G10 Jack AP Bio Summary Sheet

Basic concepts: ☆Ligand recognized by receptor

- Cohesion H_2O ≻≺ H_2O
- Adhesion H_2O ≻≺ Na^+
- capillary action 顺小管往上流

→ allele 等位基因

☆Homo Sapiens ⇐ scientific binary naming.

☆ Cladogram (Evolutionary Tree)

- 只要找后面的都有这个trait.

evidence {
- physical characteristics
- intermediate species
- embryo developments
- DNA/genetic materials ☆ ← most accurate

⇒ Homologous / Analogous Structures

相同功能但进化关系不同

☆Taxonomy 分类学

Domain ← eukaryote, bacteria, archea

Kingdom

Phylum (phyla)

Class

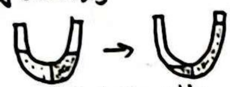
Order

Family

Genus (Genera)

Species

☆ Osmosis



← semi-permeable

hypotonic 低渗透压 → H_2O

hypertonic 高渗透压 → H_2O

isotonic 等渗透压 ⇄ H_2O

渗透压：阻止水diffuse需压（往高浓度一侧施压）

Plant	Animal
Turgid	Lysed
Flaccid	Normal
Plasmolyzed	Shriveled

☆ Turgor Pressure 渗透压

cell wall 给内部施压

⇒ Guard Cells (有stomata)

气孔 排水

- Bulk transport (package)
  - Exocytosis (out)
  - Endocytosis (in)
- Endosymbiosis Theory
  - mitochondria
  - plastid
- Plasmid [bacteria] ☆ separate DNA outside
- Fermentation 发酵
  Glucose → 2 Lactic acid + 2ATP

chromatin

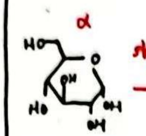
chromatid (sister) - 一对

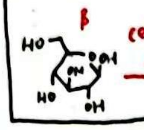
chromosome

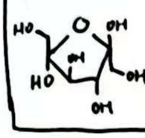
rep. ↻ DNA
transcription ↓
RNA — Central Dogma
translation ↓
Protein

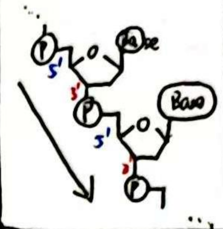
• Organic molecules.

Carbohydrates (saccharides)	Lipids (long-term, keep body temperature)	Protein (Function)	Nucleic acids (Commander)
• mono: Glucose (α → starch; β → cellulose)	• Triglyceride, Glycerol 甘油	20 aminoacids, peptide bond. ☆ no Phosphorous	ATCG in DNA, AUCG in RNA, phosphodiester bond. ☆ no Sulfer
Fructose	• Phospholipid: Liposome, Micelle	• Primary Structure; • Secondary {α-helix, β-sheet}; • Tertiary - R groups; • Quaternary - multi	Purines: AG; Pyrimidines: CT(U)
	• Steroid [3-4 rings]: sex hormones, bile acids 胆汁酸, vitamin. ☆ cholesterol 胆固醇 @ animal cell membrane, synthesized in liver 肝, obtained from diet	Common Functions: Enzyme, Defensive, Storage, transport, Hormonal, Receptor, Motor, Structural	Complementary base-pairing rule: ATCG / TAGC. RNA + OH



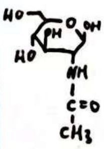






• di:
- animal - Lactose (α+β)
- plants - Maltose (α+α), Sucrose (G+F)

• poly:
- starch {Amylose ← long chain; Amylopectin ↓ 分叉}
- glycogen ← 大分叉
- cellulose
- chitin 几丁质 — in 昆虫壳, in 甲壳



Cells

plasma membrane + cytosol + chromosomes + ribosomes

Prokaryotic: 可+ nucleoid, cell wall, flagella (not enclosed by a membrane)

Eukaryote: +nucleus, nuclear envelope, chromatin ⇔ chromosome (X), nucleolus (核仁制造ribosome), nuclear pore 核孔, endoplasmic reticulum (rER: Ribosome, sER: Lipids), ribosome, vesicle, Golgi apparatus (蛋白折叠), lysosome, mitochondria, chloroplast, centrioles 中心粒 (↑ cytoskeleton)

自己的环状DNA

giant in plant cells → vacuole

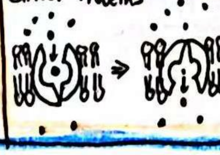
Cell Membrane

selective permeability

① Protection: Phospholipid + Cholesterol

② Transport: Proteins
- passive {simple diffusion (water, CO_2); facilitated diffusion (ion channel, carrier protein) → water, ions}
- active (against concentration gradient) → Glucose, Carbohydrates, aminoacids, nucleotides
  - Protein Pump + ATPase (低浓度→高浓度)
  - Secondary active transport

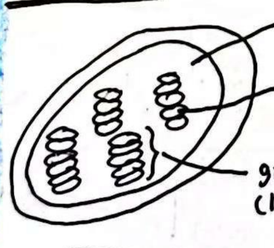
Carrier Proteins

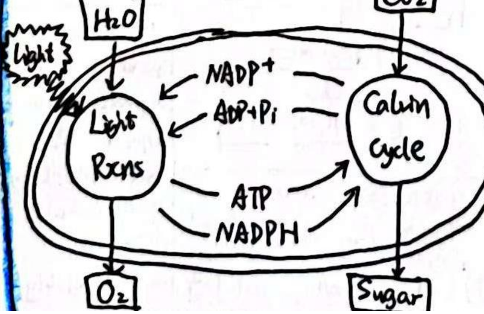


Active - Sodium-Potassium Pump

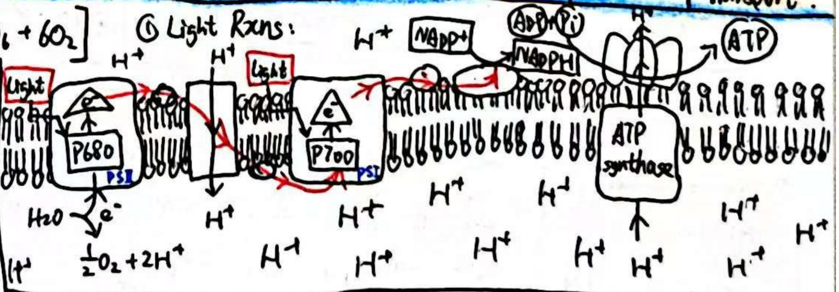
Photosynthesis

$[6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2]$





① Light Rxns:



② Dark Rxn / Calvin cycle:

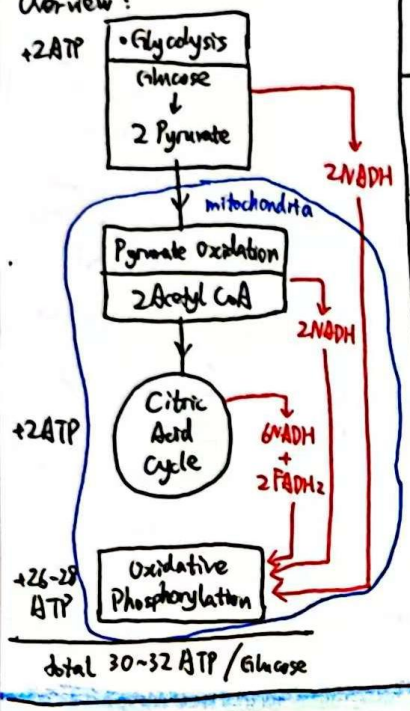
3 Ⓟ-C-C-C-C-C-Ⓟ [RuBP] + $3CO_2$ —Rubisco→ (carbon fixation) 3 Ⓟ-C-C(C)-C-C-C-Ⓟ (short-lived)

(reduction) → 6 Ⓟ-C-C-C (diff molecules); 6 ATP → 6 ADP → 6 Ⓟ-C-C-C-Ⓟ; 6 NADPH → 6 $NADP^+$ + 6 Pi → 6 Ⓟ-C-C-C [G3P]

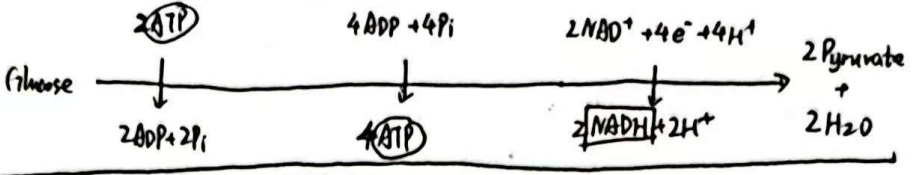
1 G3P ←; 5 G3P → (regeneration) 3 ATP → 3 ADP + 2 Pi → RuBP

Cellular Respiration $[C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O]$

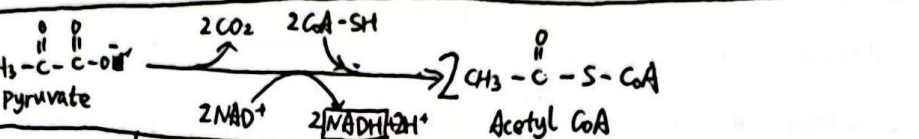
Overview:



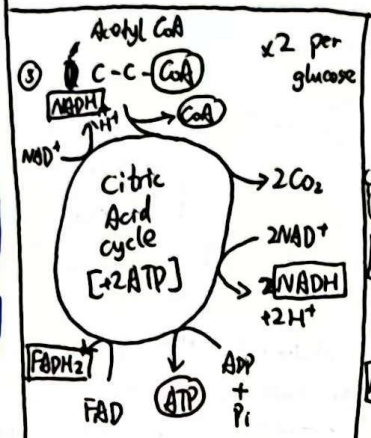
① Glycolysis [+2ATP]



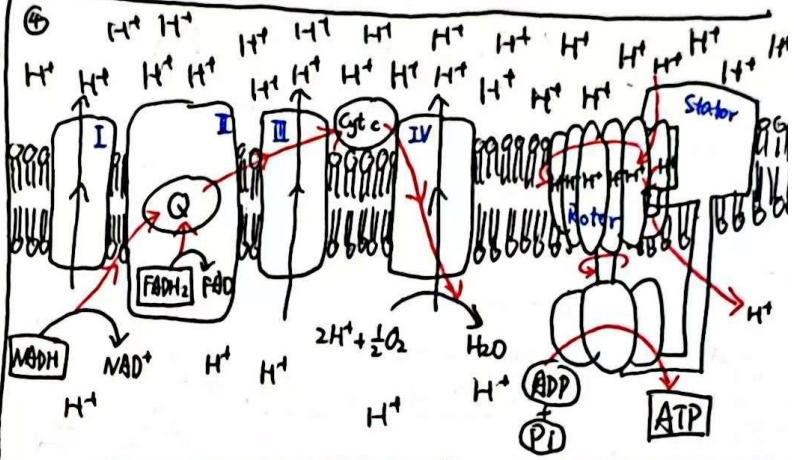
② Pyruvate Oxidation



③ Citric Acid Cycle [+2ATP] (×2 per glucose)



④



DNA rep. [semi-conservative replication]

① Initiation ☆unzip.
- Helicase (replication fork)
- primase (+RNA primer)
- topoisomerase → X strand 🚫
- ssDNA binding proteins → stablize

② Elongation
- Leading Strand ✓
- Lagging Strand (ex Okazaki Fragments)

③ Termination
- DNA Ligase (connect DNA fragments)
- DNA polymerase I (replace RNA primer with DNA)

Transcription

[Promoter, Enhancer, Activator]

① Regulation
- Transcription Factors
- Helicase
- RNA Polymerase

② RNA processing
- + 5' Cap
- + 3' Poly-A tail
- RNA Splicing [spliceosome] exon/intron

☆operon in prokaryotes

Lac operon — RNAP bind -/- blocker

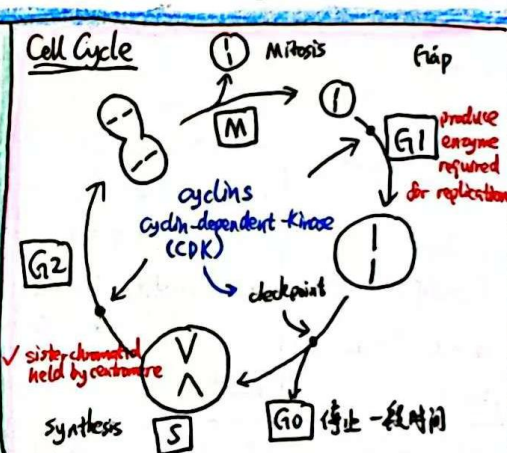
Translation @Ribosome

codons → (tRNA) → amino acids

- multiple Ribosome can translate at the same time.

[E = tRNA exit site; P = polypeptide exid; A = bring new amino acid]

Cell Cycle



Mitosis

- Prophase { nuclear envelope X; chromosome condense → chromatin; centrioles move to poles; spindle fibers attached. }
- Metaphase { chromosome aligned @ equator }
- Anaphase { sister chromatids seperate }
- Telophase { nuclear envelope ✓; cytokinesis: animals (cell plate), plants (cleavage furrow) }

Meiosis

gene far is more likely to cross over

- Prophase I { ~~crossing over~~ }
- Metaphase I { +crossing over }
- Anaphase I { homologous chromosome seperation }
- Telophase I

☆Meiosis I (Diploid → Haploid) (sister chromatid seperation)

⇒gametes 精子 4♀ or 1◎

Heredity

- ~~dom.~~ homozygote PP or pp
- heterozygote: Pp
- ☆Law of Dominance dom. → rec.
- ☆Law of Segregation 3:1, 9:3:3:1
- ☆Law of Independent Assortment

Tools: ① Test Cross { ALL offspring dom. ⇒ father homo-dom.; ANY offspring rec. ⇒ father hetero. }

② Pedigree { Y-linked (X if any female infected); dom./rec.? (find difference); X-linked / autosomal? Try eliminate X-linked. }

complete dominance	PP 紅	Pp 紅	pp 白
incomplete dominance	C^RC^R 紅	C^RC^W 粉	C^WC^W 白
Codominance.	I^AI^B ✿		

Eco system

Organism in same env.
- Competition
- symbiosis
  - commensalism 不利害
  - mutalism 互惠互利
  - parasitic 寄生

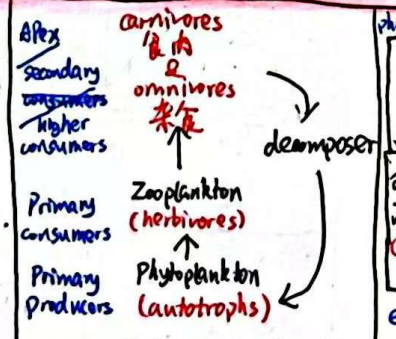
biotic factors

abiotic factors (H_2O, O_2, air, sunlight, soil, light, climate ...).

individual → population → community → Ecosystem.

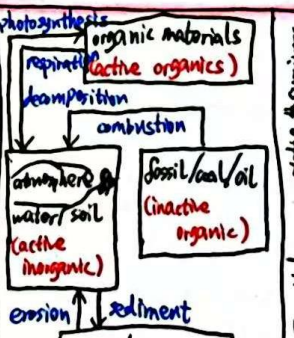
☆Hardy-Weiberg Eq.
no allele frequency change
no evolution

changes:
- ① natural selection
- ② migration (gene flow)
- ③ mutation
- ④ genetic drift



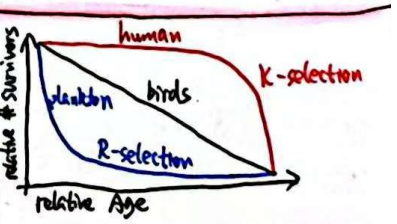
☆Niche 生態位 (識別)

☆Simpson's Diversity Index $= 1 - \Sigma(\frac{n}{N})^2$



☆Keystone species ← dom. species, large ↑ • apex predator

☆single producer not ! ☆



	R	K
# of offspring	high	low
parental care	low	high
reproductive maturity	early	late
offspring size	small	large
independence @ birth	early	late
ability to learn	low	high
lifespan	short	long
early mortality	high	low