UNDERGRADUATE PROGRAMME IN BIOCHEMISTRY

Paper No- 11
Hormones : Biochemistry and Function

THEORY

1. **Introduction to endocrinology** **(4 lectures)**
   Functions of hormones and their regulation. Chemical signaling - endocrine, paracrine, autocrine, intracrine and neuroendocrine mechanisms. Chemical classification of hormones, transport of hormones in the circulation and their half-lives. Hormone therapy. General introduction to Endocrine methodology.
   [Endocrinology (2007) Hadley and Levine, p8-14, p22-25, p74-82, p85-88]

2. **Hormone mediated signaling** **(14 lectures)**
   Hormone receptors - extracellular and intracellular. Receptor - hormone binding, Scatchard analysis. G protein coupled receptors, G proteins, second messengers - cAMP, cGMP, IP_3, DAG, Ca^{2+}, NO. Effector systems - adenyl cyclase, guanyl cyclase, PDE, PLC. Protein kinases (PKA, PKB, PKC, PKG). Receptor tyrosine kinases - EGF, insulin, erythropoietin receptor; ras - MAP kinase cascade, JAK - STAT pathway. Steroid hormone/ thyroid hormone receptor mediated gene regulation. Receptor regulation and cross talk.
   [Lehninger: Principles of Biochemistry (2013) Nelson and Cox, p433-460, p471-472; Endocrinology (2007) Hadley and Levine, p39-62; The Cell: A Molecular Approach (2009) Hooper and Hausman, p644-646].

3. **Hypothalamic and pituitary hormones** **(6 lectures)**
   Hypothalamic - pituitary axis. Study the physiological and biochemical actions of hypothalamic hormones, pituitary hormones - GH, prolactin, TSH, LH, FSH, POMC peptide family, oxytocin and vasopressin, feedback regulation cycle. Endocrine disorders - gigantism, acromegaly, dwarfs, pigmies and diabetes insipidus.
   [Endocrinology (2007) Hadley and Levine, p94-151]

4. **Thyroid hormone** **(4 lectures)**
   Thyroid gland. Biosynthesis of thyroid hormone and its regulation; its physiological and biochemical action. Pathophysiology - Goiter, Graves disease, cretinism, myxedema, Hashimato's disease.
   [Endocrinology (2007) Hadley and Levine, p293-312]

5. **Hormones regulating Ca^{2+} homeostasis** **(4 lectures)**
   PTH, Vitamin D and calcitonin. Mechanism of Ca^{2+} regulation and pathways involving bone, skin, liver, gut and kidneys. Pathophysiology - rickets, osteomalacia, osteoporosis.
   [Endocrinology (2007) Hadley and Levine, p182-207; Vander's Human Physiology (2008) Widmaier et al., p546-551]

6. **Pancreatic and GI tract hormones** **(4 lectures)**
   Regulation of release of insulin, glucagon, gastrin, secretin, CCK, GIP, adipolectin, leptin and ghrelin. Summary of hormone metabolite control of GI

function. Physiological and biochemical action. Pathophysiology - diabetes type I and type II.
[Endocrinology (2007) Hadley and Levine, p211-220, p224, p230, p239-260; Vander's human Physiology (2008) Widmaier et al., p606-615]

7. Hormones of adrenals (6 lectures)
Aldosterone, renin angiotensin system, cortisol, epinephrine and norepinephrine. Fight or flight response, stress response. Pathophysiology – Addison's disease, Conn's syndrome, Cushing syndrome.
[Endocrinology (2007) Hadley and Levine, p322-332, p344-360]

8. Reproductive hormones (4 lectures)
Male and female sex hormones. Interplay of hormones during reproductive cycle, pregnancy, parturition and lactation. Hormone based contraception.
[Vander's Human Physiology (2008) Widmaier et al., p654-684]

9. Growth factors (2 lectures)
PDGF, EGF, IGF-II, and erythropoietin.
[Endocrinology (2007) Hadley and Levine, p264-286]

Essential Readings

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M. W.H. Freeman & Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10-14641-0962-1.
2. Vander's Human Physiology (2008) 11th ed., Widmaier, E.P., Raff, H. and Strang, K.T. McGraw Hill International Publications, ISBN: 978-0-07-128366-3.
3. Endocrinology (2007) 6th ed., Hadley, M.C. and Levine, J.E. Pearson Education (New Delhi), Inc. ISBN: 978-81-317-2610-5.
4. The Cell: A Molecular Approach (2009) 5th Ed. Cooper, G.M. and Hausman, R.E. ASM Press & Sunderland, (Washington DC), Sinauer Associates. (MA). ISBN:978-0-87893-300-6.

PRACTICALS

1. Glucose tolerance test.
2. Estimation of serum Ca^{2+}.
3. Estimation of serum T4.
4. HCG based pregnancy test.
5. Estimation of serum electrolytes.
6. Case studies.