

# VIVEKANANDA COLLEGE THAKURPUKUR

KOLKATA-700063  
NAAC ACCREDITED 'A' GRADE



**Topic: Telome Theory**

**Course Title: Archaedoniate  
(Pteridophytes)**

**Paper: BOT-A-CC-2-4-TH**

**Unit: 3**

**Semester: II**

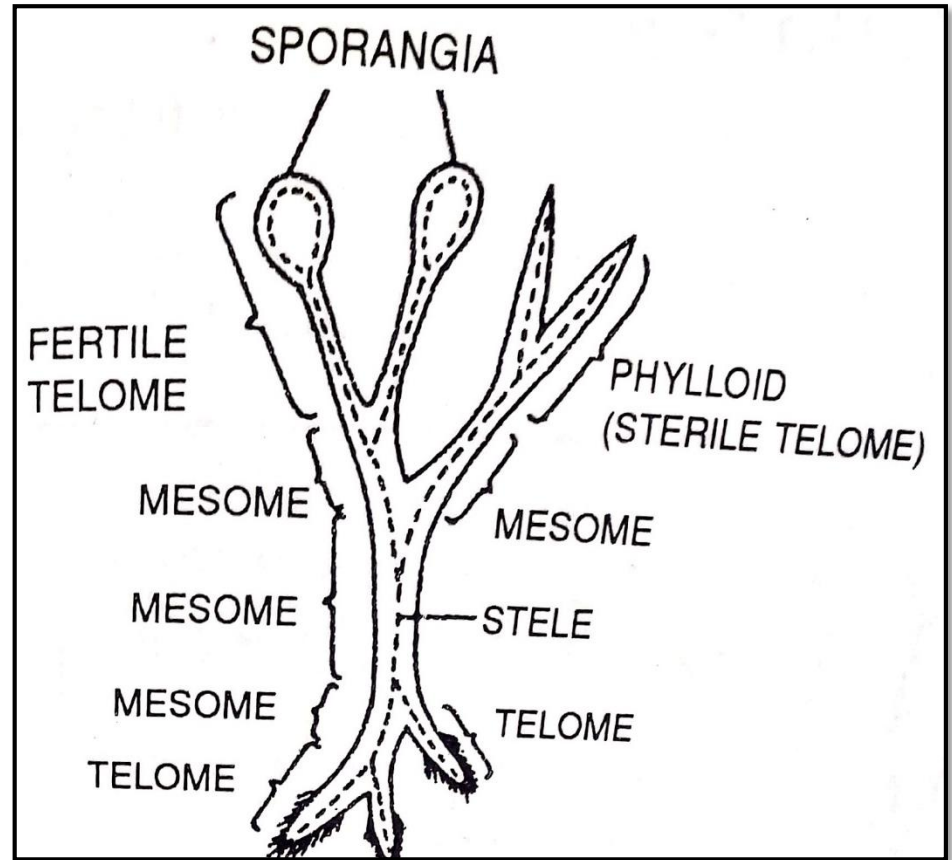
**Name of the Teacher: Dr. Asis Kumar Pal**

**Name of the Department: Borany**

# Telome Theory

- This theory was first proposed by Walter Zimmermann in 1930 (and gradually modified on 1938 and 1949).
- It is based on the discovery of first rootless, leafless, dichotomously branched land plant *Rhynia* by Kidston and Lang from the middle Devonian Rhynie chart bed and synthesises the major steps in the evolution of vascular plants.

- From the point of most distal forking a single ultimate termination of a dichotomously branched axis was termed by Zimmermann as 'telome'.
- The internode below the telome i.e. the part of the axis in between two dichotomies is called 'mesome'.
- Zimmermann described 3 categories of telome: (i) phylloid or sterile telome; (ii) fertile telome, (iii) syntelome or telome trusses.

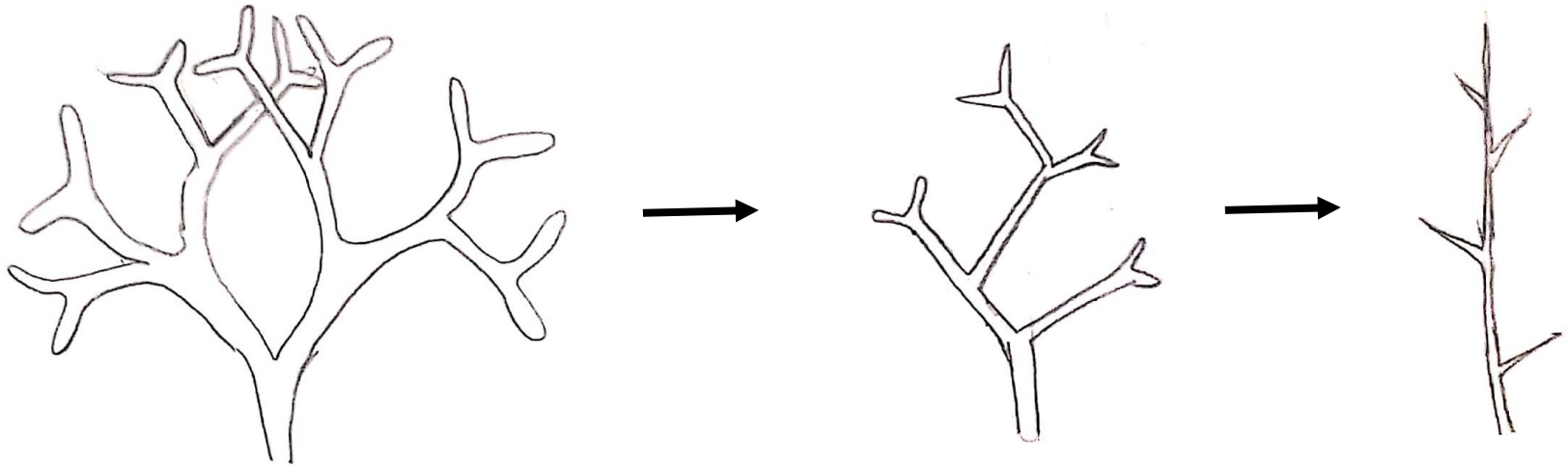


**Syntelome**

According to this theory, the organogenesis and progressive differentiation of higher vascular plants proceeded along five elementary process namely:

1. Overtopping
2. Planation
3. Syngeneses or webbing
4. Reduction
5. Curvation

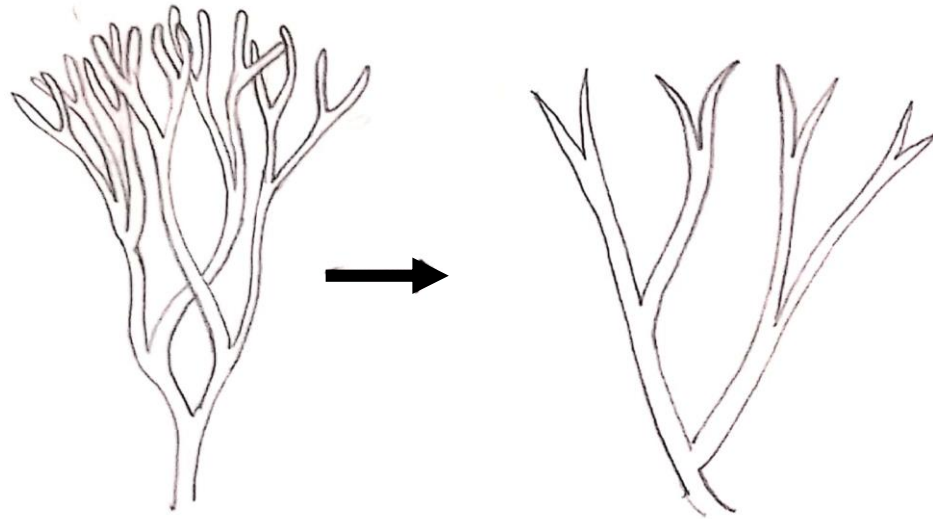
# Overtopping



## Evolutionary Process of Overtopping

- At first the dichotomously branched, leafless axis become sympodial and finally monopodial.
- Of the two dichotomies, one branch overgrows the above, becomes stronger and erect ,and transformed into main axis by the activity of the apical meristem.
- The other branch becomes short and lateral.
- This process is repeated at each dichotomy. The main axes become the stem and the overtopped branches turned into leaves on lateral branches.

# Planation

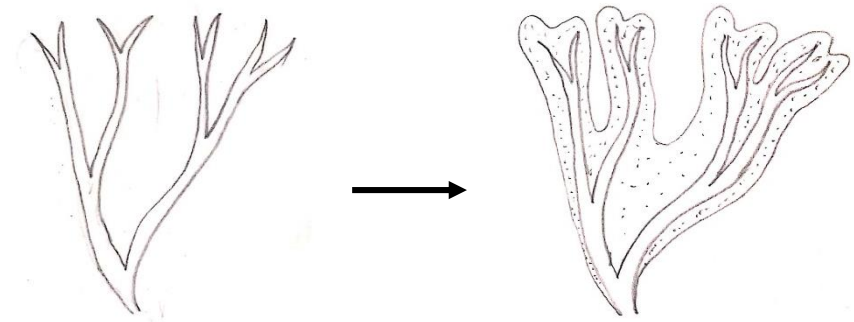


## Evolutionary Process of Planation

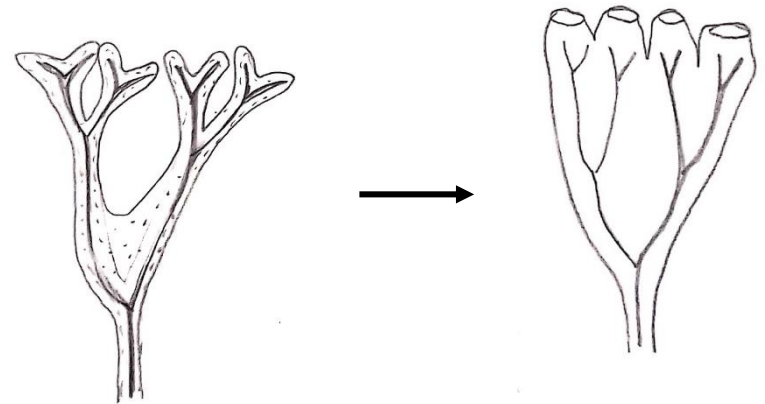
- The 3 dimensional dichotomies become at first arranged in one plane only.
- As a result the radial symmetry is changed into bilateral symmetry.

# Syngeneses or Webbing

- This is fusion of adjacent telomes and mesomes, may be either foliar or axial.
- **Foliar syngeneses:**
  - Telome and mesomes of planted branches are inter-connected by infilling with photosynthetic tissues along with other tissues and result in leaves with *open dichotomous venation*.
  - Closed reticulate venation results from the lateral fusion of dichotomizing veins.
  - If the process is accompanied by overtopping, pinnately veined leaves are resulted.
- **Axial syngeneses:**
  - Several axes may fuse together along with parenchymatous webbing.
  - The protosteles remain free and thus a polystelic condition results.
  - Webbing along with fusion of steles lead to the formation of various complex types of steles.



**Evolutionary Process of Webbing**



**Evolutionary Process of Syngeneses**

# Reduction

- In this process, the telome truss becomes reduced in a single telome.
- As a result needle like microphyllous leaves of lycopsida, sphenopsida and some conifer are originated

# Curvation

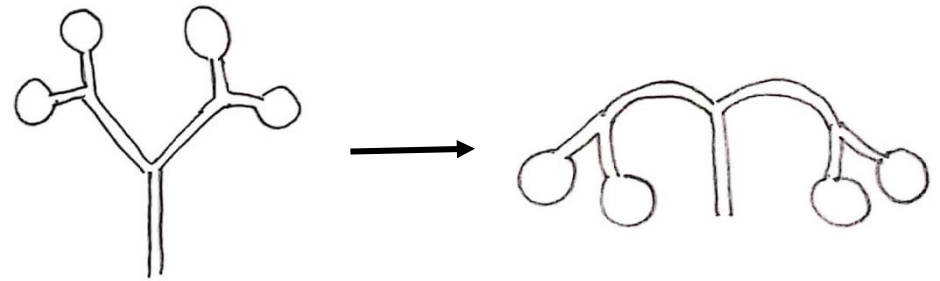
This phenomenon occurs in fertile telome only. This may occur in two ways:

- **Recurvation**

- Here only downward shifting of sporangia takes place as found in sphenopsids

- **Incurvation**

- In this process shifting of the sporangia to the lower surface of the sporophyll takes place as in pteropsids.



**Evolutionary Process of Recurvation**



**Evolutionary Process of Incurvation**

# Merits of Telome Theory

It is a masterpiece which skillfully explains the following important aspects:-

1. The origin and evolution of the sporophytes of land plants.
2. Relationship between the root, stem and leaves in a plant body (The entire sporophyte is an axis that has an underground portion called the root and aerial part called the shoot. The appendages of shoot i.e. the sporophylls, sporangia and sterile leaves are nothing but modified parts of the stem).
3. The evolution of leaf, sporophyll and sporangia within the members of pteridophyta.

# Demerits of Telome Theory

1. The structural organization as exhibited by *Zosterophyllum* and *Baragwanthia* having lateral sporangia that appears at an earlier age than that of *Rhynia* do not confirm with the structure of first vascular land plant as suggested by Zimmermann.
2. The origin of microphyllous leaves of Lycopods as explained by Zimmermann to be the product of overtopping and reduction was greatly criticized by a number of workers. Bower suggested enation theory for the origin of microphyllous leaves which was later supported by many other workers (Eames, Takhtajan, etc.).
3. The appearance of whorled or spiral groups of sporangia of some primitive fossil members cannot be explained by the telome concept.
4. According to telome theory, the 'polystele' is the product of syngeneses. But Stewart opined that the term should be 'eustele' because it is originated by the syngeneses of several vascular segments.