Classics of Science: The Mutation Theory

Although experiments in plant breeding take a considerable length of time, especially when the results desired are variations from the usual form of the plant, a plot of oenothera would be an interesting addition to any garden, for its historical associations, for its scientific possibilities, and for its own sake.

THE MUTATION THEORY, Experiments and Observations on the Origin of Species in the Vegetable Kingdom, by Hugo de Vries (1903), translated by Prof. J. B. Farmer and A. D. Darbishire, Chicago, 1909.

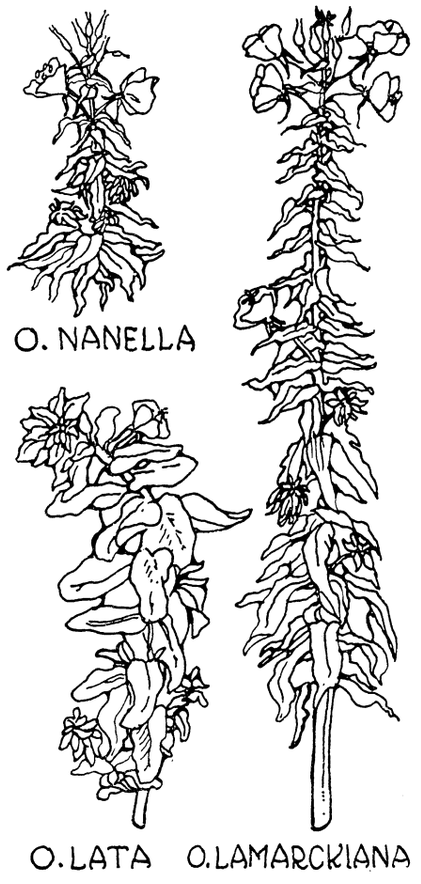
A Mutating Plant

The chief obstacle in the way of getting material suitable for investigating the origin of species is our complete ignorance of the conditions under which this process takes place. In order to obtain this material I started in 1886, to search the country round Amsterdam for species, exhibiting such monstrosities or other peculiarities as I thought would suit my purpose. As a result of my quest I brought over one hundred species into cultivation, but only one of these turned out to be what I really wanted.

From this I conclude that most of the species in this locality are passing through a period of non-mutation, and that plants which happen to be actually passing through a mutable phase are encountered at any rate, relatively rarely.

The plant in question is *Oenothera Lamarckiana,* which together with its nearest allies *O. biennis* and *O. muricata* have been introduced into Europe from America. The species *Lamarckiana* differs from the others by its taller growth, by its much larger and more beautiful flowers, by the fact that self-fertilization rarely occurs, by its different leaves, and so forth. *O. Lamarckiana* was introduced from America into our gardens, from which it has subsequently escaped. At any rate this was the case in the locality in which I found it.

This was close to Hilversum and afforded peculiarly favorable circumstances for the most minute investigation. I visited the place during the summers of the years 1886-1888 almost every week, and, since that date at least once or twice nearly every year. The plant grew in a disused potato-field to which it had spread from a neighboring park. It began to spread in about the year 1875, and during the 10 years 1875-1885 it extended over about half the field. In



THE PARENT OENOTHERA and two of its mutants. Drawings made from de Vries' book

the succeeding years it multiplied still more rapidly; until the field was finally planted with forest trees. At the present day traces of the plant still exist.

A rapid multiplication of this kind during the course of a relatively short period of time has often been considered as one of the conditions for the appearance of a mutable period. This consideration led to a closer investigation on the spot, which confirmed the conclusion.

The plant exhibited a high degree of fluctuating variability in all its organs and characters. It presented also numerous variations of another kind, of which I shall only mention fasciation and "pitcher"-like malformation. Most of the plants were biennials, but many were annuals; and a few lived three years, as in the case of the beet.

(*Just turn the page*)

"Radio" Aids Cancerous Mice

An attack on cancer is being made by high frequency electricity, close in wavelength to the short waves that have recently been found so effective in radio communication.

The researches conducted by the U. S. Public Health Service under the direction of Dr. J. W. Schereschewsky with his laboratory at the Harvard Medical School, have been in progress at intervals during the last five years and have now been informally reported to a congressional committee in connection with a request of an appropriation of $5,000 to provide assistants and material for the work.

Experiments so far have been confined to mice and chickens. Much progress must be made before there can be any possibilities of applying the results to human beings. Mice with tumors artificially acquired in the laboratory were improved by being subjected to doses of oscillating electricity produced by vacuum tubes similar to those used in radio sets.

The frequencies used by Dr. Schereschewsky in his experiments ranged from 8,300 to 135,000 kilocycles per second, a range that expressed in the more familiar language of radio corresponds to wavelengths below about 40 meters. The most effective frequencies were found to be about the middle of the extremes used and more deaths of the mice occurred at the high and low ends of the frequency range. Some of the mice treated suffered a shriveling of the ears and tail due to the current to which they were subjected, but many were perfectly normal after the treatment that had a beneficial effect on their cancers.

The dosages of electricity used by Dr. Schereschewsky were much more than anyone could possible receive from radio broadcasting and public health officials discounted in advance any ideas or suggestions that the speed of radio would by this means aid in the treatment of cancer. They also emphasized the fact that the method was still in its early experimental stage upon animals only, and that treatment of human being is still far in the future.

The investigations are being supported by the U. S. Public Health Service with laboratory space furnished by the Harvard Medical School. They are now being pushed on account of the promising results and the unique methods that have been developed.

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The Mutation Theory

(*Continued from page* 105)

New Species

That I really had hit upon a plant in a mutable period became evident from the discovery, which I made a year later, of two perfectly definite forms which were immediately recognizable as two new elementary species. One of them was a short-styled form: *O. brevistylis,* which at first seemed to be exclusively male, but later proved to have the power, at least in the case of several individuals, of developing small capsules with a few fertile seeds. The other was a smooth-leaved form with much prettier foliage than *O. Lamarckiana* and remarkable for the fact that some of its petals are smaller than those of the parent type, and lack the emarginate form which gives the petals of *Lamarckiana* their cordate character. I call this form *O. laevifolia.*

Both *O. brevistylis* and *O. laevifolia* come perfectly true from seed as will be shown later on. They differ from *O. Lamarckiana* in numerous characters, and are therefore to be considered as true elementary species.

When I first discovered them (1887) they were represented by very few individuals. Moreover each form occupied a particular spot on the field. *O. brevistylis* occurred quite close to the base from which the Oenothera had spread; *O. Laevifolia* on the other hand, in a small group of 10 to 12 plants, some of which were flowering whilst others consisted only of the radical leaves, in a part of the field which had not up to that time been occupied by *O. Lamarckiana.* The impression produced was that all these plants had come from the seeds of a single mutant. Since that time, both the new forms have more or less spread over the field.

I could find neither of these forms in the herbaria of Leiden, Paris or Kew; nor have they, so far as I have been able to discover, been described from other localities. Whether or no they did arise in my locality can of course no longer be determined. But I think that until proof to the contrary is forthcoming this must be regarded as extremely probable. So much at any rate is certain that the discovery of these two species increased my hope of witnessing the origin of other species from the same stock—a hope which was soon to be fulfilled.

In the autumn of 1886 I brought two samples from Hilversum to Amsterdam for cultivation in the experimental garden. One lot consisted of nine particularly fine rosettes with almost fleshy roots; the other, of the seed from a quinquelocular fruit from a plant growing in the middle of the field. Lastly, in the autumn of 1887 I collected the seeds of *O. laevifolia.* I obtained in this way three groups which, in conformity with the principle of nomenclature adopted by growers of beets, I call families; and these I continue to grow, separately, to the present day.

From these three families and their numerous lateral branches I have derived my whole culture, which has embraced several thousands of individuals almost every year. Latterly several hundreds of plants have been artificially fertilized for seed purposes every year.

Furthermore I have imported *O. brevistylis* direct from Hilversum, because it did not arise in my cultures. I have also occasionally made collections of seed in the field to afford material for control experiments.

In each of these three families new species have arisen in my garden; and they have been essentially the same in the three groups.

Hugo de Vries was born in Holland, February 16, 1848, and celebrated his 80th birthday this month at his home at Lunteren. His book, "The Mutation Theory," from which the above extract is taken, was published in 1903, and became one of the foundation-stones of the science of heredity. Mendel's fundamental paper was discovered by scientists about the same time. In the light of the investigations which followed the meaning of the term "mutation" has changed somewhat. More definite **criteria** of species are now available, and there is some doubt whether an entirely new species can arise by mutation. But *Oenothera Lamarckiana,* although probably not a pure strain in the beginning, remains a very interesting plant, and when de Vries retired in 1918 as Emeritus Professor of Botany of the University of Amsterdam he went to live at his country place where he could experiment further with his cultures of the "sporting evening primrose."

Science News-Letter, February 18, 1928

Do You Know That—

Explorers from the British Museum found two bronze water pumps buried on the site of an ancient Etruscan city.

A scientist has figured that once around the universe is 63,000 billion times the distance from the earth to the sun.

A wireless transmitter in Great Britain starts and stops the fog signals in the Firth of Clyde more than a mile away.

Pork should be thoroughly cooked, because poorly cooked pork may harbor parasites of a disease known as trichinosis.