GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Anticancer chemotherapeutics, PG_00066140		
Field of study	Chemistry		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Specialty subject group
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Pharmaceutical Technology and Biochemistry -> Faculty of Chemistry -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Agnieszka Potęga	
	Teachers	dr hab. inż. Agnieszka Potęga dr inż. Natalia Maciejewska	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	20.0	0.0	15.0	0.0	15.0	50

E-learning hours included: 0.0

eNauczanie source addresses:
Moodle ID: 776 Chemoterapeutyki przeciwnowotworowe
https://enauczanie.pg.edu.pl/2025/course/view.php?id=776

Additional information:
The lectures will take place online through Microsoft Teams

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	50	5.0	20.0	75

Subject objectives

Lectures aims to familiarize students with the mechanisms of action of drugs used in cancer treatment, their metabolism, and clinical aspects. Within the framework of the course, students gain knowledge of the available anticancer drugs, their clinical applications, and associated side effects, including toxicity. The programme includes a detailed analysis of classical cytostatics, modern targeted therapies, and immunotherapies. Additionally, issues related to the design of new drugs, the development of innovative therapeutic strategies, and the challenges associated with treating human cancers will be addressed.

Laboratory classes are designed to deepen general biochemical knowledge and practical mastery of experimental methods used in research on anticancer chemotherapeutics. Students learn how to plan and conduct biochemical experiments and how to draw conclusions based on the results obtained. Particular emphasis is placed on understanding the mechanisms of action of selected anticancer compounds, assessing their biological activity, toxicity, and effects on cancer cell lines. During the course, students also acquire practical skills in basic laboratory techniques such as cell culture, cell staining, cytotoxicity assays (e.g., MTT), and data analysis using statistical tools.

Seminar classes are designed to broaden biochemical knowledge to include topics in contemporary cancer therapy research. Students prepare individual presentations on current trends in experimental oncology and clinical oncology, based on scientific literature and materials indicated by the instructor. The seminar aims to develop students' ability to critically analyse scientific data, engage in substantive discussion, and communicate knowledge in an accessible and engaging way in both scientific and popular science formats.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W01] recognizes problems of modern chemistry, including properties and obtaining chemical compounds, necessary for making calculations, including the dependence of the compound's structure and its reactivity	The student recognizes contemporary challenges in the design and synthesis of compounds with anticancer activity; understands the relationship between chemical structure, reactivity, and the mechanism of action of drugs used in cancer therapy.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K7_K03] understands non-technical aspects and effects of the graduate's activities, including the impact of the chemical industry on the environment	The student understands the non-technical aspects of research on anticancer chemotherapeutics, including ethical, social, and environmental implications of their synthesis, production, and application; recognizes the impact of the chemical and pharmaceutical industry on the environment and public health.	[SK1] Assessment of group work skills [SK5] Assessment of ability to solve problems that arise in practice
[K7_W05] defines the principles of sustainable development, national and European conditions for environmental management, in the field of intellectual property protection and patent law	The student defines the principles of intellectual property protection and patent law in the context of developing new anticancer drugs, and explains the role of sustainable development and European/national regulations in the research and implementation of pharmaceuticals.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
[K7_W04] indicates methods for the synthesis of chemical compounds with defined properties	The student identifies and describes methods of synthesis of selected anticancer chemotherapeutics and is able to present their structural modifications aimed at achieving desired biological properties.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects

Subject contents

Lecture:
- Introduction to anticancer chemotherapy (history of cancer treatment and development of chemotherapy, classification of anticancer drugs according to molecular targets, basic mechanisms of action of cytostatic drugs).
- Basic principles of chemotherapy (combination therapy, cell cycle and drug sensitivity).
- Classic anticancer drugs (alkylating agents and platinum compounds, antimetabolites, DNA topoisomerase inhibitors, microtubule-targeting drugs).
- Hormone therapy in cancer treatment (estrogen receptor modulators, aromatase inhibitors).
- Targeted therapies (tyrosine kinase inhibitors, monoclonal antibodies, immunotherapy).
- Problems in cancer treatment (drug interactions and toxicity, cancer cell resistance, mutations and escape mechanisms).
- New directions and strategies in cancer treatment (therapies targeting cancer mitochondria, therapies against cancer stem cells, cell and gene therapies).

Laboratory:
- Assessment of cell survival after exposure to chemotherapeutics.
- Study of the interaction of chemotherapeutics with DNA.
- Combination tests analysis of the synergism of drugs used in chemotherapy.
- Use of microscopic methods to assess the effects of therapy.
- Assessment of the interaction of chemotherapeutics with mitochondria.

Seminar:
- Analysis of scientific publications on new oncological drugs.
- Discussion of innovative approaches to the design of anticancer drugs.

Prerequisites and co-requisites

Basic knowledge in organic chemistry, cell biology, biochemistry, and molecular biology.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Conducting seminar classes	60.0%	25.0%
Conducting laboratory classes	60.0%	25.0%
Final examination	60.0%	50.0%

<table>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>Krystyna Orzechowska-Juzwenko; Zarys chemioterapii nowotworów narządowych i układowych; Volumed; Wrocław 2000; ISBN: 83-87804-15-0

Lauren Pecorino; Biologia molekularna nowotworów w praktyce klinicznej; Edra Urban & Partner; Wrocław 2018; ISBN: 978-83-65835-63-5</td></tr>
<tr><td>Supplementary literature</td><td>Review articles on new anticancer drugs and therapeutic strategies in scientific journals, as well as materials from pharmaceutical companies (provided by lecturers and/or collected independently by students).</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">Lecture:
- What are the main mechanisms of action of classic anticancer drugs (e.g., antimetabolites, DNA alkylating agents)?
- What is the difference between cytostatics and targeted therapies in cancer treatment?
- What characteristics must a cancer cell have in order to be susceptible to treatment with conventional chemotherapeutics such as DNA alkylating agents?
- What are the most commonly used anticancer therapies for breast, lung and colon cancer?
- Discuss the role of immunotherapy in cancer treatment.
- What mechanisms allow the immune system to be used in cancer therapy?
- What are the stages of clinical trials for new anticancer drugs? What legal regulations govern them?

Laboratory:
- What are the basic mechanisms of action of chemotherapeutic agents?
- How does intercalation differ from DNA alkylation?
- How to interpret the results of an SRB or Trypan Blue test?
- What is drug synergism analysis?
- What changes in mitochondria indicate mitochondrial membrane depolarisation?
- How to morphologically recognise an apoptotic cell under a fluorescence microscope?

Seminar:
- What molecular mechanisms are responsible for cancer resistance to chemotherapy?
- What is the difference between targeted therapy and conventional chemotherapy?
- What are the main reasons for the failure of clinical trials in oncology?
- How are therapeutic strategies designed for different types of cancer?
- What are the potential directions for the development of innovative anticancer drugs?</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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