

THE ROLE OF BIOFILMS IN CHRONIC INFECTIONS

CU characterization:

CU name: The role of biofilms in chronic infections

Scientific area acronym:

Duration: Modular

Working hours: 168

Contact hours: T (8); L (24)

ECTS: 6

Observations: Observations

Teacher in charge and respective teaching load in the CU: Rita Sobral - 32

Other teachers and respective teaching load in the CU:

Intended learning outcomes (knowledge, skills and competences to be developed by the students):

By the end of this curricular unit, the students should have acquired the following competencies: (1) Describe and explain the molecular basis for the formation of bacterial biofilms of clinical importance.

(2) To distinguish and describe the various techniques used to isolate, characterize, and quantify biofilms.

(3) Compare and contrast the different in vitro and in vivo models developed for the study of bacterial biofilms.

(4) Understand the importance of bacterial biofilms in the context of chronic infections.

(5) To analyze and interpret experimental results of biofilm formation and inhibition in a critical and clear way.

(6) To be able to distinguish and describe the various treatments available and to analyze and compare their effects and outputs.



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Syllabus:

1. Fundamental principles of bacterial biofilm formation – definition, stages of the development process and molecular components.

2. Physiological functions of the biofilm structure - protective role and persistence development.

- 3. Description of multi-species biofilms in a clinical context.
- 4. Biofilms in the context of wounds and invasive medical devices.
- 5. Role of biofilms in chronic infections.
- 6. In vivo and in vitro models for biofilm studies.
- 7. Specific case of biofilm formation by *Escherichia coli*.
- 8. Specific case of biofilm formation by *Staphylococcus aureus*.
- 9. Specific case of biofilm formation by *Pseudomonas aeruginosa*.

10. New therapeutic approaches for the treatment of infections associated with biofilm development.

Evidence of the syllabus coherence with the CU intended learning outcomes:

The content of the classes aims to highlight the fundamental principles of bacterial biofilms in the clinical context and their role in specific situations. The theoretical presentations are structured so to present the concepts established in the literature and describe chosen scientific works that aim to stimulate the student to develop his/her ability to analyze and to describe the molecular phenomena associated with the observations and methodologies exposed using the appropriate concepts and vocabulary.

The experimental component is designed according to the following objectives: (1) complement and reinforce the understanding of the concepts addressed in the theoretical classes, (2) develop technical and experimental capacities and tools for the manipulation of pathogenic bacteria, (3) increase the ability to describe and report in a concise, coherent, and effective manner and with technical and scientific precision, the observation of experiences and results.

Teaching methodologies (including assessment):

The teaching methodology is based on the separation of theoretical and practical contents, with a theoretical class (1h) and a practical class (3h) during four days of the week. The theoretical classes are of expository nature, encouraging the participation of the students. The learning process is complemented by an oral presentation on biofilm development in a clinical context by a microorganism that was not described in class, based on scientific papers retrieved by bibliographic search performed by the students. The oral presentation will be performed by a group of 2 students followed by discussion, to be held during the last 2 theoretical sessions. The practical classes will consist of laboratory sessions in autonomy, followed by treatment and analysis of the results obtained by each student.



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The theorical component will be evaluated by test and/or exam composed of multiple answer questions.

This component contributes 75% of the final grade. The remaining 25% correspond to the evaluation of the oral presentation.

The student who obtains an overall rating not lower than 10 will be approved.

Evidence of the teaching methodologies coherence with the CU intended learning outcomes:

The content of the classes is selected in order to highlight the fundamental principles of the problem of bacterial biofilms and their consequences in the clinical practice, as well as to present a temporal and critical view of the various methods of biofilm analysis and the evolution of the several treatment strategies adopted overtime. The exposure of scientific papers on studies on biofilm development in a clinical context is incorporated into the program in order to stimulate the student to develop his/her capacity of critical analysis and interpretation of results and to be able to describe the molecular phenomena associated with the methodologies exposed using the appropriate concepts and vocabulary.

The experimental component is designed according to several objectives: (1) complement and reinforce the understanding of the concepts addressed in the theoretical classes, (2) develop technical and experimental capacities and tools in the context of the manipulation of pathogenic bacteria that form biofilms, (3) increase the ability to describe and report in a concise, coherent and effective way, and with technical and scientific precision, the observation of the experiments.

References for consultation / mandatory existence:

Microbial Biofilms. 2004. Mahmoud Ghannoum, George A. O'Toole. ASM Press. ISBN : 9781555818944

Bacterial Biofilms. 2008. Romeo, Tony. Springer. ISBN 978-3-540-75418-3.

- Biofilms in Human Diseases: Treatment and Control. 2019. Kumar, S., Chandra, N., Singh, L., Hashmi, M.Z., Varma, A. Springer. ISBN 978-3-030-30757-8
- The Role of Biofilms in Device-Related Infections. 2009. Shirtliff, Mark E., Leid, Jeff G. Springer. ISBN 978-3-540-68119-9
- **Biofilm Infections.** 2011. Bjarnsholt, Th., Jensen, P.Ø., Moser, C., Høiby, N. Springer. ISBN 978-1-4419-6084-9