# PhD in Information and Communication Technology for Health

# Università degli Studi di Napoli Federico II

# Module Title: The challenges in the diagnosis and management of biofilm related infections: the customization, the use of nanoparticles and much more.

# Lecturer: Dr. Giovanni Balato

## University of Naples Federico II

## Department of Public Health

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## BIO: Giovanni Balato, born in 1984, has graduated in Medicine at the University of Naples Federico II, on 2009, and specialized in Orthopedics and Traumatology in 2015, with a specific interest in knee arthroplasty, primary and revision, particularly septic ones. He completed a clinical fellowship in Hip and Knee Adult Reconstruction at the IFCA Hospital, in Florence. In December 2015, he became PhD in Microbiology at Second University of Naples with thesis: Antimicrobial efficacy of antibiotic bone cement: in vitro study on antibiofilm activity. He is actually holding the position of assistant professor at the University Federico II. He is author and co-author of 62 publications, 13 of them specifically on knee infection after TKA. He has presented from the podium on knee replacement and related matters in 12 international meetings. He has many ongoing research projects on PJI, in particular, he is currently investigating the implementation of diagnostic processes in PJI, biofilm formation on antibiotic bone cement , and the development of specific biofilm dyes that could help orthopedic surgeons to remove all the infected tissues during PJI surgical treatment.

# Lecturer: Prof. Carlo Petrarca

## University of Naples Federico II

## Department of Electrical and Information Technologies

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## BIO: Carlo Petrarca was born in Caserta (Italy) in 1967. He is presently Associate Professor of Electrical Engineering at the Department of Electrical Engineering and Information Technology, University of Naples FEDERICO II, teaching courses on basic circuit theory and characterization and modelling of materials for electrical engineering. His research interests include high voltage testing and modelling, non-destructive testing of components, electromagnetic characterization and treatment of innovative materials, lightning effects on power systems, complex networks analysis.

# Lecturer: Dr. Marco Balato

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## Department of Electrical and Information Technologies

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## BIO: Marco Balato was born in Napoli (Italy) in 1984. He received the Master degree in electronic engineering and the Ph.D. degree in Energy Conversion from the Second University of Naples “SUN”, Italy, in 2011 and 2014, respectively. He is currently working, as Assistance Professor, in the Department of Electrical and Information Technologies of University of Naples "Federico II". His main research interests are in power electronics, modeling, and control techniques for energy conversion systems from renewable sources.

# Dates and Locations (rooms are in ed.XX, floor I, via Claudio 21, Napoli)

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| --- | --- | --- | --- |
| Date | Hours | Room | Lecturer |
| 29 settembre 2020 | 9.30-12.30 | Softel I floor | G. Balato |
| 01 ottobre 2020 | 14:30-17:30 | Softel I floor | G. Balato/M. Balato |
| 08 ottobre 2020 | 9.30-12.30 | Softel I floor | G. Balato/M. Balato |
| 15 ottobre 2020 | 9.30-12.30 | C2A Ground Floor | G. Balato/M. Balato |
| 22 ottobre 2020 | 9.30-12.30 | Softel I floor | C. Petrarca/M. Balato |
| 23 ottobre 2020 | 9.30-12.30 | C2A Ground Floor | C. Petrarca/G. Balato/M. Balato |

# ECTS Credits: 4 (0.2 per hour)

# Overview

*This course will focus on one of the most important and dramatic complications after medical device implantation such as total joint replacement. Peri-prosthetic joint infections represent until now a challenge for orthopedic surgeons. In the recent years Numerous efforts are made in the context of diagnosis and treatment of surgical site infections. In this field the relation between engineers and physicians is crucial to develop new technology with aim to early detect and treat properly patients with septic complications. The course will provide the students with notions about clinical and therapeutic aspects on periprosthetic infections. Every lesson consists of a first part on the overview of the specific diagnostic and therapeutic options, and a second part on an implementation of different hands-on session to show how to use that technology in practice. At the end of the lesson, students are encouraged to start a discussion on why and how to adopt that virtualization approach in their research activities*.

# Content

**I Lesson - Introduction**: An overview of the Peri-prosthetic joint infections. Focus on Biofilm related infections and on complex diagnostic and therapeutic work-up (3h).

**II Lesson - The role of customization of the joint spacers**: The impact of the knee spacer geometry on the quality of life, on the patient's functional results and on the complexity of the surgical procedure. The simple geometrical guidelines will be described and discussed (3h).

**III lesson – Antibiotic bone cement on the treatment of the bone and joint infections**: An overview of the most common used bone cements for the treatment of biofilm infections. A detailed description of indications, the choice of antibiotics and complications. Moreover, typical antibiotic release profiles will be shown to point out their lack of effectiveness (3h).

**IV Lesson** –**The use of metal nanoparticles in the treatment of biofilm infections:** After an exhaustive description of nanoparticles technology, it will be shown their use as possible indicators in the diagnosis and in guided debridement for surgical management. Moreover, the proper combination between metal nanoparticles and bacterial dye as a rapid diagnostic method will be discussed (6h).

**V Lesson – Smart Knee Brace**: The role of IOT for monitoring sensitive post-operative information: Inflammation, temperature, volume, power, infection and muscle activity. The typical threshold values assumed by the above quantities will be shown in order to design a proper smart knee brace (3h).

**VI Lesson – Conclusions** (2h)

# Notes

Doctoral Students with noticeable experience on this Module topics can participate as Tutors.

Participants to the Module (including those interested to the Tutorship positions) are requested to e-mail to prof. Name of the Professor the following: Student name, name of the PhD course and cycle.

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