

an indeterminate climb, five named hormones pulling against each other, and dozens of elements serving the plant's mineral needs



Growth, permanent and irreversible

- growth: permanent, irreversible increase in bulk/form; quantitative: length, size, volume, mass, cell number
- vascular plant growth: indeterminate, lifelong, confined to meristems; leaves/flowers/fruits determinate, fixed size
- unicellular plants show uniform, determinate growth

Meristems



apical (root/shoot tips) drives primary growth in length; intercalary (at nodes/internode bases) lengthens internodes and forms leaf primordia; lateral (vascular cambium in dicots/gymnosperms) drives secondary growth in girth

Three phases of growth

Cell division lag phase

thin-walled, non-vacuolated meristematic cells divide mitotically; growth is slow

→
in sequence

Cell enlargement log phase

the new cell vacuolates, absorbs water, becomes turgid, and enlarges rapidly

→
in sequence

Cell maturation stationary phase

the cell differentiates and specializes; growth rate slows to a steady state

every dividing meristematic cell moves through this same lag-log-stationary sequence

Measuring growth *

Direct method

a simple measuring scale, for coarse linear growth

Horizontal microscope

used to measure growth in the field

Auxanometer

precise linear growth of the shoot; arc type or Pfeffer's type

Crescograph

J.C. Bose's instrument; magnifies growth up to 10,000 times, recording it per second

