

SYLLABUS
CDS 611 - CHILD GROWTH AND DEVELOPMENT I
COURSE DIRECTOR: E. PRESTON HICKS

COURSE DESCRIPTION

This is a two-credit hour graduate level seminar course. The topics covered are focused primarily on craniofacial growth and development from birth up through adolescence. The purpose of the course is to acquaint the student with the scientific literature that supports current knowledge and understanding of the basic biologic principles that explain human growth and development from a clinical perspective. The course is a prerequisite to CDS 612 Child Growth and Development Part II.

The first part of this course consists of a video lecture series, concerning the core concepts of human dentofacial growth and development. The material presented concentrates on information that is clinically relevant to diagnosis and treatment planning for the child dental patient. The chief challenge to the practitioner is to be able to distinguish between normal and abnormal development of facial growth and dental occlusion. To meet this challenge successfully, a clinician must have substantial knowledge and understanding of normal stages of growth and development. Armed with this knowledge and understanding the practitioner will be able to detect developing malocclusions in a timely manner and then either treat or refer the child as appropriate.

COURSE OBJECTIVES

The student will be able to:

1. Define and contrast the concepts of differential growth and growth gradients as used in this course.
2. Explain and define the concepts of growth, development, pattern, timing and variability.
3. Define the term "normal" and apply the concept to making an orthodontic diagnosis.
4. Discuss the major genetic, epigenetic and environmental factors that account for normal variation in craniofacial form.
5. Describe and relate basic mechanisms of the postnatal growth of the cranium, the nasomaxillary complex and the mandible.
6. Discuss the basic mechanisms of theories of bone growth control and integrate the implications of each theory to accomplishing growth modification therapy.
7. Describe the chronology of dental development (primary and permanent teeth) from birth to adulthood.
8. Describe the radiographic indicators used for determining dental age from age 3 to 12 years of age.
9. Discuss the major occlusal changes from birth through adolescence and correlate with craniofacial skeletal growth gradients in each plane of space.
10. Define the concept of biological age and discuss its relevance to diagnosis and treatment planning in a growing child.
11. Differentiate the concepts of skeletal age and skeletal maturity indicators (SMI's).
12. Define the Enlow concepts of displacement and area relocation and discuss relevance to interpreting serial growth changes of the craniofacial complex using cephalometric

- superimposition techniques.
13. Discuss the findings from Bjork's human longitudinal studies using radiographic markers placed in facial bones to contemporary cephalometric diagnosis and to interpretation of superimposition of serial cephalometric tracings.
 14. Compare and contrast Petrovic's servosystem theory to Moss's functional matrix theory of growth control and discuss their implications to growth modification of the mandible.

COURSE EVALUATION

Grades are determined by: (1) class discussion and quality of literature presentations in seminars; and, (2) scores on the midterm and final examinations.

All activities in this course are conducted under the College of Dentistry Code. The College has high expectations of each student concerning their professional and academic responsibilities including self-governance. If you have questions about expected standards of behavior, it is your responsibility to discuss and clarify these questions with the course director.

SEMINAR TOPICS

A reading list will be distributed for each seminar session. Students will be expected to discuss and critique each article when called upon during the seminar.

COURSE MATERIALS

- I. Video Module DVD Lectures (These are to be viewed prior to the assigned session)
 - A. VM 1, Introduction to Basic Concepts
 - B. VM 2, Principles of Craniofacial Growth and Development
 - C. VM 3, Theories of Growth Control
 - D. VM 4, Overview of the Development of the Occlusion
 - E. VM 5, Course Review with Clinical Applications

- II. Slide-Tape DVD Lectures (These are to be viewed prior to the assigned session)
 - A. ST-01, Basic Concepts of Physical Growth
 - B. ST-02, The "Hows and Whys" of Bone Growth
 - C. ST-03, Postnatal Growth and Development of the Cranio-Facial Skeleton
 - D. ST-04, Postnatal Growth and Development of the Primary Dentition and Occlusion
 - E. ST-05, Development of the Mixed Dentition and Occlusion
 - F. ST-06, Physical and Dentofacial growth and Development during

Adolescence

- III. Textbooks
 - Proffit, William, and Henry Fields. Contemporary Orthodontics, 3rd ed. St. Louis: Mosby, 2000.
 - Enlow, Donald. Facial Growth, 3rd ed. Philadelphia: W.B. Saunders Company, 1990.
 - Workbooks for DVDs (ST 1-6 and VM 1-5)

1. **VM 1** focuses on why we need knowledge and understanding for diagnosing and treating occlusofacial problems in the growing child. Review **ST-01** before **VM-1**. Reading assignment—Enlow, Chapter 2, Parts 1 and 2; Proffit, Chapter 2, pp.18-24.
2. **VM 2** reviews basic mechanisms of growth and development of the cranium, nasomaxillary complex, and the mandible and focus on the significance of these mechanisms in diagnosis and treatment. Review **ST-02 and ST-03** prior to **VM-2**. Reading assignment—Enlow, Chapter Chapter 18; Proffit, Chapter 2, pp. 24-36.
3. **VM 3** presents the theories of growth control with emphasis on the relevance of these theories to growth modification treatment. Reading assignment—Enlow, Chapters 6, 7, and 8; Proffit, Chapter 2, pp. 36-41.
4. **VM 4** integrates information from previous discussions in **VMs 1-3** to understanding development of the occlusion from the primary to the mixed to the young permanent dentition. Particular emphasis is given to the mixed dentition because of the high incidence of problems that can occur during this stage of development. Review **ST-04, ST-05 and ST-06** prior to **VM-4**. Reading assignment, all of Chapter 3 and Chapter 4 in Proffit.
5. **VM 5** reviews and summarizes clinical applications relative to diagnosis and treatment planning or referral. Reading assignment, review all of Enlow's text and review Chapters 2 through 5 in Proffit's text.

PURPOSE AND USE OF THE SLIDE-TAPE AND VIDEO MODULE DVD WORKBOOKS

The slide-tape videos (the ST series), along with assigned readings Enlow's and Proffit's texts, are designed to provide the didactic foundation for understanding the video lecture modules. It would be preferable for students to review the assigned reading material and the appropriate slide-tape material prior to the video lecture module. The slide-tape material may not be essential for all students to review in depth, since much of their content is basic. Each participant therefore needs to decide the level of study required to be current on definition of terms and concepts. Assuming that many students may be "rusty" or out of date in this knowledge area, the slide-tape videos are made available for reviewing and updating your information base and for supplementing the text readings in Proffit. This material along with the workbook exercises should help make some of the terms and concepts discussed in the video lectures more readily understandable.

**COURSE SCHEDULE
CDS 611**

DIRECTOR: DR. E. PRESTON HICKS

CDS 611: CHILD GROWTH AND DEVELOPMENT I

FIRST YEAR ORTHODONTIC & PEDO RESIDENTS

(NOTE: The DVDs for ST 1-6 and VM 1-5 are to be reviewed out of class prior to the assigned session)

<u>Session</u>	<u>Topic</u>	<u>Instructor</u>
1	Introduction: Basic Concepts Video Tapes: ST-01: Basic Concepts of Physical Growth (Review Prior to Class) VM-1: Introduction to Basic Concepts (Shown in class)	Dr. Hicks
2	ST-02: The "Hows and Whys " of Bone Growth ST-03: Postnatal Growth and Development of the Cranio-Facial Skeleton VM-2: Principles of Craniofacial Growth and Development	Dr. Hicks
3	VM-3: Theories of Growth Control	Dr. Hicks
4	ST-04: Post-natal Growth and Development Of the Primary Dentition and Occlusion ST-05: Development of the Mixed Dentition and Occlusion VM-4: Overview of the Development of the Occlusion (Part 1)	Dr. Hicks
5	ST-06: Physical and Dentofacial growth and Development during Adolescence VM-4: Overview of the Development of the Occlusion (Part 2)	Dr. Hicks
6	VM-5 Course Review with Clinical Applications	Dr. Hicks
7	Midterm Exam on Video Material	Dr. Hicks
8	Review Midterm Exam	Dr. Hicks
9	Skeletal Age and Dental	Dr. Hicks

Assessments of Maturity Status

10	Bjork Seminar	Dr. Hicks
11	Bjork Seminar	Dr. Hicks
12	Bjork--Clinical Applications (Students will find and present a composite tracing in the patient pool of an upper classman)	Dr. Hicks
13	Petrovic Seminar	Dr. Hicks
14	Petrovic Seminar	Dr. Hicks
15	Petrovic--Clinical Applications (Students will find and present a composite tracing of a patient treated with a functional appliance)	Dr. Hicks
16	Moss Seminar	Dr. Hicks
17	Moss Seminar and Course Review	Dr. Hicks
18	Course Final Examination	Dr. Hicks

COURSE OUTLINE AND READING ASSIGNMENTS

SESSION 9: Skeletal & Dental Age Assessments of Maturity Status Dr. Hicks

All students will need to read articles listed below:

Coutino, S. Buschang, P.H. et al.: Relationships between Mandibular Canine Calcification Stages and Skeletal Maturity. Am J. Orthod Dentofacial Orthop 1993, 104:262-268.

The class will find panoramic radiographs showing each stage of canine development.

Garcia-Fernandez, P., Torre, H., Flores, L., Rea, J.: The Cervical Vertebrae as Maturational Indicators. J Clin Orthod. 1998 Apr;32(4):221-225.

Kucukkeles, N., Acar, A., Biren, S., Arun, T.: Comparisons Between Cervical Vertebrae and Hand-Wrist Maturation for the Assessment of Skeletal Maturity. J Clin Pediatr Dent. 24 (1):47-52, 1999.

Leite, H.R., O'Reilly, M.T., Close, J.M.: Skeletal Age Assessment Using the First, Second and Third Fingers of the Hand. Am J Orthod Dentofacial Orthop. 1987 Dec;92(6):492-498.

Assigned articles listed below:

Carpenter, C.T., Lester, E.L.: Skeletal Age Determination in Young Children: Analysis of Three Regions of the Hand/Wrist Film. J Pediatr Orthop. 1993 Jan-Feb;13(1):76-79.

Van Lenthe, F.J., Kemper, H.C., Van Mechelen, W.: Skeletal Maturation in Adolescence: A Comparison Between the Tanner-Whitehouse II and the Fels Method. Eur J Pediatr. 1998 Oct; 157(10): 798-801.

Shaikh, A.H., Rikhasor, R.M., Qureshi, A.M.: Determination of Skeletal Age in Children Aged 8-18 Years. JPMA – The Journal of the Pakistan Medical Association. 1998 Apr; 48(4):104-106.

So, L.L.: Skeletal Maturation of the Hand and Wrist and its Correlation with Dental Development. Aust-Orthod J. (Australian Orthodontic Journal) 1997 Oct;15(1):1-9.

Cox, L.A.: The Biology of Bone Maturation and Ageing. Acta-Paediatr Suppl (Acta-paediatrica Supplement). 1997 Nov; 423:107-108.

Gilli, G.: The Assessment of Skeletal Maturation. Hormone Research 1996;45 Suppl 2:49-52.

Kullman, L.: Accuracy of Two Dental and One Skeletal Age Estimation Method in Swedish Adolescents. Forensic Sci Int. 1995 Oct 30;75(2-3):225-36.

Loder, R.T., Estle, D.T., Morrison, K., Eggleston, D., Fish, D.N., Greenfield, M./L., Guire, K.E.: Applicability of the Greulich and Pyle Skeletal Age Standards to Black and White Children of Today. Am J Dis Child. 1993 Dec;147(12): 1329-33.

SESSION 10: Bjork Seminar Dr. Hicks

Bjork, A.: A Discussion on the Significance of Growth Changes in Facial Pattern and Their Relationship to Changes in Occlusion. D. Record 71:197-208, 1951.

Bjork,A.: Variability and Age Changes in Overbite and Overjet. Amer J Orthodont. 39: 779-801, 1953.

Bjork,A.: Facial Growth in Man, Studied With the Aid of Metallic Implants. Acta Odont. Scand, 13:9-34, 1955.

Bjork,A.: Cranial Base Development. A Follow-up Study of the Individual Variation in Growth Occuring Between the Age of 12 –20 Years and its relation to Brain Case and Face Development. Amer. J Orthodont. 41:198-225, 1955.

Bjork,A. and Helm,S.: Prediction of Age at Maximum Puberal Growth in Body Height. Angle Orthod 37:137-143. 1967.

Bjork, A.: The use of Metallic Implants in the Study of Facial Growth in Children: Method and Applications. Am J Phys Anthrop 29:243-254. 1968.

SESSION 11: Bjork Seminar

Dr. Hicks

Bjork, A.: Sutural growth of the upper face studied by the implant method. Acta Odontol Scand 24:109-127, 1966.

Bjork,A. and Skieller,V.: Facial Development and Tooth Eruption. An Implant Study at the Age of Puberty. Amer J Orthod. 62:339-383. 1972.

Bjork,A.: Growth of the Maxilla in Three Dimensions as Revealed Radiographically by the Implant Method. Br J Orthod 4: 53-64. 1977.

Bjork,A.: Variations in the Growth Patterns of the Human Mandible: Longitudinal Radiographic Study by the Implant Method.J.D. Res. 42:400-411, 1963.

Bjork,A.: Prediction of Mandibular Growth Rotation. Amer J Orthod 55:585-599. 1969.

Bjork, A. and V. Skieller: Normal and abnormal growth of the mandible: a synthesis of longitudinal and cephalometric implant studies over a period of 25 years. Eur. J. Orthod. 5:1-46, 1983.

SESSION 12: Bjork Clinical Application

Dr. Hicks

Baumrind, S., Korn, E.L. and E.E. West: Prediction of mandibular rotation: an empirical test of clinician performance. Am. J. Orthod. 86(5): 371-385. 1984.

Skieller, V., Bjork, A. and T. Linde-Hansen: Prediction of mandibular growth rotation evaluated from a longitudinal implant sample. Am. J. Orthod. 86:359-370, 1984.

Bjork, A.: Sarnas,K.V., Rune, B.: Intramatrix Rotation – The Frontal Bone. Eur J Orthod. 17(1): 3-7. 1995 (Feb)

Bjork,A.: Facial Growth Rotation Reflections on Definition and Cause. Proc Finn Dent Soc 87(1): 51-58. 1991.

SESSION 13: Petrovic Seminar**Dr. Hicks**

Graber, T.M., Rakosi, T., Petrovic, A.G.: Dentofacial Orthopedics with Functional Appliances. 2nd Edition. Chapters 2 & 3. Pgs. 13-63 & 64-73.

McNamara, J.A. Jr. Neuromuscular and skeletal adaptations to altered function in the orofacial region. *AJO* 64:578-606, 1973.

McNamara, J.A., Jr. The role of muscle and bone interaction in craniofacial growth. In: Control Mechanisms in Craniofacial Growth, Monograph 3, Craniofacial Growth Series, University of Michigan, Ann Arbor, 1975.

McNamara, J.A., Jr. Functional determinants of craniofacial size and shape. In: Craniofacial Biology, Monograph 10, Craniofacial Growth Series, U. of Michigan, Ann Arbor, 1981.

SESSION 14: Petrovic Seminar**Dr. Hicks**

Petrovic, A.G., Stutzmann, J.J. and Oudet, C. The final length of the mandible: Is it genetically predetermined? In: Craniofacial Biology, Monograph 10, Craniofacial Growth Series, Univ. of Michigan, Ann Arbor, 1981.

Carlson, D.S. Growth Modification: From Molecules to Mandibles. In Growth Modification: What Works, What Doesn't, and Why, Monograph 35, U. of Michigan, Ann Arbor, 1999.

Petrovic, A.G. Experimental and cybernetic approaches to the mechanisms of action of functional appliances on mandibular growth. In: Malocclusion and the Periodontium, Monograph 15, Craniofacial Growth Series, U. of Michigan, Ann Arbor, 1984.

SESSION 15: Petrovic Clinical Application**Dr. Hicks**

Petrovic, A.G., Stutzmann, J.J. and Lavergne, J.M. Mechanisms of craniofacial growth and modus operandi of functional appliances: a cell-level and cybernetic approach to orthodontic decision making. In: Craniofacial Growth Theory and Orthodontic Treatment. Craniofacial Growth Series #23, Univ. of Michigan, Ann Arbor, 1990.

Mao, J.J., Nah, H. Growth and development: Hereditary and mechanical modulations. *AJODO* 125(6):676-689, 2004.

SESSION 16: Moss Seminar**Dr. Hicks**

Moss, M.L. The functional matrix. In: Vistas in Orthodontics. Ed. by B.S. Kraus and R.A. Riedel. Philadelphia: Lea and Febiger, 1962.

Moss, M.L. The primary role of functional matrices in facial growth. *AJO* 55:566, 1969.

Moss, M.L., Salentijn, L.: The Capsular Matrix. *Am J Orthod.* 1969b;56:474-490.

Moss, M.L.: Twenty Years of Functional Cranial Analysis. *Am J Orthod.* 61:479-485. 1972.

Moss, M.L.: Neurotrophic Regulation of Craniofacial Growth. In: McNamara JA, editor. Control Mechanisms of Craniofacial Growth. Ann Arbor: University of Michigan Press, 1975:Monogr 3:25-50.

Johnston, L.E. The functional matrix hypothesis: Reflections in a jaundiced eye. In: Factors Affecting Growth of the Midface. Ed. by J.A. McNamara, Jr., Monograph 6, Craniofacial Growth Series, Ann Arbor, Mich., Center for Human Growth and Development, University of Michigan, 1976.

SESSION 17: Moss Clinical Application**Dr. Hicks**

Moss, M.L.: Genetics, Epigenetics, and Causation. Am J Orthod 80:366-75. 1981.

Behrents, R.G. and Johnston, L.E. The influence of the trigeminal nerve on facial growth and development. AJO 85(3): 199-206. 1984.

Moss, M.L., Skalak, R., Patael, H., Sen, K., Moss-Salentijn, L., Shinozuka, M., Vilmann, H.: Finite Element Method Modeling of Craniofacial Growth. Am J Orthod(87)453-472. 1985.

Moss, M.L.: Finite Element Method Comparison of Murine Mandibular Form Differences. J Craniofac Genet Dev Biol. (8)3-20. 1988.

Johnston, L.E. Fear and loathing in orthodontics: Notes on the death of theory. In: Craniofacial Growth Theory and Orthodontic Treatment. D.S. Carlson (Ed.), Craniofacial Growth Series, Monograph 23, Ann Arbor, Mich., Center for Human Growth and Development, University of Michigan, 1990.

Moss, M.L.: The Functional Matrix Hypothesis Revisited. 1. The Role of Mechanotransduction. Am J Orthod Dentofac Orthop 112:8-11. 1997.

Moss, M.L.: The Functional Matrix Hypothesis revisited. 2. The Role of an Osseous Connected Cellular network. Am J Orthod Dentofac Orthop 112:221-226. 1997.

Moss, M.L.: The Functional Matrix Hypothesis Revisited. 3. The genomic Thesis. Am J Orthod Dentofac Orthop 112:338-342. 1997.

Moss, M.L.: The Functional Matrix Hypothesis Revisited. 4. The Epigenetic Antithesis and the Resolving Synthesis. AJO. 112(4): 410-414. 1997.

SESSION 18: Final Examination**Dr. Hicks**