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PUBLISHED WEEKLY AT NO. 37 PARK ROW, NEW YORK.

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VOL. XXXVI., No. 16. [New Series.] Thirty-second Year.

NEW YORK, SATURDAY, APRIL 21, 1877.

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DARWIN ON THE EFFECTS OF CROSS AND SELF FERTILIZATION IN PLANTS.

position is not only firmly established but seems possessed erations under as different conditions as possible, and sow of even a superabundant support. For eleven years he has them in alternate rows with seedsmatured in the old garden. of opinions already enunciated, leading to their wider generalization. His conclusion is closely connected "with var- other individual of the same variety must be carefully preious important physiological problems, such as the benefit derived from slight changes in the conditions of life, and this stands in the closest connection with life itself. It ably remain constant, even if grown under different condiseparation or union in the same individual, and lastly on the against intercrossing. whole subject of hybridism, which is one of the greatest obstacles to the general acceptance and progress of the great principle of evolution."

In briefly reviewing Mr. Darwin's new work, or rather its conclusions, for we cannot attempt the consideration of his his own statement, made to avoid misapprehension, namely, that the term "crossed plant seedling, or seed," means one of crossed parentage, that is, one derived from a flower fertilized with pollen from a distinct plant of the same species. And a self-fertilized plant seedling, or seed, means one of fertilized with pollen from the same flower, or sometimes from another flower on the same plant.

From his observations on plants, and guided to a certain persons. extent by the experience of breeders of animals. Mr. Darwin many years ago became convinced that it is a general law of Nature that flowers are adapted to be crossed at least occasionally by pollen from a distinct plant. It often occurred to him that it would be advisable to try whether seedlings from cross-fertilized flowers were in any way superior to those from self-fertilized flowers. It so happened that, without any thought of the above inquiry, he raised close together two large beds of self-fertilized and crossed seedlings from the same plant of linaria vulgaris. To his surprise, the crossed plants, when fully grown, were plainly taller and more vigorous than the self-fertilized ones. As it seemed quite incredible that the difference between the two beds of seedlings could have been due to a single act of self-fertilization, Mr. Darwin attributed the fact to some accidental cause; but in order to test the matter, he prepared two more beds from the carnation dianthus caryophyllus, which, like the linaria, is almost sterile when insects are excluded; and hence the inference may be drawn that the parent plants must have been intercrossed during every, or almost every, previous generation. Nevertheless, the self-fertilized seedlings were plainly inferior in height and vigor to the others. This was the starting point of Mr. Darwin's experiments, conducted with all the refinement and minuteness necessary for the most accurate of observations.

Of the conclusions reached, the first and most important is that cross-fertilization is generally beneficial, and self-fertilization injurious. This is shown by the difference in height. weight, constitutional vigor, and fertility of the offspring from crossed and self-fertilized flowers, and in the number in the mere union of two distinct individuals, but from such individuals having been subjected during previous gen-

ing intercrossed with individuals thus exposed, or from spontaneous variation. Animals to be paired should therefore It is impossible to finish the perusal of any of Mr. Charles be kept under as different conditions as possible, and excel-Darwin's works without a genuine feeling of admiration, not lent results have been obtained from the interbreeding of only for the manner in which the investigator pursues every individuals reared on distant and differently situated farms. branch of the great principles he has enunciated to its minutest. With all species of plants which freely intercross, by the aid ramification, but for the almost inconceivable patience with of insects or the wind, the best plan is to secure seeds of the which he accumulates grain after grain of proof, until his required variety which have been raised for some genbeen conducting the difficult and delicate inquiry of which The intercrossing of the stocks will yield far more favorable his recent volume is the record; and yet the result to be ad- results than any mere exchange of seeds. Florists may learn duced, from the great mass of facts so slowly and labori- that they have the power of fixing each fleeting variety of ously gathered, is no strikingly novel discovery, although color, if they will fertilize the flowers of the desired kind with much is embodied that is new. It is rather a substantiation their own pollen for half a dozen generations, and from the seedlings under the same conditions. But a cross with any vented, as each has its own constitution. After a dozen generations of self-fertilization, the new variety will probthrows light on the origin of the two sexes, and on their tions; and there is no longer any necessity of guarding

With respect to mankind, Mr. George Darwin has concluded, from a statistical investigation which has already been reviewed in these columns, that the evidence of any evil due to the intermarriage of first cousins is conflicting, and on the whole points to the same being very small. Our countless experiments, it is best to begin by the repetition of author infers that, with mankind, the marriages of nearly related persons, some of whose parents and ancestors had lived under very different conditions, would be much less injurious than that of persons who had always lived in the same place and followed the same habits of life. He sees no reason to doubt that the widely different habits of life of self-fertilized parentage, that is, one derived from a flower men and women in civilized nations, especially amongst the upper classes, would tend to counterbalance any evil from marriages between healthy and somewhat closely related

THE TRANSMISSION OF CORRECT TIME.

The public clocks in the city of Vienna, Austria, are at present driven by a pneumatic system, actuated at the Imperial Observatory by an automatic arrangement connected with an astronomical timepiece. The idea originated with an engineer named E. A. Mayrhope, who had long experimented with the transmission of time by means of electricity, and at last gave it up in favor of pneumatic transmission, which is free from the drawbacks and uncertainties connected with the use of electric batteries, insulated wires for transmission, delicate contact breakers, and other complicated arrangements. Such annoyances have occurred in the experiments made in this country, where electric arrangements for the transmission of time have thus far never been in use for any considerable period. Some years ago, a time ball in the New York Custom House, intended to be regulated by an electric current from the Dudley Observatory at Albany, soon failed, because of the constant attention required, which could only be expected from persons specially engaged and exclusively interested in electric transmissions. Therefore it is not to be expected that such an enterprise can be successful until telegraph companies take hold of the matter; and only in such case is there possibility of a regular working of electric timepieces.

The method of Mr. Mayrhope consists in originating a wave of compressed air, which is sent through airtight tubes laid along the street gas mains to all the public clocks. This wave is transmitted once every minute, when the minute hands of all the clocks move forward the required distance. of seeds produced by the parent plants. The advantages of It is intended to extend this system until it includes the clocks cross-fertilization do not follow from some mysterious virtue in all the schools, public institutions, hotels, railroad depots, and the houses of such persons as desire it.

There is no doubt that this method has the enormous aderations to different conditions, or to their having varied in vantage of simplicity, especially when applied to a great a manner commonly called spontaneous; so that in either case number of clocks. Such a pneumatic tube may have ever their sexual elements have in some degree differentiated. so many branches; and at the end of every branch the im-Again, the injury from self-fertilization follows from the pulse must invariably reach the moving lever which, pushed want of such differentiation in the sexual elements. Thus by an elastic membrane, will propel the minute hand. It when plants of the *ipomaa* and of the *mimulus*, which had must, however, be borne in mind that, by this system, the been self-fertilized for the seven previous generations, and clocks will not move so instantaneously as by the electric had been kept all the time under the same conditions, were current. Electricity is transmitted over a telegraph wire intercrossed one with another, the offspring did not profit with a velocity of from 4,000 to 12,000 miles per second, acin the least by the cross. On the other hand, as showing cording to the perfection of the insulation; therefore the that the benefit of a cross depends on the previous treatment motion of the various clocks will be practically isochronous.

thate. Suggestions for Ornamental Fences and House Trimmings. With one page of illustrations.—New way of Outlining Theatrical Scenery.—Re-production of the Portland Vase.—Why Fine Gold Floats.—Design for Ornamental Chess Board, 1 engraving.

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- MISCELLANEOUS.-The German Excavations at Olympia,-Remark-a) is Roman Archeological Discoveries.-The Village Lyceum.-Value of Ashes as Fertilizers. VI.

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of the progenitors, plants which had been self-fertilized for But the wave of compressed air, transmitted by the elasticithe eight previous generations were crossed with plants ty of the atmosphere, moves only with the velocity of sound, which had been intercrossed for the same number of gen- which is, on an average, only 1.100 feet, or little over one erations, all having been kept under the same conditions as fifth of a mile, per second, minus the resistance in the narfar as possible. Seedlings from this cross were grown in row tubes, which may reduce it somewhat; so that its vecompatition with others derived from the self-fertilized locity of transmission may vary from 25,000 to 70,000 times mother-plant crossed by a fresh stock; and the latter seed- less than that of electricity. This, however, is of little praclings were to the former in height as 100 to 52, and in fertil- tical importance, as it would only cause the clocks to be one ity as 100 to 4. second behind for every 1,100 feet distance from the central

Under a practical point of view, agriculturists and hortistation: and if in some cases seconds had to be counted, the culturists may learn much from the above conclusions. correction would be easily applied. Clocks at a mile distance Thus it appears that the injury from the close breeding of would be about five seconds behind; and the correct amount animals and from the self-fertilization of plants does not having been determined by direct observation, a constant necessarily depend on any tendency to disease or weakness number would have to be added to the time indicated by common to the constitution of the related parents, and only each clock, in order to find the correct time to within a fracindirectly on their relationship, in so far as they are apt to tion of a second

resemble each other in all respects, including their sexual But if we go into such close calculations, the difference in time for difference in longitude ought not to be neglected. nature; and secondly, that the advantages of cross-fertilization depend on the sexual elements of the parents having At the latitude of Vienna, the degrees of longitude are become in some degree differentiated by the exposure of nearly forty-six mi.eslong: that means that meridians drawn , their progenitors to different conditions, or from their hav- on whole numbers of degrees are nearly forty-six miles apart.