

istence of a second rare specimen of some foreign tree was found out in Paris, by its long-widowed spouse in the Jardin des Plantes at last producing perfect seeds. A little talk about bees, and moths, and midges, and such creatures, finding out what they have seen, and your second lecture is over.

In the third lecture you take the garden geranium, and beg them to examine it very closely too see if it is symmetrical. Several will discover the unsymmetrical outer green leaves; one or two will discover the hollow back of the stem: then the pelargonium, and its more visible unsymmetry: then the common *tropæolum*; in each of which they find also the same parts, and count, and describe them: and lastly the *tropæolum Canariense*, with its grotesque irregularity; and they are startled to find that the curious-looking flower they know so well is constructed on the same type, and is called by the same name; and by the end of the lesson they have learned something of irregular flowers, as referred to regular types.—something of continuity in nature.

So in succession, I cannot give more detail, you lead them through flowers where the parts cohere, as in the *campanula*, through plants deficient or odd, through roses, and *mignonette*, and *honey-suckle*, and all the simple flowers you can find; till they thoroughly know the scheme on which a simple flower is made. Then you challenge them to a dandelion or daisy: and each has to write down his ideas. Your one or two geniuses will hit it: some will be all wrong, without a shadow of doubt; the majority fairly puzzled. You give them no hint of the solution, tell them to lay it aside; and you give them the little thrift, and challenge them to find its seeds, and how they are attached. This many will do, and pick out the little seed with its long thread of attachment, and then they will go back to their dandelions with the key to the structure; and find its seeds, too, and be charmed to discover the remains of its poor outer green envelope, and even its little dust-bags. How proud they are of the discovery! they think they have the key of knowledge now. And then you begin a little terminology,—calyx and sepals, corolla and petals, stamens and pollen, pistil and stigma, and so on: and test their recollection of the forms of all the flowers they have examined. Then you notice the spiral arrangement of leaves on a twig of oak, or thorn, or willow, and the internodes; and the over-lapping of the sepals of the rose and *Herb Robert*; the alternance of the parts; and finally they work out the idea, that the floral whorls grow on the stem, and are a sort of depressed spiral of leaves with the internodes suppressed. A few monstrosities and pictures are shewn, and the grand generalization is made; the pistils are re-examined with fresh interest to test the theory; and all their old knowledge is raked up once more. Then, too, the value of the theory is criticised; and a lesson of caution is learnt.

Then a step forward is made towards classification, by cohesion and adhesion of parts; and the floral schedule is worked; and so step by step to fruits, and leaves, and stems, and roots, and the wondrous modifications of parts for special uses, as in climbing plants; and the orchids, which are a grand puzzle till a series of pictures from Darwin step in to explain the use of the parts and plan of the flower. Then some chemistry of the plant is introduced with some experiments, and the functions of all the organs are discussed. And lastly, strict descriptive terms are given, and the rest of the course is occupied by the history and the systems of classification, with constant reference however to the other conceptions that the class has gained.

Such a method as this has many advantages. It is thoroughly scientific, however irregular it may seem, and a professor of Botany may smile or shed tears over it for anything I care; and the knowledge is gained on a sound basis of original observation. Whatever flower a boy sees after a few lessons, he looks at with interest, as modifying the view of flowers he has attained to. He is tempted by his discoveries; he is on the verge of the unknown, and perpetually transferring to the known: all that he sees finds a place in his theories, and in turn reacts upon them, for his theories are growing. He is fairly committed to the struggle in the vast field of observation, and he learns that the

test of a theory is its power of including facts. He learns that he must use his eyes, and his reason, and that then he is equipped with all that is necessary for discovering the truth. He learns that he is capable of judging of other people's views, and of forming an opinion of his own. He learns that nothing in the plant, however minute, is unimportant; that he must observe truthfully; that he owes only temporary allegiance to the doctrines of his master, and not a perpetual faith. No wonder that Botany, so taught, is interesting: no wonder that M. Demogeot, who visited some English schools last year at the request of the French Emperor, expressed himself to me as charmed with the vivacity and intelligence of the botanical class of one of my colleagues. (1)

Very possibly a master might make his boys get up a book on Botany, and learn it in the order in which it stands in the book,—cellules and parenchyme, protoplasm and chlorophyll, stems and medullary rays, petioles and phyllodes, rhizomes and bulbs, hairs and glands, endosme and exosme, secretions and excretions, and so on, and ultimately come to the flower and fruit; and possibly a boy of good digestion might survive it and pass a respectable examination in a year's time. But this is not the aim, and even if in this way a greater number of facts could be learned, it would be far inferior to the method of investigation. A master must never forget that his power of teaching facts and principles is far inferior to a willing pupil's power of learning and mastering them. He must inspire his boys, and rely on them; nor will he be disappointed. Those who have in them anything of the naturalist will collect and become acquainted with a large number of species, and follow out the study with care and accuracy; and the mass to whom an extensive knowledge of species is a very unimportant matter, but who can appreciate a sound method of investigation and proof, will have gained all that they can gain from botanical teaching. And it must be remembered by those who speak of teaching science, and yet have never tried it, that a method which would succeed with a few naturalists, might utterly fail with the mass.

There is a time in the growth of mind in which there is considerable activity and considerable power of accumulation, but little power of method. And to assist at this stage on rigorous definitions, on sternest formality, is to forget the indications given by nature alike in the growth of the individual and of the world. In a boy's mind is only the becoming twilight of science, which brightens out slowly, if at all, into the perfect day. A boy leaves the botanical class as a rustic leaves the militia after three months' drill. He has gained something, he is more awake, can listen and learn better, knows what he is about; in fact he has been drilled. Year after year, I have had new boys and old in my classes, and always have been able to notice that at first the new boys seemed to be at a positive disadvantage in competing with the old, although the object I was teaching had no reference to Botany.

(To be continued.)

### Intellect in Agriculture.

If a man whose capital consists of the clothes on his back, \$5 in his pocket, and an axe over his right shoulder, undertakes to hew for himself a farm out of the primitive forest, he must, of course, devote some years to rugged manual labor, or he will fail of success. It is, indeed, possible that he should find others, even on the rude outposts of civilization, who will hire him to teach school, or serve as county clerk, or survey lands, or do something else of like nature; thus enabling him to do his chopping trees, and rolling logs, and breaking up his stumpy acres, by proxy; but the fair presumption is that he will have to chop and dig, and burn off and fence, and break up, by the use of his

(1) The spirit of this method is admirably illustrated in *Le Maôût's* "Leçons élémentaires de Botanique, fondées sur l'Analyse de 50 Plantes vulgaires."