

FOUNDATION KNOWLEDGE FOR THE GENERAL DENTIST

An outline, with selected examples, of the basic knowledge, cognitive skills and abilities for the practice of general dentistry.

FK1: Apply knowledge of molecular, biochemical, cellular, and systems-level development, structure and function to the prevention, diagnosis, and management of oral disease and the promotion and maintenance of oral health.

Foundation Knowledge disciplines covered by FK1 include: Gross and Head and Neck Anatomy, Regional Anatomy, Dental Anatomy, Gnathology, Occlusion (including TMJ), General and Oral Histology, Embryology, Physiology, Cell Biology, Biochemistry, Molecular Biology, Genetics, Neuroscience, Nutrition, Oral Biology, General and Systemic Pathology, Cancer Biology, etc.

Clinical Science areas where FK1 may have relevance include: Periodontology, Oral and Maxillofacial Surgery, Occlusion, TMD, Ergonomics, Prosthodontics, Pediatric Dentistry, Orthodontics, Implant Dentistry, Forensic Dentistry, Oral Medicine, Oral Pathology, Clinical Nutrition, etc.

FK1-1: Apply knowledge of the structure and function of the normal cell and basic types of tissues comprising the human body. (Encompasses Gross and Head and Neck Anatomy, General and Oral Histology, Dental Anatomy, Occlusion, TMJ, etc.).

Select examples include:

- structure of the human body in general and the craniofacial region in particular
- structure and function of salivary glands, including the production, secretion, content and the function of saliva
- development and structure of the deciduous and permanent teeth
- development and structure of periodontal tissues
- development, structure and function of the major muscles of mastication and facial expression
- development, structure and function of the temporomandibular joint and its supporting and accessory structures.
- anatomical and functional relationships of landmarks of the oral cavity and contiguous regions
- structure and function of oral mucosa
- structure, function, and metabolism of collagen, proteoglycans and other proteins in connective and mineralized tissue
- calcium and phosphorus metabolism, the formation of biological hydroxyapatite and its role in the mineralization of hard tissues (e.g., bone and teeth)
- calcium and phosphorus metabolism - role of osteoblasts, osteoclasts, osteocytes, as well as Vitamin D3.
- Blood coagulation systems and its control

FK1-2: Apply knowledge of structure and function of cell membranes and the mechanism of neurosynaptic transmission. (Encompasses Membrane Biology, Cell Biology, Biochemistry and Molecular Biology, Physiology, Neuroscience, etc.).

Select examples include:

- local and central mechanisms of pain modulation
- the role of ion channels in neurotransmission, sodium channel function and mechanism of action of local anesthetics
- function of specific neurotransmitters in a variety of physiological and pathologic conditions
- the role of dopamine in Parkinson's disease
- structure and function of sensory and motor pathways of the central nervous system as they relate to normal functioning of the body in general, and of the craniofacial region in particular
- innervation and anesthesia of the oral cavity
- relationships between sensory and motor innervations and the functions of the orofacial complex (mastication, salivation, orofacial somatosensation, pain, taste and smell)

FK1-3: Apply knowledge of the mechanisms of intra and intercellular communications and their role health and disease. (Encompasses Biochemistry, Cell Biology, etc.).

Select examples include:

- mechanism of neurotransmitter and hormone signaling – i.e., pain, hormones like of insulin, thyroxin, neurotransmitters like acetylcholine, adrenaline, etc., through their cell surface receptor
- role of second messengers in muscle contraction (with implications on myofacial pain), cardiostimulation (with implications for local anesthesia), in glycogen breakdown in the liver (with implications to diabetes and nutrition), of stimulation of bone growth and breakdown (with implications for understanding implant behavior), etc.
- role of intra and intercellular signaling during osteointegration of implants
- role of cell signaling in sensitivity to drugs or bacterial toxins

FK1-4: Explain how the regulation of major biochemical energy production pathways and the synthesis/degradation of macromolecules function to maintain health, and how dysregulation in disease affects the management of oral health. (Encompasses Biochemistry, Cell Biology, Membrane Biology, Physiology, Molecular Pathology, Nutrition, Sports Medicine, etc.).

Select examples include:

- major anabolic and catabolic pathways for proteins, carbohydrates, and lipids and how energy for all activities of the body is derived
- mechanisms of biologic energy transduction
- the role of insulin in regulation of glucose and lipid metabolism, and the pathogenesis of types I and II diabetes mellitus

FK1-5: Apply knowledge of the atomic and molecular characteristics of biological constituents to predict normal and pathological function (Encompasses Biochemistry, Cell Biology, Genetics etc.).

Select examples include:

- the role of nucleic acids, DNA and RNA, in heredity and metabolic regulation
- the role of enzymes as catalysts in bodily functions such as digestion, blood coagulation, respiration
- Metabolic turnover of lipids, carbohydrates and proteins in lysosomes and proteosomes

FK1-6: Apply knowledge of the mechanisms that regulate cell division and cell death, to explain normal and abnormal growth and development. (Encompasses Cell Biology, Physiology, Molecular Biology, Pathology, Cancer Biology, etc.).

Select examples include:

- how abnormalities in regulation of cell division and cell death result in cancer
- the role of growth factors and their receptors in uncontrolled tissue proliferation
- the role of oncogenes in the context of normal growth factor-initiated signal transduction and how this information is used to treat cancer (e.g., antibodies to EGFR in breast cancer; tyrosine kinase inhibitors in leukemia)
- the role of oncogenes as tumor suppressor genes and in the context of normal growth factor-initiated signal transduction and how this information is used to treat cancer (e.g., antibodies to EGFR in breast cancer; tyrosine kinase inhibitors in leukemia)
- The role of growth factors and platelets in wound healing

FK1-7: Apply knowledge of biological systems and their interactions to explain how the human body functions in health and disease. (Encompasses Physiology, General and Systems Pathology, etc.).

Select examples include:

- basic principles of nutrition, sources of vitamins, minerals, and their importance in oral and systemic health and disease
- how osteoporosis affects the structure and function of the maxillofacial complex
- gastric acid reflux and its impact on oral structures

FK1-8: Apply knowledge of the principles of feedback control to explain how specific homeostatic systems maintain the internal environment and how perturbations in these systems may impact oral health. (Encompasses in Physiology, Systems Pathology, Oral Medicine, Pharmacology, etc.).

Select examples include:

- the hydroelectrolytic balance of the body and consequences of fluid and hemodynamic disturbances
- how loss of fluids due to trauma or due to polypharmacy can lead to xerostomia

FK2: Apply knowledge of physics and chemistry to explain normal biology and pathobiology in the prevention, diagnosis, and management of oral disease and the promotion and maintenance of oral health.

Foundation Knowledge disciplines covered by FK-2 include: Physiology, Systems Pathology, and Pharmacology, etc.

Clinical Science areas where FK2 may have relevance include: Oral Medicine, Oral Pathology, Periodontology, Diagnosis and Treatment Planning, History and Physical Examination, Emergency Care, Oral and Maxillofacial Surgery, Pediatric Dentistry, etc.

FK2-1: Apply knowledge of the principles of blood gas exchange in the lung and peripheral tissue to understand how hemoglobin, oxygen, carbon dioxide and iron work together for normal cellular function. (Encompasses Physiology, Systems Pathology, Oral Medicine, Pharmacology, etc.).

Select examples include:

- diffusion to gas exchange in the lung
- normal blood chemistry and how blood chemistry assists diagnosis of common conditions such as anemia, diabetes, bleeding disorders, cyanosis, and acidosis

FK3: Apply knowledge of physics and chemistry to explain the characteristics and use of technologies and materials used in the prevention, diagnosis, and management of oral disease and the promotion and maintenance of oral health.

Foundation Knowledge disciplines covered by FK-3 include: Basic Radiology, Dental Material Sciences, Biomaterials, Biophysics, etc.

Clinical Science areas where FK3 may have relevance include: Prosthodontics, Restorative Dentistry, Oral Diagnostics, Applied Biomaterials, Preventive Dentistry, Laser-Assisted Dentistry, Applied Pharmacology, Radiology, Implant Dentistry, Endodontics, Esthetic Dentistry, Cosmetic Dentistry, Radiation Oncology, Oral Oncology, etc.

FK3-1: Apply knowledge of the principles of radiation to understand radiobiologic concepts and the uses of radiation in the diagnosis and treatment of oral and systemic conditions (Encompasses Basic and Oral Radiology, etc.).

Select examples include:

- types of radiation and their impact on biologic systems
- safeguards against radiation exposure
- radiographic techniques for optimal diagnosis

FK3-2: Apply knowledge of the principles of chemistry to understand the properties and performance of dental materials and their interaction with oral structures in health and disease. (Encompasses Dental Material Sciences, Biomaterials, etc.).

Select examples include:

- advantages and disadvantages of biomaterials used in dentistry
- compatibility of dental materials both with each other and with biologic systems
- substantivity and the adhesion chemicals, drugs, dental plaque, food, etc. to dental materials or to tissues in the mouth

FK3-3: Apply knowledge of the principles of lasers to understand the interaction of laser energy with biological tissues and uses of lasers to diagnose and manage oral conditions (Encompasses Biophysics, Laser-Assisted Dentistry, etc.).

Select examples include:

- benefits and limitations of laser devices for detecting dental caries
- practical use of lasers for surgical procedures involving soft tissue and hard tissues
- safety considerations for the use of lasers

FK4: Apply knowledge of the principles of genetic, congenital and developmental diseases and conditions and their clinical features to understand patient risk in the prevention, diagnosis, and management of oral disease and the promotion and maintenance of oral health.

Foundation Knowledge disciplines covered by FK4 include: Genetics, Developmental Biology, Embriology, Craniofacial Biology, etc.

Clinical Science areas where FK4 may have relevance include: Oral Medicine, Oral Pathology Orthodontics, Pediatric Dentistry, Oral Diagnostics, Oral and Maxillofacial Surgery, Facial Prosthesis, Periodontology, Pediatric Dentistry, Radiology, Cariology, etc.

FK4-1: Apply knowledge of genetic transmission of inherited diseases and their clinical features to inform diagnosis and the management of oral health. (Encompasses Genetics, Hereditary Medicine, Developmental Biology, Teratology, etc.).

Select examples include:

- *Ectodermal dysplasia, Amelogenesis imperfecta, Hereditary hemorrhagic telangiectasia, neurofibromatosis, dentogenesis imperfecta, osteogenesis imperfecta, basal cell nevus syndrome, various bleeding disorders, osteoporosis, and other hereditary conditions*

FK4-2: Apply knowledge of congenital (non-inherited) diseases and developmental conditions and their clinical features to inform the provision of oral health care. (Encompasses Genetics, Developmental Biology, Teratology, etc.).

Select examples include:

- *Sturge-Webber Angiomatosis* and other non-hereditary conditions
- anterior overjet and thumb-sucking

FK5: Apply knowledge of the cellular and molecular bases of immune and non-immune host defense mechanisms in the prevention, diagnosis, and management of oral disease and the promotion and maintenance of oral health.

Foundation Knowledge disciplines covered by FK5 include: Immunology, Immunopathology, Microbiology, Virology, etc.

Clinical Science areas where FK5 may have relevance include: Oral Pathology, Periodontology, Preventive Dentistry, Pediatric Dentistry, Diagnosis and Treatment Planning, History and Physical Examination, Cariology, Implant Dentistry, Emergency Care, Oral Radiology, Endodontics, Oral and Maxillofacial Surgery, Clinical Laboratory Sciences, etc.

FK5-1: Apply knowledge of the function and dysfunction of the immune system, of the mechanisms for distinction between self and non-self (tolerance and immune surveillance) to the maintenance of health and autoimmunity. (Encompasses Immunology, Immunopathology, Immunobiology, Microbiology, Virology, etc.).

Select examples include:

- the role of the immune system in the pathogenesis of periodontal disease
- the effect of immunization in the prevention of infectious diseases

FK5-2: Apply knowledge of the differentiation of hematopoietic stem cells into distinct cell types and their subclasses in the immune system and its role for a coordinated host defense against pathogens (e.g., HIV, hepatitis viruses) (Encompasses Immunopathology, Immunology, Hematology, etc.).

Select examples include:

- synthesis and secretion of salivary antibodies and their use for diagnostic purposes.

FK5-3: Apply knowledge of mechanisms that defend against intracellular or extracellular microbes and the development of immunological prevention or treatment strategies. (Encompasses Immunopathology, Immunobiology, Immunology, Microbiology, Virology, Mycology, Parasitology, etc.).

Select examples include:

- the induction of antibody response to prevent influenza or hepatitis
- the development and successful use of vaccines against polio and measles
- the potential for use of vaccines for caries

FK6: Apply knowledge of general and disease-specific pathology to assess patient risk in the prevention, diagnosis, and management of oral disease and the promotion and maintenance of oral health.

Foundation Knowledge disciplines covered by FK6 include: Cellular and Molecular Pathology, General and Systems Pathology, etc.

Clinical Science areas where FK6 may have relevance include: Periodontology, Oral Pathology, Oral Medicine, Oral Oncology, Oral Cancer, Oral Diagnostics, Diagnosis and Treatment Planning, History and Physical Examination, Endodontics, Emergency Care, Oral Radiology, Oral and Maxillofacial Surgery, Clinical Laboratory Sciences, Prosthodontics, Craniofacial Prosthodontics, Applied Biomaterials, etc.

FK6-1: Apply knowledge of cellular responses to injury, the underlying etiology, biochemical and molecular alterations and natural history of disease, to assess therapeutic intervention. (Encompasses Cellular and Molecular Pathology, General Pathology, etc.).

Select examples include:

- formation and removal of free radicals from cells and conditions under which tissue injury occurs due to lack of perfusion
- susceptibility of different cell types (cardiomyocytes, neurons) to the effects of anoxic injury caused by vascular compromise

FK6-2: Apply knowledge of the vascular and leukocyte responses of inflammation and their cellular and soluble mediators to understand the prevention, causation, treatment and resolution of tissue injury. (Encompasses Cellular and Molecular Pathology, General Pathology, Pharmacology, Immunopathology, etc.).

Select examples include:

- the role that arachidonic acid-derived mediators play in various steps of acute inflammation and how the inflammatory process can be moderated by use of specific inhibitors of these mediators (COX inhibitors, aspirin)
- benefits of neutralizing various immune mediators (e.g., anti-TNF in rheumatoid arthritis) in the context of specific diseases
- benefits of regulated functions of the inflammatory response (e.g., the elimination of infectious agents)

FK6-3: Explain the interplay of platelets, vascular endothelium, leukocytes, and coagulation factors in maintaining fluidity of blood, formation of thrombi, and causation of atherosclerosis as it relates to the management of oral health. (Encompasses Cellular and Molecular Pathology, General Pathology, etc.).

Select examples include:

- implications of the administration of local anesthesia with epinephrine to a severely atherosclerotic patient
- evaluation of patients for oral surgical procedures

FK6-4: Explain the impact of systemic conditions on the treatment of dental patients. (Encompasses Systemic Pathology, Internal Medicine, Medically Complex Patient, etc.).

Select examples include:

- joint replacement
- osteoporosis
- bacterial endocarditis
- diabetes
- AIDS

FK6-5: Explain the mechanisms, clinical features, and dental implications of the most commonly encountered metabolic systemic diseases. (Encompasses Systemic Pathology, Internal Medicine, Medically Complex Patients, etc.).

Select examples include:

- Diabetes
- Hyper- and hypothyroidism

FK7: Apply knowledge of the biology of microorganisms in physiology and pathology in the prevention, diagnosis, and management of oral disease and the promotion and maintenance of oral health.

Foundation Knowledge disciplines covered by FK7 include: Microbiology, Virology, Parasitology, Mycology, Oral Epidemiology, Oral Public Health, Statistics, etc.

Clinical Science areas where FK7 may have relevance include: Cariology, Periodontology, Oral Pathology, Oral Malodor, Oral Medicine, Oral Diagnostics, Diagnosis and Treatment Planning, History and Physical Examination, Endodontics, Emergency Care, Oral Radiology, Oral and Maxillofacial Surgery, Applied Pharmacology, Applied Epidemiology, Preventive Dentistry, Community Dentistry, etc.

FK7-1: Apply the principles of host–pathogen and pathogen–population interactions and knowledge of pathogen structure, transmission, natural history, and pathogenesis to the prevention, diagnosis, and treatment of infectious disease. (Encompasses Microbiology, Virology, Parasitology, Mycology, Pharmacology, Oral Biology, Pulp Biology, etc.).

Select examples include:

- mechanisms by which bacteria increase their drug resistance susceptibility
- use of anti-virals in the treatment of Herpes simplex infection
- emergence of antibiotic resistant bacteria
- components the oral microflora
- components of and formation of dental plaque
- the role of specific bacterial groups in the production of periodontal disease
- the role of bacteria in production of dental caries, pulpal and periapical pathology

FK7-2: Apply the principles of epidemiology to achieving and maintaining the oral health of communities and individuals. (Encompasses Epidemiology, Public Health, Preventive Medicine, Preventive Dentistry, etc.).

Select examples include:

- evaluate potential effectiveness of fluoride, varnishes, brushing, flossing, mouthwashes to prevent caries, periodontal disease and oral malodor
- evaluate patterns of health and disease to better manage community oral health
- apply the principles of universal precautions in preventing the transmission of infectious diseases

FK7-3: Apply the principles of symbiosis (commensalisms, mutualism, and parasitism) to the maintenance of oral health and prevention of disease. (Encompasses Parasitology, Microbiology, Pharmacology, Immunopathology, etc.).

Select examples include:

- the protective effect of normal oral flora and its perturbation after antibiotic treatment or immunosuppressive therapy

FK8: Apply knowledge of pharmacology in the prevention, diagnosis, and management of oral disease and the promotion and maintenance of oral health.

Foundation Knowledge disciplines covered by FK8 include: Basic and Applied Pharmacology, Biomedical Research, Evidence Based Dentistry, Public Health Policy, etc.

Clinical Science areas where FK8 may have relevance include: Clinical Pharmacology, Cariology, Periodontology, Endodontics, Oral and Maxillofacial Surgery, Pediatric Dentistry, Preventive Dentistry, Applied Epidemiology, Community Dentistry, etc.

FK8-1: Apply knowledge of pathologic processes and basic principles of pharmacokinetics and pharmacodynamics for major classes of drugs and over the counter products to guide safe and effective treatment. (Encompasses Basic and Applied Pharmacology, Cancer Biology, etc.).

Select examples include:

- explain modes of action of the major classes of antimicrobial drugs
- apply therapeutic strategies help minimize or prevent drug resistance
- understand the use of multiple drugs with different mechanisms of action for cancer chemotherapy
- Explain how conventional drug therapies could have side effects that impact on systemic conditions (i.e. the use of bisphosphonates and mandibular bone metabolism, the use of anti HIV protease inhibitors and caries incidence)

FK8-2: Select optimal drug therapy for oral conditions based on an understanding of pertinent research, relevant dental literature, and regulatory processes. (Encompasses Clinical and Applied Pharmacology, Public Health Policy, Evidence Based Dentistry, Biomedical Research, etc.).

Select examples include:

- explain the limitations of the claims for therapeutic efficacy and safety as reported by oral product/pharmaceutical manufacturers
- understand the process by which drugs become approved and withdrawn in the United States

FK9: Apply knowledge of sociology, psychology, ethics and other behavioral sciences in the prevention, diagnosis, and management of oral disease and the promotion and maintenance of oral health.

Foundation Knowledge disciplines covered by FK9 include: Sociology, Psychology, Philosophy and Ethics, Cultural Competence, Ergonomics, Applied Nutrition, Communication Skills, Emotional Intelligence and other Behavioral Sciences, etc.

Clinical Science areas where FK9 may have relevance include: all major clinical disciplines where patient interaction is anticipated including Speech Therapy and Clinical Nutrition, Nicotine Replacement Therapy, and Practice Management including Access to Care and Patient Education and Compliance.

FK9-1: Apply principles of sociology, psychology, and ethics in making decisions regarding the management of oral health care for culturally diverse populations of patients. (Encompasses Sociology, Psychology, Ethics, Cultural Competence, Emotional Intelligence, Communication Skills, Community Health, Public Health, etc.).

Select examples include:

- understand patient responses to treatment recommendations based on beliefs associated with cultural or ethnic background
- assess community-based interventions for prevention of oral disease

FK9-2: Apply principles of sociology, psychology and ethics in making decisions and communicating effectively in the management of oral health care for the child, adult, geriatric, or special needs patient. (Encompasses Sociology, Psychology, Ethics, Communication Skills, Child Psychology, Geriatric Medicine, Patients with Special Needs, Applied Nutrition, Speech Therapy, etc.).

Select examples include:

- use of behavior modification techniques in treatment of young children
- use of appropriate methods for tobacco cessation education
- use of appropriate methods for dietary counseling

FK9-3: Apply principles of sociology, psychology, and ethics in managing fear and anxiety and acute and chronic pain in the delivery of oral health care. (Encompasses Sociology, Psychology, Ethics, Applied Pharmacology, Psychotherapy, etc.).

Select examples include:

- management of pain and anxiety in patients with history of substance abuse
- understand the implications of transference and projection in the doctor-patient relationship

FK9-4: Apply principles of sociology, psychology, and ethics in understanding and influencing health behavior in individuals and communities. (Encompasses Sociology, Psychology, Ethics, Public Health, Community Health, Medical and Dental Informatics, etc.).

Selected examples include:

- develop effective strategies for achieving water fluoridation in a community
- understand reasons for avoidance of professional dental care

FK10: Apply quantitative knowledge, critical thinking, and informatics tools in the prevention, diagnosis, and management of oral disease and the promotion and maintenance of oral health.

Foundation Knowledge disciplines covered by FK10 include: Statistics, Public Health Dentistry, Descriptive and Analytical Epidemiology, Dental and Health Informatics, Evidence-Based Dentistry, Applied Research, etc.

Clinical Science areas where FK10 may have relevance include: all major disciplines associated with practicing dentistry including Practice Management.

FK10-1: Apply basic mathematical tools and concepts, including functions, graphs and modeling, measurement and scale, and quantitative knowledge, to an understanding of the specialized functions of membranes, cells, tissues, organs, and the human organism, especially those related to the head and neck, in both health and disease. (Encompasses Basic Algebra, Basic Mathematics, Analytical and Descriptive Epidemiology, Statistics, Critical Evaluation of the Scientific Literature, Evidence Based Dentistry, etc.).

Select examples include:

- interpret and apply graphical representations of drug levels as a function of dosage and pharmacokinetics
- explain the impact of diet, salivation and swallowing on salivary pH
- analyze skeletal growth and development patterns in children.
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FK10-2: Apply the principles and logic of epidemiology and the analysis of statistical data in the evaluation of oral disease risk, etiology, and prognosis. Encompasses Evidence-Based Dentistry, Epidemiology, Statistics, Preventive Dentistry, Health Promotion, Public Health Dentistry, Community Dentistry, etc.).

Select examples include:

- understand the relative risk and attributable risk as useful guides to clinical and public oral health decision making with regard to caries, periodontal disease and oral cancer prevention
- understand the ability of a diagnostic test to discriminate between high and low risk of disease given the prevalence of the disease

FK10-3: Apply the basic principles of information systems, use, and limitations, to information retrieval and clinical problem solving. (Encompasses Dental Informatics, Health Informatics, Descriptive and Analytical Epidemiology, Evidence-Based Dentistry, Library Sciences, etc.).

Select examples include:

- understand and be able to access search capability of bibliographic databases

(Cochrane Data Base, PubMed, and others), using at least two Boolean connectors, on a clinical topic

- utilize an electronic health record system to manage oral health care
- understand and apply the levels of evidence in the scientific literature
- understand how to formulate a PICO (Patient, Intervention, Comparison, Outcome) question for a problem in oral health

FK10-4: Apply knowledge of biomedical and health informatics, including data quality, analysis, and visualization, and its application to diagnosis, therapeutics, and characterization of populations and subpopulations. (Encompasses Dental Informatics, Evidence-Based Dentistry and Medicine, Health Informatics, etc.).

Select examples include:

- the role of informatics in health care quality
- the role of informatics in health policy

FK10-5: Apply elements of the scientific process, such as inference, critical analysis of research design, and appreciation of the difference between association and causation, to interpret the findings, applications, and limitations of observational and experimental research in clinical decision-making using original research articles as well as review articles. (Encompasses Evidence-Based Dentistry, Applied Research, etc.).

Select examples include:

- the value of evidence from observational versus experimental studies in determining the efficacy of therapeutic interventions