2026 Akita University Faculty of Medicine Syllabus

Category ： 基礎医学 II
Course Title ： Cell Structure and Function II - Endocrinology -
Eligible Students ： grade 1 Related Course
Code ： 71563003
Schedule ： week 2 ～ week 17
Credits ： 0.5

1. **Lead Instructor**

   Tomohiro Numata (Professor, Department of Integrative Physiology)

2. **Instructors**

   Tomohiro Numata (Professor, Department of Integrative Physiology)
   Kaori Sato (Lecturer, Department of Integrative Physiology)

3. **Course Description Outline(Course Objectives)**

   This course provides a systematic foundation in endocrine physiology that underlies homeostasis and clinical pathophysiology. Students will learn (1) normal endocrine regulatory mechanisms supporting homeostasis, and (2) how these mechanisms become dysregulated in endocrine-related diseases encountered in clinical settings.
   In addition, the course aims to strengthen practical competence by training students to efficiently search and evaluate reliable medical information related to endocrinology, and to apply such information in guided exercises. Through lectures, information retrieval, and exercises, students will experience an active learning process that supports the development of lifelong learning habits. The course also addresses professionalism (trust, integrity, compassion, reflection, ethics), behavioral science in medicine, patient safety, medical systems/law, evidence-based medicine (EBM), and appropriate use of ICT in clinical and academic contexts.

   (1) Be able to explain the homeostasis maintenance and adaptation of living organisms. (1-1 1-2, 2-1 2-6, 3-1 3-6, 4-1 4-7, 5-1 5-4, 6-1 6-2)
   (2) Be able to explain the regulatory mechanism for maintaining homeostasis. (2-1 2-6, 3-1 3-6, 4-1 4-7, 5-1 5-4, 6-1 6-2)
   (3) Be able to explain the types and functions of information transmission. (2-1 2-6, 3-1 3-6, 4-1 4-7, 5-1 5-4, 6-1 6-2))
   (4) Explain the mechanism of information transmission by receptors. (2-1 2-6, 3-1 3-6, 4-1 4-7, 5-1 5-4, 6-1 6-2))
   (5) Be able to illustrate the location of each endocrine organ and list the hormones secreted from it. (2-1 2-6, 3-1 3-6, 4-1 4-7, 5-1 5-4, 6-1 6-2)
   (6) Explain hypothalamic and pituitary hormones' names, actions, and interrelationships. (2-1 2-6, 3-1 3-6, 4-1 4-7, 5-1 5-4, 6-1 6-2)
   (7) Be able to explain the effects of hormones secreted by the thyroid gland and the secretion regulation mechanism. (2-1 2-6, 3-1 3-6, 4-1 4-7, 5-1 5-4, 6-1 6-2)
   (8) Explain the effects and secretion regulation mechanisms of hormones involved in bone metabolism. (2-1 2-6, 3-1 3-6, 4-1 4-7, 5-1 5-4, 6-1 6-2)
   (9) Be able to explain the effects of hormones secreted from the pancreas and the secretion regulation mechanism. (2-1 2-6, 3-1 3-6, 4-1 4-7, 5-1 5-4, 6-1 6-2)
   (10) Explain the effects and secretion regulation mechanism of hormones secreted from the adrenal glands. (2-1 2-6, 3-1 3-6, 4-1 4-7, 5-1 5-4, 6-1 6-2)
   (11) Be able to explain the synthesis and metabolic pathways and effects of male and female hormones. (2-1 2-6, 3-1 3-6, 4-1 4-7, 5-1 5-4, 6-1 6-2)
   (12) Be able to explain the actions and secretion regulation mechanisms of hormones secreted from the gastrointestinal tract. (2-1 2-6, 3-1 3-6, 4-1 4-7, 5-1 5-4, 6-1 6-2)
   (13) Explain the effects and secretion regulation mechanism of hormones secreted from fat. (2-1 2-6, 3-1 3-6, 4-1 4-7, 5-1 5-4, 6-1 6-2)

(14) Be able to explain the functions of sexual and reproductive organs. (2-1 2-6, 3-1 3-6, 4-1 4-7, 5-1 5-4, 6-1 6-2)
(15) Learn about related professionalism (trust, honesty, consideration, reflection, ethics), medical behavioral science, medical safety, medical law (system), comprehensive judgment using ENM, and appropriate use of ICT. (1-1 1-2, 3-3, 3-5, 3-7, 4-4)

臨床現場で遭遇する病態について理解するため、生体の恒常性の基礎となる正常な内分泌機構を理解する。また、修得した内容を診療で実践していくために、各疾患の病態における内分泌機構を理解する。さらにそれぞれの学生が内分泌に関連する医学情報を検索する力をつけるとともに演習を行う。これらの講義、情報の検索、演習によるアウトプットの一連の内容から、自発的な学習様式を経験することで生涯にわたる学習習慣を形成する。また、関連するプロフェッショナリズム（信頼、誠実、思いやり、省察、倫理）医療行動科学、医療安全、医療法（制度）、EBM を活用した総合的な判断、ICT の適切な活用について学ぶ。

概要
（１）生体の恒常性維持と適応を説明できる。(1-1〜1-2、2-1〜2-6、3-1〜3-6、4-1〜4-7、5-1〜5-4、6-1〜6-2）
（２）恒常性維持のための調節機構を説明できる。(2-1〜2-6、3-1〜3-6、4-1〜4-7、5-1〜5-4、6-1〜6-2）
（３）情報伝達の種類と機能を説明できる。(2-1〜2-6、3-1〜3-6、4-1〜4-7、5-1〜5-4、6-1〜6-2)）
（４）受容体による情報伝達の機序を説明できる。(2-1〜2-6、3-1〜3-6、4-1〜4-7、5-1〜5-4、6-1〜6-2)）
（５）各内分泌器官の位置を図示し、そこから分泌されるホルモンを列挙できる。(2-1〜2-6、3-1〜3-6、4-1〜4-7、5-1〜5-4、6-1〜6-2）
（６）視床下部ホルモン・下垂体ホルモンの名称、作用と相互関係を説明できる。(2-1〜2-6、3-1〜3-6、4-1〜4-7、5-1〜5-4、6-1〜6-2）
（７）甲状腺から分泌されるホルモンの作用と分泌調節機構を説明できる。(2-1〜2-6、3-1〜3-6、4-1〜4-7、5-1〜5-4、6-1〜6-2）
（８）骨代謝で関わるホルモンの作用と分泌調節機構を説明できる。(2-1〜2-6、3-1〜3-6、4-1〜4-7、5-1〜5-4、6-1〜6-2）
（９）膵臓から分泌されるホルモンの作用と分泌調節機構を説明できる。(2-1〜2-6、3-1〜3-6、4-1〜4-7、5-1〜5-4、6-1〜6-2）
（１０）副腎から分泌されるホルモンの作用と分泌調節機構を説明できる。(2-1〜2-6、3-1〜3-6、4-1〜4-7、5-1〜5-4、6-1〜6-2）
（１１）男性ホルモン・女性ホルモンの合成・代謝経路と作用を説明できる。(2-1〜2-6、3-1〜3-6、4-1〜4-7、5-1〜5-4、6-1〜6-2）
（１２）消化管から分泌されるホルモンの作用と分泌調節機構を説明できる。(2-1〜2-6、3-1〜3-6、4-1〜4-7、5-1〜5-4、6-1〜6-2）
（１３）脂肪から分泌されるホルモンの作用と分泌調節機構を説明できる。(2-1〜2-6、3-1〜3-6、4-1〜4-7、5-1〜5-4、6-1〜6-2）
（１４）性生殖器の機能について説明ができる。(2-1〜2-6、3-1〜3-6、4-1〜4-7、5-1〜5-4、6-1〜6-2）
（１５）関連するプロフェッショナリズム（信頼、誠実、思いやり、省察、倫理）医療行動科学、医療安全、医療法（制度）、ENM を活用した総合的な判断、ICT の適切な活用について学ぶ。(1-1〜1-2、3-3、3-5、3-7、4-4）

4. **Textbook/Reference Books**

「人体の正常構造と機能」日本医事新報社
「標準生理学」医学書院

5. **Assessment**

Attendance, reports and exams.
To be eligible for the common examination, students must attend at least two-thirds of the lectures in each course.

出席状況、レポート及び試験
ただし、統一試験の受験資格は、各講座の講義について出席率が 2/3 以上であることを要件とする。

6. **Out of Class Study/Message**

- Proceed with lectures according to designated textbooks and handouts.
- The selected textbook should be prepared by the first day of the course.
- Slight changes may occur depending on the schedule of the instructor.

・指定教科書及び配布資料に沿って講義を進める。
・指定教科書は事前に指示するので、講義初日までに用意し、予習して受講すること。
・担当教員の予定により、若干変更する場合がある。

Topics and Contents of class, Course Objectives						
	Class Date	**Period**	**Class Format**	**Topics and Contents of class, Course Objectives**	**Instructors**	**Class Room**
1	10 / 1 (Thu)	5-6	Lecture	Theme: Endocrine hormone: General Principles Content: Homeostasis and endocrine regulation; hormone classes and receptors; feedback control; overview map of endocrine organs. Learning Objectives: 1.Explain homeostasis and adaptation using concrete examples (e.g., fluids, metabolism). 2.Diagram negative/positive feedback and apply them to endocrine regulation. 3.Explain differences between hormone classes and receptors (membrane vs nuclear) and signaling pathways. 4.Illustrate major endocrine organs and match representative hormones with target organs.	Tomohiro Numata	講義棟第一講義室
2	10 / 8 (Thu)	5-6	Lecture	Theme: Endocrine hormone：Hypothalamic hormones Content: Integrative roles of the hypothalamus; releasing/inhibiting hormones; portal system; linkage to the pituitary. Learning Objectives: 1.Organize the names and roles of hypothalamic releasing/inhibiting hormones. 2.Diagram hypothalamus–pituitary–peripheral gland axes (HPA/HPT/HPG, etc.). 3.Interpret hormone levels (high/low) to explain the direction of feedback disturbance (overview level).	Tomohiro Numata	講義棟第一講義室
3	10 / 15 (Thu)	5-6	Lecture	Theme: Endocrine hormone：Anterior pituitary hormones Content: Overview of anterior pituitary hormones; GH/IGF-1 axis; PRL regulation; excess/deficiency states. Learning Objectives: 1.Explain regulation of the GH–IGF-1 axis (stimuli/inhibition and feedback). 2.Explain dopamine-mediated inhibition of prolactin secretion. 3.Outline typical clinical features associated with GH/PRL excess or deficiency.	Tomohiro Numata	講義棟第一講義室
4	10 / 22 (Thu)	5-6	Lecture	Theme: Endocrine hormone：Posterior pituitary hormones Content: Vasopressin (AVP) in osmoregulation and water balance; oxytocin physiology; representative disorders. Learning Objectives: 1.Explain AVP secretion triggers (osmolality, circulating volume) and target sites (e.g., collecting duct). 2.Outline AVP-related disorders (central diabetes insipidus, SIADH) in terms of water–sodium balance. 3.Explain key actions of oxytocin (labor, lactation).	Kaori Sato	講義棟第一講義室

Topics and Contents of class, Course Objectives						
	Class Date	**Period**	**Class Format**	**Topics and Contents of class, Course Objectives**	**Instructors**	**Class Room**
5	10 / 29 (Thu)	5-6	Lecture	Theme: Endocrine hormone：Thyroid hormones Content: T3/T4 synthesis and secretion; HPT axis; actions (metabolism, growth); hyper/hypothyroidism. Learning Objectives: 1.Describe the overview of thyroid hormone synthesis and secretion. 2.Diagram the HPT axis and explain the relationship between TSH and T3/T4. 3.Outline typical symptoms and key laboratory patterns (TSH and FT4 combinations) in hyper/hypothyroidism.	Tomohiro Numata	講義棟第一講義室
6	11 / 5 (Thu)	5-6	Lecture	Theme: Endocrine hormone：Bone metabolism and hormones Content: Calcium/phosphate homeostasis; PTH, active vitamin D, calcitonin; framework of bone remodeling. Learning Objectives: 1.Explain actions of PTH and active vitamin D across intestine, kidney, and bone. 2.Diagram feedback control responding to changes in blood calcium. 3.Outline basic disease patterns (rickets/osteomalacia, primary hyperparathyroidism) as directional changes in Ca/P.	Tomohiro Numata	講義棟第一講義室
7	11 / 12 (Thu)	5-6	Lecture	Theme: Endocrine hormone：Pancreatic hormones Content: Insulin and glucagon; glucose regulation; fed vs fasting states; fundamentals of diabetes mellitus. Learning Objectives: 1.Explain secretion triggers and actions of insulin and glucagon. 2.Outline metabolic switching between fed and fasting states. 3.Explain the basic distinction between type 1 and type 2 diabetes from the perspective of insulin deficiency/resistance.	Tomohiro Numata	講義棟第一講義室
8	11 / 19 (Thu)	5-6	Lecture	Theme: Endocrine hormone：Adrenal cortical hormones Content: Adrenal zonation; cortisol, aldosterone, androgens; HPA axis and RAAS; representative disorders. Learning Objectives: 1.Match adrenal cortex zones to their major hormones. 2.Explain cortisol regulation (HPA axis) and major actions (metabolism, immune). 3.Explain aldosterone regulation (RAAS) and effects on electrolytes and blood pressure. 4.Outline the pathophysiology (directional overview) of Cushing syndrome, Addison disease, and primary aldosteronism.	Tomohiro Numata	講義棟第一講義室

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	Class Date	**Period**	**Class Format**	**Topics and Contents of class, Course Objectives**	**Instructors**	**Class Room**
9	12 / 3 (Thu)	5-6	Lecture	Theme: Endocrine hormones: Adrenal medullary hormones Content: Catecholamines (epinephrine/norepinephrine); stress response; linkage to autonomic nervous system; pheochromocytoma (intro). Learning Objectives: 1.Explain how catecholamine synthesis/secretion is coupled to sympathetic activity. 2.Organize α / β receptor actions and major organ responses (heart, vessels, metabolism). 3.Outline typical symptoms suggestive of pheochromocytoma (e.g., paroxysmal hypertension).	Tomohiro Numata	講義棟第一講義室
10	12 / 10 (Thu)	5-6	Lecture	Theme: Endocrine hormones: Gastrointestinal hormones, Adipose hormones Content: GI hormones (gastrin, secretin, CCK, incretins, etc.); appetite and energy regulation (e.g., leptin). Learning Objectives: 1.Explain major GI hormones in terms of secretion triggers and actions (acid secretion, gallbladder contraction, etc.). 2.Explain the concept of incretins and their contribution to glucose regulation. 3.Explain roles of adipose-derived hormones (e.g., leptin) in appetite and metabolic regulation.	Tomohiro Numata	講義棟第一講義室
11	12 / 17 (Thu)	5-6	Lecture	Theme: Endocrine hormones: Male Reproduction and Hormones Content: HPG axis; testis (Leydig/Sertoli cells); testosterone; spermatogenesis; feedback control. Learning Objectives: 1.Diagram the HPG axis (GnRH → LH/FSH → testis) and explain regulation. 2.Explain distinct roles of Leydig and Sertoli cells. 3.Explain testosterone actions and feedback regulation. 4.Describe an introductory classification of causes of male infertility.	Tomohiro Numata	講義棟第一講義室
12	1 / 7 (Thu)	5-6	Lecture	Theme: Endocrine Hormones: Female Reproduction and Hormones Content: Menstrual cycle; ovarian hormones (estrogen/progesterone); ovulation; endocrine aspects of pregnancy/lactation. Learning Objectives: 1.Explain the menstrual cycle as coordinated changes in GnRH, LH/FSH, and ovarian hormones. 2.Outline ovulation mechanisms including the LH surge. 3.Outline key hormones involved in pregnancy and lactation.	Tomohiro Numata	講義棟第一講義室

Topics and Contents of class, Course Objectives						
	Class Date	**Period**	**Class Format**	**Topics and Contents of class, Course Objectives**	**Instructors**	**Class Room**
13	1 / 14 (Thu)	5-6	Exercise	Theme: Endocrine Hormones: Seminar 1 Content: Review of major endocrine axes (HPA/HPT/HPG/pancreas); typical questions and mini-cases. Learning Objectives: 1.Diagram endocrine axes and explain stimuli, inhibition, and feedback. 2.Use simple lab patterns (TSH/FT4, glucose, Na, etc.) to state the likely direction of pathophysiology. 3.Summarize key points concisely and explain them to others.	Tomohiro Numata	講義棟第一講義室
14	1 / 21 (Thu)	5-6	Exercise	Theme: Endocrine Hormones: Seminar 2 Content: Integration of endocrine disorders (excess vs deficiency; primary vs secondary); evidence confirmation using information retrieval. Learning Objectives: 1.Explain the basics of distinguishing primary vs secondary disorders using hormone combinations. 2.Describe a basic sequence from pathophysiology → tests → treatment direction for representative disorders (intro level). 3.Search reliable sources using ICT and summarize key points while following appropriate citation/academic integrity rules.	Tomohiro Numata	講義棟第一講義室