



## Unit 1

### Chemistry of Life

- Water has hydrogen bonds = fun, special properties!
  - Cohesion** (water molecules stick to *each* other)
  - Adhesion** (water molecules stick to *other* surfaces)
  - Surface tension** (bugs walk on water!)
- Hydrolysis** = cleave monomer bonds; **dehy. synt.** = form
- DNA and RNA**: made of nucleic acids, genetic information
  - Nucleotides** made of (1) deoxy/ribose, (2) phosphate grp, (3) nitrogenous base.
- Proteins**: made of amino acids; order of the polypeptide ⇒ protein's structure and function.
- Carbohydrates**: made of sugar monomers; store energy!
- Lipids**: nonpolar, vary in saturation; found in cell membrane



## Unit 2

### Cell Structure & Function

- Organelle** mania: **ribosomes** make proteins; **ER** detoxes, makes lipids; Golgi complex folds, packages proteins; **mitochondria** powerhouse of cell; **lysosomes** expels waste
- Inner membrane folds → increase surf. area... more ATP made! more resources, more waste expelled = win, win!
- High surface area + smaller volume = ideal ratio for cells
- Phospholipid bilayers** are (**p**)icky: nutrients pass on their own, some need channel proteins to chaperone
  - Small nonpolar ( $N_2$ ,  $O_2$ ,  $CO_2$ ) easily pass; large polar don't
- Passive transport** = high to low conc. w/o ATP cost
  - Facilitated diffusion uses proteins to move  $H_2O$ ,  $Na^+$ ,  $K^+$ , etc
- Active transport** = low to high. conc. w/ ATP cost (bike up hill)
- Endosymbiosis theory**: organelles merged > form new species



## Unit 3

### Cellular Energetics

- Enzymes** lower activation energy ⇒ catalyze chem rxn
- Enzymes meet **substrate @ active site**
- Enzymes love certain pH, temperature, concentration; otherwise they'll be less efficient or **denature**
- Competitive inhibitors** (compete for active site) and **noncompetitive inhibitors** (sabotage active site binding) = BAD
- PHOTOSYNTHESIS – 2 parts**: (1) chlorophylls charge electrons in photosystems I and II w/ light energy; (2) Calvin cycle powers carb. production @ stroma using electrons
- Cell respiration (need  $O_2$ ) & fermentation (don't need) make ATP
- CELL. RESPIRATION**: transfer of electrons → proton gradient → ATP produced → organism uses up energy → cycle repeats!
- Big takeaway: organisms always need energy to function!



## Unit 4

### Cell Communication & Cell Cycle

- SIGNALING** types: **paracrine** = nearby cells, **endocrine** = long distances, **autocrine** = within own cell
- Signal transduc.**: reception → transduction → response
- Reception: ligand (molecule) binds to cell memb. receptor (e.g. ion-gated channel, G-protein coupled receptor)
- Transduction: signal amplifies w/ help of messengers
- Response: gene transcription activates/some other way
- Negative feedback** = reduce stimulus (insulin & glucose).
- Positive feedback** = increase response (oxytocin & birth)
- Cell cycle**: three stages of **interphase** (G1, S, G2) before it enters into mitosis
- Mitosis: cell duplicates entire genome → identical daughter cells



## Unit 5

### Heredity

- Meiosis**: di→haploid set of chromosomes (n)
- Meiosis I: homologous chromosomes cross over (swap bits) and split ( $X \times \gg X$  and  $X$ )
- Meiosis II: sister chromatids ( $X \gg \backslash$  and  $/$ )
- Crossing over & indep. assortment** = more genetic diversity
- Mono/dihybrid crosses = handy tool to predict inheritance patterns for autosomal/sex-linked genes.
- Genotype** = genetic makeup, **phenotype** = appearance
- Pedigrees – use to track traits across multiple generations!
- Environment can affect phenotype: weight, melanin, fur color...
- Human genetic disorders – caused by mutated alleles, chromosome changes (**nondisjunction**), etc



## Unit 6

### Gene Expression & Regulation

- DNA** replicates 5' to 3'-style, **semi-conservative** way
- Enzyme** mania: **helicase** = unwinds; **topoisomerase** = prevents coiling; **DNA polymerase** = builds DNA molecule; **ligase** = combines fragments in lagging strand.
- Transcription**: DNA copied into RNA; processing involves (1) GTP cap and poly-A tail addition + (2) intron splicing
- Translation**: ribosome reads mRNA ⇒ protein!
- Gene expression – regulated by **transcription factors** (eukaryotic) or **operons** (prokaryotic).
- DNA mutations ⇒ protein loses/gains function (or unaffected)
- Gel electrophoresis**: separates DNA fragments by size
- PCR**: amplifies DNA segments
- Bacterial transformation**: introduces DNA to bacterial cells.



## Unit 7

### Natural Selection

- Reproductive success = evolutionary **fitness**
- Competition + selective pressure ⇒ **natural selection**
- Random events (**mutations**) & **genetic drift** drive evol.
- Use **Hardy-Weinberg** equation to predict equilb. freqs!
- Common ancestry links lots of organisms
- Phylogenetic trees, cladograms**: relates diff. lineages
- Extinction**: provides newly available niches.
- Variation**: affects population dynamics



## Unit 8

### Ecology

- Homeostasis** = maintain internal equilibrium, respond to env.
- Net gain in energy = growth in an organism!
- Endotherms**: use heat → int. temps. (**exotherms** can't)
- Some factors limit populations; popns create **s (logistic) curve**
- Simpson's Diversity Index**: calculates ecosystem diversity
- More biodiversity in ecosys. = more resilient to disruptions
- Kinds of species interactions: **commensalism**, **mutualism**, **parasitism**, **predator-prey**, **competition**, etc.
- Going up a trophic level = only 10% energy transferred; most energy lost via heat

## 100 FRQ Tips

- Read. The. Question. Carefully. (read directions carefully)
- Figure out which are worth the most points, the least points, will take the longest, will be the quickest... then prioritize!
- Identify and graph/draw questions = quickest to respond to (don't require complete sentences) and get out of the way
- Skip the fluff and go straight to the point
- Label your responses (a, b, c, ...)
- COMMIT TO YOUR ANSWER! Erase "might" and "possible" and "I think" from your vocabulary
- If possible, always give an example