

Macromolecular Structures – Complete Syllabus

Course: Macromolecular Structures – MSc in Nanotechnology Engineering (Sapienza)

Instructor: Prof. Beatrice Vallone

Semester: Fall 2025

Schedule: Wednesdays (2h), Fridays (3h) – Start: Sept 24, 2025

Lecture Plan & Readings (Table Format)

Date	Topic	Readings (Required / Optional)
Sept 24 (Wed)	Introduction, Evolution as Framework, Cell as Engineered System	Required: Alberts Ch.1 Optional: Moody et al., Nature E&E (LUCA)
Sept 27 (Fri)	Chemistry of Life: Water, Bonds, Thermodynamics	Required: Alberts Ch.2; Lehninger Ch.2 Optional: Dill & Bromberg Ch.1–2
Oct 1 (Wed)	Carbohydrates & Lipids	Required: Alberts Ch.2 (sections on carbs/lipids)
Oct 4 (Fri)	Proteins: Amino Acids, Peptide Bond, Primary Structure	Required: Alberts Ch.4 (start)
Oct 8 (Wed)	Protein Folding & Higher Structures	Required: Alberts Ch.4 (finish) Optional: Petsko & Ringe
Oct 11 (Fri)	Enzyme Structure & Catalysis	Required: Alberts Ch.4 (enzymes); Lehninger Ch.6
Oct 15 (Wed)	Functional Proteins: Myoglobin & Hemoglobin	Required: Alberts Ch.4; Lehninger Ch.7
Oct 18 (Fri)	Antibodies & Immune System	Required: Alberts Ch.24
Oct 22 (Wed)	Cytoskeleton I: Actin, Myosin	Required: Alberts Ch.17

Oct 25 (Fri)	Cytoskeleton II: Microtubules & Motors	Required: Alberts Ch.17
Oct 29 (Wed)	Membrane Structure & Function	Required: Alberts Ch.11
Nov 1 (Fri)	Membrane Transport: Carriers, Channels, Pumps	Required: Alberts Ch.12
Nov 5 (Wed)	Signal Transduction & Receptors	Required: Alberts Ch.16
Nov 8 (Fri)	Nucleic Acids: DNA & RNA Structure	Required: Alberts Ch.5
Nov 12 (Wed)	DNA Replication & Repair	Required: Alberts Ch.6
Nov 15 (Fri)	Transcription & Gene Expression	Required: Alberts Ch.7
Nov 19 (Wed)	Translation & Protein Synthesis	Required: Alberts Ch.7; Lehninger Ch.27
Nov 22 (Fri)	Genomes & Evolutionary Principles	Required: Alberts Ch.8
Nov 26 (Wed)	Metabolism Overview: Bioenergetics	Required: Alberts Ch.13; Lehninger Ch.13
Nov 29 (Fri)	Glycolysis & Fermentation	Required: Alberts Ch.13; Lehninger Ch.14
Dec 3 (Wed)	Citric Acid Cycle & Oxidative Phosphorylation	Required: Alberts Ch.14; Lehninger Ch.15
Dec 6 (Fri)	Photosynthesis & Metabolic Integration	Required: Alberts Ch.14 (photosynthesis)
Dec 10 (Wed)	Nanotechnology Applications in Biomedicine	Optional: Vo-Dinh selected sections
Dec 13 (Fri)	Course Wrap-Up, Review, Q&A	No readings

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