



Dipartimento di Scienze e Tecnologie

ANNO ACCADEMICO 2017/2018

**CORSO di STUDIO in BIOTECNOLOGIE
INSEGNAMENTO in BIOCHIMICA CLINICA**

DOCENTE Prof. Dino DE CONNO

GENERAL PART

1) INTRODUCTION TO CLINICAL BIOCHEMICAL STUDY

- Definition, historical, purpose and biotechnological and biomedical applications

2) MODERN LABORATORIES OF CLINICAL BIOCHEMISTRY

- Organization, functionality, minimum organizational requirements
- Basic Laboratory and Specialist Laboratory, Point of care testing

3) SAFETY IN LABORATORY

- Chemical, physical and biological sources of danger
- Risk prevention procedures, universal precautions
- Statements on current national accident prevention legislation for the laboratory: behavior, duties and responsibilities of workers
- Description and proper use of Personal Protective Devices (D.P.I.)
- Chemical and biological hoods: type and correct use

4) LABORATORY EXAMPLES

- Definition, type, purpose and suitability of request

5) COLLECTION AND PREPARATION OF BIOLOGICAL MATERIALS

- Patient Preparation and Proper Drawing Techniques
- Definition of biological sample and typology (whole blood, plasma, serum, urine and other biological materials). Serum separation and Centrifugation
- Notes on the main anticoagulants and preservatives
- The chain of custody in biochemical and clinical investigations for medical and legal purposes
- Acceptance and suitability of specimens and correct storage and transport modes
- Pre-analytical variability: causes, monitoring and remedies

6) LABORATORY RESULTS AND VARIABILITY

- Measurement concept and measurement definition in the laboratory. Sizes and Units of Measurement
- Analytical Variability: reliability, accuracy, precision, specificity and analytical sensitivity of laboratory tests. Laboratory errors and their evaluation

7) INTERPRETATION OF BIOCHEMICAL RESULTS

- Reference Values and Decision-Making Levels on the Population
- Sensitivity and Clinical Specificity and Predictive Value of Laboratory Results
- Biological Variability: Time, Causal and Evaluation of Critical Difference
- Laboratory reference and use in clinical decision
- Notes on the meaning and application of Evidence Based Laboratory Medicine or EBLM

8) QUALITY CONTROL IN THE LABORATORY

- Internal Quality Control (C.Q.I.). Definition and Use of Control Materials
- Rules and Control Systems: Quality Control Statistics, Alarm and Action Signals, Westgard Rules, Shewhart-Levey-Jennings Control Cards
- Excerpts on External Quality Control or External Quality Assessment (V.E.Q.)
- Control of analytical methods: instrument calibration and definition of calibrators
- Analytical variability: sources of random and systematic errors, their detection and monitoring, resolution and revision of operational procedures

9) BASIC AND INSTRUMENTAL ANALYTICAL TECHNIQUES

- Analyzes, Reagents and Work Solutions. Chemical, enzymatic and immunochemical reactions: principle, kinetics and biochemical applications
- Laboratory glassware and proper use. Technical Balance, Analytic and Weighing Method
- Separation Techniques: Centrifugation and Ultracentrifugation, Centrifugal Types, Filtration and Dialysis
- Optical measurement techniques: Light properties and light-matter interaction. Spectrophotometry and Ultraviolet-visible absorption photometry. The Law of Lambert-Beer. Turbidimetry, Nephelometry, Spectroscopy of Reflection, Fluorimetry. Spectrometry of Atomic Absorption and Mass Spectrometry (MALDI-Tof and SELDI-Tof)
- Electrophoretic techniques: analytical principle, methodological typologies (solid support electrophoresis, capillary electrophoresis). Immuno-electrophoresis (Immuno-electrophoresis) and Immunotyping in the Study of Monoclonal Seroprotein Components
- Potentiometric techniques: direct and indirect method (ISE module) for the determination of serum and urinary electrolytes (sodium, potassium, chlorine and lithium)
- Chromatographic techniques: analytical principle and applications for column chromatography, ion exchange, filtration, chromatography in High Pressure Liquid or H.P.L.C.
- Immunological techniques: antigen-antibody reaction, qualitative and quantitative precipitation reaction, gel immunoprecipitation (simple and double radial immunodiffusion) and liquid immunoprecipitation

Dipartimento di Scienze e Tecnologie

- Immunoassay techniques: hormone dosing applications, for tumor and infectious biomarkers. Analytical Principle of Immunoenzymatic Methods (E.I.A., E.L.I.S.A.), Methods in Immunofluorescence and Chemiluminescence

SPECIAL PART -

10) CARBOHYDRATES - Laboratory Diagnostics

- General characteristics, biochemistry and physiology of carbohydrate metabolism
- Homeostasis, hormonal regulation and blood concentration (Glycemia)
- Hyperglycemia and Diabetic Disease (Type 1 and 2 - Epidemiology and Etiopathogenesis)
- Role of the biochemical laboratory in the diagnosis, monitoring and evaluation of diabetic complications: basal blood glucose, glycosuria, glucose tolerance tests, glycosylated hemoglobin, glycated plasma proteins, ketone bodies, insulin and peptide C, microalbuminuria
- The laboratory in diagnosis and monitoring diabetes in pregnancy
- Hypoglycemia: classification and laboratory testing

11) LIPIDS, LIPOPROTEINS, DYSLIPIDEMIAS, ATHEROSCLEROSIS - Laboratory Diagnostics

- Main classes of lipids. Lipoproteins and Apolipoproteins: Classification, Metabolism and Physiology
- Dyslipidemia: definition, classification of Fredrickson, genetic or familial hyperlipidemia and secondary hyperlipidemia
- Atherosclerosis: Definition and role of etiopathogenesis in cardiovascular diseases
- Laboratory Diagnostics in the Study and Evaluation of:
 - a) Familial dyslipidemia: determination of lipid profile (total cholesterol, HDL- and LDL -cholesterol, triglycerides), apolipoprotein A and B
 - b) Secondary dyslipidemia: hematochemical tests for diabetes, hepatic disease, thyrotoxicosis, nephrotic syndrome and chronic renal failure
- Descriptive values and desirable values, interpretation of laboratory results and therapeutic goals

12) PLASMA AND URINARY PROTEINS - Laboratory Diagnostics

- Classification, synthesis, metabolism and function of the major plasma proteins
- Plasmaprotein Electrophoresis and Path Study or Electrophoretic Graphs in Normal and Pathological Conditions
- Dosage of total plasma protein by chemical method (Biuret or Blue of Coomassie), of individual proteins by immunochemical method in Nephelometry
- Laboratory Determination of Urinary Proteins of Clinical Interest: Bence-Jones Protein, Albuminuria and Total Proteinuria

13) ENZYMES - Laboratory Diagnostics

- Enzymes, isoenzymes and enzymatic kinetics. Classification and characteristics of enzymes of clinical interest
- Laboratory methods for determination of enzymatic activity

Dipartimento di Scienze e Tecnologie

- Alteration of enzymatic activity and clinical significance of serum enzymes in hepatocellular, pancreatic, muscular, skeletal, myocardial, bone, blood and tumor diseases

14) RENAL FUNCTIONAL STUDY - Laboratory Diagnostics

- Anatomy and renal physiology. Renal physiopathology related to the filtration, reabsorption and secretion function. Acute and chronic kidney failure
- Non-protein Nitrogen Compounds: Urea, Uric Acid, Creatinine, Creatine, Ammonia. Biochemistry and Physiopathology, Methods of Measurement in Clinical Trials, Pre- and Analytical Variability, Reference Values and Clinical Significance

- Urine examination: Chemical composition of urine and collection of morning urine samples and 24 hours for biochemical examinations. Standard test: determination of chemical-physical and microscopic characteristics by manual methods (use of reactive strips with microscopic urinary sedimentation) and with modern automated methods. Pre- and analytical variability, interpretation and clinical evaluation of results

- Biochemical Markers of Glomerular Filtration: Definition and Meaning of Glomerular Filtration Speed (GFR) and Renal Clearance. Laboratory determination of creatinine, urea and inulin clearance. Determination of glomerular filtration estimate (eGFR) and its diagnostic value. Determination of Cystatin-C

- Biochemical Markers of Nephropathy and Renal Impairment: Laboratory Determination and Clinical Significance of Total Proteinuria and Albuminuria. Meaning of biochemistry of hyperuremia, hyperuricaemia and gout, hypercreatinemia. Laboratory Determination and Biochemical Evaluation of Calcium, Phosphate, Magnesium, Vitamin D and Parathormone. Evaluation of hydroelectrolyte balance by laboratory study of the determination of Sodium, Potassium, Chlorine and Bicarbonates

15) EPATOBILIARY AND PANCREATIC DISEASES - Laboratory Diagnostics

- Hepatobiliary and pancreatic physiopathology. Determination of the activity of liver enzymes such as biochemical markers of hepatic cytolysis and dysfunction of the bile ducts. Dosage of direct and indirect serum bilirubin, Urobilinogen urinary dosage and Ictericum classification. Laboratory evaluation of the peptides synthesis and metabolic function of the liver. Notes on the significance of infectious viral hepatitis markers (HAV, HBV and HCV) and tumor markers. Determination of the activity of pancreatic enzymes such as specific biochemical markers of cellular damage and other non-specific markers of pancreatic dysfunction

16) CARDIOVASCULAR HAZARDS AND RISKS - Laboratory Diagnostics

- Description of normal and ischemic myocardium. Myocardial lesion cardiac biomarkers: determination of creatine kinase, myoglobin and troponin. Myocardial cardiac biomarkers: laboratory determination of natriuretic peptides. Laboratory tests in cardiovascular risk assessment: lipid profile and lipoprotein, basal blood glucose, inflammatory proteins. Homocysteine and its metabolism

17) ENDOCRINE GLANDS DISEASE - Laboratory Diagnostics

Dipartimento di Scienze e Tecnologie

- General principles of hormone synthesis and function. Introduction to endocrinopathies etiopathogenesis. Laboratory analytical methods used for hormone dosing. Pre- and analytical variability. Hormone dosage and biochemical significance for Adenohypophysis and Neurohypophysis, Thyroid, Adrenal Glands, Gonads, Pancreas. Dosing and Evaluation of Pregnancy Hormones

18) TUMORAL DISEASES - Laboratory Diagnostics

- General and epidemiology of tumors. Nature, Classification, Clinical Applications of Major Cancer Biomarkers. Laboratory methods and analytical measurement: detection limit, accuracy and methodological precision. Analytical causes of spurious variations, false positives and false negatives. Diagnostic accuracy indicators, sensitivity and clinical specificity, predictive value of laboratory outcomes in the population