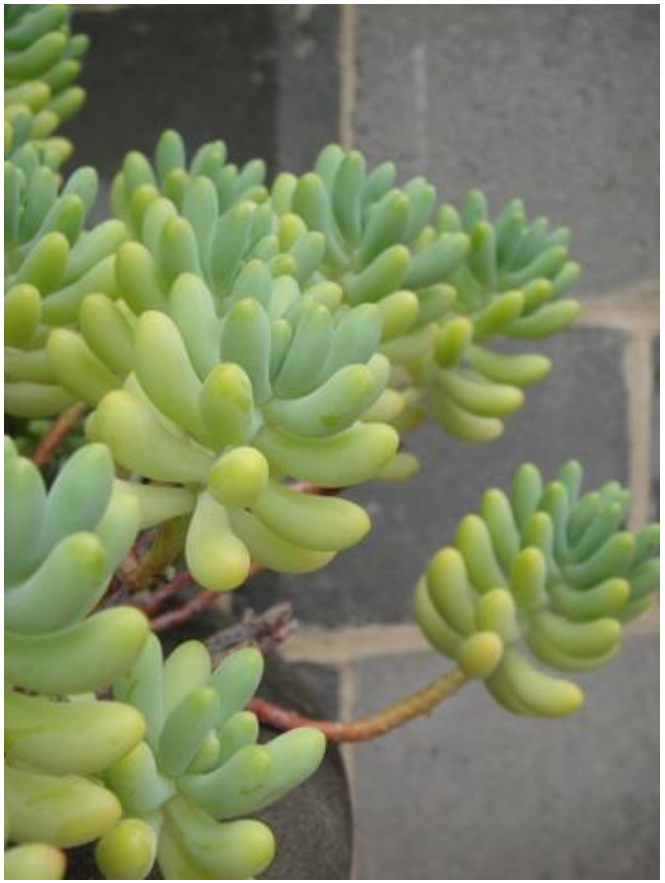
第 9 章　植物的运动

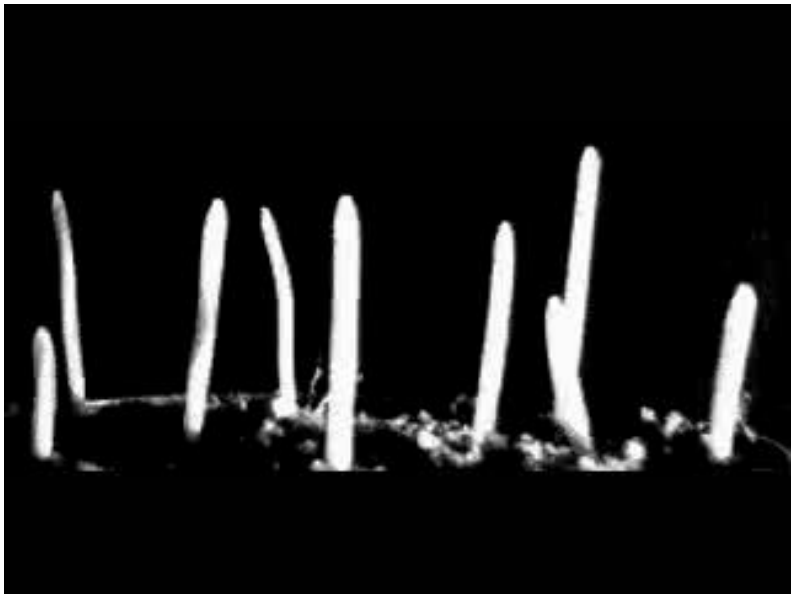
第 1 节　向性运动

- 指植物受环境因子单方向刺激而产生的定向生长运动
- 正向性 vs.负向性。
  - 向光性
  - 向重力性
  - 向水性
  - 向触性

一、向光性

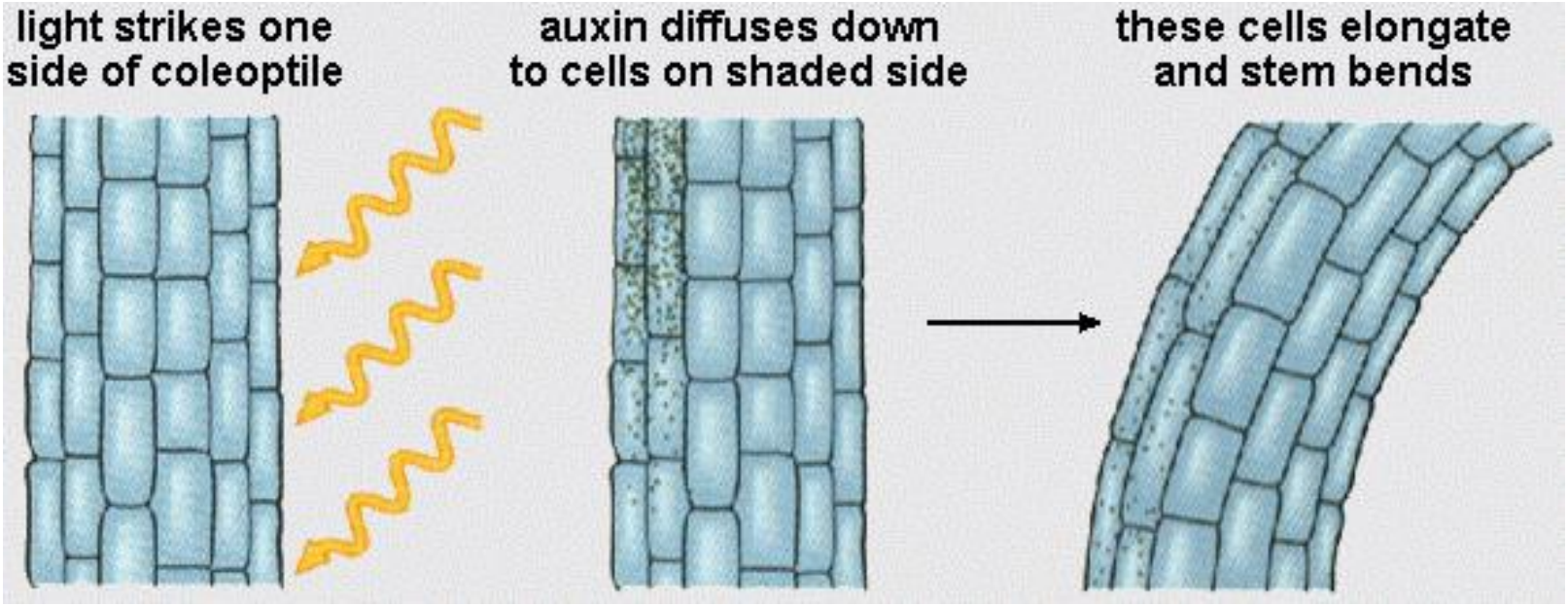
Figure 11.9 A cyclamen plant that received light from one direction for several weeks. Note how all visible plant parts are oriented on the side that received light.



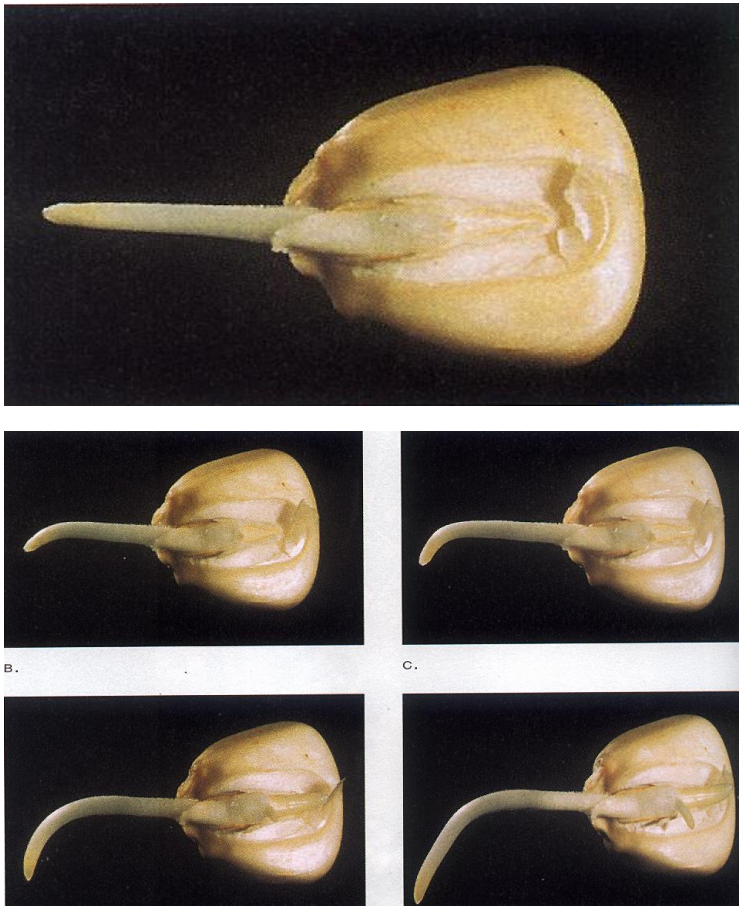


玉米幼苗的向光性

生长素引起向光生长


light strikes one side of coleoptile
auxin diffuses down to cells on shaded side
these cells elongate and stem bends

二、向重力性（向地性）



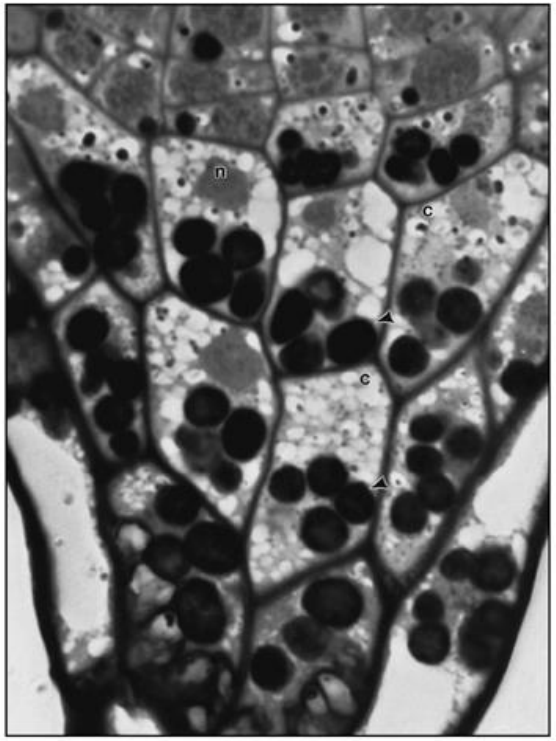
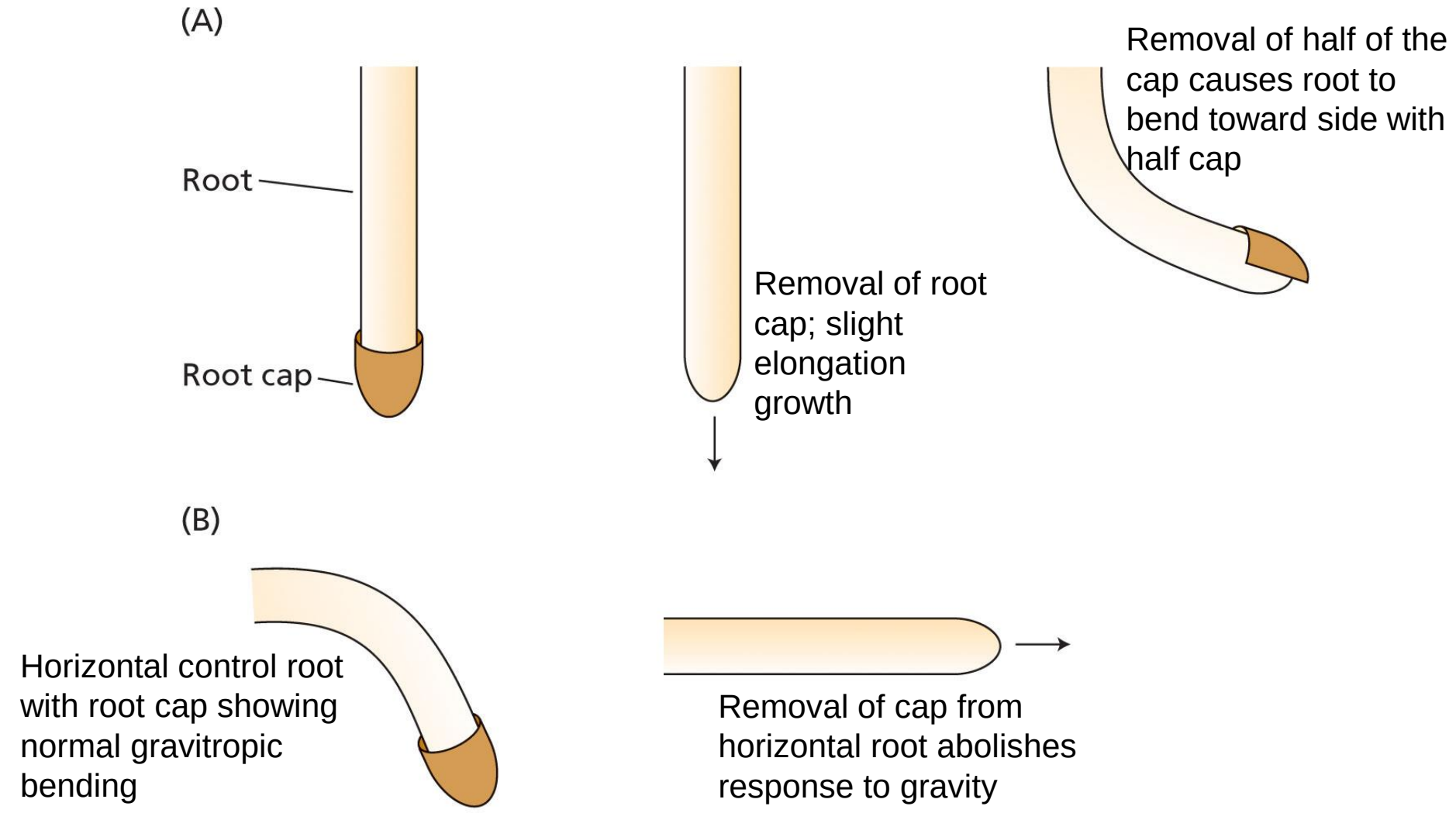


Figure 11.11 A root cap of a tobacco plant. The force of gravity is at the bottom of the picture. Note that the amyloplasts (more or less spherical dark objects) are toward the bottom of each cell. There is conflicting evidence as to whether or not the amyloplasts play a role in the perception of gravity by roots, ×2,000. *(Light micrograph courtesy John Z. Kiss)*

根：正向重力性

根冠是感受重力的部位


(A)
Root
Root cap
Removal of root cap; slight elongation growth
Removal of half of the cap causes root to bend toward side with half cap
(B)
Horizontal control root with root cap showing normal gravitropic bending
Removal of cap from horizontal root abolishes response to gravity

造粉体在植物感受重力性中的作用

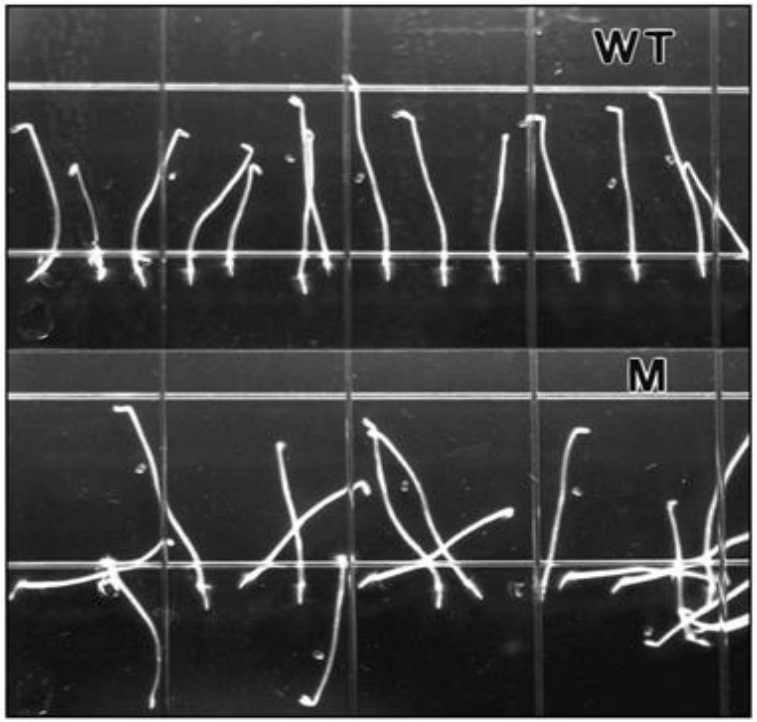
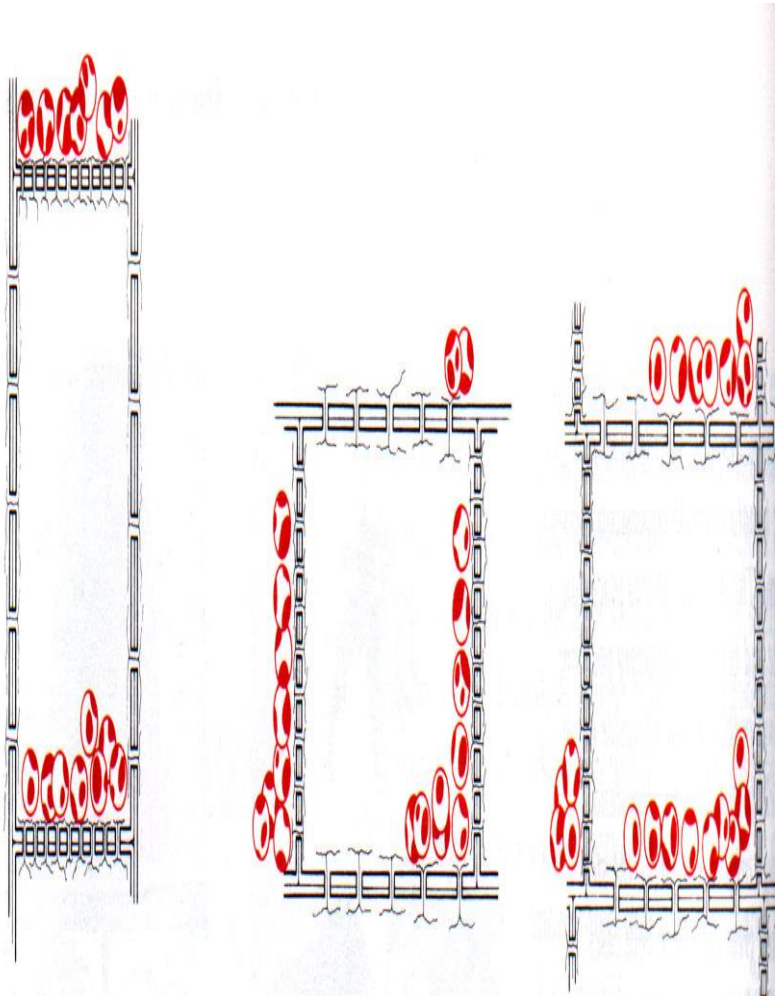
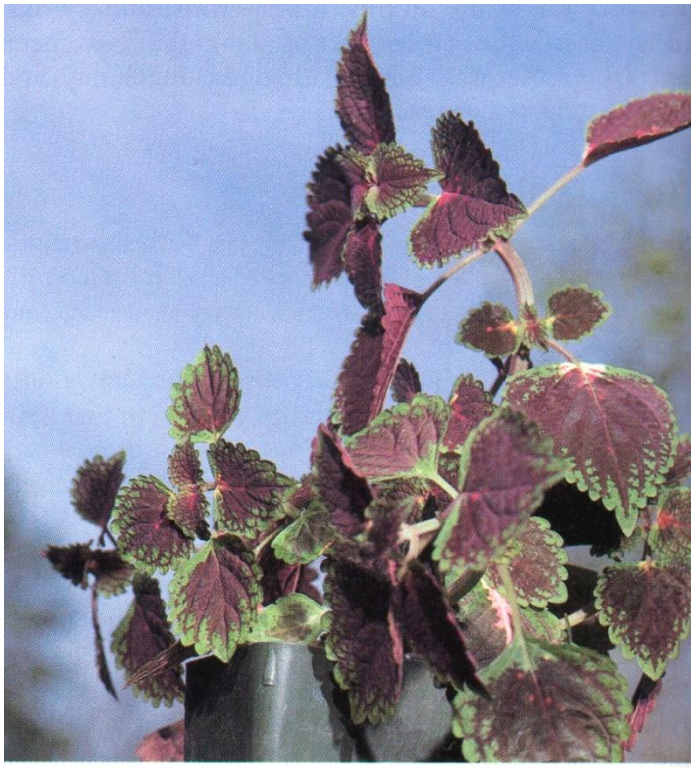
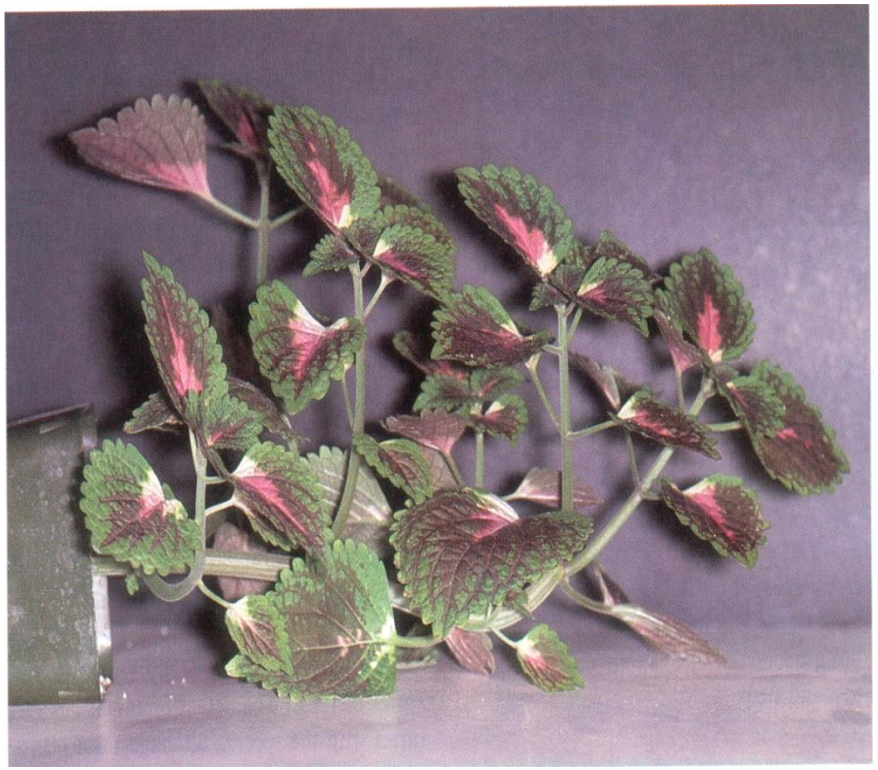


Figure 11.12 Tobacco seedlings grown in the dark. The source of gravity is at the bottom of the pictures. Normal "wild type" seedlings in the top row are all more or less perpendicular to the gravity. The seedlings in the bottom row are mutants with much less starch than normal plants. The mutant seedlings are disoriented, suggesting that any amyloplasts of typical mass function as statoliths in the perception of gravity. However, mutants of other species lacking amyloplasts do respond to gravity, suggesting that parts of cells other than amyloplasts may be involved in the perception of gravity, ×0.5. *(Courtesy John Z. Kiss)*



负向重力性





As the Coleus plant was placed on its side, the stems bent upward within 24 hours of the pot being tipped over.

负向重力性

拟南芥

向日葵幼苗

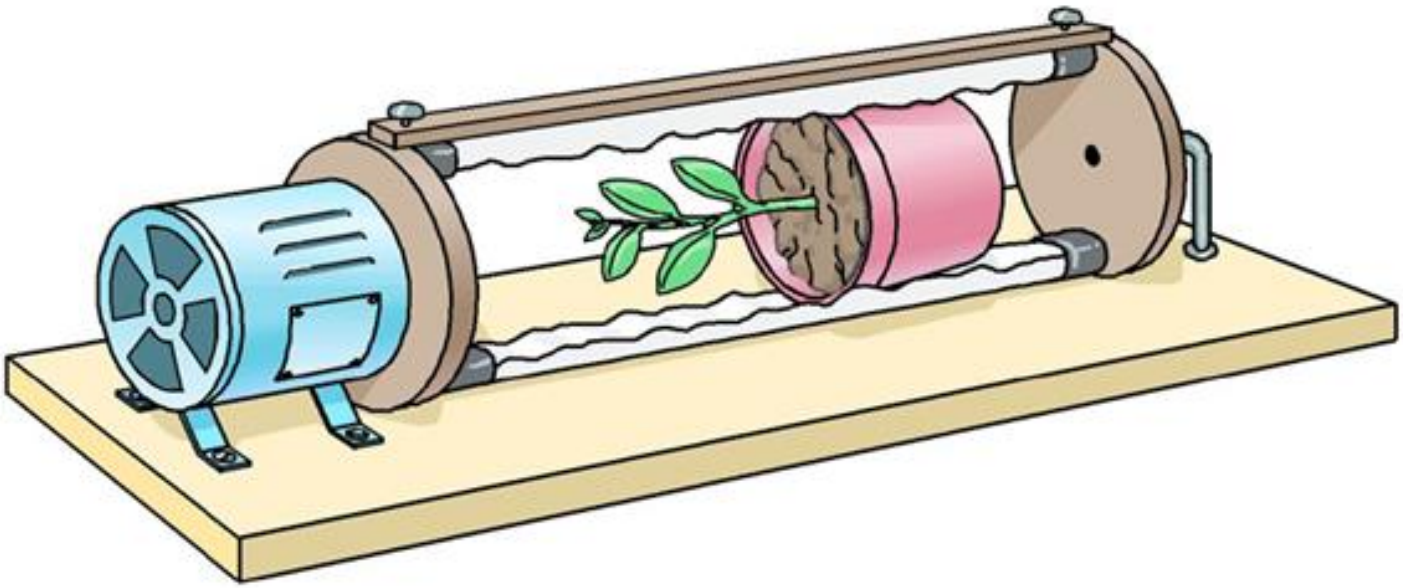
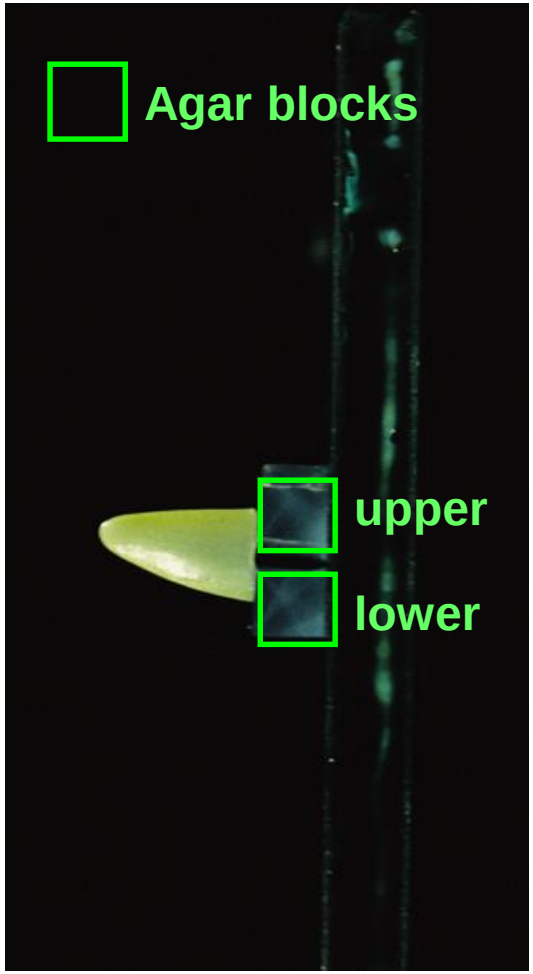
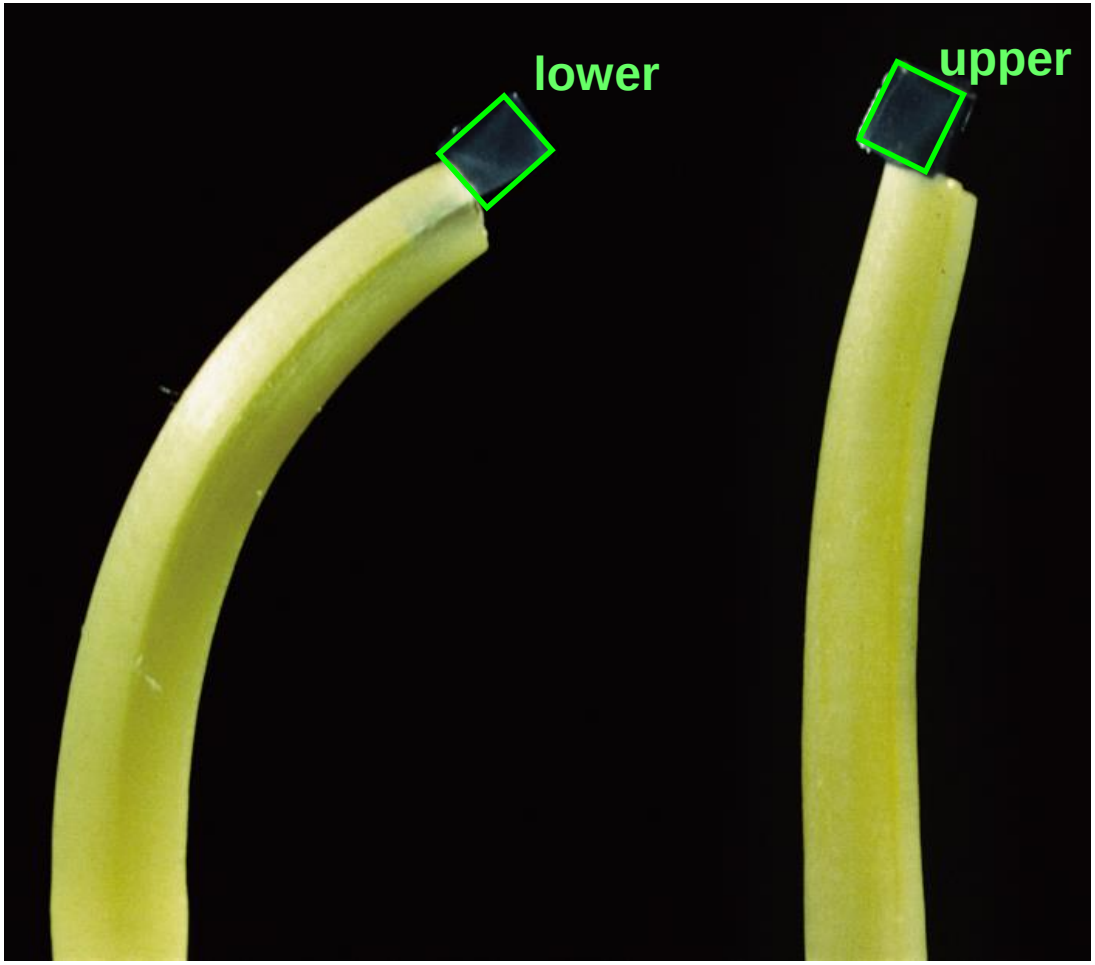


Figure 11.13 A clinostat, which is a tool used by plant biologists to negate the effects of gravity. Growing plants or seedlings are slowly rotated so that the statoliths in cells that perceive gravity do not settle to the bottom, and typical growth or bending of stems or roots away from gravity does not occur.

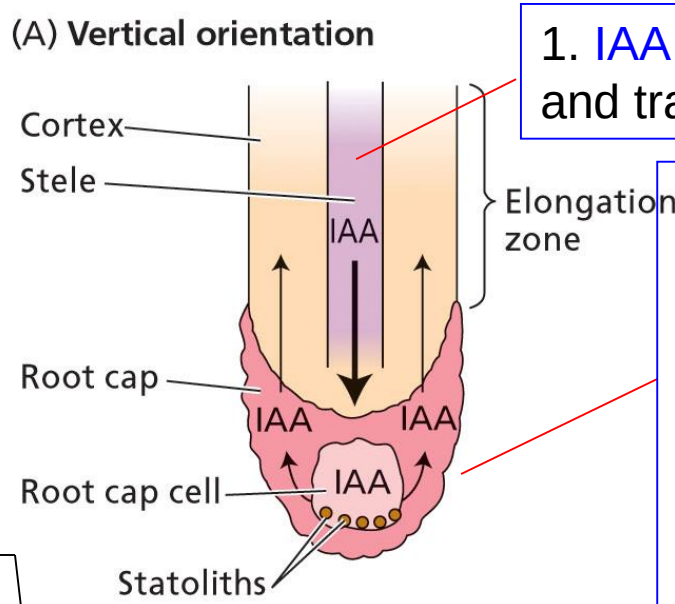
生长素在向重力性中的作用：生长素的不均匀分布





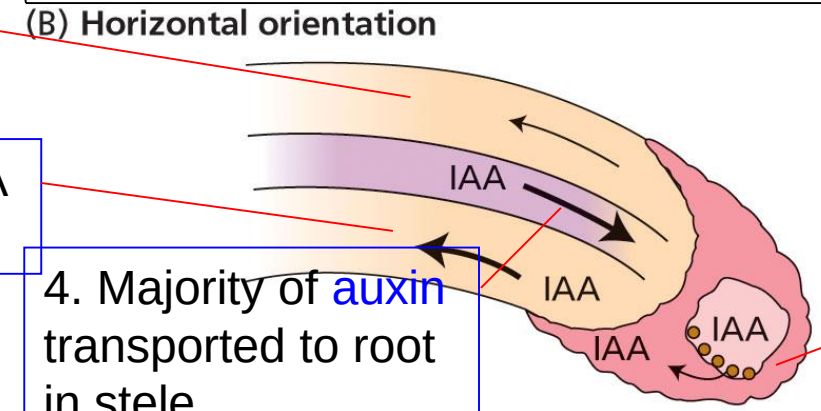
Auxin is transported to the lower side of a horizontally oriented oat coleoptile tip.

在向重力性中生长素再分布模型



1. IAA is synthesized in shoot and transported to root in stele

2. In vertical root, statoliths settle to basal ends. Auxin transported acropetally in root via stele and equally distributed on all sides of root cap. IAA is transported basipetally within cortex to elongation zone.

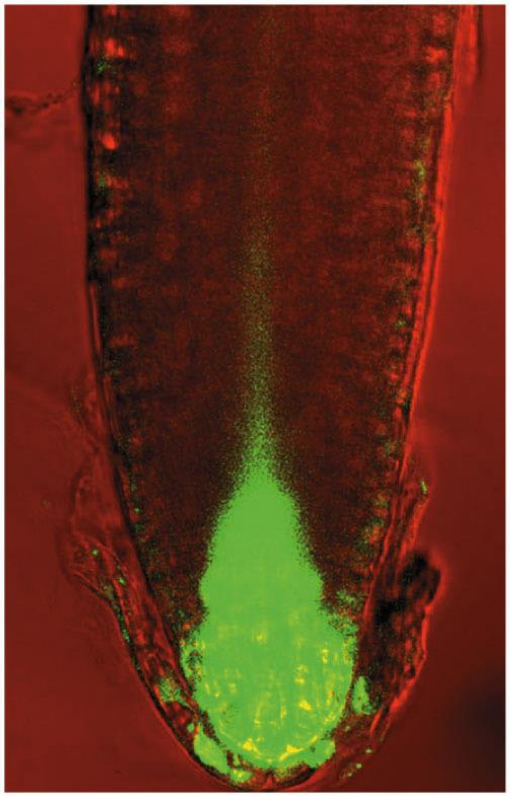


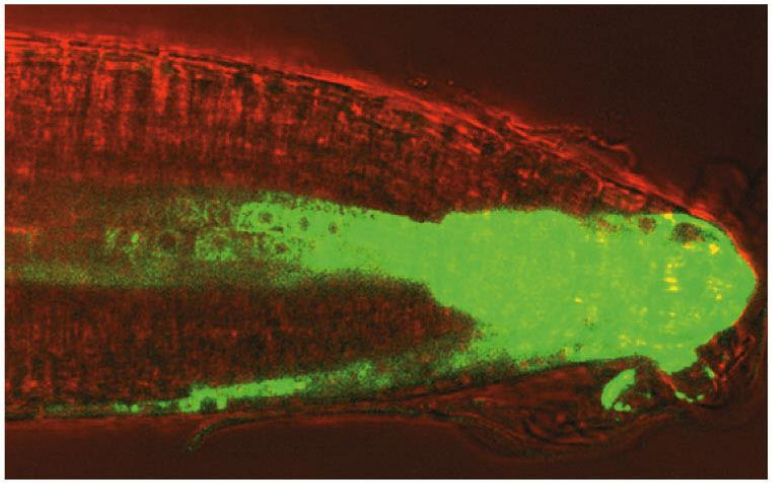
6. Lower conc. of IAA stimulates growth on upper side

5. High conc. of IAA inhibits growth

4. Majority of auxin transported to root in stele

3. Statoliths settle on side of cap cells, triggering polar transport of IAA to lower side of cap.





向重力性是由于生长素的不对称分布引起的

三、向触性

Figure 7.14 The terminal leaflets of this garden pea plant leaf are modified as tendrils.

Figure 11.8 Typical twining of a tendril produced by a manroot plant. Note that the direction of coiling reverses near the midpoint.

A. Stigma before pollination
B. Stigma being touched by pollinator

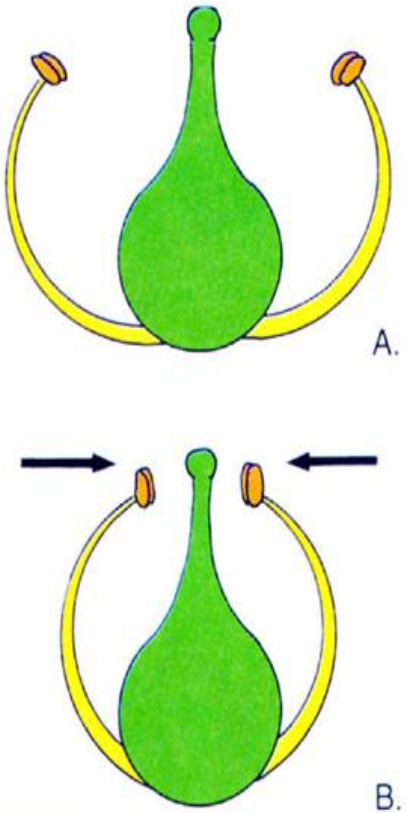
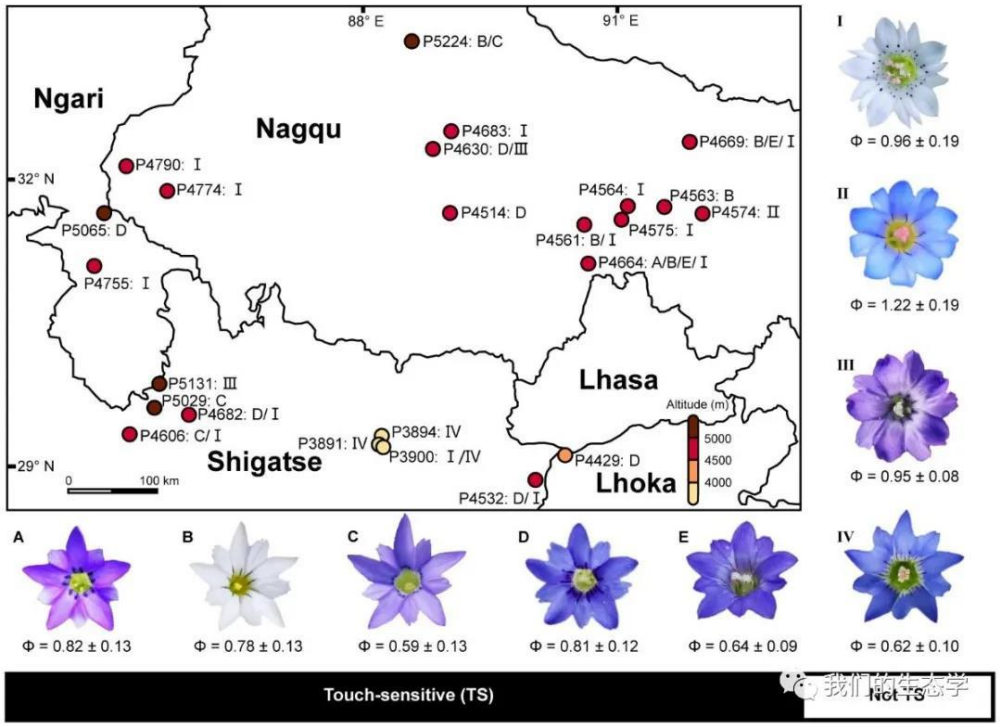


Figure 11.16 Contact movements of the stamens of a barberry flower. *A*. Position of the stamens before contact. *B*. Position of the stamens after they have jerked inward in response to contact.



Dai et al., ***Science Bulletin***, 2021

触敏性龙胆属植物的花关闭过程

第 2 节　感性运动

- 指没有一定方向的外界刺激所引起的运动，其反应方向与刺激方向无关。很多植物的感性运动是由于细胞膨压变化而引起的非生长性运动，有的则与生长有关。
  - 感震运动
  - 感夜运动

感震运动

含羞草的感震运动

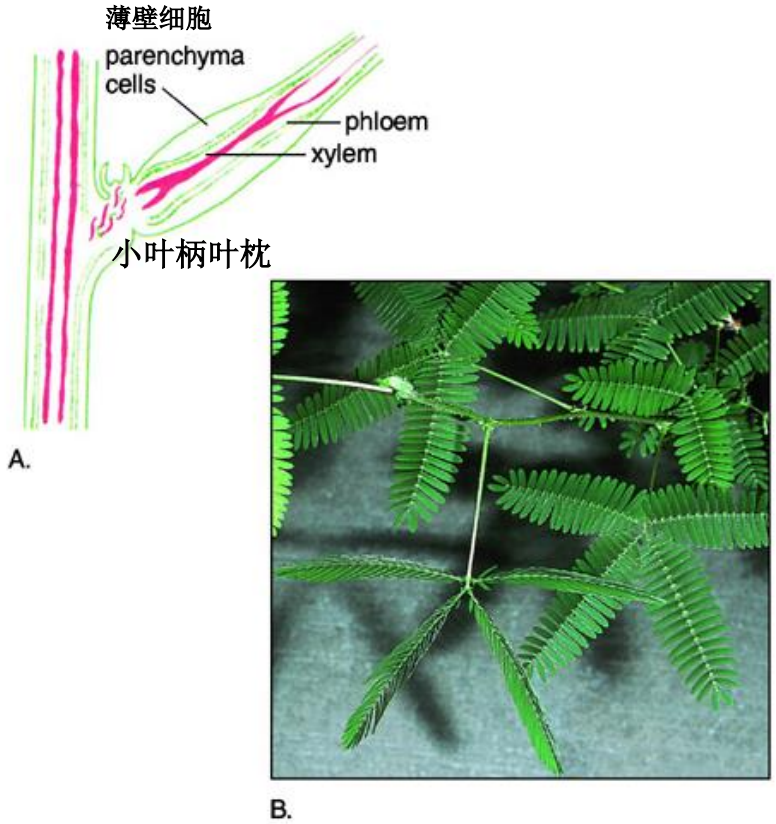


Figure 11.14 A. A longitudinal section through the pulvinus of a sensitive plant (*Mimosa pudica*). B. The leaflets of the leaf toward the bottom of this picture have folded upward in response to being bumped. The other leaves of this sensitive plant have remained fully expanded.

总叶柄或小叶柄的叶枕细胞膨压变化，造成叶片（小叶）运动

含羞草

捕蝇草的感震运动

捕蝇草

感夜运动（睡眠运动）

A.

B.

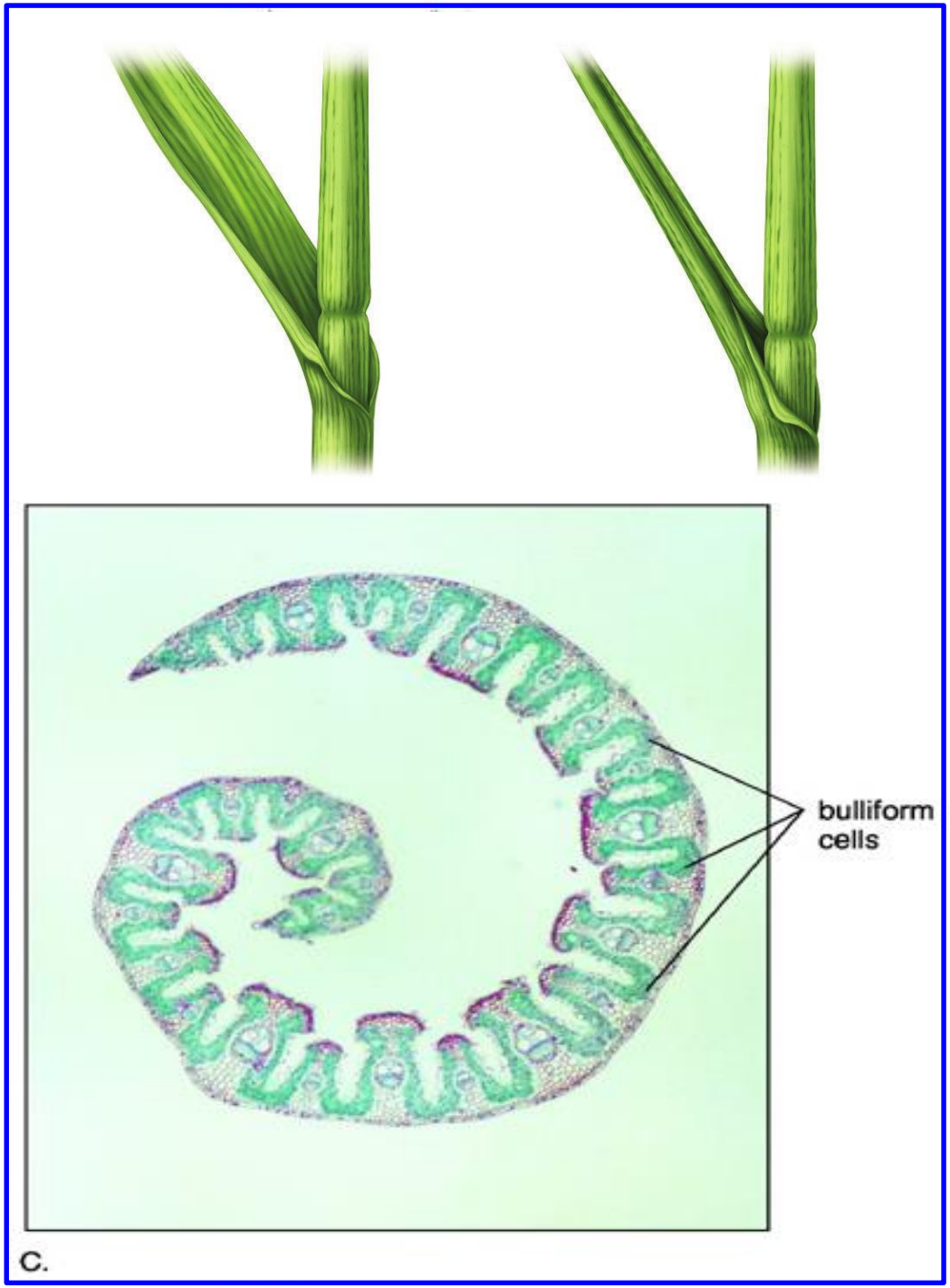
Figure 11.17 A prayer plant (*Maranta*). *A*. The plant at noon. *B*. The same plant at 10 P.M., after "sleep" movements of its leaves have occurred.

感夜运动（睡眠运动）

生理节律*Circadian Rhythms*

菜豆

保水运动



第 3 节　阳光跟踪

Figure 11.18 Wild grape vines in the fall. Note how little overlap of leaves has occurred.

向日葵的一天

第4节　自动运动

螺旋运动

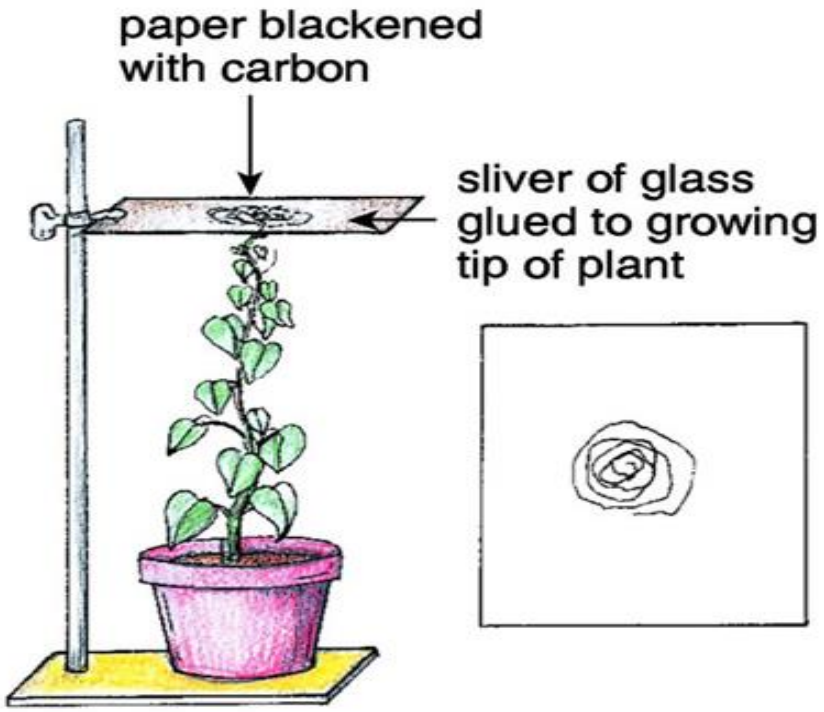
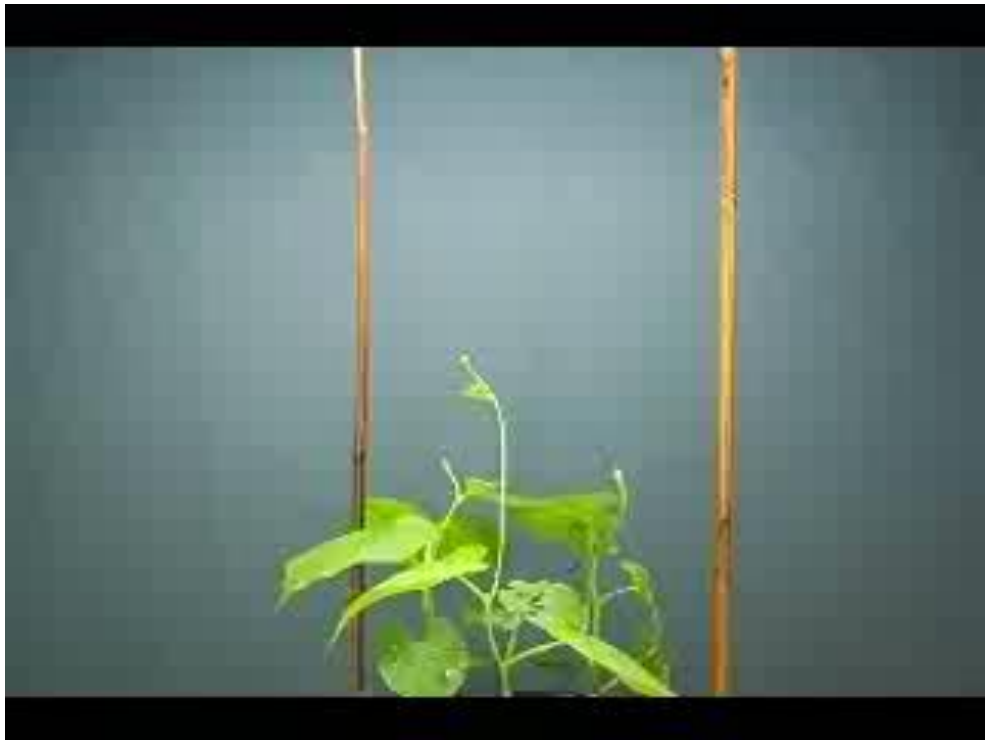


Figure 11.7 Charles Darwin's demonstration of spiraling growth.

拟南芥的螺旋运动

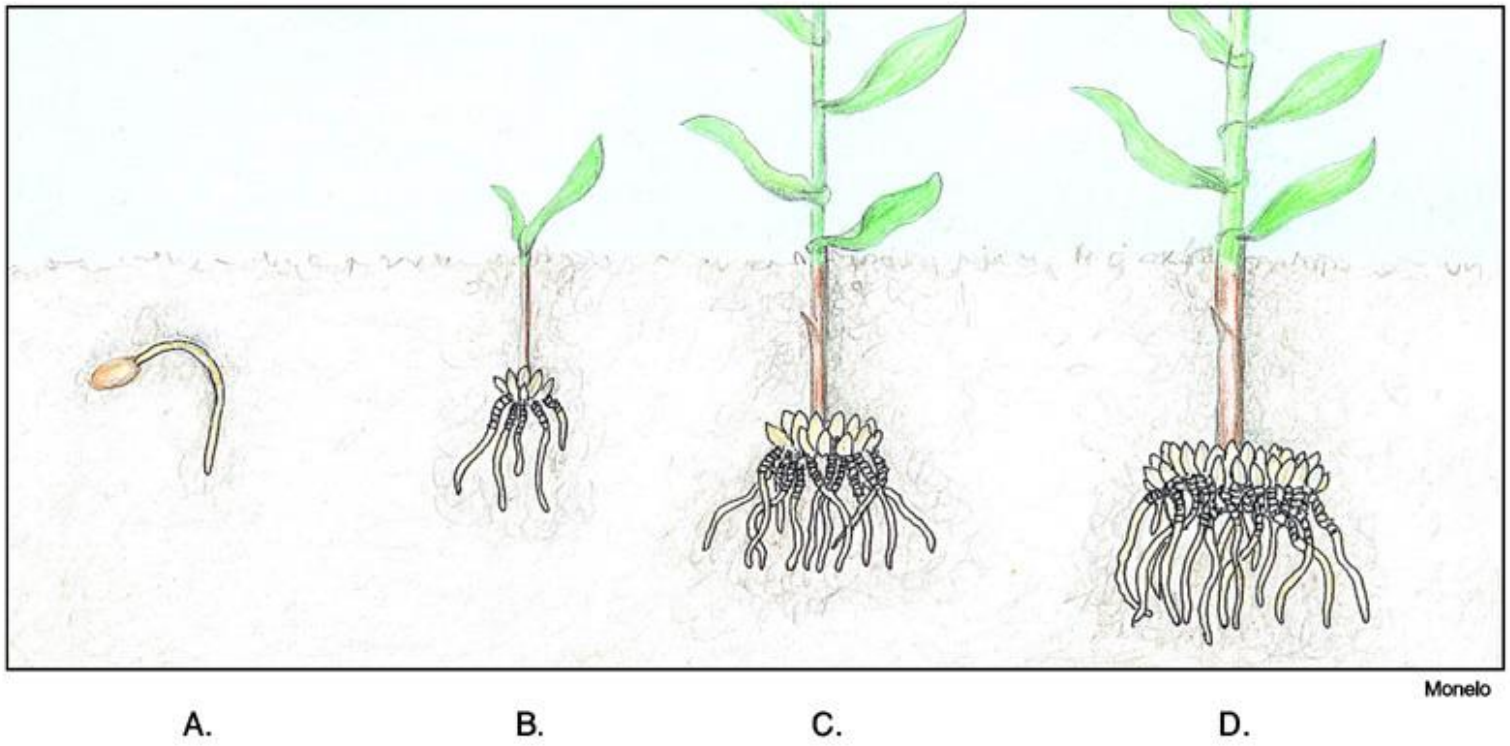
向日葵幼苗

缠绕运动



菜豆

收缩运动



A seed germinates; **B**. Contractile roots pull a newly formed bulb down several millimeters during the first season; **C.** the bulb is pull down farther the second season; **D.** The bulb is pull down even farther the third season. The bulb will continue to be ……

祝同学们学业有成！