FELLOWSHIP CURRICULUM
2014-2015

Division of Endocrinology, Diabetes, and Metabolism
## UC Davis Training Program in Endocrinology, Diabetes, and Metabolism – Goals and Objectives

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## 1. Program information

### i. Sponsoring Institution

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<tr>
<th>Name:</th>
<th>University of California (Davis) System</th>
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<tbody>
<tr>
<td>Address:</td>
<td>4150 V Street, Suite G400</td>
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<tr>
<td></td>
<td>Sacramento, CA 95817</td>
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JACHO Approved: Yes
Program director located at this site: Yes

<table>
<thead>
<tr>
<th>Number of inpatient beds:</th>
<th>528</th>
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<tbody>
<tr>
<td>Number of Internal Medicine faculty:</td>
<td>231</td>
</tr>
<tr>
<td>Number of Endocrinology faculty:</td>
<td>26</td>
</tr>
</tbody>
</table>

### Chair, Department of Internal Medicine:

<table>
<thead>
<tr>
<th>Name:</th>
<th>Timothy E. Albertson, M.D., M.P.H., Ph.D.</th>
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</thead>
<tbody>
<tr>
<td>Title:</td>
<td>Chair, Department of Internal Medicine</td>
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<td>Address:</td>
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</tbody>
</table>

### Chief, Division of Endocrinology and Metabolism:

<table>
<thead>
<tr>
<th>Name:</th>
<th>Sidika E. Karakas, MD.</th>
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<tbody>
<tr>
<td>Title:</td>
<td>Professor of Medicine</td>
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<td>Fax:</td>
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<tr>
<td>Email:</td>
<td><a href="mailto:sekarakas@ucdavis.edu">sekarakas@ucdavis.edu</a></td>
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</table>
Participating Hospitals

Name: Veterans Administration, Mather

Distance from primary hospital: 10 miles 16 minutes
Are these rotations required: Yes
Number of months assigned to this site: 12

JACHO Approved Yes
Program director located at this site: No
Number of inpatient beds: 60
Number of Internal Medicine faculty: 
Number of Endocrinology faculty: 4

Chairman, Department of Medicine
David Sigel, MD.

Chief, Division of Endocrinology
Arthur Swislocki, MD.

Unique Features of the Different Training Sites:

We employ 2 distinct sites, because each has unique features and training opportunities:

1. UC Davis Medical Center (UCDMC) is a large University Hospital. Inpatients are derived from a large network of physicians in Internal Medicine and Family Practice who are associated with the medical center. Other patients are admitted via the Emergency Department or through other specialty services or Departments. UCDMC maintains a large number of clinics in all disciplines of Internal Medicine and other Departments. Especially important for our training program are the Endocrinology, Diabetes, Pediatric/Adolescent Endocrinology, and Gestational Diabetes Ob Clinics.

2. VA Mather Hospital is closely affiliated with the UC Davis. It serves -- veterans. In addition to the primary care clinics staffed by internal medicine specialists, most medicine subspecialties and surgical specialties have clinics at the VA. The endocrine training at this site is primarily outpatient; it provides experience with common endocrine disease such as diabetes, hyperlipidemia, thyroid disease and endocrine diseases seen in middle aged and older man (such as male osteoporosis and hypogonadism).

Faculty for both training sites:

Number of Internal Medicine Faculty: 231
Number of Endocrinology Faculty: 26
ii. Program Number: 1430521078

iii. Program Director:

<table>
<thead>
<tr>
<th>Name</th>
<th>Sidika E. Karakas, MD.</th>
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iv. Co-Director

<table>
<thead>
<tr>
<th>Name</th>
<th>Alison M. Semrad, D.O.</th>
</tr>
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<tbody>
<tr>
<td>Title</td>
<td>Assistant Professor</td>
</tr>
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<td><a href="mailto:alison.semrad@ucdmc.ucdavis.edu">alison.semrad@ucdmc.ucdavis.edu</a></td>
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v. Key Faculty:

<table>
<thead>
<tr>
<th>Name</th>
<th>Pamela Prescott, MD*</th>
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<tbody>
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<td>Professor of Medicine</td>
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<td><a href="mailto:pamela.prescott@ucdmc.ucdavis.edu">pamela.prescott@ucdmc.ucdavis.edu</a></td>
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<thead>
<tr>
<th>Name</th>
<th>Prasanth Surampudi, MD</th>
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<tr>
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<td>Assistant Professor</td>
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</tr>
<tr>
<td>Name:</td>
<td>Arthur Swislocki, MD.</td>
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</tr>
<tr>
<td>Title:</td>
<td>Professor</td>
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<tr>
<td>Address:</td>
<td>Veterans Administration Hospital</td>
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<td></td>
<td>150 Muir Road</td>
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<td></td>
<td>Martinez, CA 94553</td>
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<td>Telephone:</td>
<td>(925) 372-2070</td>
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<tr>
<td>Fax:</td>
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<tr>
<td>Email:</td>
<td><a href="mailto:arthur.swislocki@med.va.gov">arthur.swislocki@med.va.gov</a></td>
</tr>
</tbody>
</table>
iv. **Other Key Faculty**
Mark Moriwaki, MD*
Kent Ishihara, MD
Sonal Phatak, MD

Other Full-Time Faculty:
Lars Berglund, MD
Stephen Lippman, MD

Voluntary faculty
William Cushard, MD
Bahar Aghighi, MD*
Michael Okimura, MD*
Gail Wong, MD*
Craig Smith, MD*
Seleda Williams, MD

* Graduate of our training program
2. Introduction

This subspecialty training program in endocrinology, diabetes and metabolism is designed to provide advanced training and experience at a level for the fellow to acquire the knowledge, skills, attitudes and experience required for all of the competencies needed by a consultant in this field. This program is designed to fulfill the needs of those fellows who anticipate their future activities to be solely the clinical practice of this specialty, those who expect to function as clinician-educators and those who intend to pursue careers in clinical and/or basic endocrine research. The program recognizes that some fellows may evolve into specialists whose activities encompass more than one of the above career paths. The teaching environment and educational experiences for fellows, detailed below, will equip them to become strong clinicians, educators, and investigators in endocrinology, diabetes and metabolism.

The educational program has been designed to meet the following core competencies:

**Patient Care:** Recognize the relative significance of endocrine disorders in relation to other medical conditions; recognize the acuity levels of illness; fully understand the indications, contraindications and risks of common and uncommon procedures.

**Medical Knowledge:** Use literature and reference sources to increase knowledge base, demonstrate sophisticated knowledge in the areas of underlying pathophysiology and the clinical aspects of simple and complicated disease states; apply knowledge in the treatment of patients.

**Professionalism:** Establish trust with staff; exhibit honesty, reliability and responsibility; demonstrate respect for patients, staff and junior house staff who you are supervising; accept assignments graciously; attend conferences.

**Interpersonal and Communication Skills:** Communicate verbally and nonverbally in a productive manner; work effectively as a member of the health care team.

**Practice Based Learning and Improvement:** Understand limitation of knowledge and use references and literature to improve practice patterns; accept feedback and change behavior; ask for help when needed; learn from the outcomes of patients under your care and alter practice patterns to improve outcomes in the future.

**Systems Based Practice:** Develop a sophisticated understanding about the health care system/structure and develop mechanisms to utilize ancillary services to benefit patients.

The core competencies developed by the educational program are summarized in the next table.
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<th>Continuing Education</th>
<th>Clinical Training</th>
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<td>1-Data Gathering: History &amp; PE</td>
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<tr>
<td>2-Differential Diagnosis: Prioritized</td>
<td>MD</td>
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<tr>
<td>3-Clinical Judgment: EBM Decisions</td>
<td>CESD</td>
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<tr>
<td>4-Management Plan: from cc to c/c</td>
<td>CC</td>
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<tr>
<td>5-Cost Effective Care: Analysis of Risks/Benefits/Patient Goals</td>
<td>CD</td>
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<tr>
<td>Medical Knowledge</td>
<td>JC</td>
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<tr>
<td>1-Appropriate Breadth &amp; Depth of Knowledge</td>
<td>Res</td>
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<tr>
<td>2-Ability to Explain Underlying Pathophysiology</td>
<td>ER</td>
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<tr>
<td>Inpatient Consults</td>
<td>Inpt</td>
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<tr>
<td>Ambulatory Clinics</td>
<td>Amb-C</td>
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</table>

Legend: CP – Clinical Practice; MD – Mechanisms of Disease; CESD – Clinical Epidemiology and Study Design; CC – Clinical Conference; CD – Case Discussion; JC – Journal Club; Res – Research Conference; ER – Endocrine Review; Inpt – Inpatient Consults; Amb-C – Ambulatory Clinics. See following pages for detailed descriptions.
3. **Didactic teaching**

i. **Clinical Practice Course (CP)**

**Goals and Objectives:** To prepare the fellows for the endocrine problems they will commonly encounter in the inpatient consult service and the outpatient clinics. Through this course, the resident will gain

- Fundamental information and practical approaches for the diagnosis and management of endocrine disorders
- Technical and practical skills that are required by a consultant in endocrinology, diabetes and metabolism

Specifically, they will gain understanding of

- History and physical examination with emphasis on endocrine organs
- Selection and interpretation of endocrine biochemical tests
- Selection and interpretation of imaging procedures such as sonography, radionuclide scans, computerized axial tomography, magnetic resonance imaging

**Course organizer:**

**Schedule:** Yearly; mid-July to end of September; 16 hours of didactic teaching

**Course contents:**

1. Hypo/hyperthyroidism
2. Thyroid nodule: benign and malignant
3. Thyroid ultrasound (2 hr)
4. Type 2 diabetes mellitus
5. Type 1 diabetes mellitus
6. Insulin pumps and Devices (1-2 hr)
7. Adrenal disorders and testing
8. Pituitary disorders and testing
9. Hypo/hypercalcemia
10. Osteoporosis, DEXA interpretation
11. Polycystic ovary syndrome
12. Endocrine Emergencies
13. Hypogonadism
14. Nuclear Medicine: Thyroid and parathyroid disease (2 hr)

ii. **Mechanisms of disease course (MD)**

**Goals and Objectives:** Through this course, the fellows will gain the understanding of

- Basic and advanced endocrine biochemistry, physiology and pathophysiology, which provide the basis for understanding endocrine diseases and their management
• Mechanistic information related to the diagnosis, management and prevention of endocrine disorders
• Knowledge and skills necessary for critical analysis of the laboratory testing and the endocrine literature

Course organizer:

Schedule: Yearly; beginning of September to end of November; 18 hours of didactic teaching

Course contents:

1. Receptors/Signaling Pathways – I
2. Receptors/Signaling Pathways – II
3. Nuclear Receptors; Hypothalamus/Pituitary
4. Adrenal Axis
5. PTH/Hypocalcemia/Hypercalcemia
6. Regulation of Bone Metabolism
7. Thyroid Axis
8. Endocrinology of Adipose Tissue and Appetite
9. Energy Homeostasis/Metab/Panc Hormones - I
10. Energy Homeostasis/Metab/Panc Hormones - II
11. Endocrine Regulation of ECF/Electrolytes
12. Growth Hormone
13. Reproductive Endocrine – Male/Female
14. Epigenetics
15. Sexual Differentiation
16. Puberty
17. Placental Endocrine/Adaptation to Pregnancy
18. Menopause/Andropause

iii. Clinical epidemiology and study design course (CESD)

Goals and Objectives:

• Understand the principles of conducting clinical epidemiologic research
• Be familiar with three basic study designs (cross-sectional, case-control, and cohort, including experimental trials) and be able to discuss their conducts, strengths, and limitations.
• Identify sources of secondary data and discuss their strengths and limitations, including metanalysis.
• Discuss principles of measurements in clinical epidemiological studies, including the use of questionnaires, precision, accuracy, sensitivity, specificity, and predictive accuracy.
• Discuss basic methods of analyzing data, including descriptive and analytic statistical approaches.
• Be familiar with statistical software packages, such as NQuery, Epilinfo, STATA, and others as discussed.
• Discuss ethical issues involved in conducting clinical epidemiologic research.
• Be familiar with funding sources.
• Develop a proposal for a research project.

Course organizer: Stephen A. McCurdy, MD, MPH and Patrick Romano, MD, MPH

Schedule: Yearly; early July; 30-hours of didactic teaching

Course contents:
1. Developing the Research Question
2. Study Design: Overview and Cohort Studies
3. Study Design: Case-Control Studies
4. Study Design: Cross-Sectional
5. Study Design: Experimental Trials
6. Using Secondary Data
7. Literature and metanalysis
8. Qualitative Research Methods
9. Experimental Trials II
10. Choosing Subjects and Recruitment
11. Biostat I: Descriptive Statistics
12. Biostat II: Basic Analytic Statistics
13. Planning Measurements: Precision, and Accuracy
14. Diagnostic Tests
15. Questionnaire Design
16. Biostat III: Linear Regression
17. Biostat IV: Logistic Regression
18. Sample Size and Power
19. Hands-on STATA session (Computer Lab)
20. Avoiding Errors: Confounding and Bias
22. Implementing the Study: Pretesting, Quality Control, Protocol Revisions
23. Data Management and Analysis
24. Biostat V: Survival and Lifetable Approaches
25. The Publication Game
4. Continuing education:

**Overview:** The ongoing education sessions are held October through June; Two 45-60 minute sessions on Thursday afternoons (4PM – 6PM). The monthly schedule for Thursday afternoons comprise 2-3 h of Clinical Conferences, 1 h of Case Discussions, 1 h of Journal Club, 1 h of Research Conference, and 1-2 h Board Review/Guideline review. Thus, the ongoing education provides on the average 8 h per month (or 72 h per year) education.

i. **Clinical conference (CC)**

**Goals and objectives:** The fellows will gain the understanding of
- Variety of diseases of endocrinology and metabolism in greater depth than at the bedside or the ambulatory care setting.
- The recent developments in diagnosis and treatment of endocrine diseases.
- The pathology and cytology findings of the endocrine tissues.
- Review nuclear medicine findings of various endocrine diseases.

**Course organizer:** Mark Moriwaki, MD.

**Schedule:** October – June, Thursday afternoons, 2-3 h per month

**Teaching methods:** Various endocrine diseases are discussed by the Division faculty and guest speakers. Disorders that occur at low frequency and are infrequently encountered by a fellow during the program are also discussed. Quarterly joint meetings are held with the Nuclear Medicine and Pathology Departments to review shared patients.

ii. **Case discussions (CD)**

**Goals and objectives:** The fellows will
- Have the opportunity to discuss interesting or challenging cases with the faculty
- Appreciate that there may be several ways to approach a case and develop critical thinking
- Will review the recent literature
- Develop the skills in communication and presentation

**Course organizer:**

**Schedule:** October – June, Thursday afternoons, 1 h per month

**Teaching methods:** Interesting and challenging cases are discussed by the Division faculty and when necessary experts from other divisions are invited. A fellow is paired with a faculty member to assist with development of the case presentation. The fellow presents the case as
a slide presentation. The case is opened to discussion. The fellow reviews the recent literature related to the case. The best approach for the case is discussed based on the recent literature.

iii. Journal club (JC)

Goals and objectives: The fellows will

- Develop the ability to critically appraise original investigative published reports.
- Develop the necessary organizational skills to concisely summarize the major points of a published report.
- Present scientific information in a semi-formal setting and address constructive comments and criticism.
- Effectively use audiovisual media to improve communication.
- Emphasize the importance of use of biostatistics in study design and data analysis.
- Further develop the skills and self-discipline necessary for scholarship and self-study.

Course organizer:

Schedule: October – June, Thursday afternoons, 1 h per month

Teaching methods: The fellow will discuss articles for consideration with the course organizer and the articles that improve the understanding of the mechanisms or can influence the current clinical practice are given priority. The fellow presents an article, usually as a slide presentation. The relevant articles either supporting or challenging the primary article are briefly reviewed. The fellow specifically comments on the validity of the experimental design and on the statistical analytic methods used and provides his/her opinion of the validity and importance of the findings, the potential application of the findings, and any apparent flaws.

iv. Treatment Guidelines and Board Review

Goals and objectives: The fellows will strengthen their knowledge of

- Endocrine biochemistry, physiology and pathophysiology
- Diagnosis and management of endocrine diseases including
  - selection and interpretation of endocrine biochemical tests
  - selection and interpretation of imaging procedures such as sonography, radionuclide scans, computerized axial tomography, magnetic resonance imaging, positron emission tomography
  - interpretation of cytology and pathology
  - pharmacotherapy for endocrine disorders and appropriate use of surgery, radiation therapy, treatment with radioisotopes
- Implementation of the latest guidelines and literature into medical practice as they relate to the patient and health systems
Course organizer: Alison Semrad, DO.

Schedule: October – June, Thursday afternoons, 1 h every other month

Teaching methods: Dr. Semrad mentors fellows who will review the latest clinical guidelines in endocrinology and diabetes published by the major professional organizations with the faculty and fellows. Discussions are focused on the implementation of these guidelines into the clinical practice of the outpatient clinics and in hospital patient management. The fellows and faculty review all aspects of endocrinology, using Board Review questions. The answers are discussed, based on the information from the latest guidelines and literature.

v. Research conference (RC)

Goals and objectives: To educate fellows
- In the status of current, cutting edge clinical and basic research carried out by the faculty, other fellows, members of other Divisions within the Department of Medicine, or other Departments in the institution, or by invited speakers
- To participate in the critique of the presentation and be exposed to the interactive discussions
- To present their own research projects at different stages of development
- To practice abstracts presentations for meetings

Course organizer: Sidika E. Karakas, MD.

Schedule: October – June, Thursday afternoons, 1 h every other month

Teaching methods: Interactive discussion of presented research among experts on topics of basic and clinical science of endocrinology and metabolism, including experimental design, methodology, statistical analysis and interpretation of data. In addition, those fellows actively participating in either basic or clinical research present their research project to the division at least annually.

5. Annual symposia

Endocrine/Diabetes: This yearly two full-day symposium takes place in the spring and reviews the recent developments in the management of diabetes and a broad range of endocrine and metabolic pathologies. The symposium is organized by Drs. Sidika Karakas, Chief of the Division, and Pamela Prescott, senior faculty in the Division.

6. In-patient clinical training (Endocrine Consultation Service):

Overview: The Endocrine Consult provides services for the adult in-patients at the UC Davis Medical Center admitted to the general internal medicine, subspecialties of medicine (i.e. cardiology, cardiac intensive care unit, nephrology, transplant, etc.), general surgery and specialties of surgery (i.e. cardiothoracic, trauma, vascular, neurosurgery). Although
consultative services are provided also at the VA Medical Center, this constitutes a minor fraction of the consults.

The fellows rotate in 3-month blocks: three fellows rotate through 1 month on UC inpatient consult, 1 month on clinics rotation, and 1 month on VA-consult/clinic/CCRC (Clinical Research Center) rotation, while the fourth fellow is assigned to a 3 month research block. On the average, each fellow serves 3 months a year, or total of 6 months during their training, on the UC inpatient consult service.

Goals and Objectives:

- To teach how to be an effective consultant in endocrinological disorders (this includes understanding what question is being asked by the referring physician, providing prompt evaluation of patients when consulted, providing effective and timely communication with the referring physician/team).

- To develop competence in the diagnosis and management of broad range of endocrine and metabolic disorders. This experience specifically stresses those aspects that are most commonly encountered in the inpatient setting such as:
  - Endocrine emergencies, including:
    - Hypercalcemia and hypocalcemia
    - Thyroid storm
    - Myxedema coma
    - Acute adrenal insufficiency
    - Pituitary apoplexy
  - Disorders of fluid, electrolyte, and acid-base metabolism including:
    - Hypernatremia and hyponatremia
    - Hyperkalemia and hypokalemia
    - Metabolic acidosis
    - Metabolic alkalosis
    - Disorders of magnesium metabolism
    - Diabetes insipidus, central and neophrogenic
  - Diabetes mellitus, including:
    - Acutely ill surgical and medical patient
    - Intravenous insulin protocols
    - Transition from intravenous to subcutaneous insulin
    - Post discharge management and follow-up planning for newly diagnosed patient
  - Disorders of lipid, carbohydrate, and protein metabolism including principles of enteral and parenteral nutritional support
  - Hormone-producing neoplasms
  - Endocrine adaptations and maladaptations to systemic diseases
  - The neurosurgical patient during and after transphenoidal pituitary surgery
  - Differential diagnosis and management of disorders of primary and secondary hypertension
- Neuroendocrinology and endocrine aspects of psychiatric diseases
- The interpretation of laboratory tests; immunoassays; and radionuclide, ultrasound radiologic and other imaging studies for the diagnosis and treatment of endocrine and metabolic disease including the effects of a variety of unrelated disorders and performance and interpretation of stimulation and suppression tests.

**Teaching Methods:** Hospital care is both consultative and continuing. For each interaction, the fellow will spend sufficient time with the patient to carry out a history and physical examination and then to interact with and be directly supervised by the endocrine faculty assigned to that activity. The learning experience surrounding a patient interaction evolves from review of history, physical examination and laboratory results with the faculty, taking direction from the faculty and being provided with references or other learning materials that can be used for self-instruction and subsequent review with the faculty. Consultation is frequently requested to determine the impact of endocrine disease on coexisting illnesses that necessitated hospitalization. The fellow will also learn, under supervision, how to interact not only with the patient and family, but also with other physicians and staff caring for the patient. The experience will provide leadership and supervisory experience for the endocrine fellow who is responsible for the activity of internal medical residents and medical students who rotate through the endocrine service.

<table>
<thead>
<tr>
<th>Practice Setting</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Number of consults/week</td>
<td>5-10</td>
</tr>
<tr>
<td>Number of fellows/team</td>
<td>1</td>
</tr>
<tr>
<td>Number of residents/team</td>
<td>0-2</td>
</tr>
<tr>
<td>Number students/team</td>
<td>0-2</td>
</tr>
<tr>
<td>Average duration of rounds (hrs)</td>
<td>2 h, 5 times each /wk</td>
</tr>
</tbody>
</table>

**Patient Encounters:** Fellows evaluate patients by history, physical examination, and review of available laboratory and other data. The fellow formulates a differential diagnosis, plan for further evaluation and management. These are reviewed with faculty assigned to teaching rounds. Learning occurs by an iterative process through continuing interaction with faculty, review of pertinent literature and further discussion as new data emerge or changes in the patient’s condition occur as a consequence of recommended treatment. Experience in the inpatient setting will include preparation of appropriate patients with endocrine disease for surgery as well as postoperative management, radiation therapy and/or treatment with iodine-I-131. Interaction with professionals from other departments is reviewed and evaluated. For inpatients who have surgery or biopsy, pathology and cytology are reviewed with appropriate specialists in those departments.

**Procedures and Services:** Fellows will coordinate the evaluation and management of the endocrine aspects of the patient’s illness. After interaction with the endocrine-attending physician, the fellow will order appropriate laboratory tests, biopsies, and imaging and infusion studies, as dictated by the patient’s problem. They will learn to understand the indications, benefits and risks of these procedures. Data will be reviewed with attending physician and
treatment recommended. Special resources are available for patients with diabetes mellitus, including certified diabetes educators, nutritionists and a diabetes management team. Patient floors have ample electronic equipment.

**Disease Mix and Patient Characteristics:** On request, fellows provide consultation to the Internal Medicine service and other departments such as surgery, vascular surgery, obstetrics and gynecology, psychiatry, ophthalmology, neurosurgery, orthopedic surgery, etc. Patients will have a variety of diseases that impact on the endocrine system, diseases of other systems with coexisting endocrine disease, or manifestations of primary endocrine disease such as diabetes mellitus, thyroid or parathyroid disease that warrant hospitalization. Patients will be more than 18 years old, including the geriatric age group, and both sexes. Sex and age of patients will parallel their distribution among the variety of endocrine disease that occurs in hospitalized patients. The severity of illness will be much greater than in the ambulatory setting.

**Reading Lists and Educational Resources:** Fellows are requested to use major textbooks and electronic resources suggested by the faculty. These include the textbooks of Endocrinology (Williams or Becker), the Thyroid (Braverman and Utiger), UpToDate practice guidelines of the American Thyroid Association (www.thyroid.org), American Association of Clinical Endocrinologists (www.AACE.com), The Endocrine Society (www.endo-society.org), and the American Diabetes Association (www.diabetes.org). Fellows are encouraged to read monthly the Journal of Clinical Endocrinology and Metabolism, Endocrine Reviews, THYROID, Diabetes, Diabetes Care, the Journal of Clinical Investigation and others depending on their specific interests.

**Evaluation:** See section on evaluation, below.

**Schedule for inpatient service:** Fellows rotate through the in-patient consultation service 3 months a year (every third month during clinical block), during each year of the 2-year fellowship. Although the Endocrine Service provides consultation at the VA-Mather Hospital, this service is small—approximately 3 patients per month. These inpatient consultations at the VA-Mather Hospital will be seen by the fellow assigned to the VA-consult/clinic/CCRC rotation.

**Facilities and Resources:** The program has full-time administrative and secretarial support, which facilitates scheduling, arranging consultations, evaluations, preparing conference schedules and referrals. Fellows have office space on each campus that contains computer facilities that can be used for email and internet services, including literature searches. The faculty regularly receives a number of journals and books, all of which are available to the fellow.

Our hospital has modern facilities and services, including in-patient, ambulatory care and laboratory resources and these are readily available to all fellows. In addition, complete biochemistry laboratories and hormone assays are available 24 hours per day. The hospital has facilities for karyotyping. The Department of Radiology provides MRI, CT, ultrasound, DEXA and radiologic imaging services that can conduct studies for all types of endocrine diseases including adrenal vein and petrosal sinus sampling. The hospital supports a dietary/nutritional service. There is a fully staffed surgical pathology laboratory for the
interpretation of surgical and cytology specimens, including immunohistologic studies. Cytology interpretations of thyroid aspirations are available within a few hours and fellows review these specimens with the Department of Pathology staff. Nuclear Medicine provides all routine radionuclide-imaging methods including radio-iodine thyroid scanning and ablation, adrenal and parathyroid scanning as well as MIBG and technetium pyrophosphate bone scans. Podiatric Medicine provides care to all patients at the university hospital on an as-needed basis. Specialists in Neuro- and Retinal Ophthalmology provide care and teaching for patients with autoimmune thyroid disease and diabetes mellitus.

7. Ambulatory Endocrine Training Program:

Overview: The ambulatory training program is conducted at 2 sites: 1) On the UC Davis campus in Ambulatory Clinical Care (ACC) and Glassrock Buildings and 2) at the VA Mather Outpatient Clinic Building. The fellow on the in-patient consult service has no outpatient clinic obligation except for Friday morning Fellow Continuity clinic. The outpatient clinic fellow will attend the clinics at UCDMC and VA sites; the fellow on the VA-consult/clinic/CCRC (Clinical Research Center) rotation attends the clinics at the VA. All fellows attend the Friday morning Fellow Continuity clinic for all rotations.

The weekly schedules for each block are presented in the next three tables:

<table>
<thead>
<tr>
<th>UC Davis Consult Fellow</th>
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<tbody>
<tr>
<td><strong>Day</strong></td>
<td>Monday</td>
</tr>
<tr>
<td><strong>Morning</strong></td>
<td>Consults</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Afternoon</strong></td>
<td>Consults</td>
</tr>
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</table>

** UCD consult fellow and VA consult fellow split the weekend coverage at both hospitals. Each fellow covers both hospitals for 2 weekends on each block.

<table>
<thead>
<tr>
<th>Outpatient Clinic Fellow</th>
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<tbody>
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<td><strong>Morning</strong></td>
<td>ACC</td>
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<tr>
<td></td>
<td>Dr. Semrad or Dr. Surampudi</td>
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<tr>
<td><strong>Afternoon</strong></td>
<td>ACC</td>
</tr>
<tr>
<td></td>
<td>Dr. Prescott or Dr. Surampudi</td>
</tr>
</tbody>
</table>

** Four weeks divided into two 2 week blocks are scheduled during an Outpatient Clinic rotation for Research. Fellows only attend their Continuity clinic during designated research weeks.
VA-Consult/Clinic/CCRC Fellow

<table>
<thead>
<tr>
<th>Day</th>
<th>Monday</th>
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<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning</td>
<td>Consults</td>
<td>VA Dr. Wong</td>
<td>Dr. Jialal, every other week</td>
<td>VA Dr. Swislocki</td>
<td>ACC Fellows’ Continuity clinic</td>
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<tr>
<td>Afternoon</td>
<td>Consults</td>
<td>Consults</td>
<td>Consults</td>
<td>Consults, Conference</td>
<td>Consults</td>
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</table>

**Additional clinics/activities at the VA will be covered by the VA fellow.**

Clinic structure:

**Clinics at the UCDMC:**

- Thyroid clinic focuses on history taking, examination, assessment, and treatment of benign and malignant thyroid diseases, including imaging and ultrasound guided fine needle aspiration biopsy for ambulatory patients with thyroid nodules.
- Diabetes Clinic exposes the fellows to the state-of-the-art management such as pump therapy, continuous glucose monitoring, and incretin analogs.
- PCOS Clinic focuses on the patients with PCOS and other diseases that mimic PCOS such as congenital adrenal hyperplasia, prolactinoma, other causes of menstrual disorders and hirsutism.
- Andrology Clinic focuses on men with hypogonadism and other reproductive disorders.
- Fellows’ Continuity Clinic focuses on interesting and challenging cases. The fellows have their own patient template and supervised by Dr. Prescott, Dr. Phatak, Dr. Semrad, or voluntary faculty who practice outside of UCDMC. Thus, the fellows appreciate different approaches.
- General Endocrine Clinics receive a wide variety of endocrine cases. In these clinics the patients are scheduled with an attending and the fellows see the new and interesting cases under the supervision of the attending.
- Pediatric Endocrine Clinic belongs to the Pediatric Endocrinology Division. Our fellows routinely attend the clinic once a week. Additional information is provided under the Special Ambulatory Rotations section.
- The gestational diabetes clinic is run by the department of Obstetrics/Gynecology at UCD. In these clinics, the fellows manage the glycemic control of pregnant patients with gestational and pregestational T2DM and T1DM under the supervision of faculty of the Department of Ob/Gyn.

**Clinics at the VA Mather**
Goals and Objectives:
Since most endocrine care is delivered in an ambulatory setting, the ambulatory experience is emphasized throughout the duration of the training program.

Educational Purpose: To learn about a variety of diseases of endocrinology and metabolism, through initial consultation and provision of continuing care.

The ambulatory experience is intended to expose the fellow to a wide array of basic and complicated endocrine and metabolic diseases, as they present and are diagnosed and managed in the ambulatory arena. This duplicates the venues at which most patients with disorders in this discipline are managed. Under supervision, the endocrine fellow is expected to develop proficiency in detecting and managing these diseases. She/he should develop an understanding of not only the underlying pathophysiology and epidemiology of the diseases, but also the importance of the experience of illness including the social context of the patient. She/he should develop the ability to interact effectively with patients as well as the interdisciplinary team members and larger systems, which are inherent to the care of the patient.

The General Goals and Objectives for the ambulatory experience are competency-based:

- Patient Care: Prioritize the daily “work” of the clinic; recognize the relative significance of a patient’s list of medical conditions; recognize the acuity levels of illness; understand the indications, contraindications and risks of common procedures; work with all providers to provide patient-focused care.

- Medical Knowledge: Use literature and reference sources to increase knowledge base; demonstrate basic knowledge in the areas of underlying pathophysiology and the clinical aspects of basic disease states; apply knowledge in the treatment of patients.

- Professionalism: Establish trust with patients, their families, and staff; exhibit honesty, reliability and responsibility in patient care; demonstrate respect for patients and staff; work to fulfill the needs of patients; accept assignments graciously; attend conferences.

- Interpersonal and Communication Skills: Write understandable and legible notes; develop ability to listen to patients, their families, mentors and staff and communicate
verbally and nonverbally in a productive manner; work effectively as a member of the health care team.

- Practice Based Learning and Improvement: Understand limitation of knowledge; use references and literature to improve practice patterns; accept feedback and change behavior; asks for help when needed.
- Systems Based Practice: Advocate for patients; learn about the health care system/structure and begin to develop mechanisms to utilize ancillary services to benefit patients.

Specific Goals for the ambulatory experience:
During the ambulatory experiences, the fellow will gain the following:

1. Basic and advanced endocrine biochemistry, physiology and pathophysiology, which provide the basis for understanding endocrine diseases and their management.
2. Fundamental information and practical approaches for the diagnosis, management and prevention of endocrine disorders.
3. The technical and practical skills that are required by a consultant in endocrinology, diabetes and metabolism.
4. Clinical skills in a progressive fashion and with increasing responsibility appropriate for a consultant in endocrinology, diabetes and metabolism.
5. Knowledge and skills necessary for providing cost-effective, ethical and humanistic care of patients with diabetes and disorders of endocrinology and metabolism.
6. Knowledge and skills necessary for critical analysis of the laboratory testing and the endocrine literature.

Specific Objectives for the ambulatory experience:
During the ambulatory experience, the fellow will learn:

1. Endocrine biochemistry, physiology and pathophysiology.
2. Hormone action and inter-relationships.
3. Diagnosis and management of endocrine diseases including:
   i. history and physical examination with emphasis on examination of the fundi, thyroid, breasts, skin, genitalia.
   ii. selection and interpretation of endocrine biochemical tests.
   iii. selection and interpretation of imaging procedures such as sonography, radionuclide scans, computerized axial tomography, magnetic resonance imaging, positron emission tomography, etc.
   iv. fine needle aspiration of the thyroid and interpretation of cytology and pathology; use of thyroid ultrasound and ultrasound-guided biopsy
   v. understanding pharmacotherapy for endocrine disorders and appropriate use of surgery, radiation therapy, treatment with radioisotopes, etc.
4. Procedural and technical skills required by the endocrine subspecialist.

5. Aspects of professionalism, including peer interactions, communication with patients, their families and other health care providers, confidentiality and avoidance of conflict of interest.

6. Understanding of existing and emerging endocrine literature.

7. Advanced aspects of personal scholarship and self-instruction.

8. The fellow will become proficient, at a level expected from the subspecialist, in the management of the following:

   - Thyroid disorders including:
     - Hyperthyroidism and hypothyroidism
     - Nodular thyroid diseases
     - Thyroid cancer
     - Goiter
     - All varieties of thyroiditis

   - Pituitary and neuroendocrine disorders including:
     - Prolactinoma
     - Alpha-subunit-secreting pituitary tumors
     - Acromegaly
     - Cushing’s disease
     - Gonadotropin-secreting pituitary tumors
     - Thyrotropin producing pituitary tumors
     - Nonfunctioning tumors
     - Craniopharyngioma
     - Hypophysitis
     - Infiltrative disease (sarcoidosis, histiocytosis-X)

   - Adrenal disorders including:
     - Cushings syndrome (adrenal, pituitary, pseudo-, iatrogenic)
     - Adrenal insufficiency (primary, secondary, crisis, glucocorticoid therapy)
     - Pheochromocytoma
     - Mineralocorticoid excess
     - Non-functioning adenoma (benign, malignant)
     - Hirsutism, virilization
     - Congenital adrenal hyperplasia
     - Fluid and electrolytes (hypo and hypernatremia, hypo and hyperkalemia)

   - Disorders of calcium and skeletal metabolism including:
     - Hyperparathyroidism and other causes of hypercalcemia
     - Hypoparathyroidism and other causes of hypocalcemia
     - Metabolic bone diseases, osteoporosis
     - Evaluation and treatment of kidney stones

   - Polycystic Ovary Syndrome (PCOS)

   - Menopause and female reproductive endocrinology

   - Male hypogonadism and reproductive endocrinology

   - Hyperlipidemias
- Nutritional disorders and obesity
- Psychosocial issues
- Diabetes mellitus and related disorders, including:
  - Patient monitoring and treatment objectives in children and adults
  - Acute and chronic complications such as:
    - Diabetic ketoacidosis
    - Hyperosmolar coma
    - Hypoglycemia
  - Microvascular and macrovascular disease including:
    - Diabetic retinopathy
    - Diabetic nephropathy
    - Diabetic neuropathy
    - Diabetic dermopathy
    - Coronary heart disease
    - Peripheral vascular disease
    - Cerebral vascular disease
- Infections
- Patient education

In addition, fellows will gain skills in the management of patients of all ages with diabetes mellitus, including but not limited to the following aspects of the disease:

- The rationale, indications, performance and interpretation of glucose tolerance tests
- The utilization and interpretation of glycosylated hemoglobin levels, islet cell and insulin antibody levels in patient management and counseling
- Rationale for and calculation of diabetic diets
- Prescription of exercise programs
- Oral anti-diabetic therapy
- Chronic insulin administration including the use of all varieties of insulin delivery systems
- Glucose monitoring devices
- Funduscopic examination, recognition, and appropriate referral of patients with diabetic retinopathy
- Foot care
- Psychosocial effects of diabetes mellitus on patients and their families
- Patient and community education
- Preconception and contraceptive counseling
- Hypoglycemic syndromes

Specialty Rotations:

Pediatric Endocrinology:

Location: Glassrock Building at the UCDMC campus
Schedule: Once a week, half day, both years of training
Faculty: Dennis Styne, MD
Goals and Objectives: The fellows will
- understand aspects of the common endocrine disorders that are unique to children, acquire the ability to screen for, evaluate and treat the main forms of multiple endocrine neoplasia
- understand the pathogenesis of congenital hypothyroidism and to be familiar with the application of screening programs for its detection and treatment
- understand the physiology of normal and abnormal puberty
- gain practical knowledge of unique aspects of endocrine testing in children; become familiar with the common genetic pediatric endocrine disorders, e.g. Prader-Willi Syndrome, Laurence-Moon-Biedi Syndrome, Frohlich’s Syndrome
- learn skills related to history taking, examination, assessment, and management of pediatric endocrinology ambulatory patients
- learn to evaluate and manage growth disorders in children, including the various indications for growth hormone therapy
- acquire the knowledge required to manage Turner’s Syndrome (diagnosis, evaluation, specific therapies)
- learn to evaluate and manage pubertal disorders (delayed and advanced; benign vs. true precocious puberty)
- learn the work-up and chronic management of congenital adrenal hyperplasia
- master the evaluation and management of hypopituitarism (congenital and iatrogenic) in children
- learn to evaluate and manage congenital hypothyroidism and common thyroid disorders in children.

Diabetes in pregnancy:
Gestational Diabetes:
Location: ACC, Suite 2500, UCDMC.
Schedule: One half day a week
Faculty: Nancy Field, MD, Nina Boe, MD

Goals and Objectives: The fellows will
- learn the definition of gestational diabetes and its epidemiology in various ethnic groups
- understand the risks to mother and fetus of the various forms of diabetes and pregnancy
- know the risk factors and standard approaches to screening for gestational diabetes
- understand principles of nutritional counseling for diabetes in pregnancy that are unique to the pregnant state
- develop an approach to monitoring glycemic control in pregnancy
- know the indications for initiation of insulin therapy in diabetes in pregnancy; understand the principles of medication management (oral agents and insulin) of diabetes in pregnancy during labor, delivery and the postpartum period; understand postpartum surveillance for the development of frank type 2 diabetes
- acquire the skills and knowledge necessary to counsel high-risk patients and patients with existing diabetes on pre-conception care and pregnancy planning.
Ophthalmology Elective for the Endocrine Fellows

**Location:** ACC Building, UCDMC.

**Schedule:** Three half days during the 2nd year plus a 1-2 hour didactic teaching.

**Goals and Objectives:** The fellows will
- learn to identify background and proliferative diabetic retinopathy
  - perform direct fundoscopy of the undilated and dilated eye
  - interpret fundus photography and/or angiography of diabetic retinopathy
- learn the risk factors for progression of diabetic retinopathy
- learn the preventive measures
- learn the treatment options for non-proliferative and proliferative retinopathy
- learn the guidelines for referring the diabetic patients retinal evaluation
- recognize the findings indicating emergency referral

**Teaching method:** The session will start with a didactic presentation on a Thursday afternoon during the Divisional teaching sessions. The next Friday afternoon, each fellow will invite two patients (total of six patients) with known diabetic retinopathy to the Ophthalmology Clinic. Under the supervision of the Ophthalmology attendings, the endocrine fellows will perform direct fundoscopy on dilated and undilated eyes. Interpretation of retinal imaging will be discussed.

Diabetic foot care (elective):

**Location:** VA-Mather

**Schedule:** One half day per week, during the 2nd year of training

**Goals and Objectives:** The fellow will
- learn the pathophysiology and clinical features of common disorders affecting the diabetic foot
- understand the proper use of non-invasive vascular testing
- learn the methods to diagnose osteomyelitis.
- develop a practical approach to the diagnosis and treatment of diabetic foot wounds and infections, including the indications for podiatric consultation and the principles antibiotic groups employed in treatment

Nuclear Medicine (elective):

**Location:** UCDMC Nuclear Medicine Department

**Schedule:** One week during the 2nd year of training

**Goals and objectives:** The fellow will
- learn the theory and practice of thyroid scanning and uptake measurements
• become familiar with different radioisotopes used for common endocrine scans (i.e. thyroid, parathyroid, adrenal)
• learn the theory and practice of radioactive iodine treatment used for benign thyroid disease and thyroid cancer
• learn to consult the patients about the risks and benefits of nuclear medicine procedures
• review several thyroid, parathyroid, adrenal scans with the nuclear medicine attending.

Pathology (elective):

Location: Out-Patient Pathology Associates, Sacramento
Schedule: One week during the 2nd year of training

Goals and objectives: The fellow will
• advance their knowledge and performance of fine needle aspiration of the thyroid
• gain further experience in interpreting thyroid cytology

8. Research Training:

Overview: All fellows are required to participate in a research project. The research training starts at the beginning and continues all though of the fellowship program. As the schedule rotates in 3-month blocks, the fellows get 3 months of protected research time each year of their fellowship. The clinical obligation during the VA-consult/clinic/CCRC rotation permits fellows to work on their research projects through the entire year.

Soon after starting their program, fellows attend the Course given by Epidemiology and learn the basic principles of research design and analysis. Then the fellows meet with the Division faculty to discuss their research interests; and each fellow chooses a faculty mentor be his/her primary guide and resource for the project. If none of the core faculty is able to precept in the fellow’s particular area of interest then he/she can chose a mentor from the other Divisions.

Within the first 6 months of training, the fellows prepare their project outlines and present at the Divisional research meeting in order to receive feedback. Afterwards they are expected to present their progress periodically. They are also encouraged to apply to the Endocrine Fellows Foundation, and submit abstracts to the national meetings.

Clinical and Translational Science Center: Clinical Research Center (CCRC) training
UC Davis is one of the first 12 institutions to receive the Clinical Translational Grant from the NIH. The CCRC is part of this program. During the CCRC rotation the fellows become familiar with all the protocols related to endocrinology and learn special techniques used in clinical research.

Goals and objectives: The fellows are expected to learn
• the key elements of design of a hypothesis-driven research proposal
• the ethical responsibilities when engaged in human or animal research
• scientific rigor and the basic or clinical scientific skills necessary for successful conduct of their project
• the resources and support to enable them to analyze, disseminate and publish the results of their research
• to critically evaluate and analyze research data.
• special techniques used in clinical research (at the CCRC) including
  - body composition measurements by bioelectrical impedance, BodPod and DEXA
  - energy expenditure measurements using metabolic cart
  - intravenous glucose tolerance test based on the Bergman’s Minimal Model using the Millennium software
  - stable isotope techniques
  - adipose tissue needle aspiration

**Teaching methods:**
1. Month-long project development course: The curriculum for the course has been included in the appendix.
2. Weekly seminars: These one-hour seminars are offered Monday at 5:30-6:30 PM and Tuesdays at noon and cover a variety of research topics.

**9. Increasing independence and responsibility:**
Although, the specific components of the training program itself are not incremental, the fellows trained to assume increasing responsibility and autonomy to become successful independent practitioners. For example,
• in-patient consultation services, initially the fellow reviews all patients with the faculty attending immediately. Over time however, the more latitude is given to the fellow to determine which cases require immediate attending input and which can be presented routinely at the next formal rounds
• in the continuity clinic gradually increasing autonomy is given to fellows to manage routine aspects of care as their expertise increases, although the attending faculty member always reviews each patient
• the fellows gain increasing autonomy in planning the case presentations for rounds and the topics of journal clubs.

**10. Evaluation**
Continuous evaluation is conducted in a 360° manner, using the E*Value program.

**Consultation service:** The attending is the principal evaluator of the fellow. Fellows are evaluated in all aspects of clinical activities and patient care, including attributes of professionalism. Evaluation forms focused on the new competencies, developed by the American Board of Internal Medicine and the Residency Review Committee, are employed for these evaluations and the attending and fellow are expected to discuss the evaluation before the end of the month, and before the evaluation form is given to the Program Director.

**Ambulatory care:** Directly observed patient interactions are carried out periodically in the general endocrinology clinics and in the Continuity Clinic for the entire 2-year training period. At semiannual intervals, the Program Director reviews the E*Value summaries of all of the evaluations for each fellow and the fellow’s self-assessment evaluation form; the areas of strength and weaknesses are discussed and the plans for improvement are made. This competency is continuously evaluated by attending physicians, clinic directors and faculty during interactions in all teaching venues.
Annually, a summary evaluation is prepared by the Program Director, documenting the degree to which the fellow has mastered each component of the new competencies. Fellows will be advanced to a position of greater responsibility after they have demonstrated satisfactory scholarship and professional growth. The fellows' clinical knowledge will be assessed annually using the endocrine self-assessment program – in-training examination (ESAP-ITE).

To complete the circle of evaluation, fellows evaluate the faculty members who serve as Attending of the Month, on a regular basis and report those evaluations, using E*Value. A summary of these evaluations is provided to individual faculty members once per year, which contains appropriate counseling about improving their teaching effectiveness, if necessary.

In addition, their peers and the senior nursing staff in the general endocrinology clinic evaluate fellows twice per year. Fellows will periodically select continuity patients to fill out confidential evaluation forms.

Annually, the fellows evaluate the program as a whole, using American Board of Internal Medicine forms. The Fellowship Director and the Division Chief review of these evaluations of the faculty and the program. The educational effectiveness of the curriculum is assessed and plans for improving the program are developed.

The fellows meet with the Program Director monthly, at least 8 times a year, for ongoing suggestions.

Fellows are required to keep their own record of procedures, indicating who supervised the procedure, and copies of the procedure logbook or equivalent documents are provided to the Program Director for the their file.

**Counseling and Remediation:** If a fellow requires remediation in one or more areas that impact on clinical competence, the program director meets with the faculty members who had most contact with the fellow to develop a plan of remediation, implement the plan and evaluate the fellow’s response. These members serve as an ad hoc committee to monitor the progress of the fellow. If a faculty member receives poor evaluations as an attending physician, those evaluations and plans for improving performance will be discussed in a meeting with the Program Director.

The research mentor, using forms developed by the American Board of Internal Medicine, evaluates the research performance of each fellow. Those evaluations will be discussed with the fellow and then forwarded to the Program Director for review and inclusion in the fellow’s file.

A mailing at one year after completion of training and every five years thereafter will do evaluation of the graduates. The evaluation will employ a survey instrument that asks the graduates’ perception of the program’s relevance to their current activities, suggestions for improvement and ideas for additions and/or changes to the curriculum.

**Teaching and Evaluation of Competencies:** A summary of the assessment tools is presented in the next Table.
EVALUATION METHODS
RRC COMPETENCIES RELATIVE TO ACGME

<table>
<thead>
<tr>
<th></th>
<th>360-Degree Evaluation</th>
<th>Continuity Clinic Evaluations</th>
<th>Monthly Evaluations (Consult Service)</th>
<th>Observed H&amp;P’s</th>
<th>Peer Evaluation</th>
<th>Procedure Log Books</th>
<th>Program Director’s Semi-Annual Evaluations</th>
<th>Research Evaluations</th>
<th>Scholarly activities</th>
<th>Presentations</th>
<th>Weekly Clinical Conference's</th>
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<td><strong>Systems-Based Practice</strong></td>
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<td>X</td>
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</table>

**Patient Care**: This is evaluated by numbers of individual evaluations by attending physicians, continuity clinic Directors, Program Director and Division Head, other faculty peers and nursing staff.

**Medical Knowledge**: Each fellow will complete the Endocrine Self-Assessment Program near the end of the first year of training and at the end of the training program. This is a computer (CD-ROM)-based exercise consisting of 150 questions distributed throughout all areas of endocrinology and metabolism. A standing committee of the Endocrine Society in collaboration with UpToDate prepares it. After questions are answered, for quantitative evaluation, the fellow can turn the page, learn the correct answer, and read a discussion of the subject area in general, and with specific reference to why the answer is correct and why the other possible answers are incorrect. During this discussion, hot links to specific pages in the UpToDate database are provided. All material is contained in this CD-ROM. Thus this exercise is an important quantitative evaluation tool for Medical Knowledge as well as an excellent self-learning exercise. The Endocrine Self-Assessment Program is updated annually. Objective assessment of the fellow’s medical knowledge and knowledge status relative to fellows across the nation will be made annually with the ESAP-in-training examination. Medical knowledge is also assessed by attending physicians for consult rounds, Continuity Clinic Directors, by attending physicians during presentations at Endocrine Clinical rounds, and the Program Director. All of these evaluations are maintained in file.

**Practice-Based Learning and Improvement**: This competency is continuously evaluated by attending physicians, clinic directors and faculty during interactions in all teaching venues. Fellows prepare and deliver at least 15 clinical presentations based on their current patients with literature analysis and medical decision-making. Faculty evaluates these presentations, and the evaluations are provided to the Program Director. Also, records of these presentations
including PowerPoint files for each one are maintained by the fellow and saves in the
dedicated shared file.

**Interpersonal and Communication Skills:** These competencies are continuously evaluated by attending physicians on the inpatient service, attendings and continuity clinic directors, peers, nurses, the Program Director and the Division chief during the activities listed in the table above, and employing the forms and interactions described above under Evaluations.

**Professionalism:** Similar to Interpersonal and Communication skills, this competency is evaluated as described in Table, through direct observation and multiple evaluations

**Systems-Based Practice:** Teaching and Evaluation of this competency occurs in many venues as outlined in Table. Since almost all types of medical care systems are encountered in the various clinical activities during this training program, fellows have an excellent opportunity to understand and participate in modern health care systems.

Following tables summarize the integrated approach to teaching and evaluation:
## Disorders of the Thyroid

<table>
<thead>
<tr>
<th>Method of Education</th>
<th>Method of Evaluation</th>
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<tbody>
<tr>
<td><strong>Formal Instruction</strong></td>
<td><strong>Direct Clinical Experiences</strong></td>
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<tr>
<td></td>
<td>In-patient</td>
</tr>
<tr>
<td>1. Hyperthyroidism</td>
<td></td>
</tr>
<tr>
<td>a) Grave’s Disease</td>
<td>Y</td>
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<tr>
<td>b) Thyroiditis</td>
<td>Y</td>
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<tr>
<td>c) Toxic nodule</td>
<td>Y</td>
</tr>
<tr>
<td>d) Toxic multinodular goiter</td>
<td>Y</td>
</tr>
<tr>
<td>e) Struma Ovarii</td>
<td>Y</td>
</tr>
<tr>
<td>f) Thyrotoxicosis factitia</td>
<td>Y</td>
</tr>
<tr>
<td>g) Other</td>
<td>Y</td>
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<td>2. Hypothyroidism</td>
<td></td>
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<tr>
<td>a) Thyroiditis</td>
<td>Y</td>
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<tr>
<td>b) Post-ablative</td>
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<td>c) Other</td>
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<td>3. Thyroid Cancer</td>
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<tr>
<td>a) Papillary thyroid cancer</td>
<td>Y</td>
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<tr>
<td>b) Medullary thyroid cancer</td>
<td>Y</td>
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<td>c) Anaplastic thyroid cancer</td>
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<td>d) Other</td>
<td>Y</td>
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<td>4. Nodules</td>
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</tr>
<tr>
<td>a) Simple nodule</td>
<td>Y</td>
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<td>b) Multinodular goiter</td>
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<td>c) Diffuse goiter</td>
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<tr>
<td>d) Other</td>
<td>Y</td>
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<tr>
<td>5. Other</td>
<td></td>
</tr>
<tr>
<td>a) Polyglandular autoimmune syndrome</td>
<td>Y</td>
</tr>
<tr>
<td>b) Pregnancy-related thyroid disease</td>
<td>Y</td>
</tr>
<tr>
<td>c) Non-thyroidal illness</td>
<td>Y</td>
</tr>
<tr>
<td>6. Disease Specific Studies/ Procedures</td>
<td></td>
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<tr>
<td>a) Fine needle aspiration</td>
<td>Y</td>
</tr>
<tr>
<td>b) Thyroid ultrasound</td>
<td>Y</td>
</tr>
<tr>
<td>c) Thyroid scan-iodine</td>
<td>Y</td>
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<tr>
<td>d) Thyroid scan-Technetium</td>
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</table>
### Disorders of the Hypothalamus and Pituitary

<table>
<thead>
<tr>
<th>Method of Education</th>
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<tbody>
<tr>
<td>Formal Instruction</td>
<td>Direct observations with patient</td>
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<td></td>
<td>Discussions with faculty</td>
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<tr>
<td>Direct Clinical Experiences</td>
<td>Clinical Presentations</td>
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<tr>
<td></td>
<td>Written Examinations</td>
</tr>
<tr>
<td>In-patient</td>
<td>Y</td>
</tr>
<tr>
<td>Out-patient</td>
<td>Y</td>
</tr>
<tr>
<td>Attd. Rds</td>
<td>Y</td>
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<tr>
<td>Discussions</td>
<td>Y</td>
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<tr>
<td>Conferences</td>
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<tr>
<td>Self-directed learning</td>
<td>Y</td>
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<td></td>
<td>Y</td>
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</tr>
</tbody>
</table>

#### 1. Pituitary Tumors

- **a) Cushing’s Disease**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

- **b) Acromegaly**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

- **c) Prolactinoma**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

- **d) Non-functioning adenomas**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

#### 2. Space-Occupying/Infiltrative Disease

- **a) Cranipharyngioma**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

- **b) Hemochromatosis**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

- **c) Histiocytosis X**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

- **d) Sarcoid**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

#### 3. Hypopituitarism

- **a) Adrenal**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

- **b) Thyroid**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

- **c) Growth hormone**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

- **d) Gonadotropins**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

#### 4. Water Balance

- **a) Diabetes insipidus**
  - In-patient: N
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

- **b) SIADH**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

#### 5. Disease Specific Studies/Procedures

- **a) GnRH stimulation**
  - In-patient: N
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

- **b) Insulin induced hypoglycemia**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

- **d) IPSS**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

- **e) Pituitary imaging MRI/CT**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N

- **f) Dexamethasone suppression**
  - In-patient: Y
  - Out-patient: Y
  - Attd. Rds: Y
  - Discussions: Y
  - Conferences: Y
  - Direct observations with patient: Y
  - Discussions with faculty: Y
  - Clinical Presentations: Y
  - Written Examinations: N
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<thead>
<tr>
<th>Adrenal Disorders</th>
<th>Method of Education</th>
<th>Adrenal Disorders</th>
<th>Method of Evaluation</th>
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<td></td>
<td>Formal Instruction</td>
<td>Direct Clinical Experiences</td>
<td>Direct observations with patient</td>
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<tr>
<td></td>
<td></td>
<td>In-patient</td>
<td>Out-patient</td>
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<td></td>
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<td>Y Y Y Y Y Y Y Y</td>
<td>Y Y Y Y Y</td>
</tr>
<tr>
<td>1. Cushings syndrome</td>
<td>a) Adrenal</td>
<td>Y Y Y Y Y Y Y Y</td>
<td>Y Y Y Y Y</td>
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<tr>
<td></td>
<td>b) Pituitary</td>
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<td>Y Y Y Y Y</td>
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<tr>
<td></td>
<td>c) Pseudo-</td>
<td>Y Y Y Y Y Y Y Y</td>
<td>Y Y Y Y Y</td>
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<tr>
<td></td>
<td>d) Iatrogenic</td>
<td>Y Y Y Y Y Y Y Y</td>
<td>Y Y Y Y Y</td>
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<tr>
<td>2. Adrenal Insufficiency</td>
<td>a) Primary (including polyglandular)</td>
<td>Y Y Y Y Y Y Y Y</td>
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<tr>
<td></td>
<td>b) Secondary</td>
<td>Y Y Y Y Y Y Y Y</td>
<td>Y Y Y Y Y</td>
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<tr>
<td></td>
<td>c) Adrenal crisis</td>
<td>Y Y Y Y Y Y Y Y</td>
<td>Y Y Y Y Y</td>
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<td></td>
<td>d) Glucocorticoid therapy</td>
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<td>3. Pheochromocytoma</td>
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<td>Y Y Y Y Y Y Y Y</td>
<td>Y Y Y Y Y</td>
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<tr>
<td>4. Mineralocorticoid Excess</td>
<td>a) Aldosteronism</td>
<td>Y Y Y Y Y Y Y Y</td>
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<tr>
<td>5. Nonfunctioning Adrenal Mass (Including Incidentaloma)</td>
<td>a) Benign</td>
<td>Y Y Y Y Y Y Y Y</td>
<td>Y Y Y Y Y</td>
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<tr>
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<td>b) malignant</td>
<td>Y Y Y Y Y Y Y Y</td>
<td>Y Y Y Y Y</td>
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<tr>
<td>6. Hirsutism and Virilization</td>
<td></td>
<td>Y Y Y Y Y Y Y Y</td>
<td>Y Y Y Y Y</td>
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<td>7. Congenital adrenal hyperplasia</td>
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<td>Y Y Y Y Y Y Y Y</td>
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<td>8. Fluid and electrolytes</td>
<td>a) Hypernatremia and hyponatremia</td>
<td>Y Y Y Y Y Y Y Y</td>
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<tr>
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<td>b) Hypokalemia and Hyperkalemia</td>
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<td>c) Metabolic acidosis and alkalosis</td>
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<td>9. Hypertension</td>
<td>a) Primary (Essential)</td>
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<tr>
<td></td>
<td>b) Secondary (Endocrine)</td>
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### Disorders of Bone and Mineral

<table>
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<tr>
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<th>Formal Instruction</th>
<th>Direct Clinical Experiences</th>
<th>Clinical Case Discussions</th>
<th>Self-directed learning</th>
<th>Method of Evaluation</th>
<th>Direct observations with patient</th>
<th>Discussions with faculty</th>
<th>Clinical Presentations</th>
<th>Written Examinations</th>
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<tr>
<td></td>
<td>In-patient</td>
<td>Out-patient</td>
<td>Attd. Rds</td>
<td>Conferences</td>
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<td>1. Biology of Bone</td>
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<td>c) Bone matrix/mineralization</td>
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<td>d) Regulation of bone remodeling</td>
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<td>2. Physiology of calcium, magnesium, and phosphorous homeostasis</td>
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<td>c) Calcium flux in/out of bone</td>
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<td>3. Molecular biology, biochemistry, and mechanism of action of calcitropic hormones</td>
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<td>a) Synthesis and metabolism of PTH</td>
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<td>d) Vitamin D and metabolites</td>
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<td>Y</td>
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<tr>
<td>e) Calcitonin</td>
<td>Y</td>
<td>N</td>
<td>N</td>
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<td>Y</td>
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<td>4. Clinical Evaluation of Bone and Mineral Disorders</td>
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<tr>
<td>a) Comprehensive, relevant history</td>
<td>Y</td>
<td>Y</td>
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<td>Y</td>
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<td>b) Physical examination</td>
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<td>5. Laboratory Methods/ Understanding assays for:</td>
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<td>a) Calcium, phosphorus, and magnesium</td>
<td>Y</td>
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<td>Y</td>
<td>Y</td>
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<td>b) Ionized calcium</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>c) PTH</td>
<td>Y</td>
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## Disorders of Bone and Mineral (page 2)

### Method of Education

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### Method of Evaluation

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### Imaging techniques/other procedures

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<th>b) Bone scintigraphy</th>
<th>c) Bone density and measurement</th>
<th>d) Bone biopsy</th>
<th>e) Bone histomorphometry</th>
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### Postmenopausal and Age-related Osteoporosis

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<th>b) Pathogenesis</th>
<th>c) Role of physical activity</th>
<th>d) Nutrition and osteoporosis</th>
<th>e) Prevention of osteoporosis</th>
<th>f) Evaluation and treatment of osteoporosis</th>
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### Other Forms of Osteoporosis

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<th>b) Idiopathic (male and female) osteoporosis</th>
<th>c) Glucocorticoid osteoporosis</th>
<th>d) Transplant related osteoporosis</th>
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### Rickets and Osteomalacia

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<th>b) Bone disease secondary to Gl/liver d/o</th>
<th>c) Vitamin D dependent rickets</th>
<th>d) Hypophosphatemic rickets</th>
<th>e) Tumor induced osteomalacia</th>
<th>f) Hypophosphatasia</th>
<th>g) Fanconi syndrome and RTA</th>
<th>h) Drug induced osteomalacia</th>
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### Comments


### Imaging Techniques

- a) Bone radiology in children and adults
- b) Bone scintigraphy
- c) Bone density and measurement
- d) Bone biopsy
- e) Bone histomorphometry
- f) Parathyroid imaging

### Osteoporosis

- Postmenopausal and Age-related Osteoporosis
- Other Forms of Osteoporosis

### Rickets and Osteomalacia

- Nutritional rickets and osteomalacia
- Bone disease secondary to Gl/liver d/o
- Vitamin D dependent rickets
- Hypophosphatemic rickets
- Tumor induced osteomalacia
- Hypophosphatasia
- Fanconi syndrome and RTA
- Drug induced osteomalacia
### Disorders of Bone and Mineral (page 3)

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### Gonadal Disorders

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- a) Normal female reproductive physiology including puberty
- b) Primary/secondary amenorrhea
- c) Dysfunctional uterine bleeding
- d) Hirsutism/virilization
- e) Polycystic ovarian syndrome
- f) Infertility
- g) Menopause

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- a) Normal male reproductive physiology including puberty
- b) Hypogonadism
- c) Gynecomastia
- d) Erectile dysfunction
- e) Infertility
- f) Prostatic disorders

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- a) Intersex disorders
- b) Precocious puberty
- c) Delayed puberty
- d) Gonadal dysgenesis

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- a) Testicular tumors
- b) Ovarian tumors

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- e) Induction of spermatogenesis
- f) Male/Female hormone replacement
- g) Ovulation induction
### UC Davis Training Program in Endocrinology, Diabetes and Metabolism – Goals and Objectives

#### Diabetes Mellitus

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# Disorders of Lipid Metabolism

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<tr>
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### UC Davis Training Program in Endocrinology, Diabetes and Metabolism – Goals and Objectives

#### Method of Education

<table>
<thead>
<tr>
<th></th>
<th>Formal Instruction</th>
<th>Direct Clinical Experiences</th>
<th>Clinical Case Discussions</th>
<th>Self-directed learning</th>
<th>Direct observations with patient</th>
<th>Discussions with faculty</th>
<th>Clinical Presentations</th>
<th>Written Examinations</th>
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<tr>
<td></td>
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<td>In-patient</td>
<td>Out-patient</td>
<td>Att'd. Rds</td>
<td>Conferences</td>
<td></td>
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</tbody>
</table>

1. Obesity
   a) Pathophysiology
   b) Diagnosis
   c) Management

2. Starvation
   a) Anorexia nervosa
   b) Bulimia

3. Vitamin Deficiency
   a) Water soluble
   b) Fat soluble

4. Total Parenteral Nutrition
   a) Management

5. Disease Specific Studies/Procedures
   a) Other

---

### Method of Evaluation

- Y: Yes
- N: No
SECTION 2

Goals and Objective of Endocrine Education Based on Specific Organ Systems

Disorders of the Adrenal Cortex and Medulla

Introduction
A complete understanding of the diseases affecting the adrenal gland is essential for the endocrinologist. Adrenal pathophysiology includes numerous life-threatening conditions ranging from electrolyte disturbances, alterations in blood pressure, and malignancy. Indeed, it is essential that the endocrinologist accurately recognizes and promptly manages the patient with adrenal disease.
An appropriate knowledge base for this area includes an understanding of the hormonal and neurological regulation of electrolytes and blood pressure, the biosynthesis of steroid hormones and their target tissues/actions, the genetic basis for inherited diseases of the adrenal gland, recognition of adrenal cortical hyper- and hypo-function as well as adrenal medullary hyperfunction, static and dynamic tests of adrenal gland function, adrenal imaging techniques and management of adrenal dysfunction. Many of these diseases affecting the adrenal gland are common, such as the incidental adrenal mass, and will be routinely encountered in most clinical training settings. In contrast, conditions such as pheochromocytomas are rarer. As noted, however, the latter condition represents an extremely critical medical diagnosis. Thus, appropriate training in adrenal disease will likely reflect a combination of both hands-on clinical encounters and an array of additional learning experiences including both formal teaching and self-directed methods.

Discussion
The training program provides opportunities for the endocrine fellow to develop competence in the clinical evaluation and management of patients with adrenal cortical and adrenal medullary disorders. This clinical experience includes opportunities to diagnose and manage adult outpatients and inpatients of both sexes.
The fellow is given opportunities throughout the training period to assume responsibility for and follow patients to observe the evolution and natural history of these disorders, as well as the efficacy of therapy.

Physiology
The endocrine fellow must have a basic understanding of the normal physiology of the adrenal cortex and medulla. This knowledge base includes:
(1) adrenal gland embryology, anatomy, and zonation
(2) adrenal steroid pathways of biosynthesis, specific enzymatic steps, and steroid hormone structures
(3) steroid metabolism
(4) hypothalamic-pituitary-adrenal axis and normal patterns of ACTH and cortisol secretion
(5) regulation of adrenal glucocorticoid, androgen, and estrogen secretion
(6) factors affecting measured levels of steroids in plasma and urine
(7) molecular and cellular mechanisms as well as physiologic effects of glucocorticoids, mineralocorticoids, androgens, and estrogens
(8) renin-angiotensin-aldosterone system and regulation of mineralocorticoid secretion
catecholamine biosynthetic pathway, physiological effects of catecholamines, excretion of catecholamines and catecholamine metabolites.

The method of education for adrenal physiology includes formal instruction and reading the chapters covering adrenal cortex and adrenal medulla from one of the major endocrine textbooks and other resources.

Evaluation and Management of Adrenal Disorders
Competency in the evaluation and management of the adrenal disorders required by the Residency Review Committee are listed in the Form at the end of this section (Disorders of the Adrenal). For each disorder listed, the fellow must have a thorough knowledge of:
1. clinical presentation
2. pathophysiology
3. physical examination findings
4. differential diagnosis
5. laboratory findings
6. typical imaging findings
7. clinical management

The primary methods of education for these disorders are direct clinical experiences and clinical case discussions, and presentations at the Core Conferences. These case discussions would usually take place on hospital rounds or in the outpatient endocrine clinic setting. The training program provides and documents a breadth of adrenal topics in clinical case conferences. The knowledge base of all of the adrenal disorders listed in the Form (Disorders of the Adrenal) is enhanced with self-learning.

Rare Causes of Adrenal Disorders
The fellow will become familiar with rare causes of the adrenal disorders listed in the Form. For example, for the category of “Mineralocorticoid Excess,” in addition to primary aldosteronism, the fellow should be familiar with the spectrum of causes from renin-dependent (e.g., renovascular disease, coarctation of the aorta) to renin-independent (e.g., 11-β-hydroxysteroid dehydrogenase deficiency, Liddle’s syndrome, hypercortisolism, congenital adrenal hyperplasia). The fellow will learn the special features of Cushing’s syndrome, adrenal insufficiency, aldosteronism, and pheochromocytoma in the hospitalized patient.

Congenital Adrenal Hyperplasia; 21-hydroxylase deficiency
The fellow will have a thorough knowledge of the clinical presentation, pathophysiology, differential diagnosis, laboratory findings, and clinical management of 21-hydroxylase deficiency and should be familiar with other forms of congenital adrenal hyperplasia.

Hypertension
With regard to hypertension, the fellow will know when to consider secondary (endocrine) causes of hypertension and how to manage essential hypertension in patients with endocrine disease (e.g., diabetes mellitus).

Glucocorticoid Therapy
Although not required by the RRC, a thorough understanding of glucocorticoid therapy must be achieved (see Form). This part of the curriculum includes:
UC Davis Training Program in Endocrinology, Diabetes and Metabolism – Goals and Objectives

(1) knowledge of the different glucocorticoid preparations (oral and parenteral)
(2) chronic maintenance glucocorticoid dosing
(3) inpatient and outpatient “stress” coverage dosing
(4) management of glucocorticoid withdrawal including evaluation of hypothalamic pituitary-adrenal axis function
(5) recognition of the manifestations of excessive and insufficient glucocorticoid therapy.

Adrenal Studies and Procedures
The endocrine fellow will understand the indications for and the interpretation of all of the tests and procedures listed in the Tables below. In addition, the fellow should be able to personally conduct cosyntropin stimulation tests and dexamethasone suppression tests. The fellow should be proficient in identifying normal and abnormal adrenal glands on computerized imaging. Methods of education should include formal instruction, direct clinical experiences, clinical case discussions, and self-directed learning.

Dynamic Endocrine Tests
- Cosyntropin stimulation test – 1 μg and 250 μg
- Corticotropin-releasing hormone (oCRH) stimulation test
- Dexamethasone suppression tests (DST)
- oCRH/DST protocol
- Insulin tolerance test
- Saline suppression test for aldosterone
- Clonidine suppression test for catecholamines

Imaging and Radiology Procedures
- Adrenal venous sampling for aldosterone
- Inferior petrosal sinus sampling for ACTH with oCRH stimulation
- Computerized adrenal imaging (CT, MRI)
- CT-guided adrenal FNA biopsy
- $^{123}$I-metaiodobenzylguanidine (MIBG) scintigraphy
- Indium In-111-labeled pentetreotide (OctreoScan®) scintigraphy
- $[6ß^{131}]$iodomethyl-19-norcholesterol (NP-59) scintigraphy
Bone and Mineral Disorders

Introduction
A clear understanding of disorders of bone and mineral metabolism is a critical component of the fellowship in Endocrinology, Diabetes, and Metabolism. Osteoporosis is the major public health problem in this area. It is responsible for at least 1.3 million fractures and costs $18 billion in direct health care costs in the United States each year. The lifetime risk of a fracture of the vertebrae, wrist, or hip due to osteoporosis is nearly 40% for white women and increases to about 50% when other age-related fractures are included. Although osteoporosis is more common in women, men also incur substantial bone loss with aging, and elderly men have age-specific hip fracture rates and a prevalence of vertebral fractures that are at least half those in women. Given the widespread prevalence of osteoporosis, the endocrinology fellow needs to learn to work with the patient’s primary care and other physicians in providing appropriate consultative and management advice in the care of patients with osteoporosis.

In addition to osteoporosis, a number of other disorders of bone and mineral metabolism are commonly referred to the practicing endocrinologist for evaluation and management. They include primary hyperparathyroidism, hypercalcemia of malignancy, Paget’s disease and nephrolithiasis. The remainder of the disorders in this area requires the knowledge and experience of an endocrinologist to accurately diagnose and manage. These include hypoparathyroidism, other forms of hyper- and hypocalcemia, as well as disorders of other minerals (i.e., magnesium and phosphorus), osteomalacia in its various forms, and developmental bone disorders.

The overall competencies that an endocrinology fellow needs to acquire in this area must begin with a solid understanding of the anatomy and biology of bone matrix and cellular elements. The fellow must also be well versed in the physiology of calcium, magnesium, and phosphorus homeostasis, and understand the biochemistry of the calcium-regulating hormones. With this as a background, the fellow must be competent in the clinical evaluation of bone and mineral disorders, including obtaining a relevant, comprehensive history and performing the relevant physical examination, as well as ordering and interpreting the appropriate laboratory tests in a cost-effective manner. The specific disorders and the management skills needed for each are described in the template and discussed further later. Clinical experience must include opportunities to diagnose and manage patients of both sexes in both the inpatient and outpatient setting. The fellow must also learn to function as a consultant for other physicians in these disorders. To truly understand the evolution and natural history of bone and calcium disorders, as well as the effectiveness of therapeutic interventions, the educational program must have at least 30% of the experience in this area in ambulatory care settings.

Our training program facilitates the acquisition of these skills through a number of tools. These include, but are by no means limited to, didactic lectures, interactive computer programs, oral case presentation and discussion, and most importantly, direct and close supervision by the faculty of fellows’ evaluation and management of patients with as wide a spectrum as possible of bone and calcium disorders.

In the attached Discussion of specific learning areas, the panel recognizes certain essential areas, which each training program must cover. In addition, there are a number of areas that while desirable and should be covered by the program, are not mandatory, particularly if the relevant patient population is not available or appropriate faculty expertise is not present.
Discussion

The attached template summarizes the key learning areas for the clinical training program. These are discussed below.

Biology of Bone
The necessary basic background in this area must include an understanding of the fundamentals of bone biology. Specifically, the fellow must know the macroscopic and microscopic structure of bone, as well as the fundamentals of bone remodeling and growth (i.e., the processes of intramembranous and endochondral ossification). S/he must also have knowledge of the cells in bone, specifically osteoblasts, osteocytes, and osteoclasts, as well as the composition and mineralization of the bone matrix. Finally, s/he must be familiar with the various systemic and local factors regulating bone development and remodeling.

Physiology of Calcium, Magnesium, and Phosphorus Homeostasis
A basic understanding of mineral homeostasis must include knowledge of the factors regulating intestinal absorption, renal handling, and flux in and out of bone of these compounds. Included in this is the role of systemic hormones (1,25(OH)₂D, PTH, growth hormone, estrogen, glucocorticoids, and others) as well as dietary factors (intake of these minerals, other factors such as sodium intake). The fellow must also have an understanding of alterations in calcium and phosphorus homeostasis during physiological states such as puberty, pregnancy, lactation, and aging.

Molecular Biology, Biochemistry, and Mechanism of Action of Calcitropic Hormones
The fellow must have an understanding of the synthesis and secretion of PTH, its peripheral metabolism, and mechanism of action. S/he must have knowledge of the role of the calcium-sensing receptor in normal physiology. The fellow must understand the role of PTH-rP in malignancy. S/he must understand the synthesis, metabolism, and action of vitamin D and its key metabolite, 1,25(OH)₂D. S/he should be aware of the potential normal skeletal and non-skeletal actions of PTH-rP and 1,25(OH)₂D. Finally, s/he must have an understanding of the synthesis and secretion of calcitonin, as well as its action on bone resorption.

Clinical Evaluation of Bone and Mineral Disorders
The fellow must learn to obtain a comprehensive but relevant history and perform the appropriate physical examination. This must include a detailed musculoskeletal examination, as well as other parts of a comprehensive examination (e.g., gonadal exam) when appropriate.

Laboratory Methods
The fellow must understand the methods, strengths, and limitations of the various measurements s/he will be requesting. S/he must understand issues of assay accuracy, variability (assay and biologic) and detection limits. S/he must be able to integrate a number of tests and recognize specific patterns of test abnormalities associated with various disease states. The fellow must have knowledge of abnormalities in protein binding that might affect serum calcium measurements, as well as possible artifacts/physiological alterations in the serum phosphorus and magnesium determinations. S/he must understand issues regarding the collection and interpretation of ionized calcium and urinary calcium measurements. S/he
must have a full understanding of PTH assays, including the effects on the assay of changes in renal function, and the correct interpretation of the assay in light of the ambient serum calcium concentration. Similarly, s/he must have knowledge of calcitonin assays, as well as the role of stimulated calcitonin testing in the diagnosis of C-cell hyperplasia and medullary thyroid carcinoma. More recently, assays for PTH-rP have become available, and the fellow must have an understanding of when a PTH-rP level may be useful in the evaluation of the patient. S/he must have a knowledge of assays for 25-OHD and 1,25(OH)₂D, and understand the situations warranting either the 25-OHD measurement (i.e., in the evaluation of vitamin D deficiency or intoxication) or the 1,25(OH)₂D measurement (as, for example, in the evaluation of possible granulomatous hypercalcemia). The fellow must also understand gonadal steroid and other hormonal measurements as they apply to the evaluation of bone and calcium disorders.

The recent availability of biochemical markers of bone turnover has added another tool for the evaluation of osteoporosis and other metabolic bone diseases. The fellow must have a working knowledge of markers of bone formation and resorption, and their indicated uses. Finally, the fellow must have knowledge of molecular diagnostics, particularly as they apply to disorders of bone and calcium metabolism. This includes understanding the different techniques of molecular diagnostics (i.e., mutation identification using single-strand conformational polymorphism, direct DNA sequencing, restriction endonuclease analysis, etc.). While general applicability of these techniques at this point is principally for the MEN syndromes, clearly they will be increasingly used in the future in the laboratory evaluation of bone and mineral disorders.

**Imaging Techniques/Other Procedures**

The training program should have a close working relationship with a skeletal radiologist who can provide expert interpretation of bone radiographs of adults and children. The fellow must develop the fundamental skills to recognize the radiographic appearance of at least common metabolic bone diseases (i.e., osteoporosis, hyperparathyroidism, osteomalacia, Paget disease, etc.). Similarly, s/he must have an understanding of bone scintigraphy and its appropriate use.

Understanding bone mass measurements is a critical component in the evaluation of osteoporosis. The fellow must have knowledge of the technical aspects of DEXA measurements, and understand issues of quality control, precision, and interpreting DEXA measurements, both in terms of diagnosing osteopenia and osteoporosis, as well as in interpreting longitudinal changes. S/he should understand the use of DEXA for assessment of body composition. S/he should also be familiar with other available technologies, such as quantitative CT, ultrasound, and digital radiography.

The fellow should, if possible, acquire the skills to perform and interpret bone biopsies. Bone histomorphometry is useful in the evaluation of difficult metabolic bone diseases, and still remains instrumental for the definitive diagnosis of osteomalacia and renal osteodystrophy.

The fellow must learn the fundamentals of parathyroid imaging (scan and ultrasound), including the appropriate use of these tests in the cost-effective evaluation of the hyperparathyroid patient. S/he must also learn the appropriate use of CT and MR imaging in the evaluation of patients with persistent or recurrent hyperparathyroidism.

**Postmenopausal and Age-Related Osteoporosis**

As noted in the introduction, osteoporosis is the major public health disorder in this area, and likely the most common referral diagnosis. As such, the fellow must have a thorough understanding of the epidemiology and current concepts of the pathogenesis of
postmenopausal and age-related osteoporosis. The fellow must also be familiar with the impact of physical activity and nutritional factors (in particular, calcium and vitamin D nutrition) on bone mass and of factors such as medications, impaired vision, and propensity to fall on fracture risk. S/he must be able to advise the patient on appropriate prevention measures, and learn to manage the woman going through the menopausal transition. S/he must be well versed in the diagnostic evaluation of osteoporosis, including the correct interpretation of BMD data within the context of the clinical setting of the particular patient. S/he must be able to exclude secondary causes of osteoporosis, including multiple myeloma, underlying malignancy, primary hyperparathyroidism, osteomalacia, and osteogenesis imperfecta. S/he must be comfortable with the use of both non-pharmacologic (i.e., lifestyle changes, calcium supplementation, and, working with a physiatrist, prescription of appropriate physiotherapy) and pharmacologic measures (HRT, SERMs, bisphosphonates, calcitonin, and PTH, when available) for the treatment of osteoporosis. S/he must be able to evaluate the patient who has sustained an osteoporotic fracture and institute measures to reduce the risk of subsequent fractures. The fellow must also be familiar with issues of pain management in patients with vertebral or other fractures. Finally, s/he should be able to work with the Orthopedist in the evaluation of patients with delayed healing of fractures.

Other Forms of Osteoporosis
In addition to postmenopausal and age-related osteoporosis, the fellow must be familiar with the evaluation and management of other forms of osteoporosis. Principal among these are glucocorticoid- and increasingly, transplant-associated osteoporosis. S/he should work closely with the primary physicians in the management of these difficult patients, since particularly the post-transplant patient often has multiple endocrine abnormalities (i.e., hyperglycemia, hyperlipidemia) in addition to the metabolic bone disorder. Where appropriate, the fellow should advise on the management of all of the multiple endocrine/metabolic derangements in these patients. The fellow must also be familiar with other skeletal complications of glucocorticoid use, including avascular necrosis. In addition, the fellow must know how to evaluate and manage other forms of osteoporosis, including idiopathic (male and female) osteoporosis and various forms of secondary osteoporosis.

Rickets and Osteomalacia
While less common than the various forms of osteoporosis, the fellow must learn to evaluate and treat the osteomalacic disorders and to distinguish these from osteoporosis. Nutritional vitamin D deficiency is particularly a problem in the elderly, and increases significantly the risk of hip fracture. In addition, recognition of vitamin D deficiency often uncovers a previously unsuspected diagnosis, such as non-tropical sprue, in an otherwise minimally symptomatic patient. The fellow must know the appropriate tests to order in this setting (i.e., 25-hydroxyvitamin D level, PTH, urine calcium), including possibly a bone biopsy when needed. Inherited disorders of vitamin D action or phosphate handling can be difficult to manage, and the fellow should have appropriate exposure to these. The evaluation of patients with tumor-induced osteomalacia is often extremely difficult, as the underlying tumor may be impossible to identify. As such, the fellow must also be familiar with the medical management of these patients.

Hypocalcemic Disorders
The fellow must know how to manage acute hypocalcemia as, for example, in the post-operative setting. This includes the use of intravenous calcium preparations and when they are indicated. S/he must also be able to manage chronic hypocalcemia with oral calcium
and vitamin D preparations and, if indicated, a thiazide diuretic. Working with a dietician, s/he should be able to advise the patient with hypoparathyroidism regarding dietary phosphate restriction, and use phosphate binders when indicated. S/he must also be able to assess the patient with various forms of hypocalcemia, including that due to acute pancreatitis, acute illnesses, and associated with the use of various medications. The fellow must also know the various types of parathyroid resistance syndromes and the appropriate testing necessary to establish a diagnosis of pseudohypoparathyroidism. S/he should be familiar with possible resistance to other hormones as well as the non-endocrine disorders in these patients.

Renal Osteodystrophy
While primarily managed by the nephrologist, the endocrine fellow must have a clear understanding of renal osteodystrophy in its various forms, including secondary and tertiary hyperparathyroidism. The role of the endocrinologist may be most important during and following parathyroid surgery in these patients, and the fellow must be familiar with the post-operative management of these patients, particularly hungry bone syndrome. Use of bone biopsy and bone histomorphometry is particularly useful in the evaluation of renal osteodystrophy and if possible, the fellow should have appropriate training in these techniques.

Paget’s Disease
The fellow must be familiar with current concepts of the pathogenesis, natural history, and treatment of Paget’s disease. The evaluation and management of Paget’s disease involves an understanding of the appropriate laboratory studies to identify the extent and severity of the disease (bone markers, scintigraphy, and radiographs), as well as combining this data with the patient’s symptoms, leading to a decision about appropriate therapy. The latter may include observation or pharmacologic therapy with calcitonin, oral, or intravenous bisphosphonates.

Hypercalcemic Disorders
The fellow must have a full understanding of the evaluation and management of hypercalcemia. S/he must be able to use the PTH assay to make a diagnosis of primary hyperparathyroidism versus non-parathyroid hypercalcemia (i.e., hypercalcemia of malignancy, that due to granulomatous disorders, or other miscellaneous causes of hypercalcemia). S/he must be comfortable differentiating primary hyperparathyroidism from FHH, as well as pursuing, where appropriate, a diagnosis of familial hyperparathyroidism or an MEN syndrome. Included in this is an understanding of genetic testing for these syndromes.

If a diagnosis of primary hyperparathyroidism is established, the fellow must know the necessary evaluation of these patients leading to a decision regarding surgical or medical management. If the patient goes for surgery, the fellow must work with the surgical team in the peri- and post-operative management of these patients, including post-operative hypocalcemia. Specifically, the fellow must be able to distinguish hungry bone syndrome from post-operative hypoparathyroidism, and manage both appropriately. If a decision is made for medical therapy or observation, the fellow must be familiar with the follow-up of these patients and the endpoints that would result in a recommendation for surgery. Finally, s/he must be familiar with evolving approaches to the management of patients with primary hyperparathyroidism, both surgical (i.e., minimal access parathyroidectomy, alcohol ablation) and medical (i.e., bisphosphonates, calcium receptor agonists).
In addition to primary hyperparathyroidism, the fellow must know the evaluation and management of parathyroid cancer. S/he must be able to effectively evaluate and manage the patient with hypercalcemia in the setting of a suppressed PTH (i.e., hypercalcemia of malignancy, that due to granulomatous disorders).

**Other Mineral Abnormalities**

The fellow must be able to identify the possible causes of hypo- and hypermagnesemia in a patient, and to institute appropriate therapy. S/he must be able to identify situations in which hypomagnesemia is the cause or contributing to hypocalcemia. S/he must also be able to identify the etiology of hyper- or hypophosphatemia in a patient, and to treat these conditions.

**Nephrolithiasis**

The fellow must be able to evaluate the patient with nephrolithiasis. Based on the type of stone and the evaluation (i.e., identification of hypercalciuria, hyperoxaluria, hyperuricosuria, or low urinary citrate), the fellow must be able to identify any underlying disorders such as primary hyperparathyroidism or enteric hyperoxaluria. S/he must know the medical management of the patient based on this evaluation, and to work with a dietician in the appropriate dietary management of these patients.

**Genetic, Developmental, and Dysplastic Skeletal Disorders**

The fellow should be familiar with these disorders, which can present both in children and in adults. These include various sclerosing bone disorders and skeletal dysplasias. The fellow should also be able to evaluate the patient referred because of an elevated bone density, in the absence of radiographic sclerosis. An experienced skeletal radiologist is a great asset to the training program in the accurate diagnosis of these conditions based on the radiographic findings. The fellow should have exposure to the evaluation and management of patients with osteogenesis imperfecta as well as appropriate medical management of both the skeletal aspects of fibrous dysplasia and, when present, the management of precocious puberty in these patients.

**Skeletal Neoplasms/Infiltrative Disorders**

The fellow should be able to identify benign and malignant skeletal neoplasms on skeletal radiographs, and institute appropriate referrals to the orthopedic surgeon as well as the radiation and medical Oncologists. S/he should also be familiar with the various infiltrative disorders of bone, including mast cell disease and histiocytosis X.

**Extraskeletal Calcification/Ossification**

These include relatively uncommon conditions such as tumoral calcinosis, dermatomyositis, and various ossification disorders. While the fellow may not necessarily have the opportunity to manage these relatively rare conditions, s/he should be familiar with these disorders and their treatment.
Introduction
Diabetes is an increasingly common, potentially devastating, extraordinarily expensive, treatable, but incurable, chronic disease. It is by far the most common endocrine disorder that seriously impacts health and limits longevity in those affected. An estimated 16 million Americans, and 135 million people worldwide, have diabetes. The World Health Organization projects the latter will grow to 300 million by the year 2025. Many more have impaired glucose tolerance or impaired fasting glucose and are at high risk for atherosclerotic disease and diabetes. People with diabetes are at 2- to 4-fold increased risk for a myocardial infarction or a stroke. Diabetes is the leading cause of blindness with its onset in working age adults and of non-traumatic amputations, and the most common single cause of end-stage renal disease requiring dialysis and transplantation. Medical care for people with diabetes costs approximately $100,000,000,000 per year in the United States. Much of this is for the care of long-term microvascular and macrovascular complications of diabetes that are now known to be in large part preventable.

Discussion
Sequelae of Treatment
It is now well-established that treatment makes a long-term difference for people with diabetes. Currently available treatments are far from ideal, but they are demonstrably effective. These treatments involve an integrated care team (e.g., an endocrinologist, a diabetes educator, a nutritionist). Among the specific objectives of our training program is to teach our fellows (residents) in Endocrinology, Diabetes and Metabolism to know and understand the evidence that in people with diabetes:
(1) glycemic control reduces the risk of microvascular events (retinopathy, nephropathy and neuropathy) and may reduce macrovascular events;
(2) treatment of dyslipidemia reduces the risk of macrovascular events;
(3) treatment of hypertension and even early nephropathy reduces end-stage renal disease and other microvascular as well as macrovascular events;
(4) aspirin reduces macrovascular events;
(5) treatment of early retinopathy reduces blindness;
(6) foot care reduces amputations; and
(7) implementation of Standards of Care results in better glycemic control and reduces costs.

Treatment Goals and Minimum Outcome Measures
Additional objectives are to know, understand and pursue the recommended treatment goals (updated by the ADA in each January issue of Diabetes Care) and minimum outcome measures shown in the following tables.

<table>
<thead>
<tr>
<th>Treatment Goals</th>
<th>Goal</th>
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<tr>
<td>Hemoglobin A1c (%)</td>
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<tr>
<td>Preprandial glucose (mg/dL)</td>
<td>90-130</td>
<td>&lt;80, &gt;140</td>
</tr>
<tr>
<td>Peak postprandial glucose</td>
<td>&lt;180 mg/dL</td>
<td></td>
</tr>
<tr>
<td>Bedtime glucose (mg/dL)</td>
<td>100-140</td>
<td>&lt;100, &gt;160</td>
</tr>
<tr>
<td>LDL-C (mg/dL)</td>
<td>&lt;100</td>
<td>&gt;130</td>
</tr>
</tbody>
</table>
Triglycerides (mg/dL) | < 150 | > 400
--- | --- | ---
Blood Pressure (mmHg) | < 130/80 | > 135/90
Urine microalbumin | Normal | Elevated

*Actions might include additional self management education, medical nutrition therapy, or both; increased glucose monitoring, patient contact, or both; adjustment of meal plan, exercise, or pharmacological therapy. In some individual patients it may be appropriate not to act, but the rationale for that decision should be made explicit. These goals need to be modified for children with diabetes.

**Minimum Outcome Measures**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobin A₁c</td>
<td>Annually*</td>
</tr>
<tr>
<td>Dilated Eye Exam</td>
<td>Annually</td>
</tr>
<tr>
<td>Foot Exam</td>
<td>Annually</td>
</tr>
<tr>
<td>Blood Pressure</td>
<td>Annually</td>
</tr>
<tr>
<td>Urine Microalbumin</td>
<td>Annually</td>
</tr>
<tr>
<td>Fasting Lipid Profile</td>
<td>Annually</td>
</tr>
<tr>
<td>Self Management Education</td>
<td>Annually</td>
</tr>
<tr>
<td>Medical Nutrition Therapy</td>
<td>Annually</td>
</tr>
<tr>
<td>Serum TSH</td>
<td>Annually</td>
</tr>
<tr>
<td>Self Blood Glucose Monitoring</td>
<td>Yes</td>
</tr>
<tr>
<td>Tobacco Counseling</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*ADA Recommendation: Quarterly until glycemic control is achieved, then semiannually or annually.

**Comprehensive Patient Evaluation**

Given this knowledge it is our objective to teach fellows to evaluate patients with diabetes comprehensively including assessments of:

1. glycemic control (long-term with HbA₁c, short-term with the history and the SMBG log including identification of both hyper- and hypoglycemia);
2. blood pressure control;
3. lipid control (fasting lipid profile);
4. the status of microvascular complications (history, dilated eye examination, detailed foot examination including monofilament testing, urine albumin);
5. macrovascular complications (history, cardiovascular examination);
6. the need for additional self management education, medical nutrition therapy, or both;
7. smoking status.

These basic principles are emphasized throughout the fellow’s training experience in our inpatient and outpatient care settings as well as in our didactic program and our clinical conferences. It is our premise that, while complications of diabetes must be detected and treated in their early stages, the prevention of complications through comprehensive diabetes care is the new paradigm in the management of diabetes.

An additional objective of our program is to provide, through research experience and didactic instruction, insights into the basic and clinical scientific advances that will lead to improvements in the prevention and treatment of diabetes and its complications.

**Clinical Experience**

Our training program provides opportunities for the fellow in Endocrinology, Diabetes and Metabolism to develop clinical competence and expertise in the management of diabetes. Our educational program – including the mission of the Division of Endocrinology, Diabetes and Metabolism, the educational goals and objectives and the anticipated educational...
outcomes of our fellowship program, its methodologies for teaching, faculty, methods of evaluation and its educational settings (inpatient consultations, outpatient clinics and conferences including the formal didactic program) – was detailed in Section I. Our facilities and resources were described in Section II. Its clinical experiences as they relate to diabetes are described in the paragraphs that follow.

The clinical experiences of our fellows include opportunities to diagnose and manage inpatients and outpatients, representing adolescent and adult patients of both sexes and representing variable acuity, with both types 1 and type 2 diabetes as well as the uncommon types of diabetes. It also includes opportunities for the fellow to function in the role of consultant for patients and other physicians and services in both inpatient and outpatient settings.

Training in comprehensive diabetes care occurs repetitively in the setting of the fellow’s supervised inpatient and outpatient care of people with diabetes in the context of our didactic diabetes teaching program. The latter includes Lectures (e.g., Standards of Care for People with Diabetes, Management of Type 1 Diabetes, Management of Type 2 Diabetes, Diabetic Ketoacidosis and Nonketotic Hyperosmolar Syndrome, Diabetic Macro- and Microvascular Complications, Dyslipidemia, Hypertension, and Hypoglycemic Syndromes), as well as self-directed and faulty-directed reading about diabetes, including both specific and generic reading.

In this context fellows become competent and then expert in the comprehensive management of diabetes through supervised, progressive responsibility for the care of people with diabetes in their inpatient and outpatient activities throughout their fellowship training. This allows them to observe the natural history of diabetes and its complications, as well as the effectiveness of therapeutic interventions. Fellows have experience representing variable acuity and the full spectrum of diabetes. To accomplish these goals, more than 30% of the training in diabetes occurs in ambulatory care settings.

**Patient Encounters, Fellow Supervision and Evaluation**

Patient encounters are supervised by a member of the Endocrinology, Diabetes and Metabolism faculty who reviews the historical, physical and other information gathered by the fellow with that fellow at the bedside/examination table and provides immediate confirmatory or corrective feedback. That faculty member then reviews the fellow’s diagnostic and therapeutic plans, again providing immediate feedback. Learning is facilitated further by self-directed reading of the literature, reading suggested by the responsible faculty member, or both and by patient follow-up. The latter includes analysis of subsequent laboratory findings and of the patient’s course with refinement of the management plan over time, again in consultation with the responsible faculty member. Thus, learning is evaluated by direct observation of the fellow by the faculty member and discussions with that and other faculty and colleagues including presentations at rounds and case conferences as well as by formal written self-assessment (e.g., ESAP, ASAP, or both).

**Biochemistry and Physiology**

Our curriculum emphasizes biochemistry and physiology, including cell and molecular biology as they relate to diabetes and its complications. These are fundamental to the management of diabetes. The appropriate utilization and interpretation of clinical laboratory, radionuclide and radiologic studies for the treatment of diabetes is stressed throughout the clinical and didactic program.

**Preventive Care**
Fellows have clinical experience in multidisciplinary diabetes education and treatment programs. As detailed earlier, our program emphasizes the training of fellows in the preventive aspects of diabetes care (i.e., glycemic control, lipid control, blood pressure control, aspirin, smoking cessation etc. and the identification and treatment of early microvascular and macrovascular complications) in the context of the Standards of Care and Outcome Measures recommended by the American Diabetes Association (updated each January in *Diabetes Care*) [or the Medical Guidelines for the Management of Diabetes Mellitus recommended by the American Association of Clinical Endocrinologists (*Endocrine Practice* 6:43, 2000).] Patient education – by the physician, the diabetes educator, the nutritionist and other specialists – is a fundamental component of diabetes care. Because diabetes is so common, patients with this disease are seen by fellows in virtually all of their inpatient and outpatient encounters and the team approach is also utilized in all of those settings. In addition, multidisciplinary diabetes education and treatment is the central focus of our Diabetes Clinic (specify).

**Accreditation Council for Graduate Medical Education Program Requirements**

The ACGME Program Requirements for Residency Education in Endocrinology, Diabetes and Metabolism include a heavy emphasis on diabetes. We include these guidelines for your reference.

**III.A.4.** Residents must have clinical experience in a multidisciplinary diabetes and education program.

**III.A.5.** Residents must have formal instruction, clinical experience, or opportunities to acquire expertise in the evaluation and management of the following disorders…

c. Type 1 and 2 diabetes mellitus including
   (1) Patient monitoring and treatment objectives in adolescents and adults
   (2) Acute and chronic complications, including
      (a) Diabetic ketoacidosis
      (b) Hyperosmolar non-ketotic syndromes
      (c) Hypoglycemia
      (d) Microvascular and macrovascular disease, including
         (i) Diabetic Retinopathy
         (ii) Diabetic nephropathy
         (iii) Diabetic neuropathy
         (iv) Dermatologic aspects of diabetes
      (v) Coronary heart disease
      (vi) Peripheral vascular disease
      (vii) Cerebrovascular disease
    (e) Infections in the diabetic patient
    (3) Gestational diabetes
    (4) Diabetes mellitus in the pregnant patient
    (5) The surgical patient with diabetes mellitus
    (6) Patient education
    (7) Psychological issues
    (8) Genetics and genetic counseling as it relates to patients with endocrine and metabolism disorders
    (9) Dietary principles

**III.B.5.** (Provision must be made for the residents to acquire experience and skill in the following areas:) Management of adolescent and adult patients of all ages with diabetes
mellitus, including but not limited to the following aspects of the disease:
(a) The utilization and interpretation of autoimmune markers of type 1 diabetes in patient management and counseling
(b) Prescription of exercise program
(c) Rationale for and calculation of diabetic diets
(d) Oral antidiabetic therapy
(e) The use of intravenous insulin in acute decompensated diabetes mellitus
(f) Chronic insulin administration, including use of all varieties of insulin delivery systems
(g) Glucose monitoring devices
(h) Funduscopic examination, recognition, and appropriate referral of patients with diabetic retinopathy
(i) Foot care
(j) Psychosocial effects of diabetes mellitus on patients and their families
(k) Patient and community education

III.C.1. The formal curriculum of the program must, at a minimum, provide instruction in the following:
(1) Pathogenesis and epidemiology of diabetes mellitus
(2) Genetics as it relates to endocrine diseases
(3) Developmental endocrinology, including growth and development and pubertal maturation, as it relates to diabetes.
(4) Endocrine physiology and its pathophysiology in diabetes and principles of hormone action.
(5) Biochemistry and physiology, including cell and molecular biology and immunology, as they relate to diabetes.
(6) Signal transduction pathways and biology of hormone receptors.

Fellows in our program have formal instruction, clinical experience or opportunities to acquire expertise in each of these areas. The methods of education/educational settings and the methods of evaluation are detailed in the table.

Technical and Other Skills
Fellows also develop technical and other skills relevant to diabetes. The issues of the performance of endocrine clinical laboratory and radionuclide studies and basic laboratory techniques – including quality control, quality assurance and proficiency standards – are addressed specifically in the fellow’s didactic program. In addition, fellows gain experience in these areas in their clinical and research activities.
Provision is made for the fellows to acquire experience and skill in the interpretation of laboratory tests, including those based on immunoassays, radionuclide, ultrasound, radiologic and other imaging studies and the effects of a variety of non-endocrine disorders on laboratory and imaging studies, and performance and interpretation of stimulation and suppression tests. This occurs in their inpatient and outpatient activities and in their patient-based conferences including the didactic program.
Provision is also made for the fellows to acquire experience and skill in the management of adolescent and adult patients of all ages with diabetes mellitus, including the utilization and interpretation of autoimmune markers of type 1 diabetes in patient management and counseling, prescription of exercise programs, the rationale for and calculation of diabetic diets, oral antidiabetic therapy, the use of intravenous insulin administration in acute decompensated diabetes, the use of all varieties of insulin delivery systems, glucose monitoring devices, funduscopic examination and recognition and appropriate referral of
patients with diabetic retinopathy, foot care, psychosocial effects of diabetes on patients and their families, and patient and community education. They acquire experience and skill in each of these aspects of diabetes care through conferences and their inpatient and outpatient activities. Among the latter, the Diabetes Clinic focuses specifically on diabetes care including the team concept and approaches to the prevention of complications.

**Formal Instruction**
The curriculum of our training program provides formal instruction in the pathogenesis and epidemiology of diabetes and genetics as it relates to diabetes. This occurs in lectures, clinical conferences and research seminars as well as in patient care settings. Indeed, discussions of issues such as the relative roles of insulin deficiency and insulin resistance in the pathogenesis of type 2 diabetes, the possible reasons for the increasing incidence of diabetes in developing as well as developed countries, and the most recent insights into the molecular genetics of diabetes are recurring topics in the fellows’ clinical and research activities. Thus, there is considerable informal as well as formal instruction in these areas.

Finally, fellows also receive formal instruction in developmental endocrinology – particularly growth, development and pubertal maturation – as it relates to diabetes, in endocrine physiology and pathophysiology in diabetes and systemic diseases and principles of hormone action, in biochemistry and physiology, including cell and molecular biology and immunology, as they relate to endocrinology and metabolism in general and diabetes in particular, and signal transduction pathways and biology of hormone receptors. These are fundamental to the practice of modern endocrinology, diabetes and metabolism including clinical diabetology.
Gonadal Disorders

Introduction
Endocrinology of the reproductive system encompasses normal pubertal development and adult male and female reproductive function and the effects of excesses or deficiencies of reproductive hormones on other body systems. Issues in reproductive endocrinology are extremely prevalent in the population, highlighting the importance of this area in an endocrine training program. Disorders of this system may arise at a hypothalamic, pituitary or gonadal level as a result of a primary abnormality or secondary to abnormalities in other endocrine or non-endocrine organs. These disorders may present as primary or acquired hypogonadism, infertility, or erectile dysfunction or with evidence of hyperandrogenism or hyperestrogenism. In addition, this area includes abnormalities of primary or secondary reproductive end organs such as skin, penis and accessory sex organs such as prostate, uterus, or breast. This is an extremely important area of endocrinology, not only due to the prevalence of primary abnormalities of the reproductive system per se, but also because of the profound impact of gonadal hormone abnormalities on other endocrine and non-endocrine systems including bone, thyroid, adrenal, metabolic, dermatologic, cardiovascular, muscle, neurologic and psychiatric. Disorders of non-reproductive systems may be hormone dependent and conversely non-reproductive disorders often affect the reproductive axis.

Discussion

Goals
It is our intention that the fellow develops the following:

1. An understanding of the physiology of: (1) normal male and female adrenarche and puberty; (2) the normal menstrual cycle; (3) normal male reproductive physiology; (4) the physiology of the menopause and the physiology of reproductive aging in men and women; and (5) an understanding of the genetics of disorders of the reproductive system.

2. An understanding of the biochemistry, cell biology, and molecular biology of gonadotropin-releasing hormone, the gonadotropins, gonadal steroids and the inhibin/activin/follistatin family of proteins; an understanding of factors involved in growth and differentiation of the gonads (including germ cell development ), internal genitalia and accessory sex organs, and autocrine/paracrine interactions in reproductive function; knowledge of the mechanism of gonadotropin and steroid hormone action.

3. Familiarity with the types of assays available for the measurement of gonadotropins, steroids, inhibins and insulin and the clinical utility of these assays in the diagnosis and management of patients with reproductive disorders; familiarity with the evaluation and interpretation of semen analysis.

4. An understanding of how to perform, evaluate and determine the utility of dynamic provocative endocrine testing as it applies to the reproductive system.

5. An understanding of how to evaluate and determine the utility of pelvic ultrasonography and hypothalamic/pituitary, adrenal, prostate and testicular imaging, and bone densitometry.
6. A comprehensive understanding of how to evaluate and manage disorders of sexual differentiation, disorders arising in the pediatric age group including congenital adrenal hyperplasias, chromosomal disorders such as Turner and Klinefelter syndromes, and precocious or delayed puberty.

7. A comprehensive understanding of how to evaluate and manage female reproductive disorders including: (1) primary amenorrhea; (2) secondary amenorrhea or oligomenorrhea; (3) galactorrhea; (4) hyperandrogenism; (5) dysfunctional uterine bleeding; (6) ovarian lesions; (7) premenstrual symptoms; (8) peri-menopausal and menopausal symptoms; and (9) infertility. The fellow may also receive training in ovulation induction.

8. A comprehensive understanding of how to evaluate and manage male reproductive disorders including: (1) primary and acquired male hypogonadism; (2) gynecomastia; (3) erectile dysfunction; (4) testicular masses; (6) prostatic disorders; and (7) fertility disorders including induction of spermatogenesis.

9. Due to their prevalence the following areas should receive special attention: (1) the diagnosis, pathophysiology, and genetics of polycystic ovarian syndrome and its metabolic consequences; (2) male subfertility, erectile dysfunction and prostate disorders; and (3) perimenopausal and menopausal management, including decreased libido.

10. An understanding of the clinical presentation and prevalence of hormone producing neoplasms of the testis and ovary and of tumors that affect hypothalamic and pituitary function; familiarity with the treatment of hormone responsive tumors and disorders (breast, prostate, endometrium, neurologic).

11. An understanding of the effects of age on the reproductive axis in men and women and the subsequent effects of hypogonadism on other systems.

12. An understanding of the effects of acute and chronic disease on the reproductive system in men and women.

13. An understanding of the interaction of psychosocial disorders with the reproductive system including premenstrual dysphoric disorder, eating disorders, perimenopausal mood disorders, sexual dysfunction, decreased libido and substance abuse and facility in basic counseling and triage in these areas.

14. An understanding of the physiology and importance of the following drugs as they apply to the reproductive system: (1) GnRH, GnRH agonists/ antagonists, gonadotropins; (2) hormonal contraceptives; (3) selective androgen and estrogen receptor modulators (SARMS and SERMS); (4) hormone replacement therapy in men women; (5) non-hormonal strategies for menopause management; and (6) non-prescription and environmental compounds.

15. An understanding of the emerging technologies and treatment and how they impact on the comprehensive management of reproductive endocrine disorders including assisted reproductive technologies and genetic testing and facility in counseling patients regarding these options.
Training
1. The training program must provide opportunities for the fellow to develop clinical competence in reproductive endocrinology. The opportunity to diagnose and manage male and female adolescent and adult patients with reproductive endocrine disorders will occur primarily in an outpatient setting due to the generally non-acute nature of these problems, but must also include attention to reproductive endocrine issues in inpatients with other endocrine and non-endocrine diagnoses. This training is likely to require interaction with pediatric endocrinology, gynecology, urology, oncology, genetics, surgery, pathology, radiology and/or other subspecialties.

2. The fellow must be given the opportunity to assume responsibility for and follow patients with reproductive endocrine disorders throughout the training period. Due to the nature of these disorders, the majority of follow-up will be in outpatient settings. Appropriate experience with the spectrum of reproductive endocrine disorders in adolescents and in male and female patients may require that fellows see patients with a number of different attendings or in several different types of clinics.

3. In addition to mentored inpatient and outpatient diagnosis and management of patients with endocrine abnormalities pertaining to the reproductive system, fellows must given the opportunity to gain experience with case presentation and critique in informal and formal settings to develop their own skills as teachers and consultants.

4. Due to the rarity of certain conditions and the need to cover a broad spectrum of reproductive endocrine disorders in males, females and adolescents, patient encounters must be supplemented by an ordered series of sessions that may be either didactic or problem-oriented in approach.

5. Formal instruction must be provided in the types of assays used for measurement of gonadotropins, steroids and inhibins and the concepts of standards, sensitivity and specificity as they pertain to these hormone assays. Individualized instruction must also be provided in examination of the pelvis, breast, testis and prostate and in semen analysis. Formal instruction and experience in induction of spermatogenesis must be provided. Other technologies, which have an impact on diagnosis and management of disorders of the reproductive system, may be included such as pelvic ultrasound and induction of ovulation.

6. Self-assessment tools should be available to assist the fellow in acquiring knowledge in reproductive endocrine areas.

Evaluation
Fellows should be evaluated on their clinical skills in patient interactions, physical diagnosis, differential diagnosis and formulation of evaluation and treatment plans throughout the training period. Feedback must be given in an ongoing manner in the clinical setting and formal verbal and written evaluation must be provided at year-end. Procedures must be monitored in an ongoing way throughout the training period and ongoing verbal feedback provided to the fellow. Case presentations in formal and informal settings will provide an important means of evaluating students and advantage should be taken of the available self-evaluation programs.
Hypothalamic-Pituitary Disorders

Introduction
Growth, development and reproduction are regulated by the interactions of the endocrine and nervous systems. The pituitary regulates endocrine organs under the influence of the hypothalamus. Disorders of the pituitary and hypothalamus may therefore cause isolated or multisystem endocrine hypofunction and hyperfunction. Furthermore, expanding lesions of the pituitary/hypothalamic area may cause neurologic dysfunction.

Goals: Fellows will acquire an understanding of (1) neuroendocrine physiology, specifically hypothalamic/pituitary anatomy and morphology, regulation of hormone secretion, cellular and molecular mechanisms of action (receptors, signal transduction pathways, gene interaction); (2) the pathophysiology, clinical manifestations, diagnostic approaches, and treatment of hypothalamic and pituitary dysfunction. By the end of their training, fellows will be competent in the evaluation and management of patients with hypothalamic-pituitary disorders (see below).

Training and Evaluation: These objectives will be accomplished through a combination of interdisciplinary conferences, formal lectures, case discussions, direct clinical experience, and self-directed learning. Clinical training will include close interactions with other related disciplines, including neurosurgery, neuroradiology, neurology, neuro-ophthalmology, pathology, and nuclear medicine. Fellows will receive regular evaluations through frequent individual assessments from supervising faculty and semiannual evaluations by the Program Director.

Discussion

Diagnostic Testing
The fellow will be able to understand the indications, performance and interpretation of the following tests.

Basal Hormone levels
(1) prolactin (PRL)
(2) insulin-like growth factor-1 (IGF-1)
(3) growth hormone (GH)
(4) free thyroxine (T4)
(5) thyrotropin (TSH)
(6) cortisol (plasma and urine, including metabolites)
(7) adrenocorticotropic hormone (ACTH)
(8) luteinizing hormone (LH)
(9) follicle stimulating hormone (FSH)
(10) testosterone/estradiol
(11) serum osmolality
(12) urine osmolality

Dynamic Testing
(1) Insulin-hypoglycemia stimulation (insulin tolerance test)
(2) Thyrotropin Releasing Hormone (TRH) stimulation test
(3) Gonadotropin Releasing Hormone (GnRH) stimulation test
(4) Corticotropin Releasing Hormone (CRH) stimulation test
(5) GH stimulation tests (L-dopa, arginine, clonidine, exercise, glucagon, GH
Releasing Hormone [GHRH, insulin-hypoglycemia)
(6) ACTH (cosyntropin) stimulation test
(7) Metyrapone test
(8) Dexamethasone suppression test
(9) Oral glucose suppression test
(10) Water deprivation test.

Neuroradiology
The fellow will understand the indications for and interpretation of the following procedures:
Magnetic Resonance Imaging (MRI)
Computed Tomography (CT)

Neuro-ophthalmology
The fellow will understand the indications for and interpretation of formal visual field examinations

Other Tests (growth charts, radiologic bone age)

Treatment Modalities
The fellow will understand the indications, advantages and adverse effects of surgical, medical and irradiation (conventional and stereotactic) therapies for hypothalamic-pituitary disorders.

Specific Disorders
The fellow will receive formal instruction, and clinical experience in the evaluation and management of the following disorders.

Pituitary Adenomas

Prolactinomas
(1) Manifestations (galactorrhea, amenorrhea, infertility, erectile dysfunction, osteopenia, neurologic mass effects)
(2) Diagnostic tests (basal PRL, assessment for hypopituitarism when indicated, exclusion of other causes of hyperprolactinemia, MRI)
(3) Management options (dopamine agonists, surgery, and irradiation)
(4) Special considerations for pregnancy and MEN1

GH-secreting adenomas
(1) Manifestations (acromegaly, gigantism, neurologic mass effects)
(2) Diagnostic tests (IGF-1, glucose suppression test of GH, assessment for hypopituitarism when indicated, MRI)
(3) Management options (surgery, somatostatin analogs, GH antagonists, and dopamine agonists, irradiation)
(4) Special considerations - ectopic GHRH syndrome, assessment for co-secretion of PRL, TSH, ACTH, association with MEN1

ACTH-secreting adenomas
(1) Clinical manifestations – Cushing’s syndrome
(2) Diagnostic tests (urinary free cortisol, ACTH, dexamethasone suppression testing, CRH testing, MRI, Inferior Petrosal Sinus Sampling, assessment for hypopituitarism when indicated)

(3) Management options (surgery, irradiation, medical [ketoconazole, mitotane, metyrapone, and other agents])

(4) Special considerations - differential diagnosis from ectopic ACTH and ectopic CRH is critical; Nelson’s syndrome

**TSH-secreting adenomas**

(1) Clinical manifestations - hyperthyroidism

(2) Diagnostic tests (Free T4, TSH, alpha-subunit, consideration for TRH testing, MRI, assessment for hypopituitarism when indicated)

(3) Management options (surgery, irradiation, and somatostatin analogs)

(4) Special consideration - differential diagnosis from thyroid hormone resistance is critical

**Gonadotropin cell adenomas**

(1) Clinical manifestations - mass effects (neurologic dysfunction, hypopituitarism)

(2) Diagnostic tests (LH, FSH, glycoprotein subunits, TRH test, assessment for hypopituitarism, MRI, visual field assessment when indicated)

(3) Management options (surgery, irradiation)

**Non-secreting tumors**

(1) Clinical manifestations - mass effects (neurologic dysfunction, hypopituitarism)

(2) Diagnostic tests (assessment for hypopituitarism, MRI, visual field assessment when indicated)

(3) Management options (surgery, irradiation)

**Space-occupying and Infiltrative Disorders of the Pituitary and Hypothalamic Region**

Space occupying lesions (Craniopharyngiomas, Rathke’s cleft cysts, meningiomas, arachnoid cysts, chordomas, dysgerminomas, hamartomas, gangliocytomas, abscess, metastases)

Infiltrative/inflammatory disorders (sarcoidosis, tuberculosis, Langerhans cell histiocytosis, lymphoma, lymphocytic hypophysitis, hemochromatosis)

**Hypopituitarism/Panhypopituitarism**

(1) Clinical manifestations (growth failure, fatigue, decreased strength, body hair loss, fine facial skin wrinkling, infertility, amenorrhea, erectile dysfunction, constipation, cold intolerance, bradycardia, orthostatic hypotension)

(2) Etiology

   Congenital (gene, receptor, embryopathic)

   Acquired (tumors, infiltrative, trauma, apoplexy and Sheehan’s, irradiation, metabolic [weight loss, anorexia nervosa, malnutrition, hemochromatosis, critical illness], drug (corticosteroids, dopamine)

**Selective hormone deficiencies**

(1) Gonadotropins (Kallmann’s syndrome, weight loss, idiopathic)

(2) ACTH (iatrogenic from glucocorticoid suppression, idiopathic very rare)

(3) TSH (rare)

(4) Growth Hormone
Child onset (congenital or acquired)
(i) Manifested as growth failure
(ii) Differential diagnosis (hypothalamic vs pituitary, GH insensitivity syndrome, differentiate from non GH deficiency causes of short stature [systemic disease, dyschondroplasias, Turner’s syndrome, psychosocial, etc. ])
Adult onset is usually associated with other hormone deficiencies in panhypopituitarism. See above.

Treatment
(1) Growth hormone administration - dose adjusted by IGF-1 levels Special consideration
   – IGF-1 treatment for GH insensitivity
(2) Thyroxine -dose adjusted clinically and by Free T4 levels
(3) Glucocorticoids - dose adjusted clinically
(4) Estrogen/Progestin - oral, transdermal
(5) Testosterone - injection, transdermal
(6) GnRH - possible utility with hypogonadotropic hypogonadism of hypothalamic etiology
(7) HCG and HMG/FSH - for fertility in men and women

Posterior Pituitary Disorders

Diabetes Insipidus
(1) Clinical Manifestations - polyuria, polydipsia, thirst, dehydration

(2) Differential diagnosis
   Central vs. nephrogenic
Congenital (familial) vs. acquired (see causes of hypopituitarism plus drug induced [cisplatin, carbamazepine, lithium, vincristine,etc.] plus metabolic [hypercalcemia, hypokalemia], sickle cell anemia)
   Psychogenic polydipsia
   Others causes of polyuria

(3) Diagnostic testing
   Overnight water deprivation test
   Measurement of vasopressin
   Diagnostic trial of desmopressin
   MRI
   Assessment of anterior pituitary function

(4) Treatment
   Desmopressin - nasal, oral, parenteral
   Chlorpropamide
   Thiazide diuretics (esp. nephrogenic)

(5) Special considerations
   Coexistent thirst center damage
   Pregnancy - DI may be transient, may be associated with acute fatty liver of pregnancy

Hyponatremia
(1) Clinical manifestations (nausea, vomiting, headache, confusion, seizures, coma, death)
   - symptoms dependent upon degree and speed of onset
(2) Differential diagnosis
Hypovolemic - appropriate vasopressin (ADH) secretion
Euvolemic - inappropriate ADH secretion (SIADH) {need to exclude hypothyroidism, hypoadrenalism}
Hypervolemic - (intravascular hypovolemia, e.g., cirrhosis, CHF)
(3) Diagnostic tests
   Urine and serum osmolality and urine sodium
   Exclude other causes of hyponatremia (high triglycerides, glucose)
(4) Treatment
   Mild - water restriction
   Severe - saline, hypertonic saline, furosemide, monitor closely to avoid central pontine myelolysis

Miscellaneous Hypothalamic Syndromes
(1) Laurence-Moon-Biedl Bardet
(2) Prader-Willi Syndrome
(3) Sotosí Syndrome (cerebral gigantism)
(4) Pineal region tumors
(5) Empty sella syndrome
Introduction
Hyperlipidemia refers to elevations in plasma cholesterol, triglycerides or both. These are usually due to an increase in the concentration of very low-density lipoprotein (VLDL) and/or low density lipoprotein (LDL) in plasma and result from disturbances in lipoprotein metabolism. The term dyslipidemia is generally used to describe abnormalities in plasma lipoproteins that include low levels of high-density lipoprotein (HDL), and/or abnormalities of lipoprotein composition or distribution. The lipid section requires an understanding of the physiology and pathophysiology of lipoprotein metabolism, the clinical impact of disorders of lipoprotein metabolism, and their treatment. An understanding of the pathobiology of the dyslipidemias requires a fundamental understanding of lipoprotein physiology, and the various sites at which defects can occur in these metabolic pathways. This includes an appreciation of the pathogenesis and diagnosis of both genetic disorders and secondary forms of dyslipidemia that result from the presence of several endocrine and other diseases, lifestyle variations, and/or the use of a variety of drugs. The area of lipids also requires training in the therapy of these disorders. Therapeutic options include both lifestyle (diet and physical activity) and pharmacological therapy.

Importance of Lipids
Many forms of dyslipidemia are associated with an increased risk of cardiovascular disease (CVD), especially coronary artery disease. These include those that have high levels of LDL, and some forms of hypertriglyceridemia, which can be a marker of other abnormalities associated with increased cardiovascular risk. Low levels of HDL in plasma also can be associated with increased CVD risk. Epidemiological studies have demonstrated that the major importance of dyslipidemia is that they are associated with an increased risk of developing accelerated or premature CVD. Clinical trials have shown that CVD symptoms and cardiovascular events can be markedly attenuated by appropriate therapy of these disorders. However, not all forms of dyslipidemia are associated with increased CVD risk. An understanding of the relationship between various forms of dyslipidemia and other cardiovascular risk factors in determining overall cardiovascular risk is important in the prevention and treatment of accelerated or premature CVD. Marked elevations of plasma triglycerides also can result in pancreatitis and other features of the chylomicronemia syndrome. An understanding of the multiple factors that may contribute to marked hypertriglyceridemia and its management, which dramatically reduce the risk of pancreatitis in these patients, is essential.

Discussion
Goals
By the completion of their fellowship, fellows should be competent in the diagnosis of the various common genetic and acquired forms of dyslipidemia. They should have a good understanding of the various laboratory tests that are available to aid in their diagnosis, and should be aware of the strengths and limitations of these diagnostic tests. Fellows also should be competent in the management of these disorders. This includes an understanding of the dietary principles and other life style modifications involved in the treatment of dyslipidemia and in atherosclerosis prevention. The fellow also should be competent to prescribe the major classes of drugs used to treat dyslipidemia, singly and in combination, and be aware of their major side effects.
Training
These skills should be acquired through a variety of means, which may vary between
different programs, depending on the size and specific interest of the faculty, and whether or
not the program includes a clinic dedicated to the diagnosis and treatment of lipid disorders.
Suggested training to acquire these skills might include:

(1) Formal training such a didactic lectures and/or self-directed learning through reading
material concerning physiology and pathophysiology
(2) Familiarity with the latest guidelines for the diagnosis and management of
hyperlipidemic patients that are issued by the National Cholesterol Education Program.
These are updated periodically
(3) Hands on evaluation and follow-up of outpatients with various genetic and acquired
forms of dyslipidemia in either general endocrine continuity clinic or in rotations through
specialized lipid disorders clinic
(4) Lectures and/or reading materials regarding the application of diet therapy and lifestyle
changes
(5) Formal lectures and/or reading material on the pharmacological management of the
hyperlipidemic/dyslipidemic patient

Where no formal lectures are given, a specific list of articles on these topics, common to all
programs, should be provided to fellows at the beginning of their fellowship experience.

Specific Disorders of Lipid Metabolism
Triglyceride
Chylomicrons (risk for pancreatitis)
LPL deficiency
Mix of two common disorders: chylomiconemia syndrome
VLDL (with low HDL)
familial hypertriglyceridemia (FHTG)
familial combined dyslipidemia (FCHL)
diabetic dyslipidemia
Type III, remnant removal disease
Cholesterol
With increased triglyceride: FHTG, FCHL, diabetes
LDL: defective LDL receptor or ligand
Lp(a)

Other Endocrine Dyslipidemia
Hypothyroidism
Cortisol excess
Acromegaly
Estrogen, testosterone
(Other) drugs, alcohol
Management
Severe hypertriglyceridemia and pancreatitis
Atherosclerosis risk: LDL level and heterogeneity, Lp(a), low HDL with and without high
triglyceride
Special considerations

One area that requires special emphasis is the approach to the diagnosis and management of diabetic dyslipidemia and the dyslipidemia that frequently accompanies insulin resistance. The focus in many diabetic clinics is on management of hyperglycemia, which has been convincingly shown to be of benefit to the prevention of microvascular complications of diabetes. However, the major cause of morbidity and mortality in this disease is due to complications of macrovascular disease. An approach to the prevention and treatment of the macrovascular complications of diabetes is often inadequately emphasized in the management of the diabetic patient. With the increasing awareness of the importance of treatment of dyslipidemia and other modifiable risk factors in addition to hyperglycemia, special emphasis on the management of diabetic dyslipidemia, and the dyslipidemia that accompanies the insulin resistant syndrome, should be included as part of the lipid curriculum. This includes knowledge of the specific changes in lipids and lipoproteins that occurs in diabetes and the insulin resistance syndrome, how these changes are affected by the management of hyperglycemia, specific approaches to the management of these lipid abnormalities in diabetes, and a global approach to CVD risk factor management in diabetes and the insulin resistance syndrome.

Another area that requires emphasis is the management of the patient with marked hypertriglyceridemia. Elevation of plasma triglycerides to levels that put a patient at risk of pancreatitis usually results from a combination of a common genetic form of hypertriglyceridemia with one or more acquired forms of hypertriglyceridemia, and/or the use of lipid raising drugs. Marked hypertriglyceridemia is one of the most common causes of recurrent pancreatitis, but frequently is not diagnosed and treated appropriately. It is important that fellows understand the interaction of genetic and secondary forms of hypertriglyceridemia in the etiology of marked hypertriglyceridemia. At the completion of their fellowship, fellows should be able to identify the major genetic and acquired conditions that are involved in the causation of marked hypertriglyceridemia. They also should be competent in the management of this condition, with a view to the prevention of recurrent pancreatitis.

An uncommon condition that fellows should be competent with the diagnosis and treatment of is remnant removal disease (type III hyperlipoproteinemia), or remnant removal disease. General internists or primary care physicians usually do not correctly diagnose this genetic form of dyslipidemia. The clinical and laboratory features that lead to the diagnosis of this relatively uncommon condition should be part of the lipid curriculum for endocrinology fellows. Fellows also should be aware of the different therapeutic options in this condition. With the advent of newer and improved lipid-lowering agents, combinations of drugs that affect lipid metabolism are being used more frequently. Some of these combinations are rational, effective, safe and cost effective. Others are associated with potentially dangerous side effects. It is important that fellows understand the relative risks and benefits of combination therapy for the treatment of dyslipidemia. In rare instances with high LDL that is resistant to therapy, apheresis may be indicated.

There are a number of rare disorders of lipid and lipoprotein metabolism, which have provided considerable insight into our understanding of lipid and lipoprotein metabolism. These include lecithin cholesteryl acyl transferase deficiency, hepatic lipase deficiency, cholesterol ester transport protein deficiency, apolipoprotein CII deficiency, abetalipoproteinemia and Tangier disease. For example, the recent identification of the molecular defect in Tangier disease has provided important insight into the understanding of reverse cholesterol transport. However, most practicing endocrinologists and even lipid specialists are unlikely to see any of these conditions in their lifetime. Therefore, a detailed working knowledge of these conditions should not be a requirement for the lipid curriculum.
A less rare condition is hypobetalipoproteinemia. Fellows should be familiar with this condition, its diagnosis and implications.

**Evaluation**

The attending physicians with whom they work in their continuity and subspecialty clinics should evaluate fellows at least annually. Evaluations must include comments regarding clinical judgment, medical knowledge, clinical skills, humanistic qualities, professionalism, medical care, and continuing scholarship (ABIM).
Nutrition and Obesity

Introduction
Endocrinology is concerned with the actions of hormones and the organs and tissues in which the hormones are formed. A number of hormones are particularly involved with fuel, vitamin, and mineral metabolism. They are profoundly involved in substrate flux and the utilization of food for energy production and storage. Their importance in nutrition is therefore great. A practicing endocrinologist must have a basic knowledge of nutrition to understand the endocrine interactions that occur. At a minimum, there must be in an endocrinology subspecialty training curriculum a core knowledge in nutrition (including nutrition support), and an understanding of eating disorders (including obesity, anorexia nervosa and bulimia).

The goals for the training of Endocrine Fellows in Nutrition are to have a working knowledge of the above conditions, both basic pathophysiology and treatment modalities.

Discussion

Core Knowledge in Nutrition
Fuel Metabolism
Role of hormones and peptides in the regulation of fuel metabolism
Central Nervous System Regulation
Micronutrient Requirements
Vitamins: A, D, E, K, folate, ascorbate, thiamine, riboflavin, niacin, B12, biotin, pantothenic acid, pyridoxine
Antioxidants
Inositol, choline, carnitine
Minerals: Ca, P, Mg, Mn, Fe, Zn, Cu, Se, iodine
Vitamins and Minerals
(1) Sources in the diet: bioavailability and absorption
(2) Parenteral preparations
(3) Metabolism
(4) Antagonists
(5) Drug/nutrient interactions
(6) Deficiency syndromes
(7) Excess syndrome
(8) DRIs (normal requirements)
(9) Dietary supplements

Macronutrient Utilization: carbohydrates, proteins and fats
Modulation of Disease Processes by nutrients in food and by dietary supplements (carcinogenesis, diabetes mellitus, cardiovascular disease, pregnancy, metabolic bone disease)

Obesity
Who Are the Obese?
(1) body composition
(2) prevalence

What Causes Overweight?
(1) gene/environment interactions
(2) energy balance
(3) neuro-endocrine causes: rare hypothalamic obesity syndromes, pituitary, adrenal, thyroid, PCO, insulin resistance, leptin deficiency
(4) drug induced
(5) primary psychiatric

Health Hazards
(1) insulin resistance leading to the metabolic syndrome
(2) mechanical complications
Clinical Classification and Natural History
Clinical Evaluation

Treatment
(1) behavior modification
(2) diet treatments including:
   high protein, high fat, low carbohydrates, protein-supplemented modified fast, liquid diets
   low fat, high carbohydrate diets, traditional diet (ADA, AHA), non-traditional diets
(3) physical activity
(4) pharmacological treatment
(5) surgery
(6) setting up a weight management practice
(7) complications of treatment (e.g., gallstones, electrolyte abnormalities, arrhythmias, vitamin deficiency)

Obesity Clinical Trials – evaluation and interpretation

Eating Disorders

Anorexia/Bulimia
The Clinical Syndromes
(1) anorexia: diagnosis, full blown syndrome, pre"syndrome"
(2) bulimia: purging, exercise, laxative, exercise as purging

Neuro-Endocrine Metabolic Abnormalities
(1) gonadotropin abnormalities
(2) hypo metabolic manifestations
(3) HPA axis interrelations
(4) other pituitary abnormalities: GH, prolactin
(5) estrogen abnormalities

Clinical Sequelae
(1) osteoporosis
(2) amenorrhea
(3) dentition
(4) CVD

Psychological Characteristics

Treatment

Nutrition Support
Energy Malnutrition (Marasmus) head and neck cancer, malabsorption, CNS disease, anorexia and bulimia, GI obstruction, iatrogenic, drug induced, senescence

Protein Malnutrition (Adult Kwashiorkor-Like Syndrome) critical illness acute vs sustained/chronic, trauma, burn, protein-losing enteropathy, HIV, cancer, nephrotic syndrome

Nutritional Assessment

history, physical exams, including anthropometrics, laboratory assessment, body composition: bia DXA, metabolic cart

Treatment

(1) enteral: oral and tube feeding
(2) parenteral
(3) pharmacological (anabolics)
(4) combined modalities
(5) monitoring treatment

Interpretation of Clinical Trials in Nutrition Support

Specific Technical Procedures

Metabolic Cart - Energy Expenditure
DXA for Body Composition
Bioelectrical Impedance Analysis
Total Parenteral Nutrition Formulation/Management

Emergencies

Extreme Obesity

(1) decompensated respiratory failure
(2) decompensated cardiovascular failure
(3) cellulitis and other skin disorders
(4) complications of treatment (acute cholecystitis, arrhythmias)

Anorexia/Bulimia

(1) cardiac arrhythmia
(2) sepsis
(3) hypotension
(4) hypoglycemia
(5) psychosis
(6) electrolyte abnormalities

Parenteral Nutrition

(1) catheter related sepsis
(2) thrombus or emboli
(3) bleeding
(4) hypo and hyperglycemia

Re-feeding Syndrome

(1) volume overload and heart failure
(2) electrolyte abnormalities and arrhythmia
Thyroid Disorders

Introduction
Thyroid specific disorders include both anatomical defects of the thyroid gland as well as disorders due to the effects of thyroid hormones on extrathyroidal tissues. Thyroid disorders are among the most common diseases encountered by the endocrine consultant as they occur in the population with a prevalence greater than 10% in some studies. Furthermore, the incidence of thyroid disorders is rising, in part because our diagnostic tools are much more sensitive and sophisticated. Thyroid disorders account for a significant amount of morbidity in our society and the fellow should be competent in their diagnoses and treatment.

Discussion

Program Requirements
1. The training program provides opportunities for the fellow to develop clinical competence in the area of thyroid disease. Clinical experience includes opportunities to diagnose and manage (1) adolescent and adult inpatients and outpatients of both sexes with (2) a variety of thyroid diseases of (3) varying acuity. The program also includes opportunities to function in the role of an endocrinology consultant for patients and other physicians and services in both inpatient and outpatient settings.

2. The fellows are given opportunities to assume responsibility for and follow patients throughout the training period in both inpatient and outpatient settings to observe the evolution and natural history of thyroid disorders, as well as the effectiveness of therapeutic interventions. To accomplish these goals, the educational program has at least 30 percent of the training in endocrine subspecialty related ambulatory care settings. Residents must have experience representing variable acuity and a wide spectrum of thyroid related diseases.

3. The curriculum emphasizes biochemistry and physiology, including cell and molecular biology, as they relate to thyroid disease. The appropriate utilization and interpretation of clinical laboratory, radionuclide, and radiologic studies for the diagnosis and treatment of thyroid diseases is stressed.

4. Residents do have formal instruction, clinical experience, or opportunities to acquire expertise in the evaluation and management of the disorders listed below as well as aspects of those disorders that relate to: (1) psychiatric disease, (2) aging, with particular emphasis on the care of geriatric patients and thyroid related changes associated with aging, and (3) adaptations and maladaptations to systemic diseases with respect to effects on the hypothalamic-pituitary-thyroid axis.

5. In relation to the diseases listed below, there is formal instruction in: (1) thyroid physiology and pathophysiology in systemic diseases and principals of hormone action, (2) biochemistry and physiology, including cell and molecular biology and immunology, as they relate to thyroid disease, and (3) signal transduction pathways and biology of thyroid hormone receptors and their interaction with other hormone receptor pathways.
6. In relation to the diseases listed below, residents have experience in the performance of endocrine clinical laboratory and radionuclide studies and basic laboratory techniques, including quality control, quality assurance, and proficiency standards. Provision must be made for the fellow to acquire experience and skill in the following areas:

(1) The interpretation of laboratory tests; immunoassays; and radionuclide, ultrasound, radiologic, and other imaging studies for the diagnosis and treatment of thyroid diseases; and

(2) The effects of a variety of non-endocrine disorders on laboratory and imaging studies and performance and interpretation of stimulation and suppression tests as related to thyroid disease; and

(3) Thyroid related emergencies, including:
   (a) Severe hypo- and hyperthyroidism (thyroid storm and myxedema coma);
   (b) Severe thyroid dysfunction during and after pregnancy;
   (c) Tracheal compression from a goiter or from the treatment of thyroid disease;
   (d) Agranulocytosis secondary to anti-thyroid drug therapy.

**Specific Disease Disorders**

The methods of education and methods of evaluation for the disorders of the thyroid are provided in the subsequent table and listed in 6 broad areas.

1. The fellow must have a comprehensive understanding of all causes of thyrotoxicosis. The major method of education will be by direct clinical experiences in the out-patient clinic, by clinical case discussions on attending rounds and in conferences, and by self-directed learning for Graves' Disease, thyroiditis, and toxic nodular goiters. For these disorders the fellow will be evaluated by direct observations and discussions with the faculty, as well as by clinical presentations. For other causes of thyrotoxicosis, the fellow may use self-directed learning, clinical case discussions, or obtain formal instruction to assure adequate understanding of the other causes of thyrotoxicosis.

2. The fellow must have a comprehensive understanding of all causes of hypothyroidism. Autoimmune and post-ablative hypothyroidism should be learned by direct clinical experience in the out-patient setting, as well as by clinical case discussions and self-directed learning. Teaching of the other causes of hypothyroidism may also utilize formal instruction, clinical case discussions, or self-directed learning to meet this objective.

3. The fellow must have a comprehensive understanding of thyroid cancer. Differentiated epithelial thyroid cancer should be learned by direct clinical experience in the out-patient setting and supplemented by experience in the inpatient setting. Further teaching by clinical case discussion and self-directed learning is encouraged. Medullary thyroid cancer should also be learned by direct clinical experience in either the out-patient or inpatient setting with supplementation by formal instruction, clinical case discussion, and self-directed learning. Other causes of thyroid cancer may be taught by clinical case discussions or self-directed learning.

4. The fellow must have a comprehensive understanding of the causes of nodules and goiters. The single nodule, multinodular goiter, and a diffuse goiter should be learned by direct clinical experience in the out-patient setting with supplementation by clinical case discussions and self-directed learning. Other causes of nodules and goiters may be taught by self-directed learning in addition to direct clinical experience and clinical case discussion.
5. The fellow must be familiar with other causes of thyroid dysfunction. These include pregnancy related thyroid dysfunction, polyglandular autoimmune syndrome, and thyroid dysfunction in non-thyroidal disease. These diseases should be learned by direct clinical experience in the in-patient or out-patient setting. They may be supplemented by clinical case discussions and self-directed learning. Other causes of thyroid dysfunction may be taught by self-directed learning in addition to clinical case discussions and direct clinical experience.

6. The fellow must have sufficient experience to become competent in the following procedures. (1) The fellow must perform at least 10 fine needle aspiration biopsies of a thyroid nodule. The fellow is expected to review the cytology with a pathologist who has expertise in interpretation of thyroid cytopathology. (2) The fellow is expected to review imaging studies with individuals who have expertise in interpreting these images. Such studies include thyroid ultrasound and nuclear imaging studies.

The curriculum committee recognizes that proficiency in fine needle aspiration biopsy, which includes indications, interpretation and complication, often requires more than 10 procedures, and encourages the fellow to perform as many as practical during their training.

Evaluation
The evaluation of the fellows in all areas should include direct observations with the patient and discussions with the faculty. Additional evaluations can occur following clinical presentations by the fellow.