Course syllabus

Klinisk kemisk diagnostik
Clinical Chemical Diagnostics

EEMF10, 5 credits, G2 (First Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED BME
Date of Decision: 2023-04-13

General Information

Main field: Technology.
Compulsory for: BME3
Language of instruction: The course will be given in English on demand

Aim

The course will give the students insights into how biochemical and biomolecular diagnostics are utilized in today's health care, in hospital laboratories as well as in primary health care. The most common clinical chemical analyses and various public health issues, as well as the most common latin/greek terms used in health care will be discussed. The principles for pharmacological therapy are illustrated, as well as the concepts of biobanking and different types of "omics". The course will also provide understanding of the importance of using biomarkers in the pharmaceutical drug development process.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- have knowledge of the most common diseases – prevalence, risk factors, progression and treatment.
- understand the greek/latin terms of common diseases and anatomy.
- have a thorough understanding of the investigation process and various causes of male and female infertility.

- have a pathological understanding of various examinations / treatments such as basic seminal fluid parameters and ovarian morphology.
- have knowledge of the principles and use of assisted fertilization.
- have knowledge of the mechanisms of some common pharmacological substance groups.
- have knowledge of the implication of the biobank legislation.
- have knowledge of the most common methods for detection of drugs of abuse in biological samples.
- have knowledge of some of the markers and methods used to detect alcohol abuse.
- understand the process of oncological diagnostic workflow to establish therapeutic strategies for cancer patients.
- have knowledge of the principles of mass spectrometry, the main parts of a mass spectrometer and their functions.
- have general knowledge on the principles of separation techniques e.g. chromatography (GC & RP-HPLC) and electrophoresis coupled to MS.
- have a broad knowledge of the application of mass spectrometry in clinical lab settings: from routine or established assays to clinical research
- have knowledge of different ”omics” – concepts and their impact on diagnostics.
- have a knowledge and a basic understanding of MS-based protein identification and quantification techniques discussed during the course.
- have knowledge about the basic differences between LC-SRM based and antibody based assays for protein quantifications.

Competences and skills
For a passing grade the student must

- be able to use the greek/latin terms of common diseases and anatomy.
- be able to define terms such as reproduction, PCOS, azoospermia.
- be able to formulate and follow a study plan for the most common clinical chemical analyses with analysis principles, indications and clinical relevance.
- be able to report on the role and importance of patient-centered analyzes in healthcare, principles for their use in different situations and challenges in the development of new patient-centered diagnostics.
- be able to discriminate between screening and confirmatory methods used to detect drugs/alcohol abuse.
- have insight into histology and direct prognostic and predictive correlations in pathology.

Contents

The course content includes

• fundamental knowledge of the most common diseases - e.g., cardiovascular diseases, tumors and diabetes – prevalence , pathophysiology and implications, e.g., how common is diabetes, why do one get diabetes, which are the most common complications?

• the most common clinical chemical analyses, indications, principles of analysis and interpretation – e.g., what is CRP, how is CRP measured and what a high level of

CRP implies.

• the most common medical terms – e.g., myocardial infarction, hypertension, aortic rupture, anterior and distal.

• the principles of assisted fertilization – pathophysiological background to and clinical handling of infertility.

• the principles of patient-centered diagnostics – Quality perspective in diagnostics. Definition, scope and advantages/disadvantages of patient-centered laboratory work. Role in triage and diagnostics, respectively. Where and who performs patient-centered analyzes, which analyzes are performed. The technical and medical challenges of the future.

• the mechanisms of some common pharmacological substance groups – e.g., drugs for the treatment of high blood pressure, diabetes, infections, cancer or pain such as betablockers, insulin, antibiotics, cytostatic and painkillers.

• the overview of the most common drugs of abuse, their classification, and the most commonly used methods for their detection in biological samples.

• the main features and application of the biobank legislation – what is a biobank, who can ”deposit” and ”withdraw”, who owns the samples?

• fundamentals of tumor biology with direct correlation to patient centered diagnostics and treatment options, decision making in oncology

the principles of mass spectrometry and separation techniques, e.g. chromatography, electrophoresis, and their applications in clinical lab settings.

• different ”omics” – what is the meaning of genomics, transcriptomics and proteomics? How can the information be used in research and health care? Why does the genome and proteome of individuals differ?

• the importance of biomarkers in drug development and their use throughout pharmaceutical research. How can biomarkers be used to improve pharmaceutical development and provide earlier confidence in accelerating or discontinuing compounds in clinical development?

• targeted proteomics using LC-SRM technology for protein biomarker quantification that complements antibody based immunoassays, and the pros and cons of each technology will be discussed.

Examination details

Grading scale: UG - (U,G) - (Fail, Pass)
Assessment: During the course, two compulsory project work is carried out in groups which are presented in oral presentations. For an approved course, active participation in the project work and the laboratory sessions, approved laboratory reports and an approved written exam are required.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Assumed prior knowledge: EITA01 Introduction to Biomedical Engineering and KOKA20 General and Organic Chemistry.
The number of participants is limited to: No

Contact and other information

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