



# UNIVERSITÀ DEGLI STUDI DI PALERMO

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| DEPARTMENT              | Fisica e Chimica - Emilio Segrè                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |                  |
| ACADEMIC YEAR           | 2022/2023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |                  |
| MASTER'S DEGREE (MSC)   | CULTURAL HERITAGE CONSERVATION AND RESTORATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      |                  |
| INTEGRATED COURSE       | BIOTECHNOLOGIES AND ENTOMOLOGY FOR THE CULTURAL HERITAGE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      |                  |
| CODE                    | 16599                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                      |                  |
| MODULES                 | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                      |                  |
| NUMBER OF MODULES       | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |                  |
| SCIENTIFIC SECTOR(S)    | BIO/03, AGR/11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      |                  |
| HEAD PROFESSOR(S)       | PALLA FRANCO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Professore Associato | Univ. di PALERMO |
| OTHER PROFESSOR(S)      | MANACHINI BARBARA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Professore Associato | Univ. di PALERMO |
|                         | ROSY INES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |                  |
|                         | PALLA FRANCO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Professore Associato | Univ. di PALERMO |
| CREDITS                 | 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |                  |
| PROPAEDEUTICAL SUBJECTS |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |                  |
| MUTUALIZATION           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |                  |
| YEAR                    | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |                  |
| TERM (SEMESTER)         | 2° semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |                  |
| ATTENDANCE              | Not mandatory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                      |                  |
| EVALUATION              | Out of 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |                  |
| TEACHER OFFICE HOURS    | <p><b>MANACHINI BARBARA</b><br/><b>ROSY INES</b></p> <p>Tuesday 10:00 11:30 Viale delle Scienze, 13. Edificio 5A, stanza 004</p> <p>Thursday 10:00 11:30 Ricevimento studenti polo Trapani c/o la sede del polo di Trapani, Via del principe di Napoli e on line su richiesta.</p> <p><b>PALLA FRANCO</b></p> <p>Monday 15:00 17:00 Studio del docente, Dipartimento STEBICEF - Sez Botanica ed Ecologia vegetale, via Archirafi 38 - I piano, 90123 Palermo</p> <p>Wednesday 15:00 17:00 Studio del docente, Dipartimento STEBICEF - Sez Botanica ed Ecologia vegetale, via Archirafi 38 - I piano, 90123 Palermo</p> <p>Friday 14:00 16:00 Studio del docente, Dipartimento STEBICEF - Sez Botanica ed Ecologia vegetale, via Archirafi 38 - I piano, 90123 Palermo</p> |                      |                  |

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| <b>PREREQUISITES</b>      | The student must possess the knowledge acquired during the academic teachings, focused particularly to the Biological Area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>LEARNING OUTCOMES</b>  | <p><b>KNOWLEDGE AND ABILITY OF COMPREHENSION</b></p> <p>The aim of the course is to point out the knowledge of issues related to the assessment of cultural heritage the state of conservation with specific attention to biological deterioration induced by micro (bacteria, fungus) and macro (insects, vegetal systems) biological systems. Knowledge of scientific literature relating to the consolidation and the biopulse of artifacts of historical and artistic interest. Understand and evaluate the potential risks arising from the application of biotechnology for constituent materials and the execution techniques of each type of article. General insight into insects and other arthropods that may cause deterioration of artifacts of historical-artistic interest. Knowledge of the main control and pest management modes.</p> <p><b>CAPACITY TO APPLY KNOWLEDGE AND COMPREHENSION</b></p> <p>Define and draw up appropriate intervention protocols for non-invasive sampling, controlled application, defined both in time and mode for each case, in addition to an adequate control system and combating microbial and entomological infestations in the Green conservation.</p> <p><b>MAKING JUDGMENT</b></p> <p>Evaluate the result of bioeteriogenic identification and technological application, referring to the results of the application of similar methodologies, used for other experiences or reported in literature. Define and apply methodologies that relate to sustainable restoration.</p> <p><b>COMMUNICATIVE SKILLS</b></p> <p>Relate to the issues analyzed and the solutions that can be adopted in order to obtain results that meet both the minimum intervention criteria and the restorative conservation of the artifacts. Ability to use the specific language of these specialized disciplines and to focus on the related issues. Ability to interact responsibly with scientific and restorative experts, defining preventive and restorative conservation interventions, selecting appropriate materials and techniques for appropriate instrumentation.</p> <p><b>LEARNING ABILITY</b></p> <p>Ability to apply the acquired knowledge and to elaborate the results achieved in the works for the preservation or restoration of artifacts of different composition. Ability to implement technical and scientific knowledge and to acquire new ones, both in literature and in the field of molecular biotechnology applied to Cultural Heritage.</p> |
| <b>ASSESSMENT METHODS</b> | <p>The assessment of student learning is to ensure both the possession of the skills and knowledge of the subjects covered by the teaching and the ability to include them in application projects in the field of the preservation and restoration of artifacts of historical artistic interest. In addition, it evaluates the possession of an adequate technical-scientific dictionary and exposure skills. Student assessment is performed by oral exam, covering the topics of both modules: Molecular Biology and Entomology, applied to BB.CC.</p> <p>The final evaluation of the Integrated Course, expressed in thirty-two, is given by the weighted average of the score reached by the student in the two modules. The student passes the exam if he has at least one score of 18/30 in each test. The evaluation will be formulated as follows:</p> <ol style="list-style-type: none"> <li>1) Basic knowledge of the topics covered and limited ability to elaborate acquired knowledge, correlation with specific application aspects for the correct conservation and restoration of cultural heritage. Sufficient ability to analyze the topics presented. Limited autonomy for judging and showing the procedures followed (rating 18-21)</li> <li>2) Good knowledge of the topics covered and good skills in compiling the acquired knowledge, correlating with specific application aspects for the proper conservation and restoration of cultural heritage. Good ability to analyze the topics presented. Good autonomy for judging and showing the procedures followed (rating 22-24)</li> <li>3) Extensive knowledge of the topics covered and more than good skills in the processing of acquired knowledge, correlation with specific application aspects for the correct conservation and restoration of cultural heritage. Good analysis of the arguments presented. Autonomy of judgment and exposure of the procedures followed more than good (rating 25-27).</li> <li>4) Excellent knowledge of the topics covered, excellent skills in compiling the acquired knowledge, correlation with specific application aspects for the correct conservation and restoration of cultural heritage other than those of teaching. Excellent ability to analyze the phenomena presented. Excellent autonomy for judging and showing the procedures followed (rating 28-30)</li> <li>5) Excellent knowledge of the topics covered, excellent ability to compile</li> </ol>                       |

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|                         | acquired knowledge, correlation with specific application aspects for the correct conservation and restoration of cultural heritage other than those of teaching. Excellent ability to analyze the phenomena presented. Excellent autonomy for judging and showing the procedures followed (vote 30 and praise).                                             |
| <b>TEACHING METHODS</b> | The course is annual developed into the two periods of the IV year. In particular, in the first semester there is the module "Molecular Biology applied to Cultural asset." While in the second half, the module "Entomology applied to Cultural asset.". The didactic activity is exclusively carried out by lessons, equipped by multimedia presentations. |

## MODULE APPLIED MOLECULAR BIOLOGY FOR THE CULTURAL HERITAGE

*Prof. FRANCO PALLA*

### SUGGESTED BIBLIOGRAPHY

- Fabbri B. (2012) Science and Conservation in Museum Collection - Nardini Editore, Firenze
- Giordano A et al. (2018) The Conservation of Contemporary paintings: from Dry Cleaning to Micro-emulsions. In Nanotechnologies for Diagnostic, Conservation and Restoration of Cultural Heritage, Elsevier (ISBN 978-0-12-813910-3)
- Giordano A., Cremonesi P. (2019) Gel Rigidi Polisaccaridici per il trattamento dei manufatti artistici", Il Prato, ( ISBN 9788863365016
- Giordano A. Cremonesi P. (2020) New Methods of Applying Rigid Agar Gels: From Tiny to Large-scale Surface Areas, Studies in Conservation, Taylor e Francis, Vol 66,n2 (ISBN –IOD 20201848272)
- Lorusso S. et al (2014) Risk management in the field of cultural heritage: museum, libraries, archives – MIMESIS Editore, Milano, (ISBN 978-88-5753-288-2)
- Palla F & Barresi G (2022) Biotechnology and Conservation of Cultural Heritage, 2nd edition- Springer, (ISBN 978-3-030-97584-5) .
- Palla F. et al (2015) Conservation Science in Cultural Heritage. 15 Special Issue - MIMESIS Editore, Milano (ISBN 978-88-5754-122-8)
- Tiano P. & Pardini C. (2005) LE PATINE. Genesi, significato, conservazione - Nardini Editore , Firenze (ISBN 88-404-4093-3)
- Saiz-Jimenez C. (2013) - Molecular Biology and Cultural Heritage, Balkema, the Netherland (ISBN 905809555X)
- Video, presentazioni ppt e pubblicazioni scientifiche fornite dal docente

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|-------------------------------|-----------------------------------------------|
| <b>AMBIT</b>                  | 50687-Attività formative affini o integrative |
| <b>INDIVIDUAL STUDY (Hrs)</b> | 102                                           |
| <b>COURSE ACTIVITY (Hrs)</b>  | 48                                            |

### EDUCATIONAL OBJECTIVES OF THE MODULE

The module aims is addressed to the assessment of the conservation of cultural heritage with specific attention to biodeterioration, as well as the use of innovative and sustainable methodologies for bio-consolidation and bio-cleaning of artifacts of historical-artistic interest . It also focuses on methods for direct and indirect control and to contrast microbial colonization and entomological infestations using innovative protocols. Critically evaluated possible environment-environment interactions, through the analysis of chemical-physical parameters. Problems related to the conservation and the exploitation of archaeological finds that are submerged and the importance of the study of ancient finds / fossils will be addressed, using anti-DNA analysis. Particular emphasis will be put on the use of bioactive molecules for the biopulse of the surface of the artifacts.

## SYLLABUS

| Hrs | Frontal teaching                                                                                                                                                        |
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| 4   | Issues of the course.<br>Revealing and identifying biodeteriogens by means of technological protocols based on analysis genomic microbial DNA .                         |
| 2   | Hypogeal environments: revealing of microbial taxa in patinas and biofilms                                                                                              |
| 3   | Aerosol of conservation /fruiton environments, sampling (gelatine membrane) and identification of microorganisms detrimental both for cultural assets and human health. |
| 3   | Removal of coherent and incoherent layers.<br>Biocleaning by viable bacterial cells or purified enzymes. Enzymes structure and specificity of action.                   |
| 4   | Characteristics and selective criteria of enzymes in relation to the undesired layers. Hydrolasis (amylase, esterase, lipase, protease) useful in restoration projects. |
| 2   | State of the art of enzymes for restoration of organic (paper, painting on wood or canvas) and inorganic (frescoes) manufacts                                           |
| 4   | Different "dirt" patinas detectable on artworks surface and adequated removal strategies.                                                                               |
| 3   | Selection of experimental condition specific for enzyme application: temperature, salt condition, supports (gel, Nylon membrane).                                       |
| 2   | Green conservation: novel biological molecules with enzymatic or biocidal activity.                                                                                     |
| 2   | Blak-crust: bio-removal by viable bacterial cells.                                                                                                                      |
| 2   | Attention and Risk indexes ,in Cultural Heritage indoor environments, relationship environment/ artwork/human.                                                          |
| 4   | Waterlogged findings: conservative problem for ex situ and in situ conservation and sustainable fruition.                                                               |
| 2   | Ancient DNA                                                                                                                                                             |
| 2   | Morphological and molecular investigation on archaeological findings                                                                                                    |
| 4   | Detection and identification of biodeteriogens through technological protocols based on the analysis of microbial DNA                                                   |
| 3   | In vitro culture: liquid and solid media by samples from woks of arts surface and deep layers.                                                                          |
| 2   | Sample preparation and observation by optical (OM), scanning electron (SEM) and confocal (CLSM) microscopy                                                              |



## MODULE APPLIED ENTOMOLOGY FOR THE CULTURAL HERITAGE

*Prof.ssa BARBARA ROSY INES MANACHINI*

### SUGGESTED BIBLIOGRAPHY

Il testo raccomandato e' (suggested book):

- Chiappini, Liotta, Reguzzi, Battisti. Insetti e Restauro. Calderini Ed agricole 2001. EAN: 9788820646820. ISBN 10: 882064682X

Tuttavia altri testi sono suggeriti e considerati sostanzialmente equivalenti o di approfondimento. /However other books could be considered:

- Caneva, Nugari, Salvatori: La biologia nel restauro, Nardini editore. ISBN 10: 8840440305

- Fausta Gallo: Il biodeterioramento di libri e documenti, Centro studi per la conservazione della carta – ICCROM (1992). ISBN 19871335645

Articoli di approfondimento:

- Manachini B., Billeci N., Palla F. 2013. Exotic insect pests: the impact of the Red Palm Weevil on natural and cultural heritage in Palermo (Italy). Journal of Cultural Heritage, vol. 145: 177-182

- Manachini B., Billeci N., Lo Russo LC., Palla F. 2012. Impoverishment of Sicilian (Italy) historical and cultural assets by an insect alien species: the case of the Red Palm Weevil. Conservation Science and Cultural Heritage 12: 145-165.

- Isolani B, Manachini B., De Ranieri S. 2012. 1793 - I beni naturali diventano beni culturali. In Sistemi biologici e beni culturali Palermo. Eds Regione Siciliana - Assessorato dei beni Culturali, Ambientali e I.S. - CRPR. : Regione siciliana. 68-89. ISBN 978-88-6164-200-3.

- Sineo, L., Carotenuto, G., Di Lorenzo, D., Picone, B., Manachini, B., Palla, F. 2012. La cripta dei cappuccini di palermo. Un laboratorio multidisciplinare. In Sistemi biologici e beni culturali. Eds Regione Siciliana - Assessorato dei beni Culturali, Ambientali e I.S. - CRPR. : Regione siciliana. 68-89. ISBN 978-88-6164-200-3.(pp.35-42). ISBN 978-88-6164-200-3.

- Palla F, Sineo L, Manachini B (2011). Bacteria, fungi and arthropod pests collected on modern human mummies. Journal of Entomological and Acarological Research, vol. 43, p. 69-76,

In aggiunta il materiale didattico presentato a lezione sara' reso disponibile dal docente sulla piattaforma Unipa previa iscrizione al corso.

In addition, the didactic materials presented during the lessons will be uploaded on the Unipa website under the course link.

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| <b>AMBIT</b>                  | 50687-Attività formative affini o integrative |
| <b>INDIVIDUAL STUDY (Hrs)</b> | 51                                            |
| <b>COURSE ACTIVITY (Hrs)</b>  | 24                                            |

### EDUCATIONAL OBJECTIVES OF THE MODULE

This course is aimed at those involved with, or responsible for, the care of objects in collections - museums, galleries, libraries, archives, historic houses, etc. Lectures/discussions focus on the theory and practice of Integrated Pest Management (IPM) and include practical sessions on recognizing pest insects and insect damage and monitoring insects present in a collection (on an exhibition or in-store). Basic knowledge on morphology and physiology of insects that are pests of BBCC is essential to know how to control them and the different methods applicable. The focus is on chemical pesticides and the importance of safe use by the operators.

The course will offer guidance on how to deal with insect pest problems likely to be encountered. The focus is on insects and the damage they cause, together with up-to-date information on the detection, monitoring, and trapping of pests, and the emphasis is on prevention as the key to successful Integrated Pest Management. The advantages and disadvantages of physical and chemical control measures are also evaluated. In addition, positive aspects of insects in the art and as materials for arts crafts and BBCC will be presented.

Main objectives of the course:

1. To introduce the main insect pests which attack BBCC - What they need to live - How to identify them - The damage they cause - Ways to prevent them becoming established.
2. To understand pest environments/habitats.
3. To consider the selection of the most appropriate treatments for controlling pests.
4. To investigate methods of establishing an Integrated Pest Management (IPM) programme
5. Positive aspect of insects

## SYLLABUS

| Hrs | Frontal teaching                                                                                                                                                                                                                                                                                                                              |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Presentation of the course and examination procedures. Evaluation of the previous knowledge.                                                                                                                                                                                                                                                  |
| 9   | Importance of insects. Insecta: origins and affinities with other arthropods. Integument system and colours. External morphology. Reproduction, eggs and ootaxis. Embryonic and postembryonic development. Moults, metamorphosis, preimaginal stages, adult. Order and major species of BBCC importance. Their biology, ecology and ethology. |
| 3   | Monitoring and different methods of control. The integrated pest Management (IPM) in BBCC                                                                                                                                                                                                                                                     |
| 2   | Alien Insect in the BBCC problems and practical issues                                                                                                                                                                                                                                                                                        |
| 2   | Biotechnology applied to insects pest in BBCC                                                                                                                                                                                                                                                                                                 |

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| 2 | Practical examples and curiosities also from archeo-entomology                                                                          |
| 2 | Positive aspects of insects in the Cultural Heritage and of Art                                                                         |
| 1 | Museum of natural science and entomological collections                                                                                 |
| 2 | Subject proposed by and in accordance with students found on news and related to insects and BBCC, or other subjects of their interest. |