also imported 3,211 hundredweight of husks and shells of the cocoa-bean, which are also used up for cheap cocoa. There are about ten chocolate and cocoa manufacturers in Holland, whose yearly requirements of cocoa-beans may be estimated at 3,000 tons, in round numbers, principally of Guayaquil, Caracas, and Domingo kinds. They mostly manufacture cocoa preparations, known by the name of soluble cocoa, cocoatine, and cocoa-powder; viz., the roasted and powdered cocoa-beans deprived of most of their natural fat, or the cocoa-butter, which is used as a valuable ingredient by manufacturers of chocolate and cocoa sweetmeats, and also for pharmaceutical preparations. In the early part of last month no less than twenty-five tons of this cocoa-butter was sold in Holland, and fifty tons in London. The oldest of the Dutch cocoa-works was founded on a small scale more than a century ago, and most of the other works have existed from forty to sixty years; but all of them remained insignificant until the before-mentioned powdered preparations found their way to foreign countries, especially England and Germany, where certain Dutch brands of powdered cocoa have been very well received and enjoy a large sale. There are people who suppose that the superiority of the Dutch cocoa-powder is to be attributed to a peculiar mode of manufacture, different from the methods followed in other countries. The idea to extract the fat from the roasted cocoa-beans, and to sell the powder, is said to have originated in the brain of a Dutch chocolate-maker about 1830. It is now generally practised in France and England. The average consumption in the United Kingdom last year, per head of the population, was, of cocoa, 0.41 pounds; coffee, 0.86; tea, 4.87. Tea brings into the revenue £4,500; coffee, only £200,000; and coffee mixtures and chiccory, £5,273. The latter seem to be declining.

LETTERS TO THE EDITOR.

**** The attention of scientific men is called to the advantages of the correspondence columns of* SCIENCE *for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.*

The editor will be glad to publish any queries consonant with the character of the journal.

Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Recent Methods in the Study of Bryozoa.

IN *Science* for Oct. 7, Prof. Joseph F. James refers to certain new methods in the study of *Bryozoa*, and doubts their efficacy in classification; he also refers to a forthcoming publication which shall make this clear. Pending the publication of this paper by my esteemed friend, I cannot help expressing my decided approval of the methods he calls in question. Theoretically, development has proceeded in two lines, — one internal, to accommodate itself to the needs of internal function; and one external, to accommodate itself to environment, to the world with which the being comes in contact. Variations of function are far less frequent than those of environment: hence internal structure may still be very similar when external features have already extensively varied. Hence internal structure usually furnishes the reliable characters, which distinguish genera and higher groups; external features are used for specific determination.

Very few who have practically attempted the classification of paleozoic *Bryozoa* into genera as defined according to the old method have failed to see that such genera contained heterogeneous assemblages of forms, often ran into each other, and contained no distinct positive characters which were useful when great numbers of *Bryozoa* were to be classified. The new method has furnished solidity to this structure. The species fall into easily recognized groups, as distinct as those of other organisms on the same scale of development; all this simply because of the abandonment of external characteristics in the distinguishing of genera, for those of an internal nature, made easily accessible by the slide and the microscope.

In this department of study, Prof. H. A. Nicholson took the first decided stand, and is still contributing at short intervals valuable papers on this interesting group of fossils; but I believe that to one of our fellow-countrymen, Mr. E. O. Ulrich, belongs the credit of the perfection of this system. His work, which expresses his matured views on this subject, is now in the press, forming a part of Vol. VIII. of the forthcoming 'Illinois Report.' By his kindness I have been permitted to see plates, and furnished with private extracts from the same, and I feel free to say that it will be a monumental work in history of the study of *Bryozoa*.

The practical test of the theory of development, which holds good everywhere else in animated nature, is also satisfactory here. Instead of artificial we have natural classification, and that also of a more definite and practical form. It remains to be seen whether microscopic sections are sufficient to determine the species. A circumstance peculiar to *Bryozoa* makes this in almost all cases possible. The form, size, and arrangement of cells may be readily seen in tangential section; the presence of interstitial cells may also be thus discovered; whereas the little elevations or low spines around the apertures of some cells may be seen in the sections as spiniform tubuli. Elevated patches of cells may usually be recognized by the local increased size of cells in the sections, and maculæ will be shown by judicious longitudinal sections.

It remains to be seen what characters of specific importance cannot be shown in microscopic sections. One of these is the size of the specimen; another, its method of branching; a third, its general contour. These may all be expressed by a simple drawing, taking no cognizance of individual cells. Besides the details above referred to, microscopic slides will of course furnish numerous others referring to internal structure alone. The fact, however, is, that not only do microscopic slides reveal the characteristic features of the surface, but they often reveal them in a much better way than the specimens at hand; for these may be abraded, perhaps ever so little, but just enough to rub away the little spines, or to remove the walls of interstitial cells, and, by thus exposing the diaphragms of the same, lead to the conclusion that they do not exist. Any one who has ever looked over a quart-measure of specimens without finding one suitable for description will know what this means.

As regards the publication of Mr. Foord, 'Contributions to the Micro-Paleontology of the Cambro-Silurian Rocks of Canada,' it is an excellent exemplification of the *methods* (for this is what Professor James criticises) of the advanced school of students of the *Bryozoa*, and is a practical recognition of the merits of a work done by an American paleontologist. All of the species figured are accompanied by magnified sections of the same, and all except *Monticulipora Westoni* have also figures of the specimen's natural size; and perhaps the shape of that species, "Zoarium irregularly hemispherical," would not be difficult to grasp by the working paleontologist. The fact that Prof. H. A. Nicholson, immediately after the separation of Mr. Foord from the Geological Survey of Canada, was pleased to publish papers conjointly with that gentleman, serves to show what that eminent authority's opinion as to the merits of Mr. Foord's specific work was.

These remarks I hope represent fairly the claims of the new school as to the advantages of their methods of study. One observation alone remains to be made. I suppose that Professor James was not in earnest when he objected to the new method on account of the difficulty of making slides, no more than the physicist who should object to the advance made in his science simply on account of some of the refined mechanisms now used in his department, no more than the student of *Entomostraca* who should object to the classification reached in his science from the difficulty in finding a specimen which is willing to be quiet enough to let itself be accurately drawn. He simply expresses the difficulty he finds in leaving his old methods of study and adapting himself to new ones, and this accidentally escaped into print, not in the form in which he would be willing to have it remain at second thought. But the truth is, that microscopic slides are not difficult to make. Messrs. W. F. and John Barnes of Rockford, Ill., manufacture an instrument which I know from experience to be both cheap and useful. The specimen to be cut is ground with emery until a plane is formed having the same direction as the intended section. Then successively finer grades of emery are used until a fine polish is obtained, which can be made very fine indeed by using polishing-powder sprinkled over a piece of plate glass. Then the specimen is carefully washed, dried, and glued with Canada balsam to the slide which is to retain the specimen. Then the specimen is ground away until only a thin sheet remains fastened in the Canada balsam, after which it is again smoothed, washed, and protected by a thin cover-glass. Forty to sixty slides can be made in a day.

Some of my first slides I find useful to this day, and every day adds experience, or a word from some friend working in the same field. The difficulty of making sections is a myth.

Cambridge, Mass., Oct. 31. AUG. F. FOERSTE.

Search for Gems and Precious Stones.

IN reference to the interesting article of Prof. P. L. Simmonds on the search for gems and precious stones, read before the Society of Arts of England recently, reprinted in your issue of Oct. 14, allow me to suggest a few corrections. Professor Simmonds estimates the yield of the Brazilian diamond-mines at £800,000 annually, while a little later on he says that the yield has dwindled to 24,000 carats, which, at the outside will not yield more than £2 to £3 a carat, and that of India, Borneo, and Australia at £200,000, when these latter figures would probably cover the annual product of Brazil as well as that of the other three countries named. Australia produces so very little as scarcely to be a factor in the computation. Even before the opening of the African mines, in 1867, the estimated value of the product of Brazil from 1861 to 1867 was only £1,888,000, or something over £300,000 per annum, at a time when Brazilian diamonds commanded a higher price than at present, and now they produce much less. His statement that the opal is out of fashion would have been true several years ago, but is not to-day, when more of these stones are sold, and at better prices, than ever before.

The carat is given as 3.174 grains; whereas, since there are 151.5 English diamond carats in an English Troy ounce of 480 grains, an English carat would be 3.1683168 Troy grains, or, less exact, 3.168. A diamond carat is always divided into four diamond grains equalling .792074 of a Troy grain. If 31.103 grams equal an English Troy ounce, a carat would be .205304 of a gram.

An international syndicate composed of London, Paris, and Amsterdam jewellers, wishing to establish a uniform carat, in 1877 confirmed .205, however, as the true value of a carat, in which case we have 151.76 carats in an ounce Troy.

These may seem trifling differences, but yet they are enough to affect a $10,000 lot of diamonds, worth $100 a carat, to the amount of $4.83 between the 3.174 carat and the 3.168 carat, and $19.80 between the former and the syndicate carat.

It would perhaps have been better to make the reference to imperial jade, which he mentions several times, under the head of the jade-quarries of Burma, as this (*Feitsui*) imperial jade is jadeite, not jade, and is generally only emerald green in spots or streaks, the mass being a dead white, lending a vividness to the green which occasionally almost rivals the emerald, and has the hardness of 7.

Of the articles of jade shown by the New Zealand Court at the colonial exhibition, England, Professor Simmonds says, "Evidencing the skill of the Maoris in working this hard material, the second in this respect to the diamond, although much more fragile," etc. This would lead one to infer that the material possesses great hardness, when, in fact, the hardness of jade is only 6.5, less even than that of rock crystal, and it can be worked with sand, by which laborious means, undoubtedly, all of the aboriginal ornaments of the Maori were made. So far as its fragility is concerned, it is the toughest of all known minerals, and this is the reason why it is so difficult to work. It would require less time to polish twenty surfaces of agate, which is harder than jade, than it would to polish one of jade on the same wheel. Krantz, the mineral-dealer of Bonn, having a fifty-pound piece of jade which he wished broken into small hand specimens, a friend kindly offered him the use of a large half-ton trip hammer to break it with. At the first blow the hammer was demolished, and the jade was only fractured by being heated and thrown into cold water.

We frequently hear minerals or gems loosely spoken of as second or third in hardness to the diamond. On the Mohs scale of hardness, the diamond is represented by 10, the sapphire by 9, topaz 8, and quartz 7; but, although the difference on the scale is only 1, there is room for several substances between the diamond and the sapphire; and, as we have no such known substance in nature, we place diamond on 10. In reality, so great is the difference between these two substances, that, if the hardness of the sapphire is 9, that of the diamond would be fully 100, relatively to the rest of the scale. Professor Simmonds also says that coral has the hardness and brilliancy of agate. Quartz and agate are placed at 7 in the Mohs scale, whereas coral has only the hardness of about 3, the same as that of marble (calcite), and can be scratched by fluorite. It is impossible to see how this opaque substance can be said to "shine like a garnet, with the tint of the ruby."

A word, in closing, about the hardness of agate and rock crystal. Mineralogically these are classed together at 7; but in reality the crystalline varieties should be 7, and the crypto-crystalline varieties 7.3, since they will readily scratch quartz, and quartz will not scratch them. GEORGE F. KUNZ.

New York, Oct. 31.

Living Lights.

WE have noticed in your journal (*Science*, x. No. 246) a review of the book on phosphorescence called 'Living Lights.' The writer, it seems, must have made a very hasty perusal to have failed to see that the statements therein are not conjectural, but in each case are from individuals we are accustomed to honor as credible witnesses.

The fact of this review being in the columns of a science journal is, of course, the only reason for our interest in it. The most charitable construction which we can put on this surprising exhibition of lack of knowledge is that the reviewer did not notice the array of great names which support the statements of the book, for we cannot think that any one would knowingly dispute the words of such men — and naturalists.

The reviewer starts off by throwing discredit and ridicule on the entire world of luminosity, seemingly denying that attribute to all living objects. He says, "Not only do fire-flies fly, glow-worms glow, zoöphytes twinkle in the sea, but sea-anemones, alcyonarians, gorgonias, star-fishes, earth-worms, crabs, shell-fish, lizards, frogs, toads, fishes, birds, monkeys, and men must be added," etc.

We confess to embarrassment in approaching the task of replying to such, for one is impressed with the notion that some occult jest is intended; but again we are reminded of the character of the journal, and a feeling of surprise follows at the incomprehensible lack of knowledge displayed regarding the subject in hand.

The reviewer continues, "There is no excuse for conjectural illustrations, and ideal views of possible appearances." Shall we inform him that twelve of the plates in 'Living Lights' are process copies taken from lately published bulletins of M. Filhol, M. Dubois, and from sketches of the deep-water dredged objects obtained by the gentlemen of the 'Challenger,' 'Travailleur,' 'Porcupine,' 'Majenta,' and others, several of whom kindly furnished the author with advanced papers for use in his work?

Thus for twelve of the illustrations: for the remaining ones, it were absurd indeed to defend them. The former, as being matter not yet widely extant, some of it not published outside of society bulletins, may well be regarded as unfamiliar. The quotation which the reviewer takes from the book is treated so as to mislead. The author evidently meant to convey that it is difficult to represent the phenomenon of luminosity in marine animals, as their integrity is injured on exposure to air, though no question is entertained of their luminosity. A kindly review of this portion would rather praise the caution exhibited by the author in stating that the pictures may possibly not exactly portray the real appearance as it exists in the sea. The statements of the reviewer are so sweeping and (possibly) damaging among those not informed, it would seem advisable to state facts, though it is a humiliating thought that the brilliant work of so many eminent men should in such quarters be unknown.

It is but justice to do this, as the author of 'Living Lights' is at present beyond reach, at a distance from home, and of course unable to reply seasonably.

The statement, "zoöphytes twinkling in the sea" might well have covered the ground for one group, without enumerating "sea-anemones, alcyonarians, gorgonias," etc., also; but this enumeration will serve to suggest what objects concern us, as those arraigned for false attributes. We presume that few will deny the luminous gift to fire-flies, glow-worms, etc., which are mentioned in this connection. Let us, then, pass to the sea-anemone record. Colonel Pike of Brooklyn, an American naturalist not to be questioned, has given at length his testimony, and we know that the author himself has an experience as to their luminosity, which,