

all his spare time was devoted to the committing of Euclid to memory! I shuddered as I thought of what was to be my own fate in a few short months, when I too must be subjected to this fearful imposition. But the first hour or two which Dr. Gloag (a name strange, perhaps, to southern ears, but very high indeed on the roll of successful teachers—Clerk-Maxwell, indeed, was one of his pupils) devoted to geometry showed those of us who had any taste for the subject that it was one to be learned by head, not “by heart” (the idiotic phrase in common use)—and that my friend’s parents had simply taken him from a good teacher and sent him to an exceedingly bad one—for it came to be discovered after some time that he had really considerable aptitude for geometry.

But if he had been in fact quite unfit for the study, otherwise than in learning to repeat Euclid by rote, what object beyond mere torture would have been attained by forcing it upon him? This leads to another remark of great importance in connection with the mass of elementary text-books.

What sort of students are those who require to be told to take the square of the velocity, divide it by the radius, and find the proportion of this quotient to 32 . . . :—without farther explanation or proof? What the better are they of the information? Call you this “teaching science?” Has it improved their minds? Will they be able to make any use of it in after life? I do not see how these questions and many other connected ones can be answered except by a prompt negative. One of two things. The pupil who requires to be taught in this way is either as yet too young, or is one who will never become old enough, to learn even the rudiments of science.

To our metaphor once more. Grass-plats, moss, and flower-beds for the happy sports of children—the bare rock and rough moor for the stern work of men. Your gravel-walks and Macadamised roads are excellent things in their way, but keep them to their legitimate users, the carriage and the perambulator for the invalid and the infant who can neither work nor even play.

My reasons for writing on this subject are very serious ones. I have to consider each year how best to instruct some couple of hundred students in the elements of physics, and have to be constantly on the out-look for a really good text-book of an elementary character. In the higher branches of the subject there is, happily, little difficulty, but that a really good, short, and simple treatise on the merest elements has been (at least till very lately) wholly unprovided is, I think, clear from the ridiculous discussions about *Centrifugal Force*, and other connected ideas, which are even now constantly to be found in our more practical periodicals.

P. G. TAIT

LETTERS TO THE EDITOR

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

Nectar-Secreting Glands

MR. FRANCIS DARWIN has made an interesting addition to his important discovery of nectar-bearing glands on the young

fronds of *Pteris aquilina*, supplied from the ever-welcome experience of Mr. Fritz Müller. The latter gentleman finds that in Brazil the *Pteris aquilina* is protected from the leaf-cutting ants by those attracted to the nectar, and Mr. Darwin adds some speculations on the origin of the glands and their continued functional activity in Europe where they now appear to be useless. On this part of the question I should like to make the following remarks:—

Prof. Heer has shown that in the Miocene plant-beds at Eningen and Radoboj, ants are the most numerous amongst the fossil insects, and in 1849 as many as sixty-six species had been described from these two localities. In 1865 the number found at Eningen alone is recorded as forty-four. I do not know what the total number of species is that have been recorded from the two places up to the present time, but it probably does not fall short of eighty. Amongst the fossil ants from Radoboj there are species of the Tropical American genera *Atta* and *Ponera*. One of the fossil species of *Atta* resembles in general form and in the venation of the wings the curious *Atta cephalotes* of Tropical America.

As there are only about forty species of ants existing now in the whole of Europe it is evident that in the Miocene epoch they must have played a much more important part in Europe than they do now. Plants may then have been exposed to the attacks of enemies that have become extinct along with the general impoverishment of the fauna and flora of Europe that took place in Post-pliocene times; and the protection afforded by ants attracted to the nectar-bearing glands at the critical stage of the unfolding of the young and tender leaves may have been as important to some plants in Europe, then, as it is to many in Tropical America now.

With regard to the persistency of the nectar-producing glands up to the present time in Europe, it is to be remarked that many plants are identical with those living in the Miocene period and the world-wide distribution of *Pteris aquilina* seems to indicate that it is of very ancient origin. If a plant has not otherwise varied there is no reason apparent why it should do so in this respect so long as the secretion of nectar is not positively injurious to it. I have recently noticed in my garden that the ants that attend the glands at the bases of the leaves of the cherry, the plum, the peach, and the apricot, stroke with their antennæ some of the glands that are not excreting when they arrive at them, just as they do the bodies of the aphides. I have not actually noticed that this promotes a flow of nectar, but ever since I became a disciple of Darwin I have been convinced that the most trivial circumstance is worthy of notice; and it may be that the slight irritation of the glands kept up by the ants is sufficient to ensure the perpetuation of a function of the plant now useless to itself. It is, however, perhaps too soon to assume that the glands are entirely useless to the plants in Europe. Darwin states that there is good evidence that the absence of glands in the leaves of peaches, nectarines, and apricots leads to mildew (“Animals and Plants under Domestication,” vol. ii. p. 231).

Darwin refers at the same place to the variation of the glands of the leaves in the above-mentioned fruit trees and I may add that they are extremely variable on the cherry, being sometimes absent, sometimes on the stalk and sometimes on the blade of the leaf. The young leaf in its earliest stage, before it expands, has a complete fringe of them, thus bearing out Mr. Francis Darwin’s theory that they are homologous with the serration-glands of Reinke.

May I suggest to some of your correspondents that information as to how far north in Great Britain or in Europe the glands on the above fruit trees are attended by ants and especially if the wild cherry (which I have not had an opportunity of observing) is so attended, would be of great interest. THOMAS BELT
Cornwall House, Ealing, June 8

On Time

“The fact is, that we have not yet quite cast off the tendency to so-called metaphysics,”—Tait, “Rec. Adv. in Phys. Sc.,” p. 11.

In Thomson and Tait’s “Natural Philosophy,” of which I have only the German edition in my possession, I find, § 246: “Die Zeiten, während welcher irgend ein besonderer Körper, der durch keine Kraft angetrieben wird, die Geschwindigkeit seiner Bewegung zu ändern, gleiche Wege durchläuft, sind einander gleich.” And § 247: “Dieser Satz drückt bloss die für die Messung der Zeit allgemein getroffene Uebereinkunft aus.”

These quotations quite express what is generally understood.