

RECRUITING AND TRAINING PHYSICIANS-SCIENTISTS TO EMPOWER TRANSLATIONAL RESEARCH

A MULTILEVEL TRANSDISCIPLINARY APPROACH

FOCUSSED ON METHODOLOGY, ETHICS AND INTEGRITY IN BIOMEDICAL RESEARCH



RESEARCH TRAINING PROGRAM

I. General Information

Title of the research project:

Collagen structure study through scanning and transmission electron microscopy.

Name and address of the department:

DIMIT - Human Morphology Lab

Student's supervisor:

Marina Protasoni

II. Description of the project

The program aims to take the student through the different steps of scientific research. The main scientific goal of the project will be studying in detail the fine structure of collagen fibrils in human body. Scientific literature shows a substantial lack of understanding of collagen structure in different body districts, how collagen fibrils are created and the morphological mechanism through which they interact with other molecules of extracellular matrix. Further understanding of this field might lead to the creation or improvement of biomaterial which may be used in clinical practice. The study will be conducted on collagen rich tissues, in particular on Human tendons, adipose and connective tissue.

The techniques used in this field of study for collagen fibrils are preparation of human samples for electron microscopy (fixation, dehydration, embedding in resin, ultrathin cutting and Staining). Observation of the samples with Scanning and Transmission Electron Microscope. Finally the analysis of the images taken with specific software (FIJI and AI based) the data and results will be eventually elaborated in a scientific publication.

The research group has been active on the ultrastructural research of collagen until the end of 1990s with publication of scientific papers and systematic reviews. National and international collaborations have been active on this field for 2 years now. This specific project will be active from 2024 on, for undergraduate Medical Students.

Type of research project:

Basic science

Clinical research without lab work

Clinical research with lab work

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III. Student's involvement

- | | |
|--|---|
| The student will mainly observe | <input type="checkbox"/> YES <input type="radio"/> NO |
| The student will observe the experiments but will be involved in data analysis | <input type="checkbox"/> YES <input type="radio"/> NO |
| The student will take active part in experiments ("lab work") | <input type="radio"/> YES <input type="checkbox"/> NO |
| The student will take active part in clinical examination (clinical research) | <input type="checkbox"/> YES <input type="radio"/> NO |
| The student will be allowed to work with patients | <input type="checkbox"/> YES <input type="radio"/> NO |

What are the tasks expected to be accomplished by the student?

The student will gain autonomy in the following tasks/skills:

- Preparation of Samples to be analysed with TEM and SEM techniques including ultrathin cutting, staining and proficient observation;
- Performing bibliography research;
- Participation to the regular Laboratory Meetings;
- Qualitative and quantitative analysis and discussion of morphological data;
- Organising and conducting an experimental procedure, reporting to supervisors;
- Write a scientific essay reporting what has been obtained.

What is expected from/what will be the general outcome of the student?

- To prepare a poster / presentation / scientific report / abstract
- The student's name will be mentioned in a future publication
- Opportunity to present together with the supervisor the results on a conference
- No specific outcome is expected

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IV. Requirements

What skills are required from the student?

The student is required no previous skills/knowledge but the following criteria would be beneficial:

- Basic experience with lab practice
- Team work and learning attitude

Is there any special knowledge or a certain level of studies needed?

Subjects passed:

Human Anatomy; Human Physiology

Previous experience with:

Certificate of:

None

Are there any legal limitations in the student's involvement in the project?

YES NO

If yes, what are the limitations?

For the use of students considering participating in the project, further information can be found from the following references:

- Wess T.J. Collagen fibril form and function. *Advances in Protein Chemistry* (2005); 70:341-374
- Raspanti M. et al. Not only tendons: The other architecture of collagen fibrils. *Int J Biol Macromol.* (2018); 107:168-1674
- Revell C.K. et al. Collagen fibril assembly: New approaches to unanswered questions. *Matrix Biology plus* (2021); 12:100079

V. Schedule

Duration of the project:

1 month 2 months 3 months

There are approximately 4 hours of work per day.

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Available months:

January February March April May June
 July August September October November December

How many students can you accept to the project at the same time? 1

Special remarks:

(e.g., students should bring a stethoscope and a white coat, any vaccinations required, etc.)

Students should bring a white coat

NOTE: a scientific report is required at the end of the program