# Model Core Curriculum for Pharmacy Education

# -2022 Revision-

**The Study Group on the State of Human Resources Development in Pharmacy**

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## Concept of the Model Core Curriculum for Pharmacy Education

### 1 Basic Principles and Background

○ Catchphrase: *"Fostering medical professionals who can play an active role in connecting diverse settings and people, with a focus on society and communities of the future"*

The revision adopted a unified catchphrase for the three areas of: medicine, dentistry, and pharmacy education, with the aim of training healthcare professionals who can play an active role in connecting diverse settings and people, with a view to an ever-changing society and regions of the future.

In recent years, we have been faced with various problems such as demographic changes, coexistence of multiple diseases, the aged and a high death rate society, health inequalities, increasing healthcare costs, emerging and re-emerging infectious diseases and disaster risks, and these social structural changes are expected to intensify further as the years go by. As such, it is essential to train healthcare professionals who can accurately look at these events that have a significant impact on society, respond flexibly to the diverse changes of the times and difficult-to-predict events, and remain active throughout their lives and respond to society's needs.

To this end, pharmacists are required to cultivate the qualities and competencies that are fundamental to being a healthcare professional, to work in inter-and intra-healthcare cooperation and to play an active role in the diverse and evolving changes in society. In addition, a perspective that takes into account the values of patients and their families and an altruistic attitude are important. Furthermore, the information handled in the medical fields, including big data and artificial intelligence (AI), is expanding and expanding in terms of both quality and quantity, and they are required to contribute to society by making appropriate use of this information.

In order to realize these goals from an educational perspective, it was decided to present new *basic qualities and competencies required of pharmacists*, create curricula based on the originality and ingenuity of each university, develop human resources who scientifically explore the discovery and solution of problems, and partially standardize the educational content of medicine, dentistry, and pharmacy.

In addition, the revision of the Model Core Curriculum (MCC) for Pharmacy Education (revised in 2013) (hereinafter referred to as the *2013 Revision*) is based on the pillar of Outcome-based Education (OBE), which sets out the *basic qualities and abilities required as pharmacists* as a lifelong goal. The reforms were intended to deepen the MCC for Pharmacy Education (revised in 2013) and promote reforms from the perspective of quality assurance in pharmacy education.

○ The common qualities and competencies required in medicine, dentistry, and pharmacy, with a view to society in 2040 and beyond.

In addition to the six years of pre-graduate education, the training of pharmacists requires time for postgraduate study. The MCC needs to be revised in anticipation of the society after 2040, when students will be active as healthcare professionals. As a result, the proportion of patients with multiple coexisting diseases and those with various social backgrounds is expected to increase. As healthcare professionals, we are required to take a comprehensive view of these patients and their lifestyles. In addition, in conjunction with the decline in the working-age population, the burden on the working-age population is expected to increase in Japan, and geographically speaking, the population is expected to

decrease by half in about half of all residential areas in Japan. In response to this rapid demographic change, it is important to train healthcare professionals who can respond to drastic changes in the demand for medical care. In addition, although there are limitations to incorporating all of the new science and technology that may be utilized in the medical fields in the future as a MCC in pre-graduate education ahead of time, it is necessary to acquire a background in the ability to utilize basic information, science, and technology, including ethics.
In addition, the basic qualities and competencies required of healthcare personnel are common regardless of the field of specialty. Therefore, in this revision, the basic qualities and competencies required are, in principle, standardized across the three fields of medicine, dentistry, and pharmacy. It is important to promote horizontal coordination of education in the pre-graduate stage in multiple professions and to share values as healthcare professionals.
In light of this situation, after considering the linkage with the MCC for Medical and Dental Education based on the 2013 revised version, two new qualities and abilities were added: "Generalism" and "Information Technology".

**2 Positioning in University Education**

○ Organization of the MCC:

The MCC is a curriculum developed by each university, from which the core parts that should be commonly addressed in six-year pharmacy education are extracted and systematically organized as a model. Therefore, as in the past, approximately 70% of the specific pharmacy education at each university should be based on the MCC, while the remaining 30% should be organized voluntarily and autonomously by universities based on their own graduation accreditation and degree-awarding policies, curriculum organization and implementation policies, admission policies, etc.

In order to increase the feasibility of these efforts, we have organized a policy of reviewing the detailed achievement objectives, but we would also like to emphasize the need to carefully examine what should be done in pre-graduate education, on the assumption that not all knowledge and skills associated with advances in pharmacy and medicine should be acquired in pre-graduate education, but rather acquired over the course of a person's lifetime. In training future pharmacists, who are expected to contribute to clinical practice such as medicine, welfare and public health in order to solve various problems of patients, consumers and society, it is necessary for them to acquire the ability to think independently and develop leadership skills.

In addition, the criteria for the examinations shared by universities (hereinafter referred to as *Common Achievement Test (OSCE or CBT)*) to assess whether or not student pharmacists have acquired the knowledge and skills that they should acquire before starting practical training in clinical settings are considered by the organizers of the common achievement test.

○ Significance of Practical Experience in Clinical Settings

Practical experience in clinical settings (hereinafter referred to as *practical experience*) is expected to be an opportunity not only to gain practical experience and improve skills, but also to enhance the perspective required for holistic and comprehensive healthcare, such as the background and values of patients, economic factors and relationships with family members, by taking the initiative and actively participating as a member of the healthcare team, and to learn the basic aspects of pharmacists' professional knowledge, thinking,

skills and attitudes.

Therefore, universities are required to guarantee the suitability and quality of student pharmacists participating in practical experience in clinical settings and to further promote practical experience, giving due consideration to patient safety and privacy protection, and expect the MCC, together with guidelines on practical experience to be prepared separately, to help in this regard.

**3 What Is Expected from Student Pharmacists**

In order to achieve the goals of the current revision - 'Connecting diverse settings and people to play an active role' - a broad view of the concepts of pharmacy and medicine is required.

For example, one of the aspects required of healthcare today is preventive medicine. In other words, when considering healthcare as a whole, it is necessary to consider not only the diagnosis and treatment of illness, but also the background to illness, and to recognize the importance of social determinants of health, sports and exercise, nutrition, and dietary education. From the perspective of having a broad perspective, it is also important to recognize that each patient has his or her own lifestyle and that what they experience in the medical field, including home healthcare, is only one part of their life. If students approach their studies, including practical training with this in mind, they will be able to achieve more meaningful results.

Being able to connect diverse settings and peoples means not only the passive aspect of responding to diverse demands and changes that will occur in the future, but also the possibility of forming diverse career paths as pharmacists and having a variety of opportunities. In fact, the majority of pharmacists today are engaged in hospitals, community pharmacies, etc. as clinical practitioners, but there are also pharmacists who have advanced into diverse areas such as the development, manufacturing, and marketing of pharmaceuticals, public administration including public health centers and health research institutes, school health, and education including other areas. It should be added that in an era when pharmacists may live to be 100, there are diverse options not only at the graduation stage but also at various stages after graduation.

Even after choosing a career path from a variety of options, a broad range of pharmacy interests is required throughout life. For example, even if they choose a clinical path, they need to be constantly aware of a research mindset in their pharmacy practice, and even if they choose a research path, they need to be constantly aware of clinical settings in order to make new pharmacy discoveries. It is also important for pharmacists to be aware of different positions and situations and to collaborate with other pharmacists who have chosen other career paths. Furthermore, building relationships not only among pharmacists, but also actively building relationships with many people in a wide range of fields, including pharmacy and medicine, and being interested and involved as a member of society themselves, will be essential for achieving the objective of connecting diverse settings and peoples.

Finally, as learning is based on the accumulation of our predecessors, we would like students to feel the preciousness of learning from the first lesson when they enter school, and as life is spun out of the activities of life since time immemorial, we would like students to feel the severity of life and the meaning of life and death in their practical training. The following is a brief summary of the study environment for student pharmacists. In addition, we must not forget that the learning environment for students is

based on the cooperation of many people, including patients and those involved in pharmacy education outside the university, as well as university faculty and staff. Therefore, we would like you to understand yourself, to give back to society the results of your studies with gratitude and respect for the opportunities you have been given to study pharmacy with the support of various people, and to devote yourself throughout your life to playing the role of a community leader and further developing pharmacy and healthcare in the next generation. Above all, we strongly urge students to have a high sense of ethics and culture as a member of society.

**4 Requests to All Parties Involved in Pharmacy Education**

We would like universities to cooperate with relevant organizations, including local pharmacists' associations, hospital pharmacists' associations, and hospital/pharmacy practical experience district coordination organizations, including the implementation of practical experience in clinical settings and early experience training as a motivator for student pharmacists. In particular, in order to foster pharmacists who can play an active role by connecting people in various settings, we would be grateful if universities would cooperate in practical experience in clinical settings, including home healthcare and various health activities. In the future, it is expected to include content that is more aware of the local comprehensive community care system than ever before, as well as to incorporate content related to the uneven distribution of pharmacists.

In addition, pharmacists are required to collaborate with many professions, not only healthcare professions, from the perspective of team medicine and inter- and intra-healthcare teams in clinical settings. For this reason, we would like to request the cooperation of all parties concerned in various ways to ensure that education is conducted with this in mind from the pre-graduation stage. Universities are requested to ensure that there is sufficient time for experiments and practical experience in clinical settings to ensure that necessary learning content has been adequately covered.

When educating student pharmacists, it would also be appreciated if the information given in section 3: *What We Want from Student Pharmacists Who Want to Become Pharmacists* also be taken into account.

**5 Informing Patients and the Public and Requesting their Cooperation**

As mentioned in section 3: *What We Want from Student Pharmacists Who Want to Become Pharmacists*, the understanding of citizens involved as patients is essential for the smooth and safe implementation of practical experience in clinical settings. In order to widely solicit the cooperation of citizens in practical training in clinical settings with regard to consent from patients, it is desirable for each university to devise ways to publicize the necessity and importance of pharmacy education, for example by using the following *Requests to Patients and Members of the Public* sample text and posters prepared by the Council of Pharmacy Education.

***Requests to Patients and Members of the Public*** **Sample Text**:

Requests to Patients and Members of the Public

The cooperation of patients and their families is essential in training healthcare professionals. Student pharmacists majoring in pharmacy at universities who have passed common achievement tests* to assess whether they have acquired the necessary knowledge and skills they need before starting their practical training in clinical settings will do so in clinical settings under the guidance and supervision of pharmacists.

Student pharmacists acquire the necessary qualities and skills through various forms of contact with patients and the public and by handling medicines and other items used by the public, mainly through practical training in clinical settings. Your cooperation will enable us to *give back* in the future in the form of better medical care and advances in pharmacy and medicine, so we ask for your cooperation in helping to educate student pharmacists.

※ The third-party organization, the Centre for Pharmacy Common Testing, conducts computer-based testing (CBT) to test knowledge and objective structured clinical examinations (OSCE) to assess skills and attitudes with the help of simulated patients.

## MCC for Pharmacy Education Revision Overview

The MCC for Pharmacy Education is designed to enhance practical clinical skills through training in clinical settings, to acquire the knowledge and skills in the fundamentals of the pharmaceutical sciences, pharmacotherapeutics, public health, pharmacy practice experiences, etc., which are studied before graduation in the six-year Pharmacy Education system, in order to study and acquire the *basic qualities and competencies required as pharmacists* throughout life. The curriculum is designed to help students acquire the competencies to play an active role in society as pharmacists. Pharmacists are expected to fulfill their duties in the manufacturing, dispensing and supply of medicines, to provide the public with appropriately quality-controlled medicines efficiently and without excess or deficiency, and to take on the social responsibility of widely contributing to pharmaceutical hygiene and the health promotion of patients and consumers. For these reasons, pharmacists must have sufficient qualities and competencies as *healthcare professionals* who are sincerely close to patients and consumers and proactively contribute to the promotion of community health, not only in health and healthcare, but also in nursing care and welfare. They must also acquire and utilize specialist knowledge and skills so that they can make appropriate scientific judgments and have the attitude to contribute to the development of medicine and pharmacy with a spirit of scientific inquiry.

## I. Basic Policy for Revisions

1. Educational content designed for pharmacists who can play an active role in a society undergoing major changes.

In recent years, we have been faced with various problems such as demographic changes, and these changes in social structure are expected to further intensify as the years go by. In addition, as inter- and intra-healthcare teams progress as part of a comprehensive community care system, there is a greater need to improve the efficiency of objective tasks and enhance interpersonal tasks, and the roles and tasks of pharmacists in community healthcare, including during large-scale disasters, are undergoing significant changes. The content was designed to develop pharmacists who can provide safe, high-quality medical care as healthcare professionals and contribute to the improvement and promotion of public health in such a transforming society.

2. Development of a new MCC that presents the *basic qualities and competencies required of pharmacists* to be aimed at throughout life.

In the 2013 revision, there was a mix of a structure of academic outcome-based education with the *basic qualities required as pharmacists* required at graduation and a process-based education that presented GIOs and SBOs*. This was changed to a new development of learning outcomes-based education with the *basic qualities and competencies required as pharmacists* as a lifelong goal.

3. Greater freedom for each university to responsibly implement the curriculum.

In the 2013 revised version, the subjects to be studied were described in detail as SBOs, and each university spent time covering them that it did not have time to incorporate university-specific content into its curriculum. The detailed SBOs were abolished and the

content to be studied was made into a “core,” allowing universities more freedom in curriculum development to enable responsible education based on their respective philosophy and diploma policy.

The MCC has been revised to enable students to not only memorize many concrete facts, but also to think about their common features and differences, and acquire comprehensive academic skills that can be utilized to solve new challenges and problems. Each university was to develop its curriculum based on its academic objectives.

4. The establishment of an educational system of Clinical Pharmacy.

The emphasis is not on practical training in clinical settings (e.g. training for new early career training) with the aim of immediately being able to practice as a specialist at individual facilities, but on what to do as pharmacists for the benefit of the public in the future, and what issues to find solutions for, and how to contribute to society. In this MCC, an educational system called Clinical Pharmacy was established to produce pharmacists who can prevent diseases and provide responsible pharmacotherapy suited to individual patient conditions from the first year of university, through cooperation between the university and the medical fields.

5. Perspectives on human resource development for scientific exploration.

To meet social needs, the MCC aims to develop human resources who can scientifically explore, make discoveries, and find solutions to problems in order to contribute to the further development of healthcare.

6. Partial commonality with the MCC for medical and dental education.

From the perspective of promoting interprofessional healthcare teams, the content that should be common was discussed and harmonized on the occasion of the revision of the MCC for Education in Medicine, Dentistry, and Pharmacy.

* GIOs and SBOs: In the 2013 revised version, the general instructional objectives (GIOs) (outcomes that students obtain through their studies) were set to acquire *basic qualities* and the SBOs, Specific Behavioral Objectives, (individual practical competences that students should acquire in order to reach the GIO).

## II. Structure of the MCC for Pharmacy Education

1. The text of the MCC for Pharmacy Education consists of the following main sections:

**A. Basic Qualities and Competencies Required of Pharmacists**
**B. Social Pharmacy**
**C. Fundamentals of the Pharmaceutical Sciences**
**D. Pharmacotherapeutics**
**E. Pharmaceutical Health Science**
**F. Clinical Pharmacy**
**G. Research**

2. Each of the major items, B-G, contains major learning objectives and connections with "A: Basic Qualities and Competencies Required of Pharmacists" as well as guidelines for evaluation.

**〈Major learning objectives〉**

Objectives to be achieved through each of the major components B-G.
Standard learning outcomes at the time of completion (graduation), assuming completion of the MCC. The standard learning outcomes are set based on the content of the studies in the relevant major subject areas in order to acquire the basic qualities and competencies required of pharmacists in the major subject area *A*.

**〈Connection with A: Basic Qualities and Competencies Required of Pharmacists〉**

It describes how the study of each major item B-G is connected to lifelong goal A: Basic Qualities and Competencies Required of Pharmacists. This content is also described in the following *III Policy for the Development of Each Major Item*.

**〈Guidelines for evaluation〉**.

The perspectives for assessing student achievement of the learning objectives are presented in the evaluation guideline points of emphasis in each sub-item.

3.Each of the primary sections (B-G) is further divided into secondary and tertiary ones. The secondary sections include: aims, learning objectives, and focus of evaluation.

**〈Aims〉**

Describe the perspective from which this secondary section is based on what has been studied so far in the area, its position in the relevant medium, and how it relates to other areas. In some cases, part of the aim may be omitted from the secondary section.

**〈Learning Objectives〉**

The learning objectives are the main body of the MCC and indicate the ability to understand individual knowledge and skills in a conceptual and systematic manner, and to make decisions and take action by using the acquired knowledge and skills.

**〈Focus of Evaluation〉**

The learning items guiding the evaluation are clearly stated.

## III. Policy for the Preparation of Each Major Item
### A. The Basic Qualities and Competencies Required of Pharmacists

The Basic Qualities and Competencies Required of Pharmacists have been coordinated and standardized between schools of medicine, dentistry, and pharmacy. *Pharmacotherapy Management* is different from *Clinical Skills* in the basic qualities and competencies required of physicians and dentists and is specific to pharmacy. *Information Technology* is closely related to *problem-solving based on specialist knowledge*, but together with the *generalism*, it has been made into an item in light of the current social background.

The descriptions of each of the qualities and competencies are specific in pharmacy, which differs from medicine and dentistry.

B. Social Pharmacy
C. The Fundamentals of the Pharmaceutical Sciences
D. Pharmacotherapeutics
E. Pharmaceutical Health Science
F. Clinical Pharmacy
G. Research

## IV. Creation of Three University-specific Policies: Diploma Policy (DP), Curriculum Policy (CP), and Admission Policy (AP)

The lifelong goal *A. Basic Qualities and Competencies Required as Pharmacists* and the goals of major items B to G at the time of graduation, as indicated in this MCC, are different in terms of the time of achievement, but the content of the study are related to each other. Each university needs to fully understand this point and in order to realize unique education in accordance with the university's DP, build a curriculum that is sufficiently connected to *A. The Basic Qualities and Competencies Required as Pharmacists* when determining their DP goal.

It is important that the DP developed by each university can be assessed at the time of graduation. The *A. Basic Qualities and Competencies Required of Pharmacists* described in this MCC indicate the qualities and competencies to be aimed for throughout life, and do not indicate the content to be acquired at graduation, as in the *10 Basic Qualities Required of Pharmacists* described in the 2013 revised edition of the MCC. Each university should not directly adopt *A. Basic Qualities and Competencies Required of Pharmacists* described in the MCC as its DP, but should define it in accordance with its own educational policy (Fig. 1). In other words, with reference to the content of *A. Basic Qualities and Competencies Required of Pharmacists*, a DP that can be evaluated at the time of graduation is formulated from the academic objectives listed in major items B to G, taking into full account the uniqueness of each university, human and material resources, the educational environment, and an effective CP and AP for the six years of study.

Therefore, although the mutual interactions among the major subjects *B Social Pharmacy* to *G Research* will differ depending on each university's unique curriculum, the basic interrelationships can be imagined as shown in Figure 2: The student who studies six-year pharmacy education will strive to acquire *A Basic qualities and competencies*

*required of Pharmacists* as a result of their six years of study of these contents, as well as through lifelong learning after graduation.

This MCC shows the framework of the curriculum by classifying it into primary, secondary, and tertiary sections, but it is not a list of subject assignments for the teacher/faculty. Each university needs to be aware of the connections between each item from the students' perspective, set the subject structure with reference to the classification of major items B to G, and construct an original and effective curriculum so that students can achieve the learning objectives in the secondary sections.

In the future, it is hoped that further seamless education from pre-graduate education to post-graduate training, etc., will foster a lifelong attitude to study with *A. Basic Qualities Required of Pharmacists* as a lifelong goal.

## V. Future Implementation of the MCC for Pharmacy Education

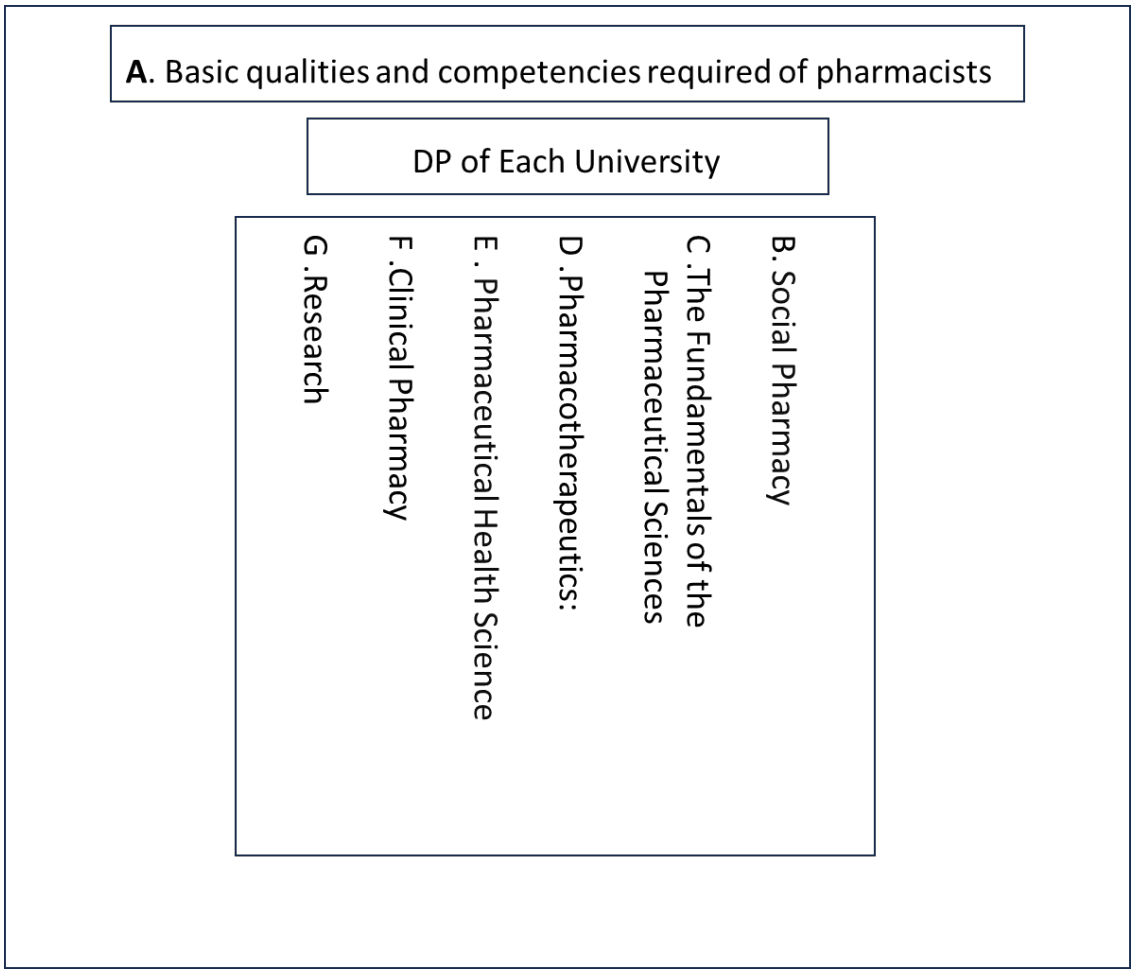
It is important that each university is strongly aware that the construction and implementation of its own university curriculum based on the MCC for Pharmacy Education, in accordance with its philosophy and DP, and will help ensure internal quality assurance in education.

It is also important for each university to not only provide education in accordance with this MCC, but also to strive to develop pharmacists with language skills and a wide range of liberal arts education.

The purpose of the MCC is not to formulate a program, but to make it more substantial when it is actually put into practice in the field of education. From this perspective, it is important that each university starts to verify this MCC from the moment it is implemented, and constantly endeavors to collect data and implement improvement measures.

**Figure 1:** ***A.*** *Basic Qualities and Competencies Required of Pharmacists* and DP.

Based on the academic goals of major items B-G, each university needs to develop its own DP that leads to the lifelong goal *A. Basic Qualities Required and Competencies of Pharmacists*.



## A. Basic Qualities and Competencies Required of Pharmacists

Pharmacists are expected to develop the following qualities and competencies throughout their lives so that they can contribute to society by contributing to the development of medicine and pharmacy, with a rich sense of humanity and high ethical standards as healthcare professionals, recognize medical safety as pharmaceutical professionals, and responsibly protect the lives and health of patients and consumers.

**1. Professionalism**

Pharmacists are to have a rich sense of humanity and a deep awareness of the dignity of life, a sense of mission and responsibility to contribute to the maintenance and promotion of human health as pharmacists, a sense of ethics to respect the rights of patients and consumers and protect their interests, and make their best efforts to prevent the occurrence of health problems/harm (drug-related harm, medical accidents/errors, serious side effects, etc.) caused by pharmaceuticals and other products, realize medical care, welfare and public health that prioritizes life and living with an altruistic attitude (altruistic approach?).

**2. Generalism**

Achieve high quality medical, welfare, and public healthcare by understanding the physical, psychological, and social backgrounds of patients and consumers, and by taking a holistic and integrated view of the situation.

**3. Lifelong Learning**

As pharmacists responsible for medical, welfare, and public health care, set their own goals to achieve and continue to learn throughout their lives, while studying and teaching themselves and others.

**4. Research**

From a pharmaceutical perspective, accurately identify issues in medicine, welfare, and public health, and contribute to the development of pharmacy by appropriately planning and practicing academic and research activities while acquiring scientific thinking for problems solution.

**5. Problem-solving**

Acquire pharmacological knowledge and skills to understand the relationship of pharmaceuticals and other chemical substances to life and the environment from a professional perspective, to make appropriate scientific judgements, and to use these for diverse and advanced medical, welfare, and public health purposes.

**6. Information Technology**

Take an interest in advanced and cutting-edge technologies in society and actively utilize technologies related to epidemiology, artificial intelligence and big data, making use of their expertise as pharmacists and in compliance with ethics, laws, institutions, and norms related to information, science, and technology.

**7. Pharmacotherapy Management**

Independently plan, implement, and evaluate pharmacotherapy healthcare management including the appropriate supply of medicines, dispensing of medicines according to the situation, providing medication guidance/counseling and proposing patient-centered care to prescribers.

**8. Communication**

Communicate empathetically and well with patients, consumers, and healthcare professionals to support their decision-making through the appropriate and smooth exchange of information.

**9. Interprofessional Collaboration**

Understand the roles of all the professionals who make up an inter-healthcare team partnership and practice quality patient- and consumer-centered healthcare, welfare, and public health, while building equal relationships with each other.

**10. Medicine in Society**

Take on roles in medical care, welfare, and public health from a broad perspective that spans from the local and international perspectives, from pre-disease and prevention to treatment, prognosis management, and end-of-life care.

## B. Social Pharmacy

**<Major learning objectives>**
In order to develop A. Basic Qualities, Abilities, and Competencies Required of Pharmacists throughout Life, in the Model Core Curriculum for Pharmacy Education, student pharmacists learn about the responsibilities of pharmacists, the social nature required of pharmacists, activities in society and the communities, regulations on pharmaceuticals, and the Information Technology, and acquire an awareness as pharmacists who play a role in medicine, healthcare, nursing, and welfare, and the competencies to contribute to ensuring healthy lives for the public in light of changes and diversification in society, which are bases for studying C. Fundamentals of the Pharmaceutical Sciences, D. Pharmacotherapeutics, E. Pharmaceutical Health Science, F. Clinical Pharmacy and G. Research.

**B. Social Pharmacy Comprises the Following Five Secondary sections.**
**B-1. Responsibilities of Pharmacists**
**B-2. Social Abilities Required of Pharmacists**
**B-3. Pharmacist Activities in Society and Communities**
**B-4. Regulation of Pharmaceuticals Products**
**B-5. Information Technology**

**< Connection with A. Basic Qualities and Competencies Required of Pharmacists >**

[B-1. Responsibilities of Pharmacists] is the learning that cultivates the qualities and competencies of *[Professionalism], [Generalism]* and *[Lifelong Learning]*, which are the prerequisites for the learning in primary sections B to G. [B-2. Social Abilities Required of Pharmacists] cultivates the qualities and abilities of *[Communication], [Interprofessional Collaboration]* and *[Generalism]* and is mainly linked to the learning in [F. Clinical pharmacy]. [B-3. Pharmacist Activities in Society and Communities] cultivates the qualities and competencies of *[Generalism], [Problem-solving]* and *[Research]*, and is mainly related to the learning in [E. Pharmaceutical Health Science]. [B-4. Regulation of Pharmaceuticals Products] is the learning that cultivates *[Professionalism], [Problem-solving]* and *[Pharmacotherapy Management]*, and is connected to the learning in [C. Fundamentals of the Pharmaceutical Sciences], [D. Pharmacotherapeutics], [E. Pharmaceutical Health Science] and [F. Clinical Pharmacy]. [B-5. Information Technology] is the learning that cultivates the ability of *[Information Technology], [Medicine in Society], [Research], [Professionalism]* and is mainly connected to the learning in [E. Pharmaceutical Health Science], [F. Clinical Pharmacy] and [G. Research]. As described above, learning in primary sections B cultivates all the qualities and competencies listed in [A. Basic Qualities and Competencies Required of Pharmacists] and are also linked learning in all the sections of [C. Fundamentals of the Pharmaceutical Sciences], ]D. Pharmacotherapeutics], [E. Pharmaceutical Health Science], [F. Clinical Pharmacy] and [G. Research].

**<Guidelines for evaluation>**
1) Address ethical issues in medicine, healthcare, and welfare based on codes of ethics and ethical principles.

2) Support decision-making in an altruistic manner, respecting the psychology and position of patients and consumers.
3) Work with others through smooth communication.
4) Explain their behavior as pharmacists in relation to the law and their social mission.
5) Explain the handling of medicinal products and information in accordance with laws, regulations, and guidelines.
6) Analyze and evaluate current social and regional conditions and issues, using information materials and data appropriately.
7) Identify issues in medicine, healthcare, and welfare and present solutions based on their expertise.
8) Recognize the roles and responsibilities expected of pharmacists and take action to improve their own qualities and competencies.

## B-1. Responsibilities of Pharmacists

### B-1-1. Ethics and Professionalism Required of Pharmacists

| Aim |
| --- |
| Cultivate professionalism underpinned by a rich sense of humanity and a deep appreciation of the sanctity of life, and develop the sense of ethics required of medical personnel and the competencies to make decisions and take action to deal appropriately with ethical issues. Furthermore, acquire the competencies to contribute to healthcare with an altruistic attitude that respects the rights of patients and consumers. |
| Related sections |
| C. Fundamentals of the Pharmaceutical Sciences; D. Pharmacotherapeutics; E. Pharmaceutical Health Science; F. Clinical pharmacy; G. Research. |
| Learning objectives |
| 1) Acquire ethical perspectives pertaining to life and medical care, cultivate sensitivity as a health care professional, make decisions proactively, and act as a professional in regard to various ethical issues and situations.<br>2) As a healthcare professional, always reflect, make every effort to improve themselves, and act altruistically in the public interest.<br>3) As a healthcare professional, strive to acquire the necessary knowledge and skills, cultivate their own view of professionals and work and form a concept of value for lifelong learning.<br>4) Recognize that the mission of pharmacists includes the development of future generations of pharmacists and strive to be role models for them. |
| Evaluation guidelines |
| 1,4,8 |

**B-1-2. Patient-centered Healthcare**

| Aim |
| --- |
| Understand the concepts of medical psychology and behavioral science, etc., and comprehensively understand the physical, psychological, and social backgrounds of patients and their families and acquire the ability to provide holistic, patient-centered medical care that respects basic human rights of patients. |
| Related sections |
| D. Pharmacotherapeutics; E. Pharmaceutical Health Science; F. Clinical Pharmacy |
| Learning objectives |
| 1) Develop an understanding of the psychology of the patient/patient's family and respect and support the patient's narrative and independent decision-making.<br>2) Understand the impact of the relationship between the healthcare provider and the patient/patient's family on treatment and health behaviors, and respond according to the values and state of mental readiness of the patient/patient's family.<br>3) Understand the diversity and individuality of patients and patient families and explain the importance of comprehensively utilizing patient-specific narrative-based medicine (NBM) and scientific evidence-based medicine (EBM).<br>4) Understand life-cycle specific health challenges and support patients' behavioral transformation on an ongoing basis as a companion in their lives. |
| Evaluation guidelines |
| 2,3,4 |

**B-1-3. Social Mission and Legal Responsibilities of Pharmacists**

| Aim |
| --- |
| Recognize the social mission and legal responsibilities required of pharmacists, and acquire the competencies to make a contribution forward high quality medical care, health, care and welfare as a medical professional in charge of manufacturing, dispensing and supplying medicines and a wide range of pharmaceutical affairs and hygiene, with the decision-making skills to fulfill their responsibilities. |
| Related sections |
| C. Fundamentals of the Pharmaceutical Sciences; D. Pharmacotherapeutics;<br>E. Pharmaceutical Health Science; F. Clinical Pharmacy |
| Learning objectives |
| 1) Understand the social mission, legal responsibilities, and code of ethics to be complied by pharmacists and recognize their duties and responsibilities to ensure healthy lives for patients and consumers.<br>2) Understand the legal norms necessary for performing pharmacists’ duties properly and to be able to explain them.<br>3) Understand the seriousness of health damages caused by medicines or other substances and the holistic suffering of victims themselves, their families and others, and explain the importance of the role and responsibility of pharmacists in preventing drug-related harm and medical accidents. |
| Evaluation guidelines |
| 4,5,7,8 |

## B-2. Social Abilities Required of Pharmacists

### B-2-1. Communication Skills for Patients and Consumers

| Aim |
| --- |
| Understand words and actions of others in both a cultural and social-scientific context, and communicate empathetically to build good relationships, leading to practice for the best decision-making support for patients and consumers and safe, high-quality medical, health, nursing, and welfare. |
| Related sections |
| E. Pharmaceutical Health Science; F. Clinical Pharmacy |
| Learning objectives |
| 1) Establish good human relationships through appropriate communication including non-verbal communication, considering the psychology, perspectives, environments, and conditions of the patients/consumers.<br>2) Empathize with patients, consumers, and their family members and communicate while considering their diversity.<br>3) Communicate with consideration for the psychological, physical, and social distress of the patient/patient's family while respecting their feelings. |
| Evaluation guidelines |
| 2,3 |

### B-2-2. Inter- and intra-professional Collaboration

| Aim |
| --- |
| Understand the respective professional abilities and communicate with respect for self and others and acquire the competencies to provide healthcare and welfare to patients and consumers through inter- and intra-professional collaboration. |
| Related sections |
| D. Pharmacotherapeutics; E. Pharmaceutical Health Science; F. Clinical Pharmacy |
| Learning objectives |
| 1) Understand the professional abilities of other professionals involved in medical care, healthcare, and welfare and explain the role and specialty of pharmacists in inter- and intra-professional collaboration.<br>2) In order to implement interprofessional cooperation with building equal human relationships with other professionals involved in medicine, healthcare, and welfare, communicate the pharmacist's own thoughts and feelings appropriately with respect to others' opinions.<br>3)Explain the barriers and problems pharmacists face in promoting interprofessional collaboration and make efforts to resolve them. |
| Evaluation guidelines |
| 2,3,7 |

## B-3. Pharmacist Activities in Society and Communities

### B-3-1. Healthcare in Communities

| Aim |
|---|
| Understand the current status and issues of health and healthcare in the community, the framework for ensuring quality healthcare, the function of community pharmacies in the community and the role of pharmacists and acquire the competencies to meet the needs of health and healthcare in the community including pre-symptomatic disease, prevention, treatment, prognosis management, and end-of-life care. |
| Related sections |
| D-1. Drug Action Mechanisms and Biological Reactions; D-2. Pharmacology and Pathology; E-1. Public Health to Maintain and Promote Health; F. Clinical Pharmacy. |
| Learning objectives |
| 1) Understand the environment and lifestyles that affect health and explain the role of pharmacists in improving sanitation in the community, disease prevention, and health promotion.<br>2) Identify local health and medical issues and present measures to solve them according to local characteristics and actual conditions.<br>3) Understand the system for protecting the interests of healthcare recipients and for efficiently providing good quality and appropriate health care and explain the role pharmacists should play.<br>4) Explain the need for inter- and intra-professional collaboration between health and medical professions, including government bodies, while making use of resources available in the community.<br>5) Recognize the need to fully demonstrate pharmacists' roles and pharmacies' functions, respectively, for improving the quality of health and healthcare in the community while keeping in mind their roles and functions in light of social conditions and international trends. |
| Evaluation guidelines |
| 2,4,7,8 |

### B-3-2. Systems for Healthcare and Welfare

| Aim |
|---|
| Understand the system and framework of the safety net for the public, the duties of pharmacists and trends in social security reform, and acquire the competencies to practice appropriate roles under the social security system and provide healthcare and welfare. |
| Related sections |
| E-1. Public Health to Maintain and Promote Health; F. Clinical Pharmacy. |
| Learning objectives |
| 1) Explain the concept of the social security system and its framework.<br>2) Understand the system and structure of healthcare and welfare provided under the social security system and the roles of the relevant institutions and professions, and explain the roles required of pharmacists. |
| Evaluation guidelines |
| 4,5 |

**B-3-3. Effective Use of Healthcare Resources**

| Aim |
| --- |
| Understand the current state of the financing of the universal healthcare insurance system, the drug pricing system and the economic evaluation of pharmacotherapies, and acquire the ability to solve problems from a pharmaceutical perspective in order to maintain and sustain the healthcare insurance system. |
| Related sections |
| D-3. Drug Information Necessary for Decision-making in Healthcare;<br>F. Clinical Pharmacy. |
| Learning objectives |
| 1) Develop an understanding of issues facing the financing of healthcare insurance and explain the roles of the government, relevant institutions, and professions and the public in maintaining and sustaining the healthcare insurance system.<br>2) Develop an understanding of the cost structure associated with pharmacotherapy, the factors that influence costs, and to explain the need for pharmacists to be involved in the rationalization of healthcare costs.<br>3) Present measures to utilize these resources efficiently from a pharmacy perspective, given the finite resources. |
| Evaluation guidelines |
| 5,6,7 |

**B-4. Regulation of Pharmaceutical Products**

**B-4-1. The Environment Surrounding Drug Development**

| Aim |
| --- |
| Understand the structure of drug development, the current situation in Japan and abroad and the role of pharmacists, and acquire the ability to understand the relationship of pharmaceuticals to life and the environment from a professional perspective, and to make appropriate decisions scientifically in diverse and advanced healthcare settings. |
| Related sections |
| D-1. Drug Action Mechanisms and Biological Reactions; D-3. Drug Information Necessary for Decision-making in Healthcare; D-5. Drug Formulation Science;<br>F-1. Pharmacotherapy; F-3. Healthcare Management and Patient Safety; G. Research. |
| Learning objectives |
| 1) Understand the life cycle of pharmaceuticals from development to approval and post-marketing and explain the process and system of drug development.<br>2) Explain the legal regulations and systems for clinical research related to drug development.<br>3) Understand the trends in Japan and abroad for drug development and explain that drug development is globally promoted and that the international situation has a direct impact on healthcare in Japan. |
| Evaluation guidelines |
| 4,5,7 |

**B-4-2. Securing the Quality, Efficacy, and Safety of Products Including Pharmaceuticals and Medical Devices and Preventing Drug-induced Suffering**

| Aim |
| --- |
| Understand pharmaceutical regulations, the history and background of drug-induced suffering, and the relief system for health damages caused by medicines, leading to making decisions and taking actions to secure the quality, efficacy and safety of products including pharmaceuticals and medical devices and to improve public health through pharmaceuticals. |
| Related sections |
| D-1. Drug Action Mechanisms and Biological Reactions; D-3 Drug Information Necessary for Decision-making in Healthcare; F. Clinical Pharmacy; G. Research. |
| Learning objectives |
| 1) Understand the importance of securing the quality, efficacy, and safety of products including pharmaceuticals and explain the importance of executing their duties with up-to-date knowledge of legal regulations.<br>2) Recognize the importance of making utmost efforts to prevent health damage to patients and consumers caused by pharmaceuticals, and present actions to prevent them from occurring and what to do if they do occur.<br>3) Develop an understanding of the history and the social context of drug-induced suffering and recognize actions to prevent drug-induced suffering and the responsibilities of pharmacists. |
| Evaluation guidelines |
| 4,5,7,8 |

**B-4-3. Supply of Pharmaceuticals and Medical Devices**

| Aim |
| --- |
| Understand the systems for supplying and dispensing pharmaceuticals. |
| Related sections |
| D-3. Drug Information Necessary for Decision-making in Healthcare; F-3. Healthcare Management and Patient Safety; F-4. Contribution to Community Healthcare and Public Health. |
| Learning objectives |
| 1) Develop an understanding of the manufacturing process of pharmaceuticals and the distribution channels from shipping to the stage of use, and to recognize the importance of a stable supply of pharmaceuticals on the market.<br>2) Identify the factors that hinder the supply of pharmaceuticals and understand the roles that the government, the pharmaceutical industry, manufacturing, and wholesalers, medical institutions, and pharmacies should play in order to solve issues that may arise. |
| Evaluation guidelines |
| 4,5,7 |

### B-4-4. Controlled Drugs and Chemical Substances Requiring Special Management

| Aim |
|---|
| Understand the proper handling of drugs and chemicals requiring special controls leading to the contribution to the improvement of public health. |
| Related sections |
| D-1. Drug Action Mechanisms and Biological Reactions; D-2. Pharmacology and Pathology; E-3. Management of Chemical Substances and Environmental Health; F-1. Pharmacotherapy; F-3. Healthcare Management and Patient Safety. |
| Learning objectives |
| 1) Recognize the impact on people and society in the case of the improper use of pharmaceuticals.<br>2) Develop regulatory and pharmaceutical knowledge of pharmaceuticals requiring special control and recognize the importance of the proper use and prevention of drug abuse by pharmacists. |
| Evaluation guidelines |
| 4,5,7 |

## B-5. Information Technology

### B-5-1. Statistics in Health Science

| Aim |
|---|
| Understand how to utilize health statistics and identify issues in healthcare accurately leading to appropriate research designs and implementations for problem solving. |
| Related sections |
| D-3. Drug Information Necessary for Decision-making in Healthcare; E-1. Public Health to Maintain and Promote Health; F-1. Pharmacotherapy; F-4. Contribution to Community Healthcare and Public Health; G. Research. |
| Learning objectives |
| 1) Explain the importance of understanding and utilizing statistical data in healthcare in order to take measures to secure the health and medical safety of the public.<br>2) Understand basic statistics concepts and methods for healthcare and use and interpret statistical data correctly.<br>3) Identify issues related to healthcare in Japan and abroad from statistical materials and data in the healthcare fields and present measures to deal with them. |
| Evaluation guidelines |
| 6,7 |

**B-5-2. Digital Technology and Data Science**

| Aim |
| --- |
| Understand how to utilize digital technology and big data and matters that require attention and acquire the ability to lead them to healthcare. |
| Related sections |
| D-3. Drug Information Necessary for Decision-making in Healthcare; E-1. Public Health to Maintain and Promote Health; F. Clinical Pharmacy; G. Research. |
| Learning objectives |
| 1) Understand the development and utilization of digital technology in medicine, healthcare, and welfare, and have a perspective on making the most of them to carry out the roles of pharmacists required.<br>2) Deepen the understanding of issues in utilizing digital technologies and recognize the importance of complying with ethics, laws, systems, and norms related to digital technologies and of utilizing them based on appropriate decisions according to the environment and situation.<br>3) Understand the utilization of big data in medicine, healthcare, and welfare, deepen an understanding of the characteristics and points to note of the data and design utilizing methods based on them. |
| Evaluation guidelines |
| 6,7,8 |

**B-5-3. Outcomes of Pharmacist Activities**

| Aim |
| --- |
| Understand how to measure and assess outcomes brought from pharmacists' activities as professionals, leading to the attainment of healthcare, and the development of pharmacy and pharmaceutical science through their activities. |
| Related sections |
| F. Clinical Pharmacy. |
| Learning objectives |
| 1) Understand that pharmacists have a wide variety of opportunities to utilize their pharmaceutical knowledge and recognize the importance of evaluating pharmacist outcomes achieved by pharmacists.<br>2) With an awareness of visualizing the pharmacist's professional competencies, plan how to have a relationship with patients, consumers, and other healthcare professions, as well as pharmacists' activities in society and in the community. |
| Evaluation guidelines |
| 6,7,8 |

## C. Fundamentals of the Pharmaceutical Sciences

**<Major learning objectives>**

There is a hierarchy of learning levels within the area of Fundamentals of the Pharmaceutical Sciences, the most fundamental being physicochemical chemistry (C-1. Physicochemical Properties of Chemical Substances), chemistry (C-3. Organic Chemistry), and biology and biochemistry including microbiology (C-6. Biochemistry). Learning these subjects enables student pharmacists to acquire knowledge in terms of analytical science (C-2. Analytical Chemistry), medicinal chemistry (C-4. Medicinal Chemistry), biopharmaceutics and pharmacognosy and natural product chemistry (C-5. Pharmacognosy and Natural Product Chemistry), anatomy, physiology and immunology (C-7. Anatomy and Physiology) within the main subject areas. Thus, the scientific foundation is formed for pharmaceutics and pharmacokinetics (D. Pharmacotherapeutics), health and environmental sciences (E. Pharmaceutical Health Science), pharmacology and pathophysiology (D. Pharmacotherapeutics), including infectious diseases and infectious therapeutics.

**C. Fundamentals of the Pharmaceutical Sciences Consists of the Following Seven Secondary Sections:**

**C-1. Physicochemical Properties of Chemical Substances**
**C-2. Analytical Chemistry**
**C-3. Organic Chemistry**
**C-4. Medicinal Chemistry**
**C-5. Pharmacognosy and Natural Product Chemistry**
**C-6. Biochemistry**
**C-7. Anatomy and Physiology**

**< Connection with A. Basic Qualities and Competencies Required of Pharmacists >**

C. Fundamentals of the Pharmaceutical Sciences are associated with D. Pharmacotherapeutics, E. Pharmaceutical Health Science, F. Clinical Pharmacy, and G. Research, and it is possible to continue the lifelong learning of *[Research], [Problem-solving], [Information Technology]* and *[Pharmacotherapy Management]* as set out in A. Basic Qualities, and Competencies Required of Pharmacist. Forming this foundation in clinical settings leads to demonstrating expertise in fundamental pharmaceutical sciences, which pharmacists require, different from other medical professionals such as medical doctors, dentists, and nurses. The acquisition of competencies for this expertise is the main learning requirement.

**<Guidelines for Evaluation>**

1) Describe the chemical interactions, modes, and mechanisms of the progression of enzymatic reactions.
2) Describe the principles and characteristics of analytical methods for chemical substances, including pharmaceuticals, and analytical techniques used in clinical settings.
3) Consider how the contents of physicochemical chemistry and analytical sciences are linked to the pharmacist's profession in healthcare.
4) Describe drugs and related substances as compounds (organic or inorganic) and their physicochemical and chemical properties.

5) Describe the structure and reactivity of organic compounds.
6) Describe the test methods and analyses dealing with pharmacist's work.
7) Describe the biological reactions of organic compounds.
8) Describe the main effects, side effects, pharmacokinetics, and other characteristics of drugs used in clinical settings.
9) Describe the background to the development of medicines derived from natural products and herbs.
10) Describe how organic chemistry, medicinal chemistry, and pharmacognosy/natural product chemistry are useful in pharmacist's work.
11) Describe the maintenance of homeostasis of biological activities leading to an understanding of disease and the effectiveness of prevention and treatment.
12) Consider the development of new preventive and therapeutic methods for the homeostasis of organisms.
13) Describe that biological functions are operated by biochemical reactions of organic compounds in the cells of the human body and that organic compounds are also involved in homeostasis.
14) Describe that the human body comprises 12 organ systems and that biological homeostasis is maintained and regulated by them.
15) Consider how organ systems and their linkages lead to the digestion and absorption of ingested food, drug metabolism, and the establishment of infections and various diseases.

## C-1. Physicochemical Properties of Chemical Substances

### C-1-1. Chemical Bonding and Chemical-biomacromolecule Interactions

| Aim |
| --- |
| Understand the modes of chemical bonding and intermolecular interactions that form the basis for the interactions between proteins and other biological macromolecules necessary for expressing the actions of chemical substances. |
| Related sections |
| C-2-6. Separation Analysis; C-3-1. Fundamental Properties of Substances; C-4. Medicinal Chemistry; C-6-4. Proteins Responsible for Biological Functions; D-4-1. Absorption, Distribution, Metabolism, and Excretion; D-4-2. Pharmacokinetic Analysis; D-5-3. Drug Delivery System (DDS); D-5-1. Properties of Drugs and Formulations, E Pharmaceutical Health Science, F Clinical Pharmacy. |
| Learning objectives |
| 1) Describe the mechanisms of bonding that form pharmaceuticals and biomolecules.<br>2) Describe the various interactions that operate between drugs and biomolecules.<br>3) Describe the interactions between pharmaceuticals and biological macromolecules, which are essential for expressing actions in pharmaceuticals. |
| Evaluation guidelines |
| 1, 3 |

### C-1-2. Electromagnetic Waves, Radiation

| Aim |
| --- |
| Learn the properties of electromagnetic waves and their interaction with chemicals. |
| Related sections |
| C-2-4. Analytical Methods with Electromagnetic Waves; C-2-5. Structural Analysis Based on Chemical Properties in Organic Compounds-Principles; C-2-8. Analytical Techniques and Medical Devices, C-3-4. Structural Analysis based on Chemical Properties in Organic Compounds; D-4-2. Pharmacokinetic Analysis; E-3-2. Preservation of Living and Natural Environment; F-1-1. Individual Optimization of Pharmacotherapy. |
| Learning objectives |
| 1) Describe the types and properties of electromagnetic radiation and radionuclides used in image analysis, diagnosis, and treatment in clinical settings.<br>2) Describe the interactions between electromagnetic waves and chemicals.<br>3) Describe the effects of ionizing radiation on the body in diagnostic, therapeutic, or exposure accidents. |

| Evaluation guidelines |
| --- |
| 1, 3 |

**C-1-3. Energy and Thermodynamics**

| Aim |
| --- |
| Learn about thermodynamics to understand chemical reactions and changes in substances. |
| Related sections |
| C-2-2. Chemical Equilibrium of Solutions and Volumetric Analysis Methods; C-2-6. Separation Analysis; C-4-2. Biomolecules and their Functions; C-6-5. Bioenergy and Metabolism; D-4-1. Absorption, Distribution, Metabolism, and Excretion; D-5-3. Drug Delivery System (DDS); D-5-1. Properties of Drugs and Formulations; D-6-1. Dispensing Based on Prescriptions; E-2-1. Food Functions and Nutrition in Prevention and Care of Disease; F-1. Pharmacotherapy. |
| Learning objectives |
| 1) Describe the relationship between the exchange of energy (e.g. thermic energy and energy work) and changes in the state of substances.<br>2) Describe the relationship between the dissolution of substances and each other, energy and temperature, pressure, and concentration.<br>3) Describe the relationships between the redox reactions of substances and energy.<br>4) Provide an overview of medical technologies based on the differences in the concentrations of substances in and outside the membrane. |
| Evaluation guidelines |
| 1, 3 |

**C-1-4. Reaction Kinetics**

| Aim |
| --- |
| Learn about the reaction kinetics of chemicals. In addition, learn about the factors that affect the reaction rate and the chemical reactions by enzymes. |
| Related sections |
| C-3-1. Fundamental Properties of Substances; C-4-2. Biomolecules and their Functions; C-6-4. Proteins Responsible for Biological Functions; D-4-1. Absorption, Distribution, Metabolism, and Excretion; D-4-2. Pharmacokinetic Analysis; D-5-3. Drug Delivery System (DDS); D-5-1. Properties of Drugs and Formulations; D-6-1. Dispensing Based on Prescriptions; E-2-1. Food Functions and Nutrition in Prevention and Care of Disease; F-1-1. Individual Optimization of Pharmacotherapy. |

| Learning objectives |
| --- |
| 1) Understand changes in the amounts and state of substances involved in various chemical reactions, such as the degradation of pharmaceuticals and enzymatic reactions, and describe how to measure the amount of change in substances kinetically.<br>2) Describe factors influencing chemical reactions, including enzymatic reactions. |
| Evaluation guidelines |
| 1, 3 |

**C-2. Analytical Chemistry**

**C-2-1. Fundamentals of Analytical Methods**

| Aim |
| --- |
| Learn about the fundamentals of analytical methods, the reliability of analytical results, and the quality management of chemical substances and pharmaceuticals in clinical settings. |
| Related sections |
| C-2-7. Biomedical Analysis; D-1. Drug Action Mechanisms and Biological Reactions; D-4-2. Pharmacokinetic Analysis; E-2. Nutrition and Food Safety to Maintain and Promote Health; E-3. Management of Chemical Substances and Environmental Health; F-3-1. Supply and Management of Medicinal Products. |
| Learning objectives |
| 1) Describe how to use analytical instruments, how to handle data, and evaluate methods to ensure the reliability of analytical results in the quality management of pharmaceuticals and testing in clinical settings. |
| Evaluation guidelines |
| 2, 3 |

**C-2-2. Chemical Equilibrium of Solutions and Volumetric Analysis Methods**

| Aim |
| --- |
| Learn about chemical equilibrium and volumetric analysis methods for measuring the amount of pharmaceuticals and chemicals. |
| Related sections |
| C-1-3. Energy and Thermodynamics; C-4-2. Biomolecules and their Functions;<br>D-4-1. Absorption, Distribution, Metabolism, and Excretion; D-5-1. Properties of Drugs and Formulations; E-2. Nutrition and Food Safety to Maintain and Promote Health,<br>E-3. Management of Chemical Substances and Environmental Health; F-3-1. Supply and Management of Medicinal Products. |
| Learning objectives |
| 1) Describe the significance and methods of measuring hydrogen ion concentrations in solutions, which affect both chemical and enzymatic reactions.<br>2) Describe how hydrogen ion concentrations are maintained at constant levels in aqueous solutions, including body fluids.<br>3) Describe the phenomena in various reactions and that the amount of a substance involved in a reaction does not change.<br>4) Understand the principles of methods for quantities of substances, and describe the operating procedures and applications. |
| Evaluation guidelines |
| 2, 3 |

**C-2-3. Qualitative Analysis and Japanese Pharmacopoeia Test Methods**

| Aim |
| --- |
| Learn about the significance and contents of the Japanese Pharmacopoeia and the test methods stipulated for each pharmaceutical. |
| Related sections |
| C-2-2. Chemical Equilibrium of Solutions and Volumetric Analysis Methods;<br>C-2-4. Analytical Methods with Electromagnetic Waves; C-2-6. Separation Analysis;<br>B-4. Regulation of Pharmaceuticals Products; E-2. Nutrition and Food Safety to Maintain and Promote Health; E-3. Management of Chemical Substances and Environmental Health;<br>F-3-1. Supply and Management of Medicinal Products. |
| Learning objectives |
| 1) Describe the significance of the Japanese Pharmacopoeia in ensuring the quality of pharmaceuticals.<br>2) Describe the principles and characteristics of the Japanese Pharmacopoeia testing |

| |
|---|
| methods.<br>3) Describe the purpose and methods of inorganic ion analysis. |
| Evaluation guidelines |
| 2, 3 |

**C-2-4. Analytical Methods with Electromagnetic Waves**

| |
|---|
| Aim |
| Learn about methods of analyzing pharmaceuticals and biological components using electromagnetic waves, as well as their application in clinical settings, and the quality management of pharmaceuticals. |
| Related sections |
| C-1-2. Electromagnetic Waves and Radiation; D-4-2. Pharmacokinetic Analysis; E-2. Nutrition and Food Safety to Maintain and Promote Health; E-3. Management of Chemical Substances and Environmental Health; F-1-1. Individual Optimization of Pharmacotherapy; F-3-1. Supply and Management of Medicinal Products. |
| Learning objectives |
| 1) Describe the principles of the application of electromagnetic waves to the measurement of the concentrations of pharmaceuticals and biological components.<br>2) Describe the operation and applications of various analytical methods using electromagnetic waves.<br>3) Describe the principles of analytical methods for metals.<br>4) Describe the intended use of these analytical methods in clinical settings and pharmaceutical quality management. |
| Evaluation guidelines |
| 2, 3 |

**C-2-5. Structural Analysis Based on Chemical Properties in Organic Compounds --Principles**

| |
|---|
| Aim |
| Learn the principles and characteristics of methods for the structure analysis of organic compounds. |
| Related sections |
| B-4-2. Securing the Quality, Efficacy, and Safety of Products including Pharmaceuticals and Medical devices and Preventing Drug-induced suffering; C-1-2. Electromagnetic Waves and Radiation; C-3-1. Fundamental Properties of Substances; C-3-2. Stereochemistry of Organic |

| |
|---|
| Compounds; C-3-3. Fundamental Structure and Reactivity of Organic Compounds; C-3-4. Structural Analysis based on Chemical Properties in Organic Compounds; C-4-1. Characteristics of Functional Groups in Drugs; C-4-5. Pharmaceuticals for Major Diseases and Mechanisms; C-5-2. Drugs Derived from Natural Products. |
| Learning objectives |
| 1) Describe how the interaction between organic compounds and electromagnetic waves is influenced by chemical structures.<br>2) Describe the motion of ions in magnetic and electric fields as related to their mass. |
| Evaluation guidelines |
| 2, 3 |

**C-2-6. Separation Analysis**

| |
|---|
| Aim |
| Learn about separation analysis methods. |
| Related sections |
| C-1-1. Chemical Bonding and Chemical-biopolymers Interactions; C-1-3. Energy and Thermodynamics; D-4-2. Pharmacokinetic Analysis; E-2. Nutrition and Food Safety to Maintain and Promote Health; E-3. Management of Chemical Substances and Environmental Health; F-1-1. Individual Optimization of Pharmacotherapy; F-3-1. Supply and Management of Medicinal Products. |
| Learning objectives |
| 1) Describe the principles and methods of separating specific compounds in biological samples and pharmaceuticals.<br>2) Describe how energization forces ions to move and separate from each other.<br>3) Describe the principles and characteristics of methods for detecting and quantifying separated substances.<br>4) Describe the intended use of analytical methods in clinical settings and pharmaceutical quality management. |
| Evaluation guidelines |
| 2, 3 |

**C-2-7. Biomedical Analysis**

| Aim |
| --- |
| Learn about the principles, characteristics, and applications of analytical methods on how to handle data. |
| Related sections |
| C-2-2. Chemical Equilibrium of Solutions and Volumetric Analysis Methods;<br>C-2-3. Qualitative Analysis, Japanese Pharmacopeia Test Methods; C-2-4. Analytical Methods with Electromagnetic Waves; C-2-5. Structural Analysis Based on Chemical Properties in Organic Compounds – Principles; C-2-6. Separation Analysis; C-6-4. Proteins Responsible for Biological Functions; C-7-9. Lymphatic System and Immune System;<br>D-1-2. Pathophysiological Changes; D-1-3. Drug Safety; D-4-2. Pharmacokinetic Analysis;<br>E-3-1. Management and Use of Chemical Substances Affecting Health; E-1. Public Health to Maintain and Promote Health; F-1-1. Individual Optimization of Pharmacotherapy;<br>F-4. Contribution to Community Healthcare and Public Health. |
| Learning objectives |
| 1) Describe the need for specimen samples to be properly processed before analysis.<br>2) Describe how to handle data.<br>3) Describe the purpose, principles, outlines, and characteristics of operating procedures in analytical methods in clinical settings.<br>4) Describe the significance and content of point of care testing (POCT). |
| Evaluation guidelines |
| 2, 3 |

**C-2-8. Analytical Techniques and Medical Devices**

| Aim |
| --- |
| Learn about the various analytical techniques and medical devices for diagnosis and treatment in clinical settings. Learn about pharmaceuticals in treatment and diagnosis. |
| Related sections |
| C-1-2. Electromagnetic Waves and Radiation; C-2-2. Chemical Equilibrium of Solutions and Volumetric Analysis Methods; C-7. Anatomy and Physiology;<br>D-1-2. Pathophysiological Changes; D-1-3. Drug Safety; D-2. Pharmacology and Pathology; F-1-1. Individual Optimization of Pharmacotherapy. |
| Learning objectives |
| 1) Describe the principles and characteristics of analytical techniques with electromagnetic waves, radiation, ultrasound, and visible light to obtain body images.<br>2) Describe the differences between normal and diseased images. |

| |
|---|
| 3) Describe pharmaceuticals in treatment and diagnosis. |
| Evaluation guidelines |
| 2, 3 |

**C-3. Organic Chemistry**

**C-3-1. Fundamental Properties of Substances**

| |
|---|
| Aim |
| Learn about fundamental organic chemistry. |
| Related sections |
| C-1. Physicochemical Properties of Chemical Substances; C-3. Organic Chemistry;<br>C-4. Medicinal Chemistry. |
| Learning objectives |
| 1) Describe the names of organic compounds, structural notations, and chemical structures.<br>2) Describe the fundamental properties and reactions of organic compounds. |
| Evaluation guidelines |
| 4, 5, 10 |

**C-3-2. Stereochemistry of Organic Compounds**

| |
|---|
| Aim |
| Learn about the fundamental stereochemistry of organic compounds. |
| Related sections |
| B-4. Regulation of Pharmaceuticals Products; C-2. Analytical Chemistry;<br>C-3. Organic Chemistry; C-4. Medicinal Chemistry; C-5. Pharmacognosy and Natural Product Chemistry; D-1. Drug Action Mechanisms and Biological Reactions. |
| Learning objectives |
| 1) Describe the three-dimensional structure of organic compounds.<br>2) Describe the characteristics and relationships between isomers.<br>3) Describe that isomers may have different physicochemical and chemical properties and biological activities (interactions with biomolecules). |
| Evaluation guidelines |

| |
|---|
| 4, 5, 10 |

**C-3-3. Fundamental Structure and Reactivity of Organic Compounds**

| Aim |
|---|
| Learn about the organic compounds of carbon skeletons, functional groups, structures, properties, and reactivities. |
| Related sections |
| B-4. Regulation of Pharmaceuticals Products; C-3. Organic Chemistry; C-4. Medicinal Chemistry; C-5. Pharmacognosy and Natural Product Chemistry; D-1. Drug Action Mechanisms and Biological Reactions. |
| Learning objectives |
| 1) Classify organic compounds by carbon skeleton and functional groups.<br>2) Describe physicochemical and chemical properties (including reactivities) based on chemical structures. |
| Evaluation guidelines |
| 5, 10 |

**C-3-4. Structural Analysis Based on Chemical Properties in Organic Compounds**

| Aim |
|---|
| Learn about methods for the structural analysis of organic compounds. |
| Related sections |
| B-4. Regulation of Pharmaceuticals Products; C-1. Physicochemical Properties of Chemical Substances; C-2. Analytical Chemistry; C-3. Organic Chemistry; C-4. Medicinal Chemistry; C-5. Pharmacognosy and Natural Product Chemistry. |
| Learning objectives |
| 1) Describe equipment-based analytical methods for the structural analysis of organic compounds.<br>2) Determine the structure of organic compounds from their analytical spectra. |
| Evaluation guidelines |
| 6, 10 |

### C-3-5. Inorganic Compounds and Complexes

| Aim |
| --- |
| Learn about the names, structures, and fundamental chemical properties of compounds. |
| Related sections |
| C-2. Analytical Chemistry; C-3. Organic Chemistry; C-4. Medicinal Chemistry; C-5. Pharmacognosy and Natural Product Chemistry; C-6. Biochemistry; C-7. Anatomy and Physiology; E-2. Nutrition and Food Safety to Maintain and Promote Health. |
| Learning objectives |
| 1) Describe inorganic compounds and metal complexes that function as biomolecules and pharmaceuticals. |
| Evaluation guidelines |
| 4, 8, 10 |

## C-4. Medicinal Chemistry

### C-4-1. Characteristics of Functional Groups in Drugs

| Aim |
| --- |
| Learn about the structures and properties of the functional groups in organic drugs. |
| Related sections |
| B-4. Regulation of Pharmaceuticals Products; C-1. Physicochemical Properties of Chemical Substances; C-3. Organic Chemistry; C-4. Medicinal Chemistry; C-5. Pharmacognosy and Natural Product Chemistry; C-6. Biochemistry; D-3. Drug Information Necessary for Decision-making in Healthcare; D-4. Pharmacokinetics; D-5. Drug Formulation Science; F-1. Pharmacotherapy. |
| Learning objectives |
| 1) Describe the physicochemical and chemical properties and intermolecular interactions from the structures of functional groups. |
| Evaluation guidelines |
| 4, 8, 10 |

**C-4-2. Biomolecules and their Functions**

| Aim |
| --- |
| Learn about the interactions that occur between biomolecules that are based on the properties, structure, and reactivity of each molecule. |
| Related sections |
| B-4. Regulation of Pharmaceuticals Products; C-1. Physicochemical Properties of Chemical Substances; C-2. Analytical Chemistry; C-3. Organic Chemistry; C-4. Medicinal Chemistry; C-5. Pharmacognosy and Natural Product Chemistry; C-6. Biochemistry; C-7. Anatomy and Physiology; D-1. Drug Action Mechanisms and Biological Reactions; D-3. Drug Information Necessary for Decision-making in Healthcare; D-4. Pharmacokinetics; E-2. Nutrition and Food Safety to Maintain and Promote Health. |
| Learning objectives |
| 1) Describe the functions of biomolecules based on their chemical structure.<br>2) Describe biological reactions that maintain biological functions in terms of organic chemistry and physiochemistry. |
| Evaluation guidelines |
| 1, 5, 7, 10 |

**C-4-3. Drug Components**

| Aim |
| --- |
| Learn about the characteristics of the substructural properties of drugs and their interactions with target molecules to establish a fundamental understanding of pharmacology, pharmacokinetics, and formulation science. |
| Related sections |
| C-1. Physicochemical Properties of Chemical Substances; C-3. Organic Chemistry; C-4. Medicinal Chemistry; C-5. Pharmacognosy and Natural Product Chemistry; D-2. Pharmacology and Pathology; D-3. Drug Information Necessary for Decision-making in Healthcare; D-4. Pharmacokinetics; D-5. Drug Formulation Science; E-1. Public health to maintain and promote health; F-1. Pharmacotherapy. |
| Learning objectives |
| 1) Describe how drugs interact with a target molecule.<br>2) Describe the physical and chemical basis for the pharmacokinetics, adverse effects, and toxicity of the drugs based on the characteristics of drugs |
| Evaluation guidelines |

| |
|---|
| 4, 7, 8, 10 |

**C-4-4. Classification of Drugs Based on Target Molecules**

| Aim |
|---|
| Classify drugs based on target molecules and learn the mechanism of action to understand the efficacy, adverse effect, and contraindications of drugs. |
| Related sections |
| C-1. Physicochemical Properties of Chemical Substances; C-3. Organic Chemistry; C-4. Medicinal Chemistry; C-5. Pharmacognosy and Natural Product Chemistry; C-6. Biochemistry; D-1. Drug Action Mechanisms and Biological Reactions; D-2. Pharmacology and Pathology; D-3. Drug Information Necessary for Decision-making in Healthcare; D-5. Drug Formulation Science. |
| Learning objectives |
| 1) Describe the interactions between drugs and target molecules based on chemical structures. |
| Evaluation guidelines |
| 7, 8, 10 |

**C-4-5. Drugs for Representative Diseases: Molecular Mechanism of Drug Action**

| Aim |
|---|
| Learn about interactions between drugs and target molecules. |
| Related sections |
| B-4. Regulation of Pharmaceuticals Products; C-1. Physicochemical Properties of Chemical Substances; C-3. Organic Chemistry; C-4. Medicinal Chemistry; C-5. Pharmacognosy and Natural Product Chemistry; C-6. Biochemistry; C-7. Anatomy and Physiology; D-2. Pharmacology and Pathology; D-3. Drug Information Necessary for Decision-making in Healthcare; E-1. Public health to maintain and promote health; F-3. Healthcare Management and Medical Safety Practice. |
| Learning objectives |
| 1) Describe the interactions between drugs and their target molecules. |
| Evaluation guidelines |
| 7, 8, 10 |

## C-5. Pharmacognosy and Natural Product Chemistry

### C-5-1. Fundamentals of Pharmacognosy and Natural Product Chemistry

| Aim |
| --- |
| Learn about the origins, characteristics, uses, and constituents of natural products in pharmaceutical sciences. |
| Related sections |
| B-4. Regulation of Pharmaceuticals Products; C-2. Analytical Chemistry; C-3. Organic Chemistry; C-5. Pharmacognosy and Natural Product Chemistry; C-6. Biochemistry; D-1. Drug Action Mechanisms and Biological Reactions; D-2. Pharmacology and Pathology; E-2. Nutrition and Food Safety to Maintain and Promote Health. |
| Learning objectives |
| 1) Describe the origins, characteristics, uses, constituents, identification, and quality evaluation methods of typical crude drugs and crude drug materials. |
| Evaluation guidelines |
| 6, 9, 10 |

### C-5-2. Drugs Derived from Natural Products

| Aim |
| --- |
| Learn about the properties and characteristics of drugs derived from natural products. |
| Related sections |
| B-4. Regulation of Pharmaceuticals Products; C-3. Organic Chemistry;<br>C-4. Medicinal Chemistry; C-5. Pharmacognosy and Natural Product Chemistry;<br>C-6. Biochemistry; C-7. Anatomy and Physiology; D-1. Drug Action Mechanisms and Biological Reactions; D-2. Pharmacology and Pathology; D-3. Drug Information Necessary for Decision-making in Healthcare; E-1. Public health to maintain and promote health;<br>E-2. Nutrition and Food Safety to Maintain and Promote Health. |
| Learning objectives |
| 1) Classify useful natural products based on their chemical structures and biosynthetic pathways.<br>2) Describe the uses of crude drug extracts and organic compounds derived from natural products as pharmaceutical resources. |
| Evaluation guidelines |
| 7, 8, 9, 10 |

## C-6. Biochemistry

### C-6-1. Cells: The Smallest Biological Units

| Aim |
| --- |
| Learn about organelles' components, structures, and functions to establish a fundamental understanding of the prevention and treatment of diseases. |
| Related sections |
| C-1-1. Chemical Bonding and Chemical-biopolymers Interactions; C-4-1. Characteristics of Functional Groups in Drugs; C-4-2. Biomolecules and their Functions; C-6-2. The Fundamentals of Genetics; C-6-3. Classification, Structure and Life Cycles of Microorganisms; C-6-6. Intracellular Signaling and Intercellular Communication; C-6-7. Cell Cycle and Cell Death; C-7. Anatomy and Physiology; D-2-18. Gene Therapy, Transplantation Medicine, and Recombinant Drugs; D-4-1. Absorption, Distribution, Metabolism, and Excretion; D-5-3. Drug Delivery System (DDS). |
| Learning objectives |
| 1) Describe the components, structures, and functions of cells. |
| Evaluation guidelines |
| 11, 12 |

### C-6-2. The Fundamentals of Genetics

| Aim |
| --- |
| Learn about ontogeny, differentiation, and the proliferation of organisms controlled by the expression and transmission of genetic information in order to establish a fundamental understanding of the prevention and treatment of diseases. |
| Related sections |
| C-6-1. Cells: The Smallest Biological Units; C-6-3. Classification, Structure and Life Cycles of Microorganisms; C-7-14. Reproductive System; C-7-15. Ontogeny; D-2-18 Gene Therapy, Transplantation Medicine, and Recombinant Drugs; D-4-1. Absorption, Distribution, Metabolism, and Excretion; D-5-3. Drug Delivery System (DDS). |
| Learning objectives |
| 1) Describe that the ontogeny, differentiation, and proliferation of organisms are controlled by the expression and transmission of genetic information. |
| Evaluation guidelines |
| 11, 12 |

**C-6-3. Classification, Structure, and Life Cycles of Microorganisms**

| Aim |
| --- |
| Learn about the structures, proliferation mechanisms, energy metabolism, and gene transmission of bacteria, and the commonalities and peculiarities between viruses and fungi in order to establish a fundamental understanding of the prevention and treatment of infectious diseases. |
| Related sections |
| C-6-1. Cells: The Smallest Biological Units; C-6-2. The Fundamentals of Genetics; C-7-9. Lymphatic and Immune Systems; D-2-15. Drugs for Infectious Diseases; F-3-4. Infection Control in Healthcare Settings. |
| Learning objectives. |
| 1) Describe the different cellular structures of gram-positive and negative bacteria.<br>2) Describe the mechanisms of division and proliferation in bacteria.<br>3) Describe the mechanisms of rapid evolution in bacteria.<br>4) Describe the pathogens (viruses, bacteria, and fungi) of infections. |
| Evaluation guidelines |
| 11, 12 |

**C-6-4. Proteins Responsible for Biological Functions**

| Aim |
| --- |
| Learn about the components and structures of proteins, and the dysfunctions caused by protein structural abnormalities resulting in the disruption of cellular homeostasis. |
| Related sections |
| C-1-1. Chemical Bonding and Chemical-biopolymers Interactions; C-1-4. Reaction Kinetics; C-2-7. Biomedical Analysis; C-4-1. Characteristics of Functional Groups in Drugs; C-4-2. Biomolecules and their Functions; C-4-4. Classification of Drugs Based on Target Molecules; C-7-8. Circulatory System; C-7-10. Digestive System; D-1-1. Drug action Mechanisms; D-1-2. Pathophysiological Changes; D-4-1. Absorption, Distribution, Metabolism, and Excretion; D-5-3. Drug Delivery System (DDS); E-2. Nutrition and Food Safety to Maintain and Promote Health. |
| Learning objectives |
| 1) Describe the function of proteins.<br>2) Describe the enzymes for biochemical reactions.<br>3) Describe protein quality management. |
| Evaluation guidelines |

| |
|---|
| 11, 12 |

**C-6-5. Bioenergy and Metabolism**

| Aim |
|---|
| Learn about energy metabolism. |
| Related sections |
| C-1. Physicochemical Properties of Chemical Substances; C-4-2. Biomolecules and their Functions; C-4-5. Pharmaceuticals of Major Diseases and Mechanisms;<br>C-5-1. Fundamentals of Pharmacognosy and Natural Product Chemistry; C-7-3. Endocrine System; C-7-10. Digestive System; E-2-1. Food Functions and Nutrition in Prevention and Care of Disease; D-1-1. Drug action Mechanisms; D-1-2. Pathophysiological Changes. |
| Learning objectives |
| 1) Describe biochemical reactions (metabolic reactions).<br>2) Describe energy metabolism by biochemical reactions. |
| Evaluation guidelines |
| 11, 12 |

**C-6-6. Intra-cellular Signaling and Inter-cellular Communication**

| Aim |
|---|
| Learn about the mechanisms of intra-cellular, inter-cellular, and inter-tissue signal transmission in order to establish a fundamental understanding of the prevention and treatment of diseases. |
| Related sections |
| C-4-2. Biomolecules and their Functions; C-4-4. Classification of Drugs Based on Target Molecules; C-6-1. Cells: The Smallest Biological Units; C-7-2. Nervous System;<br>C-7-3. Endocrine System; C-7-5. Sensory System; C-7-7. Muscular System;<br>C-7-14. Reproductive System; D-1-1. Drug action Mechanisms. |
| Learning objectives |
| 1) Describe the mechanisms of intra-cellular signaling.<br>2) Describe the mechanisms of inter-cellular and inter-tissue signaling. |
| Evaluation guidelines |
| 11, 12 |

### C-6-7. Cell Cycle and Cell Death

| Aim |
| --- |
| Learn about the mechanisms of cell differentiation, proliferation, and cell death in order to establish a fundamental understanding of the prevention and treatment of diseases. |
| Related sections |
| C-6-1. Cells: The Smallest Biological Units; C-4-5. Pharmaceuticals of Major Diseases and Mechanisms; D-2-16. Malignant tumors (cancer) and drugs for their treatment. |
| Learning objectives |
| 1) Describe the cell and cell death that form tissues and organs. |
| Evaluation guidelines |
| 11, 12 |

## C-7. Anatomy and Physiology

### C-7-1. Organ Systems Overview

| Aim |
| --- |
| Learn about the composition and functions of the human body in order to establish a fundamental understanding of the mechanisms, prevention, and treatment of diseases. |
| Related sections |
| C-2-8. Analytical Techniques and Medical Devices; C-3-5. Inorganic Compounds and Complexes; C-4-2. Biomolecules and their Functions; C-4-5. Pharmaceuticals of Major Diseases and Mechanisms; C-5-2. Drugs Derived from Natural Products;<br>C-6. Biochemistry, the composition of the human body; D-1. Drug Action Mechanisms and Biological Reactions; D-2. Pharmacology and Pathology; D-4. Pharmacokinetics;<br>D-5-3. Drug Delivery Systems (DDS). |
| Learning objectives |
| 1) Describe the fundamentals of human anatomy.<br>2) Describe mutual cooperation of the organs in the human body. |
| Evaluation guidelines |
| 13, 14, 15 |

**C-7-2. Nervous System**

| Aim |
| --- |
| Learn about the structures and functions of the cells and organs in the nervous system and it's regulation in order to establish a fundamental understanding of the pathophysiology related to the system. |
| Related sections |
| C-4-2. Biomolecules and their Functions; C-6-1. Cells: The Smallest Biological Units; C-6-6. Intracellular Signaling and Intercellular Communication; D-2-1. Drugs for the Autonomic Nervous System; D-2-2. Analgesics; D-2-3. Anesthetics; D-2-4 Drugs for Neuromuscular Diseases; D-2-6. Drugs for Metabolic, Endocrine, Bone Disorders and Electrolyte Imbalance; D-2-8. Drugs for Cardiovascular Diseases. |
| Learning objectives |
| 1) Describe the structures and functions of the cells and organs in the nervous system.<br>2) Describe the regulation by the nervous system. |
| Evaluation guidelines |
| 13, 14, 15 |

**C-7-3. Endocrine System**

| Aim |
| --- |
| Learn about the structures and functions of the organs in the endocrine system, and about the regulation by hormones in order to establish a fundamental understanding of the pathophysiology related to the system. |
| Related sections |
| C-4-2. Biomolecules and their Functions; C-6-1. Cells: The Smallest Biological Units; C-6-5. Bioenergy and Metabolism; C-6-6. Intracellular Signaling and Intercellular Communication; D-2-6. Drugs for Metabolic, Endocrine, Bone Disorders and Electrolyte Imbalance; E-2. Nutrition and Food Safety to Maintain and Promote Health. |
| Learning objectives |
| 1) Describe the structures and functions of the endocrine organs and the hormones produced by them.<br>2) Describe the regulatory by the endocrine system. |
| Evaluation guidelines |
| 13, 14, 15 |

**C-7-4. Integumentary System**

| Aim |
| --- |
| Learn about the structures and functions of the skin in order to establish a fundamental understanding of the pathophysiology related to the system. |
| Related sections |
| C-6-1. Cells: The Smallest Biological Unit; D-2-2. Analgesics; D-2-7. Drugs for the Skin and Sensory System Diseases. |
| Learning objectives |
| 1) Describe the structures and functions of the skin. |
| Evaluation guidelines |
| 13, 14, 15 |

**C-7-5. Sensory System**

| Aim |
| --- |
| Learn about the structure and function of the organs in the sensory system (vision, hearing, equilibrium, smell, and taste) in order to establish a fundamental understanding of the pathophysiology related to the system. |
| Related sections |
| C-6-1. Cells: The Smallest Biological Units; C-6-6. Intracellular Signaling, and Intercellular Communication; D-2-7. Drugs for the Skin and Sensory System Diseases. |
| Learning objectives |
| 1) Describe the structures and functions of the organs in the sensory system.<br>2) Describe the functional areas in the cerebral cortex of the types of senses (vision, hearing, equilibrium, smell, and taste) and their main conduction pathways. |
| Evaluation guidelines |
| 13, 14, 15 |

**C-7-6. Skeletal System**

| Aim |
| --- |
| Learn about the structures and functions of the organs in the skeletal system in order to establish a fundamental understanding of the pathophysiology related to the system. |
| Related sections |
| C-6-1. Cells: The Smallest Biological Units; D-2-6. Drugs for Metabolic, Endocrine, Bone Disorders, and Electrolyte Imbalance; E-2-1. Food Functions and Nutrition in Prevention and Care of Disease. |
| Learning objectives |
| 1) Describe the structures and functions of the organs in the skeletal system. |
| Evaluation guidelines |
| 13, 14, 15 |

**C-7-7. Muscular System**

| Aim |
| --- |
| Learn about the structures and functions of the muscular system in order to establish a fundamental understanding of the pathophysiology related to the system. |
| Related sections |
| C-6-1. Cells: The Smallest Biological Units; C-6-5. Bioenergy and Metabolism; C-6-6. Intracellular Signaling and Intercellular Communication; D-2-1. Drugs for the Autonomic Nervous System; D-2-4. Drugs for Neuromuscular Diseases; E-2-1. Food Functions and Nutrition in Prevention and Care of Disease. |
| Learning objectives |
| 1) Describe the structures and functions of the muscular system. |
| Evaluation guidelines |
| 13, 14, 15 |

**C-7-8. Circulatory System**

| Aim |
| --- |
| Learn about the structures and functions of the organs in the circulatory system, the compositions, and functions of the blood in order to establish a fundamental understanding of the pathophysiology related to the system. |
| Related sections |
| C-2-2. Chemical Equilibrium of Solutions and Volumetric Analysis Methods; C-6-1. Cells: The Smallest Biological Units; C-6-4. Proteins Responsible for Biological Functions; C-7-13. Body Fluids; D-2-8. Drugs for Cardiovascular Diseases; D-2-9. Drugs for Hematological Diseases; D-4-1. Absorption, Distribution, Metabolism, and Excretion; E-2-1. Food Functions and Nutrition in Prevention and Care of Disease. |
| Learning objectives |
| 1) Describe the structures and functions of the organs in the circulatory system.<br>2) Describe the circulation of body fluids.<br>3) Describe the composition and functions of the blood. |
| Evaluation guidelines |
| 13, 14, 15 |

**C-7-9. Lymphatic and Immune Systems**

| Aim |
| --- |
| Learn about the structures and functions of the organs in the lymphatic system and the immune response by immunocompetent cells in order to establish a fundamental understanding of the pathophysiology related to the systems. |
| Related sections |
| C-6-1. Cells: The Smallest Biological Units; C-6-3. Classification, Structure, and Life Cycles of Microorganisms; C-7-13. Body Fluids; D-2-8. Drugs for Cardiovascular Diseases, D-2-9. Drugs for Hematological Diseases; D-2-10. Drugs for Diseases of the Immune System and Allergies; D-2-15. Drugs for Infectious Diseases; D-4-1. Absorption, Distribution, Metabolism, and Excretion; E-1. Public health to maintain and promote health; F-3-4. Infection Control in Healthcare Settings. |
| Learning objectives |
| 1) Describe the structures and functions of the organs in the lymphatic system.<br>2) Describe the immune response by immunocompetent cells. |
| Evaluation guidelines |

| |
|---|
| 13, 14, 15 |

**C-7-10. Digestive System**

| Aim |
|---|
| Learn about the structures and functions of the organs in the digestive system in order to establish a fundamental understanding of the pathophysiology related to the system. |
| Related sections |
| C-6-1. Cells: The Smallest Biological Units; C-6-4. Proteins Responsible for Biological Functions; C-6-5. Bioenergy and Metabolism; D-2-11. Drugs for Digestive Diseases; D-4-1. Absorption, Distribution, Metabolism, and Excretion; E-2. Nutrition and Food Safety to Maintain and Promote Health. |
| Learning objectives |
| 1) Describe the structures and functions of the organs in the digestive system. |
| Evaluation guidelines |
| 13, 14, 15 |

**C-7-11. Respiratory System**

| Aim |
|---|
| Learn about the structures and functions of the organs in the respiratory system and their involvement in the body fluid homeostasis in order to establish a fundamental understanding of the pathophysiology related to the system. |
| Related sections |
| C-2-2. Chemical Equilibrium of Solutions and Volumetric Analysis Methods; C-6-1. Cells: The Smallest Biological Units; C-7-13. Body Fluids; D-2-12. Drugs for Respiratory Diseases; D-4-1. Absorption, Distribution, Metabolism, and Excretion; E-2-1. Food Functions and Nutrition in Prevention and Care of Disease. |
| Learning objectives |
| 1) Describe the structures and functions of the organs in the respiratory system.<br>2) Describe the involvement of the respiratory system in the body fluid homeostasis. |
| Evaluation guidelines |
| 13, 14, 15 |

**C-7-12. Urinary System**

| Aim |
| --- |
| Learn about the structures and functions of the organs in the urinary system and the involvement of the urinary system in body fluid homeostasis in order to establish a fundamental understanding of the pathophysiology related to the system. |
| Related sections |
| C-2-2. Chemical Equilibrium of Solutions and Volumetric Analysis Methods; C-6-1. Cells: The Smallest Biological Units; C-7-13. Body Fluids; D-2-13. Drugs for Urologic Diseases; D-4-1. Absorption, Distribution, Metabolism, and Excretion; E-2-1. Food Functions and Nutrition in Prevention and Care of Disease. |
| Learning objectives. |
| 1) Describe the structures and functions of the organs in the urinary system.<br>2) Describe the involvement of the urinary system in body fluid homeostasis. |
| Evaluation guidelines |
| 13, 14, 15 |

**C-7-13. Body Fluids**

| Aim |
| --- |
| Learn about the composition of body fluids and homeostatic mechanisms in order to establish a fundamental understanding of pathophysiology. |
| Related sections |
| C-2-2. Chemical Equilibrium of Solutions and Volumetric Analysis Methods; C-6-1. Cells: The Smallest Biological Units; C-7-13. Body Fluids; D-2-13. Drugs for Urologic Diseases; E-2-1. Food Functions and Nutrition in Prevention and Care of Disease. |
| Learning objectives |
| 1) Describe the composition of body fluids and their homeostatic mechanisms. |
| Evaluation guidelines |
| 13, 14, 15 |

**C-7-14. Reproductive System**

| Aim |
| --- |
| Learn about the structures and functions of the organs in the reproductive system in order to establish a fundamental understanding of the pathophysiology related to the system. |
| Related sections |
| C-4-2. Biomolecules and their Functions; C-6-1. Cells: The Smallest Biological Units; C-6-2. The Fundamentals of Genetics; C-6-6. Intracellular Signaling and Intercellular Communication; D-2-14. The Reproductive System, Reproductive Health, and Drug Therapies. |
| Learning objectives |
| 1) Describe the structures and functions of the organs in the reproductive system. |
| Evaluation guidelines |
| 13, 14, 15 |

**C-7-15. Ontogeny**

| Aim |
| --- |
| Learn about the processes of the formation and growth of organs about hormones related to ontogeny in order to establish a fundamental understanding of the pathophysiology related to the system. |
| Related sections |
| C-4-2. Biomolecules and their Functions; C-6-1. Cells: The Smallest Biological Units; C-6-2. The Fundamentals of Genetics; D-1. Drug Action Mechanisms and Biological Reactions; D-2. Pharmacology and Pathology; D-4. Pharmacokinetics; F-3. Healthcare Management and Patient Safety. |
| Learning objectives |
| 1) Describe the processes of the formation and growth of organs.<br>2) Describe the structures of the organs and the related hormones to ontogeny. |
| Evaluation guidelines |
| 13, 14 |

## D. Pharmacotherapeutics[1]

**<Major learning objectives >**

In order to foster A. Basic Qualities, Abilities, and Competencies Required as Pharmacists in the Model Core Curriculum for Pharmacy Education throughout Life, primary section D aims to consider the responsibilities of pharmacists studied in B. Social Pharmacy, and to link the learning outcomes of C. Fundamentals of the Pharmaceutical Sciences, such as the structure and properties of drugs and the functions and homeostasis of living organisms The major objective of this section is to link the learning outcomes of E. Pharmaceutical Health Science to disease prevention and public health, and F. Clinical Pharmacy to the practice of responsible drug therapy for individual patients.

In Clinical Pharmacy, a drug therapy needs to be selected, implemented, and evaluated with due consideration given to the individual circumstances of each patient in order to optimize drug therapy on an individual basis. For this reason, this major subject is based on a systematic understanding of the pathophysiology of disease and the mechanisms of drug actions as the basis for responsible drug treatment, standardized treatment policies based on guidelines, appropriate evaluation of drug efficacy and safety based on drug information, pharmacokinetics and pharmacodynamics in order to provide evidence-based medicine, and the understanding of the theory of pharmacokinetics. The course provides students with an understanding of the theory of pharmacokinetics, the selection of appropriate dosages and formulations and the basics of prescription dispensing, and the academic skills that can be used to provide pharmacotherapy to individual patients in F. Clinical Pharmacy.

In addition, students learn the basics of implementing prevention and hygiene in the community, which is another important mission of pharmacists required in E Pharmaceutical Health Science.

**D. Pharmacotherapeutics Consists of the Following Six Secondary Sections:**

**D-1. Drug Action Mechanisms and Biological Reactions**
**D-2. Pharmacology and Pathology**
**D-3. Drug Information Necessary for Decision-making in Healthcare**
**D-4. Pharmacokinetics**
**D-5. Drug Formulation Science**
**D-6. Dispensing as the Basis for Individual Optimization**

**< Connection with A. Basic Qualities and Competencies Required of Pharmacists >**

All the secondary sections of this major subject D are important and form the basis of practical competence in pharmacotherapy, as well as learning that leads to *[Research], [Problem-solving]* and *[Information Technology]* in order to further develop science based medicine and foster a scientific perspective in pharmacists. Through the study of this major, students will acquire *［Professionalism］* and *［Lifelong Learning］*.

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[1]See p.11 for 'Structure of the Model Core Curriculum for Pharmaceutical Education (Method of presentation and points to note for use, etc.)'.

**<Guidelines for Evaluation>**
The following five items are used as guidelines for assessing achievement of the learning objectives in D. Pharmacotherapeutics:
1) Show an understanding of the pharmacological actions and mechanisms of drug actions in relation to pathological conditions and their pathogenic mechanisms, main and adverse reactions (side effects), and interactions.
2) Show an understanding of the pathologies that occur in each organ and their impact on the whole body from both anatomical and physiological perspectives.
3) Be able to collect and evaluate appropriate information on medicinal products and diseases and compare it with patient information as a basis for promoting appropriate use.
4) Show an understanding of the *in vivo* fate of medicinal products and patient characteristics in order to utilize the dosage forms and characteristics of medicinal products and implement optimal drug treatment.
5) Show an understanding of the dosage forms and characteristics of medicinal products and prepare them appropriately.

## D-1. Drug Action Mechanisms and Biological Reactions

### D-1-1. Drug Action Mechanisms

| Aim |
| --- |
| Based on the related sections C-4 and C-7, show an understanding of the mechanisms of drug actions in terms of their properties as chemical substances. |
| **Related sections** |
| C-4. Medicinal Chemistry; C-7. Anatomy and Physiology; D-2. Pharmacology and pathology; E-3. Management of Chemical Substances and Environmental Health; F-1. Pharmacotherapy. |
| **Learning objectives** |
| 1) Explain the structures and functions of the nervous system in relation to the homeostasis of the organism.<br>2) Explain drug action mechanisms based on the characteristics of their chemical structures and their relationship to the target body systems and molecules.<br>3) Understand the necessity of and give ethical consideration when conducting animal experiments (including alternative methods). |
| **Evaluation guidelines** |
| 1, 2 |

**D-1-2. Pathophysiological Changes**

| Aim |
| --- |
| Based on the related sections C-2 and C-7, show an understanding of clinically important physical changes and clinical laboratory values through their symptoms and the mechanisms of abnormal values resulting from the body's responses. |
| Related sections |
| C-7. Anatomy and Physiology; C-2. Analytical Chemistry; E-1. Public Health to Maintain and Promote Health; E-2. Nutrition and Food Safety to Maintain and Promote Health; E-3. Management of Chemical Substances and Environmental Health; F-1. Pharmacotherapy. |
| Learning objectives |
| 1) Explain the mechanisms of symptom onset in relation to the body's normal reactions and pathological changes.<br>2) Link the mechanisms of abnormal laboratory values to the body's normal responses and pathological changes and explain their clinical significance and relate them to the mechanisms of laboratory measurements. |
| Evaluation guidelines |
| 1, 2 |

**D-1-3. Drug Safety**

| Aim |
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| Based on the related sections B-1, C-7, and C-4, understand the mechanisms of adverse reactions, interactions, and the onset of drug poisoning from the mechanisms of drug reaction and physical reactions. In addition, the causes, problems, and issues of drug harm, drug abuse, and polypharmacy will be understood for their impact on society. |
| Related sections |
| B-1. Responsibilities of Pharmacists; C-7. Structure and Function of the Human Body and its Regulation; C-4. Medicinal Chemistry in Pharmacy; E-1. Public Health to Maintain and Promote Health; E-3. Management of Chemical Substances and Environmental Health; F-1. Pharmacotherapy. |
| Learning objectives |
| 1) Explain the possible adverse reactions, interactions, and drug poisoning based on the mechanisms of drug reactions, relating them to symptoms and abnormal laboratory values.<br>2) Analyze the causes of drug-induced suffering from multiple perspectives and explain preventive measures.<br>3) Understand the concept of proper drug use, analyze the causes of drug addiction, drug |

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| dependence, and drug abuse from multiple perspectives in terms of the mechanisms of action and formulate preventive measures.<br>4) Analyze the causes of polypharmacy comprehensively from pharmacy management perspectives and develop remedial and preventive measures. |
| Evaluation guidelines |
| 1, 4, 5 |

**D-2. Pharmacology and Pathology**

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| Aim |
| Based on the related sections C-4, C-6, and C-7, understand pharmacology and the pathogenic mechanisms and pathology of disease as well as the concept of disease leading to learning in other areas related to disease prevention, public health, and clinical pharmacy. |

**D-2-1. Drugs for the Autonomic Nervous System**

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| Learning objectives |
| 1) Explain the pathogenesis of pathologies caused by abnormalities in the autonomic nervous system.<br>2) Explain the action mechanisms of drugs for the autonomic nervous system.<br>3) Explain the adverse reactions of drugs for the autonomic nervous system.<br>4) Identify the similarities and differences between drugs and explain the rationale for their application to a disease. |
| Evaluation guidelines |
| 1, 2 |

**D-2-2. Analgesics**

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| Learning objectives |
| 1) Explain the onset and worsening of pain.<br>2) Explain the action mechanisms of analgesics.<br>3) Explain the adverse reactions of analgesics.<br>4) Identify the similarities and differences between analgesics and explain the rationale for their application to the relief of pain. |
| Evaluation guidelines |
| 1, 2 |

**D-2-3. Anesthetics**

| Learning objectives |
| --- |
| 1) Explain the action mechanisms of anesthetics.<br>2) Explain the adverse reactions of anesthetics.<br>3) Identify the similarities and differences between drugs and explain the rationale for their application to a disease. |
| Evaluation guidelines |
| 1, 2 |

**D-2-4. Drugs for Neuromuscular Diseases**

| Learning objectives |
| --- |
| 1) Explain the pathogenesis of neuromuscular diseases.<br>2) Explain the action mechanisms of drugs for neuromuscular diseases.<br>3) Explain the adverse reactions of drugs for neuromuscular diseases.<br>4) Identify the similarities and differences between drugs and explain the rationale for their application to a disease. |
| Evaluation guidelines |
| 1, 2 |

**D-2-5. Drugs for the Central Nervous System and Cerebrovascular Diseases**

| Learning objectives |
| --- |
| 1) Explain the pathogenesis of the central nervous system and cerebrovascular diseases.<br>2) Explain the action mechanisms of drugs for the central nervous system and cerebrovascular diseases.<br>3) Explain the adverse reactions of drugs for the central nervous system and cerebrovascular diseases.<br>4) Identify the similarities and differences between drugs and explain the rationale for their application to disease. |
| Evaluation guidelines |
| 1, 2 |

**2-6. Drugs for Metabolic, Endocrine, Bone Disorders, and Electrolyte Imbalance**

| Learning objectives |
| --- |
| 1) Explain the pathogenesis of metabolic, endocrine, bone diseases, and electrolyte imbalance.<br>2) Explain the action mechanisms of drugs for metabolic, endocrine, bone diseases, and electrolyte imbalance.<br>3) Explain the adverse reactions of drugs for metabolic, endocrine, bone diseases, and electrolyte imbalance.<br>4) Identify the similarities and differences between drugs and explain the rationale for their application to a disease. |
| Evaluation guidelines |
| 1, 2 |

**D-2-7. Drugs for Skin and Sensory System Diseases**

| Learning objectives |
| --- |
| 1) Explain the pathogenesis of skin and sensory organ diseases as abnormal responses.<br>2) Explain the action mechanisms of drugs for skin and sensory system diseases.<br>3) Explain the adverse reactions of drugs for skin and sensory system diseases.<br>4) Identify the similarities and differences between drugs and explain the rationale for their application to a disease. |
| Evaluation guidelines |
| 1, 2 |

**D-2-8. Drugs for Cardiovascular Diseases**

| Learning objectives |
| --- |
| 1) Explain the pathogenesis of cardiovascular diseases.<br>2) Explain the action mechanisms of drugs for cardiovascular diseases.<br>3) Explain the adverse reactions of drugs for cardiovascular diseases.<br>4) Identify the similarities and differences between drugs and explain the rationale for their application to a disease. |
| Evaluation guidelines |
| 1, 2 |

**D-2-9. Drugs for Hematological Diseases**

| Learning objectives |
| --- |
| 1) Explain the pathogenesis of hematological diseases.<br>2) Explain the action mechanisms of drugs for hematological diseases.<br>3) Explain the adverse reactions of drugs for hematological diseases.<br>4) Identify the similarities and differences between drugs and explain the rationale for their application to a disease. |
| Evaluation guidelines |
| 1, 2 |

**D-2-10. Drugs for Diseases of the Immune System and Allergies**

| Learning objectives |
| --- |
| 1) Explain the pathogenesis of diseases of the immune system and allergies.<br>2) Explain the action mechanisms of drugs for diseases of the immune system and allergies.<br>3) Explain the adverse reactions of drugs for diseases of the immune system and allergies.<br>4) Identify the similarities and differences between drugs and explain the rationale for their application to a disease. |
| Evaluation guidelines |
| 1, 2 |

**D-2-11. Drugs for Digestive Diseases**

| Learning objectives |
| --- |
| 1) Explain the pathogenesis of digestive diseases.<br>2) Explain the action mechanisms of drugs for digestive diseases.<br>3) Explain the adverse reactions of drugs for digestive diseases.<br>4) Identify the similarities and differences between drugs and explain the rationale for their application to a disease. |
| Evaluation guidelines |
| 1, 2 |

**D-2-12. Drugs for Respiratory Diseases**

| Learning objectives |
| --- |
| 1) Explain the pathogenesis of respiratory diseases.<br>2) Explain the action mechanisms of drugs for respiratory diseases.<br>3) Explain the adverse reactions of drugs for respiratory diseases.<br>4) Identify the similarities and differences between drugs and explain the rationale for their application to a disease. |
| Evaluation guidelines |
| 1, 2 |

**D-2-13. Drugs for Urologic Diseases**

| Learning objectives |
| --- |
| 1) Explain the pathogenesis of urologic diseases.<br>2) Explain the action mechanisms of drugs for urologic diseases.<br>3) Explain adverse reactions of drugs for urologic diseases.<br>4) Identify the similarities and differences between drugs and explain the rationale for their application to a disease. |
| Evaluation guidelines |
| 1, 2 |

**D-2-14. The Reproductive System, Reproductive Health, and Drug Therapies**

| Learning objectives |
| --- |
| 1) Explain the pathogenesis of reproductive system diseases.<br>2) Explain the action mechanisms of drugs for reproductive system diseases.<br>3) Explain the adverse reactions of drugs for reproductive system diseases.<br>4) Identify the similarities and differences between drugs and explain the rationale for their application to a disease.<br>5) Explain the pathogenesis of abnormal pregnancy and delivery.<br>6) Explain oral contraceptives and reproductive health. |
| Evaluation guidelines |
| 1, 2 |

**D-2-15. Drugs for Infectious Diseases**

| Learning objectives |
| --- |
| 1) Explain pathogens, routes of transmission, and the pathogenesis of infectious diseases.<br>2) Explain the action mechanisms of drugs for infectious diseases.<br>3) Explain the mechanisms of anti-microbial resistance.<br>4) Explain the adverse reactions of drugs for infectious diseases.<br>5) Identify the similarities and differences between drugs and explain the rationale for their application to a disease. |
| Evaluation guidelines |
| 1, 2 |

**D-2-16. Anti-cancer Drugs**

| Learning objectives |
| --- |
| 1) Explain the pathogenesis of malignant tumors.<br>2) Explain the action mechanisms of anti-cancer drugs.<br>3) Explain the mechanisms of anti-cancer drug resistance.<br>4) Explain the adverse reactions of anti-cancer drugs.<br>5) Identify the similarities and differences between drugs and explain the rationale for their application to a disease. |
| Evaluation guidelines |
| 1, 2 |

**D-2-17. Drugs for Palliative Care**

| Learning objectives |
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| 1) Explain the mechanisms of cancer pain and end-stage cancer.<br>2) Explain the mechanisms of chronic pain (non-cancer) and neuropathic pain.<br>3) Explain the action mechanisms of drugs for palliative care.<br>4) Explain the treatment of adverse reactions of drugs for palliative care.<br>5) Identify the similarities and differences between drugs and explain the rationale for their application to a disease. |
| Evaluation guidelines |
| 1, 2 |

**D-2-18. Gene Therapy, Transplantation Medicine, and Recombinant Drugs**

| Learning objectives |
| --- |
| 1) Explain gene therapy and transplantation medicine.<br>2) Explain the ethics and norms to be considered in gene therapy and transplantation medicine.<br>3) Explain the characteristics, action mechanisms, and adverse reactions of recombinant drugs. |
| Evaluation guidelines |
| 1, 2, 3, 4 |

**D-2-19. Kampo**

| Learning objectives |
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| 1) Explain the concept of Kampo, the concept of disease in Kampo, and the differences from Western medicine.<br>2) Explain the indications, adverse reactions, and precautions for use of Kampo. |
| Evaluation guidelines |
| 1, 2, 3, 4, 5 |

**D-2-20. Self-medication**

| Learning objectives |
| --- |
| 1) Explain the rationale for recommending medical attention or self-medication.<br>2) Explain the importance of understanding the patient's living situation for self-medication.<br>3) Explain interactions between medicine and food. |
| Evaluation guidelines |
| 1, 2, 3, 4 |

## D-3. Drug Information Necessary for Decision-making in Healthcare

### D-3-1. Drug Development Stages and Relevant Information

| Aim |
| --- |
| Based on the related section B-4, understand the significance of handling drug information in healthcare settings as well as the types and characteristics of information generated during each stage. |
| Related sections |
| B-4. Regulation of Pharmaceuticals and Other Products; F-1. Pharmacotherapy;<br>F-3. Healthcare Management and Patient Safety; F-4. Contribution to Community Healthcare and Public Health. |
| Learning objective |
| 1) List the types of information in the drug development stages and explain their relationship in regards to regulations and the drug development process. |
| Evaluation guideline |
| 3 |

### D-3-2. Sources and Collection of Drug Information

| Aim |
| --- |
| Based on the related section B-5, collect and utilize drug information appropriately. |
| Related sections |
| B-4. Regulation of Pharmaceuticals Products; B-5. Information Technology,<br>F-1. Pharmacotherapy; F-3. Healthcare Management and Patient Safety; F-4. Contribution to Community Healthcare and Public Health. |
| Learning objectives |
| 1) List the sources of drug information and explain their characteristics and their evaluation.<br>2) Understand the package insert as an official document (prescription, over-the-counter and behind-the-counter drugs) and interpret and explain the contents appropriately.<br>3) Understand the significance of the Interview Form, drug information for healthcare professionals, and utilize it appropriately.<br>4) Understand the process of making drug treatment guidelines and their scope of application, and utilize them appropriately.<br>5) Explain characteristics of the information issued by the Ministry of Health, Labor, and Welfare, the Pharmaceuticals and Medical Devices Agency, and pharmaceutical companies.<br>6) Appropriately utilize information on the Internet relating to healthcare.<br>7) Understand and appropriately utilize medical and pharmaceutical literature databases. |

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| 8) Search for and collect relevant information from reliable sources fit for the purpose [e.g. efficacy, effectiveness, safety (side effects), interactions, administration to pregnant women, poisoning, etc.]. |
| Evaluation guideline |
| 3 |

**D-3-3. Analysis and Evaluation of Drug Information**

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| Aim |
| Based on the related sections B-1 and B-5, analyze and evaluate collected drug information. |
| Related sections |
| B-1. Responsibilities of pharmacists; B-5. Information Technology; E-1. Public health to maintain and promote health; F-1. Pharmacotherapy; F-3. Healthcare Management and Patient Safety; F-4. Contribution to Community Healthcare and Public Health. |
| Learning objectives |
| 1) Analyze and evaluate relevant information from reliable sources fit for the purpose, taking into account quality, reliability, and validity.<br>2) Explain study designs in relation to the quality of evidence<br>3) Explain the concept of evidence-based medicine (EBM) and apply it into clinical practice.<br>4) Critically appraise clinical research papers according to their study design and appropriately interpret the results.<br>5) Appropriately analyze and evaluate the efficacy of pharmaceuticals using the information collected.<br>6) Appropriately analyze and evaluate the safety of pharmaceuticals using the information collected.<br>7) Appropriately analyze and evaluate the efficacy and safety of foods for special purposes and health foods. |
| Evaluation guideline |
| 3 |

**D-3-4. Application and Management of Drug Information**

| Aim |
| --- |
| Based on the related sections B-1 and B-5, acquire the necessary skills not only to utilize the information collected and evaluated, but also to generate new evidence if information is not available. |
| Related sections |
| E-1. Public Health to Maintain and Promote Health, F-1. Pharmacotherapy; F-3. Healthcare Management and Patient Safety; F-4. Contribution to Community Healthcare and Public Health. |
| Learning objectives |
| 1) Apply the drug information collected and evaluated, taking into consideration the intended audience for its use.<br>2) Appropriately evaluate and compare the materials and evidence collected.<br>3) Outline a research plan with consideration of appropriate information resources and study design in order to formulate missing information and to solve problems. |
| Evaluation guideline |
| 3 |

**D-3-5. Patient Information**

| Aim |
| --- |
| Based on the related section B-1, understand the information generated by patients, the media and means by which this information is exchanged, and evaluate the patient information necessary to provide optimal pharmacotherapy. |
| Related sections |
| B-1. Responsibilities of Pharmacists; B-5. Information Technology; F-1. Pharmacotherapy; F-3. Healthcare Management and Patient Safety; F-4. Contribution to Community Healthcare and Public Health. |
| Learning objectives |
| 1) Explain basic patient information from various sources and media.<br>2) Understand problem-oriented systems (POS), e.g. the SOAP format to identify problems, assess, and record plans based on patient information.<br>3) Identify the patient information necessary for personalized medicine in pharmacotherapy and explain the necessary precautions to the patients.<br>4) Explain the importance of managing patient information, considering patient confidentiality.<br>5) Explain the digitization of patient information in healthcare and how it is handled. |
| Evaluation guideline |
| 3 |

## D-4. Pharmacokinetics

### D-4-1. Absorption, Distribution, Metabolism, and Excretion

| Aim |
| --- |
| Based on the related sections C-6 and C-7, understand the concept of pharmacokinetics (absorption, distribution, metabolism and excretion), and how factors such as the patient's age and organ function affect pharmacokinetics. Acquire the basic principles necessary information required to plan, implement, and evaluate optimal pharmacotherapy, for individual patients. |
| Related sections |
| C-1-1. Chemical Bonding and Chemical-biopolymer Interactions Chemical Bonding and Interactions Between Chemicals and Biological Macromolecules; C-1-3. Energy and Thermodynamics; C-1-4. Reaction Kinetics; C-2-2. Chemical Equilibrium of Solutions and Volumetric Analysis Methods Chemical Equilibrium and Volumetric Analysis of Solutions; C-4-1. Characteristics of Functional Groups in Drugs Properties of Functional Groups in Pharmaceuticals; C-6-1. Cells: The Smallest Biological Units Cells as the Smallest Unit of Life; C-6-2. The Fundamentals of Genetics Life C-6-2 Genes Carrying Life Information; C-6-4. Proteins Responsible for Biological Functions; C-7. Anatomy and Physiology; E-1. Public Health to Maintain and Promote Health; E-1-2. Prevention and Control of the Spread of Infectious Diseases; E-2. Nutrition and Food Safety to Maintain and Promote Health; E-3-1. Management and Use of Chemical Substances Affecting Health; F-1. Pharmacotherapy. |
| Learning objectives |
| 1) Explain the pharmacokinetics of drugs based on their physicochemical properties and structures and functions of human body.<br>2) Describe examples of drug interactions caused by pharmacokinetics, explain the mechanisms behind them, and propose methods to avoid them.<br>3) Explain the impact of physiological changes on pharmacokinetics of drug and describe appropriate methods of administration based on the underlying condition. |
| Evaluation guideline |
| 4 |

**D-4-2. Pharmacokinetic Analysis**

| Aim |
| --- |
| Based on the related sections C-1, C-2, C-6 and C-7, acquire techniques to determine pharmacokinetic parameters using pharmacokinetic analysis methods that mathematically analyze the drug concentration-time profiles in the body (body fluids) after drug administration. Additionally, understand the concepts and applications of pharmacokinetic/pharmacodynamic (PK/PD) analysis. Furthermore, using pharmacokinetic parameters, develop a dosage regimen to achieve an appropriate drug concentration for effective drug therapy. In therapeutic drug monitoring (TDM), evaluate efficacy and safety based on the observed blood drug concentrations in patients, and determine the dosing methods, dose amounts, and dosing intervals in order to implement optimal drug therapy for individual patients. |
| Related sections |
| C-1-4. Reaction Kinetics; C-2-1. Fundamentals of Analytical Methods; C-2-4. Analytical Methods with Electromagnetic Waves; C-2-6. Separation Analysis; C-2-7. Techniques for Biomedical Analysis; E-1. Public Health to Maintain and Promote Health;<br>E-1-2. Prevention and Control of the Spread of Infectious Diseases; E-2. Nutrition and Food Safety to Maintain and Promote Health; E-3-1. Management and Use of Chemical Substances Affecting Health; F-1. Pharmacotherapy. |
| Learning objectives |
| 1) Explain drug concentration-time profiles using pharmacokinetic parameters with pharmacokinetic analysis methods.<br>2) Develop a dosage regimen considering the patient's physiological state using pharmacokinetic parameters.<br>3) In therapeutic drug monitoring (TDM), determine the dosage regimen (route of administration, dose, and interval) in order to implement optimal drug therapy for individual patients based on the observed drug concentrations.<br>4) Explain the concepts and applications of pharmacokinetic/pharmacodynamic (PK/PD) analysis. |
| Evaluation guideline |
| 4 |

## D-5. Drug Formulation Science

### D-5-1. Properties of Drugs and Formulations

| Aim |
| --- |
| Based on the related sections B-4, C-1, and C-2, acquire the basic knowledge to provide patients with appropriate formulations for drug treatment by understanding not only the basic theories concerning common types of formulation ingredients (solids, semi-solids, liquids, and dispersion formulations) and their physical properties, but also the factors affecting drug stability (reaction kinetics, complex reactions kinetics, etc.) and the formulation techniques used to stabilize them. |
| Related sections |
| B-4-2. Securing the Quality, Efficacy, and Safety of Products Including Pharmaceuticals and Medical Devices and Preventing Drug-induced Suffering; C-1-3. Energy and Thermodynamics; C-1-4. Reaction Kinetics; C-2-2. Chemical Equilibrium of Solutions and Volumetric Analysis Methods Chemical Equilibrium and Volumetric Analysis of Solutions; E-1. Public Health to Maintain and Promote Health; E-2. Nutrition and Food Safety to Maintain and Promote Health; E-3-1. Management and Use of Chemical Substances Affecting Health; E-1-2. Prevention and Control of the Spread of Infectious Diseases; F-1. Pharmacotherapy. |
| Learning objectives |
| 1) Explain the types of formulation ingredients, physicochemical properties, and related basic theory required for formulations, including solid, semi-solid, and liquid formulations.<br>2) Explain appropriate measures to ensure the stability of pharmaceuticals. |
| Evaluation guidelines |
| 4,5 |

### D-5-2. Formulation Design

| Aim |
| --- |
| Based on the related sections B-4, C-4, and C-5, understand the types and characteristics of formulation, modes of administration, and storage method, as indicated in the General Rules on Pharmaceutical Preparations of the Japanese Pharmacopoeia. Understand formulation pharmaceutical additives, formulation machines along with the formulation processes, formulation testing to ensure the quality of pharmaceuticals, including containers and packaging, and explain the bioequivalence between different formulations. |
| Related sections |
| B-4-1. The Environment Surrounding Drug Development; B-4-2. Securing the Quality, Efficacy, and Safety, of Products Including Pharmaceuticals and Medical Devices and |

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| Preventing Drug-induced Suffering; C-4-5. Medications for Major Diseases and Mechanisms; C-5. Pharmacognosy and Natural Product Chemistry; E-1. Public Health to Maintain and Promote Health; E-2. Nutrition and Food Safety to Maintain and Promote Health; E-3-1. Management and Use of Chemical Substances Affecting Health; E-1-2. Prevention and Control of the Spread of Infectious Diseases; F-1. Pharmacotherapy. |
| Learning objectives |
| 1) Understand the types and characteristics of formulations, routes of administration, storage methods, and explain the dispensing method of formulations.<br>2) Explain the pharmaceutical additives used in formulations, formulation machines and manufacturing processes, as well as containers, packaging, formulation testing methods, and bioequivalence to ensure the quality of the formulation. |
| Evaluation guidelines |
| 4,5 |

**D-5-3. Drug Delivery System (DDS)**

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| Aim |
| Based on the related sections, C-1, C-4, C-6 and C-7, understand the concept of DDS, drugs suitable for DDS applications and the characteristics of various DDS to select an effective DDS for the drug treatment of a patient disease. To select effective DDS for the treatment of patients' diseases and to acquire theories leading to the development and commercialization of new DDS. |
| Related sections |
| C-1-1. Chemical Bonding and Chemical-biopolymer Interactions; C-1-3. Energy and Thermodynamics; C-1-4. Reaction Kinetics, C-4-3. Drug Components; C-4-4. Classification of Drugs Based on Target Molecules; C-6-1. Cells: The Smallest Biological Units; C-6-2. The Fundamentals of Genetics; C-6-4. Proteins Responsible for Biological Functions; C-7. Anatomy and Physiology; E-1. Public Health to Maintain and Promote Health; E-1-2. Prevention and Control of the Spread of Infectious Diseases; E-2. Nutrition and Food Safety to Maintain and Promote Health; E-3-1. Management and Use of Chemical Substances Affecting Health; F-1. Pharmacotherapy. |
| Learning objectives |
| 1) Explain the concept and technology of DDS, as well as the optimal use of DDS based on the physicochemical properties and pharmacokinetic characteristics of the drug.<br>2) Understand DDS formulations and the diseases to which they are applied in order to propose an effective DDS for the drug treatment of patients. |
| Evaluation guidelines |

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| 4,5 |

### D-6. Dispensing as the Basis for Individual Optimization

#### D-6-1. Dispensing Based on Prescriptions

| Aim |
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| Based on the related sections B-1, B-4, B-5, C-1, and D-5, understand the significance and process of the series of dispensing actions to determine the need for a query by checking the contents of the prescription, assessing the appropriateness of the dosage, method of administration, and dosage form of the prescribed medicines, for providing appropriate drug therapy for individual patients. On this basis, acquire practical dispensing theory and skills to meet diverse needs in order to contribute to improving drug treatment outcomes and adherence through specific dispensing methods according to patient background and the formulation characteristics of the prescribed medicines, as well as medication guidance to patients, including dosage and storage methods. |
| Related sections |
| B-1. Responsibilities of pharmacists; B-4-2. Securing the Quality, Efficacy, and Safety of Products Including Pharmaceuticals and Medical Devices and Preventing Drug-induced Suffering; B-5-2. Digital technology and data science; C-1-3. Energy and Thermodynamics; C-1-4. Reaction Kinetics; D-5. Drug Formulation Science; F-1. Pharmacotherapy; E-1. Public Health to Maintain and Promote Health; E-1-2. Prevention and Control of the Spread of Infectious Diseases; E-2. Nutrition and Food Safety to Maintain and Promote Health; E-3-1. Management and Use of Chemical Substances Affecting Health; F-1. Pharmacotherapy. |
| Learning objectives |
| 1) Explain the items and contents of a prescription.<br>2) Evaluate the appropriateness of the dosage, administration methods, and formulation of the prescribed medicine based on the patient's background, and explain the need for inquiries about a prescription.<br>3) Follow the dispensing process, perform basic dispensing and auditing based on the patient's background and the formulation characteristics of the prescribed medications, such as powder and liquid drug forms, and explain what medication guidance should be provided for patients. |
| Evaluation guidelines |
| 4,5 |

## E. Pharmaceutical Health Science

**<Major Learning Objectives>**

In E. Pharmaceutical Health Science, students build on their studies from B Social Pharmacy, C Fundamentals of the Pharmaceutical Sciences, and D Pharmacotherapeutics in the Pharmacy Education Program. Student pharmacists learn about the prevention of diseases and health damages caused by environmental factors in society and communities, the prevention and control of infectious diseases, nutrition and food safety necessary for maintaining and promoting health, proper management and use of chemical substances affecting human health, and environmental conservation, all based on scientific evidence and the latest analytical techniques. This major section leads to the study of drug treatment, medical safety, etc. in F Clinical Pharmacy. Furthermore, through the study of E Pharmaceutical Health Science, students acquire the ability to identify and propose solutions for public health, food safety, and environmental health issues related to human health from a regulatory science perspective, to ensure healthy lives for the population, and contribute to the maintenance and development of a healthy society.

**E. Pharmaceutical Health Science Consists of the Following Three Secondary Sections:**

**E-1. Public Health to Maintain and Promote Health**
**E-2. Nutrition and Food Safety to Maintain and Promote Health**
**E-3. Management of Chemical Substances and Environmental Health**

**< Connection with A. Basic Qualities and Competencies Required of Pharmacists >**

The major section E. Pharmaceutical Health Science is an area of science in human health in society and communities. This area is important for contributing to maintaining and promoting physical and mental health as pharmacists. The qualities and abilities acquired in this major section are all the basics for developing the qualities and abilities of A. Basic Qualities and Competencies Required of Pharmacists*, [Professionalism], [Generalism], [Lifelong Learning], [Research], [Problem-solving], [Information Technology], [Pharmacotherapy Management], [Communication], [Interprofessional Collaboration]*. These are considered essential for pharmacists to meet the expectations society has of their role.

**<Guidelines for Evaluation>**

Based on scientific evidence and the collection, analysis, and evaluation of information,

1) Develop preventive and control measures for diseases and health damages caused by environmental factors in society and communities.
2) Develop preventive measures and measures to prevent the spread of infectious diseases that threaten human health.
3) Develop measures to maintain and promote human health and prevent and care diseases with regard to food and nutrition.
4) Develop preventive measures against health damages and food poisoning caused by food spoilage and contamination.
5) Develop preventive measures for health damages caused by chemical substances.
6) Develop measures to prevent and respond to pollution and harm to the environment.

7) Identify public health, food safety, environmental health issues, and propose solutions from a regulatory science perspective.

## E-1. Public Health to Maintain and Promote Health

### E-1-1. Prevention of Diseases and Health Damages Caused by Environmental Factors

| Aim |
| --- |
| Based on the various diseases and health damages acquired in the major sections B, C, and D, show an understanding of diseases and health damages caused by environmental factors and preventive measures from a public health perspective. |
| Related sections |
| B-5-1. Statistics in Health Science; B-5-2. Digital Technology and Data Science; C. Fundamentals of the Pharmaceutical Sciences; D. Pharmacotherapeutics; E-1-2. Prevention and Control of the Spread of Infectious Diseases; E-2. Nutrition and Food Safety to Maintain and Promote Health; E-3. Management of Chemical Substances and Environmental Health; F-2. Contribution of Pharmacists in Inter- and Intra-Healthcare Cooperation; F-3-3. Healthcare Safety, F-4 Contribution to Community Healthcare and Public Health, F-5 Basic Competencies Required in Clinical Settings |
| Learning objectives |
| 1) Explain the methods for the epidemiological analysis of public health problems and the process of finding solutions to maintain and improve human health.<br>2) Explain the need to appropriately prevent and mitigate various diseases and health damages caused by environmental factors in society and communities, based on the collection, analysis, and evaluation of relevant information.<br>3) Develop effective preventive and control measures for diseases and health damages caused by environmental factors based on the analysis of social impacts and global trends and an understanding of relevant laws, regulations, and systems.<br>4) Evaluate the effectiveness of preventive and control measures against diseases and health damages caused by environmental factors. |
| Evaluation guidelines |
| 1, 7 |

**E-1-2. Prevention and Control of the Spread of Infectious Diseases**

| Aim |
| --- |
| Based on the related sections B, C, and D, as well as health statistics and epidemiological methods acquired in E-1-1, learn about precautionary and preventive measures for the spread of infectious diseases. |
| Related sections |
| B. Social Pharmacy; C. Fundamentals of the Pharmaceutical Sciences; especially,<br>C-6-3. Classification, Structure, and Life Cycles of Microorganisms;<br>D. Pharmacotherapeutics; E-1-1. Prevention of Diseases and Health Damages Caused by Environmental Factors; E-2. Nutrition and Food Safety to Maintain and Promote Health; E-3. Management of Chemical Substances and Environmental Health; F-2. Contribution of Pharmacists in Inter- and Intra-Healthcare Cooperation; F-3-4. Infection Control in Healthcare Settings; F-4. Contribution to Community Healthcare and Public Health; F-5. Basic Competencies Required in Clinical Settings. |
| Learning objectives |
| 1) Explain the need for the appropriate prevention and control of the spread of infectious diseases based on the collection, analysis, and evaluation of relevant information to maintain and promote human health.<br>2) Develop effective precautionary and preventive measures for the spread of infectious diseases based on an understanding of health and medical systems, analysis of the social impact, global infection trends, and relevant laws, regulations, and systems.<br>3) Evaluate the effectiveness of precautionary measures to prevent the spread of infectious diseases. |
| Evaluation guidelines |
| 2, 7 |

## E-2. Nutrition and Food Safety to Maintain and Promote Health

### E-2-1. Food Functions and Nutrition in Prevention and Care of Disease

| Aim |
| --- |
| Based on the foundational knowledge of energy metabolism acquired in the major section C, students learn the functions of food and nutrition from the perspective of their roles in maintaining and promoting health. Additionally, students learn about effective nutritional management for the prevention and care of diseases. |
| Related sections |
| C. Fundamentals of the Pharmaceutical Sciences; C-6-5. Bioenergy and Metabolism;<br>D. Pharmacotherapeutics; E-1. Public Health to Maintain and Promote Health; E-2-2. Food Safety and Health Management; E-3. Management of Chemical Substances and Environmental Health. F-2. Contribution of Pharmacists in Inter- and Intra-Healthcare Cooperation; F-4. Contribution to Community Healthcare and Public Health; F-5. Basic Competencies Required in Clinical Settings. |
| Learning objectives |
| 1) Explain the need for food and nutrition to maintain and promote health.<br>2) Explain the need for and assessment of food and nutrition for preventing and managing diseases.<br>3) Develop effective strategies to manage diseases and health disorders resulting from nutrient excess or deficiency by considering dietary habits, living environment, health status analysis, and relevant energy metabolism and intake standards. |
| Evaluation guidelines |
| 3, 7 |

### E-2-2. Food Safety and Health Management

| Aim |
| --- |
| Based on the foundational knowledge and skills related to food and nutrition acquired in the major sections C, D, and E-2-1. Food Functions and Nutrition in Prevention and Care of Disease, as well as the knowledge and skills related to chemical substances learned in E-3-1. Management and Use of Chemical Substances Affecting Health, students in this secondary section learn about food safety and measures to prevent health damages caused by food. |
| Related sections |
| B. Social Pharmacy; C. Fundamentals of the Pharmaceutical Sciences;<br>D. Pharmacotherapeutics; E-1. Public Health to Maintain and Promote Health;<br>E-3. Management of Chemical Substances and Environmental Health, F-2. Contribution of Pharmacists in Inter- and Intra-Healthcare Cooperation; F-4. Contribution to Community |

| Healthcare and Public Health, F-5. Basic Competencies Required in Clinical Settings |
|---|
| Learning objectives |
| 1) Explain the need for implementing appropriate hygiene and safety management practices for food and food additives. This should be based on the collection, analysis, and evaluation of relevant information to maintain and promote human health.<br>2) Develop effective preventive measures for health damages and foodborne illness caused by food spoilage or contamination. Consider the extent of damage, analysis of the social impact, and relevant laws, regulations and systems.<br>3) Evaluate the effectiveness of preventive measures against health damages and foodborne illness due to food spoilage or contamination. |
| Evaluation guidelines |
| 4, 7. |

**E-3. Management of Chemical Substances and Environmental Health**

**E-3-1. Management and Use of Chemical Substances Affecting Health**

| Aim |
|---|
| Based on the related sections B, C, and D, students learn the appropriate management and use of chemical substances and preventive measures against health damages caused by chemical substances from the perspective of environmental health. |
| Related sections |
| B. Social Pharmacy; C. Fundamentals of the Pharmaceutical Sciences;<br>D. Pharmacotherapeutics; in particular, D-1-3. Drug Safety; E-1. Public Health to Maintain and Promote Health, E-2 Nutrition and Food Safety to Maintain and Promote Health;<br>E-3-2. Preservation of Living and Natural Environment. F-2. Contribution of Pharmacists in Inter- and Intra-Healthcare Cooperation; F-4. Contribution to Community Healthcare and Public Health; F-5. Basic Competencies Required in Clinical Settings. |
| Learning objectives |
| 1) Explain the management, use, storage, and disposal methods of chemical substances affecting health based on the collection, analysis, and evaluation of relevant information to maintain and promote health.<br>2) Develop effective prevention measures for health damages caused by chemical substances, based on an understanding of the extent of damage, analysis of social impacts and global trends, and relevant laws, regulations, and systems.<br>3) Develop effective pharmacological approaches based on the understanding of the social impact, analysis of global trends, relevant laws, regulations, and systems on cause-of-death investigations. |

| |
|---|
| 4) Evaluate the effectiveness of preventive measures against health damages caused by chemical substances. |
| Evaluation guidelines |
| 5, 7 |

**E-3-2. Preservation of Living and Natural Environment**

| |
|---|
| Aim |
| Based on the related sections B, C, and D, and the knowledge and skills related to health damages caused by chemical substances acquired in E-3-1, learn about preservation of living and natural environment and preventive measures against health damages caused by pollution and habitat degradation. |
| Related sections |
| B. Social Pharmacy; C. Fundamentals of the Pharmaceutical Sciences;<br>D. Pharmacotherapeutics; E-1 Public Health to Maintain and Promote Health;<br>E-2. Nutrition and Food Safety to Maintain and Promote Health; E-3-1 Management and Use of Chemical Substances Affecting Health. F-2. Contribution of Pharmacists in Inter- and Intra-Healthcare Cooperation; F-4. Contribution to Community Healthcare and Public Health; F-5. Basic Competencies Required in Clinical Settings. |
| Learning objectives |
| 1) Explain the need for the preservation of living and natural environment that affect health. Based on the collection, analysis, and evaluation of relevant information to maintain and improve health and ecosystems.<br>2) Develop effective prevention and response measures for health damages caused by pollution and habitat degradation, based on an understanding of the extent of damage analysis of social impacts and global trends, and an understanding of relevant laws, regulations, and systems<br>3) Evaluate the effectiveness of prevention and response measures against health damages caused by pollution. |
| Evaluation guidelines |
| 6, 7 |

**F. Clinical Pharmacy**

**<Major learning objectives.**

In F. Clinical Pharmacy, student pharmacists formulate appropriate pharmacotherapy plans and provide individualized and optimal pharmacotherapy from a patient- and consumer-centered perspective based on the basic knowledge of chemical substances and living organisms acquired in C. Fundamentals of the Pharmaceutical Sciences, comprehensively utilizing the knowledge of diseases and pharmaceuticals acquired in D. Pharmacotherapeutics. The student pharmacists comply with the laws, regulations, norms and ethics learned in B. Social Pharmacy, communicate with patients and consumers with respect for their position, collaborate with inter- and intra-healthcare professionals, and practice high quality pharmacological management and pharmaceutical care. They also acquire the competence to contribute to the improvement of healthcare, public health, nursing care, and welfare by utilizing the knowledge of health management learned in B. Social Pharmacy and public health, infection control, and environmental conservation learned in E. Pharmaceutical Health Science in the medical field and in the community.

**F. Clinical Pharmacy Consists of the Following Five Secondary Sections:**

**F-1. Pharmacotherapy**
**F-2. Contribution of Pharmacists in Inter- and Intra-healthcare Cooperation**
**F-3. Healthcare Management and Patient Safety**
**F-4. Contribution to Community Healthcare and Public Health**
**F-5. Basic Competencies Required in Clinical Settings**

**< Connection with A. Basic Qualities and Competencies Required as Pharmacists>**

The competencies acquired in F-1, F-3, and F-4 correspond to [*Problem-solving*], *[Information Technology], [Pharmacotherapy Management], [Generalism]* and *[Medicine in Society]*. F-2. is directly related to *[Interprofessional Collaboration]* and *[Communication]*. Through these competencies, *[Research]* is concretely put into practice. F-5 aims to enable students to demonstrate *[Professionalism]* as a medical professional in concrete action, and to foster a *[Lifelong Learning]*.

**<Guidelines for Evaluation>**

1) Identify problems in the pharmacotherapy of specific cases and examples and offer solutions or improvements.
2) Assess and evaluate the situation of individual patients and consumers, and in order to optimize the individualization of pharmacotherapy, consider effective and safe pharmacotherapy,.
3) Strive to communicate with patients, consumers, and inter- and intra-healthcare professionals who they work with and share and disseminate information. In addition, be aware of their profession as pharmacists through their interactions with inter- and intra-healthcare professionals.
4) Work in clinical settings to solve individual problems, work on medicine management, medicine information management, medical safety, and infection control.
5) Engage in disease prevention, health maintenance and promotion, public health of the local population in community medicine, nursing care and welfare, and resolve individual

issues.

6) As a healthcare professional, be attentive to the feelings of individual patients and their families and act in an altruistic manner. They also should respond with ethical considerations.
7) Have an understanding of the social responsibilities of pharmacists, be aware and prepared as a healthcare professional, and respond in cooperation with other medical, health, nursing, and welfare professionals.
8) Consider issues in clinical settings and in the community from a scientific perspective and propose solutions, publicize the results, and contribute to the advancement of pharmacy.

## F-1. Pharmacotherapy

### F-1-1. Individual Optimization of Pharmacotherapy

| Aim |
| --- |
| Enhance the ability to optimize the pharmacotherapy of each patient. Formulate optimized pharmacotherapy plans that take into account the patient's background (physical, psychological, and social) and the wishes of the patient and family, and practice prescription auditing, dispensing, medication guidance, patient education, and monitoring based on these plans. Maximize the effectiveness of pharmacotherapy, minimize risks, and ensure the appropriate use of medicines. |
| **Related Sections** |
| B-1. Responsibilities of Pharmacists; B-2. Social Abilities required of Pharmacists; D-1. Drug Action and Biological Changes; D-2. Pharmacology and Pathology; D-3. Drug Information Necessary for Decision-making in Healthcare; D-4. Pharmacokinetics; D-6. Dispensing as the Basis for Individual Optimization. |
| **Learning Objectives** |
| 1) Explain the concept of the appropriate use of medicines.<br>2) Understand the patient's condition by collecting and assessing patient information.<br>3) Use the most appropriate sources to collect information necessary for the assessment of pharmacotherapy. In addition, the information and sources obtained are to be evaluated and used effectively.<br>4) Identify problems with a pharmacotherapy and based on the assessment, develop a plan for problem-solving and individual optimization.<br>5) Assess patient conditions from their medical records to confirm and evaluate the efficacy and safety of a pharmacotherapy and then record the collected data.<br>6) Conduct prescription audits, practice prescription questions and suggestions from the perspective of the proper use of medicines, and perform dispensing, medication instruction, and patient education.<br>7) Develop a pharmacotherapy plan based on scientific evidence, taking into account the best outcome for each patient.<br>8) Monitor and assess the patient's condition throughout a pharmacotherapy to ensure its effectiveness and safety.<br>9) Plan and implement a pharmacotherapy appropriate to the situation by sharing information between all involved parties.<br>10) Evaluate the safety and efficacy of a pharmacotherapy for patients being treated with multiple diseases and multiple medicines, maintain and improve their quality of life (QOL), and practice prevention and early detection of adverse events.<br>11) Accept advice from other healthcare professionals and realize a more effective pharmacotherapy. |
| **Evaluation Guidelines** |
| 1, 2, 3, 6, 7, 8 |

## F-2. Contribution of Pharmacists to Inter- and Intra-Healthcare Teams

### F-2-1. Participation in Inter- and Intra-Healthcare Teams and the Exercise of Pharmacist's Professional Skills

| Aim |
| --- |
| Based on the related section B, build the competence to demonstrate the pharmacist's expertise in inter- and intra-professional teams and the competence to build trust with inter- and intra-healthcare professionals, and promote team formation. Consider the role required of pharmacists with an understanding of medicine, healthcare, and welfare, and be prepared to engage in quality patient- and consumer-centered medicine, healthcare, and welfare. |
| Related Sections |
| B-2. Social Abilities Required of Pharmacists and B-3. Pharmacist Activities in Society and Communities |
| Learning objectives |
| 1) Explain the roles of pharmacists as inter- and intra-healthcare professionals in a diverse healthcare team and be aware of the roles and responsibilities required of them.<br>2) Explain the healthcare system, health and welfare systems, including inter-facility cooperation according to the region.<br>3) Practice seamless patient support for changes in the care environment at the time of admission and discharge from hospital, etc., by participating in cooperation between facilities, between hospitals and pharmacies, and between pharmacies and pharmacies, and in cooperation concerning medical care, healthcare, and welfare in the community.<br>4) Clarify the important issues for patients and consumers, set common targets, share the team's activity policy, and solve problems together with the inter- and intra-healthcare professional staff working in partnership, and to provide useful information for the team's activities from a pharmacological perspective.<br>5) Encourage inter- and intra-healthcare professionals, patients, and families so that patients and families can participate in discussions and decision-making.<br>6) Share each other's professional roles, knowledge, opinions, and values in both directions, taking into consideration the different backgrounds of each healthcare professional. In addition, deepen mutual understanding, do not avoid confrontation or conflict, and formulate consensus among the professions they work with by confirming each other's ideas.<br>7) Communicate and build, maintain, and improve relationships of trust with the inter- and intra-healthcare professionals who they work with.<br>8) Reflect on their professionalism, thoughts, awareness, feelings and values as pharmacists through their interactions with other inter- and intra-healthcare professionals who they work with, better understand their experiences, and apply them to collaboration, and improve their professionalism as pharmacists. |
| Evaluation Guidelines |
| 1, 2, 3, 6, 7, 8 |

## F-3. Healthcare Management and Patient Safety

### F-3-1. Supply and Management of Medicinal Products

| Aim |
| --- |
| Based on the related sections B, C, D, and E, practice the appropriate supply and management of pharmaceuticals in medical settings. Acquire the ability to respond pharmaceutically to diverse pathological conditions and individual medical needs. |
| Related Sections |
| B-4. Regulation of Pharmaceuticals Products; C-4. Medicinal Chemistry;<br>D-5. Drug Formulation Science; D-6. Dispensing as the Basis for Individual Optimization;<br>E-3. Management of Chemical Substances and Environmental Health. |
| Learning objectives |
| 1) Ensure adequate supply and management of medicinal products based on distribution conditions.<br>2) Explain the pharmaceutical preparation, use, and quality control of preparations when commercial medicines are not available. |
| Evaluation Guidelines |
| 4, 8 |

### F-3-2. Management and Use of Drug Information

| Aim |
| --- |
| Based on the related sections B, C, and D, aim for the proper use of medicines in medical institutions and the community. Acquire the ability to formulate appropriate use and safety measures for medicines based on scientific evidence. |
| Related Sections |
| B-5. Information Technology; C-4. Medicinal Chemistry;<br>D-3. Drug Information Necessary for Decision-making in Healthcare. |
| Learning objectives |
| 1) Identify and utilize sources of information on medicinal products according to the healthcare environment to collect comprehensive and up-to-date information on medicines and consider the suitability and necessity of the information for the healthcare institution and patient population. In addition, provide and disseminate drug information after appropriate evidence-based evaluation and processing.<br>2) Pay attention to drug safety information in healthcare settings and respond promptly.<br>3) Organize and integrate information on various medicines and build and provide new knowledge that is useful in clinical practice. |

| |
|---|
| 4) Based on appropriate drug information and adverse event information, promote the appropriate use of medicines and develop safety measures according to the healthcare environment.<br>5) Understand the criteria for the use of medicines in the healthcare environment and explain the adoption and use of use of medicine from an effective, safety, and pharmaco-economical point of view. |
| Evaluation Guidelines |
| 4, 8 |

**F-3-3. Healthcare Safety**

| |
|---|
| Aim |
| Based on the related sections B and D, strive to provide safe healthcare and ensure patient safety by learning the causes and formulating preventive measures based on reported past cases and circumstances. |
| Related Sections |
| B-5. Information Technology; C-4. Medicinal Chemistry;<br>D-3. Drug information Necessary for Decision-making in Healthcare. |
| Learning objectives |
| 1) Student pharmacists reflect on their own and other cases to improve safety in healthcare settings.<br>2) Understand the responsibilities and duties of pharmacists in risk management related to healthcare and explain the concepts of patient safety, clinical and administrative systems, and specific safety measures.<br>3) Collect medical errors and incident/accident cases, analyze the factors involved, understand the legal actions (criminal and civil liability) when they occur and when responding to them, and consider appropriate responses and preventive measures. |
| Evaluation Guidelines |
| 4, 8 |

**F-3-4. Infection Control in Healthcare Settings**

| Aim |
| --- |
| Based on the related sections C, D, and E, practice infection prevention and control in healthcare settings and provide healthcare environments in order to protect the health of patients and healthcare professionals.<br>Strive to control infections, including taking measures to prevent the spread of infections in the event of outbreaks. |
| Related Sections |
| B-3. Pharmacist Activities in Society and Communities; B-4. Regulation of Pharmaceuticals Products; C-6. Biochemistry; D-2-15. Drugs for Infectious Diseases; E-1-2. Prevention and Control of the Spread of Infectious Diseases. |
| Learning objectives |
| 1) Act with attention to infection prevention and health management through environmental cleaning and disinfection.<br>2) Understand and practice standard precautions specific to infection routes.<br>3) Understand the necessary acts in mitigating infection outbreaks and strive for infection control.<br>4) Understand infection control against emerging and re-emerging infectious diseases, based on the latest findings and administrative responses. |
| Evaluation Guidelines |
| 4, 8 |

**F-4. Contribution to Community Healthcare and Public Health**

**F-4-1. Disease Prevention, Health Maintenance and Promotion, and Contribution to Care and Welfare in the Community**

| Aim |
| --- |
| Based on the related sections B, D, and E, acquire the ability to prevent disease and promote the health of the community. Support the community in taking actions for disease prevention and health maintenance and promotion as pharmacists, practice primary care, and acquire the ability to participate in comprehensive community care in collaboration with intra- and inter-healthcare professionals. |
| Related Sections |
| B-1. Responsibilities of Pharmacists; B-2. Social Abilities Required of Pharmacists;<br>B-3. Pharmacist Activities in Society and Communities; B-5. Information Technology;<br>D-1-2. Pathophysiological Changes; D-2-20. Self-medication; E-1. Public Health to |

| Maintain and Promote Health. |
|---|
| Learning objectives |
| 1) Student pharmacists can support the maintenance and management of the health of the community by providing useful information and creating an environment where they can easily give advice as health consultants.<br>2) Understand the role of the family pharmacist in a comprehensive community care system, promote community collaboration to improve the care and welfare of the community, and make efforts to maintain and improve the habitat and QOL.<br>3) Understand the health status of the community and the problems of the medical, health, nursing care, and welfare environment unique to the region, and examine and propose initiatives to improve these problems based on scientific evidence. |
| Evaluation Guidelines |
| 5, 7, 8 |

**F-4-2. Contributions to Public Health and Disaster Response in the Community**

| Aim |
|---|
| Based on the related sections B and E, contribute to the improvement of public health by promoting disease prevention, infectious disease control, and environmental conservation of the community. Support disaster preparedness in the community as pharmacists who can fulfill their responsibilities in the event of a disaster. |
| Related Sections |
| B-1. Responsibilities of Pharmacists; B-2. Social Abilities Required of Pharmacists;<br>B-3. Pharmacist Activities in Society and Communities; E-1. Public Health to Maintain and Promote Health. |
| Learning objectives |
| 1) Practice the preservation, maintenance, and improvement of the healthcare environment by preventing disease and the spread of infection to ensure a healthy environment for the community.<br>2) Practice educational activities for the health literacy of the community.<br>3) Understand and practice the roles that pharmacists should play in the event of disasters both real and simulated. |
| Evaluation Guidelines |
| 5, 7, 8 |

## F-5. Basic Competencies Required in Clinical Settings

### F-5-1. Basic Attitudes for Working in Health, Social Welfare, and Public Health Settings

| Aim |
| --- |
| Based on the related sections A and B, be aware and prepared to fulfill the mission of pharmacists in clinical settings and in the community and to contribute to the realization of a smooth and effective sharing of information for the best possible patient- and consumer-centered healthcare, welfare, and public health. |
| Related Sections |
| B. Social Pharmacy |
| Learning objectives |
| 1) Attend to individual patients and consumers, strive to understand their physical, psychological and social characteristics, and take their feelings into account to gain a holistic and comprehensive understanding of them.<br>2) Be aware of their responsibilities in healthcare as pharmacists, act with self-discipline and comply with their duties, laws, and regulations as pharmacists. Have an awareness of the dignity of life and fulfill their social mission.<br>3) Student pharmacists should understand the opinions or written texts of others and express their own opinions using effective methods and means of explanation.<br>4) Student pharmacists should fulfill their individual responsibilities and contribute to intra- and inter-professional team activities.<br>5) Understand the importance of continuing professional development for pharmacists, and keep abreast of social trends in medicine, healthcare, nursing care, welfare, information, science, and technology.<br>6) Strive to collect reproducible, reliable, and detailed evidence in order to contribute to the improvement of the quality of healthcare. |
| Evaluation Guidelines |
| 6, 7, 8 |

## G. Research

**<Major Learning Objectives>**
Students find research topics on their own by utilizing the knowledge and skills learned in major sections B to F, formulate research questions, and develop research plans based on the collection, analysis, and evaluation of information related to those questions. Conduct research and come to conclusions based on the analysis and consideration of the results. Acquire the problem-finding and problem-solving skills necessary for research that contribute to advances in pharmacy. Understand the basic attitudes required in research and cultivate the qualities to carry out research in a scientific and ethical manner.

**G. Research Consists of the Following Two Secondary Sections:**
**G-1. Attitude Towards Finding Topics and Conducting Research**
**G-2. Conducting Research**

**< Connection with A. Basic Qualities and Competencies Required of Pharmacists >**
The research abilities acquired in the major section G. Research is the basis of all the qualities and abilities required for pharmacists to contribute to society through the advances in pharmacy.

**< Guidelines for Evaluation >**
1) Understand the academic importance and social significance of research in pharmacy, evaluate the results of research reports through critical thinking, and find topics to be explored by themselves.
2) Engage in research with the responsibility to contribute to the advances in pharmacy.
3) Formulate hypotheses, set research questions, and develop plans through creative thinking to solve research topics.
4) Conduct research in an ethical manner and in compliance with laws, regulations, and guidelines.
5) Come to conclusions based on analysis and consideration of research results using creative thinking and to write up academic reports and present their results.

### G-1. Attitude Towards Finding Topics and Conducting Research

#### G-1-1. Critical and Comprehensive Thinking for Finding Research Topics

| Aim |
|---|
| Based on the related sections B to F, acquire critical and comprehensive thinking skills for finding research topics on their own. |
| Related sections |
| B. Social Pharmacy; C. Fundamentals of the Pharmaceutical Sciences;<br>D. Pharmacotherapeutics; E. Pharmaceutical Health Science; F. Clinical Pharmacy. |
| Learning objectives |

| |
|---|
| 1) Evaluate the academic importance, social significance, and scientific methodology in previous research related to pharmacy through critical thinking based on scientific evidence.<br>2) Find research topics to investigate on their own through comprehensive thinking based on the analysis and evaluation of previous reports. |
| Evaluation guidelines |
| 1 |

**G-1-2. Attitude Towards Research**

| |
|---|
| Aim |
| Based on the related sections B to F and G-1-1, cultivate an attitude to engage in research that contributes to advances in pharmacy and to conduct research on their own. |
| Related sections |
| B. Social Pharmacy; C. Fundamentals of the Pharmaceutical Sciences; D. Pharmacotherapeutics; E. Pharmaceutical Health Science; F. Clinical Pharmacy;<br>G-1-1. Critical and Comprehensive Thinking for Finding Research Topics. |
| Learning objectives |
| 1) Conduct research that contributes to the development of pharmacy in an appropriate manner. |
| Evaluation guidelines |
| 2, 4 |

## G-2. Conducting Research

### G-2-1. Formulate and Develop Research Plans

| Aim |
| --- |
| Based on the related sections B to F and G-1-1, acquire the ability to formulate and develop research plans. |
| Related sections |
| B. Social Pharmacy; C. Fundamentals of the Pharmaceutical Sciences;<br>D. Pharmacotherapeutics; E. Pharmaceutical Health Science; F. Clinical Pharmacy;<br>G-1. Attitude toward Exploring Pharmacy Issues and Conducting Pharmacy Research Attitude Towards Finding Topics and Conducting Research. |
| Learning objectives |
| Formulate and develop research plans through creative thinking based on scientific evidence and conduct research. |
| Evaluation guidelines |
| 3 |

### G-2-2. Research, Analysis, and Discussion of Results

| Aim |
| --- |
| Based on the related sections B to F, G-1, and G-2-1, through their experience, students will acquire the ability to conduct their own research and obtain results. |
| Related sections |
| B. Social Pharmacy; C. Fundamentals of the Pharmaceutical Sciences;<br>D. Pharmacotherapeutics; E. Pharmaceutical Health Science; F. Clinical Pharmacy;<br>G-1. Attitude toward Exploring Pharmacy Issues and Conducting Pharmacy Research, and G-2-1. Formulate and Develop Research Plans. |
| Learning objectives |
| 1) Understand the basic attitudes required to conduct their own research in a scientific and ethical manner.<br>2) Using creative thinking, analyze and discuss their results, and come to conclusions from their research by evaluating their academic significance and social impact.<br>3) Deepen creative thinking through academic reporting of research results and discussions. |
| Evaluation guidelines |
| 4, 5 |

## Appendix

## Establishment of the Study Organization and List of Members

## About the study group on the state of human resources development in pharmacy

### 1. Objective

The committee will consider specialized matters relating to human resource development in pharmacy colleges under the new system from 2006 and compile reports as necessary.

### 2. Matters for Consideration

(1) The study of measures to guarantee the quality of pharmacy education
(2) The development of a MCC for pharmacy education
(3) Others

### 3. Method of Implementation

(1) The committee members of the Annex will examine the issue.
(2) If necessary, sub-committees may be established to study the issue.
(3) If necessary, the views, etc. of interested parties may be sought.

### 4. Implementation Period

The period shall be from 27 August 2021 to 31 March 2023.

### 5. Other

General affairs relating to this conference are handled by the Medical Education Division of the Higher Education Bureau.

**List of Members of the Study Group on the State of Human Resources Development in Pharmacy**

| | |
|---|---|
| ・GOTO, Naomasa | Former President, Kyoto Pharmaceutical University |
| ・HAZAMA, Kenji | President, Japanese Society of Home Pharmacy |
| ・HOMMA, Hiroshi | Exective Director, Council on Pharmaceutical Education of Japan |
| ○INOUE, Keizo | Vice-Chancellor, Teikyo University |
| ・INUI, Kenichi | President, Japan Society for Pharmaceutical Education |
| ・ISHII, Itsuko | Director, Japanese Society of Hospital Pharmacists |
| ・KITAZAWA, Kyoko | Visiting Professor, Kyoto Pharmaceutical University |
| ・KONISHI, Yasuhiko | President, Shizuoka General Hospital |
| ◎NAGAI, Ryozo | President, Jichi Medical University |
| ・NISHIJIMA, Masahiro | President, Japan Accreditation Board for Pharmaceutical Education |
| ・OKUDA, Masahiro | Auditor, Japanese Society of Pharmaceutical Health Care and Sciences |
| ・SASAKI, Shigetaka | President, Pharmaceutical Society of Japan |
| ・TAJIRI, Yasunori | Vice-President, Japan Pharmaceutical Association |
| ・TESHIROGI, Isao | Vice-President, Japan Pharmaceutical Manufacturers Association |
| ・TSUCHIYA, Koichiro | Dean, Graduate School of Medical, Dental and Pharmaceutical Sciences, Tokushima University |
| ・YAMAGUCHI, Ikuko | Chairperson of the Board of Directors, Consumer Organization for Medicine and Law, COML, a accredited non-profit organization (NPO) |
| ・YANAGIDA, Toshihiko | Dean, School of Nursing, Faculty of Medicine, Miyazaki University |

17 persons in total

*Alphabetical order (titles omitted)

◎: Chairperson, ○: Vice-chairperson

As of February 14, 2023

# Establishment of a Permanent Organization on the Model Core Curriculum for Pharmacy Education

Established July 26, 2011

Partially amended on December 23, 2021 Director-General of Higher Education Bureau

**1. Objective.**

Establish a permanent organization for the revision of the MCC for Pharmacy Education, based on the deliberations of the Study Group on the State of Human Resources Development in Pharmacy.

**2. Role.**

(1) Revision of the MCC in response to the revision of the National Pharmacist Examination Criteria and changes in the legal system and nomenclature.
(2) Verification and evaluation of the MCC, including verification of the educational effects on students.
(3) Research and studies necessary for the revision of the MCC.
(4) Matters necessary for the use of the MCC, such as making the MCC known to relevant institutions and verifying the status of efforts by each university.
(5) Other matters necessary for the revision of the MCC.

**3. Composition of the establishment, etc.**

(1) An organization (Expert Research Committee on the Revision of the MCC for Pharmacy Education) is established to carry out expert research and studies, etc., and to prepare drafts for the revision of the MCC, etc., and is hosted by the Ministry of Education, Culture, Sports, Science and Technology.
(2) The composition of the committee referred to in (1) shall be as per the Annex.
(3) If necessary, the necessary organizations may be established to share responsibility for research, studies, etc.
(4) If necessary, the views, etc. of interested parties may be sought.

**4. Committee members**

(1) Committee members are appointed from among persons with outstanding insight into pharmacy education curricula, national pharmacist examinations, and other relevant matters.
(2) The term of the committee members shall expire at the end of the financial year following the financial year in which the appointment was made.
(3) Additional committee members may be added as necessary.
(4) Committee members may be reappointed.

**5. Other**

General affairs relating to the organization of 3 are handled by the Medical Education Division of the Higher Education Bureau.

## Specialist Research Committee on the Revision of the MCC for Pharmacy Education

| | |
|---|---|
| ・HIRAI, Midori | Professor Emeritus, Kobe University |
| ・HIRATA, Kazumasa | Professor, School of Pharmaceutical Sciences, Wakayama Medical University |
| ○HOMMA, Hiroshi | Exective Director, Council on Pharmaceutical Education of Japan |
| ◎INOUE, Keizo | Vice-Chancellor, Teikyo University |
| ・ISHII, Itsuko | Director, Japanese Society of Hospital Pharmacists |
| ・ITO, Tomoo | Director, Pharmaceutical Common Achievement Tests organization, a Non-Profit Organization |
| ・KADOYAMA, Kaori | Professor, Faculty of Pharmaceutical Sciences, Osaka Medical and Pharmaceutical University |
| ・KONISHI, Yasuhiko | President, Shizuoka General Hospital |
| ・KONO, Fumiaki | Professor, Graduate School of Medical, Dental and Pharmaceutical Sciences, Tokushima University |
| ・KOSANO, Hiroshi | Professor Emeritus, Teikyo University |
| ・NAGATSU, Masanori | Executive Director, Japan Pharmaceutical Association |
| ・OZAWA, Koichiro | Vice-Chancellor, Hiroshima University |
| ・SUZUKI, Tadashi | Professor, Graduate School of Pharmaceutical Sciences, Nagoya City University |
| ・TAKAHASHI, Hideyori | Professor, Faculty of Pharmaceutical Sciences, Tokyo University of Science |
| ・TAKATA, Sanae | Representative Director, Japan Accreditation of Nursing Education |
| ・YANO, Ikuko | Professor, Kobe University Hospital |

*Alphabetical order (titles omitted)

◎: Chairperson, ○: Vice-chairperson

As of 14 February 2023

**2019-2021**

**Ministry of Education, Culture, Sports, Science and Technology Research on the State of Healthcare Personnel at Universities.**

**Committee for the Investigation and Review of the Six-year Pharmacy Education System, Association of Private Pharmaceutical School of Japan**

**Committee Members:**

| | |
|---|---|
| ・* GOTO, Naomasa | Chairman, National Council of Deans of Pharmacy Colleges and Pharmaceutical Sciences |
| ・* HIRAI, Midori | Professor Emeritus, Kobe University |
| ・* HIRATA, Kazumasa | Professor, School of Pharmaceutical Sciences, Wakayama Medical University |
| ・* HOMMA, Hiroshi | Exective Director, Council on Pharmaceutical Education of Japan |
| ・ICHIJO, Hidenori | Professor, Graduate School of Pharmaceutical Sciences, The University of Tokyo |
| ○*INOUE, Keizo | Chairman, The Association of Private Pharmaceutical School of Japan |
| ・* ITO, Tomoo | Director, Pharmaceutical Common Achievement Tests organization, a Non-Profit Organization |
| ・KASANUKI, Hiroshi | Specially Appointed Professor, Waseda University; Former President, Tokyo Women's Medical University |
| ・KIRINO, Yutaka | President Emeritus and Professor Emeritus, Tokushima Bunri University |
| ・* KOSANO, Hiroshi | Professor, Faculty of Pharmaceutical Sciences, Teikyo University. |
| ・* MASADA, Mikio | Invited Professor, Faculty of Pharmaceutical Sciences, Osaka Medical and Pharmaceutical University. |
| ・* NAKAMURA, Akihiro | Vice-Chairman, Japan Society for Pharmaceutical Education |
| ・NISHIJIMA, Masahiro | President, Japan Accreditation Board for Pharmaceutical Education |
| ・*OKU, Naoto | President, Pharmaceutical Common Achievement Tests organization, a Non-Profit Organization |

| | |
|---|---|
| ・SASAKI, Shigetaka | President, Pharmaceutical Society of Japan |
| ・* SHIRAHATA, Akira | Academic Advisor, Josai University. |
| ・* SUZUKI, Tadashi | Professor, Graduate School of Pharmaceutical Sciences, Nagoya City University |
| ・TAKATA, Sanae | Representative Director, Japan Accreditation of Nursing Education |
| ・* TAKEDA, Kayoko | Associate Professor, Faculty of Pharmaceutical Sciences, Hokkaido University of Science. |
| ・* YAMADA, Tsutomu | Professor, Institute for Advanced Education and Research, Nagoya City University |

20 persons in total

Alphabetical order, titles omitted
○: Chairperson, *: Executive committee member
As of March 31, 2021

**<Major Items Study Sub-committees>**

**B. Social Pharmacy**

| | |
|---|---|
| ・ARITA, Etsuko | Professor, School of Pharmacy, Kitasato University |
| ・KAMEI, Miwako | Dean, Faculty of Pharmaceutical Sciences, Teikyo Heisei University |
| ・KISHIMOTO, Keiko | Professor, School of Pharmacy, Showa University |
| ・KONDO, Yuki | Associate Professor, Graduate School of Pharmaceutical Sciences, Kumamoto University |
| ・MASUYAMA, Koichi | Professor, School of Pharmacy, Tokyo University of Pharmacy and Life Sciences |
| ◎NAKAMURA, Akihiro | Vice-Chairman, Japan Society for Pharmaceutical Education |
| ・OKAWA, Kyoko | Professor, School of Pharmacy and Pharmaceutical Sciences, Mukogawa Women's University |
| ・ONDA, Mitsuko | Professor, Faculty of Pharmaceutical Sciences, Osaka Medical and Pharmaceutical University |
| ○SHIRAHATA, Akira | Academic Advisor, Josai University |
| ・TAJIMA, Keiichi | Pharmacist, Kumagaya City Pharmaceutical Association Pharmacy |

**C. Fundamentals of the Pharmaceutical Sciences**

| | |
|---|---|
| ◎GOTO, Naomasa | Chairperson, National Council of Deans of Pharmacy colleges and Pharmaceutical Sciences |
| ○HOMMA, Hiroshi | Exective Director, Council on Pharmaceutical Education of Japan |
| ・KARASAWA, Koji | Lecturer, School of Pharmacy, Showa University |
| ・KOGURE, Kentaro | Professor, Graduate School of Medical, Dental and Pharmaceutical Sciences, Tokushima University |
| ・MOHRI, Junichi | Lecturer, Department of Pharmacy, Kitasato University Hospital |
| ・NAGASAWA, Kazuki | Professor, Faculty of Pharmaceutical Sciences, Kyoto Pharmaceutical University |
| ・SUZAKI, Etsuko | Professor, School of Pharmacy, Shujitsu University |
| ・TAKAHASHI, Hideyori | Professor, Faculty of Pharmaceutical Sciences, Tokyo University of Science |
| ・TAKASU, Kiyomasa | Professor, Graduate School of Pharmaceutical Sciences, Kyoto University |

[Advisors]

| | |
|---|---|
| ・AKAJI, Kenichi | Vice-President, Kyoto Pharmaceutical University |
| ・MIYATA, Okiko | President, Kobe Pharmaceutical University |

**D. Pharmacotherapeutics**

| | |
|---|---|
| ・HOSOYA, Osamu | Director of Pharmacy, Japanese Red Cross Medical Center |
| ・ITO, Kousei | Professor, Graduate School of Pharmaceutical Sciences, Chiba University |
| ○ITO, Tomoo | Director, Pharmaceutical Common Achievement Tests organization, a Non-Profit Organization |
| ◎KOSANO, Hiroshi | Professor, Faculty of Pharmaceutical Sciences, Teikyo University |
| ・NAGATA, Taizo | Chairman, Tokyo Pharmaceutical Association |
| ・OTSU, Fumiko | Professor, Faculty of Pharmacy, Meijo University |
| ・SAKAMOTO, Kenji | Professor, Faculty of Pharmaceutical Sciences, Teikyo University |
| ・TAMURA, Yutaka | Professor, Faculty of Pharmacy and Pharmaceutical Sciences, Fukuyama University |

**E. Pharmaceutical Health Science**

| | |
|---|---|
| ・ARATA, Yoichiro | Professor, Faculty of Pharmaceutical Sciences, Teikyo University |
| ・HARA, Shuntaro | Professor, School of Pharmacy, Showa University |
| ○HIRAI, Midori | Director, Hyogo Red Cross Blood Center |
| ◎HIRATA, Kazumasa | Professor, School of Pharmaceutical Sciences, Wakayama Medical University |
| ・KOTAKE, Yaichiro | Professor, School of Pharmaceutical Sciences, Hiroshima University |
| ・MATSUNO, Sumio | Professor, Faculty of Pharmacy, Kinki University |
| ・ONO, Atsushi | Professor, Faculty of Pharmaceutical Sciences, Okayama University |
| ・SUZUKI, Ryo | Professor, Faculty of Pharmacy, Kanazawa University |
| ○TAKEDA, Kayoko | Associate Professor, Faculty of Pharmaceutical Sciences, Hokkaido University of Science |

**F. Clinical Pharmacy**

| | |
|---|---|
| ・ISHII, Itsuko | Director of Pharmacy, Chiba University Hospital |
| ・KADOYAMA, Kaori | Associate Professor, Faculty of Pharmaceutical Sciences, Osaka Medical and Pharmaceutical University |
| ・KAMIZUKA, Tomoko | Chief, Department of Pharmacy, Fukui-ken Saiseikai Hospital |
| ・MANO, Yasunari | Associate Professor, Faculty of Pharmaceutical Sciences, |

| | |
|---|---|
| | Tokyo University of Science |
| ○MASADA, Mikio | Invited Professor, Faculty of Pharmaceutical Sciences, Osaka Medical and Pharmaceutical University |
| ・MIYAKE, Keiichi | Vice-President, Hyogo Pharmaceutical Association |
| ・OKUDA, Masahiro | Director of Pharmacy, Osaka University Hospital |
| ◎SUZUKI, Tadashi | Professor, Graduate School of Pharmaceutical Sciences, Nagoya City University |

**Information Science and Technology Study Group**

| | |
|---|---|
| ・KINOSHITA, Atsushi | Associate Professor, Faculty of Pharmaceutical Sciences, Hyogo University of Medical Science. |
| ◎KOSANO, Hiroshi | Professor, Faculty of Pharmaceutical Sciences, Teikyo University |
| ・MIYAZAKI, Satoru | Dean, Faculty of Pharmaceutical Sciences, Tokyo University of Science |

Alphabetical order, titles omitted
◎ : Team leader ○ : Vice-team leader
As of March 31, 2021

## 2022
## Ministry of Education, Culture, Sports, Science and Technology Research on the State of Healthcare Personnel at Universities.
## Pharmacy Education Survey, Research and Evaluation Committee, Council on Pharmaceutical Education of Japan

**Committee Members:**

| | |
|---|---|
| ・ARATA, Yoichiro | Professor, Faculty of Pharmaceutical Sciences, Teikyo University |
| ・GOTO, Naomasa | Former President, Kyoto Pharmaceutical University |
| ・HIRATA, Kazumasa | Professor, School of Pharmaceutical Sciences, Wakayama Medical University |
| ○HOMMA, Hiroshi | Exective Director, Council on Pharmaceutical Education of Japan |
| ・ISHII, Itsuko | Director, Japanese Society of Hospital Pharmacists |
| ・ITO, Akihiko | Professor, Faculty of Pharmaceutical Sciences, Teikyo Heisei University |
| ・KADOYAMA, Kaori | Professor, Faculty of Pharmaceutical Sciences, Osaka Medical and Pharmaceutical University |
| ・KAMEI, Miwako | Professor, Faculty of Pharmaceutical Sciences, Teikyo Heisei University |
| ・KOSANO, Hiroshi | Professor Emeritus, Teikyo University |
| ・MATSUURA, Masayoshi | Director, Japan Pharmaceutical Association |
| ・NAGATSU, Masanori | Executive Director, Japan Pharmaceutical Association |
| ・OTSU, Fumiko | Professor, Faculty of Pharmacy, Meijo University |
| ・OZAWA, Koichiro | Professor, School of Pharmaceutical Sciences, Hiroshima University |
| ・SUZUKI, Tadashi | Professor, Graduate School of Pharmaceutical Sciences, Nagoya City University |
| ・TAKAHASHI, Hideyori | Professor, Faculty of Pharmaceutical Sciences,Tokyo University of Science |
| ・TAKATA, Ryuhei | Director, Japanese Society of Hospital Pharmacists |

16 persons in total

Observers

| | |
|---|---|
| ・INOUE, Keizo | Vice-Chancellor, Teikyo University |

| | |
|---|---|
| ・KONO, Fumiaki | Professor, Graduate School of Medical, Dental and Pharmaceutical Sciences, Tokushima University |
| ・KONISHI, Yasuhiko | President, Shizuoka General Hospital |

3 persons in total

Alphabetical order, titles omitted
◯: Chairperson
As of February 14, 2023

## Major items working group

**B. Social Pharmacy**

| | |
|---|---|
| ・ARITA, Etsuko | Professor, School of Pharmacy, Kitasato University |
| ・ISHII, Itsuko | Professor and Director of Pharmacy, Chiba University Hospital |
| ◯KAMEI, Miwako | Professor, Faculty of Pharmaceutical Sciences, Teikyo Heisei University |
| ・KINOSHITA, Atsushi | Associate Professor, Faculty of Pharmaceutical Sciences, Hyogo Medical University |
| ・KISHIMOTO, Keiko | Professor, School of Pharmacy, Showa University |
| ・KOSANO, Hiroshi | Professor Emeritus, Teikyo University |

**C. Fundamentals of the Pharmaceutical Sciences**

| | |
|---|---|
| ・BABA, Hiroko | Professor, Faculty of Rehabilitation, Niigata University of Health and Welfare. |
| ◯GOTO, Naomasa | Former President, Kyoto Pharmaceutical University |
| ・HOMMA, Hiroshi | Exective Director, Council on Pharmaceutical Education of Japan |
| ・KURAMOTO, Nobuyuki | Professor, Faculty of Pharmaceutical Sciences, Setsunan University |
| ・KOGURE, Kentaro | Professor, Graduate School of Medical, Dental and Pharmaceutical Sciences, Tokushima University |
| ・MISHIMA, Masaki | Professor, Faculty of Pharmaceutical Sciences, Tokyo University of Pharmacy and Life Sciences |
| ・NAGASAWA, Kazuki | Professor, Faculty of Pharmaceutical Sciences, Kyoto Pharmaceutical University |
| ・NOMIZU, Motoyoshi | Professor, Faculty of Pharmaceutical Sciences, Tokyo |

| | |
|---|---|
| | University of Pharmacy and Life Sciences |
| ・SUGIHARA, Takumichi | Professor, Faculty of Pharmaceutical Sciences, Niigata University of Pharmacy and Life Sciences |
| ・SUZAKI, Etsuko | Professor, School of Pharmacy, Shujitsu University |
| ・TAKAHASHI, Hideyori | Professor, Faculty of Pharmaceutical Sciences, Tokyo University of Science |
| ・TAKASU, Kiyomasa | Professor, Graduate School of Pharmaceutical Sciences, Kyoto University |

**D. Pharmacotherapeutics**

| | |
|---|---|
| ・HORI, Satoko | Professor, Faculty of Pharmaceutical Sciences, Keio University |
| ・KOGO, Mari | Professor, School of Pharmacy, Showa University |
| ○KOSANO, Hiroshi | Professor Emeritus, Teikyo University |
| ・NADAI, Masayuki | Professor, Faculty of Pharmacy, Meijo University |
| ・OTSU, Fumiko | Professor, Faculty of Pharmacy, Meijo University |
| ・OZAWA, Koichiro | Professor, School of Pharmaceutical Sciences, Hiroshima University |
| ・TAKEDA, Kayoko | Associate Professor, Faculty of Pharmaceutical Sciences, Hokkaido University of Science |
| ・TAMURA, Yutaka | Professor, Faculty of Pharmacy and Pharmaceutical Sciences, Fukuyama University |

**E. Pharmaceutical Health Science**

| | |
|---|---|
| ・ARATA, Yoichiro | Professor, Faculty of Pharmaceutical Sciences, Teikyo University |
| ・KOTAKE, Yaichiro | Professor, School of Pharmaceutical Sciences, Hiroshima University |
| ・HARA, Shuntaro | Professor, School of Pharmacy, Showa University |
| ○HIRATA, Kazumasa | Professor, School of Pharmaceutical Sciences, Wakayama Medical University |
| ・MATSUNO, Sumio | Professor, Faculty of Pharmacy, Kinki University |
| ・ONO, Atsushi | Professor, School of Pharmaceutical Sciences, Okayama University |
| ・SUZUKI, Ryo | Professor, Faculty of Pharmacy, Kanazawa University |

**F. Pharmacy Practice Experiences**

| | |
|---|---|
| ・HOSOYA, Osamu | Director of Pharmacy, Japanese Red Cross Medical Center |

| | |
|---|---|
| ・KADOYAMA, Kaori | Professor, Faculty of Pharmaceutical Sciences, Osaka Medical and Pharmaceutical University |
| ・KATAYAMA, Shuya | Representative Director, Hikari Pharmacy |
| ・KAWANA, Michiyo | Pharmacist, Cocokara Fine Pharmacy Kinuta Store |
| ・MANO, Yasunari | Professor, Faculty of Pharmaceutical Sciences, Tokyo University of Science |
| ・NAGATA, Taizo | Representative Director, Sakuradai Pharmacy |
| ・NAKAJIMA, Mikiro | Professor, School of Pharmaceutical Sciences, Nagasaki University |
| ・OTSU, Fumiko | Professor, Faculty of Pharmacy, Meijo University |
| ・SUGAWARA, Mitsuru | Professor, School of Pharmaceutical Sciences and Pharmacy, Hokkaido University |
| ○SUZUKI, Tadashi | Professor, Graduate School of Pharmaceutical Sciences,Nagoya City University |
| ・YAJI, Keiko | Deputy Chief of Pharmacy, Kagoshima University Hospital. |
| ・YAMADA, Shigeki | Professor and Head of Pharmacy, Fujita Medical University Hospital |

**G. Research**

| | |
|---|---|
| ○HIRATA, Kazumasa | Professor, School of Pharmaceutical Sciences, Wakayama Medical University |
| ・HOMMA, Hiroshi | Exective Director, Council on Pharmaceutical Education of Japan |
| ・SUZUKI, Tadashi | Professor, Graduate School of Pharmaceutical Sciences, Nagoya City University |
| ・TOMIOKA, Yoshihisa | Professor, Graduate School of Pharmaceutical Sciences, Tohoku University |

Alphabetical order, titles omitted
○: Team leader
As of 14 February 2023

**Abbreviations**

| Abbreviation | Name/Term | Japanese Translation |
|---|---|---|
| B | | |
| BCP | Business Continuity Plan | 業務継続計画 |
| C | | |
| CT | Computed (Computerized) Tomography | コンピュータ断層撮影 |
| CTZ | Chemoreceptor Trigger Zone | 化学受容器引き金帯 |
| D | | |
| DDS | Drug Delivery System | 薬物送達システム |
| DESC | Describe, Express/Explain/Empathy, Specify, Choose | 相手の意見を尊重しつ自身の考えや感情を適切に伝えるためのアサーティブコミュニケーション |
| E | | |
| EBM | Evidence-based Medicine | 根拠に基づく医療 |
| I | | |
| ICT | Information and Communication Technology | 情報通信技術 |
| IR スペクトル | Infrared Spectrum | 赤外スペクトル |
| M | | |
| MRI | Magnetic Resonance Imaging | 磁気共鳴画像法 |
| MS | Mass Spectrum | マススペクトル |
| N | | |
| NBM | Narrative-based Medicine | 物語に基づく医療, 説明に基づく医療 |
| NMR | Nuclear Magnetic Resonance | 核磁気共鳴 |
| O | | |
| OBE | Outcome Based Education | 学修成果基盤型教育 |
| P | | |
| PET | Positron Emission Tomography | 陽電子放射断層撮影法 |
| pH | Hydrogen Ion Concentration | 水素イオン濃度 |
| PK/PD 解析 | Pharmacokinetic/Pharmacodynamic Analysis | 薬物動態学/薬力学解析 |

| | | |
|---|---|---|
| POCT | Point of Care Testing | ポイントオブケア検査 |
| POS | Problem-oriented System | 問題志向型システム |
| Q | | |
| QOL | Quality of Life | 生活の質 |
| R | | |
| RMP | Risk Management Plan | 医薬品リスク管理計画 |
| S | | |
| SDM | Shared Decision making | 共同意思決定 |
| SOAP | Subjective, Objective, Assessment, Plan | 患者の主観的情報, 客観的情報, 評価, 計画 |
| SPECT | Single Photon Emission Computed Tomography | 単光子放射型コンピュータ断層撮像法 |
| SPIKES | Setting, Perception, Invitation, Knowledge, Empathy/Exploration and Strategy/Summary | がんの告知など、悪い知らせを伝える 6 段階のプロトコール |
| T | | |
| TDM | Therapeutic Drug Monitoring | 治療薬物モニタリング |