This is of interest in the study of cosmic development.

C. B. WARRING.

Poughkeepsie, N.Y., June 16, 1883.

Flight of the flying-fish.

The difficulties in the way of accurate observation of the flying-fish in motion are numerous and real. Seen always from above, usually at a distance which is constantly increasing, and while the observer himself is in rapid motion, it is not strange that such conflicting opinions exist, or that the mode of flight is so often spoken of as a mystery.

During a trip by steamer from New York to Rio Janeiro *viâ* the West Indies and Pará, and on the return trip coming directly from Rio to New York, I watched flying-fish nearly every day, and frequently all day, and satisfied myself on the following points: —

The fish usually leaps clear of the water at once, leaving it commonly at an angle of 45° or less. After leaving the water, no forward impulse whatever is received (except sometimes from the wind) until the water is again touched, when the tail may be used effectively without immersion of the rest of the body. Very soon after leaving the water, yet not instantly, the pectorals are spread, and an instant later the ventrals.

Both sets of fins are kept *quietly* extended so far as any *voluntary* vibration is concerned. Any similar, tensely stretched membrane would quiver more or less when cutting the air at such speed.

Ordinarily the two pectorals lie in about the same plane. They are never carried much below the body, but are frequently lifted considerably above it, especially when going before the wind, at which time the whole fish rolls from side to side, precisely as does a sailing-vessel under similar circumstances. The course may be a simple curve, as it commonly is in calm weather, or it may be undulating, as is usually the case in rough weather or over a heavy swell. I think the ventrals are used to direct the fish up or down, as they certainly work independently of the pectorals, and closing them would naturally drop the tail. Toward the close of the first stretch, and when the fish wishes to re-enter the water, the pectorals are instantly closed, and he shoots head foremost into the water with only a slight splash.

If, on the contrary, he wishes to continue in the air, the long lower lobe of the tail is allowed to drop into the water, and a few vigorous strokes send him upward and forward, sometimes enabling him to clear another hundred feet before repeating the action, which I have seen him do at least seven or eight times before finally entering the water for a fresh start.

Not unfrequently the tail is dropped, seemingly by closing the ventrals, and an undulating motion so obtained, even when there are no waves or swells to be cleared; and, although the tail may not then touch the surface, it looks as if the fish were *feeling* for the water, which I think is really the case. The poetic wetting of the wings in the crest of a wave so as to prolong the flight appears to be a harmless bit of imagination for all but the fish: to him it is disastrous. His tail alone needs wetting; and, when by mistake he takes the top of a wave bodily, it usually topples him over, or at least checks him noticeably. The drying of the wings would be rather favorable than otherwise.

I was not able to detect any voluntary change of direction to right or left while in the air.

Once a large fish rose quite close to us, and started directly toward the steamer. When within a few yards, he suddenly closed his pectorals, plunged into the water, and almost instantly issued again in a nearly opposite direction.

Examination of a Pacific species in alcohol (and I presume the same general structure holds good for the genus) shows that the pectorals are inserted at such an angle with the axis of the body, that, if the body be horizontal and in motion, the air striking on their lower surfaces must tend to raise the fish, although at the expense of a certain amount of forward motion. Evidently, then, any beating of the pectorals would only retard the fish still more, even if it did support him somewhat in the air. The conclusion seems inevitable, however, that the tail alone is the propeller, the other fins acting solely and passively as supporters.

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HEITZMANN'S MICROSCOPICAL MORPHOLOGY.

Microscopical morphology of the animal body in health and disease. By C. HEITZMANN, M.D. New York, *J. H. Vail & Co.*, 1883. 19+849 p. 8°.

DR. HEITZMANN, formerly of Vienna, now of New York, is well known as an unusually good histological draughtsman. Ten years ago he published some investigations on the minute structure of protoplasm. To his own researches on this subject he has long attributed an importance which scientific men of much greater experience and ability have failed to recognize. The present volume, a very well made and beautifully illustrated book, although it comes in the guise of a manual of normal and pathological histology, is obviously intended principally to bring forward the author's own theories, and to insist upon their fundamental character and great value.

The author so openly implies his conviction that he is a neglected grandeur, that he incites the critic to a severity of comment that a tone of modesty more commensurate with the real value of his researches would not have called forth. The general defect of the book is want of judgment on the author's part, and an exaggerated confidence in his own notions. Thus, being unusually skilful with his fingers, he scoffs at microtomes (p. 7), and closes a slurring paragraph upon them with, "The greater the complication, the less is the value of such machines." A man who makes such a statement without any limitation reveals a hopeless lack of comprehension of the indispensable requirements of many branches of histological investigation. The second chapter in the book discusses the general properties of living matter, and contains a number of characteristic loose assertions: for instance, "Life is evidently a peculiar kind of motion of the molecules (plastidules) of living matter, of a relatively short duration" (p. 14). This is

simply a false statement, since the utmost that could be said is, that unknown molecular changes occur in living organisms. There is no basis for saying that life is 'a peculiar kind of motion,' much less that it is evidently so.

The pages from 20 to 142 are essentially an extended exposition of the author's theories in regard to cells and protoplasm, which he groups under the general term of 'the bioplasson doctrine.' He maintains that all protoplasm is a network, that the nucleus is only a part of the network, and that the network of the so-called 'cells' is really continuous, the whole body forming one mesh. The cells are not distinct elements, but only partially differentiated centres of the mesh: he drops the term 'cell' altogether. He very complacently explains that he has revolutionized the generalizations of all histologists before him, but admits that he expects recognition only from the future. "The present generation of histologists will very probably never realize the harm done by the misnomer 'cell,' etc." (p. 57).

Unfortunately, Heitzmann has entirely overlooked the extremely obvious reasons for rejecting his bioplasson doctrine. He mentions (p. 134) the independent cells, which migrate within the body, but merely remarks that their occurrence 'does not alter the general rule.' If he had been acquainted with the work of the last few years by Fleming, His, Hatschek, and many others, upon the development of tissues, he would have known that a great many of them are derived from just such independent cells, forming a natural group, for which the brothers Hertwig have proposed the name 'mesenchyma.' The existence of these tissues alone suffices to overthrow the theory of a continuous protoplasmatic network as the basis of organic structure. Further, he has overlooked that during segmentation of the ovum a complete separation of the cells is effected: hence it is self-evident, that, even if the network of adjacent cells is found to be continuous in later life, such a disposition is secondary, and cannot, therefore, possess the fundamental significance our author has assigned to it.

As the part, so is the whole, with numerous defects from want of judgment or wider knowledge, and blemishes from want of modesty. The largest part of the volume is taken up with accounts of the various tissues and organs and the pathological changes in them. There is little sense of proportion, — eight pages are given to the cornea, but only one-third of a page to all the sense organs; sixty-three pages to the teeth, and barely two to the development of nervous tissue. If he is to be judged by those two pages, we must assume the author to be entirely unacquainted with the literature of his subject, and to have made no accurate original observations. Indeed, throughout the volume the attention bestowed on recent histological literature is so meagre that it impresses us as an intentional and convenient neglect, rather than as the outcome of ignorance and oversight.

The unequal attention given to different topics renders it impossible to regard the volume as a text-book, although it imitates the form of one. It is really a series of special arguments, or, to speak more accurately, of bare assertions, to prove that the bioplasson doctrine is true of certain tissues. This attempt would be excellent in a series of scientific articles which discussed the doctrine by accurately stating careful and exact observations, and judiciously considering the objections. The author, however, ignores even these elementary requirements of logical argument. On the contrary, as is not unusual with persons of narrow views, he is excessively dogmatic. Of a rigorous scientific demonstration there is only pretence.

Besides the main text, there are numerous contributions in fine print by twenty other writers, whose articles nearly all partake of the singularities of the chief portion of the work.

Those descriptions which do not touch upon the bioplasson doctrine, but merely recite the elements of histology, such as they may be found in numerous text-books, are more accurate than the rest. The style of the book is good, clear, and simple. The presentation of the subject-matter is well arranged and natural. Many of the illustrations are excellent, some could hardly be improved, and all are good in point of technical execution. A large proportion are said to represent the bioplasson network in various tissues: of those that are purely diagrammatic, it can only be said that they are pictorial theories; those, however, which are stated to be drawn from the tissues, represent an organization which we cannot admit to be actual, — a number of spherical granules of nearly even size, and at even distances from one another, connected together by threads of uniform diameter. We believe that figs. 10, 32, 66, 114, 120, and others, showing this pattern of globules and linking threads, have their prototype in the author's imagination, which has distorted the actual

appearance of the protoplasmatic network of cells. If these appearances are real, Dr. Heitzmann's best plan of securing recognition for his views would be to send preparations to be examined by histologists of experience in research. The discovery of the reticular character of protoplasm is very interesting, and our author deserves praise for insisting on this point; but we find in his volume little to awaken the expectation that it will earn recognition for the 'bioplasson doctrine;' which, in our opinion, is not shown to deserve serious consideration, although it is possible or even probable that in certain cases a secondary connection is established between the protoplasm of adjacent cells.

It should be added that special consideration of the pathological chapters has been purposely omitted from this notice as inappropriate here.

EUROPEAN ORTHOPTERA.

Prodromus der europäischen Orthoptera. Von C. BBUNNER VON WATTENWYL. Leipzig, *Engelmann*, 1882. 32, 466 p., 11 pl., map. 8°.

THE activity of systematists within the past thirty years has rarely received a more striking proof than in the publication of the volume before us. When H. Fischer published his classic work on European Orthoptera, the number of recognized species on that continent was less than two hundred and fifty. Brunner, one of our leading writers, now places the number at very nearly double the former figure. The increase is particularly marked in the Locustariae, which have nearly trebled.[1] Already, while Fischer's work was passing through the press, Fieber was making discoveries in the little worked region of south-eastern Europe; and, of late years, Bolivar and others have shown how little the Iberian peninsula was known; yet one would scarcely have looked for such striking additions in so old a field as Europe, and among such bulky insects as the Orthoptera.

Meanwhile there has been great activity in the study of Orthoptera of other parts of the world; and it may safely be said, that, if the number of European Orthoptera has doubled, that of the world at large has quadrupled in the same period. This has entailed much revision and remodelling, in the work of which Brunner, Saussure, and the gifted and lamented Stål, have performed the most honorable part, though they may have been outdone in (diluted) quantity by Walker.

[1] Brunner credits Ephippigera with forty-nine species, of which only ten are given by Fischer. The additions are largely from Bolivar's work in Spain.

There was need, then, that some one should crystallize the methods of recent days for a region so abounding in workers as Europe. This Brunner has now attempted.

He disclaims at the outset any attempt at a monograph. Europe, he rightly says, is no natural province, and the Orthoptera, in the sense of the older naturalists as used in his work, no natural order. For the convenience only of the numerous workers in this region upon the somewhat heterogeneous groups which have been classed under Orthoptera, he issues this Prodromus. It is excellent as a systematic review. The groups are clearly and succinctly defined, but the work is mainly of value in a faunal sense. There is no superfluity of language; analytical tables abound; the balance of parts is admirable; every genus is well illustrated; and, as an expression and synthesis of current toxonomic views, it will serve a most useful purpose. But the biology of these insects is entirely and purposely overlooked; and there is yet room for some one, working upon the excellent model of Fischer, but with the light the newer biological studies have given, to produce a work which shall be classical, and far more fruitful than this can be.

MACHINERY AT PARIS, 1878.

Rapports du jury international, groupe VI., classe 54 : Les machines et les appareils de la méchanique générale. Par M. HIRSCH, ingénieur des ponts et chaussées. Paris, *Imprimerie nationale*, 1883. 8°.

M. HIRSCH has collated and edited the notes of the members of the section of the jury of which he was secretary, and compiled a very extensive and detailed report, with the addition of considerable matter original with himself, thus making a valuable work of the official report. The principal classes of exhibits here examined are steam engines and boilers, with their accessories (divided into stationary and locomotive engines and portable machines), hot-air engines, electric and other motors, hydraulic machinery, compressed-air apparatus, machinery of transmission, machinery of transportation, dynamometers, and miscellaneous parts of machinery. There seem to have been no steam-boilers or accessories from the United States except the Hancock inspirator, which is well noticed. The engines of Corliss and Wheelock are studied at length, and apparently with very satisfactory results, the latter taking the *grande médaille*. A large number of engines were exhibited, — copies of the American Corliss engine, which has evidently