



UNIVERSITÀ  
POLITECNICA  
DELLE MARCHE

---

**Artificial Intelligence Applied to  
Advanced Imaging of Collagen-  
Based Tissues in Physiological,  
Pathological and Tissue  
Engineering Conditions**

**Prof. Alessandra Giuliani**

Dept. of Odontostomatologic and Specialized  
Clinical Sciences (DiSCO) - [www.univpm.it](http://www.univpm.it)



## Supervisor: Prof. Alessandra Giuliani

### Research Group Description

**Prof. Alessandra Giuliani**, PhD; Associate Professor in  
Applied Physics, <https://orcid.org/0000-0003-4177-7441>  
([Publication List](#), H-index = 26)

Head of the Applied Physics Group, Dept-DiSCO  
Università Politecnica delle Marche.

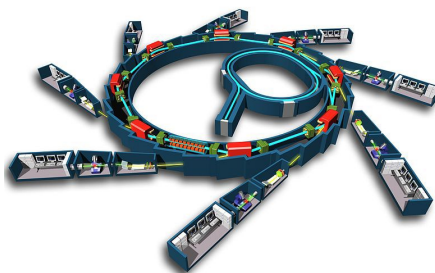


### **Applied Physics Group (SSD PHYS-06/A) in the Medical Area - Dept. DiSCO**

The research lines of the group focus on tissue physiopathology, biomaterials, tissue engineering and regenerative medicine. The aim of the research is to study, using advanced physical techniques based on synchrotron radiation, the structural changes of different types of biological tissue when affected by specific pathologies (advanced diagnostics), in conditioned environmental conditions (such as micro- or macro-gravity), or to verify the outcome of a treatment, often performed with innovative tissue engineering techniques. We are approaching this study also with the support of digital platforms suitable for the application of artificial intelligence to image processing.

## Available experimental and data analysis techniques

Access to Synchrotron imaging beamlines  
at European Large Scale Facilities



X-ray high resolution detector  
granted to ELETTRA Synchrotron



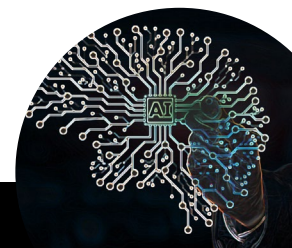
Elettra Sincrotrone Trieste



Benchtop  
microtomographic system



Dedicated HW and Data Storage



Digital Platforms for Data Analysis and  
Artificial Intelligence



UNIVERSITÀ  
POLITECNICA  
DELLE MARCHE

# The Department of Odontostomatologic and Specialized Clinical Sciences

Director: Prof. Andrea Giovagnoni

## AT A GLANCE

DISCO



Last three years  
2022-23-24

15 Scientific Areas  
MEDS-07/B, MEDS-14/B, MEDS-14/C, MEDS-16/A, MEDS-22/A, MEDS-22/B, MEDS-20/A, MEDS-21/A, MEDS-26/A, MEDS-08/C, MEDS-26/B, BIOS-07/A, BIOS-08/A, BIOS-09/A, BIOS-10/A, PHYS-06/A



617  
Publications



45 Staff

>2.700.000 €  
Research income



30 PhD, Post-doc,  
Research fellows



1 Centre of Artificial Intelligence & Digital Health in Medicine and Biology AIDH  
1 Centre of Health Education and promotion (CIESS)

Teaching programs for **undergraduates** in Medicine and Surgery, Dentistry, Professional education, Physiotherapy, Dietetics, Dental hygiene, Nursing, Speech Therapy, Obstetrics, Biomedical laboratory techniques, Prevention techniques in the environment and workplace, Medical, Imaging and Radiation Therapy techniques.

**Postgraduate Medical Training** specialty in Gynecology and Obstetrics, pediatrics, radiology, urology, nuclear medicine



### Master's Degree in:

- Nutrition and Dietetics;
- Applied Nutrition and Dietetics;
- Sports Applied Nutrition and Dietetics;
- Vegetarian Nutrition and Dietetics;
- Operative management of the pathology of the lower genital tract of the endometrial cavity
- Expert in diet planning
- Nutrition in Physiological condition
- Nutrition in pathological condition

8 Clinical research Units

5 Research Laboratories



2025

# Artificial Intelligence Applied to Advanced Imaging of Collagen-Based Tissues in Physiological, Pathological and Tissue Engineering Conditions

**Mechanical stimuli are regulators of the extracellular matrix (ECM) activity**, with special reference to collagen bundles: sustained mechanical stimulation may lead to modifications of the collagen composition, amount and distribution. These interactions can determine pathophysiological processes, including **developmental defects, fibrosis, inflammatory diseases, tumor growth and metastasis**. Thus, **maintaining or restoring tissue tension, by modulating external forces**, is key to the success and regulation of tissue remodeling/repair and wound healing.



## Two main objectives:

- (1) the **identification of three-dimensional morphometric parameters** deriving from the tomographic image analysis of pathological (fibrotic or cancerous) and regenerated collagen-based tissues, through **segmentations guided by artificial intelligence** followed by **data mining**;
- (2) to **reconstruct volume forces and contact forces acting locally** in these contexts.