Zoology Comprehensive Cheat Sheet

Elite Academic Reference Guide

1. Animal Systematics & Taxonomy

1.1 Hierarchical Classification

Kingdom → Phylum → Class → Order → Family → Genus → Species.

1.2 Binomial Nomenclature

Introduced by Carl Linnaeus. Format: *Genus species* (Italicized, Genus capitalized, specific epithet lowercase).

1.3 Key Phyla Overview

- **Porifera:** Cellular grade, asymmetrical, choanocytes.
- **Cnidaria:** Tissue grade, radial symmetry, cnidocytes.
- **Platyhelminthes:** Acoelomate, bilateral, flatworms.
- **Annelida:** Metameric segmentation, schizocoelom.
- **Arthropoda:** Chitinous exoskeleton, jointed appendages.
- **Chordata:** Notochord, dorsal hollow nerve cord, pharyngeal slits.

2. Comparative Physiology

2.1 Circulatory Systems

- **Open:** Hemolymph bathes organs directly (Arthropods, Molluscs).
- **Closed:** Blood confined to vessels (Annelids, Vertebrates).
- **Heart Chambers:** Fish (2), Amphibians/Reptiles (3), Birds/Mammals (4).

2.2 Excretion & Osmoregulation

- **Ammonotelic:** Excrete ammonia (Aquatic animals; high water required).
- **Ureotelic:** Excrete urea (Mammals, adult amphibians).
- **Uricotelic:** Excrete uric acid (Birds, reptiles, insects; water conservation).
- **Structures:** Flame cells (Platyhelminthes), Malpighian tubules (Insects), Nephridia (Annelids), Kidneys (Vertebrates).

3. Cellular & Molecular Biology

3.1 Cell Cycle Regulation

Driven by Cyclins and Cyclin-Dependent Kinases (CDKs):

$$\text{MPF} = \text{Cyclin B} + \text{CDK1}$$

Triggers entry into mitosis from the G2 phase.

3.2 Energy Metabolism

- **Glycolysis:** Cytoplasm → 2 ATP + 2 NADH per glucose.
- **Krebs Cycle:** Mitochondrial matrix → $2\ \text{ATP}, 6\ \text{NADH}, 2\ \text{FADH}_2$.
- **Oxidative Phosphorylation:** Inner mitochondrial membrane via ETC →≈ 28-32 ATP.

4. Genetics & Evolution

4.1 Hardy-Weinberg Equilibrium

Allele frequencies remain constant in the absence of evolutionary forces:

$$p + q = 1, \quad p^2 + 2pq + q^2 = 1$$

Where p = freq. of dominant allele, q = freq. of recessive allele.

4.2 Evolutionary Forces

- **Natural Selection:** Differential survival based on adaptation.
- **Genetic Drift:** Random changes in allele frequencies (Bottleneck & Founder effects).
- **Gene Flow:** Migration of individuals between populations.
- **Mutation:** Ultimate source of novel genetic variation.

5. Developmental Biology

5.1 Embryonic Cleavage Patterns

- **Isolecithal:** Holoblastic equal (Echinoderms).
- **Mesolecithal:** Holoblastic unequal (Amphibians).
- **Telolecithal:** Meroblastic discoidal (Birds, Reptiles).

5.2 Germ Layers

- **Ectoderm:** Epidermis, nervous system, neural crest.
- **Mesoderm:** Muscles, skeleton, circulatory & excretory systems.
- **Endoderm:** Epithelial lining of gut, respiratory tract, liver, pancreas.

6. Ecology & Behavior

6.1 Population Growth Models

Exponential growth:

$$\frac{dN}{dt} = rN$$

Logistic growth (incorporating carrying capacity K):

$$\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$$

6.2 Trophic Efficiency

Lindeman's 10% Rule: Only about 10% of energy is transferred from one trophic level to the next.