

Title:

Emerging Applications and Innovative Research in Biomedicine and Renewable Energies

Abstract:

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

The course will present a global view 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 and technical requirements that are driving the developments of both sectors.

This course will try to show the participants their importance from a social point of view, and their impact in the development of modern societies

Tuesday 23/04:

Date: 23/04	9:30-11:30
Department: Thermal and Fluids Engineering Speaker: Jesús Gómez.	
Title: Introduction to renewable energies and its challenges	
Abstract: Our society faces the challenge of supplying energy to a growing population in a climate change scenario. The solution must be addressed in a clean and renewable way. To do so, many governments and international institutions have promoted the development of renewable energies as they are free of direct pollution and carbon emissions. The challenges that should solve these renewable technologies and the solutions proposed by both the research and the industry communities will be detailed in this talk.	

Date: 23/04	12:00-14:00
Department: Thermal and Fluids Engineering Speaker: Jesús Gómez.	
Title: Efficiency trends on buildings	
Abstract: The building sector makes a significant contribution to global emissions and need to play a central role in efforts to reduce them. In fact, this sector consumes roughly 36% of energy consumption and produce 40% of CO2 emissions in the world. Furthermore, improving the energy efficiency of buildings can also generate other economic, social and environmental benefits. Better performing buildings provide higher levels of comfort and wellbeing for their occupants, and improve health by reducing illnesses caused by a poor indoor climate. In this sense, new building designs and new energy saving strategies will be explained.	

Wednesday 24/04

Date: 24/04	9:00-11:00
Department: Thermal and Fluids Engineering Speaker: Carolina Marugán.	
Title: An overview of renewable energies	
Abstract: In this talk we will detail the characteristics of different renewable energies technologies. In particular, we will focus on bioenergy, solar energy (photovoltaic and thermo-solar), wind energy or geothermal energy. We will study the characteristics of the different resources and the estimated maximum capacity for energy production in different regions of the world.	

Date: 24/04	11:30-13:30
Department: Thermal And Fluids Engineering Speakers: Carolina Marugán.	
Title: The future of renewable energies	
Abstract: In this module we will focus on one hand in the challenges for renewable technologies and on the other, on the new research lines in renewable energies. Regarding the challenges, the renewable sector will need to overcome at least two significant barriers: the price (only the renewable technologies that are able to compete at lower cost will last) and the inflexibility (in order to be able to cover the demand, storage systems have to be developed). Concerning the new research lines, we will see an overview of the new materials to manufacture solar cells, new designs of solar receivers for CSP or advanced storage systems such as flow batteries or solid batteries for electric cars.	

13:30-14:30. Visit to labs: Carolina Marugán

Thursday 25/04

Date: 25/04	9:00-11:00
Department: Bioengineering and Aerospace Engineering Department Speaker: Arrate Muñoz.	
<p>Title: Computational bioimaging: Fostering a revolution in healthcare</p> <p>Abstract: This talk addresses the main developments in field of computational bioimaging that are driving a major revolution in healthcare.</p> <p>For centuries, the observation of specimens under optical microscopes have been performed manually being the comparison between different groups of specimens a qualitative task. The incorporation of digital cameras and computers in the 80s launched the initial steps of more objective, less time consuming and accurate characterization of specimens. Those developments were key for basic molecular research, the pharmacological industry and the clinic. Nevertheless, they were infant steps when compared with the progress experienced in the last couple of decades. The increase in the computational power and other technological developments that will be presented in the talk are driving a revolution in healthcare. Some of them are: The incorporation of digital illumination, the hardware-reconstruction software pairing, the surge of superresolution microscopy and the incorporation of novel probes (i.e., nanoprobes, infrared imaging). Besides, we will put emphasis in today's adoption of deep learning tools on a wide variety of applications that it is opening completely new and unexpected venues on computational imaging for healthcare.</p>	

Date: 25/04	11:30-13:30
Department: Bioengineering and Aerospace Engineering Department Speaker: Javier Pascau.	
<p>Title: Image guided surgery in oncological treatments</p> <p>Abstract: Intraoperative Electron Beam Radiation Therapy (IOERT) procedures involve the delivery of radiation to a target area during surgery by means of a specific applicator. 10 year ago, we developed a new treatment planning system for IOERT incorporating tools for both surgical simulation and radiation dose distribution estimation. Although the planning step improved treatment quality and facilitated follow-up, the actual position of the patient, the applicator and other tools during the surgical procedure was still unknown. Our research then focused on image-guided navigation technologies for IOERT treatments, with innovative solutions that overcome the limitations of previous systems in complex surgical scenarios. Recently, we have shown how surgical navigation combined with 3D printing allows us to personalize oncological surgery, adapting the treatment to the needs of the specific patient.</p> <p>This talk will present the development of Treatment Planning Systems for IOERT and the advanced image-guided solutions that have been proposed in the last years. Technical details on dose estimation, surgical navigation technologies or clinical 3D printing will be provided. Several clinical applications in oncology will be described, with an special emphasis in the practical difficulties when translating research to the clinical setting. Finally, we will show examples of how navigation and 3D printing have been translated to other clinical environments such as maxillofacial surgery or surgical training.</p>	

13:30-14:30. Visit to labs: Javier Pascau

Friday 26/04

Date: 26/04	9:00-11:00
Department: Bioengineering and Aerospace Engineering Department Speakers: 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 a preclinical context in order to model different genodermatoses, allowing the deeper understanding of different rare skin diseases and providing an <i>in vivo</i> 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: 26/04	11:30-13:30
Department: Bioengineering and Aerospace Engineering Department Speakers: Diego Velasco.	
<p>Title: 3D skin bioprinting/ skin-on-a chip: technologies, applications and future</p> <p>Abstract:</p> <p>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.</p> <p>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.</p> <p>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.</p>	