

2025 Akita University Faculty of Medicine Syllabus

Category	: 基礎医学 III
Course Title	: Neuroscience and Organ function I - 神経科学・各臓器の機能・運動生理学・感覚生理学・自律神経科学 -
Eligible Students	: grade 2 Related Course
Code	: 71563012
Schedule	: week 1 ~ week 12
Credits	: 4

1. Lead Instructor

Tomohiro Numata (Professor, Department of Integrative Physiology, 6272)

Takafumi Miki (Professor, Department of Cell Physiology, 6069)

2. Instructors

Tomohiro Numata (Professor, Department of Integrative Physiology, 6272)

Takafumi Miki (Professor, Department of Cell Physiology, 6069)

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3. Course Description Outline(Course Objectives)

A deep understanding of the human body's functions is essential to address unknown pathological conditions encountered in clinical practice and to devise appropriate treatments. This understanding begins with a comprehensive grasp of physiological functions at all molecular, cellular, tissue, and systemic levels.

To apply the knowledge from lectures to clinical practice, students will actively explore the fundamental mechanisms underlying various diseases using ICT (information and communication technology) and critically evaluate potential treatment options. This structured approach helps lay the foundation for lifelong learning habits.

To realize evidence-based medicine (EBM), students will engage in international literature searches and data analysis, fostering their scientific curiosity. Moreover, they will develop the ability to understand the knowledge and techniques they discover and communicate them effectively to others. This process strengthens their presentation skills and the communication abilities required for collaboration.

Through these learning activities, students will cultivate a foundation for lifelong learning and establish the fundamental research mindset necessary for future professional endeavors. Additionally, the course includes learning activities focused on professionalism (including trust, integrity, empathy, reflection, and ethics), as well as medical behavioral science, medical safety, healthcare law and systems, and comprehensive decision-making using EBM. Appropriately using ICT is emphasized to build a well-rounded and integrated body of knowledge.

This holistic approach ensures students have the skills and understanding necessary for clinical and research settings.

(1) Be able to provide an overview of the nervous system, from molecules and cells to organs and individuals, including its physiological functions and pathology. (1-1 1-2, 2-1 2-6, 2-8, 3-1 3-7, 4-1 4-7, 5-1 5-4, 6-1 6 -2)

(2) Understand the structure and function of the nerves that form the basis of the nervous system, and based on this, be able to comprehensively outline everything from physiological functions to pathology at each level of the human body. (1-1 1-2, 2-1 2-6, 2-8, 3-1 3-7, 4-1 4-7, 5-1 5-4, 6-1 6 -2)

(3) Understand the normal functions of the central nervous system and its pathology, and be able to explain related diseases and their causes. (1-1 1-2, 2-1 2-6, 2-8, 3-1 3-7, 4-1 4-7, 5-1 5-4, 6-1 6 -2)

- (4) Understand the normal functions of peripheral nerves and their pathology, and be able to explain related diseases and their causes. (1-1 1-2, 2-1 2-6, 2-8, 3-1 3-7, 4-1 4-7, 5-1 5-4, 6-1 6-2)
- (5) Understand the normal function of the autonomic nervous system and its pathology, and be able to explain related diseases and their causes. (1-1 1-2, 2-1 2-6, 2-8, 3-1 3-7, 4-1 4-7, 5-1 5-4, 6-1 6-2)
- (6) Understand the normal function of motor nerves and their pathology, and be able to explain related diseases and their causes. (1-1 1-2, 2-1 2-6, 2-8, 3-1 3-7, 4-1 4-7, 5-1 5-4, 6-1 6-2)
- (7) Understand the normal functions of sensory nerves and their pathology, and be able to explain related diseases and their causes. (1-1 1-2, 2-1 2-6, 2-8, 3-1 3-7, 4-1 4-7, 5-1 5-4, 6-1 6-2)
- (8) Understand the normal functions of environmental physiology and its pathology, and be able to explain related diseases and their causes. (1-1 1-2, 2-1 2-6, 2-8, 3-1 3-7, 4-1 4-7, 5-1 5-4, 6-1 6-2)
- (9) Understand the normal function of skeletal muscles and their pathology, and be able to explain related diseases and their causes. (1-1 1-2, 2-1 2-6, 2-8, 3-1 3-7, 4-1 4-7, 5-1 5-4, 6-1 6-2)
- (10) Understand the normal function of the myocardium and its pathology, and be able to explain related diseases and their causes. (1-1 1-2, 2-1 2-6, 2-8, 3-1 3-7, 4-1 4-7, 5-1 5-4, 6-1 6-2)
- (11) Understand the normal function of smooth muscle and its pathology, and be able to explain related diseases and their causes. (1-1 1-2, 2-1 2-6, 2-8, 3-1 3-7, 4-1 4-7, 5-1 5-4, 6-1 6-2)
- (12) Understand the normal function of the heart and circulation and its pathology, and be able to explain related diseases and their causes. (1-1 1-2, 2-1 2-6, 2-8, 3-1 3-7, 4-1 4-7, 5-1 5-4, 6-1 6-2)
- (13) Understand the normal function of breathing and its pathology, and be able to explain related diseases and their causes. (1-1 1-2, 2-1 2-6, 2-8, 3-1 3-7, 4-1 4-7, 5-1 5-4, 6-1 6-2)
- (14) 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未知の病態に対処して治療法を考案するためには、人体の機能に関する知識が欠かせない。この知識の取得は人体の機能について、分子・細胞・組織・個体に至る各階層の生理機能を包括的に理解することから始まる。講義で得た知識を診療に活かすためには、各疾患の根本的なメカニズムを ICT を駆使して検索し、治療の可能性について主体的に検討する。これらの計画により、生涯を通じて学び続ける習慣の礎が築かれる。EBM を実現するために国際的な文献検索の方法の実践やデータを読み解く体験を通じ、科学的探究心を養う。また自らの発見した知識や技術を理解し、他者に分かりやすく説明するための表現力やその作成過程で生じるコミュニケーション能力を養う。これらの学習を通じて、生涯学習に加えてリサーチマインドの基礎を身につける。また、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 を活用した総合的に理解するための学習も含め、ICT の適切な活用 に焦点を当てて包括的な知識を築き上げる。

ねらい

- (1) 神経系について、分子・細胞から臓器・個体の階層にわたり、神経系の生理機能から病態まで含めて概説することができる。(1-1～1-2、2-1～2-6、2-8、3-1～3-7、4-1～4-7、5-1～5-4、6-1～6-2)
- (2) 神経系の基礎となる神経の構造と機能を理解し、これを基盤にして人体の各階層における生理機能から病態まで含めて包括的に概説することができる。(1-1～1-2、2-1～2-6、2-8、3-1～3-7、4-1～4-7、5-1～5-4、6-1～6-2)
- (3) 中枢神経の正常な機能とその病態を理解し、関連する疾患やその原因について説明することができる。(1-1～1-2、2-1～2-6、2-8、3-1～3-7、4-1～4-7、5-1～5-4、6-1～6-2)
- (4) 末梢神経の正常な機能とその病態を理解し、関連する疾患やその原因について説明することができる。(1-1～1-2、2-1～2-6、2-8、3-1～3-7、4-1～4-7、5-1～5-4、6-1～6-2)
- (5) 自律神経の正常な機能とその病態を理解し、関連する疾患やその原因について説明することができる。(1-1～1-2、2-1～2-6、2-8、3-1～3-7、4-1～4-7、5-1～5-4、6-1～6-2)
- (6) 運動神経の正常な機能とその病態を理解し、関連する疾患やその原因について説明することができる。(1-1～1-2、2-1～2-6、2-8、3-1～3-7、4-1～4-7、5-1～5-4、6-1～6-2)
- (7) 感覚神経の正常な機能とその病態を理解し、関連する疾患やその原因について説明することができる。(1-1～1-2、2-1

～2-6、2-8、3-1～3-7、4-1～4-7、5-1～5-4、6-1～6-2)

(8) 環境生理の正常な機能とその病態を理解し、関連する疾患やその原因について説明することができる。(1-1～1-2、2-1～2-6、2-8、3-1～3-7、4-1～4-7、5-1～5-4、6-1～6-2)

(9) 骨格筋の正常な機能とその病態を理解し、関連する疾患やその原因について説明することができる。(1-1～1-2、2-1～2-6、2-8、3-1～3-7、4-1～4-7、5-1～5-4、6-1～6-2)

(10) 心筋の正常な機能とその病態を理解し、関連する疾患やその原因について説明することができる。(1-1～1-2、2-1～2-6、2-8、3-1～3-7、4-1～4-7、5-1～5-4、6-1～6-2)

(11) 平滑筋の正常な機能とその病態を理解し、関連する疾患やその原因について説明することができる。(1-1～1-2、2-1～2-6、2-8、3-1～3-7、4-1～4-7、5-1～5-4、6-1～6-2)

(12) 心臓・循環の正常な機能とその病態を理解し、関連する疾患やその原因について説明することができる。(1-1～1-2、2-1～2-6、2-8、3-1～3-7、4-1～4-7、5-1～5-4、6-1～6-2)

(13) 呼吸の正常な機能とその病態を理解し、関連する疾患やその原因について説明することができる。(1-1～1-2、2-1～2-6、2-8、3-1～3-7、4-1～4-7、5-1～5-4、6-1～6-2)

(14) 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

スタンフォード神経生物学

カンデル神経科学

5. Assessment

Attendance, reports and exams

出席状況、レポート及び試験

6. Out of Class Study/Message

- Proceed with lectures according to designated textbooks and handouts.
- The designated 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	4 / 7 (Mon)	1-2	Lecture	Theme: Orientation and Introduction to Cell Physiology Comprehend and have the ability to provide an overview of physiology. 生理学の概要を理解し、概説できる。	Tomohiro Numata	第 2 講義室
2	4 / 7 (Mon)	3-4	Lecture	Theme: Overview of the nervous system (1) Introduction of the nervous system The goal of learning is to be able to explain the following issues. (1) Composition of the central nervous system and peripheral nervous system (2) Central nervous system network configuration (1) 中枢神経系と末梢神経系の構成を概説できる。 (2) 中枢神経系の構成を説明できる。	Tomohiro Numata	第 2 講義室
3	4 / 7 (Mon)	5-6	Lecture	Theme: Overview of the nervous system (2) The membrane potential of biological membrane 1 The goal of learning is to be able to explain the following issues. (1) Ion composition of intracellular solution / external solution of cells, osmotic pressure and resting membrane potential (2) Formation of membrane potential (1) 細胞内液・外液のイオン組成、浸透圧と静止(膜)電位を説明できる。(2) 膜電位発生機構について説明できる。	Tomohiro Numata	第 2 講義室
4	4 / 7 (Mon)	7-8	Lecture	Theme: Overview of the nervous system (3) The membrane potential of biological membrane 2 The goal of learning is to be able to explain the following issues. (1) Ion composition of intracellular solution / external solution of cells, osmotic pressure and resting membrane potential (2) Formation of membrane potential (1) 細胞内液・外液のイオン組成、浸透圧と静止(膜)電位を説明できる。(2) 膜電位発生機構について説明できる。	Tomohiro Numata	第 2 講義室
5	4 / 7 (Mon)	9-10	Lecture	Theme: Overview of the nervous system (4) Action potential1 The goal of learning is to be able to explain the following issues. (1) Understand and explain the processes involved in the generation and conduction of action potentials. (2) Outline and describe the roles of membrane ion channels, pumps, receptors, and enzymes in cellular function. (1) 活動電位発生と伝導機構について説明できる。 (2) 膜のイオンチャネル、ポンプ、受容体、酵素の機能を概説できる。	Tomohiro Numata	第 2 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
6	4 / 8 (Tue)	1-2	Lecture	<p>Theme: Overview of the nervous system (5) Action potential2</p> <p>The goal of learning is to be able to explain the following issues.</p> <p>(1) Understand and explain the processes involved in the generation and conduction of action potentials.</p> <p>(2) Outline and describe the roles of membrane ion channels, pumps, receptors, and enzymes in cellular function.</p> <p>(1) 活動電位発生と伝導機構について説明できる。 (2) 膜のイオンチャネル、ポンプ、受容体、酵素の機能を概説できる。</p>	Tomohiro Numata	第 2 講義室
7	4 / 8 (Tue)	3-4	Lecture	<p>Theme: Overview of the nervous system (6) Mechanism of nerve excitation and conduction</p> <p>The goal of learning is to be able to explain the following issues.</p> <p>(1) Types and functions of the information transmission mechanism</p> <p>(2) Receptor signaling mechanism</p> <p>(3) Morphology of synapses (including neuromuscular junctions) and synaptic transmission mechanism (excitatory, inhibitory)</p> <p>(1) 情報伝達の種類と機能を説明できる。(2) 受容体による情報伝達の機序を説明できる。(3) シナプス (神経筋接合部を含む) の形態とシナプス伝達の機能 (興奮性、抑制性) を説明できる。</p>	Tomohiro Numata	第 2 講義室
8	4 / 8 (Tue)	5-6	Lecture	<p>Theme: Introduction to muscles, skeletal muscle (1)</p> <p>(1) Explain the excitation-contraction coupling of skeletal muscle. (2) Explain the mechanism of contractile force regulation of skeletal muscle.</p> <p>(1) 骨格筋の興奮収縮連関について説明できる。 (2) 骨格筋の収縮力調節の仕組みを説明できる。</p>	Takafumi Miki	第 2 講義室
9	4 / 8 (Tue)	7-8	Lecture	<p>Theme: Skeletal muscle (2)</p> <p>(1) Explain the excitation-contraction relationship of skeletal muscles. (2) Explain the mechanism of skeletal muscle contractility regulation.</p> <p>(1) 骨格筋の興奮収縮連関について説明できる。(2) 骨格筋の収縮力調節の仕組みを説明できる。</p>	Takafumi Miki	第 2 講義室
10	4 / 8 (Tue)	9-10	Lecture	<p>Theme: Skeletal muscle (3)</p> <p>Explain the mechanism of neuromuscular transmission. 神経筋伝達の仕組みについて説明できる。</p>	Takafumi Miki	第 2 講義室
11	4 / 9 (Wed)	1-2	Lecture	<p>Theme: Skeletal muscle (4)</p> <p>Learn about typical diseases related to skeletal muscle and neuromuscular transmission. 骨格筋及び神経筋伝達に関連する代表的な疾患について学ぶ。</p>	Takafumi Miki	第 2 講義室
12	4 / 9 (Wed)	3-4	Lecture	<p>Theme: Cardiac muscle (1)</p> <p>Explain the structure and contraction of the myocardium. 心筋の構造と収縮について説明できる。</p>	Takafumi Miki	第 2 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	4 / 9 (Wed)	5-6	Lecture	<p>Theme: Overview of the nervous system (7) Ion channels and diseases</p> <p>The goal of learning is to be able to explain the following issues.</p> <p>(1) Structure, function, and genes of ion channels. Pathophysiology caused by genetic abnormalities (channelopathy)</p> <p>(2) Synapse and plasticity</p> <p>(1) イオンチャネルの構造と機能、遺伝子とその異常が起こす病態について説明できる。(2) シナプスと可塑性について説明できる。</p>	Tomohiro Numata	第 2 講義室
14	4 / 9 (Wed)	7-8	Lecture	<p>Theme: Overview of the nervous system (8) Neurotransmitters and neurotransmitter mechanisms in the brain</p> <p>The goal of learning is to be able to explain the following issues.</p> <p>(1) Demonstrate the ability to explain the primary neurotransmitters present in the brain and articulate their respective effects.</p> <p>(2) Outline the elucidating the mechanism of neuromuscular transmission.</p> <p>(1) 主な脳内神経伝達物質とその作用を説明できる。(2) 神経筋伝達機構について説明できる。</p>	Tomohiro Numata	第 2 講義室
15	4 / 9 (Wed)	9-10	Lecture	<p>Theme: Central nervous system (1) Structure and function of the cerebral cortex</p> <p>The goal of learning is to be able to explain the following issues.</p> <p>(1) Outline the cerebral cortex division, structure, and function</p> <p>(1) 大脳皮質区分と構造機能局在について説明できる。</p>	Tomohiro Numata	第 2 講義室
16	4 / 11 (Fri)	1-2	Lecture	<p>Theme: Central nervous system (2) Functional differences in the cerebral cortex</p> <p>The goal of learning is to be able to explain the following issues.</p> <p>(1) Structure and function of the cerebral cortex</p> <p>(2) Functional differences such as language areas and gender differences in the cerebral cortex</p> <p>(1) 大脳皮質の構造と機能について説明できる。(2) 大脳皮質の言語、性差などの機能差について説明できる。</p>	Tomohiro Numata	第 2 講義室
17	4 / 11 (Fri)	3-4	Lecture	<p>Theme: Central nervous system (3) Brain stem</p> <p>The goal of learning is to be able to explain the following issues.</p> <p>(1) Outline the structure, conduction path, and function of the brain stem</p> <p>(1) 脳幹の構造と伝導路、機能について説明できる。</p>	Tomohiro Numata	第 2 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
18	4 / 11 (Fri)	5-6	Lecture	Theme: Cardiac muscle (2) Explain the excitation-contraction coupling of cardiac muscle. 心筋の興奮収縮連関について説明できる。	Takafumi Miki	第 2 講義室
19	4 / 11 (Fri)	7-8	Lecture	Theme: Cardiac muscle (3) Explain the mechanism of contractile force regulation of cardiac muscle. 心筋の収縮力調節について学ぶ。	Takafumi Miki	第 2 講義室
20	4 / 11 (Fri)	9-10	Lecture	Theme: Cardiac muscle (4) Explain the electrical activity of cardiac muscle. 心筋の電気活動について説明できる。	Takafumi Miki	第 2 講義室
21	4 / 14 (Mon)	1-2	Lecture	Theme: Smooth muscle (1) Learn the structure and the mechanism of contraction of smooth muscle. 平滑筋の構造と収縮の仕組みを学ぶ。	Takafumi Miki	第 2 講義室
22	4 / 14 (Mon)	3-4	Lecture	Theme: Smooth muscle (2) (1) Learn about smooth muscle contraction regulation by physiologically active substances. (2) Explain the structure and function of skeletal muscle, myocardium, and smooth muscle in comparison. (1) 生理活性物質による平滑筋収縮調節について学ぶ。 (2) 骨格筋、心筋、平滑筋の構造と機能を対比して説明できる。	Takafumi Miki	第 2 講義室
23	4 / 14 (Mon)	5-6	Lecture	Theme: Central nervous system (4) Cerebellum The goal of learning is to be able to explain the following issues. (1) Structure and function of the cerebellum (1) 小脳の構造と機能について説明できる。	Tomohiro Numata	第 2 講義室
24	4 / 14 (Mon)	7-8	Lecture	Theme: Central nervous system (5) Meninges/ventricles The goal of learning is to be able to explain the following issues. (1) Composition of meninges / ventricular system and cerebrospinal fluid environment (1) 髄膜・脳室系の構成と脳脊髄液環境について説明できる。	Tomohiro Numata	第 2 講義室
25	4 / 14 (Mon)	9-10	Lecture	Theme: Central nervous system (6) Sleep/wakefulness The goal of learning is to be able to explain the following issues. (1) EEG and sleep/wake mechanism (1) 脳波と睡眠・覚醒の機構について説明できる。	Tomohiro Numata	第 2 講義室
26	4 / 15 (Tue)	1-2	Lecture	Theme: Central nervous system (7) Memory/learning The goal of learning is to be able to explain the following issues. (1) Structure of limbic system for memory and learning mechanism (1) 記憶と学習の機構を辺縁系の構成と関連させて説明できる。	Tomohiro Numata	第 2 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
27	4 / 15 (Tue)	3-4	Lecture	Theme: Central nervous system (8) Epilepsy/dementia The goal of learning is to be able to explain the following issues. (1) Explain the mechanism of epilepsy and dementia. (1) てんかんや認知症の機序について説明できる。	Tomohiro Numata	第 2 講義室
28	4 / 15 (Tue)	5-6	Lecture	Theme: Heart/Circulation (1) - Structure of the heart and circulatory system (1) Explain the structure of the heart. (2) Explain the features of blood vessels / nerves and coronary arteries distributed in the heart and their distribution areas. (3) Explain systemic circulation and pulmonary circulation. (4) The aorta and major branches (head and neck, upper limbs, chest, abdomen, lower limbs) can be illustrated to outline the distribution area. (1) 心臓の構造を説明できる。 (2) 心臓に分布する血管・神経、冠動脈の特長とその分布域を説明できる。 (3) 体循環と肺循環を説明できる。 (4) 大動脈と主な分枝(頭頸部、上肢、胸部、腹部、下肢)を図示し、分布域を概説できる。	Takafumi Miki	第 2 講義室
29	4 / 15 (Tue)	7-8	Lecture	Theme: Heart/Circulation (2) - Physics of circulatory physiology Explain the basics of cardiovascular physiology, such as Ohm's law and Poiseuille's law. オームの法則やポアズイユの法則等、循環生理学の基本事項について説明できる。	Takafumi Miki	第 2 講義室
30	4 / 15 (Tue)	9-10	Lecture	Theme: Heart/Circulation (3) - Electrical activity of the myocardium (1) Explain the electrical activity of the myocardium (2) Explain the action potential and automaticity of the myocardium. (1) 心筋の電気活動について説明できる。 (2) 心筋の活動電位及び自動能について説明できる。	Takafumi Miki	第 2 講義室
31	4 / 16 (Wed)	1-2	Lecture	Theme: Heart/Circulation (4) - Electrical activity of the myocardium (1) Explain the physiological significance of each waveform of the body surface electrocardiogram (ECG). (2) Explain the relationship between ECG and the action potential of cardiac myocytes. (3) Heart rate and rhythm abnormalities can be read from ECG. (1) 体表面心電図の各波形の生理的意義を説明できる。 (2) 体表面心電図と活動電位との関係について説明できる。 (3) 体表面心電図から、心拍数及びリズム異常を読み取ることができる。	Takafumi Miki	第 2 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
32	4 / 16 (Wed)	3-4	Lecture	Theme: Heart/Circulation (5) - ECG exercises From the actual ECG, the heart rate, atrioventricular conduction time, intraventricular conduction time, cardiac electrical axis, etc. can be read. 実際の心電図から、心拍数、房室伝導時間、心室内伝導時間、心臓電気軸等を読み取ることができる。	Takafumi Miki	第 2 講義室
33	4 / 16 (Wed)	5-6	Lecture	Theme: Central nervous system (9) Limbic system The goal of learning is to be able to explain the following issues. (1) Emotions and motivational mechanisms of the limbic system (1) 大脳辺縁系の情動、動機付けの機序について説明できる。	Tomohiro Numata	第 2 講義室
34	4 / 16 (Wed)	7-8	Lecture	Theme: Central nervous system (10) Hypothalamus The goal of learning is to be able to explain the following issues. (1) Somatic movement, autonomic function, endocrine reaction related to the hypothalamus (1) 視床下部に関連する体性運動、自律機能、内分泌反応について説明できる。	Tomohiro Numata	第 2 講義室
35	4 / 16 (Wed)	9-10	Lecture	Theme: Pathology of the central nervous system (1) Alzheimer's disease, neurodegenerative disease The goal of learning is to be able to explain the following issues. (1) Mechanism of Alzheimer's disease and neurodegenerative diseases (1) アルツハイマー、神経変性疾患の発生機序について説明できる。	Tomohiro Numata	第 2 講義室
36	4 / 18 (Fri)	1-2	Lecture	Theme: Pathology of the central nervous system (2) Mental illness, a neurodevelopmental disorder The goal of learning is to be able to explain the following issues. (1) Mechanism of Alzheimer's disease and neurodegenerative diseases (1) アルツハイマー、神経変性疾患の発生機序について説明できる。	Tomohiro Numata	第 2 講義室
37	4 / 18 (Fri)	3-4	Lecture	Theme: Peripheral nervous system Composition of spinal nerves and nerve plexus The goal of learning is to be able to explain the following issues. (1) Composition of spinal nerves and nerve plexus and skin segment (dermatome) (1) 脊髄神経と神経叢の構成と皮膚分節（デルマトーム）について説明できる。	Tomohiro Numata	第 2 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
38	4 / 18 (Fri)	5-6	Lecture	Theme: Introduction to Respiration (1) Outline physiological approaches in the pathological assessment, diagnosis and determination of therapeutic efficacy of respiratory diseases. (1) 呼吸器疾患の病態評価、診断、治療効果判定における生理学的アプローチを概説できる。	Kazuya Tanimura	第 2 講義室
39	4 / 18 (Fri)	7-8	Lecture	Theme: Introduction to Respiration (1) Outline physiological approaches in the pathological assessment, diagnosis and determination of therapeutic efficacy of respiratory diseases. (1) 呼吸器疾患の病態評価、診断、治療効果判定における生理学的アプローチを概説できる。	Kazuya Tanimura	第 2 講義室
40	4 / 18 (Fri)	9-10	Lecture	Theme: Introduction to Respiration (1) Outline physiological approaches in the pathological assessment, diagnosis and determination of therapeutic efficacy of respiratory diseases. (1) 呼吸器疾患の病態評価、診断、治療効果判定における生理学的アプローチを概説できる。	Kazuya Tanimura	第 2 講義室
41	4 / 21 (Mon)	1-2	Formative assesment	Theme: Formative assessment		第 2 講義室
42	4 / 21 (Mon)	3-4	Formative assesment	Theme: Formative assessment		第 2 講義室
43	4 / 21 (Mon)	5-6	Self learning	Theme:		
44	4 / 21 (Mon)	7-8	Self learning	Theme:		
45	4 / 21 (Mon)	9-10	Self learning	Theme:		
46	4 / 22 (Tue)	1-2	Lecture	Theme: Respiration (1) - Structure of respiratory system (1) Explain the structure of the airway, the lobe of lung, lung area and the hilum. (2) Explain the difference between pulmonary circulation and systemic circulation. (3) Explain the structure of the mediastinum and pleural space. (1) 気道の構造、肺葉・肺区域と肺門の構造を説明できる。 (2) 肺循環と体循環の違いを説明できる。 (3) 縦隔と胸膜腔の構造を説明できる。	Yosuke Okamoto	第 2 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
47	4 / 22 (Tue)	3-4	Lecture	Theme: Respiration (2) - The mechanics of lung ventilation (1) Explain the kinds of respiratory muscles and the mechanism of respiratory movements. (2) Explain the pulmonary volume fraction. (3) Explain pulmonary ventilation, dead space, lung compliance, airway resistance, and closing volume. (1) 呼吸筋と呼吸運動の機序を説明できる。 (2) 肺気量分画を説明できる。 (3) 換気、死腔、肺コンプライアンス、気道抵抗、クロージングボリュームを説明できる。	Yosuke Okamoto	第 2 講義室
48	4 / 22 (Tue)	5-6	Lecture	Theme: Autonomic nerve (1) Composition and function of autonomic nerve The goal of learning is to be able to explain the following issues. (1) Composition and function of autonomic nerves (1) 自律神経の構成と機能について説明できる。	Tomohiro Numata	第 2 講義室
49	4 / 22 (Tue)	7-8	Lecture	Theme: Autonomic nerve (2) Transmission mechanism and action of autonomic nerve The goal of learning is to be able to explain the following issues. (1) Autonomic nerve transmission mechanism and action on organs (1) 自律神経の伝達機構と臓器への作用について説明できる。	Tomohiro Numata	第 2 講義室
50	4 / 22 (Tue)	9-10	Lecture	Theme: Motor nerve (1) The goal of learning is to be able to explain the following issues. (1) Spinal cord structure, functional localization, and conduction pathway (2) Spinal reflex and reciprocal innervation muscle (1) 脊髄の構造、機能局在と伝導路を説明できる。 (2) 脊髄反射と筋の相反神経支配について説明できる。	Tomohiro Numata	第 2 講義室
51	4 / 23 (Wed)	1-2	Lecture	Theme: Motor nerves (2) Voluntary movements The goal of learning is to be able to explain the following issues. (1) Relationship between the mechanism of voluntary movement and the pyramidal tract (1) 随意運動の発現機構を錐体路を中心として説明できる。	Tomohiro Numata	第 2 講義室
52	4 / 23 (Wed)	3-4	Lecture	Theme: Motor nerves (3) Cerebellum and basal ganglia The goal of learning is to be able to explain the following issues. (1) Functions of the cerebellum and basal ganglia (1) 小脳と大脳基底核の機能について説明できる。	Tomohiro Numata	第 2 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
53	4 / 23 (Wed)	5-6	Lecture	Theme: Heart/Circulation (6) - Arrhythmias (1) Be able to outline arrhythmia. (2) Be able to outline abnormal electrocardiograms (sinus arrhythmia, extra systoles, atrioventricular conduction disorders). (1) 不整脈について概説できる。(2) 異常心電図 (洞性不整脈、期外収縮、房室伝導 障害) について概説できる。	Takafumi Miki	第 2 講義室
54	4 / 23 (Wed)	7-8	Lecture	Theme: Heart/Circulation (7) - Cardiac cycle Explain hemodynamics (changes in atrial pressure, atrial volume, ventricular pressure, ventricular volume, aortic pressure, aortic blood flow, capillary pressure, venous pressure, etc.) associated with the cardiac cycle. 心周期にともなう血行動態 (心房圧、心房容量、心室圧、心室容量、大動脈圧、大動脈血流、毛細血管圧、静脈圧、等の変化) を説明できる。	Takafumi Miki	第 2 講義室
55	4 / 23 (Wed)	9-10	Lecture	Theme: Heart/Circulation (8) - Pump function of the heart 1 (1) Learn about the pump function of the heart. (2) Explain the Starling law of the heart. (1) 心臓のポンプ作用について学ぶ。(2) 心臓のスターリングの法則について説明できる。	Takafumi Miki	第 2 講義室
56	4 / 25 (Fri)	1-2	Lecture	Theme: Respiration (3-1) - Gas exchange (1) Explain the relationship between gas exchange and blood flow in the alveoli. (2) Explain the effects of lung ventilation and blood flow (ventilation-blood flow ratio) on arterial blood gas. (3) Explain the alveolar air-arterial oxygen partial pressure difference (A-aDO ₂). (1) 肺胞におけるガス交換と血流の関係を説明できる。 (2) 肺の換気と血流 (換気血流比) が動脈血ガスにおよぼす影響を説明できる。 (3) 肺胞気-動脈血酸素分圧較差 (A-aDO ₂) について説明できる。	Yosuke Okamoto	第 2 講義室
57	4 / 25 (Fri)	3-4	Lecture	Theme: Respiration (3-2) - Gas exchange (1) Explain the relationship between gas exchange and blood flow in the alveoli. (2) Explain the effects of lung ventilation and blood flow (ventilation-blood flow ratio) on arterial blood gas. (3) Explain the alveolar air-arterial oxygen partial pressure difference (A-aDO ₂). (1) 肺胞におけるガス交換と血流の関係を説明できる。 (2) 肺の換気と血流 (換気血流比) が動脈血ガスにおよぼす影響を説明できる。 (3) 肺胞気-動脈血酸素分圧較差 (A-aDO ₂) について説明できる。	Yosuke Okamoto	第 2 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
58	4 / 25 (Fri)	5-6	Lecture	Theme: Sensory nerve (1) General remarks The goal of learning is to be able to explain the following issues. (1) Composition and function of sensory nerves (2) Contents of psychophysics (1) 感覚神経の構成と機能について説明できる。 (2) 心理物理学の内容について説明できる。	Tomohiro Numata	第 2 講義室
59	4 / 25 (Fri)	7-8	Lecture	Theme: Sensory nerve (2) Somatosensory 1-General mechanical sensation, Temperature sensation, pain sensation The goal of learning is to be able to explain the following issues. (1) Mechanical sense acceptance mechanism and conduction path. Receptive mechanism and conduction path of temperature sensation and pain sensation. (1) 機械感覚、温度感覚と痛覚の受容機構と伝導路について説明できる。	Tomohiro Numata	第 2 講義室
60	4 / 25 (Fri)	9-10	Lecture	Theme: Sensory nerve (3) Somatosensory 2 - Proprioceptive conduction path The goal of learning is to be able to explain the following issues. (1) Proprioceptive sensation, conduction path, and brain acceptance (1) 固有感覚と伝導路、脳の受容について説明できる。	Tomohiro Numata	第 2 講義室
61	4 / 29 (Tue)	1-2	Lecture	Theme: Sensory nerve (4) Vision 1 General remark The goal of learning is to be able to explain the following issues. (1) Structure and function of the eyeball (1) 眼球の構造と機能を説明できる。	Tomohiro Numata	第 2 講義室
62	4 / 29 (Tue)	3-4	Lecture	Theme: Sensory nerve (5) Vision 2 Visual acceptance and conduction path The goal of learning is to be able to explain the following issues. (1) Visual acceptance and conduction path (1) 視覚の受容、伝導路について説明できる。	Tomohiro Numata	第 2 講義室
63	4 / 29 (Tue)	5-6	Lecture	Theme: Heart / Circulation (9) - Pump function of the heart 2 (1) Explain the preload and afterload. (2) Explain the relationship between cardiac output and heart rate, cardiac contractility, preload, and afterload. (3) Explain the regulation mechanism of cardiac contractile force. (1) 前負荷、後負荷について説明できる。(2) 心拍出量と心拍数、心収縮性、前負荷、後負荷 との関係について説明できる。(3) 心臓収縮力の調節機構について説明できる。	Takafumi Miki	第 2 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
64	4 / 29 (Tue)	7-8	Lecture	Theme: Heart / Circulation (10) - Blood pressure and blood flow Explain blood pressure and blood flow in arteries, capillaries, and veins. 動脈、毛細血管、静脈の血圧と血流について説明できる。	Takafumi Miki	第 2 講義室
65	4 / 29 (Tue)	9-10	Lecture	Theme: Heart / Circulation (11) - Circulatory regulation 1 (1) Explain the mechanism of blood pressure regulation. (2) Explain the arterial baroreceptor reflex. (3) Explain the hormonal regulation of circulatory system. (1) 血圧調節の機序を説明できる。 (2) 動脈圧受容器反射について説明できる。 (3) 循環系の液性調節について説明できる。	Takafumi Miki	第 2 講義室
66	5 / 2 (Fri)	1-2	Lecture	Theme: Respiration (4-1) - Blood gas (1) Explain the partial pressure of oxygen and the partial pressure of carbon dioxide in the arteries and veins. (2) Explain the relationship between arterial blood pH and partial pressure of carbon dioxide. (3) Explain blood gas. (1) 動静脈の酸素分圧と二酸化炭素分圧について説明できる。 (2) 動脈血 pH と二酸化炭素分圧との関係について説明できる。 (3) 血液ガスについて説明できる。	Yosuke Okamoto	第 2 講義室
67	5 / 2 (Fri)	3-4	Lecture	Theme: Respiration (4-2) - Blood gas (1) Explain the partial pressure of oxygen and the partial pressure of carbon dioxide in the arteries and veins. (2) Explain the relationship between arterial blood pH and partial pressure of carbon dioxide. (3) Explain blood gas. (1) 動静脈の酸素分圧と二酸化炭素分圧について説明できる。 (2) 動脈血 pH と二酸化炭素分圧との関係について説明できる。 (3) 血液ガスについて説明できる。	Yosuke Okamoto	第 2 講義室
68	5 / 2 (Fri)	5-6	Lecture	Theme: Sensory nerve (6) Vision 3 Eye function The goal of learning is to be able to explain the following issues. (1) Mechanism of eye movement (2) Pupillary light reflex, convergence reflex, corneal reflex (1) 眼球運動の仕組みを説明できる。 (2) 対光反射、輻輳反射、角膜反射について説明できる。	Tomohiro Numata	第 2 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
69	5 / 2 (Fri)	7-8	Lecture	Theme: Sensory nerve (7) Taste/smell(1) The goal of learning is to be able to explain the following issues. (1) Taste/smell reception mechanism and conduction path (1) 味覚・嗅覚の受容機構と伝導路について説明できる。	Tomohiro Numata	第 2 講義室
70	5 / 2 (Fri)	9-10	Lecture	Theme: Sensory nerve (8) Taste/smell(2) The goal of learning is to be able to explain the following issues. (1) Taste/smell reception mechanism and conduction path (1) 味覚・嗅覚の受容機構と伝導路について説明できる。	Tomohiro Numata	第 2 講義室
71	5 / 6 (Tue)	1-2	Lecture	Theme: Sensory nerve (9) Sense of balance The goal of learning is to be able to explain the following issues. (1) Receptive mechanism and conduction path of equilibrium sensation (1) 平衡覚の受容機構と伝導路について説明できる。	Tomohiro Numata	第 2 講義室
72	5 / 6 (Tue)	3-4	Lecture	Theme: Sensory nerve (10) Hearing 1 Hearing receptive mechanism The goal of learning is to be able to explain the following issues. (1) Auditory reception mechanism and conduction path (1) 聴覚の受容機構と伝導路について説明できる。	Tomohiro Numata	第 2 講義室
73	5 / 6 (Tue)	5-6	Lecture	Theme: Heart /Circulation (12) - Circulatory regulation 2 Explain the mechanism of circulatory reaction associated with change of body position and exercise. 体位や運動に伴う循環反応とその機序を説明できる。	Takafumi Miki	第 2 講義室
74	5 / 6 (Tue)	7-8	Lecture	Theme: Heart /Circulation (13) - Organ circulation and microcirculation Explain the characteristics of the main organ circulation (coronary circulation, cerebral circulation, pulmonary circulation, portal vein, skin circulation, skeletal muscle circulation, renal circulation). 主な臓器循環（冠循環、脳循環、肺循環、門脈、皮膚循環、骨格筋循環、腎循環）の特徴を説明できる。	Takafumi Miki	第 2 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
75	5 / 6 (Tue)	9-10	Lecture	Theme: Heart /Circulation (14) - Lymphatic circulation and fetal circulation (1) Explain the flow of lymph through the thoracic duct. (2) Explain the composition and physiological significance of lymph. (3) Explain the fetal circulation. (4) Explain changes in blood circulation after birth. (1) 胸管を経由するリンパの流れを説明できる。 (2) リンパ液の組成、生理的意義について説明できる。 (3) 胎児循環について説明できる。 (4) 出生後の血液循環の変化について説明できる。	Takafumi Miki	第 2 講義室
76	5 / 7 (Wed)	1-2	Lecture	Theme: Respiration (5) - Pulmonary blood flow and shunt (1) Explain the characteristics of pulmonary blood flow. (2) Explain changes in blood gas due to shunting of pulmonary blood flow. (1) 肺血流の特徴を説明できる。(2) 肺血流のシャントによる血液ガスの変化について説明できる。	Yosuke Okamoto	第 2 講義室
77	5 / 7 (Wed)	3-4	Lecture	Theme: Respiration (6) - Regulation of respiration Explain the mechanism of respiratory regulation via the respiratory center. 呼吸中枢を介する呼吸調節の機序を説明できる。	Yosuke Okamoto	第 2 講義室
78	5 / 7 (Wed)	5-6	Lecture	Theme: Sensory nerve (11) Hearing 2 Hearing conduction path The goal of learning is to be able to explain the following issues. (1) Auditory conduction path, information processing, and its functional abnormalities (1) 聴覚の伝導路、情報処理とその異常について説明できる。	Tomohiro Numata	第 2 講義室
79	5 / 7 (Wed)	7-8	Lecture	Theme: Pathology of peripheral nerves The goal of learning is to be able to explain the following issues. (1) Demyelinating disease, neurodegenerative disease (1) 脱髄性疾患、神経変性疾患について説明できる。	Tomohiro Numata	第 2 講義室
80	5 / 7 (Wed)	9-10	Lecture	Theme: Environmental physiology (1) The goal of learning is to be able to explain the following issues. (1) Effects of environmental factors on body temperature regulation, and energy metabolism (1) 環境因子が生体の体温調節、エネルギー代謝に与える影響について説明できる。	Tomohiro Numata	第 2 講義室
81	5 / 9 (Fri)	1-2	Formative assesment	Theme: Formative assessment		第 2 講義室
82	5 / 9 (Fri)	3-4	Formative assesment	Theme: Formative assessment		第 2 講義室
83	5 / 9 (Fri)	5-6	Self learning	Theme:		第 2 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
84	5 / 9 (Fri)	7-8	Self learning	Theme:		第 2 講義室
85	5 / 9 (Fri)	9-10	Self learning	Theme:		第 2 講義室
86	5 / 12 (Mon)	1-2	Lecture	Theme: Environmental physiology (2) The goal of learning is to be able to explain the following issues. (1) Effects of environmental circadian rhythm, exercise, and physical fitness (1) 環境因子が生体の概日リズム、運動と体力に与える影響について説明できる。	Tomohiro Numata	第 2 講義室
87	5 / 12 (Mon)	3-4	Lecture	Theme: Environmental physiology (3) The goal of learning is to be able to explain the following issues. (1) Effects of environmental circadian rhythm, exercise, and physical fitness (1) 環境因子が生体の概日リズム、運動と体力に与える影響について説明できる。	Tomohiro Numata	第 2 講義室
88	5 / 19 (Mon)	1-2	Lecture	Theme: Heart / circulation (15) - Pathophysiology 1 Outline heart failure, hypertension, and myocardial ischemia. 心不全、高血圧、心筋虚血について概説できる。	Takafumi Miki	第 2 講義室
89	5 / 19 (Mon)	3-4	Lecture	Theme: Heart / circulation (16) - Pathophysiology 2 Outline heart failure, hypertension, and myocardial ischemia. 心不全、高血圧、心筋虚血について概説できる。	Takafumi Miki	第 2 講義室
90	5 / 26 (Mon)	1-2	Exercise	Theme: Exercises on the central nervous system 1 (1) Questions about the central nervous system (1) 中枢神経の講義内容を振り返り、設問に回答することができる。	Tomohiro Numata	第 2 講義室
91	5 / 26 (Mon)	3-4	Exercise	Theme: Exercises on the central nervous system 2 (1) Questions about the central nervous system (1) 中枢神経の講義内容を振り返り、設問に回答することができる。	Tomohiro Numata	第 2 講義室
92	6 / 2 (Mon)	1-2	Exercise	Theme: Exercises on skeletal, cardiac and smooth muscle (1) Questions about skeletal, cardiac and smooth muscle (1) 骨格筋・心筋・平滑筋の講義内容を振り返り、設問に回答することができる。	Takafumi Miki	第 2 講義室
93	6 / 2 (Mon)	3-4	Exercise	Theme: Exercises on heart and circulation (1) Questions about heart and circulation (1) 心臓・循環の講義内容を振り返り、設問に回答することができる。	Takafumi Miki	第 2 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
94	6 / 9 (Mon)	1-2	Exercise	Theme: Exercises on motor nerves and autonomic nerves (1) Questions about motor nerves and autonomic nerves (1) 運動神経・自律神経の講義内容を振り返り、設問に回答することができる。	Tomohiro Numata	第 2 講義室
95	6 / 9 (Mon)	3-4	Exercise	Theme: Exercises on sensory nerves 1 (1) Questions about sensory nerves (1) 感覚神経の講義内容を振り返り、設問に回答することができる。	Tomohiro Numata	第 2 講義室
96	6 / 16 (Mon)	1-2	Lecture	Theme: Respiration (7) - Pathophysiology 1 Outline the pathophysiology of respiratory diseases (obstructive diseases, restrictive diseases). 呼吸疾患（閉塞性疾患、拘束性疾患）の病態生理について概説できる。	Yosuke Okamoto	第 2 講義室
97	6 / 16 (Mon)	3-4	Lecture	Theme: Respiration (8) - Pathophysiology 2 Outline the pathophysiology of respiratory diseases (obstructive diseases, restrictive diseases). 呼吸疾患（閉塞性疾患、拘束性疾患）の病態生理について概説できる。	Yosuke Okamoto	第 2 講義室
98	6 / 23 (Mon)	1-2	Exercise	Theme: Exercises on sensory nerves 2 (1) Questions about sensory nerves (1) 感覚神経の講義内容を振り返り、設問に回答することができる。	Tomohiro Numata	第 2 講義室
99	6 / 23 (Mon)	3-4	Exercise	Theme: Exercises on peripheral nerves, and environmental physiology (1) Questions about peripheral nerves, and environmental physiology (1) 末梢神経、環境生理の講義内容を振り返り、設問に回答することができる。	Tomohiro Numata	第 2 講義室