

## **SYLLABUS**

COURSE: DHCT 2108 Oral Histology and Embryology  
SEMESTER: Fall  
CREDIT HOUR: 2.0

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COURSE DIRECTOR: Barry Rittman, Ph.D.

## GOAL

Oral Histology and Embryology is an introductory course, which covers some basic human biology with special attention to the structures in the head and neck. It introduces the dental hygiene student to many terms that are used to describe the development and tissue structure of the human body. Both the development and microscopic structure of oral tissues are described and discussed in detail.

Dental Hygiene students are beginning careers as future health care providers. It is important that Health Care Professionals be knowledgeable about the basic structure and functions of the human body. This course provides basic knowledge regarding the histology of the soft tissue and teeth with reference to the importance of these structures in the practice of clinical dentistry. This course also helps prepare the dental hygiene students for subsequent courses such as General Pathology, Oral Pathology and Periodontics.

## OBJECTIVES

### I. THE CELL

1. Give a brief description of the structure of the following cellular components:
  - 1.1 cell membrane
  - 1.2 nucleus
  - 1.3 nucleolus
  - 1.4 rough endoplasmic reticulum
  - 1.5 smooth endoplasmic reticulum
  - 1.6 cytoplasm
  - 1.7 nuclear envelope
  - 1.8 mitochondria
  - 1.9 lysosomes
  - 1.10 Golgi body
2. Describe the role of the nucleus and its parts in the formation of proteins using the terms chromatin, DNA, RNA, nucleolus, and ribosomes.
3. List the functions of the major cellular organelles: mitochondria, rough endoplasmic reticulum, Golgi body, lysosomes, smooth endoplasmic reticulum, and ribosomes.
4. Describe cilia and microvilli and distinguish between them as to structure, function and location.

### II. TISSUE MORPHOLOGY & FUNCTION

1. List the main characteristics of epithelial tissues using the terms: cells, intercellular substance, basement membrane, basal lamina, and reticular lamina.
2. For each of the following types of surface or lining epithelial tissues give the distinguishing characteristics and name a location in the human body where it is found:
  - 2.1 simple squamous
  - 2.2 simple cuboidal
  - 2.3 simple columnar
  - 2.4 pseudostratified columnar
  - 2.5 stratified squamous
  - 2.6 stratified cuboidal
  - 2.7 stratified columnar
  - 2.8 transitional
3. For glandular tissues, distinguish between exocrine and endocrine.
4. Define: hormone, ductless, serous, mucous, mixed, and duct.
5. Give the main characteristics of these connective tissues:
  - 5.1 fibrous connective tissue
  - 5.2 dense (regular and irregular)
  - 5.3 areolar
  - 5.4 fat tissue (adipose)
  - 5.5 hematopoietic tissue (blood cell forming tissue)

- 5.6 red bone marrow
- 5.7 lymphoid tissues
- 6. Define: fibroblast, collagen, and elastin.
- 7. Name the three types of human cartilage and list the locations they are found in the body.
- 8. Define: chondroblast, chondrocyte, cartilage matrix, and lacuna.
- 9. Describe the general appearance of bone and distinguish between compact and spongy bone.
- 10. Name the three types of bone cells and give their functions.
- 11. Describe the general arrangement of the nervous tissue making up the central nervous system (CNS) using the terms: neurons, neuroglia, white matter, and gray matter.
- 12. Describe the arrangement of the peripheral nervous system (PNS) and define axon, dendrite, myelin sheath, and nerve fiber.
- 13. Name the three types of muscle and give the structural characteristics of each.
- 14. Distinguish a skeletal muscle from a cardiac muscle cell from a smooth muscle cell. Give the relative size of each, the usual arrangement, and any unique features of each.

### III. EARLY HUMAN EMBRYOLOGY

- 1. Define these terms as used in the lectures and the monograph:
  - 1.1 spermatogenesis
  - 1.2 oogenesis
  - 1.3 diploid number
  - 1.4 haploid number
  - 1.5 zona pellucida
  - 1.6 corona radiata
  - 1.7 zygote, yolk sac
  - 1.8 differentiation
  - 1.9 decidua
  - 1.10 primitive streak
  - 1.11 notochord
  - 1.12 stomodeum
  - 1.13 amnion
- 2. Describe meiosis and how the chromosome number is maintained.
- 3. Describe how the sex of an individual is determined and what the X and Y chromosomes are.
- 4. List the three major things that fertilization accomplishes.
- 5. Describe cleavage of the zygote leading to the formation of the blastocyst.
- 6. Describe implantation of the blastocyst and the normal and abnormal sites implantation may occur.
- 7. Name the structures which originate from the outer cell layer and the inner cell mass of blastocyst.

8. List the functions of the placenta.
9. Describe the embryonic disc, the first two germ layers and how the third germ layer forms.
10. Give significance of the notochord and the prechordal plate in the development of the face.
11. Name structures derived from ectoderm, from mesoderm, and from endoderm.
12. Discuss the differences between fraternal and maternal twins.
13. Explain the various ways the time of pregnancy is divided and give the usual length of a full term pregnancy.

#### IV. DEVELOPMENT OF THE FACE AND ORAL CAVITY

1. Define: stomodeum, foregut, buccopharyngeal membrane, Rathke's pouch and branchial arches.
2. Give name and location of the embryonic processes which shape the facial regions.
3. Describe the location and features of cleft formation in facial development.
4. Describe the manner in which the oral cavity forms from the stomodeum using the terms: maxillary processes, globular process, lateral palatine processes (shelves), premaxillary area, nasal septum, and fusion.
5. Describe how a cleft palate forms, and how a cleft lip may develop.
6. Describe the formation of the tongue using the terms: body, terminal sulcus, lingual swellings, mandibular arch, foramen caecum, thyroid gland, and thyroglossal duct.
7. Name the germ layer, which forms the surface of the body of the tongue and that of the root of the tongue.

#### V. EARLY TOOTH DEVELOPMENT

1. Define the following terms:
  - 1.1 odontogenesis
  - 1.2 ectomesenchyme
  - 1.3 neural crest
  - 1.4 dental lamina
  - 1.5 dental papilla
  - 1.6 epithelial root sheath
  - 1.7 dental sac
  - 1.8 fibroblasts
  - 1.9 predentin
  - 1.10 odontoblastic process
  - 1.11 dentinal tubule
  - 1.12 enamel rod (enamel prism)
  - 1.13 cementum
  - 1.14 CEJ (cemento-enamel junction)
  - 1.15 principal fibers
  - 1.16 hypodontia
  - 1.17 supernumerary teeth
  - 1.18 mottled enamel

- 1.19 dentinogenesis
- 1.20 amelogenesis
- 1.21 ectoderm
- 1.22 tooth bud
- 1.23 cap stage of enamel organ
- 1.24 bell stages of enamel organ
- 1.25 odontoblasts
- 1.26 ameloblasts
- 1.27 Korff's fibers
- 1.28 dentin
- 1.29 cementoblasts
- 1.30 enamel
- 1.31 PDL (periodontal ligament)
- 1.32 DEJ (dentino-enamel junction)
- 1.33 epithelial rests of Malassez
- 1.34 anodontia
- 1.35 enamel pearls
- 1.36 enamel spindles

2. State the age of a human embryo when the first indication of tooth development is seen.
3. Describe the relationship of the dental lamina, tooth buds, surface oral ectoderm, and ectomesenchyme.
4. Name the four layers of a bell-stage enamel organ and list structures they give to, or become.
5. Describe and/or illustrate the bell-stage enamel organ, dental papilla and, dental sac.
6. Describe the main features of tooth root development and describe the role of Hertwig's epithelial root sheath.
7. Describe cementogenesis and the origin of cementoblasts.
8. State how the PDL principal fibers come to be anchored in the cementum and alveolar bone.
9. Describe the gingival epithelial relationship to the tooth.

VI. DENTIN AND ENAMEL DEVELOPMENT (Dentinogenesis and Amelogenesis)

- 1 Describe and/or illustrate the process of dentinogenesis using the terms:

- 1.1 odontoblasts
- 1.2 Korff's fibers
- 1.3 collagen
- 1.4 predentin
- 1.5 odontoblastic processes
- 1.6 organic matrix
- 1.7 dentinal tubules
- 1.8 dentin

2. Describe and/or illustrate the process of **amelogenesis** using the terms:

- 2.1 ameloblasts
- 2.2 inter-rod substance
- 2.3 reduced enamel epithelium
- 2.4 enamel rods

- 2.5 primary enamel cuticle
- 2.6 secondary enamel cuticle
- 3. Describe the process of dentinogenesis using the following terms:
  - 3.1 odontoblast
  - 3.2 odontoblast processes
  - 3.3 Korff's fibers
  - 3.4 organic matrix
  - 3.5 collagen
  - 3.6 dentinal tubules
  - 3.7 predentin
  - 3.8 dentin

## VII. ENAMEL

- 1. State the composition of mature enamel.
- 2. Define
  - 2.1 perikymata
  - 2.2 attrition
  - 2.3 mamelons
  - 2.4 fissures
  - 2.5 pits
  - 2.6 enamel cuticle
  - 2.7 Nasmyth's membrane
  - 2.8 dental cuticle
  - 2.9 enamel rods (prisms)
  - 2.10 rod sheath
  - 2.11 inter-rod substance
  - 2.12 organic matrix of enamel
  - 2.13 enamelines
  - 2.14 hydroxyapatite
  - 2.15 Hunter-Schreger bands
  - 2.16 striae of Retzius
  - 2.17 enamel lamellae
  - 2.18 enamel tufts
  - 2.19 enamel spindles
  - 2.20 dentinoenamel junction (DEJ)
- 3. State the clinical significance of the morphology of the DEJ and the direction of the enamel rods.
- 4. List the main structural feature present in dental caries.
- 5. Distinguish between smooth surface caries and fissure caries.

## VIII. DENTIN AND PULP

- 1. State the composition of mature dentin.
- 2. Describe the components of the organic and inorganic matrix of dentin.
- 3. Describe the relationship between the odontoblast process and the dentinal matrix.

4. Define the following:
  - 4.1 mantle dentin
  - 4.2 primary physiologic dentin
  - 4.3 secondary physiologic dentin
  - 4.4 dentinal tubule
  - 4.5 interglobular dentin
  - 4.6 Tomes granular layer
  - 4.7 reparative dentin
  - 4.8 tertiary dentin
  - 4.9 sclerotic dentin
  - 4.10 dead tracts
5. Discuss the clinical significance of the structure of dentin and its response to injury.
6. Describe the general morphology of the dental pulp.
7. List the components of the dental pulp and the function of each component.
8. Describe the three main functions of the dental pulp as in Permar's text, page 146.
9. Describe the main age changes seen in the dental pulp.

#### IX. CEMENTUM

1. State the composition of cementum.
2. Compare and contrast cementum and bone.
3. Compare the location, composition and function of acellular and cellular cementum.
4. Describe the clinical significance of cementum.
5. Describe the main changes in cementum seen in individuals of advanced age.

#### X. PERIODONTAL LIGAMENT

1. Describe the periodontal ligament and list its major components.
2. Briefly describe the blood and nerve supply of the periodontal ligament.
3. Describe the development, histologic structure of the periodontal ligament.
4. Describe the functions of the periodontal ligament.
5. Describe the principal fiber bundles of the periodontal ligament and associated tissues and give their functions.
6. Describe changes in the periodontal ligament with age.

#### XI. ALVEOLAR BONE

1. Describe the components of bone.
2. Describe the location, histologic appearance, function and origin of the cells associated with bone (osteoblasts, osteocytes, bone lining cells and osteoclasts).

3. Distinguish between mature and immature bone structure.
4. Describe the structure, growth and functions of spongy and compact bone.
5. Describe **in general** the process of intramembranous bone formation.
6. Describe the main features of bone remodeling, and specific details of the role of osteoclasts.
7. Define the following terms
  - 7.1 Haversian system
  - 7.2 Volkmann canal
  - 7.3 lamella
  - 7.4 circumferential lamella
  - 7.5 interstitial lamellae
  - 7.6 osteoblast
  - 7.7 osteocyte
  - 7.8 osteoclast
  - 7.9 osteoid
  - 7.10 periosteum
  - 7.11 endosteum
  - 7.12 endochondral ossification
  - 7.13 intramembranous ossification
  - 7.14 lamina dura, cribriform plate, alveolar bone proper, bundle bone
  - 7.15 alveolus
  - 7.16 alveolar crest
  - 7.17 cortical plates
8. Describe the formation, maintenance and functions of the bone of the alveolus including cellular and acellular components.
9. Describe the functional significance of the bone lining the socket being bundle bone.
10. Know the clinical significance of the differences between the alveolar bone in the mandible and the maxilla and between buccal and lingual cortical plates.

## XII. ORAL MUCOSA AND TONGUE

1. State the clinical features, classifications and functions of the oral mucosae.
2. Describe the general histologic structure of a mucosa and compare and contrast the structure of the different types of oral mucosa.
3. Be able to describe the general histology and the functions of an oral mucosa.
4. List the cell types found in oral mucosae.
5. Compare and contrast keratinizing and non-keratinizing epithelia as regards histology, function and location in the oral cavity.
6. Be able to describe and to recognize the different classifications of oral mucosae, the characteristics on which these classifications are based, and the clinical significance of these classifications.
7. Describe briefly the histologic structure of the dorsal tongue, including the four types of papillae and their functions.

8. Describe the junctional complex including gingival, sulcular, attachment epithelium components and the associated connective tissues.
9. Define the following and understand the clinical significance of each:
  - 9.1 Gingival sulcus
  - 9.2 Free gingival groove
  - 9.3 Junctional epithelium

### XIII. SALIVARY GLANDS

1. Understand the function of the salivary glands.
2. List the major and minor salivary glands and identify the types of secretions (serous or mucus).
3. Describe the histology of serous cells, mucus cells, serous demilune, and myoepithelial cells.
4. Describe the duct system, including Stenson's duct and Wharton's duct.
5. Understand the development of major glands.

### XIV. GINGIVA AND TOOTH COVERING

1. Describe the histologic structure and function of gingiva including epithelium and connective tissue.
2. Describe the junctional complex including gingiva, sulcular, attachment epithelium components and the associated connective tissues.
3. Describe the origin and function of the reduced enamel epithelium.
4. Understand the significance of guided tissue regeneration.

### XV. ERUPTION AND SHEDDING

1. Define the following terms
  - 1.1 pre-eruptive tooth movement
  - 1.2 eruptive tooth movement
  - 1.3 post eruptive tooth movement
  - 1.4 shedding of teeth
2. Describe briefly the theories of tooth movement and the mechanisms involved in each.
3. Describe the histology and the various factors involved in pre-eruptive, eruptive and post-eruptive tooth movements.
4. Describe post-eruptive tooth movement as related to the following:
  - 4.1 wear, tear, and pressure
  - 4.2 available space within the socket
  - 4.3 contraction of the transseptal ligament
5. Describe abnormal tooth movement and the tooth movement that occurs as a result of orthodontic treatment.

XVI. TEMPOROMANDIBULAR JOINT

1. Illustrate the anatomical features of the TMJ in a sagittal section through the middle of the joint.
2. Describe the different movements, which take place in the TMJ.
3. Describe the histological structures of the articular surfaces, the disc, the capsule, synovial membrane and the condyle of the mandible.
4. Discuss the development of the TMJ and how they may change with age and with abnormal movements.

## RESOURCES

### I. Media Resources

#### A. Printed media

1. Required Textbook  
*Permar's Oral Embryology and Microscopic Anatomy*, 9<sup>th</sup> Edition. Melfi, R.C. 1994, reprinted 1996. Lea and Febiger.
2. Monograph  
Rittman, B  
*Oral Histology and Embryology*  
The University of Texas-Houston Dental Branch, 2005

#### B. Electronic media

PowerPoint lectures available via the BlackBoardCourseInfo Website:  
<http://www.blackboard.uth.tmc.edu>

### II. Human Resources

Barry Rittman, Ph.D.  
Room 3.112E, 713-500-4134 cell 713-542-8108  
Email: Barry.R.Rittman@uth.tmc.edu

## STUDY PLAN AND REQUIREMENTS

All students are expected to be punctual and attend all scheduled lectures. If a student is absent, he/she is responsible for obtaining any information or materials disseminated during the lecture.

Each student is responsible for assuring her/his academic success. It is the student's responsibility to keep the course director informed regarding any missed classes or deficient grades. It is in the best interest of the student to be in communication with the course director regarding any problem or situation affecting student performance in the course.

Students experiencing any difficulties with the material in this course are required to contact the course director to identify problems and receive necessary help in mastering the material.

**DHCT 2108 ORAL HISTOLOGY AND EMBRYOLOGY**  
**Fall Semester 2005 Lecture Schedule**  
Monday and Friday, 9-9:50 am

<b>Date</b>	<b>Session Topic</b>	<b>Lecturer</b>	<b>Reading Assignment</b>
Aug 15	Introduction, The Cell		Monograph
Aug 19	Tissue Structure & Function		Chapter 1
Aug 22	Tissue Structure & Function		Chapter 1
Aug 26	Tissue Structure & Function		Chapter 1
Aug 29	Tissue Structure & Function		Chapter 1
Sep 2	Early Human Embryology		Monograph
Sep 5	<i>Labor Day Holiday</i>		
Sep 9	Early Embryology		Monograph
Sep 12	Pharyngeal Arches		Monograph
Sep 16	Pharyngeal Arches		Monograph
Sep 19	Review		
Sep 23	<b>Examination I</b> <b>Rooms 207</b>		
Sep 26	Development of Face and Oral Cavity		Chapter 2
Sep 30	Early Tooth Development		Chapter 3
Oct 3	Development of Dentin and Enamel		Chapter 3
Oct 7	Enamel		Chapter 4
Oct 10	Dentin		Chapter 5
Oct 14	Pulp		Chapter 6
Oct 17	Cementum		Chapter 7
Oct 21	Review		
Oct 24	<b>Examination II</b> <b>Room 207</b>		
Oct 28	Periodontal Ligament		Chapter 8
Oct 31	Alveolar Bone		Chapter 9
Nov 4	Oral Mucosa and Tongue		Chapter 10
Nov 7	Gingiva and Tooth Covering		Chapter 11
Nov 11	Salivary Gland		Chapter 12
Nov 14	Tooth Movement, Eruption and Shedding		Chapter 13
Nov 18	Temporomandibular Joint		Chapter 14
Nov 21 & 25	<i>No class</i>		
Nov 28	Clinical Correlation		
Dec 2	Review <b>Course Evaluation</b>		
Dec 7	<b>Examination III</b> <b>9:00 am, Room 340</b>		

## EVALUATION METHODS

1. Grades possible: A, B, C, D, F
2. Grade standards:
  - A = 93-100
  - B = 84-92
  - C = 75-83
  - D = 70-74
  - F = below 70
3. Overall requirements:
  - a. The grade for the course will be the average percentage grade received on the scheduled examinations. These examinations cover approximately equal content. They are treated as having equal value. Each examination covers all of the content preceding the examination and there is no comprehensive examination. The last examination administered during the semester examination week has the same value as the other two.
  - b. If an examination is missed, the reason for missing the examination must be satisfactory to the Director of the School of Dental Hygiene. Request an appointment with the course director as soon as possible to schedule a remake examination.
  - c. Any student receiving a grade below 70 on any examination must make an appointment for a concurrent conference with the Director of the School of Dental Hygiene and the course director for the resolution of the problem and arranging for assistance and remedial work.
  - d. Any student may make an appointment with the course director to discuss any aspect of the course at a time agreeable to the student and course director.