Objective: Explain basic anatomy and physiology of the endocrine system

- **Endocrine system**
  - Consists of target glands that produce hormones
  - Hormones:
    - Natural chemicals that exert their effect on specific tissue
    - Travel via the blood
    - Regulate; metabolism, growth and development, tissue function, sexual function, reproduction, sleep and mood

- **Endocrine glands**
  - Pituitary
  - Thyroid
  - Parathyroid
  - Adrenal
  - Pancreas
  - Ovaries in females and testicles in males

- **Negative-feedback mechanism**
  - Keeps a balance
  - Suppressing mechanism when hormone levels are high

- **Diagnostic test for endocrine disorders (Saunders Chapter 54)**
  - Stimulation and suppression test
  - Radioactive iodine uptake
  - T3 and T4 resin uptake
  - Thyroid stimulating hormone test
  - Thyroid scan with radioisotopes
  - Glucose tolerance test
  - Hemoglobin A1c

Objective: explain endocrine organs and the hormones they produce (Iggy pg. 1361)

- **Gonads**
  - Testes in males
  - Ovaries in females
  - Hormone: luteinizing hormone (LH) and follicle-stimulating hormone (FSH)

- **Adrenal gland**
  - Adrenal cortex hormones
    - Mineralocorticoids
    - Glucocorticoids
    - Androgens
  - Adrenal medulla
    - Epinephrine
    - Norepinephrine
- Mineralocorticoids
  - Aldosterone
- Glucocorticoids
  - Cortisol
- Androgens
  - Estrogen and testosterone

- Thyroid gland (Iggy pg. 1363; table 64-5)
  - Hormones
    - Follicular cells
      - Triiodothyronine (T3)
      - Thyroxine (T4)
      - Regulated by TRH and TSH
    - Parafollicular cells
      - Calcitonin (Thyrocalcitonin)
      - Regulated by serum calcium levels

- Parathyroid glands (Iggy pg. 1364)
  - Hormone: PTH
  - Regulates calcium and phosphate

- Pancreas (endocrine function)
  - Alpha cells
  - Beta cells
  - Delta cells

Objective: identify the disorders and the pathophysiology of the anterior pituitary gland

- Hypopituitarism: pituitary gland either fails to produce one or more of its hormones or do not produce enough of the hormones (Iggy pg. 1372)
  - Causes of hypopituitarism
    - Sheehan’s syndrome
    - Deficiency in ACTH and cortisol results in
    - Deficiency in TSH and thyroid hormone results in
    - Deficiency in LH and FSH results in
    - Growth hormone deficiency (Iggy pg. 1372)
      - In children

- Posterior pituitary hormone deficiency
  - Antidiuretic hormone deficiency
    - Diabetes insipidus

- Hyperpituitarism: oversecretion of anterior pituitary hormones
  - Overproduction of GH
    - Gigantism
    - Acromegaly
      - Treatment for gigantism and acromegaly
- **Diagnostic test**
  - Suppression test
  - Imaging test
- **Transsphenoidal Hypophysectomy**
  - Postoperative care (Iggy pg. 1376- pg. 1377 chart 65-3)
- **Drug therapy**
  - Octreotide (Sandostatin)
  - Bromocriptine (Parlodel)
  - Cabergoline (Dostinex)
  - Pegvisomant (Somavert)
  - 

Objective: To identify the disorders and the pathophysiology of the posterior pituitary gland including interventions (Iggy pg. 1378)

- **Diabetes insipidus**
  - Hyposecretion of ADH
  - Types of diabetes insipidus
    - Nephrogenic
    - Primary
    - Secondary
    - Drug induced
  - Sides and symptoms (pg. 1378 chart 65-5)
  - Drug therapy
    - Chloropropamide (Diabinese)
    - Desmopressin acetate (DDAVP)
    - Vasopressin (Pitressin)
  - Nursing intervention

- **Syndrome of Inappropriate Antidiuretic Hormone (SIADH)** (Iggy pg. 1380)
  - Causes
  - Sides and symptoms (related to electrolyte imbalance)
  - Medical interventions
  - Drug therapy
    - Vasopressin antagonist
      - Tolvaptan (Samsca)
      - Conivaptan (Vaprisol)
      - Diuretics
      - Demeclocycline (Declomycin)
      - Hypertonic saline

Objective: To discuss disorders of the adrenal gland (Iggy pg. 1381)

- Types of adrenal insufficiency
  - Addison’s disease (Primary adrenal insufficiency)
    - Adrenal glands cannot produce an adequate amount of hormones despite a normal or increased ACTH level
  - Secondary adrenal insufficiency
• Insufficient amount of ACTH is produced by the pituitary gland
  ▪ Tertiary adrenal insufficiency
  • Insufficient amount of CRH is produced by the hypothalamus.

Deficiencies found in adrenal gland hypofunction
  o Decreased adrenal cortex hormones
    ▪ Cortisol
      • Called the stress hormone
      ▪ Blood sugar (glucose) levels
      ▪ Fat, protein and carbohydrate metabolism to maintain blood glucose (gluconeogenesis)
      ▪ Immune responses
      ▪ Anti-inflammatory actions
      ▪ Blood pressure
      ▪ Heart and blood vessel tone and contraction
      ▪ Central nervous system activation
    ▪ Mineralocorticoids (aldosterone)
      • Regulate sodium and potassium levels
      • blood volume
      • blood pressure
    ▪ Androgens
      • Regulate sexual characteristics
  o Addison’s (Iggy pg. 1382)
    ▪ A decrease in cortisol
    ▪ Cortisol
    ▪ Aldosterone (Mineralocorticoid)
  o Sides and symptoms
    ▪ Iggy pg. 1382; chart 65-8
  o Diagnostic test
    ▪ Cortisol serum
    ▪ ACTH stimulation test
    ▪ Insulin-Induced Hypoglycemia Test
    ▪ 24 hour urine test
  o Drug Therapy
    ▪ Glucocorticoid replacement
      • Cortisone
      ▪ Hydrocortisone (Cortef) PO
        ▪ A synthetic glucocorticoid hormone
    ▪ Steroids
      • Prednisone
      • Dexamethasone
    ▪ Mineralocorticoid replacement
      • Fludrocortisone (Florinef)PO
Addison’s crisis
- Medical emergency
- Acute adrenal failure
- S/S
- Treatment

- Adrenal gland hyperfunction
  - Excessive activity of the adrenal gland
  - causes excessive production of one or more adrenal hormones
  - aldosterone, corticosteroids or/and androgenic steroids
  - Hypercortisolism causes Cushing’s syndrome/disease
  - Oversecretion of aldosterone causes hyperaldosteronism

- Cushing’s disease
  - Excessive glucocorticoids produced by pituitary gland releasing too much adrenocorticotropic hormone (ACTH)

- Cushing’s syndrome
  - Adrenal glands hypersecretion glucocorticoids
  - Over use of glucocorticoid medications

- Cushing’s Syndrome
  - Endocrine disorder characterized by excessive cortisol levels
  - Causes:
    - Tumor of the pituitary gland, adrenal gland or from cancer tumors (ectopic producing ACTH tumors)
    - Taking too much corticosteroid medications
    - Pituitary adenoma (most common cause)
  - Affects more women than men
  - Diagnostic test
    - 24-Hour urine collection to quantitate cortisol levels
    - Dexamethasone suppression test.
    - Low-dose dexamethasone suppression test
  - Interventions for Hypercortisolism
  - Drug therapy
    - Drugs that inhibit cortisol production in the adrenal glands
      - ketoconazole (Nizoral)
      - metyrapone (Metopirone)
    - Adrenal cytotoxic agents (for inoperable adrenal tumors)
      - blocks hormone production of the adrenal gland
        - Mitotane (Lysodren)

- Hyperaldosteronism (Iggy pg. 1390)
  - Excessive secretion of mineralocorticoids from the adrenal gland
  - Conn’s syndrome (primary hyperaldosteronism)
  - High levels of angiotensin II (secondary hyperaldosteronism)
Conn’s syndrome (primary hyperaldosteronism)
  - Hypernatremia
  - Metabolic alkalosis
  - Hypokalemia

  - Main cause of Conn’s syndrome
    - Tumor or hyperplasia of the adrenal gland
    - Aldosterone is produced despite low renin levels

Secondary hyperaldosteronism
  - Caused by reduced renal blood flow which leads to stimulation of the renin-angiotensin mechanism causing hypersecretion of aldosterone
  - Causes of reduced blood flow
    - Obstructive renal artery disease
    - Renal vasoconstriction
    - Heart failure, cirrhosis with ascites, nephrotic syndrome

  - S/S of hyperaldosteronism

  - Medical interventions
    - Drug therapy
      - Aldactone
      - Eplerenone (Inspra)
    - Diagnostic test
      - Serum aldosterone and renin test
      - Fludrocortisone suppression test (FST)
      - Abdominal computerized tomography (CT) scan

Objective: explain the catecholamine producing tumors in the adrenal medulla
  - Pheochromocytoma (Iggy 1390)
  - Adrenal medulla tumor causes hypersecretion of catecholamines

  - Causes
    - Episodic hypertension

  - S/S
    - Extremely high blood pressure
    - Episodic hypertension
    - Headache
    - Diaphoresis
    - Tremors
    - Short of breath
    - Tachycardia

  - Diagnostic test
    - Serum catecholamine test
    - 24 hour urine (vanillylmandelic acid- VMA)
    - Clonidine suppressor test
    - Imaging test
• Treatment
  o Adrenalectomy

• Drug therapy
  o Alpha-adrenergic blockers
  o Beta-adrenergic blockers

Objective: discuss physical assessment, clinical manifestation, interventions and laboratory test associated with disorders of the thyroid and parathyroid glands

• Hyperthyroidism (Iggy chapter 66)

• Forms of hyperthyroidism
  o Graves’ disease
  o Toxic multinodular goiter
  o Exogenous hyperthyroidism

• Graves’ disease
  o An autoimmune disease
  o Oversecretion of thyroid hormones causing the body’s metabolism to increase excessively
  o S/S
    ▪ Exophthalmos
    ▪ Goiter
    ▪ Multisystem change
    ▪ Pretibial myxedema

• Toxic multinodular goiter (Iggy Pg. 1449)
  o Excess production of thyroid hormones from thyroid nodules or adenomas

• Exogenous hyperthyroidism
  o Caused by excessive use of thyroid hormone drugs
  o Treatment for thyroid cancer
  o Weight loss

• S/S of hyperthyroidism
  o

• Thyroid storm
  o Medical emergency
  o Excessive production of thyroid hormones

• Diagnostic test for hyperthyroidism
  o Thyroid panel
  o Thyroid suppression test
  o Radioactive iodine uptake
  o TSH serum levels
  o Thyrotropin receptor antibody test

• Drug therapy
  o Block thyroid hormone synthesis
    ▪ Tapazole (methimazole)
    ▪ PTU (propylthiouracil)
    ▪ Lugol’s solution
    ▪ SSKI (Potassium Iodide)
Sodium iodide (131I)

- Thyroidectomy
  - Postoperative care

Hypothyroidism Myxedema (Iggy pg. 1400)

- Causes of hypothyroidism
  - Thyroidectomy
  - Radiation treatment
  - Hashimoto’s disease
  - Pituitary gland failure
  - Iodine deficiency
  - Antithyroid medications

- Primary hypothyroidism
  - Loss of thyroid tissue
    - Surgical removal
    - Radiation induced thyroid destruction
  - Autoimmune
  - Congenital
  - Thyroid cancer
  - Not enough iodide in soil

- Secondary hypothyroidism
  - Inadequate amount of TSH
  - Target tissues do not respond
  - Tumor to pituitary or hypothalamus
  - Trauma
  - Infection

- S/S

- Interventions for patients with hypothyroidism
  - Assess respiratory system
  - Oxygen saturation
  - Vital signs
  - Heart rate
  - Blood pressure
  - Mental status
  - Speech
  - Diet
  - Constipation

- Drug therapy
  - Levothyroxine (Synthroid) most common drug

- Myxedema coma (Iggy pg. 1403; chart 66-7)
  - Severe form of hypothyroidism
  - Medical emergency
  - Triggered by stressors
  - S/S
- Decreased cardiac output
- Cerebral hypoxia
- Bradycardia
- Hypotension
- Hypothermic

  - Lab test for hypothyroidism
    - Thyroid panel
    - Thyroid suppression test
    - Radioactive iodine uptake
    - TSH serum levels
    - Thyrotropin receptor antibody test

- Thyroiditis
  - Acute, sub-acute and chronic
  - Inflammation of the thyroid gland

- Thyroid cancers
  - Papillary
  - Follicular
  - Medullary
  - Anaplastic

Objective: discuss the pathophysiology, manifestations, treatments and diagnostic test for patients with parathyroid disorders

Hyperparathyroidism: excess amount of parathyroid hormone (PTH) increases blood calcium levels

- Causes of hyperparathyroidism (Iggy pg. 1406; table 66-3)
  - Tumors, carcinoma
  - Trauma
  - Vitamin D deficiency
  - Chronic kidney disease
  - Carcinomas in the body that produce their own PTH

- Manifestations of hyperparathyroidism
  - Osteoporosis
  - Kidney stones
  - Fatigue
  - Weakness
  - Dehydration
  - Depression
  - Abdominal distress

- Diagnostic test
  - Serum calcium and phosphate
  - Serum magnesium
  - Serum PTH
  - 24 hour urine
• Treatment for hyperparathyroidism
  o Surgical removal of the parathyroid
  o Non-surgical due to hypercalcemia
    ▪ Diuretics
    ▪ Lasix
    ▪ IV normal saline in large quantities, goal is to hydrate patient
    ▪ Calcimimetics
    ▪ Bisphosphonates

Hypoparathyroidism
• Hyposecretion of parathyroid hormone (PTH)
• Causes abnormal levels of serum calcium levels
• Causes high levels of phosphorus (hyperphosphatemia)
• Types of hypoparathyroidism
  o Iatrogenic
  o Idiopathic
  o Hypomagnesemia

• Manifestations of hypoparathyroidism
  o Hypocalcemia (Iggy pg. 189)
  o Hypomagnesemia (Iggy pg. 193)

• Treatment for hypoparathyroidism
  o Calcium supplements
  o Vitamin D
  o Magnesium supplements
  o Severe hypocalcemia; IV 10% calcium chloride or calcium gluconate

Diabetes Mellitus

Type I/insulin dependent diabetes mellitus (Iggy pg. 1416)
• Autoimmune disorder
• Affects children and young adults
• S/S
  o Metabolic syndrome (Syndrome X) (Iggy pg. 1417)

• Oral anti-diabetic medications (Iggy pg. 1423; chart 67-3)
  o Second-Generation Sulfonylurea Agents
  o Meglitinide Analogs
  o Biguanides
  o Alpha-Glucosidase Inhibitors
  o Thiazolidinedione
  o Incretion Mimetics (GLP-1 agonist)

• Difference between hypoglycemia and hyperglycemia (Iggy pg. 1452; table 67-4)
• S/s of hypoglycemia (Iggy pg. 1451- table 67-13)

• Treatment of hypoglycemia in the hospital (Iggy pg 1452)

• Laboratory and diagnostic test
  o Serum
    ▪ Fasting blood glucose
    ▪ Casual blood glucose concentration
    ▪ HbA1c (used to see manage treatment not a diagnostic test)

• Blood glucose phenomena in patients with diabetes mellitus
  o Dawn phenomenon
  o Somogyi phenomenon

• Diet
  o Carbs
  o Fats
  o Protein
  o Fiber

• Exercise

• Gestational diabetes
  o During pregnancy

• Complications of diabetes mellitus
  o Diabetes ketoacidosis
    ▪ S/S
  o Hyperglycemia Hyperosmolar State (HHS)
    ▪ S/S

• Insulin therapy for DKA and HHS
  o IV and subQ
  o IV drip
  o Regular insulin only

• Potassium therapy (K-riders)

• Resources for patients with diabetes mellitus