

Dr. Wier Amsterdam, Kerklaan 9  
2 Sept. 1879.

My dear Sir

I was very much pleased to see from your kind letter, that you had been coming to the same opinion on the causes of growth, as I had been led to through my experiments. I always deferred answering you and thanking you for your kind words on my researches, because I hoped to be able to make some more communications to you on this subject.

Since that time I experimented almost only with the tendrils of *Lycopers*, and I found some more arguments for the opinion, that the force of turgor is the true cause of the movements.

It seemed to me to be of great interest to make out, whether the attractive power of the parenchyme for water is increased by the stimulus, or whether the extensibility of the



elastic tissues becomes greater. The first is rather more probable, but it could not a priori be considered as sure.

To decide this question I cut off the upper side of the tendrils and brought the remaining portion in a solution of salt of  $\frac{1}{2}$ . Here they do not absorb water nor lose it; they keep the curvations they took during their being cut. It is easy to cut them in such a way, that the epiderm, the collenchyme and the vascular bundles of the upper side are taken off, and that only the parenchyme remains, in connection with the vascular bundles and collenchyme of the lower side. Tendrils that have been operated in this way still remain sensitive, and are able to make very close curvations. To my opinion this fact proves that the force of turgor of the parenchyme is increased by the stimulus; at all events the elastic tissues of the upper side are not necessary for the movements.

I made another experiment to prove this. If you allow a tendril to make  $\frac{1}{2}$  - 1 curvation round a thin stick and then get it off and inject it with water under the air-pump, you will see the curvations rapidly increase at the same moment. In a very few minutes the tendril makes 3-5 turns

beginning in the point, where it had touched the  
stick. I often made this experiment, it shows  
that the power of the parenchyme to grow by  
absorbing water is rapidly increased by the stimulus.  
Before the injection the cells could but slowly  
absorb water, after being injected they find it in  
aundance immediately around them.

With the movements of tendrils, the water-  
absorbing power of the parenchyme is generally  
increased, for almost all movements are temporarily  
accelerated by injection with water. But in the  
described case the effect is always the most evident.

So it is the water-absorbing power, that plays  
the principal part in the growth and the movements  
caused by stimulus. This power is due to some substance  
in the vacuole of the cells; I hope to be able to  
recognise the nature of this substance another  
year.

According to your wish, that I should  
publish in the course of the winter, I have already  
begun to write, and hope to finish before the end  
of our summer holidays.

If I were allowed to combine the results  
of this investigation with that of my experiments  
on roots, I should be led to say, that growth  
of cells and organs chiefly depends upon two causes:  
the extensibility of the cell walls, and the water-  
absorbing power of the contents of the cells. If  
the extensibility of the cell wall is different in  
various points or in various directions, the form  
of the cells and organs will change; so may grow

The hairs, fibres, ramified cells, cylindrical cells, & the peltates may be formed by the thin stolonae. Then the force of turgor causes the rapidity of the growth; it depends on the quantity of water, the light, the gravity etc, and causes the elongations, the geotropical and heliotropical curvations, and the movements of the pinnae by which many leaves and branches of inflorescences are attached to their stems. It seems to be quite clear, that both the force of turgor, and the extensibility of the cellwalls are regulated by the protoplasm. Do you think these considerations probable?

Many kind thanks for your communication on the roots of *Lychnis fithago*. I am sorry we have no young specimens in our garden, so that I am not able to see the ridges.

Sincerely thanking you again for your kind letter, I remain

Dear Sir

Yours very faithfully

J. Hugo de Vries.