Botanics. — "*On the origin of new species of plants.*" By Prof. HUGO DE VRIES.

The fact that the species existing at the present moment are, as far as we observe, invariable, can but be brought into accordance with the theory of descent when admitting that periods of constancy alternate with periods of mutability. The former may last hundreds and thousands of years, the plant, as experience shows, continues the same, all the time. The latter have, hitherto, escaped all observation.

Probably, however, because they have not been sought for. And this again had its cause in our not having a right perception of what was to be found. For the prevalent opinion that species originate through very slow changes, is not favorable to such researches.

Side by side to this supposition, the so-called selection-theory, the possibility of a discontinuous origin of species was already recognised by DARWIN. The differences between closely allied species are in fact so slight that they may quite well appear at once. This idea has since continually found a few followers, in particular among paleontologists, but also among zoologists and botanists. Starting from this principle there is no longer any ground to suppose the origin of species as being beyond observation, and consequently, neither not to look for it.

My conclusion is: plants may, alternately with long periods of constancy, go through periods in which they produce one or more new species. On the other hand, each species has originated from another in such a period. And for this it is by no means necessary that the mother-species dissolves into the new ones, converts itself into these, it may continue, with all its former properties, quite unchanged.

If this view is right, the one thing necessary is to look for plants being in such a period of mutation The chance of finding them is of course very slight, but this is no reason not to seek for them.

I have, in these researches, followed two methods. One consisted in direct observations on the wild growing-places; the other in the sowing out of seed collected from the natural habitat, or of seed from plants taken thence and brought into the garden. I sowed the seed in the garden on as large a scale as possible.

The result of this rather extensive research was the wished for. One species I found in a mutation-period. It is *Oenothera Lamarckiana*, introduced here, like *O. biennis* and *O. muricata*, from America.

I sowed its seed for the first time in 1887 and at once obtained a new form, *O. lata*, and that in three specimens. In 1888 I again sowed seed and now on a larger scale. I once more obtained *O. lata*, in five specimens, and beside it a dwarf form, *O. nanella*, likewise in five, and a species with narrow, glossy leaves, *O. scintillans* in a single specimen. My culture amounted to about 15.000 seedlings, so that both first mentioned species had appeared at the rate of 1 specimen on 3000.

I have since repeated these sowings, first on as large, later, with more experience, on a smaller scale, and now possess the ninth generation of *O. Lamarckiana* in a state of mutation.

It produces both the first mentioned species nearly every year, the third from time to time.

Moreover, I have seen arising from it a series of other forms, formerly unknown, sometimes in a single, sometimes in various, sometimes, even, in rather numerous specimens. Thus the culture of 1895 produced on 14,000 seedlings, 1 *O. gigas*, 2 *O. leptocarpa*, 8 *O. rubrinervis*, 15 *O. albida* and 176 specimens of *O. oblonga*. These forms proved at once constant at the first sowing; they are still at present, after some generations of culture, just as they were at their first appearance. Besides, of the three last named, nearly every year new specimens arise from the primitive stock.

I have now, during my fifteen years' experiment, observed about a thousand mutations, in which twelve quite distinct, and mostly seed-fast species occurred. Moreover, there originated a number of other, indistinct, sterile, or insufficiently seed-fast types.

The rules followed in these mutations are:

1. The new species originate suddenly, without intermediate forms or any other preparation.

2. From the beginning they remain unchanged in the course of the generations.

3. They are mostly, at sowing, perfectly constant, from their very first appearance. A return to the mother-species, or atavism, I never observed in those cases. Exception *O. scintillans*, with strong atavism.

4. Among them is a dwarf-form, *(O. nanella)*, which may be taken as a variety; it behaves, however, just as the others. Those others deviate from one another, and from the mother-species, as much, and in some respects more, than closely allied, older species in this and other genera.

5. They mostly appear in a great number of individuals, and repeatedly in a series of years.

6. The new properties are individually variable, according to QUETELET's law, like those of *O. Lamarckiana.* But between this variability and the mutation by which they took birth, there is no perceptible relation.

7. The mutations take place in various directions and not by preference in a determined one. Mostly they weaken the new species and so are disadvantageous *(O. albida)*, sometimes they are indifferent *(O. rubrinervis)*, sometimes probably favorable *(O. gigas)*. In many cases the fertility seems lessened, in others not at all.

The appearance of new species may be comprised in the form of a pedigree. The specimens repeating the type of *O. Lamarckiana*, then form the stock, of which each year the mutants are as many branches. In the pedigree below only these mutants are mentioned; the specimens obtained from their seed, which served me in the investigation after the constancy of the species, are left out.

The pedigree relates only to one of my experiments which was begun in 1886 with nine rosettes of two years' plants. These rosettes themselves were taken from the wild habitat, but had been removed in the autumn of the said year into the botanical garden, where in 1887 they flowered and bore seed.

Pedigree of Oenothera Lamarckiana.

Generation.	gigas	albida	oblonga	rubrinervis	Lam	nanella	lata	scintillans
8th Generation 1899 annual.		5	1	.	1700	21	1	
7th Generation 1898 annual.		.	9	.	3000	11	.	
6th Generation 1897 annual.		11	29	3	1800	9	5	1
5th Generation 1896 annual.		25	135	20	8000	49	142	6
4th Generation 1895 annual.	1	15	176	8	14000	60	73	1
3rd Generation 1890/91 biennal.				1	10000	3	3	
2nd Generation 1888/89 biennal.					15000	5	5	
1st Generation 1886/87 biennal.					9			