& gynecology books, visit our website **www.jaypeebrothers.com,** for detailed information on obstetrics & gynecology boo



ENDOCRINOLOGY
in Obstetrics & Gynecology

Editor
Suvarna Khadilkar



Federation of Obstetric & Gynaecological Societies of India

Forewords
CN Purandare
Hema Divakar

CONTENTS

PART 1 FRONTIERS IN ENDOCRINOLOGY

SECTION 1 BASICS OF ENDOCRINOLOGY

Bharti Maheshwari, Jasmine Lopez

1. Hypothalamus **3**

Bharti Maheshwari

Structural Anatomy 3; Output 4; Neuroendocrine Function 6; Hypothalamic-Adenohypophyseal (Anterior Pituitary) Axis 6; Hypothalamic-Neurohypophyseal (Posterior Pituitary) Axis 7; Clinical Relevance 7; Hypothalamic Dysfunction 8

2. Pituitary Gland **11**

Jasmine Lopez, Hilla S

Anatomy and Physiology of the Pituitary Gland 11; Functions 12; Histology 13; Pituitary Disorders 13

3. Pineal Gland **19**

Suvarna Khadilkar, Vibha More

Anatomical Relations of Pineal Gland 19; Neural Connections of Pineal Gland 19; Histology 19; Type of Cell and Hormones 20; Biosynthesis of Melatonin 20; Physiology 20; Function of Melatonin 21; Applied Physiology 22; Pathology 22

4. Ovaries **24**

Shobhana Mohandas

Anatomical Considerations 24 Physiology 26; Functions of Hormones Produced in the Ovary 29

5. Testis **35**

Vinit Shah, Omar Akhtar

Anatomy and Physiology of the Male Reproductive System 35; Testis 37; Spermatogenesis—Stages 38; Epididymis 38; Vas Deferens 39; Ejaculate 39

6. Thyroid Gland **40**

Sujata Misra

Applied Anatomy and Anatomical Relations 40; Histology 40; Physiology 40; Thyroid Function Tests 44;

7. Parathyroid Gland **46**

Ranu Patni

Anatomy 46; Histology 46; Physiology 47; Pathology 48

8. Adrenals and the Kidneys **50**

Yashodhara Pradeep, Renu Singh

Morphology: The Adrenal Cortex and Adrenal Medulla 50; Adrenal Histology and Physiology 51; Action and Function of Adrenal Cortex Hormones 52; Pathological Involvement, Hypersecretion and Effects of Glucocorticoids on Body 53. Pathological Involvement, Hypersecretion and Effects of Mineralocorticoids on Body 53; Hyposecretion of Adrenal Hormones 54; Kidneys 54

9. Pancreas **56**

Suvarna Khadilkar, Suman Kumari

Anatomy of Pancreas 56; Histomorphology of Islets 56; Endocrine Physiology 57; Pathophysiology of Insulin Secretion 59; Insulin Preparations 60; Glucagon 60; Somatostatin 61; Pancreatic Polypeptide 61

10. Human Skin and Adipose Tissue as Endocrine Units and Exercise Physiology **62**
Suvarna Khadilkar, Sachin Naiknaware
Distribution of Adipose Tissue 62; Differences between White and Brown Adipose Tissues 63; Functions of Adipose Tissue 63; Leptin 64; Major Influences on Leptin Expression in Human Adipose Tissue 65; Functions of Leptin 65; Adiponectin 66 Interleukin-6 67; Tumor Necrosis Factor (TNF)-Alpha 68 Plasminogen Activator Inhibitor-1 68; Macrophage and Monocyte Chemoattractant Protein (MCP) 69; Adipsin and Acylation Stimulating Protein (ASP) 69; Resistin 69; Proteins of Renin Angiotensin System (RAS) 70; Enzymes Involved in Metabolism of Sex Steroids 70; Enzymes Involved in the Metabolism of Glucocorticoids 70; Exercise Physiology 72;

11. Placenta and Hormonal Changes in Normal Pregnancy **76**
Sajana Gogineni, Prashanthi Vemulapalli
Anatomy and Development of Placenta 76; Anatomy at Term 76; Physiology of Placenta 76: Functions of Placenta 79

12. Physiology of Lactation **83**
Madhuri A Patel, Surekha Tayade, Amrita Singh
Anatomy 83; Physiological Basis 85; Synthesis and Secretion of Milk Components 87; Regulation of Milk Production 88

PART 2 ENDOCRINOLOGY IN CLINICAL PRACTICE

SECTION 1 PUBERTY DISORDERS
Shobhana Mohandas

13. Normal and Abnormal Puberty **93**
Nalini Shah, Swati Jadhav
Normal Puberty 93; The Age Limits for Normal Pubertal Development 93; Abnormal Puberty 95; Precocious Puberty 99

14. Disorders of Sex Development **107**
Alka Kriplani, Garima Kachhawa, Tsering Wangdi
Revised Nomenclature 107; Investigations 109 Diagnosis 110; Management 111; Gonadectomy 112; Hormonal Replacement Therapy 113 Psychosocial Management 113

15. Abnormalities of Growth and Pubertal Development in Adolescence **116**
Vaman Khadilkar, Ruma Deshpande
Physical Changes in Girls during Puberty 116; Abnormalities of Growth and Pubertal Development in Adolescence 117; General Approach to an Adolescent Girl with Pubertal Problems 117; Short Stature 117; Evaluation of a Short Adolescent 118; Tall Stature 119; Obesity 119; Evaluation of an Obese Adolescent 119; Hyperandrogenism and PCOS 120; Precocious Puberty 120; Evaluation of Girls with Early Puberty 120; Delayed Puberty 121; Evaluation of Girl with Delayed Puberty 121 Evaluation of Girl with Amenorrhea 123

SECTION 2 CONTRASEXUAL DISORDERS
Shobhana Mohandas

16. Disorders of Adrenal Gland **124**
Yashodhara Pradeep, Renu Singh, Ayush Chandra Srivastava
Disorders of Adrenals Cortex 124; Hyperfunction of Adrenals 125; Management 125; Aldosteronism 125; Hypofunction of Adrenal Cortex 128; Hypoaldosteronism 129; Congenital Adrenal Hyperplasia 129; DHEA and Adrenal Imbalance 131 Function of DHEA and DHEAS 131; Summary 133; HVA VMA Metanephrine 134

17. Hirsutism **136**
Piya Ballani Thakkar
Types of Disorders and Causes 136; Assessment of Hirsutism 137; Diagnosis and Differential Diagnosis 140; Treatment 141; Medical Management 142

18. Sex Reassignment Therapy **148**
Geeta Pandya
Sex Reassignment Therapy for Transition from Female to Male 149; Transdermal Testosterone 150; Health Risks and Side Effects of Testosterone 150; Side Effects of Testosterone 150; Hormonal Management of a Child Born with Ambiguous Genitalia 152

SECTION 3 MENSTRUAL DISORDERS
Madhuri Patel

19. Amenorrhea: Clinical Evaluation and Treatment **155**
Suvarna Khadilkar
Definitions of Amenorrhea 155; Causes of Amenorrhea 155; Clinical Features 156; Evaluation in Primary Amenorrhea 156; Specific Conditions Causing Primary Amenorrhea and Management in Brief 159; Disorders of Compartment I 162; Disorders of Compartment II 162; Primary Ovarian Failure (Hypergonadotropic Hypogonadism) 163; Pituitary or Compartment III Factors 164; Compartment IV Defects 165

20. Prolactin Disorders **167**
Pramod Gandhi
Epidemiology 167; Causes of Hyperprolactinemia 167; Prolactinoma 169; Malignant Prolactinoma 175

21. Miscellaneous Pituitary Diseases **177**
Suvarna Khadilkar, Vibha More
The Pituitary Incidentaloma 178; Gonadotropin-producing Pituitary Tumors 179 GH-secreting Pituitary Adenoma (Acromegaly) 179; ACTH-secreting Tumors (Cushing's Disease) 180 Thyrotropin (TSH)-secreting Tumors 180; Sheehan's Syndrome 180; Lymphocytic Hypophysitis 180; Vasopressin 181; Oxytocin 181; Empty Sella Syndrome 182; Causes of Pituitary Failure 182

22. Heavy Menstrual Bleeding **184**
S Sampathkumari
Causes of HMB 184; Management 187; Estrogen 189

SECTION 4 INFERTILITY
Madhuri Patil

23. Polycystic Ovarian Syndrome **195**
Shobhana Mohandas
Diagnosis 195; The Insulin Hypothesis 196; Clinical Evaluation of PCOS 197; Investigations 198; Management of PCOS 198; Other Drugs Used in the Management of PCOS 199

24. Ovulation Induction Protocols for Anovulation, PCOS, IUI and ART Cycles **203**
Madhuri Patil
Clinical Features 203; Investigations 204; Differential Diagnosis 206; Ovulation Induction 207; Risks and Complications with Clomiphene Treatment 212; Aromatase Inhibitors—Letrozole and Anastrozole 212; Gonadotropins for Ovulation Induction 213; OI Protocols using Gonadotropins 214; Kato Protocol 214; Induction of Follicular Maturation and Ovulation 219; Adjuvants Drugs to Gonadotropins 219; Down Regulation with Ovarian Steroids 223; Polycystic Ovary Syndrome 223

25. Luteal Phase Support **237**
Nandita Palshetkar, Hrishikesh Pai, Nandan Roongta
Luteal Phase Support Agents 239; Progesterone Supplementation 239; Natural Progesterone: Routes of Administration 240; hCG and Luteal Support 241; Adjunct Therapy 241; LPS in Various Protocols 242; LPS: Cochrane Review 243

26. Thyroid and Infertility **245**
Jaideep Malhotra, Diksha Goswami
Estrogens and Thyroid Hormones 245; Thyroid Disorders 246; Hypothyroidism and Infertility 246; Subclinical Hypothyroidism and Infertility 247; Autoimmune Thyroid Disease and Infertility 249; AITD and Pregnancy Outcome after ART 249; Hyperthyroidism and Infertility 250; Thyroid Function after Controlled Ovarian Hytperstimulation (COH) 251

27. Endocrinology in Clinical Practice: Male Infertility **255**
Vinit Shah
Hormonal Control of Spermatogenesis 255; History 255; Physical Examination 256; Semen Analysis 257; Causes of Male Infertility 260; Prolactinoma 262

28. Hormonal Management of Endometriosis **265**
Sonia Malik, Vandana Bhatia
Management 265; Oral Contraceptive Pill 266; Progestins 266

29. Premature Ovarian Failure **272**
Gautam N Allahbadia, Rubina Merchant
Anatomy and Embryology 272; Histology 272; Physiology 273; Normal Range of Blood Levels 274; Pathological Involvement 274; Hyposecretion and Effects on Body 275; Hypersecretion and Effects on Body 275; Premature Ovarian Failure 275; Clinical Features 278; Investigations 278; Screening for Autoimmunity 279; Management of POF 280

SECTION 5 HORMONAL CONTRACEPTION
Sajana Gogineni

30. Ovarian Transplant: An Overview **286**
Pravin Mhatre, Jyoti Mhatre
Historical Aspects 286; Indications 288; Surgical Techniques 290; Vascular Orthotopic Ovarian Transplant 291

31. Combined Hormonal Contraceptives **296**
Ritu Joshi
History of Hormonal Contraceptives 296; Combined Oral Contraceptive Pill 296; Cyclic Combined Pills 297; Starting a COC Regimen 298; Advantages of Low-dose COCs 298; Combined Vaginal Rings 301; Transdermal Contraception 303; Combined Injectable Contraceptives 304

32. Progesterone-only Contraception: Oral, Injectable, Implants, Intrauterine Systems **306**
Chellamma VK, Jyoti Ramesh Chandran
Progestogen-only Contraceptive Pill (POP) (Mini Pills) 307; Mechanism of Action 307; Effectiveness 307; Advantages of POPs 307; Disadvantages of POPs 307; Evaluation and Patient Selection 308; Counseling 308; Mechanism of Action 309; Contraceptive Efficacy 309; Contraindications 310; Evaluation 310; Noncontraceptive Benefits 310; Options Available 311; Mode of Action 313; Duration of Use 313; Effectiveness 313; Indications 313; Timing of Insertion 314; Switching from Another Method of Contraception 314; Insertion and Removal 314; Counseling 315; Mechanism of Action 316; Contraindications for LNG–IUS 317; Patient Counseling 317; Insertion 318; Continuation and Follow-up 318; Effectivenes 318

33. Emergency Contraception **321**
Ashwini Bhalerao Gandhi, Pallavi Dhamangaonkar
Indications 321; Types of EC and their Mechanism of Action 321; Levonorgestrel Alone 322; Anti-progestogen Mifepristone 322; Other Methods Tried 322; Mechanism of Action of Hormonal EC 323; Problems in Clinical Practice 324; Ethical, Legal and Regulatory Aspects of EC 324

34. Endocrinology of Medical Abortion **328**
Milind R Shah, Kunal A Doshi
Endocrinology of Early Pregnancy 328; Progesterone 328; Estradiol; 328; IGFBP-l 329; Endocrine Alteration Associated with Termination of Early Pregnancy 329; Progesterone 329; Regulation of IGFBP-l 330; Uterotonics 330; Prostaglandin Analogues 330; Gemeprost 331 Misoprostol 331; Uterine Contractility 331; Antimetabolites 332; Antiprogesterones 332; Mifepristone 332; Clinical Use of Medical Abortion 334

SECTION 6 ENDOCRINE PROBLEMS IN PREGNANCY
Sajana Gogineni, Shailesh Kore

35. Thyroid Disorders in Pregnancy **336**
Sujata Mishra
Thyroid Tests in Pregnancy 337; Types of Disorders and Causes 338

36. Gestational Diabetes Mellitus **346**
BS Susheela Rani
Definition 346; Prevalence 346; Diagnosis 346; Selective Versus Universal Screening 347; Gestational Age at Screening 347; Pathophysiology of Gestational Diabetes 347; Risk Factors 348; Complications of GDM 348; Maternal and Fetal Monitoring in GDM 350; Monitoring Glycemic Control 351; Treatment 351; Medical Nutrition Therapy 351; Pharmacotherapy 351; Antepartum Fetal Surveillance 352; Postpartum 353; Early Postpartum Care 353

37. Miscellaneous Endocrinopathies during Pregnancy **357**
Suvarna Khadilkar, Suman Kumari
Adrenal Disorders in Pregnancy 357; Congenital Adrenal Hyperplasia (CAH) and Pregnancy 357; Treatment 358; Cushing Syndrome with Pregnancy 360; Clinical Features 360; Pheochromocytoma in Pregnancy 361; Clinical Features 361

38. Endocrinological Factors in Recurrent Pregnancy Loss **365**
Shailesh Kore, Divya Kadam
Thyroid Disorders 365; Diabetes Mellitus 366; PCOS 366; Luteal Phase Deficiency 367

SECTION 7 LIFESTYLE DISEASES, MENOPAUSE, OSTEOPOROSIS
Rashmi Shah, Shailesh Kore

39. Obesity Proneness at Transitional Phases in Women's Life **369**
Rama Vaidya, Shefali Pandey
Sexual Dimorphism in Adipose Tissue Metabolic Function 370

40. Menopause: Physiology and Symptomatology **377**
Seema Sharma
Evolution of Menopause 377; Classification and Definitions 377; Age of Menopause 378; Physiology of Menopause 379; Ultrasound and Endocrine Markers 379; Early Symptoms of Menopause 382; Long-term Consequences of Estrogen Deficiency 385; Osteoporosis 386; Treatment 388

41. Management Options in Menopause **391**
Jyothi Unni
Menopausal Health Trends 391; Symptoms and Long-term Consequences 391; Management 391; Nonhormonal Therapy 393; Hormone Therapy 394

42. Menopausal Hormone Therapy: An Update **396**
Suvarna Khadilkar
The WHI Trial 396; Vasomotor Symptoms 397; Urogenital Atrophy 397; Osteoporosis 397; Cardiovascular Disease 398; Breast Cancer 399; Endometrial Cancer 400; Alzheimer's Disease 400; Drugs and Formulations in MHT 400; Side effects

Associated with Estrogen and Progesterone 403; Profile of an Ideal Hormone Therapy 405; Other Hormones 405; SERMS: Raloxifene 406

43. Osteoporosis: Risk Factors, Diagnosis and Assessment of Fracture Risk 410

Rashmi Shah

Causes and Risk Factors 410; Screening for Osteoporosis and Assessment of Fracture Risk 411

44. Prevention and Management of Osteoporosis 418

Rajeev Patni, Ranu Patni

Prevention of Osteoporosis 418; Dietary Measures 419; Pharmacologic Therapy 420; Parathyroid Hormone 422; Calcitonin 423; Hormone Replacement Therapy 424; Other Agents 424; Physical Therapy 424; Occupational Therapy 424

45. Sarcopenia in Women 427

SV Khadilkar, Rakhil Yadav

Classification 427; Hormones 428; Clinical Features 428; Investigations 428; Differential Diagnosis 429; Flow Diagram 431

46. Hormones and Breast Cancer 433

Sudeep Gupta, Gautam Goyal

Pathophysiology 433; Biological Effect of Estrogen on Breast Tumors 434; Estrogen Receptor 434; Principle of Hormonal Treatment 434; Clinical Use 435; Principles of Hormone Treatment in Breast Cancer 438: Development of Hormonal Resistance 439; Future 439

SECTION 8 HORMONES AND CANCER

Ranu Patni

47. Hormones and Cancer 442

Yogesh Kulkarni, Usha B Saraiya

Hormones and Cancers 442; Endometrial Carcinoma 442; Risk Factors 442; Tamoxifen and Endometrial Carcinoma 443; Oral Contraceptive Pills and Endometrial Cancer 444; Hormonal Treatment for Endometrial Carcinoma 444; Role of Hormone Replacement Therapy after Endometrial Cancer Treatment 445; Recommendations 445; Hormones and Ovarian Carcinoma 445; Risk Factors for Ovarian Carcinoma 445; Hormone Replacement Therapy and Risk of Ovarian Carcinoma 446; Hormone Replacement Therapy After Ovarian Cancer Treatment 446; Recommendations 446; Hormones and Cervical Cancer 446; OC Pills and Cervical Cancer 446; The Possible Postulated Mechanism 447; Hormone Replacement Therapy and Risk of Breast Cancer 447

48. Hormones and Ovarian Cancer 450

Amita Maheshwari, Neha Kumar

Hormonally Active Ovarian Tumors 450; Sex Cord Stromal Tumors 450; Granulosa Cell Tumors 451; Thecomas 452; Sertoli Leydig Cell Tumors 453; Sex Cord Tumors with Annular Tubules (SCTAT) 454; Gynandroblastoma 454; Steroid Cell Neoplasms/Lipid Cell Neoplasms 454; Other Hormonally Active Ovarian Tumors 454; Protective and Detrimental Effects of Hormones on Ovarian Cancer 455

2

Pituitary Gland

Jasmine Lopez, Hilla S

The pituitary gland is often dubbed the "master gland" because its hormones control other parts of the endocrine system, namely the thyroid, adrenals, ovaries and testes. Figure 1 shows major endocrine glands in the body as well as the organs which contain endocrine cells.

Anatomy and Physiology of the Pituitary Gland[1-3]

It is a pea-sized gland that sits in a protective bony enclosure called the sella turcica. Figure 2 shows lateral view of pituitary gland and its relations. It is composed of three lobes: anterior, intermediate, and posterior.

Anterior Lobe

Endocrine cells of the anterior pituitary are controlled by regulatory hormones released by parvocellular neurosecretory cells in the hypothalamus. The latter release regulatory hormones into hypothalamic capillaries leading to infundibular blood vessels, which in turn lead to a second capillary bed in the anterior pituitary. This vascular relationship constitutes the hypothalamo-hypophyseal portal system.

The anterior pituitary is divided into anatomical regions known as the pars tuberalis, pars intermedia, and pars distalis. It develops from a depression in the dorsal wall of the pharynx (stomodial part) known as Rathke's pouch.

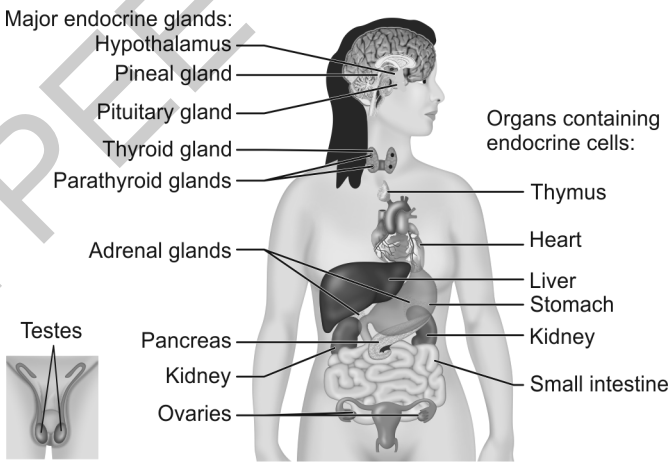
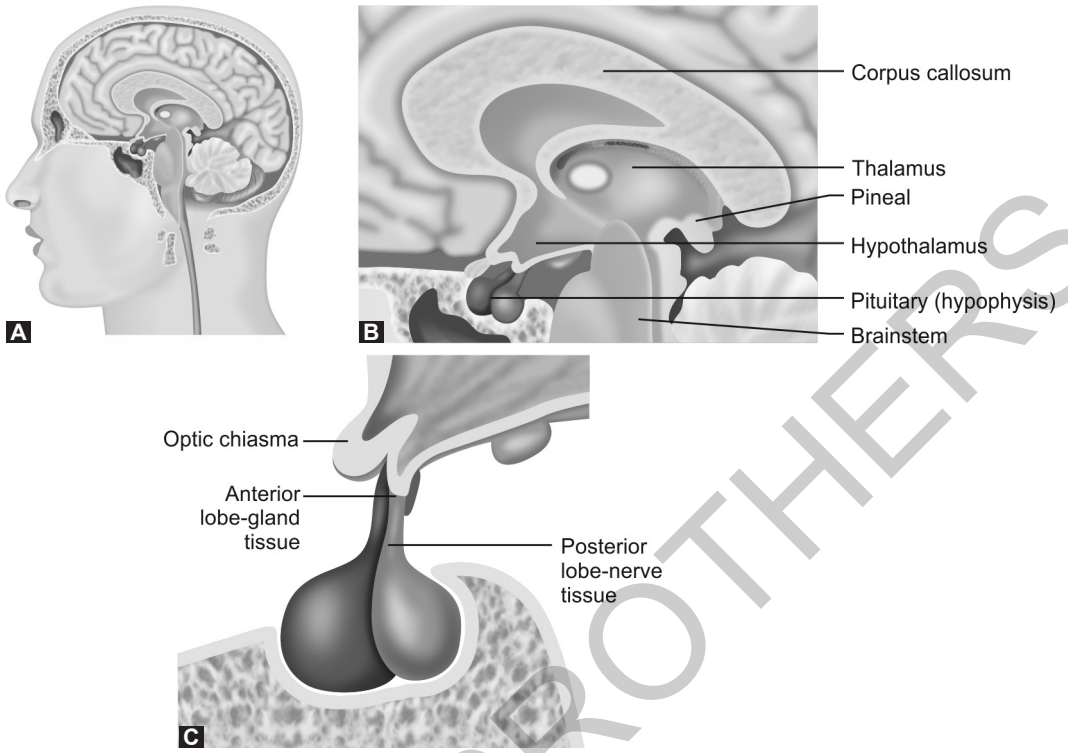


Fig. 1 Major endocrine glands

JAYPEE BROTHERS



Figs 2A to C The pituitary gland

Posterior Lobe

The posterior lobe develops as an extension of the hypothalamus. The magnocellular neurosecretory cells of the posterior side possess cell bodies located in the hypothalamus that project axons down the infundibulum to terminals in the posterior pituitary. This simple arrangement differs sharply from that of the adjacent anterior pituitary, which does not develop from the hypothalamus. The release of pituitary hormones by the lobes of the pituitary is under the control of the hypothalamus, albeit in different ways.

Intermediate Lobe

Often considered part of the anterior pituitary, the intermediate lobe produces melanocyte-stimulating hormone (MSH), although this function is often attributed to the anterior pituitary.

Functions

The pituitary gland is involved in several functions of the body including:

- Growth hormone production
- Production of hormones that act on other endocrine glands and that act on the muscles and the kidneys
- Endocrine function regulation
- Storage of hormones produced by the hypothalamus.

The pituitary gland secretes nine hormones that regulate homeostasis. Figure 3 shows pituitary hormones and their target organs. Tables 1 and 2 give details of these hormones.

Anterior pituitary hormones are regulated by hypothalamic releasing and inhibitory hormones and by negative feedback of the target glandular hormones at the pituitary and hypothalamic levels. Among pituitary hormones, only the secretion of prolactin is increased in the absence

JAYPEE BROTHERS

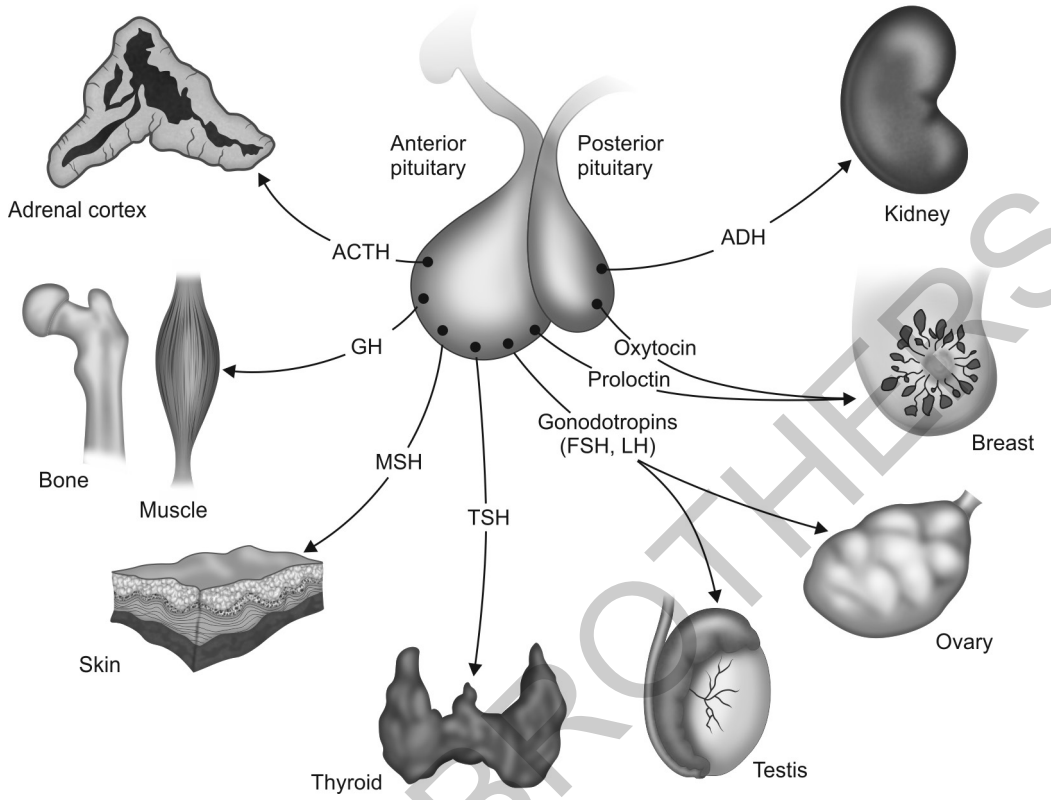


Fig. 3 Hormones of the pituitary gland and their target organs

of hypothalamic influence, because it is mainly under tonic suppression by dopamine, the main inhibitory factor. Table 3 shows hypothalamo-pituitary-gonadal feedback axis and target glands.

Histology[1]

In low power image of the pituitary gland (Fig. 4), one can identify the paler staining posterior pituitary, and the darker staining anterior pituitary.

There are two types of chromophils called acidophils and basophils.

Figure 5 shows magnified image of the anterior pituitary, stained with H and E showing two types of chromophils; pink - **acidophils**, which are more common, and purple - **basophils**.

The posterior pituitary looks very different than the anterior pituitary. It contains non-myelinated axons which are the neurosecretory cells (Fig. 6). The cell bodies of these cells are located in the hypothalamus.

The normal ranges (Table 4) for pituitary hormone tests are highly method-dependent, resulting in significant laboratory variation. Also, age, sex, and sampling time must be taken into consideration when interpreting results.

Pituitary Disorders

Pituitary gland disease can affect many parts of the body.

The main disorders involving the pituitary gland are given in Table 5.

Remarkable advances in medical technology continue to transform health care delivery.

The diagnosis of pituitary disease is generally uncomplicated. This is despite the high prevalence of occult pituitary adenomas

JAYPEE BROTHERS

Table 1 Target organs and functions of pituitary hormones

Anterior		
The anterior pituitary makes and releases several hormones		
Hormone released	*Main target*	*Function*
Adrenocorticotrophic hormone (ACTH)	Adrenal glands	Stimulates the adrenal glands to produce cortisol. Cortisol is important in controlling your metabolism, blood sugar levels and blood pressure. It is also an anti-inflammatory agent, and helps your body to resist certain stresses such as bleeding or fasting.
Follicle-stimulating hormone (FSH)	Ovaries (women) Testes (men)	Stimulates the ovaries to produce an ovum (egg) for fertilization. Also causes an increase in the hormone estrogen. Stimulates the testes to produce sperm.
Growth hormone (GH)	Many different cells of the body	The most well-known effect in children is to increase height. In adults and children it helps to control the amount of muscle and fat in the body. It also helps to heal injuries and it promotes your immune system.
Luteinizing hormone (LH)	Ovaries (women) Testes (men)	Triggers ovulation—the release of what will become an ovum (egg) ready for fertilization. Stimulates cells in the testes to produce testosterone.
Melanocyte-stimulating hormone (MSH) (Synthesized precisely by the intermediate lobe)	Brain?	The exact role in humans is unknown. It may influence brain activity; when too much is present, it may cause darkening of the skin.
Prolactin	Breasts	Together with other hormones, prolactin stimulates the breasts to produce milk. It is also found in women who are not pregnant. Men also have prolactin, but its function is not understood well.
Thyroid-stimulating hormone (TSH)	Thyroid gland	TSH stimulates the thyroid gland to produce its own hormones, triiodothyronine (T3) and thyroxine (T4). These hormones help to control many bodily functions, including heart rate, temperature and metabolism.
Posterior		
The posterior pituitary releases only two hormones		
Hormone released	*Main target*	*Function*
Antidiuretic hormone (ADH)	Kidneys	Decreases urine production ADH also causes a rise in blood pressure.
Oxytocin	Breasts and uterus	Stimulates contraction of the uterus during childbirth. Helps breasts to release milk.

JAYPEE BROTHERS

in the general population, the widespread use of high definition imaging techniques, and the broad range of intra- and perisellar lesions that can mimic pituitary adenomas. Follow up and optimization of pituitary hormone replacement is also relatively straightforward, but management of visual impairment, reduced fertility, coarsened facial features, arthritis, obesity, headaches, and obstructive sleep apnea is often much more troublesome. The role of medical care in contributing to health improvements within societies plays a vital role in the timely diagnosis and management of pituitary disorders.

Table 2 Cell types, target organs, and actions of anterior pituitary hormones

Type of chromophil	*Class*	*Secretory product*	*Target organ*
Acidophil	Somatotrophs (about 50%)	Growth hormone (GH, also known as somatotropin, STH)	General, but a major target is the chondrocytes in epiphyseal growth plates. Promotes growth (together with insulin like growth factors)
	Mammotrophs (about 20%)	Prolactin (PRL)	Milk producing tissue (alveolar cells) in the breast
Basophil	Corticotrophs (about 20%)	ACTH (Adrenocorticotropic hormone,) also known as corticotropin. Melanocyte-stimulating hormone (MSH)	Trophic (trophic - from the greek - to nourish)- general action - promote growth and secretory activity in other endocrine glands. ACTH target is the corticosteroid cells of the adrenal cortex. MSH target is the melanocytes. TSH target is the follicular epithelial cells of the thyroid. FSH target is the follicular cells of the ovaries, to promote growth of follicles, or the sertoli cells of the testes to promote spermatogenesis. LH target is developing follicles - promotes ovulation, or the Leydig cells of the testes—where it promotes secretion of androgens, aiding spermatogenesis. Three of these tropic hormones (TSH, FSH and LH) are glycoproteins, so they can be stained up by the technique PAS.
	Thyrotrophs (about 5%)	TSH (thyroid stimulating hormone), also known as thyrotrophin	
	Gonadotrophs (about 5%)	gonadotrophins: FSH (follicle stimulating hormone) and LH (Lutenising hormone).	

Table 3 Hypothalamo-pituitary- gonadal feedback axis and target glands

Target gland	*Hypothalamic regulatory hormone*	*Pituitary hormone*	*Feedback hormone*
Thyroid gland	TRH	TSH	T_4, T_3
Gonad	LHRH	LH	E2, T
Gonad	LHRH	FSH	Inhibin, E2, T
Many organs	GHRH, SMS	GH	IGF-1
Breast	PIF	Prolactin	?
Adrenal	CRH	ACTH	Cortisol

Abbreviations: ACTH, adrenocorticotropic hormone; CRH, corticotropin-releasing hormone; E2, estradiol; GHRH, growth hormone-releasing hormone; IGF-1, insulin-like growth factor 1; LHRH, luteinizing hormone-releasing hormone; PIF, prolactin release inhibitory factor; SMS, somatostatin; T, testosterone; T_3, triiodothyronine; T_4, thyroxine; TRH, thyrotropin-releasing hormone; TSH, stimulating hormone; LH, luteinizing hormone; FSH, follicle-stimulating hormone; GH, growth hormone

JAYPEE BROTHERS

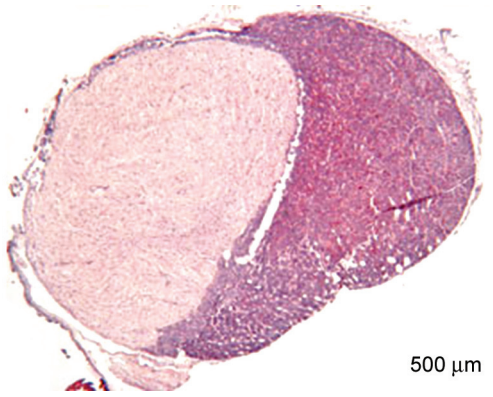


Fig. 4 Low power image of pituitary gland

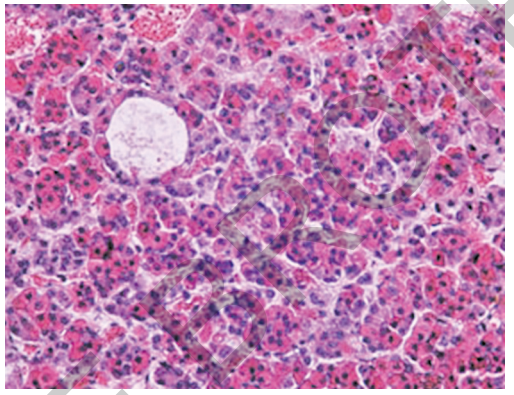


Fig. 5 Microscopic view of anterior pituitary

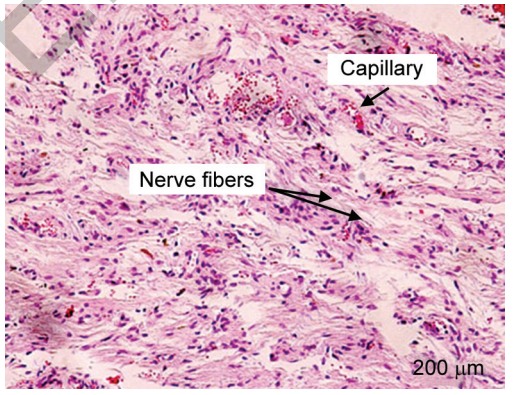


Fig. 6 Microscopic view of posterior pituitary[1]

JAYPEE BROTHERS

Table 4 Normal and abnormal secretions of pituitary hormones and their effects on the body

Hormone	*Reference range*	*Increased levels Effects on body*	*Decreased levels Effects on body*
hGH	Adult men: 0–5 ng/mL Adult women: 0–10 ng/mL Children (over six years): <16 ng/mL	Significant of: Gigantism, acromegaly	Significant of: hGH deficiency, dwarfism, hyperglycemia, failure to thrive, delayed sexual maturity
ACTH	Between 4 and 8 AM: 8–100 pg/mL Between 8 and 10 PM: <50 pg/mL	ACTH-producing tumors. Either in the pituitary or from lung cancer or ovarian cancer	Adrenal adenoma
TSH	0.2–4.7 microunits per mL (uU/mL)	Congenital hypothyroidism (cretinism) or primary hypothyroidism	Hyperthyroidism such as in Graves' disease or thyroiditis, or secondary hypothyroidism
FSH	Adult male: 4–25 U/L Premenopausal woman: 4–30 U/L Pregnant woman: Too low to measure Postmenopausal woman: 40–250 U/L	Abnormal levels can also indicate precocious puberty, hypopituitarism, Klinefelter's syndrome, Turner syndrome, testicular failure, and polycystic ovarian syndrome	Anorexia nervosa and disorders of the hypothalamus or pituitary gland
LH	Males: 1–8 mU/mL Children: 1–5 mU/mL Females in Follicular phase: 1.7–15 mU/mL Midcycle peak: 16–104 mU/mL Luteal phase: 0.6–16 mU/mL Postmenopausal women: 16–66 mU/mL	Primary gonadal dysfunction, polycystic ovarian syndrome, and pituitary adenoma	Delayed puberty, congenital adrenal hyperplasia, stress, malnutrition and diffuse pituitary or hypothalamic problems.
Prolactin	Adult males: 3–15 ng/mL Nonpregnant adult females: 3.8–23 ng/mL Pregnant women (third trimester): 95–475 ng/mL	Galactorrhea, amenorrhea, hypothyroidism, prolactin secreting pituitary tumors, infiltrative diseases of the hypothalamus, metastatic cancer of the pituitary gland stress, which may be produced by anorexia nervosa, surgery, strenuous exercise, trauma and in renal failure	Pituitary failure
ADH	1–5 pg/mL or 1–5 ng/L (SI units)	Dehydration; hypovolemia; severe physical stress (e.g. trauma, pain or prolonged mechanical ventilation) central nervous system tumors, ectopic tumors, and infection	Over hydration

JAYPEE BROTHERS

Table 5 Pituitary disorders[4]

Condition	*Direction*	*Hormone*
Acromegaly	Overproduction	Growth hormone
Cushing's disease	Overproduction	Adrenocorticotropic hormone
Growth hormone deficiency	Underproduction	Growth hormone
Syndrome of inappropriate antidiuretic hormone	Overproduction	Vasopressin
Diabetes insipidus (can also be nephrogenic)	Underproduction	Vasopressin
Sheehan syndrome	Underproduction	Any pituitary hormone
Pickardt-Fahlbusch syndrome	Underproduction	Any pituitary hormone, except prolactin, which is increased
Hyperpituitarism (most commonly pituitary adenoma)	Overproduction	Any pituitary hormone
Hypopituitarism	Underproduction	Any pituitary hormone
Thyroid disorders caused by the pituitary gland are less common though, accounting for less than 10% of all hypothyroidism cases and much less than 1% of hyperthyroidism cases	Overproduction Underproduction	Hyperthyroidism Hypothyroidism
Hypophysitis, inflammation of the pituitary gland		
Autoimmune hypophysitis (or lymphocytic hypophysitis)		
Pituitary tumor		
Pituitary adenoma		
Pituicytoma, a rare brain tumor		
Pituitary apoplexy		

References

1. Henry Gray. Anatomy of the Human Body. XI. Splanchnology 4. The Ductless Glands 1918. pp. 1821-1865 [Twentieth Edition New York: Bartleby; 2000].
2. Guyton and Hall. Thyroid Metabolic Hormones chapter 76. pp.907-16. Textbook of Medical Physiology. 12th edn. Saunders-Elsevier publishers.
3. Boron Walter F, Boulpaep Emile L. Medical Physiology, 2nd edn. Philadelphia: Saunders Elsevier; 2009. pp.1016-7.
4. "Overview of the Pituitary Gland: Pituitary Gland Disorders: Merck Manual Home Health Handbook". Retrieved 2009-04-04.

JAYPEE BROTHERS

detailed information on obstetrics & gynecology books, visit our website **www.jaypeebrothers.com,** for detailed informatio

ENDOCRINOLOGY
in Obstetrics & Gynecology

Salient Features

- Accounts of various endocrinological aspects of obstetrics and gynecology
- Covers the basics and advances in the field of endocrinology. *Part 1* covers applied basics which are relevant and important for practicing obstetricians, gynecologists, and postgraduate students. *Part 2* covers the clinical aspects and advances in diagnosis and management of various endocrinological disorders
- Contributes the entire text by experts having the vast experiences in the field of endocrinology
- Gives the current recommendations and guidelines of hormonal management of various diseases, wherever applicable
- Discusses all the endocrine problems, we face in day-to-day practice as well as some rare endocrine diseases
- Contains puberty disorders, contrasexual disorders, menstrual disorders, amenorrhea, infertility, hormonal contraception, endocrine problems in pregnancy, menopause, osteoporosis, lifestyle diseases, hormones and cancer, and overview of ovarian transplant as well
- Incorporates the algorithms for managing these complex endocrine disorders, which will make the management simple. This will immensely benefit the readers.



Suvarna Khadilkar MD DGO FICOG graduated from Grant Medical College (GMC) Mumbai, Maharashtra, India. She is Consultant Gyne-Endocrinologist, Bombay Hospital Institute of Medical Sciences and Medical Research Center, Mumbai, Maharashtra, India. She joined as a Lecturer, Department of Obstetrics and Gynecology, JJ Hospital and Grant Medical College, Mumbai, and later worked as an Associate Professor and Unit Chief, St George Hospital and Cama and Albless Hospital, Mumbai, Maharashtra, India. Further on, she was selected by MPSC on merit no 1, for Professor and Head, Department of Obstetrics and Gynecology, Government Medical College, Kolhapur, Maharashtra, India. She has been graduate and postgraduate teacher for 22 years and an Examiner, Mumbai University and Maharashtra University of Health Sciences, Maharashtra, India. After having worked in various capacities for the Journal of Obstetrics and Gynecology of India (JOGI), she was selected as an Assistant Editor, JOGI (2012). Pursuing her interest in endocrinology, she became the Chairperson, Reproductive Endocrinology Committee of FOGSI (2011–13) and also the Secretary General, Indian Menopause Society Elect (2013). She is currently the President, Association of Medical Women of India, Mumbai Branch. She is an Active Executive Member, Mumbai Ob/Gyn Society and served as Chairperson, Menopause and Reproductive Endocrinology Committee of MOGS. She has delivered over 200 invited lectures all over India. She has organized more than 100 CMEs and workshops across the country. She is the author of over 35 research papers. She has edited a FOGSI book *FAQ on AUB*. The book has won the FOGSI DC Dutta Award for the best publication 2012–13. She has co-edited three books (FOGSI) on DUB, Menopause, and Reproductive Endocrinology. She has published more than 35 articles at national and international levels. She is a recipient of about 25 awards for the research. A few to mention, Pramila Bhatia Young Scientist Award, Dr Kumud P Tamaskar Research prize, Dr CS Dawn prize, Nimish Shelat, FOGSI Reproductive Endocrinology prize.

Available at all medical bookstores
or buy online at www.jaypeebrothers.com

JAYPEE BROTHERS
Medical Publishers (P) Ltd.
www.jaypeebrothers.com

Join us on facebook.com/JaypeeMedicalPublishers

Shelving Recommendation
OBSTETRICS & GYNECOLOGY

ISBN 978-93-5152-183-9