

On the Terminal Growth of Phanerogams.

From the present standpoint of science taken in connection with the writer's own observations, the following propositions may be deduced.

(1). The theory of Hanstein, which is almost universally accepted at the present time, that the apical growth of Phanerogams does not proceed from a single point (Scheitelzelle) but is the result of the independent development of three different tissues is not proved by any of the hitherto known facts. The investigations ^{are not sufficiently exact} are ~~too inaccurate~~, they do not take sufficiently into account the difficulties which solid organs, as contrasted with those formed of a single layer of cells, offer, and they leave the possibility of the presence of a single terminal cell out of consideration. The explanations which can be gained from ~~the~~ daily streaks in the tissues are arbitrary and often contradict

my own
accurate

the, drawings. Also in some of the vascular cryptogams, the apex of the stem of the very same plant sometimes ~~now~~ exhibits an appearance such as is seen in the apex of Phanerogams and sometimes an undoubted ~~sein~~ terminal cell. (*Telaginella ciliata*.)

There are not a few facts which are directly irreconcilable with the prevailing theory of growth. — Plerom and Periblem ~~are~~ in many cases not distinct near the apex; this is most striking in thin leaves where both tissues arise from a single layer of cells. Further, Periblem and Dermatogen are at times not distinct near the apex since cells of both systems have proceeded from one mother cell. Finally, there are ^{young stages} ~~young stages~~ of leaves which do not commence with a swelling of the Dermatogen but where the ~~the~~ incipient projection shows an ~~an~~ arrangement of cells like that of the vascular cryptogams. (*Elodea*.)

3. The prevailing ~~view~~ theory of growth can on phylogenetic grounds be declared

impossible. The stem of Phanerogams is the ~~descend~~ offspring of that of the vascular cryptogams; the apical growth of Phanerogams is the continuation of the growth by means of a single cell. The metamorphosis of the latter into the Plerom-Periblem-Dermatogen growth is, from the experience of cow parative morphology, inconceivable. This experience was either too little known or too little considered in the adoption of the theory of descent up to the present time and on general grounds scarcely touches the distinct causal forces of the cell division.

4. The formation of the embryo of Phanerogams is no proof of the prevailing theory of growth. at all events, as a rule, the embryo possesses no ~~tem~~ apical cell and certainly none which would become the apical cell of the stem. But furthermore this is not the case with the vascular cryptogams and only a forced and absolute interpretation could derive about such a change. The embryo of the vascular cryptogams has at the apex

two (sometimes four) cells which are similar in shape and importance, from one of which the primary apical cell of the stem is cut off.

5. The embryo of the ^{and phanerogams} vascular cryptogams is not a Caulonema but a Thalloma like the moss sporangium from which it is phylogenetically derived. The cotyledons are not Phyllomata but Thallomata. The stem arises as a new ^{structure} formation on the embryo.

6. The ~~the~~ apical growth of Phanerogams has as yet been ^{quite} clearly observed only in a few roots (*Eleocharis*, *Vallisneria*, also in *Callitriche*, *Arisma*, *Myriophyllum*). The apical cell appears foursided in longitudinal sections, seen from above generally three ^{angled} sided. Segments are then cut off by partitions which run tangentially and in them there arises first an ~~epidermal~~ epidermal wall, and the remaining wall by which the bar cells are formed follow one another preferably from without inward. By partitions in the apical cells, cells are cut off at its base from which the vascular axis arises. The root-cap grows later preferably by division of the cells lying next to the apical cell. The epidermis remains undivided (*Callitriche*, *Eleocharis*) or divides into two layers (*Vallisneria*, *Myriophyllum*). — The analogy leads us to suppose that the apical growth of the stem is the same as the growth of the root.



Goodale, George L. 1835. "Goodale, George L. undated essay." *Asa Gray correspondence*

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