UNIVERSITÀ DEGLI STUDI FIRENZE

Bachelor's Degree Course in Biomedical Laboratory Technologies

TRAINEESHIP AND LABORATORY AIMS
BACHELOR'S DEGREE COURSE IN
BIOMEDICAL LABORATORY TECHNOLOGIES

ACADEMIC YEAR 2014/2015

First year

TRAINEESHIP AND LABORATORY I: 18 ECTS credits + 1 ECTS credit

HOSPITALS:

Azienda Ospedaliero Universitaria Careggi;
Azienda Ospedaliero Universitaria Meyer;
Nuovo San Giovanni di Dio Hospital (Azienda Sanitaria Fiorentina);
Santa Maria Annunziata Hospital (Azienda Sanitaria Fiorentina).

Laboratories included in the training program are:

Careggi Hospital: General Laboratory (Topics: clinical chemistry, hematology, urines, proteins, coagulation) and Atherothrombotic Diseases Laboratory (coagulation).

Meyer Pediatric Hospital: General Laboratory (Topics: clinical chemistry, hematology, urines, proteins, coagulation).

Nuovo San Giovanni di Dio Hospital: General Laboratory (Topics: clinical chemistry, hematology, urines, proteins, coagulation).

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SPECIFIC AIMS

Traineeship I Module

General laboratories: 15 ECTS credits for this traineeship

At the end of the training program, the student will be able to:

1. Evaluate the sample conformity for analytical purposes in order to perform clinical chemistry tests, hematology tests and coagulation tests;
2. Perform data transmission by Laboratory Information System;
3. Perform analysis using traceability requirements for specimens, requests and results;
4. Evaluate the Internal Quality Control and control chards during all analytical series;
5. Evaluate the sample conformity for pool preparation;
6. Manage and perform analytical series in high automation in clinical chemistry and hematology;
7. Determine the main parameters of a Complete Blood Count (CBC);
8. Determine the main parameters of a clinical biochemistry test;
9. Manage and perform a complete urine test;
10. Determine blood plasma protein components.

Atherothrombotic Diseases Laboratory (Azienda Ospedaliero Universitaria Careggi): 3 ECTS credits for this traineeship

At the end of the training program, the student will be able to:

1. Manage and perform analytical series (characteristics, conformity and sample preparation);
2. Perform data transmission by Laboratory Information System;
3. Perform analysis using traceability requirements for specimens, requests and results;
4. Study platelet function applying the Born aggregometry test;
5. Apply the best analytical conditions for platelet function studies;
6. Determine the main parameters of a coagulation test.

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Laboratory I Module

4/5 exercises in analytical chemistry, with the following educational goals:

- To measure volumes and concentrations;
- To determine the weight of liquid and solid substances using technical or analytical balances;
- To take care of the assigned glassware;
- To measure the pH of a solution;
- To prepare buffers;
- To titrate solutions of unknown concentration;
- To extract solvents of different polarity;
- To separate substances by Thin-Layer Chromatography.

Second year

TRAINEESHIP AND LABORATORY II: 23 ECTS credits + 1 ECTS credit

HOSPITALS:

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Azienda Ospedaliero Universitaria Meyer;
Nuovo San Giovanni di Dio Hospital (Azienda Sanitaria Fiorentina);
Santa Maria Annunziata Hospital (Azienda Sanitaria Fiorentina);
ISPO (Istituto per lo Studio e la Prevenzione Oncologica).

Laboratories included in the training program are:

Careggi Hospital: General Laboratory (immunometry section), Allergology and Autoimmunity, Anatomical Pathology, Microbiology, Seroimmunology, Forensic Toxicology.

Nuovo San Giovanni di Dio Hospital: Anatomical Pathology.

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SPECIFIC AIMS

Traineeship II Module

Management of the pre-analytical phase

At the end of the traineeship, the student will be able to:

1. Evaluate the sample conformity in the pre-analytical phase in the following diagnostic areas: immunometry, microbiology, seroimmunology, immunology, anatomical pathology, cytology, forensic toxicology.
2. Prepare the sample to perform tests in the different diagnostic fields of study.

Management of the analytical phase

At the end of the traineeship, the student will be able to:

1. Perform analyses applying the studied techniques, under the supervision of the assigned clinical tutors, according to the protocols used in the different diagnostic fields;
2. Evaluate the performance of the analytical session applying the acquired knowledge.

In particular, in each diagnostic field the student, at the end of the traineeship, will be able to:

IMMUNOMETRY Laboratory:

1. Validate the specific calibration curve;
2. Validate the analytical sessions applying the acceptance rules related to the Internal Quality Control;
3. Perform the following tests:
    a. Urine cortisol;
    b. Macroprolactin;
    c. Pregnancy test;
    d. Urine estradiol;
4. Perform tests in automation;

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5. Describe the analytical techniques used in the context of the immunoenzymatic reactions (ELISA - competitive and non-competitive methods, revelation systems in chemiluminescence, electrochemiluminescence and immunofluorescence).

FORENSIC TOXICOLOGY Laboratory:

1. Apply the ethical and deontological code required in the forensic field;
2. Manage specimens in the Forensic Toxicology Laboratory applying the specific forensic procedures;
3. Observe the analytical methods used to perform the following specific tests:
    a. Alcohol test in blood samples;
    b. Extractive analysis for the determination of Cocaine and its main metabolites in keratin;
    c. Extractive analysis for the determination of Methadone and its main metabolites in keratin;
    d. Extractive analysis for the determination of Morphine and its main metabolites in keratin;
    e. Extractive analysis for the determination of the Cannabis active principle in keratin;
    f. Extractive analysis of markers of use and abuse of alcohol in keratin;
4. Evaluate the suitability of the samples for further analysis and/or confirmation test.

ALLERGOLOGY AND AUTOIMMUNITY Laboratory:

1. Apply analytical methods in molecular allergology;
2. Perform the lymphocyte typing in B-lymphoproliferative disorders;
3. Apply analytical methods to perform the following tests:
    a. Anti-Nuclear Autoantibodies (ANA);
    b. Anti-dsDNA antibodies and antibodies to Extractable Nuclear Antigens (ENA);
    c. Autoantibodies in autoimmune hepatopathies and cholestatic diseases.

ANATOMICAL PATHOLOGY Laboratory:

1. Evaluate the sample conformity in the pre-analytical phase;
2. Prepare paraffin-embedded specimens;
3. Prepare glass slides with paraffin sections: cutting by microtome;

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4. Perform the main staining procedures in the anatomical pathology field, especially the hematoxylin and eosin staining;
5. Apply the main immunohistochemistry analytical techniques;
6. Describe the morphological characteristics of a histological specimen;
7. Intraoperative sampling: prepare a glass slide using the cryotome, perform the hematoxylin and eosin staining;
8. Adopt the safety standards of the Anatomical Pathology Laboratory.

CYTOLOGY:

1. Evaluate the sample conformity in the pre-analytical phase;
2. Urine cytology: prepare the glass slide and perform the *Papanicolau* staining;
3. Perform the FISH test;
4. Liquid-Based Cytology (LBC) with different types of specimens: prepare the glass slide and perform the *Papanicolau* staining or hematoxylin and eosin staining;
5. Liquid-Based Pap Test: prepare the glass slide and perform the *Papanicolau* staining;
6. Prepare cytological specimens (cell blocks);
7. Adopt the safety standards of the cytological laboratory.

MICROBIOLOGY:

1. Prepare cultures (using the different seeding techniques for microbiological specimens) and bacterial suspensions;
2. Prepare microscope slides;
3. Stain the microscope preparations with the Gram staining method;
4. Recognize, by microscopic observation, the most common bacterial types (*staphylococci*, *streptococci*, *Gram-negative* and *Gram-positive bacilli*);
5. Perform antibiograms according to the Kirby-Bauer agar diffusion method;
6. Use the mass spectrometry technology (MALDI-TOF) for the identification of microorganisms isolated from pathological materials;

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7. Apply the biosafety procedures and rules, according to the specific risk level, in order to prevent infectious diseases transmission.

SEROIMMUNOLOGY:

1. Perform serological diagnostic tests related to sexually transmitted diseases: Lue test I and II level, chemiluminescence methods, RPR test, TPHA test (indirect hemagglutination assay and flocculation), diagnostics of HIV infection (chemiluminescence method and Western Blot as confirmation test);
2. Perform serological diagnostic test related to Toxoplasmosis infection: chemiluminescence methods and Remington assay in immunofluorescence;
3. Perform serological diagnostic tests related to EBV infection (screening methods).

Management of the post-analytical phase

At the end of the traineeship, the student will be able to:

1. Describe all the analytical methods used and the validation parameters of the assays;
2. Evaluate the performance and the reliability of the analytical results;
3. Apply the protocols to end the work: to store or dispose of the analyzed specimens, to shut down and maintain the instruments, to maintain the personal workplace;
4. Apply the rules and regulations concerning safety and biosafety, according to the specific risk level.

Laboratory II Module

- Exercises concerning specific methods in anatomical pathology and microbiology.

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Third year

TRAINEESHIP AND LABORATORY III: 19 ECTS credits + 1 ECTS credit

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Nuovo San Giovanni di Dio Hospital (Azienda Sanitaria Fiorentina);
Santa Maria Annunziata Hospital (Azienda Sanitaria Fiorentina).

Laboratories included in the training program are:

Careggi Hospital: Cytogenetic Diagnostics, Blood Bank, Cord Blood Bank, Immunogenetic Service, Toxicology and/or Industrial Toxicology Laboratory.

Meyer Hospital: Blood Bank

Nuovo San Giovanni di Dio Hospital: Blood Bank

SPECIFIC AIMS

In each diagnostic field the student, at the end of the traineeship, will be able to:

Study of transplantation systems

A. <u>Cord Blood Bank</u>

1. **Access to the controlled access laboratory:**
   a. Adopt the rules of conduct required to access into controlled rooms, in particular in the laboratory dedicated to manipulation of stem cells from the cord, peripheral and bone marrow blood;
   b. Preserve biosafety of laboratory personnel patients and manipulated specimens used for transplantation purposes.

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2. **Working procedures for sterility preservation in the biosafety cabinet:**
    a. Adopt proper behaviors and use specific clothing to preserve sterility;
    b. Perform procedures in order to preserve biosafety and cellular products.
3. **Manipulation, storage, preservation and re-infusion of stem cells from cord and peripheral blood:**
    a. **Manipulation:** evaluate the conformity of the blood bag; collect, in sterility conditions, a specimen for cellular counting and characterization (cytofluorimetric analysis) and perform automatic concentration of the blood bag if required;
    b. **Cryopreservation:** inject a freezing mixture in the blood bag;
    c. **Storage:** place the blood bag in liquid nitrogen for a correct cryopreservation;
    d. **Re-infusion:** thaw a cryopreserved blood bag and prepare it for re-infusion.
4. **Identification and traceability of products:**
    a. Apply procedures for identification of units, samples, documents (on papers and digital), as well as of analytical data produced;
    b. Apply procedures for the traceability of the whole process.
5. **Management of cryobiological room and liquid nitrogen:**
    a. Adopt the proper behaviors in a cryobiologic room, considering the cryogenic liquid-related risks;
    b. Get into and manage a controlled access laboratory;
    c. Perform working procedures in the biosafety cabinet of the crybiological room;
    d. Manipulate, store and preserve stem cells from cord and peripheral blood for re-infusion;
    e. Apply procedures for identification and traceability processes.

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B. Blood Bank:

1. Apply procedures for identification and traceability of the donation process;
2. Perform the Indirect Coombs' Test (ICT) - manual and automatic methods;
3. Perform complete determination of the blood type - direct and indirect methods;
4. Perform the blood type determination and interpret the analytical results (AB0 - Rh - Kell systems and other blood types);
5. Interpret the analytical results of ICT and Direct Coombs' Test (DCT);
6. Evaluate cross-matching of red blood cells, plasma and platelets;
7. Perform and interpret the analytical results of cross-matching test and pre-transfusion test;
8. Separate, preserve and identify blood components.

C. HLA cross-matching:

1. Apply identification and traceability procedures for data and specimens;
2. Evaluate the conformity of the specimens (donor and recipient);
3. Perform HLA-typing by molecular biology (SSO-luminex, SSP):
   a. Electrophoretic run;
   b. Agarose gel preparation;
   c. Band visualization (SSO-luminex for automatic evaluation of the amplification product);
   d. Serum antibody search by luminex;
   e. Cytotoxic antibody search;
   f. Cytotoxic cross-matching.

Pharmacotoxicology Laboratory:

1. Prepare mobile phases used in HPLC;
2. Reconstitute lyophilized standards and controls;
3. Evaluate sample conformity;
4. Perform the main sample extraction techniques using the HPLC system;

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5. Apply the traceability procedure of the analytical process;
6. Evaluate the extraction procedure of the sample;
7. Organize the activity according to the required instrumental resources;
8. Condition the HPLC system;
9. Evaluate and interpret the calibrator chromatogram;
10. Perform a calibration;
11. Perform sample injections in the HPLC system;
12. Evaluate the analytical results according to the reference standards;
13. Ensure the repeatability of the performed analyses (preparation and use of the internal standard);
14. Evaluate the obtained chromatogram (qualitative and quantitative analysis);
15. Evaluate the analytical performance using the Quality Control (QC);
16. Apply the procedure to end the work.

Genetic and cytogenetic diagnostics:

1. Perform karyotype analyses in peripheral blood:
    a. Preparation of instruments, specific culture media and reagents and setting up of cell cultures from peripheral blood;
    b. Use of the computer system;
    c. Use of the Harvester instrument to perform the automatic fixing of the peripheral blood culture;
    d. Preparation of a chromosome smear from peripheral blood;
    e. Use of the proper staining methods for the glass slide;
    f. Use of the microscope;
    g. Karyotyping.

Laboratory III Module

- Evaluations on instrumental reports in clinical biochemistry and hematology for technical validation;
- Simulations of the final examination.

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