

groups into which they were divided. The independence of teachers will, by these new regulations, be greatly increased; for they will no longer be compelled to hurry as rapidly as possible over the elements of various branches of physics, but will be free to teach certain portions of the subject with greater thoroughness, and will secure at the same time for their pupils a better chance of passing. Thus, supposing the questions to be equally apportioned, a candidate fairly acquainted with the elements of mechanics only would have no difficulty in succeeding.

The examinations for the Science degree are at present under the consideration of the Senate, and we may hope, therefore, that before long many of Prof. Foster's grounds of complaint will have been removed.

London, Nov. 9

PHILIP MAGNUS

Gresham Lectures

IN NATURE, vol. xi. p. 2, appeared a very just and interesting article on the Gresham Lectures. I wish to endorse the opinion therein expressed of the misapplication of that institution.

Last Friday evening, at twenty minutes past seven, I entered Gresham College from curiosity. The two superb beadles to whom you allude were seated in the hall in all the glory of official gold lace. I walked into the lecture theatre, which to my surprise was more than half filled. A jerky lecturer in scarlet silk M.D. robes was unfolding the mysteries of sound. He was explaining that sound consisted of vibrations *like those of light*. He said that the lowest note appreciable to human ears was produced by 16, the highest by 24,000 vibrations per second. Prompted by his assistant (in whom I recognised the professor of chemistry at one of our metropolitan hospitals, and a talented lecturer), he said the velocity of sound was 1,125 feet per second, but did not allude to the variations in the same medium under different conditions of temperature and pressure. Light, he said, travelled 135,000 miles per second. He probably mistook an 8 for a 3 in the book from which he obtained his information. The velocity of sound in water, he said, had been determined by an English gentleman, who fixed a bell in a boat at one side of the Lake of Geneva and stayed on the other side himself; then he set the bell ringing by electricity, and plunged his head under the water at the same instant! This lucid explanation was received with all the seriousness with which it was delivered. He proceeded to explain the human voice, which he said resembled the harmonium; and he showed what he meant by the harmonium, namely, a small *harmonica*, or instrument in which plates of glass suspended on tapes are struck with a hammer consisting of a piece of cork on a whalebone. This information was also received with self-satisfied gullibility. Choking with indignation, I left the building, never having heard in all my life, either in sermon or lecture, so many false statements publicly uttered in the space of half an hour.

I am no physicist myself, but the fact that I have heard such men as Tyndall, and seen such experimenters as Frankland and Guthrie, probably accounts for my non-appreciation of the Gresham lecturer, who I understand is a classical scholar—*celui s'explique*.

MAURICE LICHTENSTEIN

Clyde Wharf Sugar Refinery, Nov. 8

Insects and Colour in Flowers

THE true Darwinian answer to my letter in NATURE, vol. x. p. 503, has been fairly given by Mr. Boulger and Mr. Comber (vol. x. p. 520); but if that answer had appeared to me to be sufficient, the letter would not have been written.

Mr. Boulger correctly attributes to me the opinion that the development of beauty is an "object in nature." He thinks it a fallacious opinion; so I suppose does Mr. Darwin. I hold that opinion advisedly, however, and believe that the rejection of it is a constant source of error in Mr. Darwin's books, for which otherwise I have the profoundest respect and admiration.

I do not dispute that colour may be attractive to insects, or that the reproduction of plants may be assisted by it; but I reject the doctrine that the colour would have no *raison d'être* if insects were exterminated, and I believe that Mr. Darwin's theories upon this point are not sufficient to explain his own facts, or such other facts as are revealed by Mr. Comber's curious researches into the dispersion of coloured flowers.

I do not see any reason to doubt that if all flowering plants had been propagated by buds and stolons only, as some plants

practically are, the world at this epoch would still have known the beauty of flowers, although probably with less variety of form and colour. It is part of the natural development of the wave of life, as sure to be produced when the total conditions are ripe for it, as leaves in the spring, or as lycopods in the coal-age and conifers in the oolite.

The law of natural selection expresses truly enough the interaction of forces in the great heaving life-sea, but the forces are not increased or diminished by it, only modified in their lines of motion, the course made clear for one and obstructed for another: here a union of similars, and there a neutralisation of opposites; while each works out a destiny of its own as an individual wave, and shares the common destiny of some larger wave of which it is a constituent part.

What insects do in relation to the colour of flowers is to modify the conditions, so that the force, which has already begun to show its tendency to develop colour, may get freer play, and in each generation approach nearer to its climax.

The many instances in which colour is developed independently of insects seem to me to show quite conclusively that the colour-producing force which exists in the plant will break through all obstructions whenever the opportunity is presented. Sometimes increased richness of soil will furnish the necessary condition; sometimes a higher temperature; sometimes cross-fertilisation; sometimes the care and selection of man.

This law holds good throughout the organic world, and accounts for colour wherever it is found. The Darwinian doctrine of mere utilitarianism is driven to the strangest devices in its attempts to do the same thing.

Mr. Boulger speaks of the development of corolla at the expense of stamens as a "degradation of organs," and regards it in the light of a disease. Many botanists would agree with him, no doubt. But where is the proof of this? Is a plant produced for the mere purpose of *re*-production? Is that even its highest purpose? Whatever *beauty* may be, the reproductive process is assuredly a mean, and not an end.

There is some ground for the hypothesis that the flower of a plant represents its nervous centre, that it is the analogue, perhaps even the homologue, of the brain and countenance of the higher animals. In vegetables the reproductive organs are associated with this nervous centre. But they are not so placed in animals, and if they had been otherwise arranged in vegetables the blossom might still have been the crowning beauty of the plant.

I do not admit that the metamorphosis of stamens into corolla is a degradation at all. I am not sure whether the production of perfectly double and perfectly barren flowers ought not to be regarded as the final goal of every species of plant—the point at which reproduction becomes no longer necessary, because the life-wave of that species has reached its climax and needs no further to be carried forward from generation to generation.

Finally, the point at issue amounts to this: Is colour in flowers a mere expedient for getting them cross-fertilised? or is it a natural and necessary phase in the development of plant-life, which serves also the secondary purpose of securing the advantage of cross-fertilisation; as the brain of man, which is primarily the great organ of thought and sentiment, serves also the secondary purpose of selecting wholesome food?

I hold to the latter view, which includes and accounts for all that the other does, and much besides. F. T. MOTT
Leicester

LORD RAYLEIGH, in NATURE, vol. xi. p. 6, questions whether the colour-sensations of insects are analogous to ours. As tending to illustrate this subject, let me quote the following paragraph from the scientific column of the *Illustrated News* of April 2, 1870, p. 362:—

"The spectrum of the light of the firefly has been examined, and it is found to be perfectly continuous, without traces of lines either bright or dark. It extends from about the line C in the scarlet to F in the blue, and is composed of rays which act powerfully on the eye, but produce little thermal or actinic effect. In other words, the fly, in producing its light, wastes but little of its power."

This, it is true, tells nothing as to the colour-sensations of the insect, but it appears to show that the same rays are luminous to its eyes which are luminous to ours.

JOSEPH JOHN MURPHY

Old Forge, Dunmurry, Co. Antrim, Nov. 8