Centre of Biotechnology of Sfax (CBS)

Laboratory of Biopesticides

Head of the Laboratory 2019- : Pr. Souad Rouis
Research Laboratories

1- Laboratory of Environmental Bioprocessess
   Director: Prof. Mohamed Chamkha

2- Laboratory of Molecular Biotechnology of Eukaryotes
   Director: Prof. Raja Gargouri

3- Laboratory of Biotechnology & improvement of Plants
   Director: Prof. Faiçal Brini

4- Laboratory of Biopesticides
   Director: Prof. Souad rouis

5- Laboratory of Microbial Biotechnology and Enzymes
   Director: Prof. Mamdouh Ben Ali

6- Laboratory of Molecular and Cellular Processess of screening
   Director: Prof. Saber Masmoudi
# List of LB laboratory researchers

<table>
<thead>
<tr>
<th>Name</th>
<th>Grade</th>
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<tr>
<td>Tounsi Slim</td>
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<tr>
<td>Rouis Souad</td>
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<td>Jamoussi Kais</td>
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<td>Hichem Azzouz</td>
<td>MC</td>
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<td>Zribi Raïda</td>
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<td>Olfa Frikha</td>
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<td>Wafa Jallouli</td>
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<td>Sameh Sellami</td>
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<td>Fatma Driss Zouari</td>
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<td>Saoussen Ben Khedr</td>
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<td>Amany Farhat</td>
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<td>Maissa chakroun</td>
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<td>Sahar KesKes</td>
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<td>Fatma Masmoudi</td>
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<td>Imen Zouari</td>
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<td>Saoussen Gafsi</td>
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<td>Technicians</td>
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<td>Fathi Hertelli</td>
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<td>Zina Salhi</td>
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<td>PhD</td>
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<tr>
<td>Nouha abdelmalak</td>
<td>PhD</td>
<td>MEDIS</td>
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</tbody>
</table>
Problematic

Application des pesticides

dépôt

dépôt sec

contamination diffuse

ruissellement des cultures (endodérive)

contamination ponctuelle

infiltration

drainage

sources d'eau

eau souterraine

Atmosphère

dérive de pulvérisation

évaporation

précipitations

transport à courte et longue distance
Social and regulatory pressure to reduce the use of chemical pesticides continues to grow. Indeed, some European countries (Denmark, France, etc.) have launched an ambitious plan to reduce pesticides.

The Present / Future: Biopesticides
The general objective of the laboratory is to carry out the required R & D steps leading to the marketing of the most promising biopesticides (effective against phytopathogens and respectful of the environment and human health) for agricultural and urban systems.
1- Select the biopesticides (microorganisms or natural products) most likely to be marketed.

2- Carry out the laboratory studies necessary to complete certain registration requirements of the products selected in 1). These studies will focus, where appropriate, on:
   - scaling up the mass production of the product;
   - product formulation;
   - understanding the mode of action of the product;
   - the compatibility of the product with the conventional phytosanitary products used in the agricultural systems selected for the tests.

3- Compare the effectiveness of biopesticides with conventional systems (chemical pesticides)
Project 1: Study, production and formulation of new bioinsecticides

A- Improving the performance of bioinsecticides based on B. thuringiensis

- Isolation of new strains of Bacillus thuringiensis
- Selection of the best strains: according to their insecticidal activities
- Molecular study of the genes encoding the delta-endotoxins of the selected strains
- Study of the mode of action of the delta-endotoxins of the selected strains
- Development of bioinsecticides based on entomopathogenic bacteria
- Exploitation of the endophytic character of B. thuringiensis in the protection of plants against insects: the case of tomato
- B. thuringiensis InhA metalloproteases: Expression, biochemical characterization and toxicity
- Improved performance of B. thuringiensis bioinsecticides by integrating new virulence factors: InhA, nematode toxin, chitinase

B- Plant-based biopesticides

C- Screening of actinomycetes strains producing bio-insecticides

D- Antibody-based biopesticides
Project 2: Study, production and formulation of antibacterial agents

A. Development of antibacterial agents of microbial origin
- Isolation of novel biocontrol strains producing antibacterial activities belonging to various bacterial genera.
- Development of mixed antibacterial agents more effective against A. tumefaciens and E. amylovora.
- Development of appropriate processes for the production and formulation of antibacterial agents: production conditions, economic environments, etc.
- Evaluation of the effectiveness of antibacterial agents developed in the field.

B. Development of antibacterial agents of plant origin
- Choice of plant material and extraction of bioactive molecules.
- Evaluation of bioactive molecules in vitro and in vivo.
- Purification, identification and structural study of bioactive molecules.
Project 3: Entomopathogenic fungi as bio-protective agents against insect pests of vegetable crops

- Isolation of entomopathogenic fungi.

- Identification of isolated fungi from a morphological and molecular point of view.

- Characterization of isolates from the point of view of their:
  - Pathogenicity against the melon aphid Aphis gossypii (Hemiptera: Aphididae) and the pumpkin fly Dacus frontalis (Diptera: Tephritidae) which attack cucurbits.
  - Thermotolerance: effect of temperature on germination and radial growth.
  - Endophytic capacity.
  - Enzymatic activity.

- Optimize mass production (liquid medium, solid medium, etc.) and the formulation of selected strains.
VRR--------------TT
Technology Readiness Level

1. Basic Principle
2. Formulation of Concept
3. Experimental Proof of Concept
4. Lab Validation
5. Validation in Real Environment
6. Demonstration in Real Environment
7. Demonstration of Prototype
8. Product Completion and Qualification
9. Product Proven

Stage of Product Development:
- Basic Research
- Feasibility
- Applied Development
- Demonstration
- Operational Deployment

Level 3: Experimental Proof of Concept
Level 2: Lab Validation
Level 1: Basic Principle
This project has received funding from the European’s Union’s Horizon 2020 Research and innovation program Under Grant Agreement N° 734921 (RISE)

IPM-4-CITRUS

From Research
From Lab

...to Market
...to Field
IPM-4-CITRUS GANTT: position of WP2

WP1: Management/Coordination
- Meetings & Conferences
- Round Tables
- Informal Education

WP2: Proof of concept
- FSU-SJ 100-1000L
- MEDIS 1-10L
- INSAT/TWB Lab scale

WP3: Activity optimisation
- IPT / CTA
- BT impact
- BBU / CTA
- Field assays
- MEDIS
- Pilot scale
- JKI
- Lab scale

WP4: Economic Maturation

WP5: Networking & Outreach Activities
- Knowledge sharing, Communication and Public/Stakeholder engagement

WP6: Dissemination & Exploitation

1. MA = Market Assessment / 2. TA = Technology Assessment / 3. RA = Regulatory Assessment / 4. DEP = Definition of Exploitation Paths
From Lab to Market...

<table>
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<tr>
<th>Market</th>
<th>API</th>
<th>For</th>
<th>Cond</th>
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<tr>
<td>Plant</td>
<td>IPM</td>
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</table>

1 production site (Nabeul)
Tunisian and African markets
1 endemic strain (Btk BLB1)

For MEDIS:
1 Manager
1 Bioprocess engineer
1 Formulation engineer
INTEGRATED PEST MANAGEMENT

BIOPESTICIDES FOR GRANADA

✓ Rational bioprocess scale-up based on biotic and abiotic strategies
✓ Developing an alternative IPM approach
✓ Based on biological control

TARGETED PESTS: insect larvae, Ectomyelois ceratoniae Zell (datte pyrale)

STRAIN: Bacillus thuringiensis spp kurstaki BLB1

3 partners
2 Associates

From Lab... ...to Field

Grenadier
Toward the Synthesis of Biopesticides & Good Agricultural Practices for Integrated Pest Management

EU registration of biopesticides
Reduction of land and water pollution
Thank you!
Waiting for your questions?

Danke schon!
3aycheck / chokran jazilan

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souadrouis4@gmail.com
Souad.rouis@cbs.rnrt.tn
Tunisia University de Sousse
Higher School od Sciences and Technology of Hammam Sousse
Energy and Materials Laboratory – LabEM LR11ES34
Website: labem.recherche-scientifique.com

Laboratory Director: Pr. Habib SAMMOUDA
LabEM Research Projects Concord with LMD
Training at our school ESSTHS
Progressive stages of the LabEM

1. Research for the 2012-15 diploma course
2. Structuring for a search by objectives 2016-19
3. Towards industry and research for development 2019-22
4. Towards federated and national and international cooperation projects 2023-26

Last Assessment by CNEARS April 2019
Various LabEM Projects

LabEM

Project 1 Valorization of composite materials and energy systems for smart and zero-energy buildings
Prof. Habib SAMMOUDA
1 Pr. + 1 MC + 5 MA

Project 2 Valorization of Biomass for the Environment and Energy
Prof. Aida KESRAOUI
1 MC + 3 MA

Project 3 Chemical and thermal plasma elaboration of nanostructures and their valorization for detection and remote sensing and the IoT
Pr. Riadh HANNACHI et Najeh HAMDAOUI
2 M.C. + 1 M.A. Hab + 2 M.A. + Dr. PES

Project 4-1
Elaboration and characterization of nanocomposites (PANI, carbon nanotubes)
Pr. Ridha AJJEL
1 Pr.
Project 4-2
Synthesis and Characterizations
Physicochemicals New Hybrid Materials
Pr. Latifa Ben HAMADA
LabEM in statistics Ten years 2012-2022

- 25 PhD
- 90 Masters
- 0 Cotutelles
- 5 Habilitations
- 150 Publications
Project 1: Valorization of Composite Materials and Energy Systems for the Zero Energy Building

Pr. Habib SAMMOUDA

Production scientifique

1. Habilitation
6. PhD
45 Publications
different Axes of LabEM Project 1

- Valorisation des Matériaux composites et des systèmes Energétiques pour le Bâtiment à Zéro Energie

- H. SAMMOUDA
  - Smart and renewable energy systems

- F. ALOULOU
  - Elaboration and Characterization of intelligent composite micro and nano-materials PCM/nano-particles -fibers for the building industry

- O. BELHAJBRAHIM
  - Renewable Energy Electrical Conversion Systems and Grid Connection

- H. DARDOUR et O. CHOUSAIEB
  - Technology and digital modeling for energy efficiency

- M. DHAHRI
  - CFD for the valorization of fluid networks in smart buildings

- M.S. AMARA
  - Numerical and experimental elaboration of Materials for energy and information storage

02/06/2023
Project 2: Valorization of Biomass for the Environment and Energy

7 Thèses et une Habilitation

30 Articles

Pr Aida KESRAOUI
Chemicals from food waste and Biomass

Biomass and Waste

- sugars
- hemicellulose
- cellulose
- lignin
- pectin
- collagen
- chitosan
- natural dyes
- waxes
- natural chelants
- bio-solvents
- bio-surfactants
- hydrogels
- PVC replacements
- chemical monomers

- bio-adhesives
- hydrophobes
- films
- Liquid fuels
- solid fuels

- bio-solvents
Different Axes of project 2

- Dr Aida Kesraoui
  - Characterization of biomass and valorization of the biosorption of micropollutes
  - Mastères: 9
  - Thèse: 2
  - Habilitation: 1
  - Publications: 22
  - Thèses en cours: 3

- Dr Rochdi Baati
  - Valorization of biomass into bioproducts
  - Thèse: 1
  - Publications: 4
  - Thèse en cours: 1

- Dr Ajmia Chouchène
  - Tunisian lignocellulosic biomass in the development of activated carbons and biochars; combination with MCP for construction
  - Mastère en cours: 1

- Dr Fadhel Aloulou
  - Composite materials based on Cement-vegetable fiber
  - Mastères: 2
  - Publications: 1
  - Thèses en cours: 1

Total 27 Articles
11 Masters; 3 thèses, 1 Habilitation
Project 3: CHEMICAL AND THERMAL PLASMA ELABORATION OF NANOSTRUCTURES AND THEIR VALORIZATION FOR DETECTION AND REMOTE SENSING And IOT

Profs: R. HANNACHI and N. HAMDAOUI

Groupe: Nanomatériaux pour les télécommunications et la Détection
ISITCom Hammam Sousse
Laboratoire des Énergie et de Matériaux
ESST Hammam Sousse
Project 3

Project 3
2023-26

3-1 Synthesis of nanostructures by plasma thermal and detection of organic pollutants by photo-thermal spectroscopy

Pr. R. HANNACHI

Study and synthesis of nanostructures by thermal plasma
Dr. Hab. A. LEBIB

Détection et Contrôle par photo-thermique de la qualité des fluides et des marqueurs tumoraux
Dr. R. BAATI
Dr. S. MEZGHENI

3-2 Synthesis and characterization of photodetectors based on metal oxides for IOT applications and spinel ferrites for applications in optoelectronic

Pr. N. HAMDAOUl

Study of substituted spinel type oxides AB2O4 synthesized by the sel method
Dr. Sobhi HCINI (MA-FS-SidiBouzid)

Study by impedance spectroscopy of spinel ferrite type oxides and application in IOT and memristors
Pr. HAMDAOUl

Journée LabEM le 26/01/2019
Compétence de l’équipe: Nanomatériaux pour les télécommunications et la détection

- Pr. L. BEJI
- Pr. Pr. Riadh Hannachi
- Pr. Najeh Hamdaoui
- Dr-Hab. Amira Lebib
- Dr. Salma Mezghenni(ISITCom)
- Dr Rochdi BAATI

- 03 Habilitations defended
- 05 Theses defended
- 46 articles published
Projet 4-1 : Elaboration and characterization of nanocomposites (PANI, carbon nanotubes)

Pr. Ridha AJJEL

- 03 Thèses soutenues
- 06 Articles
Etude des couches semiconductrices à base d’oxyde pour des applications en optoélectronique

Etude des propriétés électriques, optiques, et diélectriques des couches semiconductrices à base d’oxyde: ZnO, TiO2, MoO3

Calcul numérique

Elaboration des couches semiconductrices à base d’oxyde: ZnO

Dr Nejeh HAMDAOUI et Dr Amine MEZNI, Pr R AJJEL
• Imen BEN ELKAMEL
• Donia BEN RAHMA

Dr Mouna BANNOUR, Pr R AJJEL
• Safa Jmaa

Dr Sami AMEUR, Pr R AJJEL
• Sana Braiek

Un article publié (impact factor 3)
Deux articles soumis
Project: 4-2

Synthesis And Characterizations
Physicochemicals
New Hybrid Materials

Pr. L. BENHAMADA
Composition de l’équipe:

- 03 Thèses soutenues
- 05 Articles

Journée LabEM le 26/01/2019
<table>
<thead>
<tr>
<th>Development preparations of single crystals and polycrystalline samples</th>
<th>Crystallographic characterization and the determination of atomic arrangements by X-ray diffraction</th>
</tr>
</thead>
</table>

**This work consists of:**

- The study of thermal evolutions and research of structural transitions by ATG - ATD - DSC
- L’étude spectroscopique IR
Thank for your Attention

Website: labem.recherche-scientifique.com
Developing novel and biodegradable packaging materials with enhanced functionality from food by-products

Prof. Dr. Ing. Khaoula Khwaldia

Laboratory of Natural Substances, National Institute of Research and Physicochemical Analysis, Tunisia
Presentation of the National Institute of Research and Physicochemical Analysis (INRAP-TUNISIA)

BiotechPole Sidi Thabet

Biotechnologies, pharmaceutical and parapharmaceutical industries, life sciences & engineering applied to health

6th-7th June 23
Presentation of the National Institute of Research and Physical-chemical Analysis (INRAP-TUNISIA)

A public Research Institute placed under the authority of the Ministry of Higher Education and Scientific Research (Tunisia)

INRAP is devoted to study complex analytical problems in different fields, to develop new analytical methods to meet national needs and to valorize research results and promoting their exploitation by industries.

- INRAP is located at 30 km away from the capital Tunis;
- 17 km from Tunis-Carthage International Airport
- Near 3 industrial areas (Charguia I, Charguia II and Utica)

It is well equipped for the chemical characterization of biologically active compounds as well as the development of functional food products/packaging materials and their characterization.
Presentation of the National Institute of Research and Physical-chemical Analysis (INRAP-TUNISIA)

Partners

1-2-3-4-5-6-8-9

11- Université de Catania

(TUBITAK)

12-Université Ouargla

13- National Research Centre

Prof. Khaoula Khwaldia
**Previous related projects**

Valorization of Industrial fruits byProducts and algae biomass waste: Development of Active Coatings to extend Food shelf life and reduce food losses

ERA-NET ARIMNet2 call 2016 (*Coordination of Agricultural Research In the Mediterranean*) of *The European Union through the 7th Framework programme* for research, technological development and demonstration

**Starting date:** 01-06-2017  
**Overall budget:** 280 000 €  
**Ending date:** 31-05-2021

Prof. Khaoula Khwaldia
VIPack project - Valorisation of olive and olive oil by-products for the development of active packaging materials to extend olive oil shelf life

- Submitted under the funding line: research projects with Tunisia with the participation of science and industry (TUNGER 2+2)
- Duration: 2020/05/01 - 2023/04/30

Funding agencies

Project partners
Previous related projects

VALICET

Valorise foods and Improve Competitiveness through Emerging Technologies applied to food by-products within the circular economy framework

F.lli Santorelli Sas di Vetrano Elena & C

Prof. Khaoula Khwaldia
Project Proposal

Developing novel and biodegradable food packaging materials with enhanced functionality able to extend the shelf life of many food products

1. Extraction of active packaging materials
2. Characterization of biopolymers and bioactive compounds
3. Validation of the active biodegradable packaging solutions
4. Development of active biodegradable packaging

Prof. Khaoula Khwaldia
Project Proposal

Biopolymers (pectin, cellulose, lignin, mucilage,...) and antioxidant and antimicrobial agents (phenolic compounds, hydrophobic fractions,..) following green extraction processes

- Identify and Assess different industrial by-products or waste materials
- Evaluate various green extraction techniques
- Optimize extraction parameters (RSM)
- Purification

- Structural, physicochemical, and biological characterization

- Evaluation of the antioxidant properties of the prepared extracts, their antimicrobial activity against various food pathogens and food spoilage microbes.
- Assessment of the safety of the extracts for human consumption using appropriate toxicological approaches

Prof. Khaoula Khwaldia
**Project Proposal**

- Encapsulation of the extracts to ensure long-term stability
- Characterization of the barrier, mechanical, optical, and structural properties of the obtained materials at different storage times
- Evaluation of the biodegradability
- Application of the developed active packaging films/Coatings on different food products
- Investigate quality, storage stability, and shelf-life improvement of these treated food products.

Prof. Khaoula Khwaldia

6th-7th June 23
Thank you for your attention......

Prof. Khaoula Khwaldia, Laboratoire des Substances Naturelles (LSN)
Institut National de Recherche et d’Analyse Physico-chimique (INRAP)
Technopole de Sidi Thabet 2020 Ariana (Tunisia)
Tel +216 71537 666 Fax +216 71537 688
E-mails: khaoula.khwaldia@inrap.rnrt.tn; khaoula_khwaldia@yahoo.fr;
            khaoulakhwaldia@gmail.com
AfriOnc
Africa Breast Oncology: Discovery of Novel Susceptibility and Treatment Response Biomarkers

Assis. Prof. Yosr Z. Haffani, PhD
University of Manouba
Tunisia

Webinar 5 & 6 June, 2023
Organization’s skills, knowledge & competences

- **University Manouba** is a Public Academic Institution in TUNISIA
- **Higher Institute of Biotechnology Sidi Thabet, ISBST**
- **BiotechPole**
- First largest Biotech institution in Tunisia and carries out research in Biology, Biomedicine, Nutrition & Food Science
- Has the necessary research condition for this project

- European and African International projects
  - CBHE KA1 & KA2
    - (12) ERASMUS ICM+
    - (07) ERASMUS KA2 BiotechTunisia 2019-2024; SPAAT4FOOD 2018-2023

R&I Projects
- R&I EU framework programme (02) completed
- MHESR-Tunisia / NRF- South Africa 2019-2023 R&D Joint Grant
- **ARTISaneFood** PRIMA EU R&I programme 2018-2023
Our project idea / Innovation first hand

AfriOnc

This work will be divided into the following two main objectives:

1. The discovery with high throughput sequencing the genomic and pharmacogenomic variants of African BC patients. Ongoing R&I project discovered novel variants of the most common gene in BC - TRL 2

2. The molecular broad screening and pharmacogenomic evaluation of novel natural bioactive compounds on cell based assay for cancer. These agents may be involved in pharmaceutical industry, which consider the essential scope worldwide overcome BC to minimize the high cost of anticancer drugs
Clinical Research

- Access to clinical samples, a **biobank**, and collections of oncology patient’s samples, as well as clinical information

- Access to **facilities and technologies** such as animal house, genotyping, cell culture technologies, qPCR platforms

- Experience participating in international R&I projects in different types of tumours. Having also links with several public and private hospitals/research centres in Africa that are already collaborating with us

- Our background and experience provide a good opportunity for participating in a multidisciplinary research project
AfriOnc
Specific skills / technologies

World class expertise to the project:

• SOP Biorepository
• Oncogenomic data collection
  • Cell-based assay
• Data-driven insights in cancer care
• Modeling Human disease mutagenesis and phenotyping
  • Gene chip technology
• AI and Machine learning expertise

Webinar 5 & 6 June, 2023
THANK YOU FOR YOUR ATTENTION
Dr. Yosr Z. Haffani, PhD

yosr.haffani@isbst.uma.tn
yosrhaffani@gmail.com
orcid.org/0000-0003-2956-3651
Tel/WhatsApp +216 50 560 405

Assistant Professor in Molecular, Cell Biology & Proteomics

Higher Institute of Biotechnology Sidi Thabet
University Manouba
Tunisia

Webinar 5 & 6 June, 2023