

Biomedical Science

Anatomy, physiology and histology LO040H

Credits: 10 ECTS credits

Term: Autumn

Examination: 2-hour written multiple choice tests

Obligatory: Microscopy course - histology

Goals

To acquire knowledge about and understanding of the relationship between the different types of tissue and the structure and function of the organs. In addition, the student is to know and understand the most important mechanisms for regulating biological functions. Finally, the student is to acquire knowledge of the microscopic appearance of cells and tissues and how these together form a functional whole.

Content

- ☐ Medical nomenclature
- ☐ The composition and functions of cells and tissue..
- ☐ Blood, tissue fluids and homeostasis.
- ☐ The composition and functions of the major organ systems.
-integumentary system, circulation, respiration, digestion, urinary tract, the hormone system, special sensory organs, the nervous- and reproductive system.
- ☐ Microscopy of cells and tissue of different organs.

Syllabus

Recommended reading:

Tortora, G.J.: *Introduction to the Human Body*, Scott Foresman & Co. Publishers, ISBN 0-673-98222-X

Mariele, E.N.: *Human Anatomy*, Benjamin Cummings, ISBN 0-8053-6469-2

Alternative to Tortora, G.J.:

Bjålie, J.G. et al: *Mennekekroppen, fysiologi og anatomi*, Universitetsforlaget

Alternative to Mariele, E.N.:

Nielsen, E.H.: *Kompendium i almen histologi*,

Nielsen, E.H.: *Kompendium i spesiell histologi*, F.A.D.L.'s forlag

Mathematics, statistics, data processing LO070H

Credits : 12 ECTS credits

Terms : Autumn/ Spring

Examination : Spring 5-hour written test

Obligatory computer task

Subject components

- ☐ Mathematics
- ☐ Statistics
- ☐ Data Processing

Mathematics 4,5 ECTS credits

Goals

To be able to use mathematics as a tool to solve practical and theoretical problems in other

subjects and later work as a biomedical scientist. In addition, the student is to develop ability in practical mathematical calculation.

Content

- ☐ Graphic presentation techniques.
- The co-ordinate system, scaling and curve graphs.
- ☐ Equations:
- Linear equations, Nth grade equations.
- ☐ Derivation
- ☐ Trigonometry
- ☐ Exponential function and logarithms
- ☐ Integral calculus
- ☐ Functions of several variables

Syllabus

Recommended reading:

Kvande, Per Chr.: *Biomat, Kompendium i matematikk for 1 BIO, AFT*

Gulliksen, Tor: *Matematikk i praksis*, Universitetsforlaget, ISBN 82-00-42411-1

Statistics 4,5 ECTS credits

Goals

To be able to understand and carry out different statistical calculations and evaluations.

Content

- ☐ Error analysis, types and treatment
- ☐ Descriptive statistics
- ☐ Discrete and continuous distribution
- ☐ Calculation of Probability
- ☐ Confidence intervals and error transmission
- ☐ Significance tests and testing of hypotheses
- ☐ Variance analysis
- ☐ Regression analysis
- ☐ Quality control and strategies for taking tests
- ☐ Control card
- ☐ The use of statistical function and tools in Excel

Syllabus

Recommended reading:

Løvås, Gunnar G.: *Statistikk for universiteter og høyskoler*, ISBN 82-00-12755-9

Kvande, Per Chr.: *Kompendium i statistikk I-III AFT*

Data Processing 3 ECTS credits

Goals

To be able to develop the use of computers to write documents, use a spread sheet and move data between applications. In addition, the student is to understand, make and use relation data bases and be familiar with computer security and personal protection.

Content

- ☐ Use of the computer for work processing and spread sheet.
- ☐ Relational data base (Access).
- ☐ Computer security and protection of personal privacy
- ☐ Statistical calculation in Excel

Syllabus

Recommended reading:

Compendiums

Supporting literature: User's manuals, etc.

General chemistry LO085H

Credits: 10 ECTS credits

Terms: Autumn

Examination: Autumn 4-hour written test.

Laboratory classes are obligatory and will be documented by reports.

Goals

The student is to acquire basic chemistry theories and principles, plus a general ability in the laboratory. In addition, the student is to develop a basis for acquiring knowledge in other scientific areas and laboratory subjects.

Content

- ☐ Definition of main concepts
- ☐ Stoichiometry
- ☐ Electronic structure and the periodic table
- ☐ Thermochemistry
- ☐ Chemical bonding
- ☐ Chemical reactions
- ☐ Chemical equilibria, complex –ion equilibria
- ☐ Properties of liquids and solids
- ☐ Acid-base equilibrium in aqueous solutions,buffer solutions
- ☐ Thermodynamics
- ☐ Electrochemistry

Syllabus

Recommended reading.

Brady, James, E: *Generell kjemi grunnlag og prinsipper*, Tapir 2000

Aylward & Finley: *SI chemical data*, 3. ed., J. Wiley & Sons, 1994

Analytical chemistry LO075H

Credits: 5 ECTS credits

Terms: Spring

Examination: Spring 4-hour written test.

Laboratory classes are obligatory and will be documented by reports.

Goals

The student is to acquire basic chemistry theories and principles, plus a general ability in the laboratory. In addition, the student is to develop a basis for acquiring knowledge in other scientific areas and laboratory subjects.

Content

- ☐ Chemical reactions
- ☐ Chemical equilibria, complex –ion equilibria
- ☐ Acid-base equilibrium in aqueous solutions,buffer solutions
- ☐ Thermodynamics
- ☐ Electrochemistry

Syllabus

Recommended reading.

Skoog, West, Holler, Crouch: *Fundamentals of Analytical Chemistry*, 8. ed., Thomson 2004

Aylward & Finley: *SI chemical data*, 3. ed., J. Wiley & Sons, 1994
Alternative
Kvande: *Kompendier*, AFT

Social, scientific and humanistic subjects LO057H

Credits: 10 ECTS credits

Terms: Autumn/Spring

Examination: Oral individual test

Obligatory project works.

Subject components

- ☐ Communication, interaction and conflict solving
- ☐ Ethics

Communication, Interaction and Conflict Solving 5 ECTS credits (autumn)

Goals

To acquire basic knowledge of different theories of communication, verbal and non-verbal forms of communication. In addition, the student is to acquire knowledge of forms of co-operation and of what kind of competence other health professions have. Finally, the student is to develop his ability to communicate and co-operate.

Content

- ☐ Theory of communication
- ☐ Forms of co-operation
- ☐ Group dynamics
- ☐ Models for conflict solving
- ☐ Techniques for guidance and presentation

Syllabus

Recommended reading

Røkene, O.H., Lossius, K., Mauseth, T.: *Kommunikasjon og sosialt samspill*. J.W.Cappelens Forlag 1996

Eide, H. & Eide, T: *Kommunikasjon i relasjoner. Samhandling, konfliktløsning, etikk*, Ad Notam Gyldendal AS, 1996

Ethics 5 ECTS credits (spring)

Goals

The student is to develop a well-rounded view of people and respect for a person's integrity and autonomy. The student is to develop the ability to think ethically and to develop an approach to ethical action. Finally, the student is to develop the ability to discover conflict of values and ethical dilemmas in carrying out a task, as an individual, in a group and in society.

Content

- ☐ Basic ethics
- ☐ View of mankind
- ☐ The individual and society
- ☐ Ethics in relation to foreign cultures
- ☐ Ethics and technology
- ☐ Professional ethics

Syllabus

Recommended reading

Tranøy, K.E: *Medisinsk etikk i vår tid*, Sigma forlag. 1999.

Christoffersen, S.Aa.: *Handling, Person, Samfunn. En innføring i grunnlagsetikk for helse- og sosialfagene*. Universitetsforlaget, 2001.

Kjønstad, A.: *Taushetsplikt om barn*. Kommuneforlaget. 2001

Medical laboratory technology (Module 1) LO030H

Credits: 9 ECTS credits

Terms: Autumn: 3 credit

Spring: 6 credits

Examination: Spring 4-hour practical (lab) and theoretical (written) tests.

Laboratory classes and external practical studies are obligatory.

Goals

The student is to acquire knowledge, abilities and attitudes related to the gathering, maintenance, and treatment of human biological material. Emphasis is laid on basic laboratory technique abilities. The student is to acquire and understanding of the meaning of quality control and quality assurance in medical laboratory work.

Content

- ☐ Basic medical laboratory techniques within:
 - the taking of vein and capillary blood tests of fellow students
 - test treatment, analysis display
 - preparation of bacteria cultures and microbiological evaluation
 - pipette techniques
 - recording of results and reporting
 - cell processing
 - light microscopy
 - hygiene and the issue of contagion
 - quality improvement and internal control, the main emphasis on:
 - ☐ quality control
 - ☐ health, environment and safety

Syllabus

Recommended reading

Excerpts from:

Stakkestad, Jacob A./ Åsberg: *Brukerhandbok i klinisk kjemi*, (Utg. 2002) Arne Akademisk forlag AS, ISBN 82-7868-032-9

Rodak: *Hematology: Clinical Principles and Applications* (Utg. 2002), ISBN 0-7216-8404-1

Brunzel. N.A. *Fundamentals of Urine and Body Fluid Analysis*, ISBN 0-7216-3976-3

Tietz, W.B: *Fundamentals of Clinical Chemistry*, (4th ed.) Saunders Company, ISBN 0-7216-8634-6

Murray, Patrick R./Kobayashi, George S./Pfallen, Michael a./ Rosenthal

Ken S: *Medical Microbiology*, (3. Utg.) Wolfe International student edition, ISBN 0-7234-2010-6

Degre, Miklos/Hovig, Berit/Bukholm, Geir/ Rollag, Halvor: *Medisinsk Mikrobiologi*, Universitetsforlaget, ISBN 82-00-4229-3

Organic chemistry and biochemistry part 1 LO025H

Credits: 5 ECTS credits

Terms: Spring

Examination: Spring 4-hour written test

Obligatory laboratory theoretical exercises

Goals

To acquire basic knowledge and understanding of the structure and properties of organic molecules and some bio molecules.

Content

- Structure and bonding
- Nomenclature of polyfunctional organic compounds
- Stereochemistry and isomerism
- Structure and reactivity
- Some reaction mechanisms
- Nucleic acids structures

DNA replication and protein synthesis

Syllabus

Recommended reading

McMurry: *Fundamentals of Organic Chemistry*, 5ed.2003, Brooks &

Physics and measurement, automation LO140H

Credits: 15 ECTS credits

Terms: Autumn/Spring

Examination: December 5-hour written test (80%)

Report on automation (20%)

Subject components

- ☐ Physics and measurement techniques
- ☐ Automation

Physics In Measurement Techniques 10 ECTS credits

Goals

The student is to be able to understand the physical principles upon which measurement and analytical methods are built and be able to calculate the concentration from a measured signal. The student is also to be able to read a diagram of connection, understand user and service manuals, be able to understand checking procedures, maintenance, fault-finding and simple repairs on machines.

Content

- ☐ Optics:
 - electromagnetic radiation, geometric and wave optics
 - radiation emission and absorption
- ☐ Electronics:
 - physical measurement sizes and units, dynamics
 - direct and alternating current,
 - semi-conductor components, analogue and digital circuits,

- measuring by computer
- analogue and digital sensors,
- ☐ Instrumental analysis methods
- different photometric methods and electrochemistry

Syllabus

Recommended reading

Kvande, P. Chr: *Instrumentering I-IV*, Interne kompendier, AFT
Skoog, West, Holler: *Analytical Chemistry*, (7th ed.), W.B. Saunders
Company, ISBN 0-03-00-005938-0

Ward, Lehmann, Leiken: *Clinical Laboratory Instrumentation and
Automation*, W.B Saunders Company, ISBN 0-7216-4218-

Automation 5 ECTS credits

Goals

The student is to have a basic understanding of and be able to use automatic analytical instruments that are used in medical laboratories. The student is also to be able to understand the effect of quality assurance in analytical work and gain insight into the function and work culture of a biomedical scientist in a larger organization.

Content

- ☐ Functional units of automatic analytical instruments.
- ☐ The function and use of analytical machines
- ☐ Organization of tests and result distribution
- ☐ Use of manuals
- ☐ Procedure for maintenance and fault-finding
- ☐ Quality control programs
- ☐ Application of analytical principles to automatic analytical systems
- ☐ Processing of larger amounts of data and samples

Syllabus

Recommended reading

Ward, Lehmann, Leiken: *Clinical Laboratory Instrumentation and Auto-Mation*, W.B.
Saunders Company, ISBN 0-7216-4218-7

Steensland, Heidi: *Automasjon innen klinisk kjemi*, Tano, ISBN 82-518-3053-2
Manuals

General immunology and microbiology LO161H

Credits: 6 ECTS credits

Term: Spring

Examination: Spring 4-hour written test.

Obligatory laboratory exercises

Goals

The student is to acquire a basic theoretical understanding of the immune system's composition and mode of working. In addition, the student is to acquire an understanding of how the immune response is regulated. Also to be acquired is a basic theoretical understanding within microbiology. The student is expected to develop abilities to cultivate, locate and identify micro organisms in biological material.

Content

- ☐ The immune system's composition and way of working.
- innate and acquired immunity
- regulation of the immune response.
- ☐ The structure, function and nomenclature of bacteria, virus, fungus and protozoans:

- growth conditions and physiological and biochemical characteristics.
- the interaction of micro organisms with a host.
- anti-bacterial and anti-viral treatment
- prophylaxis

Syllabus

Recommended reading

Lea, Tor: *Basal og klinisk immunology—prinsipper og molekylære mekanismer*, Tia's forlag, 2000

Degre, Hovig, et al: *Medisinsk mikrobiologi*, Universitetsforlaget, 1994

Medical laboratory technology (Module 2) LO171H

Credits: 15 ECTS credits

Term: Autumn and spring

Examination: Spring 5-hour written test

Compulsory:

Laboratory exercises, 10 courses and laboratory reports, written works. Students have to pass an individual practical test in laboratory skills. It will be given some written exercises to be evaluated during the year, and the results will count 25 % of final score in this subject.

Goals

The student is to acquire theoretical knowledge and develop practical abilities in laboratory techniques. In addition, the student is to be able to assess and discuss the relationship between processes and results. The student is also to be able to service the different instruments that are used and understand how these function.

Through theoretical and practical laboratory work the student is to be able to carry out validation and verification of methods.

Further, the student is to acquire general knowledge of quality assurance in laboratory operations. Through theoretical and practical laboratory work the student will learn to assure his/her work in the laboratory.

Content

Medical laboratory technology

Quantitative techniques and techniques applied on cells and tissues with emphasis on principles, processes, and assessment of results.

Quantitative techniques:

- Chemical, enzymological and immunological principles of reactions
- Different metric techniques, spectrophotometry, turbidimetry, reflectrometry, ion-selective electrodes (potentiometry, amperometry), fluorometry, chromatography, atomic absorption spectrophotometry, nephelometry, osmometry.
- Calibration
- Validation of methods
- Preanalytical and analytical errors
- Reference values and biological variations

Techniques applied on cells and tissues

- Theory of staining

- Cell preparation and tissue processing
- Histochemical and cytochemical techniques
- Enzyme histochemistry
- Immunohistochemistry
- Cultivation of bacteria from human biological samples.
- Cultivation of microorganisms in different media and environments
- Identification of microorganisms;
- Antimicrobial susceptibility testing

Blood sampling of patients in hospitals

Quality management

- General consideration of quality assurance in laboratories
- Internal Quality assessment, control of different methods
- Laboratory procedure
- Quality improvement

Syllabus

Burtis, C.A. & Ashwood, E.R.:
Tietz Fundamentals of Clinical Chemistry
Saunders

Lyon, H.
Theory and Strategy in Histochemistry
Springer-Verlag

Boon/Suurmeijer
The Pap Smear
Coulomb Press Leyden

Kyrjebø, Jane Mikkelsen
Kvalitetsutvikling i helsetjenesten
Fagbokforlaget

Murray, P. et al
Medical Microbiology.
Mosby

Alternativ litteratur:
Degré, M. et al
Medisinsk mikrobiologi

Universitetsforlaget

Cell biology, molecular biology, genetics LO180H

Credits : 9 ECTS credits

Term : Spring

Examination : 5-hour written test.

Obligatory laboratory exercises

Goals

The student is to gain knowledge and understanding of the composition, differentiation, function, metabolism and molecular biology of cells. In addition, he/she is to acquire knowledge of basal genetic mechanisms.

Further, the student is to gain theoretical knowledge and practical abilities in cell cultivation, cell assessment through microscopy and basic gene-technological methods. Finally, the student is to be able to reflect upon ethical issues of the development and use of medical gene-technology.

Content

- ☐ Build up of the cell, its function and metabolism.
- ☐ Cell differentiation.
- microscopic assessment of the cervical mucous membrane
- microscopic assessment of blood cells at different stages of maturation
- ☐ Basic cell cultivation techniques.
- ☐ Molecular biology and classical genetics.
- ☐ Gene-technological methods.
- ☐ Ethical considerations concerning medical gene-technology

Syllabus

Recommended reading

Alberts, et. Al: *Essential Cell Biology*, Garland Publishing Inc., 1997

Kompendier

Handed out material

Laboratory papers.

Laboratory medicine LO210H

Credits : 12 ECTS credits

Term : Autumn The course is organised as a unit during 6 week at the beginning of the term.

Examination : December Individual written test based on 3-day group preparation (PBL)

Goals

The student is to gain knowledge and insight into sick human organism's biological processes. In addition, the student is to understand why normal and modified functions and processes in an organism can be analysed/displayed in body fluids, cells and tissue.

Content

- ☐ Cell injury and cell death.
- ☐ Inflammation
- ☐ Immunology and infections.
- ☐ Disorders of circulation.
- ☐ Hormonal regulation
- ☐ Disorders of metabolism
- ☐ Disorders of growth and neoplasia

Syllabus

Recommended reading
This will be given at the start of the course.

Laboratory technology (Module 3) LO220H

Credits : 12 ECTS credits

Term : Autumn

Examination : December 5-hour written test

Goals

The student is expected to acquire abilities in different laboratory techniques and analytical principles within haematology and immunohaematology, so as to be able to carry out, assess, explain and quality assure analysis work.

Through external study training the student is to: gain an understanding of the meaning of corporation. Attain insight into the biomedical scientist's area of work and understand the importance of being able to set priorities and organize analytical work in an acute situation. Finally, the student is to acquire knowledge about quality assurance and authorization arrangements.

Content

- ☐ Manuel and automatic counting of blood cells.
- ☐ Automation within haematology.
- ☐ Light microscopic assessment of normal and pathological blood smears
- ☐ Coagulation analysis.
- ☐ Blood diseases.
- ☐ Haemostasis and fibrinolysis.
- ☐ Blood group serology
- Pretransfusion testing
- Donation, preparation and storage
- ☐ Haemotherapy and transfusion complications.
- ☐ Authorization arrangements for the operation of the laboratory.
- ☐ Quality assurance and internal control in the laboratory.

Syllabus

Recommended reading

Steven, M.L: *Fundamentals of Clinical Haematology*, Saunders Co.,1997

Philipsens, Jens Peter: *Labortoriehæmatologi*, Bayer Diagnostcs, 1995

Medical laboratory technology (Module 4) LO230H

Credits : 24 ECTS credits

Terms : Autumn/Spring

Examination : Spring, Written 3-day group test and a 1-day individual practical-theoretical test.

Goals

The student is to develop the ability of comprehensive thinking across the borders of the main subjects of this course. He/She is to integrate the medical laboratory specialities and medical, technological and methodological knowledge.

In addition, the student is to be able to: understand the main principles of methods that are carried out in the laboratory, carry out laboratory technical work and to be able to acquire and prepare new methods.

One is to be able to assess the quality of analysis in relation to methodological and technical possibilities, limitations and sources of error.

Further, the student is to be able to understand the meaning of laboratory analyses and methods which are used in diagnostics, choice of therapy and assessment of the course of illness and prognosis.

The student is to be able to understand the importance of giving priority to analysis work in emergency treatment situations.

Finally, the student is to acquire knowledge about quality improvement and documentation of the operation of the laboratory.

Content

This module contains laboratory medicine, medical laboratory technology and quality improvement and internal control.

- ☐ Clinical relevance of laboratory analyses and methods in connection with sickness in organs and organ system.
- ☐ Taking of blood tests on patients.
- ☐ Treatment of tests.
- ☐ Different laboratory technical equipment, from small instruments used to treat patients directly, to large automatic machines used in connection with technological and methodological possibilities, limitation and sources of error, application of methods, quality control procedures and maintenance procedures.
- ☐ Physical, chemical, enzymatic and immunological methods with different measurement techniques.
- ☐ Microscopic methods for the study of body fluids, cells and tissue.
- ☐ Chemical, enzymatic and immunological techniques used on cells and tissue.
- ☐ Isolation, display, identification and antibiotic-testing of microorganisms from different biological material.
- ☐ Nuclear medical studies and methods of measurement.
- ☐ Pharmacology and toxicology.
- ☐ Authorization principles, quality assurance, quality improvement and documentation, development of the biomedical scientist's professional domain and issues of work ethics.

Syllabus

Recommended reading: Literature used earlier in the studies. And, in addition:

Brunzel, Nancy A: *Fundamentals of Urine and Body Fluid Analysis*, W.B. Saunders Company.

Rootwelt, K: *Nukleærmedisin*, Universitetsforlaget

Stakkestad & Åsberg: *Brakerhåndbok i klinisk kjemi*, Akademisk Forlag AS

Lyon, Hans: *Theory and Strategy in Histochemistry*, Springer verlag

Kiernan, J.A: *Histological & Histochemical Methods: Theory and Practice* Pergamon Press

Boon & Suumeijer: *The Pap Smear*, Coulomb Press Leyden

Main project LO240H

In the event that more than one of the modules of Medical Laboratory Technology 1-4 is failed, the student will not be permitted to undertake the project.

Credits : 12 ECTS credits

Term : Spring

Date to be submitted: Last week in May

Goals

The student is to study in depth a limited area within the medical laboratory subjects. He/She

is to develop the ability to map out, define and discuss questions related to the subject(s). In addition, the student is expected to develop his/her critical thinking and the ability to judge, present and discuss the theoretical and practical results that have been reached. Finally, the student is to develop an ability to cooperate with and be inter-dependent on others.

Content

Current issues and questions worked out in the medical environments at Trondheim University Hospital, NTNU and/or at the Institute of Medical Technology.

Evaluation

The assessment of the project will be based on:

- ☐ the process during the project work
- ☐ a project report
- ☐ an oral presentation of the project

the project report is to be delivered by the group and will be judged by the supervisors. The mark of each group member can be established on the basis of an individual oral defence of the whole report.
