important subject as the reality or unreality of heterogenesis, persons like Mr. Massee, who could speak authoritatively, should not think it necessary to make personal observations, and should be content to offer in reply to real and prolonged work only loose explanations which will not bear any serious examination.

A further instance of the same lack of care is afforded in the last sentence of Mr. Massee's letter. Referring evidently to my remark (NATURE, November 24, 1904, p. 77) as to the very different products that may be met with in the scum forming on an infusion made from unripe grasses as compared with that forming on an ordinary hay infusion, he says:—"As these fungi only develop on fading leaves it was not to be expected that they would appear in infusions of young grass." This sentence must have been penned without the writer having taken the trouble to look at p. 87 of my "Studies in Heterogenesis," to which reference was made when I directed attention to the differences in question. Had he done so he would have seen how little he had explained the differences noted on that and on the following page, and he would also have seen that the most striking difference recorded is the complete absence of Zooglœa masses (spoken of there as "areas") in the scum forming on infusions of unripe grasses. Of course if the Zooglœa masses are not there it is easy for me to understand the absence of the Fungus-germs which, as I maintain, are produced therefrom.

This point, as well as others in Mr. Massee's letter, shows the great importance of bearing in mind two wholly distinct aspects of my observations, corresponding with different stages in the processes described. We have to do (1) with the growth, the individualisation, and the processes of segmentation taking place in masses of Zooglœa. We have also to do (2) with the question of the ultimate destination, or the transformation, of the products of such segmentation. These are two parts of the subject which are to some extent distinct, and are well worthy of further separate consideration.[1]

In conclusion I would ask, Why do the bacteriologists not tell us what they know about Zooglœa—whether they are or are not aware of its developmental tendencies, and why it should undergo processes of minute segmentation, unless such processes are a result of an organising tendency destined to have some definite outcome? Why, again, should it or its segments so often tend to assume a brown colour, while it is still nothing but Zooglœa, either segmented or unsegmented? Again, why, if the brown Zooglœa does not yield the brown Fungus-germs, should there be this constant association of myriads of brown Fungus-germs (in the absence of hyphæ) in association with brown masses of Zooglœa? How can they explain, other than I have done, the actual organisation of a Zooglœa mass, and the stages by which the brown Fungus-germs seem to be formed therein? What process of "infection" in a filtered hay infusion contained in a closed pot could cause thousands of small Zooglœa masses to go simultaneously through similar processes of this kind—producing myriads of brown Fungus-germs—when not a single hypha is anywhere to be found, and when at first no Fungus-germs are to be met with outside the Zooglœa masses themselves? I trust the bacteriologists will vouchsafe to give us some information on these points, or, if they cannot reasonably explain them, that they may be induced to work at the subject, and satisfy themselves that something important can be learned concerning bacteria, even though it be outside their laboratories and by methods other than their own.

H. CHARLTON BASTIAN.

[1] My further observations on this subject will be found in the February number of the *Annals and Magazine of Natural History*.

Compulsory Greek at Cambridge.

As a corrective to much vague discussion, perhaps the following record of facts may be of interest.

Entering the University of Cambridge in 1886, entirely ignorant of the Greek language, I was, of course, obliged to pass the "Little-go" in order to proceed to the natural sciences tripos. The Greek subjects prescribed were the Gospel of St. Mark, the Pluto of Aristophanes, and the usual grammar papers, and, in conjunction with a friend similarly circumstanced to myself, I set to work to "cram" these by as "scientific" methods as we could devise, in order to pass with as little waste of time as possible.

Purchasing a copy of Wordsworth's "Primer of Greek Grammar," we read the nouns, adjectives, and the active voice of τυπτω—no more, and then started on the prescribed books. These we translated by aid of a good lexicon, word by word—thus learning the parts of the irregular verbs, which form a favourite subject in the grammar papers. Having been once through the books by this method, we procured the translations, and read these through five or six times, in order to become so familiar with the subject-matter of the books that we could translate most passages easily at sight after making out the leading words in them.

The actual time expended by us in the preparation of Greek for the examination was carefully recorded, and amounted to $105\frac{1}{2}$ working hours, and we passed the examination in the second class, with, I believe, a considerable margin of safety even in Greek. I need hardly add that my present knowledge of the language is *nil*.

JOHN C. WILLIS.

Royal Botanic Gardens, Peradeniya, Ceylon, December 28, 1904.

Polyhedral Soap-films.

THE fact that polyhedral wire frames can be used for the purpose of forming films across them is well known, but there are some features of this subject, which I have investigated, which may be of interest.

If a frame of wire representing the edges of one of the simpler polyhedra, such as a cube or octahedron, is dipped into soap solution, then on taking it out it will have films attached to its edges and meeting roughly at a point in the centre of the figure, forming a number of pyramids standing on the faces of the figure. If, however, a more complex figure, such as the rhombic dodecahedron or the eicosihedron, be taken, then the effect will be quite different; the film will then simply cover all the faces except the one which was drawn out of the solution first. The former thing will happen if the area of the $(n-1)$ faces is greater than that required to form the pyramids, while the latter will occur if the reverse is the case.

If, now, in the case of the cube, for instance, after the pyramids have been formed, a film be applied to one of the faces, then a certain amount of air becomes entirely enclosed by film, and the bubble so formed settles in the centre of the frame, forming roughly a cube suspended in the frame by twelve sheets of soap-film. On closer inspection, however, it will be seen that the faces of this cube are convex, thus showing that the air in it is compressed. By inserting a tube this cubical bubble can be inflated or reduced in size, all the time retaining its convexity, so that if thus left in communication with the air it will collapse of its own accord. A little consideration shows the reason for this, namely, that three films meeting one another cannot be in equilibrium unless their planes are inclined to one another at 120°, since the tensions in all three are equal. But since the dihedral angle of a tetrahedron, cube, or octahedron is less than 120°, therefore in these figures the internal polyhedral film must always have convex faces.

From this I expected to get an exact polyhedron with plane faces in the case of the rhombic dodecahedron, since its dihedral angles are all 120°. On trying this it was found to agree remarkably with my assumption, only, as may be gathered from what has gone before, it was not quite so simple to obtain the central bubble as in the former case. After the $(n-1)$ faces had been covered with film the figure was again immersed so as to displace about one-half the air contained in it, and while thus immersed it was turned round so as to cover the one open face with liquid. On withdrawing it there was seen the plane-faced rhombic dodecahedron. The same result can be obtained by applying a film to the nth face and then exhausting some of the enclosed air by means of a tube. By using a tube, as in the former cases, the bubble can be enlarged