to expect a popular treatise on all orders of insects, an idea at once dissipated by the title-page. There are other books covering the same ground that would answer the young student's purpose as well as this. Judging it in comparison with the multitudinous other compilations from the same pen, we have no very particular fault to find. It is sketchy, but in some respects it compares favourably, especially in some of the explanations concerning the *Coleoptera*. Some of the illustrations are good, others wretchedly bad, and unrecognisable without the explanations. When comparing the "nervures" in the wings of a butterfly with the "rays" in the fins of a fish (p. 178), the writer should have explained the minute structure of both.

The real point at issue in connection with books of this nature is their effect. They are eminently rudimentary, and not elevating. Let us take instances from the book now under review. At p. 14, after an explanation of the terminology of the external skeleton of a beetle, we read:—"At first some of these terms may appear to be harsh, repulsive, and difficult to master. In reality they are not so, and a knowledge of them is absolutely necessary to any one who wishes to understand the description of an insect." This is a very sensible remark. Yet throughout the book the utmost favour is bestowed upon absurd meaningless "English" names. The culminating point of absurdity is reached at p. 276. Amongst the small moths the author "figures" one (under a misspelt generic name), and because it (out of several hundred other fortunate little moths) has received no "popular" name, he terms it the "*Brown Dolly*"!

Anthropo-Geographie oder Grundzüge der Anwendung der Erdkunde auf die Geschichte. Von Dr. Friedrich Ratzel. (Stuttgart: Englehorn, 1882.)

We have had occasion to speak of the wide extension which geographical science has taken in Germany, and of the broad and intricate field which it covers. The work before us is a good example of this. It is the first of a series of geographical handbooks, which is to include "General Geology," by Prof. von Fritsch; "Oceanography," by Dr. von Boguslawski; "Geographical Distribution of Animals," by Prof. L. von Graff; "Climatology," by Dr. Hann; "Glaciers," by Prof. Heim; "Volcanoes and Earthquakes," by Prof. von Fritsch; and "Botanical Geography," by Dr. Oskar Drude. Dr. Ratzel's volume must not be mistaken for a treatise on Anthropology. That subject it only incidentally includes, its main purpose being to point out in detail the light which geography sheds upon history and the development of social and political economy. The author discusses the various conceptions of geography, its place among the sciences, the human element in geography, and the relations between geography and history. After a brief introduction on these points, the author proceeds to consider, in the second part, natural conditions, and their influence on mankind. Under the head of position and aspect of the dwelling-places of man, pointing out the parts which continents, islands, and peninsulas have played in the distribution of the human species and in history, he devotes a chapter to states and the various conditions which determine their boundaries, and in another discusses the distribution of centres of population. In a chapter on conditions of space he discusses the subject of great and small states, and the connection between the extent and power of states, and has some specially interesting remarks on what he calls the continental type of history. In a section on surface-forms, the author treats of such subjects as the inequalities of the earth's surface and of the contrast, ethnologically and historically, between mountainous and flat countries—of plains, steppes, and deserts. To the important subject of coast-lines, and the dependence of a country's development on their form, a

chapter is devoted, and two to the historical importance of water, in its various forms of sea, lakes, rivers, and marshes. Considerable space is, of course, given to climate and to the animal and plant world. One of the most interesting chapters is that on "Natur und Geist," in which Dr. Ratzel attempts to show the great influence of a people's surroundings on their mental and moral development. In two concluding chapters the author gathers up the lines of discussion, referring especially to the subject of human migration, its influence on history, and its effect on the mixture of races; and finally points out the practical bearings of his subject. Thus it will be seen that, whether the subject comes legitimately under the conception of geography or not, Dr. Ratzel has written a work of great interest and of much utility to the historian who wishes to treat history in a scientific spirit. It is both instructive and attractive reading.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Mimicry in Moths

I OBSERVED here, a few days ago, a case of mimicry which interested me much, and may deserve mention. The weather has been such as is usual on this part of the Riviera at this season. There has been a very hot sun, with sometimes a very cold "mistral" wind. Insect life is abundant, and not a few of our summer *Sylvia*æ seem to secure a very good living. Flies are a plague. Mosquitos are not wanting. Bees are busy, and large dragonflies hunt continually. But there is one order of insects "conspicuous by its absence," and that is the *Lepidoptera*. Neither the diurnal nor the nocturnal species have been visible.

I was much surprised, therefore, one day last week to see a large insect of this order come from above the olive trees overhead, with the wild dashing flight of the larger moths. Attracted apparently by the sheltered and sunny recess in which I was sitting and by the scarlet geraniums and bignonias which were in full flower in it, the moth darted downwards, and after a little hovering, settled suddenly on the bare ground underneath a geranium plant. I then saw that it was a very handsome species, with an elaborate pattern of light and dark chocolate browns. But the margins of the wings, which were deeply waved or dented, had a lustrous yellow colour, like a brilliant gleam of light. In this position the moth was a conspicuous object. After resting for a few seconds apparently enjoying the sun, it seemed to notice some movement which gave it alarm. It then turned slightly round, gave a violent jerk to its wings, and instantly became invisible. If it had subsided into a hole in the ground, it could not have more completely disappeared. As, however, my eyes were fixed upon the spot, I soon came to observe that all the interstices among the little clods around it were full of withered and crumpled leaves of a deep blackish brown. I then further noticed that the spot where the moth had sat was apparently occupied by one of these, and it flashed upon me in a moment that I had before me one of the great wonders, and one of the great mysteries of nature. There are some forms of mimicry which are wholly independent of the animals themselves. They are made of the colour and of the shape which are like those of the surrounding objects of their habitat. They have nothing to do except to sit still, or perhaps to crouch. But there are some other forms of mimicry in which the completeness of the deception depends on some co-operation of the animal's own will. This was one of these. The splendid margins of the fore-wings, with the peculiar shape and their shining colour had to be concealed; and so, by an effort which evidently required the exertion of special muscles, these margins were folded down—covered up—and hidden out of sight. The remainder of the wings were so crumpled up that they imitated exactly the dried and withered leaves around.

Knowing the implicit confidence in the effectiveness of this kind of concealment, which is instructive in all creatures furnished with the necessary apparatus, I proceeded to try and test this very curious psychological accompaniment of the physical machinery. I advanced in the full sunlight close up to the moth—so close that I could see the prominent "beaded eyes" with the watchful look—and the roughened outlines of the thorax, which served to complete the illusion. So perfect was the deception that I really could not feel confident that the black spot I was examining was what I believed it to be. Only one little circumstance reassured me. There was some hole or interstice in the outer covering, through which one spot of the inner brilliant margin could be seen shining like a star. Certain now as to the identity of the moth, I advanced still nearer, and finally I found that it was not till the point of a stick was used to move and shake the earth on which it lay, that the creature could believe that it was in danger. Then, in an instant the crumpled leaf became a living moth with powers of flight, which would have defied capture.

I recollect that many years ago Mr. Wallace kindly showed me a butterfly from the Eastern Archipelago whose upper wings were of a brilliant colour, but which, by the simple act of alighting on a branch, and of folding or closing its wings, became transformed into the perfect likeness of a growing leaf—a likeness so perfect that even the closest inspection only discovered new items of resemblance—inasmuch as the leaf-stalk, as well as the venation of the leaf, were all perfectly represented both in the structure and in the colouring of the under-surface of the wings.

I confess that the number and intricacy of the correlated growth and instincts which are involved in the phenomena strike me more and more as wholly outside the sphere of mere physical causation—by which I do not mean that physical causation has not had its own share of instrumentality in the matter, but that it affords no satisfying explanation of all the elements involved. The ordinary phrases of the Natural Selection Theory appear in the light of such facts to be little better than lean and empty formulæ.

ARGYLL

Cannes, November 29

Double Flowers

I AM indebted to Baron von Mueller for the communication of double flowers of *Tetratheca citiata*, which possess interest on several grounds, although the changed appearances they present are not infrequent. It may be well to premise (1) that the plant, like all its fellows of the same order (Tremandraceæ), is native to extra-tropical Australia; (2) that, under ordinary circumstances, it has 4 free sepals, 4 free petals, 8 free stamens in a single row, and a two-celled ovary; (3) that "doubling," in a strict sense, is brought about by the multiplication of petals, or by the more or less complete substitution of petals for stamens, or pistils, or both.

The Australian origin of the plant in question is so far of interest, in this connection, that it affords one more illustration of the occurrence, under natural conditions, of double flowers in a division of the globe where, according to the late Dr. Seemann, such forms are rare. The rarity, however, I believe, is not so much in the existence of such flowers, as in the number of observers, at any rate we now know of several cases of the kind.

Some of the flowers sent by Baron von Mueller were double by multiplication of petals, *i.e.* there was a second row of petals inside the first, others were double not only by multiplication of petals, but also by the partial substitution of petals for stamens; thus in one of these last-mentioned flowers, there were four sepals, three rows of petals, one of the innermost row being partly stamoid, and eight stamens in a single row. Of these eight stamens, six were perfect and the remaining two partially petaloid, one lobe of the ordinarily 4-celled anther being destitute of pollen, but enlarged into a relatively large petal-like lobe with inflexed margins. So that according to the old notion, this flower affords an instance both of progressive and of retrogressive metamorphosis, of enhanced and of arrested development associated with compensatory changes. On the hypothesis revived by Mr. Grant Allen—for it is no new notion—the two outer rows of petals would be stamens flattened out of all knowledge, while the inner row and the staminal whorl would, I presume, also afford him evidence of the truth of his opinion. For my own part I prefer to adhere to the established order of things, in which the horse precedes, rather than follows the cart, and I do so because to do otherwise would be to run

counter to what we know of the homologies of the foliar and floral organs, of leaf-buds and flower-buds, and to ignore or rather to reverse what we know of the mode and order of development of flowers in general.

Not being aware of the precise order of evolution in the flower in question, I can only reason from analogy when I express my opinion that the changes it presents and the order of arrangements of its parts from the leaves on the flower-stems up to the pistil are more consistent with the generally adopted views of morphology than they are with Mr. Grant Allen's. According to his views, so far as I understand them, I can see no reason why the sepals as well as the petals should not be flattened stamens, and if the sepals why not the bracts? if the bracts why not the leaves? The theory would thus do away with the possibility of indigestion in plants, or at least the primordial plant, could not have been troubled in this way, for it would have had no digestive organs.

I have only to add that the flowers in question offered no explanation of the great peculiarity presented by the existence of a single row of stamens in number double that of the petals. Possibly this may be the result of bifurcation at a very early stage of development. It was hardly to be expected that they would throw any light on the equally curious "obdiplostemonous" arrangement in the nearly-allied genus *Platytheca*, in which there are two rows of stamens, the outermost being superposed or opposite to the petals, instead of being alternate with them, as is usually the case in stamens so placed. A possible explanation of this in a sense partly consistent with Mr. Allen's views would be to consider the petal as in this case an outgrowth from the stamen, and not a separate organ, a view that has been propounded in the case of Primulaceæ and some Malvaceæ.

MAXWELL T. MASTERS

Fruit of Opuntia

DR. ERNST's abnormal fruit of *Opuntia*, as figured at p. 77, appears to be similar to one described and illustrated by Zuccarini (*Abhandl. d. math. phys. Class.*, B. iv., Abth. i., tab. ii.) in the case of *Cereus serpentinus*, but as Dr. Ernst gives no details as to the arrangement of the vascular bundles, it is impossible to say that the two cases are exactly parallel. The resemblance to certain gourds (*Cucurbits*), wherein the upper part of the fruit protrudes beyond the dilated end of the flower-stalk, may also be pointed out.

MAXWELL T. MASTERS

Hawk Moth Larva

I FORWARD a sketch of the larva of a hawk moth found in the Khasi Hills, Assam, in the position it assumes when disturbed. Its resemblance to a snake will be at once evident.

The head (just visible in the sketch) and two first segments of the body are retracted, and the third pair of

pale horn colour have a rough resemblance to lower jaw or teeth. Small imperfect ocelli in the third segment might be taken for nostrils. The ocellus on the 5th segment, which however, is not so conspicuous as that on the 4th, rather spoils the general effect.

The colour is olive brown reticulated with black and imitates a reptile's scales very perfectly. The lower parts are black,