Title:

New research and developments in engineering for biomedical applications

Abstract:

This course will be focused in the new challenges that current society demands in biomedicine.

Two different approaches will be proposed for that purpose.
The first one will try to set the new developments in robotics and electronic devices that are being implemented for medical issues.
The second approach will deal with the new research in biomedical fields, always from an engineering point of view

The course will present a global perspective both from the point of view of the academic research, carried out at different projects at Universidad Carlos III de Madrid, and the latest applications in society.

Monday 01/07:

Date: 01/07	9:30-11:30
Department: Bioengineering and Aerospace Engineering Department **Speaker:** Sara Guerrero.	

Title: Tissue Bioengineering and Regenerative Medicine. Skin Diseases: bench-to-bedside.

Abstract:

Tissue Bioengineering and regenerative medicine are fields crucial for the development of personalized medicine. This talk will deepen in the main challenges of skin tissue engineering and will discuss some of the recent applications in these fields. We will talk about the principles of skin tissue engineering, and its use for diseases modeling and clinical applications.

Bioengineered skin, developed in our laboratory, has been used in apreclinical context in order to model different genodermatoses, allowing the deeper understanding of different rare skin diseases and providing an *in vivo* platform that faithfully recapitulates the structure and function of the human skin, that allows the testing of new therapeutic agents, that cure or improve the quality of life of patients with no other therapeutic alternative.

In addition, these skin substitutes have demonstrated its clinical applications in the treatment of patients with different pathologies. In that context, our group has a clear translational orientation by which, the results of research done in the laboratory are directly used to develop new ways to treat patients. We will review the main leading research projects on this field from Tissue engineering and regenerative medicine group (TERMEG) at Universidad Carlos III de Madrid.

Date: 01/07	12:00-14:00

Department: Bioengineering and Aerospace Engineering Department
Speaker: Diego Velasco.

Title: 3D skin bioprinting/ skin-on-a chip: technologies, applications and future

Abstract:

Based on the 3D printing technologies and the concepts developed in tissue engineering during the last decades, 3D bioprinting is emerging as the most innovative and promising technology for the generation of human tissues and organs. In the case of skin bioprinting, thanks to the research process carried out during the last years, interfollicular skin has been printed with a structural and functional quality that paves the way for clinical and industrial applications.

On the other hand, organ/tissue-on-a-chip devices are currently on the forefront of developing technologies. Reconstruction of full-thickness skin equivalents with physiologically relevant cellular and matrix architecture is gaining importance as an in vitro tool for basic research, and for the pharmaceutical, toxicological, and cosmetic industries.

This talk addresses the main challenges of 3D skin bioprinting and skin-on-a-chip technologies and discuss some of the recent applications in these fields. Tissue Engineering and regenerative medicine group (TERMEG) projects of the Carlos III University of Madrid will be taken as the background for this talk.

Tuesday 02/07

Date: 02/07	9:00-11:00
Department: Bioengineering and Aerospace Engineering Department **Speaker:** Arrate Muñoz.	
Title: New research and developments in engineering for biomedical applications **Abstract**: This course will be focused in the new challenges that current society demands in biomedicine. Two different approaches will be proposed to that purpose. The first one will try to stabilize the new developments in robotics and electronic devices that are being implemented for medical issues The second approach will deal with the new research in biomedical fields, always from an engineering point of view The course will present a global perspective both from the point of view of the academic research, carried out at different projects at Universidad Carlos III de Madrid, and the latest applications in society	

Date: 02/07	11:30-13:30
Department: Bioengineering and Aerospace Engineering Department **Speaker:** David Pérez**.**	
Title: Bioengineering, broadening the human frontiers to the service of medicine **Abstract**: Bioengineering is in a broad sense the interface of medicine and a wide range of engineering principles to understand, modify, or control living systems. From the ancient Greek when biosignals were sensed by doctors to the irruption of Nuclear Physics in the early 20th century which set the basis of the current imaging modalities such as X-Ray, Magnetic Resonance Imaging or Positron Emission Tomography, the interest has been focused on understanding the structures and functions of the body. The body has been already completely mapped whereas the functioning is the last frontier. Over the past decade, dramatic increases in computational power and the development of machine learning techniques, have allowed the development of powerful computer-assisted analytical approaches to data from various types. One of the most prolific areas is image analysis and its various application fields, such as histopathology. In this seminar, two examples will be presented: communications between cells via exosomes and tuberculosis infection spread. Bioengineering is of course taking advantage of the massive expansion of Internet of Things, which has brought together technologies, protocols and application issues by the development of smart sensors capable of decision making, communication technologies and Internet protocols. Finally, we will discuss the technologies under development in the field of Medical Imaging such as Computed Tomography and Positron Emission Tomography.	

13:30-14:30. Visit to labs: David Pérez**.**

Wednesday 03/07

Date: 03/07	9:00-11:00
Department: Systems Engineering and Automatic **Speaker:** Luis Enrique Moreno**.**	
Title: Surgery Robotics **Abstract:** Laparoscopic surgery has evolved toward surgery robots, in the talk the evolution and different aspects of advanced surgery robots are presented and discussed.	

Date: 03/07	11:30-13:30
Department: Systems Engineering and Automatic **Speaker:** Dorin Copaci**.**	
Title: Exoskeletons, prosthesis and rehabilitation robotics **Abstract:** In the last decade, different kind of robotized devices has been developed to deal with assistance and rehabilitation. In the talk different rehabilitation robots, exoskeletons, prosthesis and powered ortheses are introduced and discussed.	

13:30-14:30. Visit to labs: Dolores Blanco

Thursday 04/07

Date: 04/07	9:00-11:00
Department: Systems Engineering and Automatic **Speaker:** Concepción Alicia Monje	
Title: New research and developments in engineering for biomedical applications **Abstract:** This course will be focused in the new challenges that current society demands in biomedicine. Two different approaches will be proposed to that purpose. The first one will try to stabilize the new developments in robotics and electronic devices that are being implemented for medical issues The second approach will deal with the new research in biomedical fields, always from an engineering point of view The course will present a global perspective both from the point of view of the academic research, carried out at different projects at Universidad Carlos III de Madrid, and the latest applications in society.	

Date: 04/07	11:30-13:30
Department: Systems Engineering and Automatic **Speaker:** Alvaro Castro	
Title: Robots for elders **Abstract**: The unceasing aging of the population in developed countries is leading advanced societies to new problems that are not solved yet. It is expected that, in a near future, health care systems will straggle to provide the proper services to the growing population of seniors, mainly due to the limited economic resources and the shortfall of qualified worker. The rise of social robots represents an interesting opportunity to ameliorate the economic burden for health care systems and to extend the independent living of older adults. This talk will review the main robotic applications focused on the elders and, in particular, we will detail the robot Mini (developed in the UC3M) and its applications.	

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Bioengineering is of course taking advantage of the massive expansion of Internet of Things, which has brought together technologies, protocols and application issues by the development of smart sensors capable of decision making, communication technologies and Internet protocols.
Finally, we will discuss the technologies under development in the field of Medical Imaging such as Computed Tomography and Positron Emission Tomography.