University of Gdańsk

Subject card

Subject name and code	When forensic science fails, PG_00211779		
Field of study	Forensic Analytics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2027/2028
Education level	Bachelor's studies	Subject group	Obligatory subject group in the field of study Optional subject group
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	4	ECTS credits	2.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Chemistry and Analytics of Cosmetics -> Department of Analytical Chemistry -> Faculty of Chemistry -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Iwona Dąbkowska	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	30.0	0.0	0.0	0.0	30

E-learning hours included: 0.0

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	30	5.0	15.0	50

Subject objectives

- Familiarizing students with the main sources of error in forensic science, with particular emphasis on laboratory, interpretative, and systemic errors.
- Developing the ability to critically assess the evidential value of forensic results and to identify the limitations of analytical methods used in practice.
- Shaping a professional attitude based on scientific rigor, responsibility, expert ethics, and awareness of the consequences of erroneous expert testimony.
- Introducing students to the mechanisms of cognitive bias in experts and to ways of limiting its influence on expert opinion.
- Presenting case studies of wrongful convictions and flawed expert testimonies as a tool for analyzing the quality of the evidential process.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[AKRL3_W12] The graduate knows and understands, at an advanced level, the latest trends and achievements in analytical chemistry, toxicology, molecular biology and instrumental methods used in forensic science.	1. Selects research, measurement, and control procedures, as well as organizational solutions that increase the laboratory's resilience to errors. 2. Justifies the use of quality assurance tools such as blind testing, second opinion, proficiency testing, and proper documentation.	[SW1] oral statement/ conversation/discussion [SW5] implementation of a problem task
[AKRL3_W06] The graduate knows and understands the principles of statistical processing of measurement data and the basics of chemometrics and validation of analytical methods.	1. Explains the basic types of errors occurring in forensic analysis: pre-analytical, analytical, and post-analytical errors. 2. Describes the sources of error in DNA, toxicological, and GSR investigations, as well as in hair and fiber analysis. 3. Explains the importance of validation, quality control, accreditation, and documentation in a forensic laboratory. 4. Interprets basic probabilistic and statistical problems in the assessment of evidential material. 5. Justifies the use of quality assurance tools such as blind testing, second opinion, proficiency testing, and proper documentation.	[SW1] oral statement/ conversation/discussion [SW5] implementation of a problem task
[AKRL3_U01] The graduate is able to identify, analyse and solve complex research problems in chemistry and forensic science by selecting appropriate methods and information sources.	1. Cooperates in the analysis of complex case studies. 2. Formulates and justifies conclusions based on data, literature, and the limitations of research methods. 3. Characterizes the limitations of selected analytical methods used in forensic science.	[SU2] presentation/project/paper/ report [SU5] implementation of a problem task [SU8] observation of student's independent or team work
[AKRL3_U10] The graduate is able to interpret data from different analytical techniques to reconstruct events or identify evidence material.	1. Recognizes interpretative errors, including the transposition of conditionals and the overuse of terms such as consistency or match. 2. Analyzes cases of flawed expert opinions in terms of the stage of the analytical process, the source of the error, and the procedural consequences. 3. Proposes corrective actions and error-prevention systems in the laboratory.	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report [SU5] implementation of a problem task [SU8] observation of student's independent or team work
[AKRL3_K01] The graduate is prepared to critically evaluate their own knowledge and its relevance to solving cognitive, practical, and societal problems, as well as to responsibly make use of expert opinions.	1. Critically assesses the limits of their own interpretative competence. 2. Understands the need for continuous updating of knowledge in analytical methods, statistics, and quality standards in forensic science. 3. Understands the importance of complying with quality procedures and the chain of custody for legal security and the scientific reliability of opinions. 4. Demonstrates responsibility for the consequences of expert errors for the individual and for the justice system.	[SK1] oral statement/conversation/ discussion [SK5] implementation of a problem task [SK8] observation of student's independent or team work

Subject contents	**Anatomy of laboratory error:** • Taxonomy of errors: pre-analytical, analytical, and post-analytical; random, systematic, and gross errors; ISO 17025 as a prevention system. • Errors at the evidence-preservation stage: scene contamination, degradation; chain-of-custody protocols. • Errors in DNA analysis: sample mix-ups, contamination, false matches in CODIS databases. • Errors in fiber and hair analysis: microscopic hair analysis, scientific foundations and limitations. • Errors in forensic toxicology: matrix effects, detection limit versus biological threshold, interpretation of postmortem concentrations. • Errors in gunshot residue (GSR) and explosion analysis: secondary transfer, environmental background, false positives. **2. Expert cognitive bias:** • Cognitive forensics – susceptibility to various forms of bias in result interpretation: confirmation bias, contextual bias, bias cascade, bandwagon effect, halo effect, spotlight effect, tachypsychia, etc. • Sources of cognitive error: human nature, environment, culture, experience, relationship to the case (source pyramid). • Errors in statistics and probabilistic interpretation: overuse of the term “match,” conditional transposition (prosecutor’s fallacy). • Systemic errors in forensic laboratories: institutional pressure, lack of blind testing, non-accredited methods, lack of awareness of the limitations of research, analytical, and laboratory methods. • Law and expert error in Poland: criminal, civil, and disciplinary liability of an expert witness; reversal of a verdict based on a new expert opinion; precedents in Polish case law. **3. Key case studies:** Well-known cases involving expert errors: Brandon Mayfield (USA, 2004); Houston Crime Lab (2002–2015); Sally Clark (UK, 1999); Lukis Anderson (USA, 2012); FBI Hair Analysis Review (2015); cases from Poland.
Prerequisites and co-requisites	• Completion of introductory courses in analytical chemistry, statistics or research methodology, and an introduction to forensic science or forensic chemistry. • Ability to critically analyze scientific texts and to perform basic interpretation of analytical data. • Knowledge of the Polish language.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
	51.0%	50.0%
	51.0%	30.0%
	51.0%	20.0%

Recommended reading

Basic literature	1. Houck M.M., Siegel J.A., *Fundamentals of Forensic Science*. 2. Saferstein R., *Criminalistics: An Introduction to Forensic Science*. 3. Cooper G.S., Meterko V., Cognitive bias research in forensic science: a systematic review. 4. Dror I.E., *Cognitive and human factors in expert decision making*.
Supplementary literature	
eResources addresses	

Example issues/ example questions/ tasks being completed	The Innocence Project report indicates that flawed or overinterpreted forensic evidence was a factor in more than 45% of cases. Polish studies point to expert cognitive bias as a systemic problem in forensic science. The course will be conducted in a workshop format, with elements of gamification and multiple active-learning methods. As intended, the course is meant to have a strong impact on shaping the student’s professional attitude: scientific rigor, awareness of the limitations of analytical methods combined with a high level of inquisitiveness, responsibility, and professional ethics. **Semester project:** Analysis of a selected wrongful conviction case from a chemical and laboratory perspective, including identification of the source of error, indication of the stage of the analytical process, and proposal of a quality control system to prevent recurrence. **Format:** written report (6–8 pages) and/or a 10–15 minute presentation.

Work placement	Not applicable

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