may be inspired with everything that bears the name of Penikese should hesitate before placing their orders.

The first chapter, 'The Journey,' is largely devoted to a description of a New England hay field and the antics of a sunbeam in an obscure New Bedford hotel. In the second chapter we learn how 'two score and ten specialists' met together 'on this desolate island,' how they scrambled for their baggage, and how the author took a nap, and what he dreamt, on the afternoon of his arrival. In chapter five the general details of the laboratory are discussed. The author tells us that there were 'bottles of alcohol, sea water, glycerine and other preserving fluids;' how there were 'the remains of a skate fish with the brains exposed' to show 'the five pairs of nerves and their surroundings exactly as they exist in nature;' how the snails 'lay their eggs, in large numbers, bunched together and sticking to each other;' how 'snails' eggs are opaque and white, being longer than broad.'

Writing of one of the leading naturalists, the unknown author says: "Sometimes he tells us about that most wonderfully curious appendage of the bivalves or the lamellibranchs, the crystalline style, and of how it has no attachment to body; this leads to an investigation, and our discoveries are marvelous."

Further on we read as follows: "Ciliary motion ten foot square would exert a force equal to ten tons." * * "One species floats on the surface of the ocean when it is calm. * * specimens, *specimens*, *specimens*, EVERYWHERE. Our professors lecture to us of nothing else; our time is spent in securing and dissecting them." * * "It is from such sketches of our lectures as