by the agency of small animals quoted as if they were well-established facts (p. 184). Chara is spoken of as "a sort of transition stage" between the red and brown seaweeds (p. 199). We fail to find any grounds for this extraordinary statement. We are informed that in Selaginella "the rain or dew will settle in the hollow of the leaf, and help to float the zoosperms; but in Pinus their dry and motionless representatives are more exposed to the wind on the outer surface of the leaf" (p. 279). It would be difficult to frame a sentence more hopelessly inaccurate than this.

The following passage from the introductory chapter is worth quoting: "Morphology by itself is thus seen to be a matter of mechanism, revealing nothing higher than a combination of mechanical movements, harmonious in action and beautiful in execution; but physiology, dependent on structure for the interpretation of the phenomena of life and the causes thereof, seeks to reveal the inner life as well as the outward expression of it" (p. IO). It will probably be new to most of us to learn that morphology reveals movements at all, mechanical or otherwise.

logy reveals movements at all, mechanical or otherwise. At p. 179 "apogamy" and "self-fertilisation" are used as equivalent terms; at p. 138 Spirogyra is said to produce gonidia, and at p. 25 reproduction in Selaginella is said to take place by means of a true seed.

We have only cited a few examples of positive errors, but throughout the book the terminology is strange and confusing, even where not absolutely incorrect.

The book is presumably intended for students "cramming" for examinations, but even for this purpose we fear that it will prove worse than useless. D. H. S.

## LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can be 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 insure the appearance even of communications containing interesting and novel facts.]

## Vitality, and its Definition

It is perhaps desirable that I should offer a few words of explanation, by way of reply to several of your correspondents, who have commented upon certain statements in my recent address to the Geological Society. In the first place, I think that any candid reader of that address

In the first place, I think that any candid reader of that address will acquit me of being guilty of such presumption as to make a statement, on my own authority, concerning the vitality of seeds. My object was to contrast the greater stability of mineral structures with the lesser stability of animal and vegetable structures. Consequently I selected what I thought would be regarded as the *extreme* examples of prolonged vitality in the animal and vegetable worlds respectively. It was quite sufficient for my purpose that competent botanists have cited the case of the germination of seeds taken from ancient Egyptian tombs as authentic, and that a botanist of such eminence as A. de Candolle should assure us that it is "not impossible." As a matter of fact, I have been informed, however, by a reliable authority that experiments on the germination of seeds taken from mummies have very recently been conducted to a successful issue.

With respect to Mr. Herbert Spencer's definition of life, my object was not to find fault with it but to show that the differences between "organic" and "inorganic" matter are of so shadowy a kind as to defy definition. Even straining the meaning of the word "correspondence" so as to give it the force implied in the passage cited from the "Principles of Biology" by your correspondent Mr. Collins, I maintain that in those changes undergone by minerals to which I apply the term "physiological" there is a complete "correspondence with external sequences." When the temperature of a crystal is altered through a certain range, expansion and contraction take place unequally in accordance with the molecular structure of the mass. In consequence of this unequal expansion and con-

traction, stresses are produced and the crystal undergoes an internal molecular rearrangement, which is determined by a latent "organisation," though it can only be detected, perhaps, by its action on the light-waves. But now let another set of forces come into play, namely, the chemical action of liquids containing gases in solution, and immediately the effects of the former change are seen in the manner in which the crystal yields to the new forces operating upon it. This *scondary* change is in fact only rendered possible by the primary one having taken place. But the changes produced by solvent action in turn weaken the stability of the whole mass, permitting other chemical affinities to assert themselves, in consequence of which the crystal enters upon a long series of metamorphoses which terminate in the complete "dissolution" of the ties that held together its molecules; it thus becomes a pseudomorph, a sort of mineral corpse, with the external form of the original crystal only, but without any of that capacity for undergoing a wonderful cycle of changes which was its original endowment. After this the materials of the "dead" crystal may be used up to form the substance of new ones.

It is scarcely necessary to add that I had no serious intention of asserting that minerals do actually live, in the sense in which "living" is popularly understood. All I care to insist upon is that minerals, like animals and plants, go through definite cycles of change, dependent on their environment, and that the dis-tinction between "organic" or "living" matter and "inorganic" or "lifeless" matter is therefore not a fundamental one. Surely no better proof of this can be adduced than the fact that the more exact we try to make our definitions of the terms "life" and "organisation," the more shadowy and intangible become the distinctions upon which we are driven to depend. I am perfectly satisfied with Mr. Herbert Spencer's admission of "insensible modifications and gradual transitions which render definition impossible." But if this be the case, it is surely not wise to maintain that the science of "non-living" beings must differ totally in its aims and its methods from that of "living' To bring out into clear relief the analogies between the beings. science dealing with the mineral kingdom and those concerned with the animal and vegetable kingdoms was the main object of my address. JOHN W. JUDD March 28

## "The Gecko moves its Upper Jaw"

THUS by the substitution of one reptile for another—of the geckc for the crocodile — the well-remembered zoological statement in Arnold's Greek prose is at length put upon a satisfactory foundation. In the spring of 1886, I captured a small gecko (*Tarantola mawitanica*) at Rome, and I have hitherto succeeded in keeping it alive and in health. One of the first things I noticed about it was the extraordinary vigour with which so small an animal would bite one's finger. And the effect produced was certainly rather due to the lizard's expression of intense ferocity during the process than to the pinch which it was



FIG. 1.—The Tarantola in the normal position of rest.



FIG. 2.—The Tarantola prepared to bite, with the upper jaw raised.

FIG. 3.—The Tarantola biting,—a common position, in which the upper jaw is depressed below the normal.

able to give. The expression chiefly depends upon two things the fact that the anterior part of the head may be bent downwards, and that the eyes are retracted into the head. Examining the former movement more carefully, it was seen that in opening the mouth the upper jaw is distinctly although slightly raised above the normal, so that the profile of the upper surface of the head becomes almost straight (compare Figs. I and 2). In biting fiercely it is common for the upper jaw to be depressed below the normal, as is plainly seen in a profile view (compare Fig. 3), although in other positions the curvature of the head is