# CRITICAL THINKING AND BIOLOGY INSTRUCTION

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The structure of the shoot apex of Podophyllum peltatum L. is described in terms of a cytohistological zonation superimposed on a tunica-corpus configuration. The tunica of P. peltatum tends to be a single layer, while the corpus is indistinct because of gradual differentiation of pith cells.

Cytohistological zonation is interpreted in terms of a distal axial zone, the metrameristem; a peripheral zone, the flanking meristem; and a subterminal axial zone, the rib meristem. Cytochemical observations indicated that RNA distribution in the vegetative shoot apex of P. peltatum varies in terms of the structurally identifiable cytohistological zones. The flanking meristem, and rib meristem were high in nuclear RNA, while the metrameristem was relatively low in RNA.

The seasonal cycle resulted in no apparent changes in the structural aspects of the vegetative shoot apex. Distribution of RNA, however, did clearly reflect changes in the state of the apex, which paralleled the seasonal cycle.

Axillary buds are described as being initiated from detached meristems which show cytohistological zonation consisting of 2 layers, stratified initials, overlaying a group of subtending cells, the basal initials. A zonal pattern characteristic of mature vegetative shoot apices becomes evident in the axillary bud during the initiation of the first leaf primordium. The position of the axillary bud is described as cauline in origin and cauline in ultimate position.

## CONCLUSIONS

Several conclusions relative to the shoot apex of Podophyllum peltatum and the affect of the seasonal cycle upon the apical meristem can be drawn from this investigation:

1. The apex of Podophyllum peltatum can be described as a dome of medium size and exhibiting an internal structure not unlike that of other angiosperm apices.
2. The structure of the vegetative shoot apex of Podophyllum peltatum remains consistent over the seasonal cycle.
3. RNA in the shoot apex of Podophyllum peltatum reflects the structurally identifiable cytohistological zones.
4. RNA distribution suggests that the flanking meristem and rib meristem are the major contributors to apical growth while the metrameristem serves as a zone of initials.
5. Relative distribution of RNA remains constant among the zones of the shoot apex over the seasonal cycle.
6. The total amount of nuclear RNA decreases in the apex during active growth of the shoot and increases during inactive periods. It is concluded that this reflects a rapid mobilization of RNA out of the nucleus during rapid growth and the accumulation of nuclear RNA during periods of inactivity.
7. Axillary buds are initiated from detached meristems at the third node. They are cauline in origin and cauline in their ultimate position. Cytohistological zonation similar to the mature vegetative apex occurs at the time the first leaf primordium is being initiated.

Science teaching, in particular, is devoting more attention to the need for teaching methods and strategies which can develop students ability to think logically, analyze, and utilize basic concepts to draw conclusions and make predictions. A model using an angiosperm seasonal study was developed. This model maintains a balance between teaching information content and enhancing higher order thinking skills. Observations of shoot apices are described based on an analysis of the theories on shoot apical organization. Measurements and descriptions of apical dome height and width of the species were obtained to serve as a basis for classroom discussions concerning the changes in apical organization over a one year period. Results of this study were used to prepare a multi-media presentation that allowed students to make observations and generate hypotheses about shoot development. During classroom discussion, fundamental anatomical and morphological questions were generated to be used as the basis for student independent laboratory projects. These projects represent one portion of an overall strategy that we have developed to enhance student thinking skills. A complete description of this strategy was published by Dr. David J. Stroup and Dr. Robert D. Allen in the National Association of Biology Teachers monograph Teaching Critical Thinking Skills in Biology.