

Science Notes.

THE EXCHANGE OF GASES BETWEEN PLANTS AND THE ATMOSPHERE.

ONE of the most important communications concerning plant physiology which has been made for a long time is that recently received by the Royal Society from Mr. Blackman, of Cambridge. It is important in that it does not deal with a region hitherto unexplored, but is a direct contradiction of statements to be found in every elementary text-book of botany.

As is well known, all plants, from the lowly mould and fungus up to the forest tree, take in oxygen and give out carbon dioxide, just as we ourselves and all other animals do. Green plants not only exhale carbon dioxide which they have manufactured, but also take in the same gas and decompose it in order to obtain carbon from which to build up protoplasm.

The epidermis of a leaf or stem shows a number of intercellular spaces or pores which open into small cavities in the leaf tissue. It would be only natural to suppose that these openings are, at all events, the principal, if not the sole means, of interchange between the air and the gases of the interior of the plant. In fact, they have been called "breathing-pores" and "mouths," but hitherto only by those whose studies had not been deep enough for them to know anything different. Now it appears that the researches of Mr. Blackman, more careful and accurate than those of any previous experimenter on the same point, have shown that the mere "dabblers" were right and the botanists wrong. Mr. Blackman's results are the more convincing because he has repeated the experiments of Boussingault (who has, of course unwittingly, misled botanists for nearly thirty years) and has shown how his results were vitiated.

The pores or stomates are in most leaves more plentiful on the under surface than on the upper, which is often, indeed, destitute of them, the number of small air-spaces rendering the under surface of most leaves of a lighter green. Conversely, it must be the case that the upper surface has a larger extent of cuticle than the lower, being less interrupted by stomates. Boussingault took two similar leaves of oleander and covered the upper surface of one and the under surface of the other with wax. The wax clogged the stomates and also rendered the cuticle impervious to gases. He found that the leaf whose upper surface was waxed did not produce starch, whereas in the other the production was normal. The production of starch was taken as an indication of the absorption of carbon dioxide, since this is the source of the carbon in the starch. Hence Boussingault concluded that stomates were not necessary to admit air, and that it was more plentifully admitted through cuticle when they were absent. The latter part of the conclusion certainly seems exceedingly improbable, and one would think must have so appeared to Boussingault.

Blackman has shown that the absence of starch in the one case was due to the mixture of gases which Boussingault substituted for pure air. He employed about 30 per cent. of carbon dioxide, which injuriously affected the leaf and interfered with starch formation by its presence. The vitality of the leaf was practically suspended, as that of an animal is by excess of

carbon dioxide. In the case of the leaf with the under surface protected by wax, a very small quantity of carbon dioxide passed through the cuticle, sufficient to form a little starch, but not enough to exert a harmful influence.

Boussingault really proved therefore the contrary of what he assumed. He employed a mixture of gases deleterious to plant life, and by clogging the stomates of a leaf protected its vitality, when another leaf not so protected was unable to fulfil its functions.

The apparatus which Mr. Blackman has devised and employed in his experiments is so delicate that he can measure the amount of carbon dioxide given out by a single germinating seed.

Dramatic Critique.

"ROMEO AND JULIET" AT "THE LYCEUM."

"ROMEO AND JULIET," as just produced at "The Lyceum," is the "Romeo and Juliet" of the drawing-room rather than that of the stage! As in the famous presentment of "Pyramus and Thisbe" before the Court of Theseus in "A Midsummer Night's Dream," the lion is taught to roar gently so as not to disturb the ladies' nerves! There is no need for a modern Quince, as Stage-manager, to announce that Romeo and Juliet are only Mr. Forbes Robertson and Mrs. Patrick Campbell, for the fact must become patent to everybody present as the play progresses. Had we not known, indeed, by the play-bills that a professional Cast of more or less celebrity was engaged in histrionically illustrating the Piece, we should have thought, as far as Shakespeare was concerned, that it was being performed by a company of amateurs. True indeed it is, that, to use a hackneyed but significant phrase, no expense has been spared in the mounting. The scenery is elaborate, if not always appropriate, and the costumes follow suit in both respects, but, even in reference to these subordinate matters, the production of "Romeo and Juliet" by Sir Henry Irving in 1882, and even that of the same play by Miss Mary Anderson subsequently, easily carry off the palm.

The glow and glamour which pervaded Sir Henry Irving's remarkable Representation are now only conspicuous by their absence, while the acting is but feeble in comparison. Mr. Forbes Robertson is personally of course a more suitable Romeo than was Sir Henry Irving, and, as being a singularly facile and elegant elocutionist, he delivers his lines with more grace and modulation, but he lacks the force and intensity which the elder actor imparted to his impersonation, and he leaves his hearers with the same impression that he gave them, when he played Romeo many years ago at the Court Theatre, to Madame Modjeska's restless Juliet, viz., that he is acting a "Part" rather than embodying a Character. In attempting to avoid rant, he has fallen into the opposite extreme of exhibiting tameness. Better things might have been expected from his long experience, especially in impersonating the "Part" before American audiences. We do not quarrel with his conception—it is in the execution of it that he is found wanting. In the lighter passages he is perhaps nearly all that could be desired, but when he has to revenge the

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