Chapter 19: Chemical Coordination and Integration

Comprehensive Study Notes

Class 11 Biology - NCERT Based

EXAM SPRINT - Complete Coverage for NEET and Board Examinations

Introduction

The human body requires two major coordination systems:

1. **Neural System:** Point-to-point rapid coordination (fast but short-lived)
2. **Endocrine System:** Chemical coordination through hormones (slow but long-lasting)

Key Difference:

- Neural coordination: Immediate response, localized effect
- Chemical coordination: Gradual response, widespread effect

Integration: Both systems work together to regulate physiological functions

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19.1 ENDOCRINE GLANDS AND HORMONES

Endocrine Glands

Definition: Ductless glands that secrete hormones directly into blood **Characteristics:**

- No ducts (unlike exocrine glands)
- Secretions called hormones
- Highly vascularized

Hormones - Modern Definition

Classical Definition: Chemical produced by endocrine glands, transported via blood to distant target organs

Current Scientific Definition:

> Hormones are non-nutrient chemicals which act as intercellular messengers and are produced in trace amounts.

Key Features:

- Non-nutrient chemicals
- Intercellular messengers
- Produced in trace amounts
- Act on target tissues/organs

Evolutionary Perspective:

- **Invertebrates:** Simple endocrine systems, few hormones
- **Vertebrates:** Complex systems, numerous hormones
- **Humans:** Highly developed endocrine system

19.2 HUMAN ENDOCRINE SYSTEM

Major Endocrine Glands

1. **Hypothalamus** - Master regulator
2. **Pituitary** - Master gland
3. **Pineal** - Biological clock

4. **Thyroid** - Metabolic regulator
5. **Parathyroid** - Calcium homeostasis
6. **Thymus** - Immune development
7. **Adrenal** - Stress response
8. **Pancreas** - Glucose homeostasis
9. **Gonads** - Reproductive functions
    - Testis (males)
    - Ovary (females)

Additional Hormone-Producing Organs

- Gastrointestinal tract
- Liver
- Kidney
- Heart

19.2.1 THE HYPOTHALAMUS

Location and Structure

Position: Basal part of diencephalon, forebrain **Components:** Several groups of neurosecretory cells called nuclei

Functions

Primary Role: Regulates wide spectrum of body functions **Mechanism:** Produces hormones that regulate pituitary function

Hypothalamic Hormones

Types:

1. **Releasing Hormones:** Stimulate pituitary secretion
2. **Inhibiting Hormones:** Inhibit pituitary secretion

Examples:

Releasing Hormones:

- **GnRH (Gonadotrophin Releasing Hormone):** Stimulates LH and FSH release
- **TRH (Thyrotrophin Releasing Hormone):** Stimulates TSH release
- **CRH (Corticotrophin Releasing Hormone):** Stimulates ACTH release
- **GHRH (Growth Hormone Releasing Hormone):** Stimulates GH release

Inhibiting Hormones:

- **Somatostatin:** Inhibits GH release
- **PIH (Prolactin Inhibiting Hormone/Dopamine):** Inhibits prolactin release

Hypothalamo-Pituitary Connection

Anterior Pituitary: Connected via hypothalamo-hypophyseal portal system **Posterior Pituitary:** Direct neural connection via hypothalamo-hypophyseal tract

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19.2.2 THE PITUITARY GLAND

Location and Structure

Position: Sella tursica (bony cavity in sphenoid bone) **Attachment:** Connected to hypothalamus by infundibulum (stalk)

Anatomical Divisions

1. Adenohypophysis (Anterior Pituitary)

Parts:

- **Pars Distalis:** Main hormone-producing region
- **Pars Intermedia:** Almost merged with pars distalis in humans

2. Neurohypophysis (Posterior Pituitary)

Part:

- **Pars Nervosa:** Storage and release of hypothalamic hormones

Anterior Pituitary Hormones (Pars Distalis)

1. Growth Hormone (GH/STH)

Function: Promotes growth of all body tissues **Target:** All body cells, especially bones and muscles
Disorders:

- **Excess in children:** Gigantism
- **Deficiency in children:** Pituitary dwarfism
- **Excess in adults:** Acromegaly (facial disfigurement)

2. Prolactin (PRL)

Function:

- Regulates mammary gland growth
- Stimulates milk production **Target:** Mammary glands

3. Thyroid Stimulating Hormone (TSH)

Function: Stimulates thyroid hormone synthesis and secretion **Target:** Thyroid gland

4. Adrenocorticotrophic Hormone (ACTH)

Function: Stimulates glucocorticoid synthesis and secretion **Target:** Adrenal cortex

5. Gonadotrophins

Luteinizing Hormone (LH):

- **Males:** Stimulates testosterone synthesis from Leydig cells
- **Females:** Induces ovulation, maintains corpus luteum

Follicle Stimulating Hormone (FSH):

- **Males:** Regulates spermatogenesis (with androgens)
- **Females:** Stimulates ovarian follicle development

Pars Intermedia Hormone

Melanocyte Stimulating Hormone (MSH)

Function: Regulates skin pigmentation **Target:** Melanocytes (melanin-containing cells)

Posterior Pituitary Hormones (Pars Nervosa)

Note: These hormones are synthesized in hypothalamus and stored/released by posterior pituitary

1. Oxytocin

Functions:

- Stimulates uterine contractions during childbirth
- Stimulates milk ejection (let-down reflex)

- Acts on smooth muscles **Target:** Uterus, mammary glands

2. Vasopressin (ADH - Antidiuretic Hormone)

Functions:

- Stimulates water and electrolyte reabsorption in kidney
- Reduces water loss through urine
- Increases blood pressure (vasoconstriction) **Target:** Kidney tubules, blood vessels

Disorder:

- **ADH Deficiency:** Diabetes Insipidus (excessive water loss, dehydration)

19.2.3 THE PINEAL GLAND

Location

Position: Dorsal side of forebrain

Hormone: Melatonin

Functions:

1. **Circadian Rhythm Regulation:** Maintains 24-hour biological clock
2. **Sleep-Wake Cycle:** Regulates sleep patterns
3. **Body Temperature:** Maintains temperature rhythm
4. **Additional Effects:**
    - Influences metabolism
    - Affects pigmentation
    - Regulates menstrual cycle

- Influences immune function

Regulation:

- **Light exposure:** Inhibits melatonin production
- **Darkness:** Stimulates melatonin production

19.2.4 THYROID GLAND

Structure

Location: Two lobes on either side of trachea **Connection:** Isthmus (thin connective tissue)
Microscopic Structure:

- **Follicles:** Spherical structures with follicular cells
- **Stromal Tissue:** Supporting connective tissue

Thyroid Hormones

1. Triiodothyronine (T_3) and Thyroxine (T_4)

Synthesis: Requires iodine **Functions:**

- **Basal Metabolic Rate:** Primary regulator
- **Growth and Development:** Essential for normal development
- **Carbohydrate, Protein, Fat Metabolism:** Regulates all major metabolisms
- **Red Blood Cell Formation:** Supports erythropoiesis
- **Water and Electrolyte Balance:** Maintains homeostasis

2. Thyrocalcitonin (TCT)/Calcitonin

Function: Decreases blood calcium levels **Mechanism:** Inhibits bone resorption

Thyroid Disorders

1. Hypothyroidism

Cause: Iodine deficiency, thyroid dysfunction **Manifestations:**

- **Goitre:** Enlargement of thyroid gland
- **Cretinism:** In children (stunted growth, mental retardation)
- **Myxedema:** In adults (slow metabolism, weight gain)
- **Irregular menstrual cycle:** In women

2. Hyperthyroidism

Cause: Overactive thyroid, cancer, nodules **Manifestations:**

- **Graves' Disease/Exophthalmic Goitre:**
  - Thyroid enlargement
  - Eyeball protrusion (exophthalmos)
  - Increased BMR
  - Weight loss

19.2.5 PARATHYROID GLAND

Structure

Number: Four glands **Location:** Back side of thyroid gland (one pair in each lobe)

Hormone: Parathyroid Hormone (PTH)

Functions (Hypercalcemic Hormone):

1. **Bone Resorption:** Stimulates dissolution/demineralization
2. **Kidney:** Increases Ca^{2+} reabsorption by renal tubules
3. **Intestine:** Increases Ca^{2+} absorption from food

Regulation:

- **Low blood Ca^{2+}:** Stimulates PTH release
- **High blood Ca^{2+}:** Inhibits PTH release

Calcium Homeostasis:

PTH + TCT work together to maintain blood calcium levels

- **PTH:** Increases blood Ca^{2+}
- **TCT:** Decreases blood Ca^{2+}

19.2.6 THYMUS

Location

Position: Lobular structure between lungs, behind sternum, ventral to aorta

Function

Primary Role: Development of immune system

Hormone: Thymosins

Functions:

1. **T-lymphocyte Differentiation:** Essential for cell-mediated immunity
2. **Antibody Production:** Promotes humoral immunity
3. **Immune System Development:** Critical during childhood

Age-Related Changes:

- **Childhood:** Active and large
- **Adulthood:** Gradual degeneration
- **Old age:** Significantly reduced, weakened immune responses

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19.2.7 ADRENAL GLAND

Structure

Number: One pair (one above each kidney) **Two Parts:**

1. **Adrenal Medulla:** Central core
2. **Adrenal Cortex:** Outer region

Adrenal Medulla Hormones

Catecholamines:

1. **Adrenaline (Epinephrine)**
2. **Noradrenaline (Norepinephrine)**

Functions (Emergency Hormones/Fight or Flight):

Physiological Effects:

- Increased alertness

- Pupillary dilation
- Piloerection (hair raising)
- Increased sweating
- Increased heart rate and contraction strength
- Increased respiration rate
- Glycogenolysis (glucose release)
- Lipolysis (fat breakdown)
- Proteolysis (protein breakdown)

Trigger: Stress, emergency situations

Adrenal Cortex Structure

Three Layers:

1. **Zona Glomerulosa:** Outer layer
2. **Zona Fasciculata:** Middle layer
3. **Zona Reticularis:** Inner layer

Adrenal Cortex Hormones (Corticoids)

1. Glucocorticoids (Cortisol - Main)

Functions:

- **Gluconeogenesis:** Glucose synthesis from non-carbohydrates
- **Lipolysis and Proteolysis:** Fat and protein breakdown
- **Cardiovascular System:** Maintains function
- **Kidney Function:** Supports normal function

- **Anti-inflammatory:** Reduces inflammation
- **Immune Suppression:** Suppresses immune responses
- **RBC Production:** Stimulates erythropoiesis

2. Mineralocorticoids (Aldosterone - Main)

Functions:

- **Na^+ and Water Reabsorption:** At renal tubules
- **K^+ and Phosphate Excretion:** Promotes elimination
- **Electrolyte Balance:** Maintains homeostasis
- **Blood Pressure:** Regulates through fluid balance

3. Androgenic Steroids (Small amounts)

Functions:

- **Puberty:** Growth of axial, pubic, and facial hair
- **Secondary sexual characteristics:** Minor contributions

Adrenal Disorders

Addison's Disease:

- **Cause:** Adrenal cortex hypofunction
- **Symptoms:** Acute weakness, fatigue, altered carbohydrate metabolism

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19.2.8 PANCREAS

Dual Nature

Composite Gland: Both exocrine and endocrine functions

Endocrine Pancreas: Islets of Langerhans

Number: 1-2 million islets **Percentage:** Only 1-2% of pancreatic tissue

Cell Types and Hormones

1. α-cells → Glucagon

Functions (Hyperglycemic Hormone):

- **Glycogenolysis:** Breaks down glycogen to glucose (in liver)
- **Gluconeogenesis:** Synthesizes glucose from non-carbohydrates
- **Reduced Cellular Glucose Uptake:** Maintains blood glucose **Result:** Increases blood glucose levels (hyperglycemia)

2. β-cells → Insulin

Functions (Hypoglycemic Hormone):

- **Enhanced Cellular Glucose Uptake:** In hepatocytes and adipocytes
- **Glycogenesis:** Converts glucose to glycogen
- **Glucose Utilization:** Promotes cellular glucose use **Result:** Decreases blood glucose levels (hypoglycemia)

Glucose Homeostasis

Balance: Maintained jointly by insulin and glucagon

- **High glucose:** Insulin release
- **Low glucose:** Glucagon release

Pancreatic Disorders

Diabetes Mellitus:

- **Cause:** Insulin deficiency/resistance
- **Symptoms:**
  - Prolonged hyperglycemia
  - Glucose in urine (glycosuria)
  - Ketone body formation
- **Treatment:** Insulin therapy

19.2.9 TESTIS

Location

Position: Scrotal sac (outside abdomen)

Dual Function

1. **Primary sex organ:** Sperm production
2. **Endocrine gland:** Hormone secretion

Structure

Components:

- **Seminiferous tubules:** Sperm production
- **Stromal/Interstitial tissue:** Hormone production

Hormone-Producing Cells

Leydig Cells/Interstitial Cells: Located in intertubular spaces

Hormone: Androgens (Mainly Testosterone)

Functions:

1. **Male Accessory Sex Organs:** Development and function
   - Epididymis, vas deferens, seminal vesicles, prostate, urethra
2. **Secondary Sexual Characteristics:**
   - Muscular growth
   - Facial and axillary hair growth
   - Aggressiveness
   - Low pitch voice
3. **Spermatogenesis:** Major stimulatory role
4. **Sexual Behavior:** Influences libido through CNS
5. **Metabolic Effects:** Anabolic effects on proteins and carbohydrates

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19.2.10 OVARY

Location

Position: Abdomen (pair of ovaries)

Dual Function

1. **Primary sex organ:** Ovum production (one per menstrual cycle)
2. **Endocrine gland:** Hormone secretion

Structure

Components:

- **Ovarian follicles:** Estrogen production
- **Corpus luteum:** Progesterone production (post-ovulation)
- **Stromal tissues:** Supporting structure

Hormones

1. Estrogen

Source: Growing ovarian follicles **Functions:**

- **Female Secondary Sex Organs:** Growth and activity stimulation
- **Secondary Sexual Characteristics:**
  - High pitch voice
  - Mammary gland development
  - Female body contour
- **Ovarian Follicle Development:** Growth stimulation
- **Sexual Behavior:** Regulation

2. Progesterone

Source: Corpus luteum (post-ovulation) **Functions:**

- **Pregnancy Maintenance:** Primary function
- **Mammary Glands:**
  - Alveoli formation (milk storage sacs)
  - Milk secretion stimulation

- **Uterine Changes:** Prepares for implantation

19.3 HORMONES OF HEART, KIDNEY AND GASTROINTESTINAL TRACT

Heart Hormone

Atrial Natriuretic Factor (ANF)

Source: Atrial wall of heart **Function:** Decreases blood pressure **Mechanism:**

- **Trigger:** Increased blood pressure
- **Action:** Causes blood vessel dilation
- **Result:** Reduced blood pressure

Kidney Hormone

Erythropoietin

Source: Juxtaglomerular cells of kidney **Function:** Stimulates erythropoiesis (RBC formation)
Importance: Maintains adequate RBC count

Gastrointestinal Tract Hormones

1. Gastrin

Source: G-cells of stomach **Functions:**

- Stimulates HCl secretion
- Stimulates pepsinogen secretion **Target:** Gastric glands

2. Secretin

Source: S-cells of duodenum **Functions:**

- Stimulates water secretion from pancreas
- Stimulates bicarbonate ion secretion **Target:** Exocrine pancreas

3. Cholecystokinin (CCK)

Source: I-cells of duodenum **Functions:**

- Stimulates pancreatic enzyme secretion
- Stimulates bile juice release **Targets:** Pancreas and gall bladder

4. Gastric Inhibitory Peptide (GIP)

Source: K-cells of duodenum **Functions:**

- Inhibits gastric secretion
- Inhibits gastric motility **Effect:** Slows gastric activity

Growth Factors

Source: Various non-endocrine tissues **Function:** Essential for tissue growth and repair/regeneration

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19.4 MECHANISM OF HORMONE ACTION

Hormone-Receptor Interaction

Key Principle: Hormones act by binding to specific hormone receptors **Specificity:** Each receptor specific to one hormone only **Location:** Receptors present only in target tissues

Types of Hormone Receptors

1. Membrane-bound Receptors

Location: Cell membrane of target cells **Hormone Types:**

- Peptide hormones
- Polypeptide hormones
- Protein hormones
- Amino acid derivatives

2. Intracellular Receptors (Nuclear Receptors)

Location: Inside target cells (mostly nucleus) **Hormone Types:**

- Steroid hormones
- Iodothyronines (thyroid hormones)

Chemical Classification of Hormones

1. Peptide, Polypeptide, Protein Hormones

Examples: Insulin, glucagon, pituitary hormones, hypothalamic hormones **Receptor Type:** Membrane-bound

2. Steroid Hormones

Examples: Cortisol, testosterone, estradiol, progesterone **Receptor Type:** Intracellular

3. Iodothyronines

Examples: T_3, T_4 (thyroid hormones) **Receptor Type:** Intracellular

4. Amino Acid Derivatives

Examples: Epinephrine, norepinephrine **Receptor Type:** Membrane-bound

Mechanisms of Action

Mechanism 1: Membrane-bound Receptors

Process:

1. Hormone binds to receptor on cell membrane
2. Hormone does NOT enter the cell
3. Generates second messengers (cAMP, IP_3, Ca^{2+})
4. Second messengers regulate cellular metabolism
5. Results in physiological effects

Second Messengers:

- Cyclic AMP (cAMP)
- Inositol triphosphate (IP_3)
- Calcium ions (Ca^{2+})
- Diacylglycerol (DAG)

Mechanism 2: Intracellular Receptors

Process:

1. Hormone enters the target cell
2. Binds to intracellular/nuclear receptor
3. Hormone-receptor complex formed
4. Complex interacts with genome (DNA)
5. Regulates gene expression
6. Results in protein synthesis changes
7. Leads to physiological and developmental effects

Key Features:

- Direct gene regulation
- Longer-lasting effects
- Involves transcription and translation

NEET-Specific Important Points

High-Yield Topics for NEET:

1. Hormone Classification:

- Based on chemical nature
- Based on mechanism of action
- Source glands and target organs

2. Hypothalamo-Pituitary Axis:

- Releasing and inhibiting hormones
- Anterior vs posterior pituitary
- Feedback mechanisms

3. Endocrine Disorders:

- Diabetes mellitus (insulin)
- Diabetes insipidus (ADH)
- Goitre (thyroid)
- Dwarfism/Gigantism (GH)

4. Hormone Functions:

- Growth and development
- Metabolism regulation
- Homeostasis maintenance
- Reproductive functions

5. Feedback Mechanisms:

- Negative feedback loops
- Hormone regulation
- Target organ responses

Common NEET Question Patterns:

1. Match the Following:

- Hormone with source gland
- Hormone with function
- Disorder with hormone deficiency

2. Assertion-Reason:

- Hormone mechanisms
- Physiological effects
- Regulatory systems

3. Multiple Choice:

- Hormone identification
- Function questions
- Disorder associations

4. Diagram-based:

- Endocrine gland locations
- Hormone pathways
- Feedback loops

Memory Aids and Mnemonics

Major Endocrine Glands:

"Hypocritical People Think All Pancreatic Tumors Give Out"

- **H**ypothalamus
- **P**ituitary
- **T**hyroid
- **A**drenal
- **P**ancreas
- **T**hymus
- **G**onads
- **O**thers (Heart, Kidney, GIT)

Anterior Pituitary Hormones:

"Go Look For The Good People"

- **G**H (Growth Hormone)
- **L**H (Luteinizing Hormone)
- **F**SH (Follicle Stimulating Hormone)

- **T**SH (Thyroid Stimulating Hormone)
- **G**H can also represent
- **P**RL (Prolactin)
- **ACTH** (AdrenoCorticoTropic Hormone)

Posterior Pituitary Hormones:

"Only Vampires" (both synthesized in hypothalamus)

- **O**xytocin
- **V**asopressin (ADH)

Adrenal Cortex Layers (Outside to Inside):

"Go Find Rex"

- **G**lomerulosa (Aldosterone - mineralocorticoid)
- **F**asciculata (Cortisol - glucocorticoid)
- **R**eticularis (Androgens)

Pancreatic Islet Cells:

"Alpha Gluco, Beta Insulin"

- **α-cells** → **Glucagon** (increases glucose)
- **β-cells** → **Insulin** (decreases glucose)

Calcium Regulation:

"PTH Puts, TCT Takes"

- **PTH** → **Puts** calcium in blood (increases)

- **TCT** → **Takes** calcium from blood (decreases)

Thyroid Hormones:

"T3 and T4 for BMR"

- **T_3** and **T_4** regulate **Basal Metabolic Rate**

Practice Questions for NEET

Multiple Choice Questions:

1. Which hormone is known as emergency hormone? a) Insulin b) Adrenaline c) Thyroxine d) Growth hormone
2. Diabetes mellitus is due to deficiency of: a) Insulin b) Glucagon c) Cortisol d) Aldosterone
3. Which gland is called master gland? a) Thyroid b) Adrenal c) Pituitary d) Pancreas
4. Goitre is caused by deficiency of: a) Iron b) Iodine c) Calcium d) Protein
5. Which hormone regulates blood calcium level? a) Insulin b) PTH c) ADH d) FSH

Match the Following:

Column I (Hormone) - Column II (Function)

1. Insulin - a) Increases blood glucose
2. Glucagon - b) Decreases blood glucose
3. ADH - c) Water reabsorption
4. Oxytocin - d) Milk ejection
5. TSH - e) Stimulates thyroid

Short Answer Questions:

1. Name the hormones secreted by anterior pituitary.
2. What is the difference between diabetes mellitus and diabetes insipidus?
3. Explain the role of hypothalamus in hormone regulation.
4. What are the functions of thyroid hormones?

Long Answer Questions:

1. Describe the structure and functions of adrenal gland.
2. Explain the mechanism of hormone action with examples.
3. Discuss the role of pancreatic hormones in glucose homeostasis.

Summary Table: Key Hormone Information

Major Hormones Quick Reference:

Gland	Hormone	Primary Function	Target	Disorder
Anterior Pituitary	GH	Growth	All tissues	Dwarfism/Gigantism
	TSH	Thyroid stimulation	Thyroid	-
	ACTH	Adrenal stimulation	Adrenal cortex	-
	LH/FSH	Reproductive	Gonads	-
	Prolactin	Milk production	Mammary glands	-
Posterior Pituitary	ADH	Water retention	Kidney	Diabetes Insipidus
	Oxytocin	Uterine contraction	Uterus/Mammary	-
Thyroid	T_3/T_4	Metabolism	All cells	Goitre/Cretinism
	Calcitonin	Ca^{2+} decrease	Bones	-
Parathyroid	PTH	Ca^{2+} increase	Bones/Kidney	-

Gland	Hormone	Primary Function	Target	Disorder
Adrenal Medulla	Adrenaline	Emergency response	Multiple organs	-
Adrenal Cortex	Cortisol	Stress response	Multiple organs	Addison's disease
	Aldosterone	Na^+/Water retention	Kidney	-
Pancreas	Insulin	Glucose decrease	Liver/Muscle	Diabetes Mellitus
	Glucagon	Glucose increase	Liver	-
Testis	Testosterone	Male characteristics	Male organs	-
Ovary	Estrogen	Female characteristics	Female organs	-
	Progesterone	Pregnancy maintenance	Uterus	-

Feedback Mechanism Types:

Type	Description	Example	Effect
Negative Feedback	Product inhibits its own production	Thyroid hormones → TSH	Maintains homeostasis
Positive Feedback	Product stimulates its own production	Oxytocin during labor	Amplifies response

Receptor Types and Mechanisms:

Receptor Type	Location	Hormone Examples	Mechanism
Membrane-bound	Cell surface	Insulin, Glucagon, Adrenaline	Second messenger system
Intracellular	Inside cell/nucleus	Steroid hormones, Thyroid hormones	Direct gene regulation

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Clinical Correlations

Common Endocrine Disorders:

1. Diabetes Mellitus

Type 1: Insulin deficiency (autoimmune) **Type 2:** Insulin resistance **Symptoms:** Polyuria, polydipsia, polyphagia **Complications:** Diabetic coma, ketoacidosis

2. Thyroid Disorders

Hypothyroidism: Fatigue, weight gain, cold intolerance **Hyperthyroidism:** Weight loss, heat intolerance, anxiety **Goitre:** Visible neck swelling

3. Adrenal Disorders

Addison's Disease: Weakness, fatigue, weight loss **Cushing's Syndrome:** Weight gain, muscle weakness, high BP

4. Growth Disorders

Growth Hormone Deficiency: Short stature **Growth Hormone Excess:** Gigantism (children), Acromegaly (adults)

5. Reproductive Disorders

PCOS: Hormonal imbalance affecting ovulation **Hypogonadism:** Reduced sex hormone production

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EXAM SPRINT - Master Chemical Coordination and Integration with focused study on hormone sources, functions, mechanisms, and clinical correlations. Regular practice of hormone identification and function-based questions is crucial for NEET success.

Source: NCERT Biology Class 11, Chapter 19 - Comprehensive coverage for NEET preparation