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Advanced Botany Master Cheat Sheet

Comprehensive Summary of Plant Anatomy, Physiology, Systematics, and Ecology

1. Plant Anatomy Histology

Meristematic Tissues

Apical Meristems: Primary growth, length increase (shoot and root tips).

Lateral Meristems: Secondary growth, girth increase (vascular cambium, cork cambium).

Intercalary Meristems: Found in nodes/internodes (e.g., grasses).

Permanent Tissues

* **Parenchyma:** Living, thin-walled, storage, photosynthesis, and secretion.* **Colenchyma:** Living, unevenly thickened primary walls, mechanical support for growing organs.* **Sclerenchyma:** Dead at maturity, lignified thick walls, fiber and sclereids for ultimate rigidity.

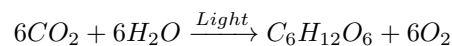
Vascular Bundles

* **Xylem:** Water and mineral transport (*uni-directional*). Elements: tracheids, vessels, xylem parenchyma, xylem fibers.* **Phloem:** Organic solute transport (*bi-directional*). Elements: sieve tube elements, companion cells, phloem parenchyma, phloem fibers.

2. Plant Physiology

Photosynthesis

Equation:



* **Light-Dependent Reactions (Thylakoids):** Photolysis of water, ATP and *NADPH* production via Photosystem II (*P680*) and Photosystem I (*P700*).* **Calvin**

Cycle (Stroma): Carbon fixation (*RuBisCO*), reduction, and regeneration of *RuBP*.* **C4 and CAM Pathways:** Adaptations to minimize photorespiration in high temperatures/arid environments using PEP carboxylase.

Respiration

* **Glycolysis:** Cytoplasm, yields 2 ATP and 2 NADH per glucose.* **Krebs Cycle:** Mitochondrial matrix, yields *NADH*, *FADH₂*, and substrate-level *ATP*.* **Oxidative Phosphorylation:** Inner mitochondrial membrane, electron transport chain yielding $\approx 32 - 34$ ATP.

Plant Hormones (Phytohormones)

* **Auxins (IAA):** Cell elongation, apical dominance, phototropism.* **Gibberellins (*GA₃*):** Stem elongation, seed germination, bolting.* **Cytokinins:** Cell division, delay senescence (anti-aging).* **Ethylene:** Fruit ripening, abscission, gaseous hormone.* **Abscisic Acid (ABA):** Stress hormone, stomatal closure, seed dormancy.

3. Plant Systematics Taxonomy

Major Divisions

* **Bryophytes:** Non-vascular, land plants, dominant gametophyte generation (mosses, liverworts).* **Pteridophytes:** Seedless vascular plants, dominant sporophyte, independent gametophyte (ferns, horsetails).* **Gymnosperms:** Naked seed vascular plants, heterosporous (conifers, cycads, ginkgo).* **Angiosperms:** Flowering plants, enclosed seeds, double fertilization, divided into Monocots and Dicots.

Floral Formula Symbols

* *K*: Calyx (Sepals) — *C*: Corolla (Petals)* *A*: Androe-cium (Stamens) — *G*: Gynoecium (Carpels)* $\oplus$: Acti-nomorphic — $\%$: Zygomorphic* : Superior ovary — $\overline{G}$: Inferior ovary

4. Reproduction in Angiosperms

Microsporogenesis

mother cell ($2n$) $\xrightarrow{\text{Meiosis}}$ Microspore tetrad (n) $\rightarrow$ Pollen grain (generative cell + vegetative cell).

Megasporogenesis

mother cell ($2n$) $\xrightarrow{\text{Meiosis}}$ 4 megaspores (n) $\rightarrow$ 3 degenerate, 1 functional $\rightarrow$ Embryo sac (7-celled, 8-nucleate structure).

Double Fertilization

* **Syngamy:** Male gamete (n) + Egg cell (n) $\rightarrow$ Zygote ($2n$).* **Triple Fusion:** Male gamete (n) + Two polar nuclei ($2n$) $\rightarrow$ Primary Endosperm Nucleus (*PEN*, $3n$).—

5. Ecology Adaptations

Ecological Groupings

* **Hydrophytes:** Adapted to aquatic habitats (aerenchyma, reduced roots).* **Xerophytes:** Adapted to arid conditions (thick cuticle, sunken stomata, CAM pathway).* **Halophytes:** Adapted to high salinity (vivipary, salt glands).

Nutrient Cycles

* **Nitrogen Fixation:** Conversion of atmospheric N_2 to NH_3 via Rhizobium-legume symbiosis or cyanobacteria.

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