



Biochemistry

Year 1 — Bachelor of Dental Surgery

Reference and Resource List — Chapters 1 to 19

Supporting the MCQ, SBA, SAQ and flashcard question bank

BM Education FZE

Disclaimer

Questions in this bank were generated with the assistance of artificial intelligence and reviewed against the references listed. They are provided for educational revision only, are not a substitute for prescribed textbooks, clinical guidelines or supervised clinical training, and no warranty is given as to their accuracy or completeness.

References are presented in Vancouver style. Part 1 lists the core sources that apply across the whole subject; Part 2 lists, for each chapter, the relevant parts of those core sources together with additional chapter-specific references. Numbers in square brackets in Part 2 refer to the numbered entries in Part 1.

PART 1 — CORE REFERENCES (ALL CHAPTERS)

1.1 Principal biochemistry textbooks

1. Kennelly PJ, Botham KM, McGuinness OP, Rodwell VW, Weil PA. Harper's Illustrated Biochemistry. 33rd ed. New York: McGraw Hill; 2026.
2. Nelson DL, Cox MM, Hoskins AA. Lehninger Principles of Biochemistry. 8th ed. New York: Macmillan Learning; 2021.
3. Berg JM, Tymoczko JL, Gatto GJ Jr, Stryer L. Biochemistry. 9th ed. New York: WH Freeman; 2019.
4. Abali EE, Cline SD, Franklin DS, Viselli SM. Lippincott Illustrated Reviews: Biochemistry. 9th ed. Philadelphia: Wolters Kluwer; 2025.
5. Lieberman M, Peet A. Marks' Basic Medical Biochemistry: A Clinical Approach. 6th ed. Philadelphia: Wolters Kluwer; 2022.
6. Baynes JW, Dominiczak MH, editors. Medical Biochemistry. 6th ed. Amsterdam: Elsevier; 2023.
7. Vasudevan DM, Sreekumari S, Vaidyanathan K. Textbook of Biochemistry for Dental Students. 5th ed. New Delhi: Jaypee Brothers Medical Publishers; 2025.
8. Satyanarayana U, Chakrapani U. Biochemistry. 6th ed. New Delhi: Elsevier India; 2021.

1.2 Cell biology, molecular biology and genetics

9. Alberts B, Heald R, Johnson A, Morgan D, Raff M, Roberts K, Walter P. Molecular Biology of the Cell. 7th ed. New York: WW Norton; 2022.
10. Lodish H, Berk A, Kaiser CA, Krieger M, Bretscher A, Ploegh H, et al. Molecular Cell Biology. 9th ed. New York: Macmillan Learning; 2021.

11. Pawlina W. Histology: A Text and Atlas, with Correlated Cell and Molecular Biology. 9th ed. Philadelphia: Wolters Kluwer; 2024.
12. Turnpenny PD, Ellard S, Cleaver R. Emery's Elements of Medical Genetics and Genomics. 16th ed. Edinburgh: Elsevier; 2021.
13. Varki A, Cummings RD, Esko JD, Stanley P, Hart GW, Aebi M, et al., editors. Essentials of Glycobiology. 4th ed. Cold Spring Harbor (NY): Cold Spring Harbor Laboratory Press; 2022.

1.3 Physiology and nutrition

14. Hall JE, Hall ME. Guyton and Hall Textbook of Medical Physiology. 15th ed. Philadelphia: Elsevier; 2025.
15. Barrett KE, Barman SM, Brooks HL, Yuan JX-J. Ganong's Review of Medical Physiology. 26th ed. New York: McGraw Hill; 2019.
16. Geissler C, Powers H, editors. Human Nutrition. 13th ed. Oxford: Oxford University Press; 2017.
17. Mann J, Truswell AS, editors. Essentials of Human Nutrition. 5th ed. Oxford: Oxford University Press; 2017.

1.4 Oral biology, saliva and cariology

18. Nanci A. Ten Cate's Oral Histology: Development, Structure, and Function. 10th ed. St Louis: Elsevier; 2024.
19. Berkovitz BKB, Holland GR, Moxham BJ. Oral Anatomy, Histology and Embryology. 5th ed. Edinburgh: Elsevier; 2017.
20. Lamont RJ, Hajishengallis GN, Koo H, Jenkinson HF, editors. Oral Microbiology and Immunology. 3rd ed. Washington (DC): ASM Press; 2019.
21. Marsh PD, Lewis MAO, Rogers H, Williams DW, Wilson M. Oral Microbiology. 6th ed. Edinburgh: Elsevier; 2016.
22. Edgar M, Dawes C, O'Mullane D, editors. Saliva and Oral Health: An Essential Overview for the Health Professional. 4th ed. London: Stephen Hancocks; 2012.
23. Fejerskov O, Nyvad B, editors. Dental Caries: The Disease and Its Clinical Management. 4th ed. Oxford: Wiley Blackwell; 2025.

1.5 Clinical and laboratory biochemistry

24. Marshall WJ, Lapsley M, Day A, Shipman K. Clinical Chemistry. 9th ed. Edinburgh: Elsevier; 2020.
25. Gaw A, Murphy MJ, Srivastava R, Cowan RA, O'Reilly DStJ. Clinical Biochemistry: An Illustrated Colour Text. 5th ed. Edinburgh: Churchill Livingstone Elsevier; 2013.
26. Rifai N, Horvath AR, Wittwer CT, editors. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics. 8th ed. St Louis: Elsevier; 2019.
27. Miller CS, Rhodus NL, Treister NS, Stoopler ET, Kerr AR. Little and Falace's Dental Management of the Medically Compromised Patient. 10th ed. St Louis: Elsevier; 2023.
28. Scully C. Scully's Medical Problems in Dentistry. 7th ed. Edinburgh: Elsevier; 2014.

1.6 Guidelines, standards and professional requirements

29. World Health Organization. Guideline: sugars intake for adults and children. Geneva: WHO; 2015. Available from: <https://www.who.int/publications/i/item/9789241549028>

30. World Health Organization. Carbohydrate intake for adults and children: WHO guideline. Geneva: WHO; 2023. Available from: <https://www.who.int/publications/i/item/9789240073593>
31. Scientific Advisory Committee on Nutrition. Carbohydrates and health. London: The Stationery Office; 2015. Available from: <https://www.gov.uk/government/publications/sacn-carbohydrates-and-health-report>
32. Scientific Advisory Committee on Nutrition. Vitamin D and health. London: SACN; 2016. Available from: <https://www.gov.uk/government/publications/sacn-vitamin-d-and-health-report>
33. Office for Health Improvement and Disparities. Delivering better oral health: an evidence-based toolkit for prevention. 4th ed. London: OHID; 2021. Available from: <https://www.gov.uk/government/publications/delivering-better-oral-health-an-evidence-based-toolkit-for-prevention>
34. National Institute for Health and Care Excellence. Type 2 diabetes in adults: management. NICE guideline NG28. London: NICE. Available from: <https://www.nice.org.uk/guidance/ng28>
35. Nomenclature Committee of the International Union of Biochemistry and Molecular Biology. Enzyme nomenclature: the ExplorEnz enzyme database. Available from: <https://www.enzyme-database.org>
36. General Dental Council. Safe practitioner: a framework of behaviours and outcomes for dental professional education. London: GDC; 2023. Available from: <https://www.gdc-uk.org>
37. Dental Council of India. Bachelor of Dental Surgery (BDS) Course Regulations, 2007 (as amended). New Delhi: DCI.
38. Field JC, Cowpe JG, Walmsley AD. The graduating European dentist: a new undergraduate curriculum framework. Eur J Dent Educ. 2017;21 Suppl 1:2–10.

1.7 Key journals for currency

Journal of Dental Research • Archives of Oral Biology • Caries Research • Journal of Clinical Periodontology • Clinical Oral Investigations • Journal of Biological Chemistry • Biochemical Journal • Nature Reviews Molecular Cell Biology • Clinical Chemistry • British Dental Journal

PART 2 — CHAPTER-SPECIFIC REFERENCES

Chapter 1 — Introduction to Biochemistry and Relevance to Dentistry

1.1 Foundations of biochemistry: definition, scope and branches; levels of biological organisation • 1.2 Homeostasis and metabolism: anabolism versus catabolism • 1.3 Why biochemistry matters in dentistry: caries, erosion and fluorosis; bone and tooth mineral; saliva

Core texts: [1] Ch. 1 (Biochemistry and medicine) • [2] Ch. 1 (The foundations of biochemistry) • [7] introductory chapters • [8] introductory and overview sections • [18] chapters on enamel, dentine and the oral environment • [38] outcomes framework for the graduating dentist

Additional

- Dawes C, Pedersen AML, Villa A, Ekström J, Proctor GB, Vissink A, et al. The functions of human saliva: a review sponsored by the World Workshop on Oral Medicine VI. Arch Oral Biol. 2015;60(6):863–74.
- Pitts NB, Zero DT, Marsh PD, Ekstrand K, Weintraub JA, Ramos-Gomez F, et al. Dental caries. Nat Rev Dis Primers. 2017;3:17030.
- Ten Cate JM. Contemporary perspective on the use of fluoride products in caries prevention. Br Dent J. 2013;214(4):161–7.

- Bartold PM, Van Dyke TE. Periodontitis: a host-mediated disruption of microbial homeostasis. *Periodontol* 2000. 2013;62(1):203–17.

Chapter 2 — Cell and Molecular Biology Essentials

2.1 Cell types and organelles: prokaryotic versus eukaryotic cells; nucleus, mitochondria, endoplasmic reticulum, Golgi, lysosomes and peroxisomes · 2.2 Biological membranes and transport: fluid mosaic model, membrane proteins and receptors; diffusion, osmosis, facilitated and active transport, endocytosis and exocytosis · 2.3 Cell cycle, cell death and oral relevance: apoptosis versus necrosis; cell turnover in oral mucosa, gingiva and pulp

Core texts: [9] chapters on membrane structure, membrane transport, the cell cycle and cell death · [2] Ch. 11 (Biological membranes and transport) · [10] chapters on organelles and intracellular traffic · [11] chapters on the cell and epithelium · [18] chapters on oral mucosa

Additional

- Singer SJ, Nicolson GL. The fluid mosaic model of the structure of cell membranes. *Science*. 1972;175(4023):720–31.
- Nicolson GL. The fluid-mosaic model of membrane structure: still relevant to understanding the structure, function and dynamics of biological membranes after more than 40 years. *Biochim Biophys Acta*. 2014;1838(6):1451–66.
- Elmore S. Apoptosis: a review of programmed cell death. *Toxicol Pathol*. 2007;35(4):495–516.
- Squier CA, Kremer MJ. Biology of oral mucosa and esophagus. *J Natl Cancer Inst Monogr*. 2001;(29):7–15.
- Dale BA. Periodontal epithelium: a newly recognized role in health and disease. *Periodontol* 2000. 2002;30:70–8.

Chapter 3 — Water, pH, Buffers and Bioenergetics

3.1 Water and acid-base chemistry: hydrogen bonding and solvent properties; pH, pKa, weak acids and the Henderson-Hasselbalch equation · 3.2 Buffer systems in blood and saliva: bicarbonate, phosphate and protein buffers; salivary buffering, plaque pH and critical pH · 3.3 Bioenergetics and redox: free energy, high-energy compounds, redox reactions and electron carriers

Core texts: [2] Ch. 2 (Water) and Ch. 13 (Bioenergetics and biochemical reaction types) · [1] chapters on water and pH and on bioenergetics · [4] units on protein structure and bioenergetics · [22] chapters on salivary buffering · [23] chapters on the chemistry of the caries process

Additional

- Dawes C. What is the critical pH and why does a tooth dissolve in acid? *J Can Dent Assoc*. 2003;69(11):722–4.
- Stephan RM. Changes in hydrogen-ion concentration on tooth surfaces and in carious lesions. *J Am Dent Assoc*. 1940;27(5):718–23.
- Bardow A, Moe D, Nyvad B, Nauntofte B. The buffer capacity and buffer systems of human whole saliva measured without loss of CO₂. *Arch Oral Biol*. 2000;45(1):1–12.
- Lynge Pedersen AM, Belstrøm D. The role of natural salivary defences in maintaining a healthy oral microbiota. *J Dent*. 2019;80 Suppl 1:S3–12.
- Buzalaf MAR, Hannas AR, Kato MT. Saliva and dental erosion. *J Appl Oral Sci*. 2012;20(5):493–502.

Chapter 4 — Amino Acids, Peptides and Proteins

4.1 Amino acids: structure, side-chain classification and ionisation; essential and non-essential amino acids; zwitterions and isoelectric pH · 4.2 Peptides and the levels of protein structure: the peptide bond, biologically important peptides, primary to quaternary structure, denaturation · 4.3 Protein types and oral relevance: fibrous and globular proteins, plasma proteins, collagen and elastin in dentine, periodontal ligament and bone

Core texts: [2] Chs. 3–5 (Amino acids, peptides and proteins; protein structure; protein function) · [1] chapters on amino acids, peptides and proteins · [4] Unit I · [7] chapters on amino acids and proteins · [18] chapters on dentine, periodontal ligament and bone matrix · [19] chapters on the periodontal ligament and dental hard tissues

Additional

- Shoulders MD, Raines RT. Collagen structure and stability. *Annu Rev Biochem.* 2009;78:929–58.
- Ricard-Blum S. The collagen family. *Cold Spring Harb Perspect Biol.* 2011;3(1):a004978.
- Goldberg M, Kulkarni AB, Young M, Boskey A. Dentin: structure, composition and mineralization. *Front Biosci (Elite Ed).* 2011;3(2):711–35.
- Beertsen W, McCulloch CAG, Sodek J. The periodontal ligament: a unique, multifunctional connective tissue. *Periodontol* 2000. 1997;13:20–40.
- Anfinsen CB. Principles that govern the folding of protein chains. *Science.* 1973;181(4096):223–30.

Chapter 5 — Enzymes and Coenzymes

5.1 Enzyme structure, function and classification: nomenclature, IUB classification, active site, specificity, lock-and-key and induced fit · 5.2 Enzyme kinetics, inhibition and regulation: factors affecting activity, V_{max} and K_m , competitive, non-competitive and uncompetitive inhibition, allosteric and feedback control · 5.3 Cofactors, isoenzymes and oral relevance: vitamin-derived coenzymes, LDH and ALP isoenzymes, salivary enzymes and enzymes of bone turnover

Core texts: [2] Ch. 6 (Enzymes) · [1] chapters on enzymes, kinetics and regulation · [3] chapters on enzyme mechanisms and kinetics · [5] chapters on enzymes and enzyme regulation · [35] enzyme classification and nomenclature

Additional

- Johnson KA, Goody RS. The original Michaelis constant: translation of the 1913 Michaelis–Menten paper. *Biochemistry.* 2011;50(39):8264–9.
- Koshland DE Jr. Application of a theory of enzyme specificity to protein synthesis. *Proc Natl Acad Sci U S A.* 1958;44(2):98–104.
- Vimalraj S. Alkaline phosphatase: structure, expression and its function in bone mineralization. *Gene.* 2020;754:144855.
- Nater UM, Rohleder N. Salivary alpha-amylase as a non-invasive biomarker for the sympathetic nervous system: current state of research. *Psychoneuroendocrinology.* 2009;34(4):486–96.
- Sorsa T, Mäntylä P, Tervahartiala T, Pussinen PJ, Gamonal J, Hernandez M. MMP activation in diagnostics of periodontitis and systemic inflammation. *J Clin Periodontol.* 2011;38(9):817–19.

Chapter 6 — Carbohydrates: Chemistry

6.1 Structure and classification of carbohydrates: mono-, di-, oligo- and polysaccharides; glucose, galactose, fructose, ribose and deoxyribose · 6.2 Isomerism and reducing behaviour: structural isomers, stereoisomers, enantiomers, epimers and anomers; reducing and non-reducing sugars · 6.3 Complex carbohydrates and oral relevance: starch, glycogen and cellulose, bacterial dextrans and levans, glycoproteins and proteoglycans, dietary sucrose and plaque polysaccharides

Core texts: [2] Ch. 7 (Carbohydrates and glycobiology) · [1] chapters on carbohydrates of physiological significance and glycoproteins · [13] chapters on glycoprotein and proteoglycan structure · [23] chapters on diet and the caries process · [20] chapters on plaque biofilm carbohydrate metabolism · [29], [30] and [31] dietary carbohydrate and sugars recommendations

Additional

- Bowen WH, Koo H. Biology of *Streptococcus mutans*-derived glucosyltransferases: role in extracellular matrix formation of cariogenic biofilms. *Caries Res.* 2011;45(1):69–86.
- Moynihan PJ, Kelly SA. Effect on caries of restricting sugars intake: systematic review to inform WHO guidelines. *J Dent Res.* 2014;93(1):8–18.
- Tabak LA. In defense of the oral cavity: structure, biosynthesis, and function of salivary mucins. *Annu Rev Physiol.* 1995;57:547–64.
- Bowen WH, Burne RA, Wu H, Koo H. Oral biofilms: pathogens, matrix and polymicrobial interactions in microenvironments. *Trends Microbiol.* 2018;26(3):229–42.

Chapter 7 — Carbohydrate Metabolism

7.1 Metabolic pathways and glycolysis: regulation of pathways; glycolysis, key regulatory steps and energy yield · 7.2 The TCA cycle and oxidative phosphorylation: key steps, cofactors, the electron transport chain and ATP synthesis · 7.3 Glucose storage, alternative pathways and clinical relevance: gluconeogenesis, glycogenesis and glycogenolysis, the HMP shunt, diabetes mellitus, glycogen storage diseases and plaque acid production

Core texts: [2] Chs. 14–16 (Glycolysis, gluconeogenesis and the pentose phosphate pathway; metabolic regulation; the citric acid cycle) · [1] chapters on carbohydrate metabolism · [5] chapters on fuel metabolism and diabetes · [8] chapters on major and minor pathways of glucose · [21] chapters on plaque metabolism and acid production · [34] management of type 2 diabetes

Additional

- Preshaw PM, Alba AL, Herrera D, Jepsen S, Konstantinidis A, Makrilakis K, et al. Periodontitis and diabetes: a two-way relationship. *Diabetologia.* 2012;55(1):21–31.
- Sanz M, Ceriello A, Buysschaert M, Chapple I, Demmer RT, Graziani F, et al. Scientific evidence on the links between periodontal diseases and diabetes: consensus report and guidelines of the joint workshop on periodontal diseases and diabetes by the International Diabetes Federation and the European Federation of Periodontology. *J Clin Periodontol.* 2018;45(2):138–49.
- Takahashi N, Nyvad B. The role of bacteria in the caries process: ecological perspectives. *J Dent Res.* 2011;90(3):294–303.
- Marsh PD. Are dental diseases examples of ecological catastrophes? *Microbiology.* 2003;149(Pt 2):279–94.
- Kishnani PS, Koeberl DD. Glycogen storage diseases. In: Rimoin D, Pyeritz R, Korf B, editors. *Emery and Rimoin's Principles and Practice of Medical Genetics.* 6th ed. San Diego: Academic Press; 2013.

Chapter 8 — Lipids: Chemistry

8.1 Lipid chemistry and classification: simple, compound and derived lipids; saturated, unsaturated and essential fatty acids · 8.2 Major lipid classes: triacylglycerols, phospholipids, glycolipids and sphingolipids; membrane lipids and the bilayer · 8.3 Cholesterol, steroids and lipid transport: structure and functions of cholesterol, steroid hormones, chylomicrons, VLDL, LDL and HDL · 8.4 Oral and clinical relevance: membrane lipids of oral tissues and lipids in inflammation

Core texts: [2] Ch. 10 (Lipids) and Ch. 11 (Biological membranes and transport) · [1] chapters on lipids of physiological significance · [3] chapters on membrane structure and lipids · [6] chapters on lipid structure and function

Additional

- Fahy E, Subramaniam S, Murphy RC, Nishijima M, Raetz CRH, Shimizu T, et al. Update of the LIPID MAPS comprehensive classification system for lipids. *J Lipid Res.* 2009;50 Suppl:S9–14.
- van Meer G, Voelker DR, Feigenson GW. Membrane lipids: where they are and how they behave. *Nat Rev Mol Cell Biol.* 2008;9(2):112–24.
- Serhan CN, Chiang N, Van Dyke TE. Resolving inflammation: dual anti-inflammatory and pro-resolution lipid mediators. *Nat Rev Immunol.* 2008;8(5):349–61.
- Van Dyke TE. Pro-resolving mediators in the regulation of periodontal disease. *Mol Aspects Med.* 2017;58:21–36.

Chapter 9 — Lipid Metabolism

9.1 Digestion, absorption and oxidation of lipids: dietary lipid digestion and absorption; β -oxidation and energy yield · 9.2 Fuel storage and biosynthetic pathways: ketone body formation and utilisation, lipogenesis, cholesterol biosynthesis and its regulation · 9.3 Lipid transport and clinical relevance: lipoprotein metabolism and atherosclerosis, essential fatty acid deficiency, lipid peroxidation in periodontal disease and nutritional lipids in immune function

Core texts: [2] Ch. 17 (Fatty acid catabolism) and Ch. 21 (Lipid biosynthesis) · [1] chapters on lipid metabolism and lipid transport · [5] chapters on fatty acid and ketone body metabolism · [24] chapters on lipids and lipoproteins

Additional

- Goldstein JL, Brown MS. A century of cholesterol and coronaries: from plaques to genes to statins. *Cell.* 2015;161(1):161–72.
- Laffel L. Ketone bodies: a review of physiology, pathophysiology and application of monitoring to diabetes. *Diabetes Metab Res Rev.* 1999;15(6):412–26.
- Tonetti MS, Van Dyke TE. Periodontitis and atherosclerotic cardiovascular disease: consensus report of the Joint EFP/AAP Workshop on Periodontitis and Systemic Diseases. *J Clin Periodontol.* 2013;40 Suppl 14:S24–9.
- National Institute for Health and Care Excellence. Cardiovascular disease: risk assessment and reduction, including lipid modification. NICE guideline NG238. London: NICE. Available from: <https://www.nice.org.uk/guidance/ng238>

Chapter 10 — Protein and Amino Acid Metabolism

10.1 Protein digestion, absorption and nitrogen economy: gastric and pancreatic proteolysis, the amino acid pool and nitrogen balance · 10.2 Amino acid catabolism and nitrogen disposal: transamination, oxidative deamination, the urea cycle, glucogenic and ketogenic carbon skeletons, phenylketonuria and alkaptonuria · 10.3 Non-protein nitrogenous substances and oral relevance: creatine, creatinine, uric acid and blood urea; protein-energy malnutrition, impaired healing and infection risk

Core texts: [2] Ch. 18 (Amino acid oxidation and the production of urea) · [1] chapters on protein and amino acid catabolism · [5] chapters on nitrogen metabolism · [8] chapters on amino acid metabolism · [24] chapters on renal function and nitrogenous waste

Additional

- Weiner ID, Mitch WE, Sands JM. Urea and ammonia metabolism and the control of renal nitrogen excretion. Clin J Am Soc Nephrol. 2015;10(8):1444–58.
- van Spronsen FJ, Blau N, Harding C, Burlina A, Longo N, Bosch AM. Phenylketonuria. Nat Rev Dis Primers. 2021;7(1):36.
- Psoter WJ, Reid BC, Katz RV. Malnutrition and dental caries: a review of the literature. Caries Res. 2005;39(6):441–7.
- Sheiham A, Steele JG, Marcenes W, Finch S, Walls AWG. The relationship between oral health status and body mass index among older people. Br Dent J. 2002;192(12):703–6.

Chapter 11 — Nucleotides and Nucleic Acids

11.1 Nucleotide and nucleic acid structure: components of nucleotides and nucleosides; the DNA double helix and base pairing · 11.2 RNA, chromatin and the gene: mRNA, tRNA, rRNA and small RNAs; chromatin, chromosomes and the gene concept · 11.3 Biological roles of nucleotides: energy transfer by ATP and GTP; cyclic AMP and cyclic GMP as signalling nucleotides

Core texts: [2] Ch. 8 (Nucleotides and nucleic acids) and Ch. 24 (Genes and chromosomes) · [1] chapters on nucleotides and nucleic acid structure · [9] chapters on DNA, chromosomes and genomes · [12] chapters on the structure and function of genes

Additional

- Watson JD, Crick FHC. Molecular structure of nucleic acids: a structure for deoxyribose nucleic acid. Nature. 1953;171(4356):737–8.
- Franklin RE, Gosling RG. Molecular configuration in sodium thymonucleate. Nature. 1953;171(4356):740–1.
- Luger K, Mäder AW, Richmond RK, Sargent DF, Richmond TJ. Crystal structure of the nucleosome core particle at 2.8 Å resolution. Nature. 1997;389(6648):251–60.
- Newton AC, Bootman MD, Scott JD. Second messengers. Cold Spring Harb Perspect Biol. 2016;8(8):a005926.

Chapter 12 — Molecular Biology Basics

12.1 DNA replication and transcription: conceptual steps of replication; transcription and RNA processing including splicing · 12.2 The genetic code and protein synthesis: features of the code; initiation, elongation and termination of translation · 12.3 Mutations and molecular applications in dentistry: point, missense, nonsense and frameshift mutations; recombinant DNA, PCR and molecular diagnostics; molecular basis of craniofacial anomalies and inherited enamel and dentine defects

Core texts: [9] chapters on DNA replication, transcription and translation · [2] Chs. 25–27 (DNA metabolism; RNA metabolism; protein metabolism) · [1] chapters on molecular genetics and gene expression · [12] chapters on mutation and molecular diagnostics

Additional

- Crawford PJM, Aldred M, Bloch-Zupan A. Amelogenesis imperfecta. Orphanet J Rare Dis. 2007;2:17.
- Barron MJ, McDonnell ST, Mackie I, Dixon MJ. Hereditary dentine disorders: dentinogenesis imperfecta and dentine dysplasia. Orphanet J Rare Dis. 2008;3:31.
- Mullis KB, Faloona FA. Specific synthesis of DNA in vitro via a polymerase-catalyzed chain reaction. Methods Enzymol. 1987;155:335–50.
- Jinek M, Chylinski K, Fonfara I, Hauer M, Doudna JA, Charpentier E. A programmable dual-RNA-guided DNA endonuclease in adaptive bacterial immunity. Science. 2012;337(6096):816–21.

- Dixon MJ, Marazita ML, Beaty TH, Murray JC. Cleft lip and palate: understanding genetic and environmental influences. *Nat Rev Genet.* 2011;12(3):167–78.

Chapter 13 — Biological Oxidation and Free Radicals

13.1 Electron transport chain and oxidative phosphorylation: components of the chain and coupling of oxidation to phosphorylation · 13.2 Inhibitors, uncouplers and reactive oxygen species: concepts, examples, ROS generation and damage · 13.3 Antioxidant systems and oral relevance: enzymatic antioxidants (SOD, catalase, glutathione peroxidase) and non-enzymatic antioxidants; oxidative stress in periodontal disease and the antioxidant role of saliva

Core texts: [2] Ch. 19 (Oxidative phosphorylation) · [1] chapters on biological oxidation and the respiratory chain · [3] chapters on oxidative phosphorylation · [6] chapters on free radicals and antioxidant defence

Additional

- Mitchell P. Coupling of phosphorylation to electron and hydrogen transfer by a chemi-osmotic type of mechanism. *Nature.* 1961;191:144–8.
- Sies H, Jones DP. Reactive oxygen species (ROS) as pleiotropic physiological signalling agents. *Nat Rev Mol Cell Biol.* 2020;21(7):363–83.
- Chapple ILC, Matthews JB. The role of reactive oxygen and antioxidant species in periodontal tissue destruction. *Periodontol 2000.* 2007;43:160–232.
- Battino M, Ferreiro MS, Gallardo I, Newman HN, Bullon P. The antioxidant capacity of saliva. *J Clin Periodontol.* 2002;29(3):189–94.
- Halliwell B, Gutteridge JMC. *Free Radicals in Biology and Medicine.* 5th ed. Oxford: Oxford University Press; 2015.

Chapter 14 — Haemoglobin and Haem Metabolism

14.1 Haemoglobin and myoglobin: structure, function and variants HbA, HbF and HbA2 · 14.2 Oxygen transport and haemoglobinopathies: the oxygen dissociation curve and factors affecting it; sickle cell disease and thalassaemia · 14.3 Haem metabolism, bilirubin and oral relevance: haem synthesis and degradation, bilirubin metabolism, types of jaundice, anaemia, pallor and cyanosis on oral examination

Core texts: [2] Ch. 5 (Protein function: reversible binding of oxygen) · [1] chapters on haemoglobin, porphyrins and bile pigments · [8] chapters on haem and haemoglobin · [24] chapters on liver function and bilirubin · [27] and [28] chapters on haematological disease in dental practice

Additional

- Perutz MF. Structure and mechanism of haemoglobin. *Br Med Bull.* 1976;32(3):195–208.
- Kato GJ, Piel FB, Reid CD, Gaston MH, Ohene-Frempong K, Krishnamurti L, et al. Sickle cell disease. *Nat Rev Dis Primers.* 2018;4:18010.
- Taher AT, Weatherall DJ, Cappellini MD. Thalassaemia. *Lancet.* 2018;391(10116):155–67.
- Fevery J. Bilirubin in clinical practice: a review. *Liver Int.* 2008;28(5):592–605.
- da Fonseca M, Oueis HS, Casamassimo PS. Sickle cell anemia: a review for the pediatric dentist. *Pediatr Dent.* 2007;29(2):159–69.

Chapter 15 — Vitamins

15.1 Classification and general properties: fat-soluble vitamins A, D, E and K and water-soluble B-complex and C; sources, absorption, storage and toxicity risk · 15.2 Functions and deficiency states: vitamin A in vision, epithelia and immunity; vitamin D in calcium-phosphate metabolism and mineralisation; vitamin E, vitamin K, vitamin C in collagen synthesis and wound healing; B-complex as coenzymes · 15.3 Oral and dental relevance:

gingival bleeding in vitamin C deficiency, enamel and bone defects in vitamin D deficiency, glossitis, angular cheilitis and stomatitis

Core texts: [1] chapters on the vitamins · [2] chapters on vitamin-derived coenzymes · [16] and [17] chapters on micronutrients · [7] chapters on fat- and water-soluble vitamins · [32] vitamin D recommendations · [33] prevention toolkit

Additional

- Institute of Medicine. Dietary Reference Intakes for Calcium and Vitamin D. Washington (DC): National Academies Press; 2011.
- Chapple ILC, Milward MR, Dietrich T. The prevalence of inflammatory periodontitis is negatively associated with serum antioxidant concentrations. *J Nutr.* 2007;137(3):657–64.
- Botelho J, Machado V, Proença L, Delgado AS, Mendes JJ. Vitamin D deficiency and oral health: a comprehensive review. *Nutrients.* 2020;12(5):1471.
- Maxfield L, Daley SF, Crane JS. Vitamin C deficiency. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2024.
- Sedghizadeh PP, Mallery SR, Thompson SJ, Kresty L. Burning mouth syndrome and nutritional deficiency: oral manifestations of vitamin B deficiency. *Gen Dent.* 2011;59(5):e210–5.

Chapter 16 — Minerals and Trace Elements: Tooth and Bone Biochemistry

16.1 Macro-minerals and trace elements: calcium, phosphorus, magnesium, sodium, potassium and chloride; iron, zinc, copper, fluoride, iodine and selenium · 16.2 Calcium–phosphate homeostasis and mineralised tissues: control by parathyroid hormone, calcitonin and vitamin D; composition of enamel, dentine, cementum and alveolar bone · 16.3 Demineralisation, remineralisation and oral relevance: fluoride and fluorapatite, enamel hypoplasia, fluorosis, osteoporosis and osteomalacia of the jaws

Core texts: [18] chapters on enamel, dentine, cementum and bone · [23] chapters on the caries process and its control · [1] chapters on mineral metabolism · [7] chapters on mineral metabolism and the biochemistry of teeth · [33] fluoride and prevention guidance

Additional

- Buzalaf MAR, Pessan JP, Honório HM, ten Cate JM. Mechanisms of action of fluoride for caries control. *Monogr Oral Sci.* 2011;22:97–114.
- DenBesten P, Li W. Chronic fluoride toxicity: dental fluorosis. *Monogr Oral Sci.* 2011;22:81–96.
- Featherstone JDB. The continuum of dental caries: evidence for a dynamic disease process. *J Dent Res.* 2004;83 Spec No C:C39–42.
- Robinson C, Shore RC, Brookes SJ, Strafford S, Wood SR, Kirkham J. The chemistry of enamel caries. *Crit Rev Oral Biol Med.* 2000;11(4):481–95.
- Bikle DD. Vitamin D metabolism, mechanism of action, and clinical applications. *Chem Biol.* 2014;21(3):319–29.
- Boskey AL. Bone composition: relationship to bone fragility and antiosteoporotic drug effects. *Bonekey Rep.* 2013;2:447.

Chapter 17 — Hormones and Endocrine Integration

17.1 Hormone classes and mechanisms of action: peptide, steroid and amino acid-derived hormones; membrane receptors and second messengers versus nuclear receptors · 17.2 Major glands and metabolic regulation: pituitary, thyroid, parathyroid, adrenals, pancreas and gonads; insulin, glucagon and stress hormones in fuel metabolism · 17.3 Endocrine disorders and oral relevance: diabetes mellitus, thyroid

dysfunction, hyperparathyroidism, altered eruption, bone density change, diabetic periodontitis and delayed healing

Core texts: [2] Ch. 23 (Hormonal regulation and integration of mammalian metabolism) · [1] chapters on hormone action and signal transduction · [14] chapters on endocrinology · [27] chapters on endocrine disease in dental practice · [34] management of type 2 diabetes

Additional

- Saltiel AR, Kahn CR. Insulin signalling and the regulation of glucose and lipid metabolism. *Nature*. 2001;414(6865):799–806.
- Röder PV, Wu B, Liu Y, Han W. Pancreatic regulation of glucose homeostasis. *Exp Mol Med*. 2016;48(3):e219.
- Bilezikian JP, Bandeira L, Khan A, Cusano NE. Hyperparathyroidism. *Lancet*. 2018;391(10116):168–78.
- Chapple ILC, Genco R; Working Group 2 of the Joint EFP/AAP Workshop. Diabetes and periodontal diseases: consensus report of the Joint EFP/AAP Workshop on Periodontitis and Systemic Diseases. *J Clin Periodontol*. 2013;40 Suppl 14:S106–12.
- Chandna S, Bathla M. Oral manifestations of thyroid disorders and its management. *Indian J Endocrinol Metab*. 2011;15 Suppl 2:S113–6.

Chapter 18 — Acid-Base Balance and Electrolytes

18.1 Blood pH and buffer systems: normal blood pH and its importance; bicarbonate, phosphate and protein buffers · 18.2 Regulation of pH and its disorders: respiratory and renal regulation and compensation; metabolic and respiratory acidosis and alkalosis · 18.3 Electrolytes and their oral relevance: distribution and function of sodium, potassium, calcium, magnesium, chloride and bicarbonate; salivary pH, plaque ecology and muscle function in mastication

Core texts: [24] chapters on acid-base and electrolyte disorders · [1] chapters on acid-base balance and water and electrolyte homeostasis · [14] and [15] chapters on renal and respiratory regulation of pH · [25] chapters on acid-base and sodium and potassium disturbance

Additional

- Berend K, de Vries APJ, Gans ROB. Physiological approach to assessment of acid-base disturbances. *N Engl J Med*. 2014;371(15):1434–45.
- Seifter JL. Integration of acid-base and electrolyte disorders. *N Engl J Med*. 2014;371(19):1821–31.
- Dawes C. Salivary flow patterns and the health of hard and soft oral tissues. *J Am Dent Assoc*. 2008;139 Suppl:18S–24S.
- Takahashi N. Oral microbiome metabolism: from “who are they?” to “what are they doing?” *J Dent Res*. 2015;94(12):1628–37.

Chapter 19 — Clinical Biochemistry (Introductory)

19.1 Reference ranges and test interpretation: the concept of a reference interval; blood glucose and diabetes screening · 19.2 Routine organ panels: lipid profile basics, liver function tests, serum urea and creatinine · 19.3 Saliva and oral relevance: saliva as a diagnostic fluid, systemic disease and oral signs, pre-operative evaluation

Core texts: [24] chapters on the interpretation of laboratory results and organ-based panels · [26] chapters on analytical principles and reference intervals · [25] chapters on liver, renal and lipid investigation · [27] chapters on laboratory assessment before dental treatment

Additional

- Horn PS, Pesce AJ. Reference intervals: an update. *Clin Chim Acta*. 2003;334(1–2):5–23.

- Pfaffe T, Cooper-White J, Beyerlein P, Kostner K, Punyadeera C. Diagnostic potential of saliva: current state and future applications. Clin Chem. 2011;57(5):675–87.
- Kaufman E, Lamster IB. The diagnostic applications of saliva: a review. Crit Rev Oral Biol Med. 2002;13(2):197–212.
- World Health Organization. Classification of diabetes mellitus. Geneva: WHO; 2019. Available from: <https://www.who.int/publications/i/item/classification-of-diabetes-mellitus>
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