CYPRUS UNIVERSITY OF TECHNOLOGY

FACULTY OF GEOTECHNICAL SCIENCES
AND ENVIRONMENTAL MANAGEMENT

ACTIVITY REPORT
2016–2018

Limassol
September 2018

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Welcome Message

Welcome to the biennial report of the Faculty of Geotechnical Sciences and Environmental Management of the Cyprus University of Technology, which describes our research activities during years 2016-2018.

The world is currently facing serious global sustainability problems – but we are also experiencing the most serious attempt to date to tackle these problems on a global scale. This is not only evident from the adoption of the United Nations Sustainable Development Goals and the Paris agreement on Climate Change; it is highlighted by numerous decisions and action plans of international organizations, national governments, major financial institutions and global corporations.

In line with these developments, our Faculty's education and research activities focus on topics that are at the heart of today's societal challenges. The agricultural and food sectors are increasingly important for providing adequate food supplies to a growing global population; however, achieving this objective without causing irreversible damage to human health and ecosystems is a serious challenge. Besides its role for primary production and food security, agriculture can be beneficial for the environment by preventing problems such as soil erosion and land desertification. Thus, depending on its future direction, the agri-food sector can exacerbate or mitigate the impacts of climate change.

Improved resource efficiency and protection of natural resources and the environment, the second major field covered by our Faculty's activity, are necessary ingredients for the transition to a sustainable global economy. Policy initiatives both at European and international level demonstrate this priority: the way to a prosperous planet is through societies with low consumption of resources and low emissions.

These societal challenges call for interdisciplinary approaches. Our Faculty offers education on natural and technological sciences like chemistry, physics, microbiology, biotechnology and toxicology, with a focus on their environmental, food and agronomical aspects. Agricultural and environmental economics and management for policy support are also important parts of our curriculum and research output.

Although recently founded, our University has academic staff that is very active in research and international cooperation. The scientific publications of our Faculty's staff and the number of externally funded research projects listed in this report confirm our devotion to high-quality research. Being part of a public University, it is also our duty to serve society by educating students from undergraduate to doctoral level and providing knowledge to the broader public through involvement in policy advisory boards, continuing education and information and awareness-raising activities. As readers of this report, I hope you will agree that we are trying hard to fulfil this duty.

Regardless of the importance of research, a University would not exist without its students. Therefore, we provide at the end of this publication a list of all our Faculty's alumni during the last two academic years. We hope to have educated these students properly, equipping them with both robust knowledge and critical skills for their future.

Dr. Theodoros Zachariadis

Associate Professor,
Dean of the Faculty

Χαιρετισμός

Με χαρά σας παρουσιάζουμε το παρόν τεύχος, που περιγράφει τις ερευνητικές δραστηριότητες της Σχολής Γεωτεχνικών Επιστημών και Διαχείρισης Περιβάλλοντος του Τεχνολογικού Πανεπιστημίου Κύπρου κατά την περίοδο 2016-2018.

Η Σχολή μας καλύπτει γνωστικά αντικείμενα που βρίσκονται στην καρδιά των σύγχρονων κοινωνικών προκλήσεων. Ο τομέας της γεωργίας και των τροφίμων καλείται να καλύψει τις διατροφικές ανάγκες του αυξανόμενου παγκόσμιου πληθυσμού, χωρίς να προκαλέσει ανεπανόρθωτη ζημιά στην ανθρώπινη υγεία και τα οικοσυστήματα του πλανήτη. Εκτός από τη συμβολή της στην πρωτογενή παραγωγή και τη διατροφική ασφάλεια, η γεωργία συμβάλλει και στην περιβαλλοντική προστασία, εφόσον αποτρέπει τη διάβρωση των εδαφών και την ερημοποίηση. Ανάλογα με την κατεύθυνση που θα πάρει, ο αγρο-διατροφικός τομέας μπορεί να επιδεινώσει ή να μετριάσει τις επιπτώσεις της κλιματικής αλλαγής.

Δεύτερο μεγάλο γνωστικό πεδίο που καλύπτει η Σχολή μας είναι η προστασία του περιβάλλοντος και των φυσικών πόρων. Σήμερα είναι αποδεκτό ότι η ευημερία του πλανήτη μπορεί να διατηρηθεί μόνο αν καταφέρουμε να έχουμε κοινωνίες με χαμηλή κατανάλωση πόρων και χαμηλές εκπομπές. Ζούμε σε μια περίοδο κατά την οποία αντιλαμβανόμαστε πλέον τη σοβαρότητα των παγκόσμιων περιβαλλοντικών προκλήσεων. Ταυτόχρονα όμως, διαπιστώνουμε ότι και το παγκόσμιο σύστημα (διεθνείς οργανισμοί, εθνικές κυβερνήσεις, χρηματοπιστωτικοί οργανισμοί και επιχειρήσεις) αλλάζει τις προτεραιότητές του, σε μια άνευ προηγουμένου προσπάθεια να εναρμονιστεί με τις ανάγκες για βιώσιμη ανάπτυξη.

Οι παραπάνω προκλήσεις απαιτούν συνεργασία μεταξύ πολλών επιστημονικών κλάδων. Σε αυτό το πλαίσιο, η Σχολή μας ασχολείται με γνωστικά αντικείμενα των θετικών και τεχνολογικών επιστημών όπως η χημεία, η φυσική, η μικροβιολογία, η βιοτεχνολογία και η τοξικολογία, με έμφαση στις περιβαλλοντικές, διατροφικές και αγρονομικές πτυχές των επιστημών αυτών. Αναδεικνύουμε επίσης την οικονομική και διαχειριστική διάσταση των προβλημάτων που καλούμαστε να αντιμετωπίσουμε.

Είμαστε ένα Πανεπιστήμιο με λίγα χρόνια ζωής, αλλά με δραστήριο διδακτικό και ερευνητικό προσωπικό που έχει έντονη ερευνητική ενασχόληση και διεθνείς συνεργασίες. Όπως θα δείτε σε αυτό το τεύχος, τόσο οι επιστημονικές δημοσιεύσεις των μελών της Σχολής όσο και τα εξωτερικά χρηματοδοτούμενα ερευνητικά έργα, τα οποία αυξάνονται κάθε χρόνο, επιβεβαιώνουν την αφοσίωσή μας στην ποιοτική έρευνα. Επιπρόσθετα όμως, εκπαιδεύουμε φοιτητές από το προπτυχιακό ως το διδακτορικό επίπεδο και συμβάλλουμε σε δραστηριότητες για την ευρύτερη κοινωνία με τη συμμετοχή μας σε επιτροπές ειδικών, ομάδες εργασίας, τοπικά συνέδρια, ενημερωτικές εκδηλώσεις, συνεχιζόμενη εκπαίδευση και πληροφόρηση του κοινού. Είμαστε μέρος ενός δημόσιου Πανεπιστημίου και έχουμε χρέος να ανταποδώσουμε στην κοινωνία την επένδυση που έχει κάνει σε μας. Οι αναγνώστες του τεύχους αυτού θα κρίνετε κατά πόσο ανταποκρινόμαστε στο χρέος μας.

Παρόλο ότι η παρούσα έκδοση δίνει έμφαση στην έρευνά μας, ένα Πανεπιστήμιο δεν μπορεί να υπάρξει χωρίς τους φοιτητές του. Γι' αυτό, το τεύχος περιλαμβάνει και τα ονόματα των αποφοίτων της Σχολής μας κατά τα τελευταία δύο ακαδημαϊκά έτη. Ελπίζουμε να τους μεταδώσαμε, στο μέτρο που μπορούσαμε, υψηλό επίπεδο γνώσεων και κριτική σκέψη.

Δρ. Θεόδωρος Ζαχαριάδης

Αναπληρωτής Καθηγητής,
Κοσμήτορας της Σχολής

The Faculty and its Departments

I. The University (www.cut.ac.cy)

The Cyprus University of Technology (CUT) is a newly established public university, which was founded by law in December 2003. It is one of the three state universities operating in the Republic of Cyprus. CUT has six Faculties and eleven academic Departments, able to offer education and high level research in primary fields of science and technology, at undergraduate and postgraduate levels. Currently it educates about 3,000 students and includes an academic and administrative staff of about 700 people.

Although it initiated its research activity very recently, CUT already participates in a significant number of research projects funded by national authorities and European programmes such as Research Framework Programmes FP7 and Horizon2020 (including one prestigious grant from the European Research Council); the LIFE Programme; European Territorial Cooperation Programmes such as Interreg, Archimed, MED etc. The University has adopted research principles which conform to the European Union's declarations on the creation of the European Research Area (ERA).

Despite its short history, the University has already been ranked 351-400th in the Times Higher Education World University Rankings in 2017-2018 and 2018-2019. Moreover, it has been ranked in the highly honourable 2nd place among the top 50 universities in New Europe, i.e. the 13 countries who have joined the European Union since 2004. This highlights the University's devotion to quality research and teaching, and motivates its staff for higher international achievements.

The University's Faculties are:

- The Faculty of Geotechnical Sciences and Environmental Management
- The Faculty of Management and Economics
- The Faculty of Engineering and Technology
- The Faculty of Health Sciences
- The Faculty of Fine and Applied Arts
- The Faculty of Communication and Media Studies

The Faculty of Geotechnical Sciences and Environmental Management, which is presented in this Report, currently consists of two Departments: the Department of Agricultural Sciences, Biotechnology and Food Science; and the Department of Environmental Science and Technology. Brief information about each Department is provided below.

II. The Department of Agricultural Sciences, Biotechnology and Food Science

(www.cut.ac.cy/abf)

The Department of Agricultural Sciences, Biotechnology and Food Science (ABF) was established and accepted its first students in 2007. By that time, the Department's staff comprised 2 faculty members, 2 members of Special Teaching Staff and 1 clerical officer. Professor Nicolas Ioannou (retired since September 2013) acted as the first Coordinator and later as the first Chair of the Department, followed by Associate Professor Christakis Papachristoforou (2012-2014) and Professor Andreas Katsiotis (2014-today). Within the remit of the Department's first Coordinator was the appointment of additional faculty members as well as the coordination with external advisory committees for the development of the Department's programs.

ABF offered its first undergraduate programme in 2007. The Department is admitting around 40 students per academic year through national examinations and offers a B.Sc. degree in Agricultural and Food Sciences with specialization in three basic areas: **(a) Crop Science & Technology, (b) Animal & Dairy Science and (c) Food Science & Technology.** For awarding the B.Sc. degree of the Department of Agricultural Sciences, Biotechnology and Food Science, students are required to complete 240 European Credit Units (ECTS).

In September 2011 the Department began offering its postgraduate programme leading to the award of the degree of **Master of Science (M.Sc.) in Agricultural Biotechnology.** The M.Sc. programme has a duration of 18 months (three semesters) and accepts around 15 students per year, distributed in the three main areas of Plant, Animal and Food Biotechnology.

The first undergraduate students successfully obtained their degrees in June 2011. The first M.Sc. degrees were awarded in 2014. The Department awarded the first doctoral title in 2012, followed by an additional two doctoral titles in 2014 and another seven during 2016-2018. By mid-2018 there were 22 PhD students in the Department.

ABF is housed in well-equipped and well-maintained **laboratory facilities**. Through public funding, adequate infrastructure was purchased to support both teaching and research. The Department is also using a greenhouse located in the broader area of Limassol, and is in the process of acquiring proper land for the creation of experimental farms.

III. The Department of Environmental Science and Technology

(www.cut.ac.cy/est)

The Department was officially established in January 2008 with two academic staff members and one clerical officer. Its initial name was 'Department of Environmental Management', and the **first undergraduate (B.Sc.) students were admitted in September 2008**. Professor Ioannis Papadopoulos acted as the first Coordinator of the Department, followed by Professor Constantinos Varotsis who also became the first Department Chair (2011-2014), and then by Professor Costas Costa (2014-2017). The undergraduate programme of the Department was modified in September 2010 so as to include additional courses in basic topics of Environmental Science and Technology in order to offer a more rigorous curriculum. Subsequently, the Department's name was formally changed to 'Department of Environmental Science and Technology' (EST), and its undergraduate degree is the **B.Sc. in Environmental Science and Technology**.

In 2017, the Department joined forces with the University's Faculty of Engineering and Technology and started offering a **B.Sc. Programme in Chemical Engineering** – the first University degree in Chemical Engineering offered in Cyprus. The programme has been accredited by the Cyprus Agency of Quality Assurance and Accreditation in Higher Education (ΔΙΠΑΕ) and has been recognized by the Technical Chamber of Cyprus (ETEK). The first Chemical Engineering students were admitted in September 2017 and are expected to graduate in June 2021. The undergraduate programme in Environmental Science and Technology has been discontinued and is only offered to those students who had enrolled for this degree up to 2017.

EST currently admits 25-30 undergraduate students every year. The goal of the undergraduate EST programme in Chemical Engineering is to offer students a comprehensive education in fundamental areas of Chemical Engineering in order to meet the worldwide needs in the area, with a special focus on the needs of the industry of Cyprus. This starts from basic topics in Chemistry, Biology, Physics and Mathematics, as a solid background for advanced and specialised topics in the design, simulation and control of physical and chemical processes and equipment, which are taught during the last semesters. The Department has built strong ties with the industry of Cyprus both in research and education, and includes a mandatory practical training of all senior students in industrial plants.

In September 2010 the Department offered its first postgraduate programme **(M.Sc. in Energy Resource Management)**, which was the first M.Sc. programme offered by the University as a whole. In September 2011 EST started providing a second **M.Sc. programme in Environmental Bioscience and Technology**. These programmes are currently re-designed in order to be in line with the educational priorities of the undergraduate Chemical Engineering programme and with the research priorities of the Department's staff.

The first undergraduate and postgraduate students successfully obtained their degrees in June 2012. The first doctoral degree was obtained in the Department in July 2012. Until summer 2018, ten doctoral students had graduated with their Ph.D. degree, while at the time there were 26 active Ph.D. students.

EST has extensive and modern **laboratory facilities** worth more than 1.5 million Euros. Adequate infrastructure was purchased to support both teaching and research needs, initially thanks to public funding and later as a combination of public University funds and research infrastructure acquired by the Department's academic staff through competitive research grants. These facilities are continuously upgraded, in order to address all educational needs of the new Chemical Engineering programme.

Personnel*

I. Department of Agricultural Sciences, Biotechnology and Food Science

Name	***Rank***	***Specialty***
Katsiotis, Andreas	Professor	Plant Breeding/Plant Genetics
Tsaltas, Dimitrios	Associate Professor	Agricultural Microbiology & Biotechnology
Miltiadou, Despoina	Assistant Professor	Animal Science/Molecular Biology
Fotopoulos, Vasileios	Assistant Professor	Plant Physiology
Manganaris, Georgios	Assistant Professor	Arboriculture/Postharvest Physiology and Technology
Stavrinides, Menelaos	Assistant Professor	Entomology/Acarology
Papademas, Photis	Assistant Professor	Dairy Science and Technology
Tzortzakis, Nikolaos	Assistant Professor	Vegetable Crops/Aromatic plants/Postharvest Physiology and Technology
Tzamaloukas, Ouranios	Assistant Professor	Animal Science/Nutrition
Kanetis, Loukas	Assistant Professor	Phytopathology/Crop Science
Botsaris, Georgios	Assistant Professor	Food Microbiology
Drouza, Chryssoula	Lecturer	Food Chemistry
Goulas, Vlasios	Special Teaching Staff	Physical Chemistry & Analysis
Pantelides, Iakovos	Special Teaching Staff	Phytopathology/Plant Biotechnology
Nikoloudakis, Nikolaos	Special Teaching Staff	Plant Genetics
Hadjimichael, Panayiotis	Academic Staff Member	Principal Instructor
Retired:		
Ioannou, Nicolas	Professor	Phytopathology
Gekas, Vassilis	Professor	Food Engineering & Technology
Papachristoforou, Christakis	Associate Professor	Animal Science/Reproductive Physiology
Georgiades, Costantinos	Academic Staff Member	Principal Instructor

***** Contact details of each staff member can be found on the corresponding webpage of each Department, which is shown in the previous Section.

II. Department of Environmental Science and Technology

Name	***Rank***	***Specialty***
Varotsis, Constantinos	Professor	Environmental Bio-Catalysis
Costa, Costas	Professor	Environmental Chemistry & Catalysis
Zachariadis, Theodoros	Associate Professor	Energy & Environmental Policy
Charalambides, Alexandros	Assistant Professor	Renewable Energy Sources
Daskalakis, Evangelos	Assistant Professor	Computational Physics of the Atmosphere
Vyrides, Ioannis	Assistant Professor	Environmental Engineering
Koutinas, Michalis	Assistant Professor	Environmental Biotechnology
Antoniou, Maria	Assistant Professor	Water & wastewater treatment
Savva, Petros	Special Teaching Staff	Environmental Chemistry & Atmospheric Pollution
Andreou, Kostas	Special Teaching Staff	Soil Ecotoxicology
Koutsoupakis, Constantinos	Special Teaching Staff	Environmental Science
Vasquez, Marlen	Special Teaching Staff	Environmental Toxicology & Microbiology

Retired:

Papadopoulos, Ioannis †	Professor	Water and Soil Science
Serghides, Despina	Professor	Bioclimatic Architecture
Theopemptou, Charalambos	Lecturer	Environmental Policy

Administrative Staff:

Zanti, Irini	Secretary of the Department of Agricultural Sciences, Biotechnology and Food Science (2007-2015)
Pillatsi, Sonia	Secretary of the Department of Agricultural Sciences, Biotechnology and Food Science (2016-)
Kiperesi, Zooula	Secretary of the Department of Environmental Science and Technology
Herodotou, Marina	Secretary of the Faculty
Nikolaidou, Fotini	Faculty Librarian

International Recognition, Outreach Activities & Social Service

As a result of their heavy involvement in international collaboration, the academic staff of our Faculty participates in a large number of national and international associations, scientific committees and advisory groups related to the topics of their research interests. For example, two Faculty members participated in the Domain Committees of the European COST programme (under its previous structure that changed in 2015), while several others take part as members of the Management Committees of individual COST Actions. Moreover, two members of the Faculty were national representatives of Cyprus in the Programme Committee of Food, Agriculture, Fisheries and Biotechnology of the European Commission's 7th Framework Programme, and in the Programme Committee on Climate Action, Environment, Resource Efficiency and Raw Materials of the European Commission's Horizon2020 Programme, respectively. The Dean of the Faculty is a member of the Scientific Committee of the European Environment Agency, the EU organisation that to provides sound and independent information on the environment in order to enable the proper implementation and evaluation of environmental policy.

Moreover, at the initiative of the Faculty's Sustainable Energy Laboratory (SEL), Cyprus has become a member of the Knowledge and Innovation Community on Climate Change (Climate-KIC) of the European Institute of Innovation and Technology (EIT). Climate-KIC is the largest public-private climate change partnership and main EU initiative to build a low-carbon economy through education, entrepreneurship and innovation.

In the national scene, due to their expertise, our academic staff is frequently invited to testify in front of Committees of the Parliament of Cyprus, assist the Ministry of Education and Culture of Cyprus in the evaluation of educational programmes of private Universities, and participate in Committees set up by the national authority that is responsible for the recognition of higher education qualifications (KYSATS). They also appear in national media offering expert opinions on topical issues related to agricultural, food, energy or environmental policy; and give lectures to schools and professional associations on topics of their specialty.

Several members of our staff have gained international recognition and are therefore invited to offer their expertise abroad. For example, in recent years some staff members have participated in the evaluation process of several Academic Institutions and Departments in Greece by contributing to the work of the Hellenic Quality Assurance Agency of Higher Education (HQAA). Moreover, Faculty staff have acted as evaluators of research proposals for the following organisations:

- European Commission (COST, FP7, Horizon 2020)
- European Science Foundation
- Austrian Science Fund
- Research Foundation of Flanders, Belgium
- Research Council of the Katholieke University of Leuven, Belgium
- Innovation Fund Denmark
- National Research Agency of France
- Agriculture and Agri-Food Canada
- USA–Israel Binational Agricultural Research and Development Fund
- Israel Science Foundation
- Ministry of Education of Greece
- General Secretariat for Research and Technology of Greece
- National Commission of Scientific and Technological Research of Chile
- Ministry of Education, University and Research of Italy

- University of Insumbria, Italy
- University of Pavia, Italy
- University of Calabria, Italy
- Investment and Development Agency, Latvia
- National Science Centre, Poland
- Foundation for Science and Technology, Portugal
- Qatar National Research Fund

Members of our academic staff have also served as external examiners of MSc theses and PhD dissertations in the following institutions:

- University of Antwerp, Belgium
- Aristotle University of Thessaloniki, Greece
- University of the Aegean, Greece
- Sant' Anna School of Advance Studies, Pisa, Italy
- University of Florence, Italy
- University of Foggia, Italy
- University of Teramo, Italy
- University of Amsterdam, The Netherlands
- Stellenbosch University, South Africa
- Tshwane University of Technology, South Africa
- KTH Royal Institute of Technology, Sweden
- University of Cranfield, UK
- University of Cyprus, Cyprus

Our academic staff are Associate Editors or members of the Editorial Board of the following international academic Journals:

- Advances in Horticultural Science
- Advances in Oceanography and Limnology
- BMC Plant Biology
- Energy Economics
- Frontiers in Agricultural Biological Chemistry
- Frontiers in Crop Science & Horticulture
- Frontiers in Microbiology
- Frontiers in Plant Abiotic Stress
- Frontiers in Plant Physiology
- Gene
- Journal of Catalysis
- Journal of Experimental Botany
- Journal of Horticultural Science & Biotechnology
- Journal of Plant Biology & Soil Health
- Journal of Post-Harvest Technology
- Phytoparasitica
- Plant Gene
- Plant Physiology and Biochemistry
- Plant Signaling & Behavior
- Postharvest Biology & Technology
- Recent Patents on Biotechnology
- Small Ruminant Research

Furthermore, several Faculty members have been invited for keynote lectures in international conferences and for delivering short academic or training courses abroad.

International conferences organised by Faculty members in Cyprus in 2016-2018 and upcoming conferences

- 4th International Conference on Sustainable Solid Waste Management, Limassol, June 2016
- Conference on "Investing for a Greener Future in Cyprus", co-organised with the European Commission Representation in Cyprus, Nicosia, June 2016

Moreover, several workshops have been held at the University premises, organised by Faculty members in the frame of their participation in externally funded research projects as well as actions funded by the European COST programme.

Additional international conferences are scheduled to be held in the near future in Limassol, with Faculty staff serving as Conference Chairpersons:

- The 20th Global Conference on Environmental Taxation (25-27 September 2019)
- The International Conference on Carotenoid Research and Applications in Agro-Food and Health (26-28 November 2019)
- The 16th Congress of the Mediterranean Phytopathological Union (23-27 March 2020)

International patents owned in part by members of our Faculty

- Efstathiou A.M., Costa C.N. & Fierro J.L.G., Novel Catalyst for the NO Reduction to N2 with the use of Hydrogen Under Lean De-NOx Conditions. International Patent Cooperation Treaty: WO 03068390 (2002); US Patent: US 2005/0090393 (2006); European Patent: EP 1475149 A1 (2008); Australian Patent: AU 2003206981 A1 (2005); Spanish Patent: ES 2192985 (2003); Japanese Patent: JP2005516767 (2005).
- Efstathiou A.M., Savva P.G. & Costa C.N., Catalyst Containing Platinum on a Support Consisting of Nano-crystal Magnesium Oxide and Cerium Dioxide Towards H2-SCR. European Patent No. EP 08010888.8 (2010).
- Efstathiou A.M., Savva P.G. & Costa C.N., Catalyst Containing Platinum and Palladium for the Selective Reduction of NOx with Hydrogen (H2-SCR). European Patent No. EP 08010887.0 (2010).
- Costa C.N., Valanidou L., Savva P.G. & Theologides C., Novel Catalyst for the NO Reduction to N2 with the use of Ethanol or Ethanol-Hydrogen Mixtures Under Lean De-NOx Conditions. European Patent No. 10390001.5/EP10390001 (2010).
- Kashfi K. & Fotopoulos V., Method of Priming Plants against Abiotic Stress Factors and Promoting Growth. International Patent No. PCT/US15/15380 (2015).
- *Patent pending*: Tapakis R. & Charalambides A., System and Method for Predicting Solar Power Generation. International Patent Application No. PCT/EP2016/055889 (2016).

Research at the Faculty:
I. Department of Agricultural Sciences, Biotechnology and Food Science

Overview

In spite of a substantial load of teaching and administrative work, the academic staff of the Department has been actively involved in numerous research projects and the submission of competitive research grants. Research is additionally boosted thanks to internal funding from the available (though limited) economic resources of the University.

The strengths of ABF for research is the existence of state-of-the-art analytical/molecular equipment, the willingness of all academic staff to be heavily involved in research initiatives and the existence of a critical mass of active research faculty. It is also noteworthy that the University provides incentives and support to faculty members to participate in competitive research. All these factors have led to a sizable number of publications in peer-reviewed journals with high impact factors, edited books and conference proceedings, as well as an international patent. ABF academic staff members have made a large number of presentations in international scientific conferences. Published results have been widely endorsed by the scientific community, as indicated by the large number of citations in the international literature.

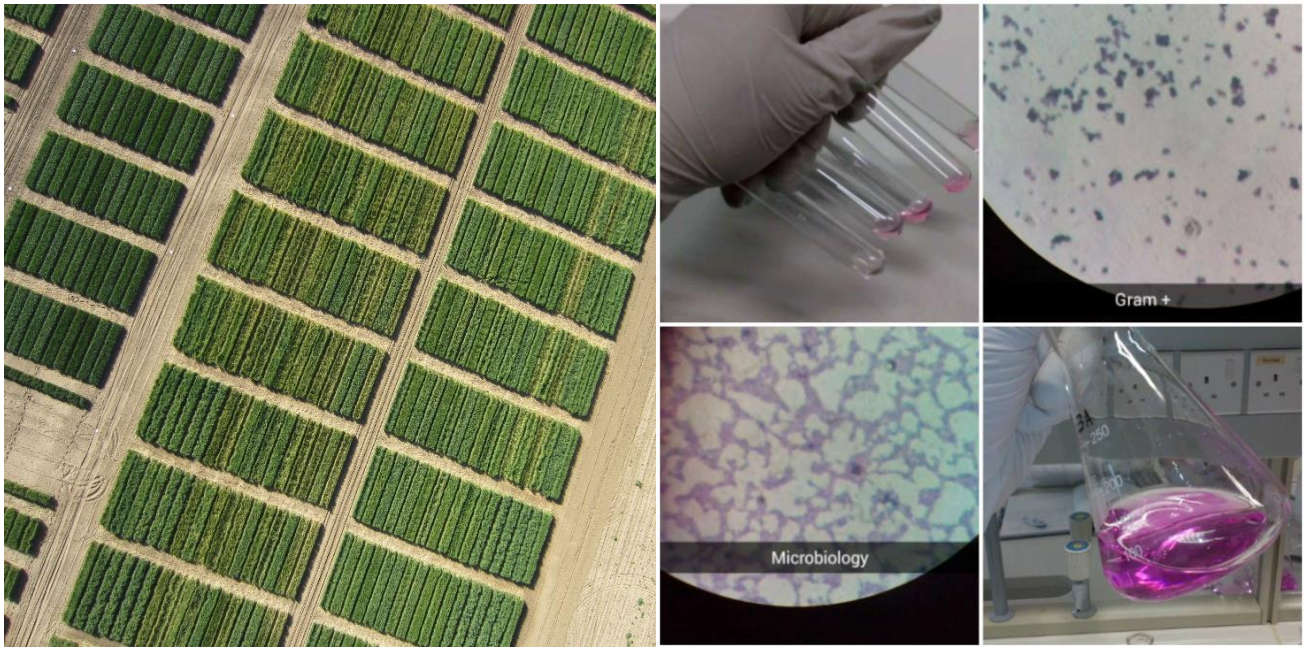
To support its focus on building strong interdisciplinary teams and generating world-class research, the ABF Department has established comprehensive research facilities, which can be broadly categorised according to its three divisions – Crop Science and Technology, Animal and Dairy Science, and Food Science and Technology. The specific divisions and their equipment are as follows:

Crop Science and Technology: LiCor 6400 photosynthesis meter, porometer, fluorometer, two plant growth rooms, nitrate/nitrite probe, plant tissue culture incubators, EpiFluoresence Stereo Microscope, EpiFluoresence Microscope, VITEK, Laminar Flow Class II, genetic analyser, spectrophotometer plate reader, fluorescence spectrophotometer, ELISA plate reader, PCR, two real time PCR, DNA electrophoresis, protein electrophoresis, 2D-protein electrophoresis, DNA hybridization oven, DNA cross linker, fermentor, nanodrop, gel documentation, MiSeq system for DNA sequencing.

Animal and Dairy Science: Dairy production Unit (cheese vat, cheese pressing equipment), incubator, flow cytometer, laminar flow class II, DNA electrophoresis, PCR, Milkoscan, nano filtration unit, homogenizer, inverted fluorescent microscope, CO_2 incubator.

Food Science and Technology: Soxhlet extractor, texture analyser, spectrophotometer, Gerber, distillators, vacuum packing machine, conductivity meter, water activity meter, automatic titrator, colorimeter, viscometer, fruit firmness tester, sample concentrator, Solid Phase Extraction Unit, Sonicator, bench top refractometer, Kjeldahl Unit, calorimeter, HPLC units (2x), GC-FID, GC-MS, FT-IR spectrophotometer, polarimeter, freeze-dryer.

Other general equipment includes various laminar flows Class I, fume hoods, electrophoresis fridges, incubators, centrifuges, shaker incubators, pH meters, vortexes, RO water, water distillation system, refrigerators and freezers -20°C, -40°C and -80°C. Finally, other Departmental facilities include a chemical storage room and a sterilisation room.



The international committee that conducted an external evaluation of the ABF Department in June 2015 commended "the highly motivated, dedicated, enthusiastic faculty members who have established a very good track record resulting in national and international recognition of their Department" and the Department's "excellent research infrastructure".

The following pages describe briefly the activities carried out by each research group of the ABF Department during the period 2016-2018. Interested readers may obtain more information by accessing the webpages of each group, or the general Departmental webpage (www.cut.ac.cy/abf).

Research Group on Plant Breeding, Plant Genetics and Experimental Design

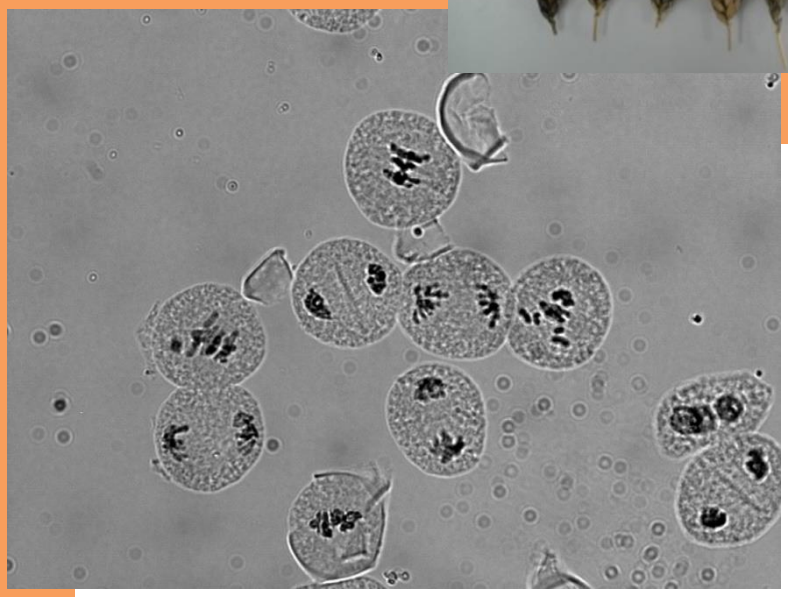
Head: Andreas Katsiotis, Professor

Team: Dr. Angelos Kyratzis, Assia Aissat, Stella Constandinou, Irene Ttigi

Plant breeding is an interdisciplinary methodology in order to manipulate heritable traits and develop new varieties with desirable traits. The specific traits that are manipulated greatly depend on the crop under consideration. The usual objectives of any plant breeding program targets higher yield, improved quality, abiotic and biotic resistance, time of flowering and maturity, to name a few. Our work is aiming to integrate knowledge from plant breeding methodologies, molecular cytogenetics, incorporation of wild relatives in cultivated species, genome organization, plant phenotypes, plant bio-diversification, molecular markers, field evaluations using NDVI Index Derived Photography etc.

Current research areas include:

- Genetic erosion of landraces,
- Evolutionary studies in oats, focusing mainly at the endemic species and their contribution to the development of the cultivated species,
- Development of pre-breeding populations using Multi-parent Advanced Generation Inter-Crosses (MAGIC) in durum wheat varieties,
- Pollen ploidy and genetic incompatibility responses in monocot and dicot species.
- Members of the group have participated in international and local plant collection missions. The group is using a number of techniques to accomplish the research described above, including molecular markers, molecular and conventional cytogenetics, flow cytometry, development of interspecific hybrids, cloning, field experimental plots, etc.
- Our group has participated in a number of national and international funded projects. We are collaborating with a number of universities, research institutes, germplasm banks, and organizations such as the European Cooperative for Plant Genetic Resources (ECPGR).



Selected publications

1. A. C. Kyratzis, D. P. Skarlatos, G. C. Menexes, V. F. Vamvakousis, **A. Katsiotis**. 2017. Assessment of Vegetation Indices Derived by UAV Imagery for Durum Wheat Phenotyping under a Water Limited and Heat Stressed Mediterranean Environment. ***Frontiers in Plant Sciences*** 8: article 1114 doi: 10.3389/fpls.2017.01114
2. K. Anestiadou, N. Nikoloudakis, **A. Katsiotis**, M. Hagidimitriou 2017. Monumental olive trees of Cyprus contributed to the establishment of the contemporary olive germplasm. ***PLOS ONE*** doi.org/10.1371/journal.pone0187697.
3. N. Nikoloudakis, A. Aissat, **A. Katsiotis.** 2018 Screening *A. ventricosa* populations for 2n gametes. ***Euphytica*** 214 (34) doi.org/10.1007/s10681-017-2017-x.
4. S. Constandinou, N. Nikoloudakis, A.C. Kyratzis, **A. Katsiotis** 2018. Genetic diversity of *Avena ventricosa* populations along an ecogeographical transect in Cyprus is correlated to environmental variables. ***PLOS ONE*** doi.org/10.1371/journal.pone.0193885

Laboratory of Agricultural Microbiology and Biotechnology

Head: Dimitris Tsaltas, Associate Professor

Team: Dr. Michalis Christoforou, Dr Despoina Bozoudi, Dr Agni Hadjilouka, Maria Tsolakidou, Minas Mina, Dimitris Anagnostopoulos, Eleni Xenofontos, Elena Kamilari, Nicos Larkos, Maria Kosma

Webpage: https://www.facebook.com/MicrobeAtCUT/

Microbes from the Farm to the Fork

Globalization of the food supply has increased the range of plant, animal and foodborne pathogens as well as amplified health and economic impacts of a single contamination incident. At the same time quality foods require the thorough analysis of the biological substrate and/or the living organisms participating and interacting in order to optimize production and prevent counterfeiting.

Production, processing, and distribution of food, increasingly takes place across vast and complex networks—each part or pathway of which must be working optimally—without the introduction of contaminants that could taint the final product. In parallel, microorganisms are responsible for the production of food in direct and indirect ways. Microorganisms are creating or transforming food to special food. Fermentations are responsible for a whole new list of products at all levels of agriculture and food production. From the farm to the fork, microbes orchestrate the transformation of biological matrices for the benefit of the environment, the plants, the animals and the humans. All fermentations are currently under deep exploration. From the soil and the rhizosphere to cheese, wine and the animal/human gut we need to unravel and understand the real role of microbes. Their role to Global Health.

“Farm to fork” is the global approach to reassure that food and feed has been traced from its very beginning steps of production in the field, the farm, the greenhouse, the sea or even the bioreactor, till the point is served to us. On the other hand “One Health” concept came to reinstate that all living organisms together with the environment require top level of health in order to positively affect each other’s health level.

Through a strong belief in “One Health” and “Farm to Fork” the Group of Agricultural Microbiology and Biotechnology at CUT is engaging in research all along the farm to fork chain. Microbiology research along the food supply chain while using all modern molecular biology techniques to study the microbial ecology and the interactions of microbes with their host and the food matrices, offers great opportunities for university training, research, collaboration and innovation in the industry.

Our Group is divided in three interacting divisions: Plant & Soil Microbiology, Food Safety and Food Fermentations. We work on plant pathogens, mycotoxigenic fungi in must products and human pathogens on leafy vegetables and we demonstrate possible risks for humans from antibiotic resistance acquired through use and misuse of antibiotics in agriculture. Recently we are also working towards the development of biosensors for microbial targets.

In parallel our group works towards understanding and supporting quality and safety of traditional fermented products of Cyprus. Characterizing their microflora evolution, we are contributing to the full profiling of the products and the development of starter cultures and probiotic inocula. Modern tools of molecular ecology and biotechnology such as Next Generation Sequencing offer new perspectives in microbial characterization. Contribution to scientific research and knowledge is summed up by the development of a culture collection from all the ongoing projects, fully supporting the European motto for “Knowledge Based Bio-Economy”. Our culture collection will be our documented “knowledge trust” for the future, creating bio-based opportunities for the Group as well as for the society.

Fig.1

A snapshot of current work

- Dissecting the role of ethylene production from the fungus *Verticillium dahliae* in tomato wilt disease
- Study of current status of grapevine trunk diseases in Cyprus
- Composting and compost plant beneficial microbes
- Study of human pathogens microflora in various growing systems (conventional, hydroponic, organic, aquaponics)
- Isolation and characterization of autochthonous microflora of Trahana (Fig. 1), Commandaria, Pitsilia Cured Meats (Fig. 2), Table Olives (Fig. 3) and Arkatena (Fig. 4) for the development of artisanal starter cultures
- Microbiome analysis of various microbial ecosystems of food and agricultural importance (Fig. 5)
- Development of microbial terroirs as an authentication and geographical origin fingerprint tool in various fermented products
- Development of molecular techniques for detection and enumeration of *Brettanomyces* spp in wine

Fig.2

Fig.3

Fig.4

Fig.5

Funding and collaborations

Dr. Tsaltas is an American Society of Microbiology Ambassador and ASM International mentor. He is national representative of the International Food Association and leading the international efforts of the Association on research for Traditional Foods and national representative of the Global Harmonization Initiative. The group is member of the ERATOSTHENIS Research Center (Center for Space Applications, Remote Sensing, Geo-Informatics, Geo-Environment and Sustainability – CSRGS http://www.cyprusremotesensing.com/). The group has extensive collaborations with researchers in Europe, Israel, Turkey, China, South Africa and USA. Funding is secured from EU (H2020 & ERASMUS+, LIFE+) and Regional funds (INTERREG) as well as National (RPF, Ministry of Agriculture). The group is also securing funds from local industries through scholarships and offered services.

Selected publications

1. D. Anagnostopoulos, D. Bozoudi and D. Tsaltas (2018). Enterococci isolated from Cypriot green table olives as a new source of technological and probiotic properties. Fermentation 2018, 4, 48; doi:10.3390/fermentation4020048
2. D. Bozoudi, M. Agathokleous, I. Anastasiou, P. Papademas and D. Tsaltas (2017). Microbial characterization of the fermentation process of Cyprus Trachana. Journal of Food Quality 2017; doi: 10.1155/2017/8749316
3. S. Pantelides E. Aristeidou M. Lazari M. Tsolakidou D. Tsaltas M. Christofidou D. Kafouris E. Christou N. Ioannou (2017). Biodiversity and Ochratoxin A profile of Aspergillus section Nigri populations isolated from wine grapes in Cyprus vineyards. Food Microbiology; doi:10.1016/j.fm.2017.06.010
4. M. Mina and D. Tsaltas (2017). Contribution of yeast in wine aroma and flavor. Yeast - Industrial Applications, ISBN 978-953-51-5782-3, Book edited by: Prof. Antonio Morata, PhD Iris Loira Calvar; https://www.intechopen.com/books/yeast-industrial-applications/contribution-of-yeast-in-wine-aroma-and-flavour

Animal Nutrition and Genetics Group

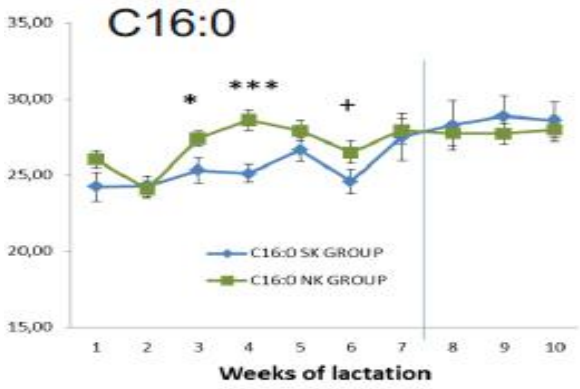
Head: Despoina Miltiadou (Associate Professor),
Ouranios Tzamaloukas (Assistant Professor)

Team: Simoni Symeou, Constantina Constantinou, Marina Neofytou (PhD candidates)

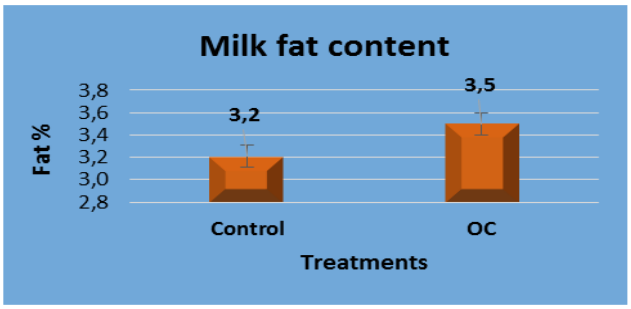
Webpage: http://ktisis.cut.ac.cy/cris/rp/rp00047

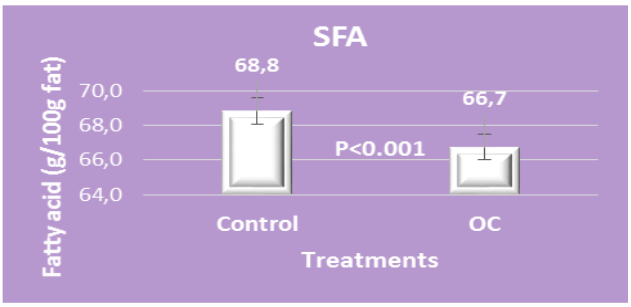
Ruminant production is currently the most important priority of the Ministry of Agriculture and the dairy industry of Cyprus, due to the amount of milk required to support the main export of the country, the halloumi cheese. Particularly, sheep and goat sector in Cyprus needs to improve its productivity and competitiveness and to ensure its survival within the EU by the means of reducing costs and improving the quantity and quality of milk produced. Within these objectives the main subjects of our group through undertaken research are focusing on (a) animal nutrition and the use of alternative feeds, (b) testing optimum management practices and (c) gene identification and gene functioning associated with production traits in small ruminants. Thus, recent findings of our group, related mainly to milk yield and quality, have been announced in international conferences and published in peer review journals, covering the following subjects:

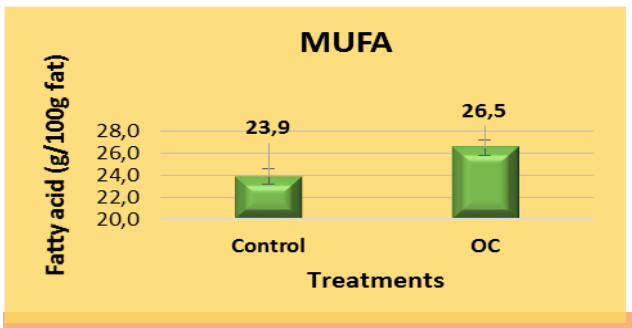
- Investigation of candidate genes affecting milk quality and milk yield of Chios sheep breed
- Research on lipids of milk and halloumi cheese, with focus on the fatty acids that have been associated with health beneficial effects in humans
- Investigating byproducts of olive oil production (namely olive cake) as an alternative feed in the main ruminant breeds of the island (Chios sheep, Damascus goat and Holstein – Friesian cattle)
- Investigating byproducts of bioethanol production (namely dried distillers grains) as alternative feed testing the effects on milk yield and milk quality in Chios ewes
- Study on different weaning methods proposed for sheep and goats for the benefits of the farmer and the quality of marketable milk obtained
- Research on mammary and liver gene expression and their regulation through management practices or nutritional supplementation in ruminants

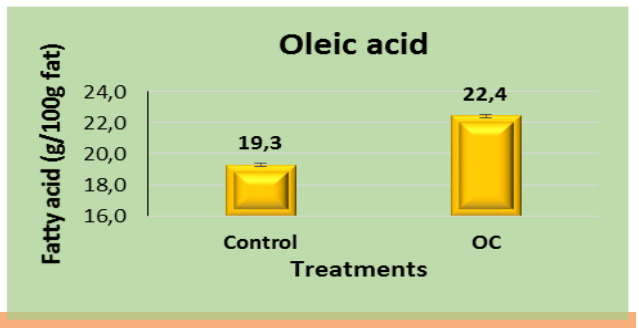


Specific milk fatty acids (such as C16:0) were affected by the weaning system applied in goat farms. Commercial milk obtained from Damascus does with suckling kids (blue line) had lower content of C16:0 compared to those with non-suckling kids (green line). These differences on milk quality was not observed after weaning (week 7, vertical line).









Improvement of lipid content of milk from Holstein-Friesian dairy cattle supplemented with a by-product of olive oil production (ensiled olive cake, OC). The increased fat content of milk observed in OC group was rich in beneficial for human health mono-unsaturated fatty acids (MUFA, oleic acid) on the expense of saturated lipids (SFA). Mammary and liver biopsies from cows were obtained to study the effect of the OC supplement in gene expression.

The research group on Animal Nutrition and Genetics has participated in several national and international projects obtaining expertise and experience in participating and/or coordinating projects which attracted funding from the Cyprus Research Foundation, co-funded by EU as well as projects supported by the local dairy and feed industry. The group has developed also an extensive network of local and international collaborators through the participation of the academic staff in international associations and networks involved in animal and dairy science in Europe, such as the European Association of Animal Production, SheepNet and different COST actions. Our group also has ongoing activities in exchanging students, academic staff and research associates for the needs of collaborative projects or through Erasmus and other EU projects building long-lasting collaborations with the industry, governmental departments and globally known institutions.

Selected publications

1. Miltiadou D., Hager-Theodorides A.L., Symeou S., Constantinou C., Psifidi A., Banos G. and Tzamaloukas O. (2017). Variants in the 3'UTR of the Ovine Acetyl-Coenzyme A Acyltransferase 2 Gene are Differentially Expressed and Associated with Dairy Traits, Journal of Dairy Science 100 :6285–6297
2. Miltiadou D., Orford M., Symeou S. and Banos G. (2017) Identification of variation in the ovine prolactin gene of Chios sheep with a cost effective sequence typing assay, Journal of Dairy Science 100 :1290–1294
3. Neofytou, M.C., Sparaggis, D., Constantinou, C., Symeou, S., Miltiadou, D., Tzamaloukas, O. Feeding ensiled olive cake affected fat and fatty acid composition of cow milk. 69th annual conference of the European Association for Animal Production EAAP 2018, Dubrovnik, Croatia.
4. Constantinou, C., Symeou, S., Miltiadou, D., Tzamaloukas, O. Effect of suckling on composition and fatty acid profile of milk in Damascus goat pre-weaning. 69th annual conference of the European Association for Animal Production EAAP 2018, Dubrovnik, Croatia.

Plant Stress Physiology Group

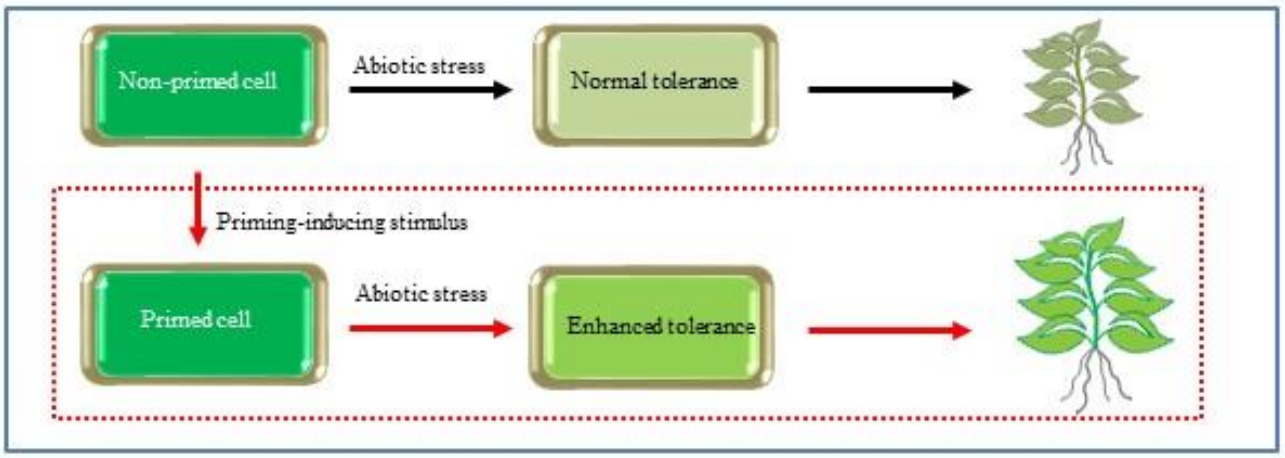
Head: Vasileios Fotopoulos, Associate Professor

Team: Dr. Andreas Savvides, Dr. Egli Georgiadou, Dr. Chrystalla Antoniou, Giannis Pavlou, Chrystalla Manoli

Webpage: plant-stress.weebly.com/

The increased frequency and extent of global climatic changes and associated extreme environmental events remarkably influence plant growth and development, ultimately affecting crop productivity throughout the world. Our research group has extensive research experience in plant stress physiology, biochemistry, molecular biology and biotechnology with emphasis on the study of oxidative and nitrosative signalling cascades involved in the plant's response to abiotic and biotic stress factors. Its staff and collaborators are comprised of plant physiologists, biochemists, molecular biologists and analytical chemists. Through our work we try to decipher the cellular mechanisms that orchestrate plant responses to such stress factors, while at the same time evaluating means of their amelioration. This is primarily done with chemical priming, which involves exposure to a priming agent such as a natural or synthetic chemical compound. Chemical priming presents opportunities for more effective use of plant priming in plant stress physiology studies and crop stress management. Furthermore, we are examining the potential use of chemical compounds towards improved growth under normal conditions.

We participate in numerous national and EU-funded research projects and are members of international associations and networks such as the International Plant Proteomics Organization, as well as COST Actions FA0605, FA1106 and FA1306. Our group also has extensive experience in hosting international exchange students through Erasmus+ and COST STSM programs, including students from Poland, Greece, Austria and Spain.



Pretreatment using a priming-inducing stimulus (e.g., chemical compound) results in enhanced cell tolerance and amelioration of stress-induced plant growth inhibition.

Our network of collaborators extends globally, including partners at VIB in Belgium, Max Planck Institute in Germany, City University of New York in the US and the University of Barcelona in Spain. In addition, we have experience in the establishment of intellectual property rights resulting from research carried out in our labs, leading to international patent WO 2015123273.A1. Attempts are currently being made to license the patented technology through a short-tech research project co-funded by the inventors' affiliating Institutes (CUT and CUNY; 'NOSH'-TEC').

Alfalfa plants (A) under drought stress, (B) well-watered, (C) pre-treated with melatonin and drought-stressed, (D) pre-treated with melatonin and watered.

Selected publications

1. Christou A, Michael C, Fatta-Kassinos D, Fotopoulos V (2018). Can the pharmaceutically active compounds released in agroecosystems be considered as emerging plant stressors? Environment International 114, 360-364.
2. Van Dingenen J, Antoniou C, Filippou P, Pollier J, Gonzalez N, Dhondt S, Goossens A, Fotopoulos V, Inzé D (2017). Strobilurins as growth-promoting compounds: How Stroby regulates Arabidopsis leaf growth. Plant Cell and Environment 40, 1748-1760.
3. Antoniou C, Chatzimichail G, Xenofontos R, Pavlou G, Panagiotou E, Christou A, Fotopoulos V (2017). Melatonin systemically ameliorates drought stress-induced damage in Medicago sativa plants by modulating nitro-oxidative homeostasis and proline metabolism. Journal of Pineal Research 62, e12401.

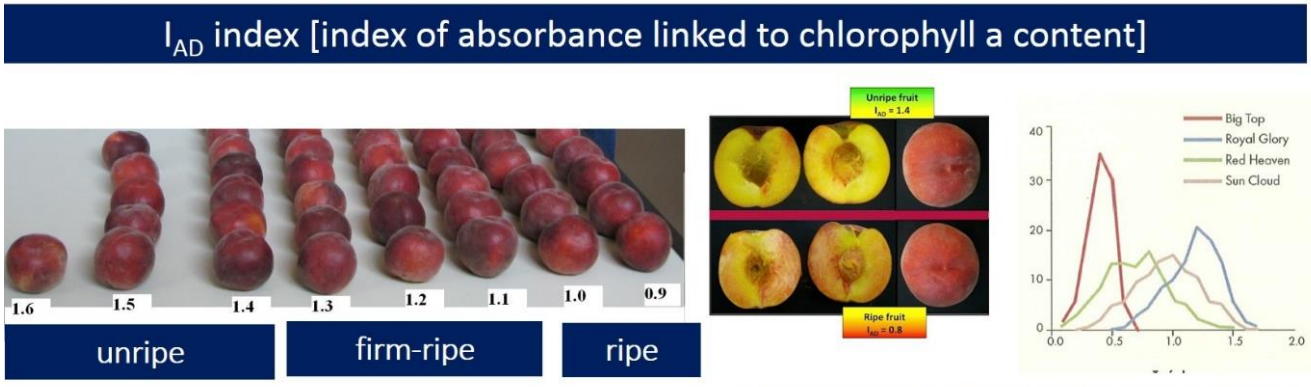
CUT Fruit Sciences/Postharvest Group

Head: George Manganaris, Associate Professor

Team: Savvas Constantinou (PhD student), Margarita Hadjipieri (PhD student), Marina Christofi (PhD student), Nicolas Valanides (MSc student), Epifanios Efstathiou (MSc student)

Webpage: www.cut.ac.cy/fruitsciencesgroup

The increasing globalisation of the fresh produce sector and the demand for high quality products stresses the need for innovative and sustainable preharvest and postharvest strategies and protocols. Prevention of postharvest losses is of major importance for global food and nutritional security. Provided that ca. 30-40% of fresh produce is never consumed and given the world demographic growth and the forecasted climate change, it is becoming a major challenge for human society to provide sufficient amount of high nutritional and sensory quality food. Towards this aim, our Group applies a multidisciplinary approach that encompasses advanced preharvest and postharvest protocols in order to preserve qualitative attributes and provide safe produce of high nutritional value. Particular attention is given to the elucidation of fruit ripening syndrome with emphasis on the development of physiological disorders and their responsiveness to chilling temperatures. Over the last years, our group has additionally worked with indigenous/traditional (unexplored) cultivars, as well as on the assessment of fruit quality with the employment of nondestructive tools.



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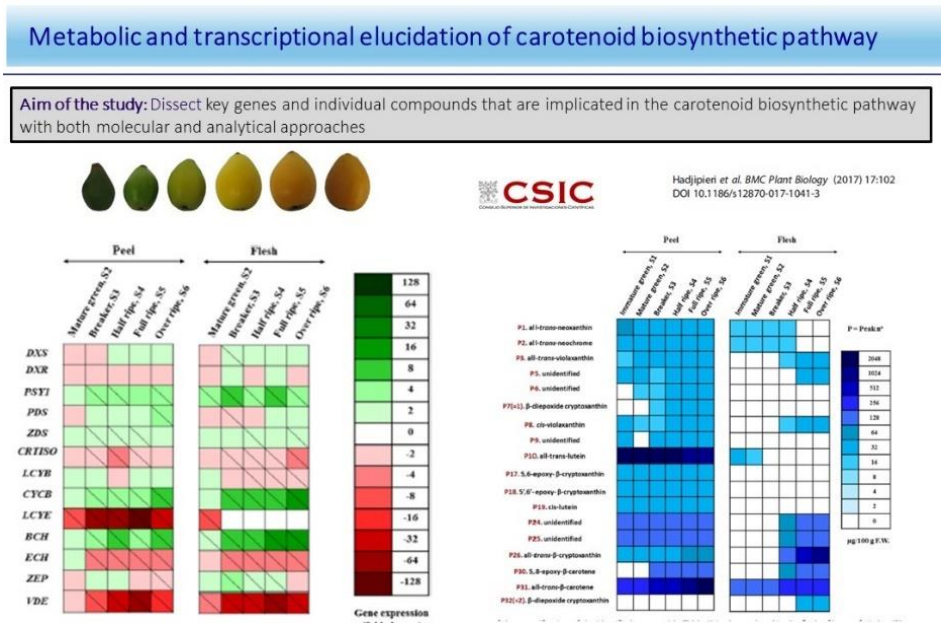
The Group has established synergies with industrial partners, both in Cyprus and abroad and a significant number of talks/seminars have been delivered to Universities, Research Institutes, growers/farmer associations and cooperative units about the challenges and future prospects in the cultivation of an array of fruit crops.

The Group is currently comprised of three PhD students: Savvas Constantinou is studying the composition of two indigenous grape cultivars ('Xynisteri', 'Mavro') from which 'Commandaria' dessert wine, a protected designation of origin product (PDO), is produced. Margarita Hadjipieri works with loquat (*Eriobotrya japonica*) fruit, a largely unexplored fruit crop that stepped out from a minor crop to a niche product that nowadays gain added value as it is available during late winter-early spring period. Marina Christofi's work plan is comprised of the assessment of the bioactive profile/phytochemical status of commercially important/promising clingstone peach cultivars, both as fresh and canned product, in order to evaluate further the effect of thermal processing (pasteurization and sterilization) on the composition of bioactives.



The group leader is currently Associate Editor in the Journal of Horticultural Science & Biotechnology, Editorial Board Member in 'Postharvest Biology & Technology' and 'BMC Plant Biology' and Review Editor in 'Frontiers in Crop Science & Horticulture' and 'Frontiers in Physiology & Plant Science'. During 2016, he has acted as a co-convenor of the III International Symposium on Horticulture in Europe [www.she2016.org, Chania, Greece, October 2016, 320 delegates] and of an International Cherry meeting [Naousa, Greece, April 2016, 130 delegates], held under the auspices of the COST FA1104 action [Sustainable production of high-quality cherries for the European market].

Selected publications

1. Fernández i Marti A, Saski CA, Manganaris GA, Gasic K, Crisosto CH. Genomic Sequencing of Japanese Plum (Prunus salicina Lindl.) Mutants Provides a New Model for Rosaceae Fruit Ripening Studies. Frontiers in Plant Science 2018, 9:21.
2. Manganaris GA, Goulas V, Mellidou I, Drogoudi P. Antioxidant phytochemicals in fresh produce: exploitation of genotype variation and advancements in analytical protocols. Frontiers in Chemistry 2018, 5:95. doi:10.3389/fchem.2017.00095
3. Constantinou S, Gómez-Caravaca AM, Goulas V, Segura-Carretero A, Koundouras S, Manganaris GA. The impact of postharvest dehydration methods on qualitative attributes and chemical composition of 'Xynisteri' grape (Vitis vinifera) must. Postharvest Biology & Technology 2018, 135, 114-122.
4. Manganaris GA, Drogoudi P, Goulas V, Tanou G, Georgiadou EC, Pantelidis GE, Paschalidis KA, Fotopoulos V, Manganaris A. Deciphering the interplay among genotype, maturity stage and low-temperature storage on phytochemical composition and transcript levels of enzymatic antioxidants on Prunus persica fruit. Plant Physiology & Biochemistry 2017, 119, 189-199.

Sustainable Agriculture Group (SAG)

Head: Menelaos Stavrinides, Assistant Professor

Team: Dr. Vassilis Litskas, Athanasia Mandoulaki, Andri Varnava, Kostas Michael, Chrysos Kaponas, Marios Xydas

Webpage: http://sustagric.weebly.com/

Sustainable food production under climate change is a major challenge for the international scientific community and the stakeholders of the agricultural sector. Accordingly, the SAG main research is focused on the following topics:

1) Sustainable vineyards under global change: In cooperation with colleagues throughout the EU we work on the development of low environmental footprint practices and biodiversity conservation in vineyards. Recently, SAG coordinated an EU project, the AgroLIFE project [LIFE13 BIO/CY/001114] that was co-funded by the LIFE+ programme, aiming to protect, to conserve and to enhance the biological diversity and ecosystem services in two important HNVFs in Cyprus, the vineyards in Commandaria region and the carob groves in Anogyra region (Fig. 1). The SAG also works on the implementation of novel spraying techniques in vineyards. The aim to minimize the sprayed volume, reducing the environmental footprint and the cost in purchasing PPP's (Plant Protection Products) (Fig. 2).

Fig. 1. AgroLife work in the field for the restoration and diversification of traditional hedgerows.

The research in sustainable vineyards will continue in the following 3 years as SAG gained funding from the Research Promotion Foundation (RPF) of Cyprus through the RESTART (2016-2020) projects.

Fig. 2. Demonstration of novel and more efficient spraying techniques to vine growers.

2) Pests in a changing climate: We participated (2015-2018) in "Genomite: New generation sustainable tools to control emerging mite pests under climate change", a multinational FACCE JPI project that aimed at developing tools and strategies for the management of spider mite pests (Acari: Tetranychidae) under climate change (Fig 3). Our work in Genomite was to assess the effects of climate change on crops, phytophagous and predatory spider mite species that are highly important for global agriculture. For this, we used the CLIMEX model to create the

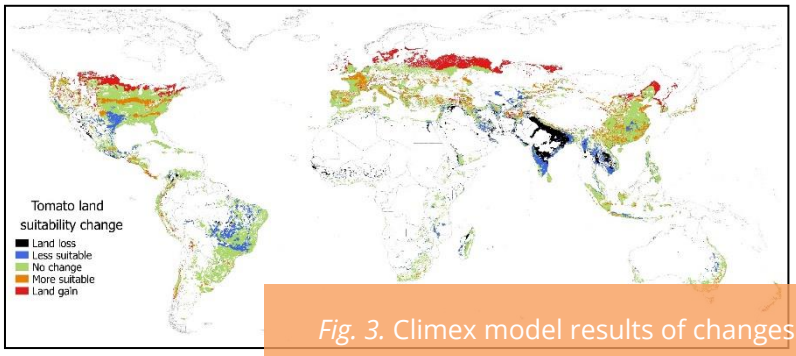


Fig. 3. Climex model results of changes in land suitability categories between 2050 (A1B – CSIRO MK.3) and 1975H for tomato.

Bioclimatic Envelopes (BE) for the species, under historic and future climate. Our goal was to identify those agricultural areas worldwide that will be vulnerable to these pests and contribute to the adaptation of the agricultural sector on the effects of climate change in pest management programmes.

3) Conservation of wild bees: The global population decline of the honeybee, *Apis melifera*, in the last decade has emphasized the importance of wild bee species in securing food production. Together with colleagues from other European countries we work on identifying and conserving the wild bees of Cyprus (Fig 4), the biodiversity of which remains poorly studied. SAG studies the ecology and seasonal activity of wild bees and experiments in Limassol area give us information about the bee species today. Our goal is to contribute to the establishment of monitoring programs that promote bee diversity and conservation. Our team was involved in the COST Action "Super-B: Sustainable pollination in Europe" through which SAG in collaboration with other members organized the Second European Bee Course in Cyprus.

Fig. 4. Wild bee of Genus Melecta sp. (left) and collecting bees with the net (right).

4) Research on ecopesticide development: SAG in collaboration with SMEs working in the field of ecopesticides development is evaluating their effects on pests and their natural enemies. Currently, the team has received funding from the RPF (Enterprises call – RESTART 2016-2020) for supporting the development of an ecopesticide, based on essential oils. The project duration will be 2 years and it will start in 2018.

The SAG comprises agricultural scientists from different disciplines such as entomology, plant science, ecology and environmental science. Through our work we try to promote sustainable agricultural methods and to highlight the importance of low environmental footprint practices, biodiversity protection and conservation in farmlands. Our goal is to contribute to the establishment of agro-environmental policy and measures in Cyprus. SAG has also worked on the development of the Agro-Environmental Indicators for Cyprus. The group has close collaboration with Cypriot (SMEs, Ministry of Agriculture, Rural Development and Environment, Open University of Cyprus) as well as international (INRA/France, CSIC/Spain, MAICh/Greece, IAMB/Italy) partners and has received funding from private and public entities from Cyprus and EU.

Selected publications

1. Litskas, V.D., Irakleous, T., Tzortzakis, N., Stavrinides, M.C. (2017). Determining the carbon footprint of indigenous and introduced grape varieties through Life Cycle Assessment using the island of Cyprus as a case study. Journal of Cleaner Production 156, 418–425.
2. Chrysargyris, A., Laoutari, S., Litskas, V.D., Stavrinides, M.C., and Tzortzakis, N. (2016). Effects of water stress on lavender and sage biomass production, essential oil composition and biocidal properties against Tetranychus urticae (Koch). Scientia Horticulturae 213, 96–103.
3. Martinou, A.F., and Stavrinides, M.C. (2015). Effects of sublethal concentrations of insecticides on the functional response of two mirid generalist predators. PLoS ONE doi: 10.1371/journal.pone.0144413

Research Group on Dairy Science and Technology

Head: Photis Papademas, Assistant Professor

Team: Dr. Maria Aspri, Panayiotis Mousikos (PhD cand.), Lina Kotsaki (PhD cand.)

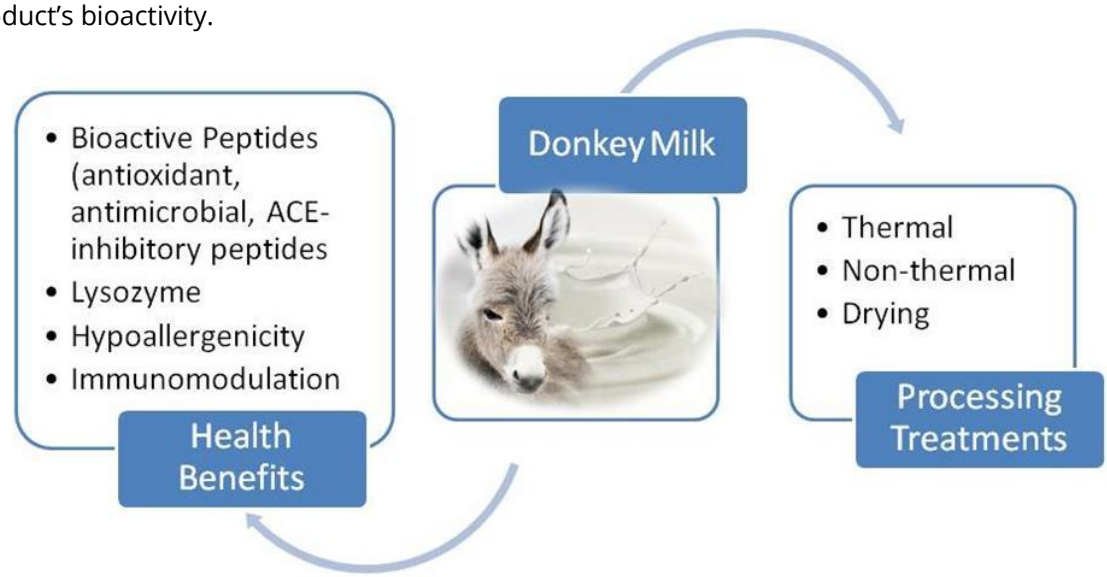
Webpage: https://ppapademas.wixsite.com/dstech

Dairy Products are a major share of the worldwide food production and the dairy industry is considered a gigantic business. It is inevitable that research on Dairy Science and Technology is needed in producing high-quality safe, nutritious dairy products.

As we are situated in the Eastern part of the Mediterranean we have the opportunity to work with milk types other than cow. Therefore, our group has extensive research experience in non-cow milks such as goat, sheep and donkey milk. We are very much interested in characterising and "adding-value" through research to traditional dairy products and we have worked significantly over the years on sheep/goat Halloumi cheese (i.e. authentication, feeding regimes/areas of production, characterisation of the product). More recently, we were involved in the study/characterisation of a Cyprus white-brined cheese named Halitzi.

Over the last years the study of donkey milk is a major research objective of our group, where the potential positive health impact of donkey milk to population suffering from health issues (i.e. immunity related disorders) are studied through an international multi-disciplinary approach. We have also extensively studied the microbiome of donkey milk and used some of the isolated lactic acid bacteria to produce fermented products with functional properties.

Very recently our group has been awarded a research grant by the national Research Promotion Foundation (RPF) to collaborate with a local enterprise to produce a bioactive donkey milk powder. It is expected that the novel, non-thermal processing method which will be used will have minimal impact on the product's bioactivity.



Our network of collaborators includes partners at Parma University and Molise University in Italy, University College Dublin in Ireland, Queen's University Belfast in the UK, the Agricultural University of Athens, Aristotle University Thessaloniki, in Greece. In addition, members of our group participate as experts in projects on donkey milk (Veterinary School, University of Milan, Italy), and in Special Interest Groups, such as the "Traditional Products" of the ISEKI Food Association.

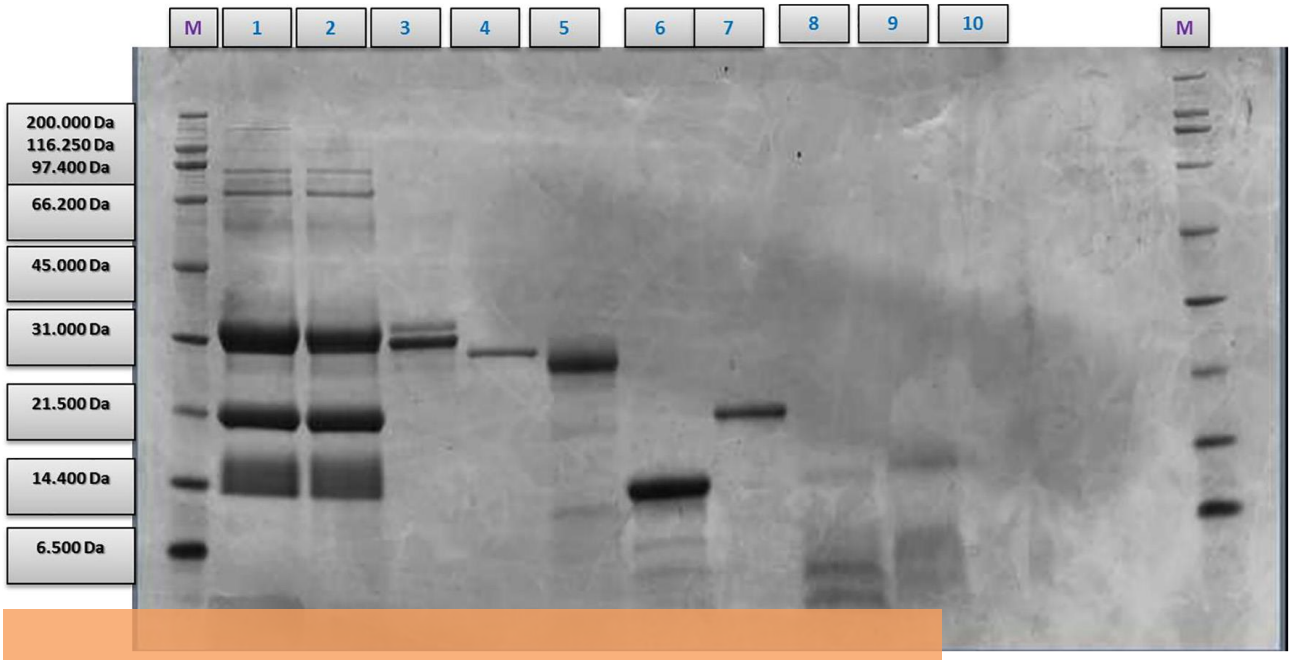


Figure 1. Protein bands detected in the SDS-PAGE gel from raw and digested donkey milk sample. Lanes are: 1) raw milk 1; 2) raw milk 2; 3) α-caseins; 4) β-caseins; 5) κ-casein; 6) α-lactalbumin, 7) β-lactoglobulin; 8) Digestion blank; 9) digested raw milk 1; 10) digested raw milk 2. Arrows indicate the positions of: LF, lactoferrin; SA, serum albumin; hcIg, high chain immunoglobulins; CNs, caseins; β-Lgs, β-lactoglobulins; LZ, lysozyme; α-lactalbumin (α-La)

Additionally, we have participated/organised numerous outreach activities such as public talks, science fairs and others, in an attempt to promote Dairy Science and Technology research and education in Cyprus. Our group has extensive experience in hosting international conferences such as the 7th IDF International Symposium on Sheep, Goat and other non-Cow Milk, which was hosted in Limassol, Cyprus in 2015.

Selected publications

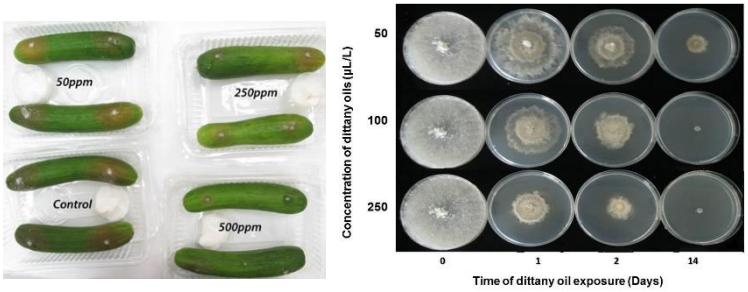
1. Aspri, M., Leni, G., Galaverna, G., Papademas, P (2018) Bioactive properties of fermented donkey milk, before and after in vitro simulated gastrointestinal digestion. Food Chemistry https://doi.org/10.1016/j.foodchem.2018.06.119
2. Souroullas, K., Aspri, M., Papademas, P (2018) Donkey milk as a supplement in infant formula: Benefits and technological challenges. Food Research International 109. https://doi.org/10.1016/j.foodres.2018.04.051
3. Aspri, M, Economou, N., Papademas, P. (2017) Donkey milk: An Overview on Functionality, Technology and Future Prospects. Food Reviews International 33(3) 316-333.
4. Bozoudi, D., Agathokleous, M., Anastasiou, I., Papademas, P., Tsaltas D. (2017) Microbiological Characteristics of Trachanas, a Traditional Fermented Dairy Product from Cyprus. Journal of Food Quality https://doi.org/10.1155/2017/8749316

Hydro-Aromatic Plants

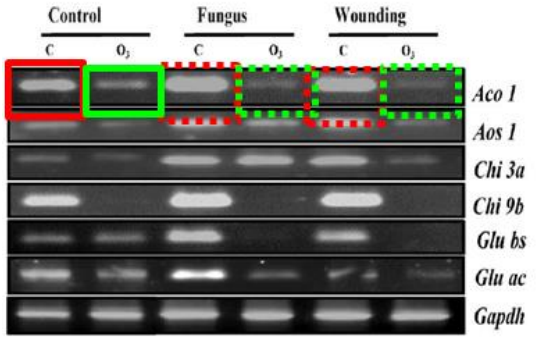
Head: Nikolaos Tzortzakis, Assistant Professor

Team: Antonios Chrysargyris (PhD), Munoo Prasad (PhD), Panayiota Xylia (PhD cand.), Omiros Antoniou (MSc cand.), Andreas Tzionis, Rea Vasiliou, Filio Athinodorou, Irini Ioannou

Webpage: http://www.cut.ac.cy/hydro-aromatic-plants



Antifungal activity of essential oils



Ozone induce resistance in tomato fruit

Plant nutrition and food safety is of great concern nowadays, attracting scientists' research interests, while crop adaptation to several abiotic and biotic factors is evidenced due to climatic changes. Our group has extensive research experience in plant nutrition and plant physiology/ biochemistry in soil as well as in hydroponics for vegetables and aromatic/medicinal plants. Additionally, the group has more than 16 years of experience in Postharvest Science, dealing with fresh produce preservation under natural sanitizers, essential oils and ozone, evaluating antimicrobial properties under pathogenic, physiological and biochemical/ molecular approaches. Group's staff and collaborators is comprised of plant physiologists, plant pathologists, biologists, food scientists, biochemists, and analytical chemists.

Through our work we try to optimise appropriate nutrition for crop needs as well as to alleviate induced resistance occurred mainly by abiotic stresses. Moreover, natural products are examined as putative sanitizers against postharvest disease with possible enhancing inputs in fresh produce quality and storability. We have recently constructed a fully automated greenhouse, examining crops in various hydroponic systems (both horizontal and vertical).

We participate in numerous national and EU-funded research projects, coordinating the HYDROFLIES, ESSOFRESH, AGROLABS, SALTAROMA, OPTIBIOCHAR and VITISMART projects. We are members of international associations and networks such as COST Actions FA1106 and EUVRIN. We have great experience in farmers and agronomists training and short courses/ summer schools.

Our network of collaborators extends globally, including partners at University of Cranfield (UK), University of Pretoria (South Africa), Volcani Centre (Israel), Reims University (France), Universitat de les IllesBalears (Spain), Marche Polytechnic University (Italy), University of Ghent (Belgium), University of Thessaly (Greece), University of Crete (Greece), MAICh (Greece), Technical Education Institute of Crete (Greece) as well as municipalities, unions and SMS.

a

b

c

d

e

(a) Spearmint in DFT, (b) Lettuce in Zig-Zag, (c) Lettuce in pumice and sawdust, (d) Tomato in perlite, (e) Lettuce in NFT

Members of the group are also members of the scientific committees at international conferences (2nd QMAP, WWPR2012, IWA Regional Workshop, WWMST2013, Postharvest Unlimited., SHE2016, and 4th International Conference on SSWM).

Selected publications

1. Chrysargyris A, Michailidi E, Tzortzakis N. 2018. Physiological and biochemical responses of Lavandula angustifolia to salinity under mineral foliar application. Frontiers in Plant Science. 9:489.
2. Xylia P, Chrysargyris A, Botsaris G, Tzortzakis N. 2017. Potential application of spearmint and lavender essential oils for assuring endive quality and safety. Crop Protection. 102:94-103.
3. Chrysargyris A, Panayiotou C, Tzortzakis N. 2016. Nitrogen and phosphorus levels affected plant growth, essential oil composition and antioxidant status of lavender plant (Lavandula angustifolia Mill.). Industrial Crops & Products. 83: 577-586.
4. Tzortzakis N, Chrysargyris A, Sivakumar D, Loulakakis K. 2016. Vapour or dipping applications of methyl jasmonate, vinegar and sage oil for pepper fruit sanitation towards grey mould. Postharvest Biology and Technology, 18: 120-127.

Research Group in Food Technology and Microbiology

Group Leader: George Botsaris, Assistant Professor

Team: Nikolas Markantonis, Christodoulos Michael, Eleni Hadjibmei, Christalla Savva, Styliani Polydorou, Zoe Papapanagiotou

The research of our group focuses in three interrelated areas within Food Technology / Biotechnology and Food Microbiology:

- Application of bacteriophage in food and veterinary diagnostics and in the biological control of bacterial diseases
- Detection and control of foodborne pathogens and other important microorganisms in the food supply chain
- Development of novel functional foods and their shelf-life evaluation.

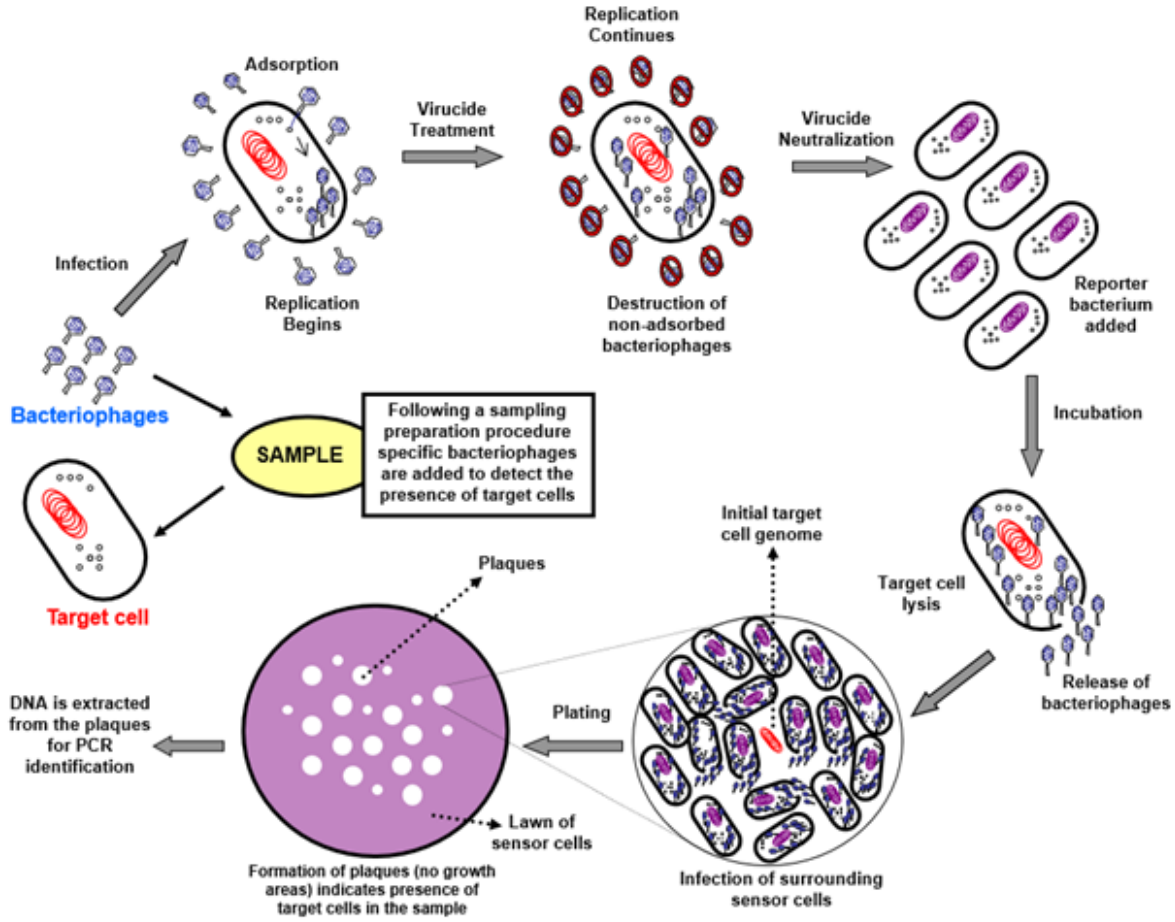


Figure 1. Diagram of phage amplification assay. Phage are added to sample and infects any target cells present in the sample. After time for infection, any remaining intact phage are destroyed using a virucide. This is neutralized by dilution and then new phage produced from the infected cell are detected by plating the sample in a lawn of phage-sensitive 'sensor' cells. To increase specificity, DNA can be extracted from plaques for PCR amplification of genomic signature sequences from the target cell.

The detection of food borne pathogens via the application of a combined bacteriophage detection and molecular confirmation by PCR is a very promising tool in food and veterinary diagnostics. The philosophy of this method is based on the detection of the targeted species of bacteria with the use of bacteriophage and the molecular identification of the species by PCR. This method has the ability to identify viable cells in less than 24 hours. The methodology we use for detecting MAP is schematically presented in Figure 1.

The phage amplification assay is faster and more sensitive compared to the conventional culture and other immunological detection methods. These advantages are shared with molecular detection methods like the PCR and qPCR. The phage amplification assay though, has the vital advantage of being able to differentiate between live and dead cells. This advantage is of critical importance when analysing processed food samples.

Following the successful application and validation of our method in milk, dairy products and powder infant formulas, we are now investigating the possibility of applying strictly lytic bacteriophage in an attempt to biologically control paratuberculosis and other mycobacterial diseases.

Towards the effort to improve food borne pathogen detection and monitoring in the food chain in Cyprus, we have recently completed a study reporting the detection of foodborne viruses in ready-to-eat meat products and meat processing plants. Recently we have also completed a study investigating the prevalence of *Salmonella* spp., *E. coli*, Enterobacteriaceae and ESBLs in the raw milk in Cyprus (see Figure 2). Other projects are also now initiated aiming at recording the prevalence of other important foodborne bacterial pathogens and viruses.

Finally, the technological development and shelf-life evaluation of novel functional foods is gaining major interest, considering the shift towards healthier products in the developed countries and the resulting increase of the functional food market. Our research interests in the area, focus on the development of novel yoghurt based products assessing the effects of functional ingredients on the viability of probiotic microorganisms and on the organoleptic quality.

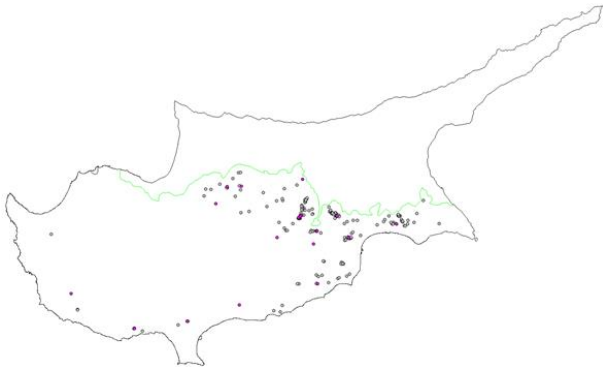


Figure 2. Prevalence of Salmonella spp. in bulk tank cow's milk from all the dairy herds in Cyprus. The dots represent the location of the farms and the positive farms are highlighted in red.

Collaborating with the local industry in a number of small projects we have managed to produce results that merited publication in scientific journals, whilst offering also solutions to problems encountered. We will continue working in close association with government services and the local industry in an attempt to provide solutions to the industry and assist the authorities in their efforts to monitor and control the prevalence of foodborne pathogens throughout the food chain.

Selected publications

1. Gerrard, Z.E., Swift, B.M.C., Botsaris, G., Davidson, R.S., Hutchings, M.R., Huxley, J.N., Rees, C.E.D. (2018) Survival of Mycobacterium avium subspecies paratuberculosis in retail pasteurised milk. Food microbiology 74, 57-63
2. Markantonis, N., Vasickova, P., Kubankova, M., Mikel, P., Botsaris, G. (2018) Detection of foodborne viruses in ready-to-eat meat products and meat processing plants. Journal of Food Safety, 38(2), e12436
3. Xylia, P., Chrysargyris, A., Botsaris, G., Tzortzakis, N. (2017) Potential application of spearmint and lavender essential oils for assuring endive quality and safety. Crop Protection, 102, pp. 94-103

Phytopathology & Integrated Management of Plant Diseases

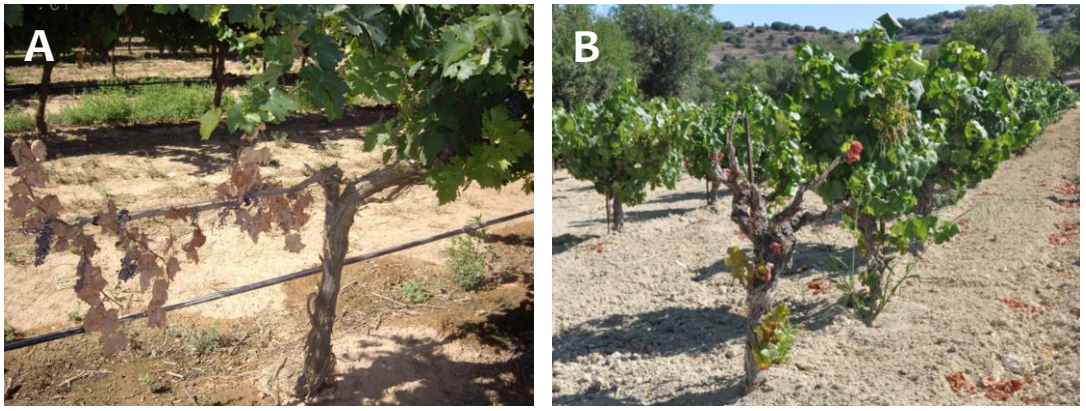
Head: Loukas Kanetis, Assistant Professor

Team: Styliana Efstathiou, Solonas Solonos, Marios Christodoulou

Our research group's work focuses on:

1. The etiology, epidemiology and management of important, existing and emerging, plant diseases, that affect the Cyprus crop production, using chemical, cultural and biorational approaches, with an emphasis on grapevine trunk diseases (GTDs);
2. The phenomenon of site-specific fungicide resistance (detection, mechanisms involved in the development and selection of resistance and development of anti-resistance strategies);
3. The development of alternative means to synthetic pesticides (pre- and postharvest);
4. The ecology of mycotoxigenic fungi and the factors affecting toxin production for developing strategies to reduce toxin contamination of fresh produce.

Based on recent data of our group the Cyprus vineyard is seriously affected by GTDs. This problem is considered at the moment as the most important established threat to the productivity and longevity of the local viticulture and subsequently of the winemaking industry. Unfortunately, the problem has not been studied in Cyprus and its importance has been neglected, since symptoms on infected vines are usually visible only years after the infections have been established. Currently, our research is focusing on the biology of the fungal species implicated in these complex patho-systems (= Esca, Petri disease, Botryosphaeria, Eutypa and Phomopsis dieback), the epidemiology of major GTDs under Cyprus conditions and the assessment of local wine-making varieties for resistance to important GTD pathogens. Working in a collaborative frame with other European Universities and local authorities and agencies, this effort is laying the groundwork for advancing the scientific knowledge pertaining to these important diseases in the country.



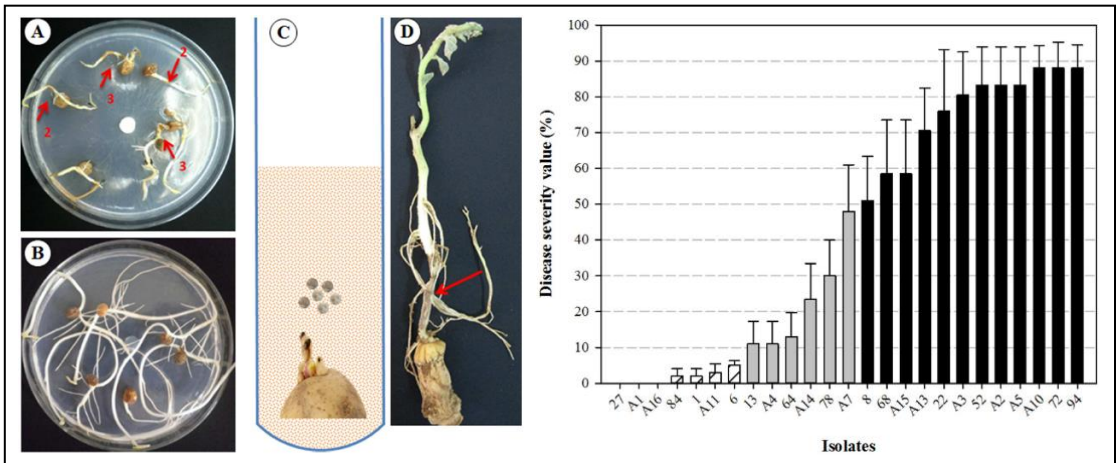
Grapevine trunk diseases: **A**, ***Esca*** - Sectorial symptoms of apoplexy. Healthy-looking leaves and grape clusters wither in a few days, but usually remain attached to the vine. **B**, ***Botryosphaeria, Eutypa & Phomopsis dieback*** - Dead spurs with weakened vegetative development and low percentage of bud break.

Since potato production is the most dynamic sector of Cyprus' primary agricultural production, we have performed research on major diseases affecting the crop. The population structure of the potato black scurf pathogen *Rhizoctonia solani* has been conducted and the potential effect of the local population on rotational hosts has been evaluated. Recently, we have also reported for the first time in Cyprus the presence of the potato powdery scab, caused by *Spongospora subterranea* f. sp. *subterranea*.

Greenhouse horticulture is an expanding production system in Cyprus with gray mold causing significant crop losses. Our research on the sensitivities of *Botrytis cinerea* populations to seven botryticides with different modes of action, highlighted the widespread phenomenon of fungicide resistance in greenhouse crops, since only 8,6% of the isolates were sensitive to all botryticides. Ongoing research is being conducted on the genetic structure and biology of B. cinerea populations in conventional and organic crop production systems. We are also conducting research on novel active compounds for the management of *B. cinerea* and other pathogens with promising results in collaboration with researchers from the University of Cyprus, Nicosia. Present results, along with information from ongoing research, will be used in developing management strategies for this important disease under Cyprus conditions.

We are also interested in the connection between mycotoxigenic fungi and food safety. Thus, we have studied the etiology of pre- and postharvest pomegranate fruit rots and the capacity of the implicated fungal species in toxin production. Research has been conducted on the natural incidence of fumonisin B2 and other toxins in pomegranate fruit produced by *Alternaria* and *Aspergillus* spp. field infections. A similar project has been completed on grapes in collaboration with the Aristotle University of Thessaloniki in Greece.

Furthermore, we have developed a strong interest on the etiology and epidemiology of emerging plant diseases in Cyprus, and currently participate as member of the management committee and national representative of Cyprus in the COST Action: "Pine pitch canker: Strategies for management of *Giberella circinata* in greenhouse and forests - PINESTRENGT", an emerging forest pathogen in Europe.



Disease severity of *Rhizoctonia solani* isolates and distribution of disease severity based on the percentage of the sprout surface covered by lesions. Isolates are classified into three aggressiveness groups - low (<10%), intermediate (10-50%) and high (>50%).

Selected publications

1. Kanetis L., Papayiannis L.C., Samouel S., Iacovides T. (2016). First report of potato powdery scab, caused by *Spongospora subterranea* f. sp. *subterranea*, in Cyprus. Plant Disease, 100(5), 1010.
2. Kanetis L., Tsimouris D., Christoforou M. (2016). Characterization of *Rhizoctonia solani* associated with black scurf in Cyprus. Plant Disease, 100(8), 1591-1598.
3. Kanetis L., Exarchou V., Charalambous Z., Goulas V. (2017). Edible coating composed of chitosan and Salvia *fruticosa* Mill. extract for the control of grey mould of table grapes. Journal of the Science of Food and Agriculture, 97(2), 452-460.
4. Kanetis L., Christodoulou S., Iacovides T. (2017). Fungicide resistance profile and genetic structure of *Botrytis cinerea* from greenhouse crops in Cyprus. European Journal of Plant Pathology, 147(3), 527-540.

Research Group on Food Chemistry and Analysis

Head: Dr. Chryssoula Drouza, Lecturer

Team: Aggelina Kritioti (PhD, student), Eleni Michailidou (PhD student), , Georgia Xadri (Msc student), Xenia Nikolaou (Msc student), Georgia Nicolaou (Msc student), Smaragda Spanou (Msc student, PhD student), Ioanna Hadjiadamou (PhD student, co-supervision), Manolis Vlasiou (PhD student, co-supervision), Anthi Dieronitou(Msc student, co-supervision).

Webpage: http://www.cut.ac.cy/abf/staff//chryssoula.drouza

Food quality has direct impact on human health consisting a major concern of the consumers worldwide. Food chemistry is involved in both elucidating the composition of the raw material / final products and the changes occurring in food during its production, processing, storage and cooking.

A comprehensive evaluation of foods requires that analytical techniques are evolved with the available technology. As a result, a major objective in food chemistry is concerned with the application and continuous development of analytical methods. This aspect is particularly important when following possible contamination of foods with substances which may involve a health risk or interfere with the fraud in nutrient evaluation of food. Food authenticity and classification is of high concern for the consumers a government and the public financial sector of a country.

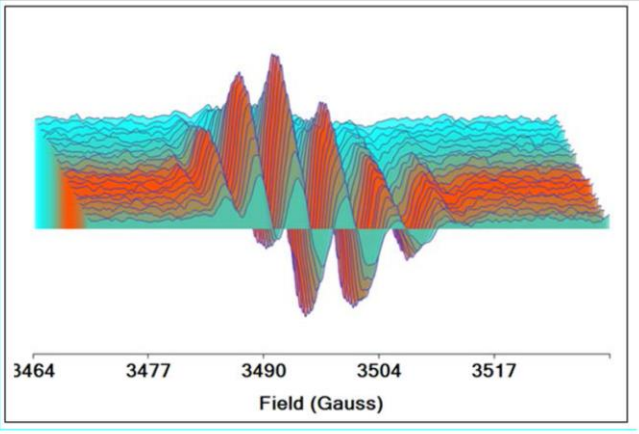
Our research group has extensive research experience in issues related to food composition, chemical changes of food as part of processing or storage, and developing methods to trace important biomolecules in the food matrix, and classification of food. Therefore, our research group has been involved in the following research projects:

(a) Investigation for the determination of markers for the discrimination/authenticity of food, such as olive oil, wine, honey and other food products (b) Study of the mechanisms of food oxidation (c) Study of the changes in the composition of food and its metabolites during processing, aging and/or storage (d) Development of new methods for the analysis of food components with high impact to the adulteration, authenticity and deterioration of food

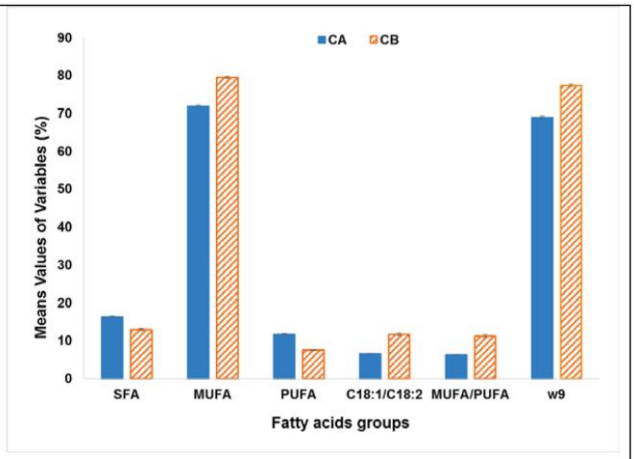
To match these targets in our group we utilize several advanced techniques such (i) chromatographic: gas chromatography (GC-MS/FID), High Performance liquid chromatography(HPLC-PDA/fluorescence/RI/UV, and (ii) spectroscopic: 1H (1 and 2D), 13C, 51V, 19F, 31P Nuclear Magnetic spectroscopy (NMR), Electron Paramagnetic spectroscopy (EPR) UV-vis spectroscopy (iii) electrochemical: CV-voltammetry.

We have recently developed a new experimental approach for recording the composition of edible oils, by labeling its components with 19F nuclei which is active in 19F NMR spectroscopy providing the ability for measuring several bioactive components of edible oils in few minutes. Another new approach has been applied for the detection of bioactive components in food by utilizing new metal-organic probes to induce paramagnetic signal in the complex food matrix characteristic of its components providing quantification and/or information for the mechanism of the food deterioration under study. These new methods are being exploited to food characterization and to discriminate it on the base of the botanical and/or geographical origin, with high economic impact to the local and the international community.

Classification studies of our group have revealed the specific markers for botanical and geographical origin of Cypriot olive oils, and wines from olive trees and vines respectively of indigenous varieties.



Kinetics of the Formation and degradation of a-Tocopheryl radical at the presence of novel metal-organic initiators for EPR study of the quality of olive oils.



Molecular markers from Cluster Analysis for the Botanical discrimination of Cypriot Virgin Olive Oils (Cypriot and Koroneiki) based on the fatty acid content.

Our network of collaborators includes partners at Aristotle University of Thessaloniki, Agricultural University of Athens, University of Ioannina, and University of Patras, Greece; University of Cyprus, Cyprus; University of Limerick, Ireland; University of Lleida, Spain; and academic members from the departments of Cyprus University of Technology.

We have participated in several national and EU-funded research projects while Dr. C. Drouza has experience in coordinating funded Infrastructure research program, which funded the purchase of an EPR spectrometer. We are members of international associations and networks including COST Action CM1305, COST Action TD1203, the International Forum on Industrial Bioprocesses (IFIBiop), and the Pancypriot Union of Chemists.

Selected publications

1. Drouza, C.; Dieronitou, A.; Hadjiadamou, I.; Stylianou, M., Investigation of Phenols Activity in Early Stage Oxidation of Edible Oils by Electron Paramagnetic Resonance and 19F NMR Spectroscopies Using Novel Lipid Vanadium Complexes As Radical Initiators. Journal of Agricultural and Food Chemistry 2017, 65, 4942-4951.
2. Kritioti, A.; Menexes, G.; Drouza, C., Chemometric characterization of virgin olive oils of the two major Cypriot cultivars based on their fatty acid composition. Food Research International 2018, 103, 426-437.
3. Karabagias, I. K.; Vlasiou, M.; Kontakos, S.; Drouza, C.; Kontominas, M. G.; Keramidas, A. D., Geographical discrimination of pine and fir honeys using multivariate analyses of major and minor honey components identified by 1H NMR and HPLC along with physicochemical data. European Food Research and Technology 2018, 244, 1249-1259.

Research Area: Food & Natural Products Research and Analysis

Head: Dr. Vlasios Goulas, Special Teaching Staff

Team: A. Hadjisolomou, L. Hadjivasilliou, D. Nicolaou, I. Loizou

Our mission is to perform profound research with state-of-the-art equipment in the field of food science and analysis, and natural products. Particular attention is given in three areas of specific expertise: (i) elucidation of the composition of foods and natural products (ii) discovering new bioactive compounds and/or extracts for food industry, and (iii) the impact of food processing and gastrointestinal digestion on stability of bioactive compounds. An array of chromatographic, spectroscopic and physico-chemical methods has been developed/modified to achieve our objectives. Furthermore, in vitro assays are used to evaluate antioxidant, antimicrobial, anti-hypertensive and antidiabetic activity.

The characterization of food and natural products is the primary scope of our research. We provide information about a wide variety of different characteristics of foods, including their composition, physicochemical and textural properties. We emphasize to the bioactive composition of foods of plant origin and natural products with the employment of advanced analytical methodologies. The phytochemical characterization is of great importance for plant foods and natural products as phytochemicals are linked with health effects. They also can be exploited as markers for the authenticity and origin of food. In period 2016-2018, we mainly studied carob and grape derivative products.

Another current topic of interest is to discover new multifunctional agents from natural products since they are considered as an extraordinary reservoir of novel chemodiverse molecules. Especially, the natural products are explored in order to pinpoint antioxidant, antimicrobial anti-hypertensive and antidiabetic compounds/ extracts. The utilization of the bioactive compounds/ extracts to produce innovative food formulations or food packaging coatings is also investigated. In this attempt, we contemplate Mediterranean flora as numerous phytochemicals with potential preventive and possibly therapeutic potential are comprised.

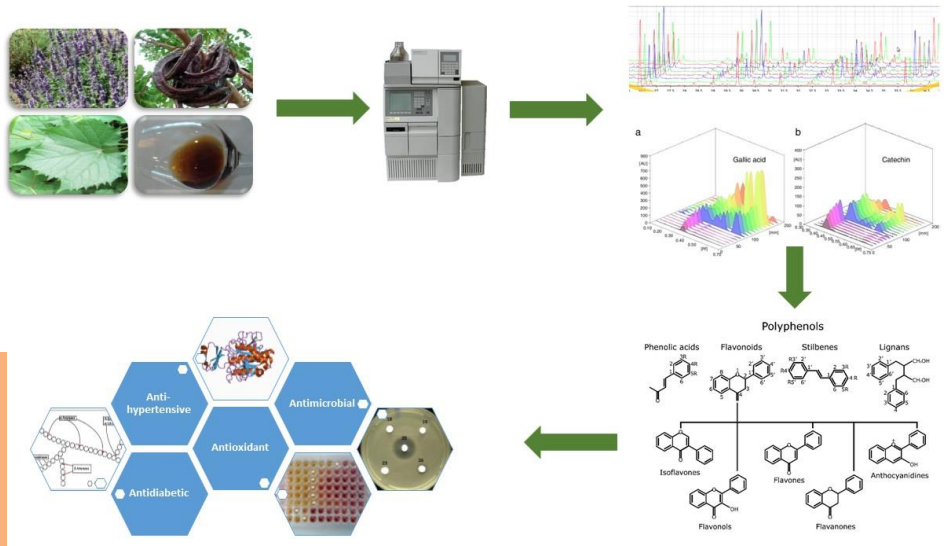


Fig. 1. Screening of bioactivity in foods and natural products

Over the past few years, there has been an increasing consumer's interest toward functional food which, beyond the basic function of supplying nutrients, claims to have health-promoting or disease-preventing properties. Thus, the stability of bioactive phytochemicals during processing operations such as drying/dehydration, ultrasound irradiation, blenching etc. is of great importance. The impact of processing and cooking methods on bioactive composition of food has been studied by our teamwork. In particular, we determined the effect of hot-air drying on the quality and bioactive composition of aromatic plants. Furthermore, the dehydration procedure of grapes destined for the production of Commandaria is also studied in order to improve the quality of final product. Moreover, the stability of bioactive compounds under gastrointestinal digestion was also perused with the employment of three stage in vitro model. Our research focused on the dynamic changes in phenolic composition and antioxidant potency occurs during in vitro digestion of common carob products.

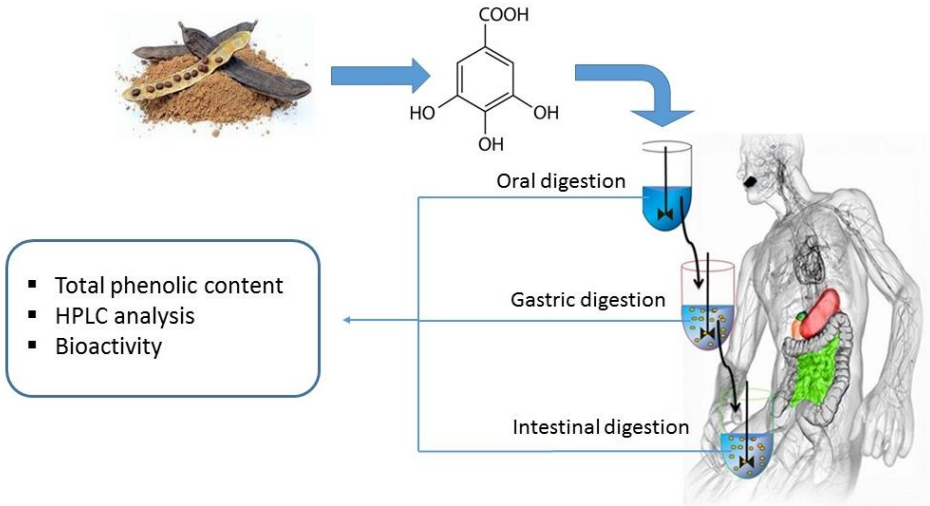


Fig. 2. Polyphenolic profile and bioactivity of carob products as affected by simulated in vitro digestion

A network of collaborators including partners at Research and Development of Functional Food Centre (CIDAF) in Spain, Department of Pharmaceutical Sciences in Antwerp (Belgium) and Department of Chemistry in Ioannina (Greece) has been established. In addition, synergies with other members of Academic staff at ABF Department and local organizations such as Department of Agriculture (Quality Products Section) have been established.

Selected Publications

1. Goulas V, Stylos E, Chatziathanasiadou MV, Mavromoustakos T, Tzakos AG. Functional components of carob fruit: Linking the chemical and biological space. International Journal of Molecular Sciences, 2016, 17, 1875.
2. Constantinou S, Gómez-Caravaca AM, Goulas V, Segura-Carretero A, Manganaris G. Metabolic fingerprinting of must obtained from sun-dried grapes of two indigenous Cypriot cultivars destined for the production of 'Commandaria': A protected designation of origin product. Food Research International, 2017, 100, 469-476.
3. Constantinou S, Gómez-Caravaca AM, Goulas V, Segura-Carretero A, Koundouras S, Manganaris G. The impact of postharvest dehydration methods on qualitative attributes and chemical composition of 'Xynisteri' grape (Vitis vinifera) must. Postharvest Biology and Technology, 2018, 135, 114–122.

Research Area: Plant Pathology, Plant Microbe Interactions

Senior Researcher: Dr. Iakovos Pantelides

Team: Michalis Aristeidou, Anna Kyriakou, Andreas Iakovou, Antria Tsalakou

Plant pathogenic microbes as well as unfavorable growth conditions can be a threat for plant growth. Approximately 25% of the world's crop yield is lost every year due to diseases caused by fungi, bacteria, viruses and other pathogens and pests. Protection of plants is mainly based on chemical products. Their use can potentially threaten humans' health and pollute the environment. In order to reduce our dependence on chemical pesticides new strategies have been developed.

Today Integrated Management plans are being widely adopted. This strategy brings together the understanding of pathogens' life cycles and their interactions with the plants and the environment. The protection plans combine a variety of non-chemical methods for managing plant diseases such as biological control. These strategies demand in depth knowledge of the plant-microbe encounters which can be friendly or hostile.

Our research focuses in interrelated areas within Plant Pathology and Biotechnology:

- Detection, evaluation and exploitation of beneficial microbes, which associate with plant aerial parts and roots and provide plants with an array of antimicrobial metabolites, hormones and plant growth promoting enzymes.
- Investigation of pathogenic or beneficial interactions between microorganism's and their plant host at molecular level in order to decipher the mechanisms of plant immunity and pathogen virulence or symbiotic cooperation.
- Evaluation and application of eco-friendly methods to control plant pathogens.
- Development of novel and effective strategies to manipulate networks and interactions existing between the plant, the plant microbial community and the environment to sustainably improve plant health and agricultural productivity.
- Our recent findings have been announced in international conferences and published in peer reviewed journals.

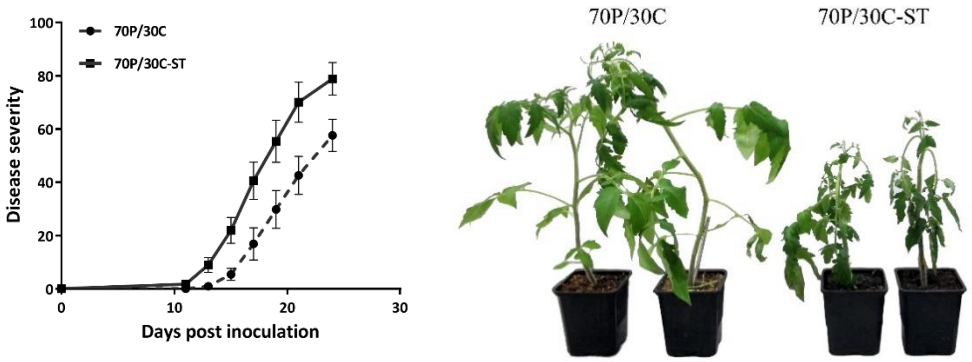


Figure 1: Fusarium wilt disease severity is less severe on tomato plants grown in a non-sterile compost substrate (70/30C) compared to plants grown in the sterile compost substrate (70/30C-ST). (A) Disease severity at each observation was calculated by the number of leaves that showed wilting as a percentage of the total number of leaves of each plant. (B) Fusarium wilt symptoms on tomato plants grown in the non-sterilized (Left) and in the sterile mix (Right) at 15 dpi.

We participate in numerous research projects at national and international level and the senior researcher is an active member of international associations and networks such as The American Phytopathological Society (APS, member), Mediterranean Phytopathological Union (MPU, member), Hellenic Phytopathological Society (HPS, board member), as well as COST Actions (e.g. FA1405 "Using three-way interactions between plants, microbes and arthropods to enhance crop protection and production"). Our group also has experience in hosting international exchange students through Erasmus+ programs.

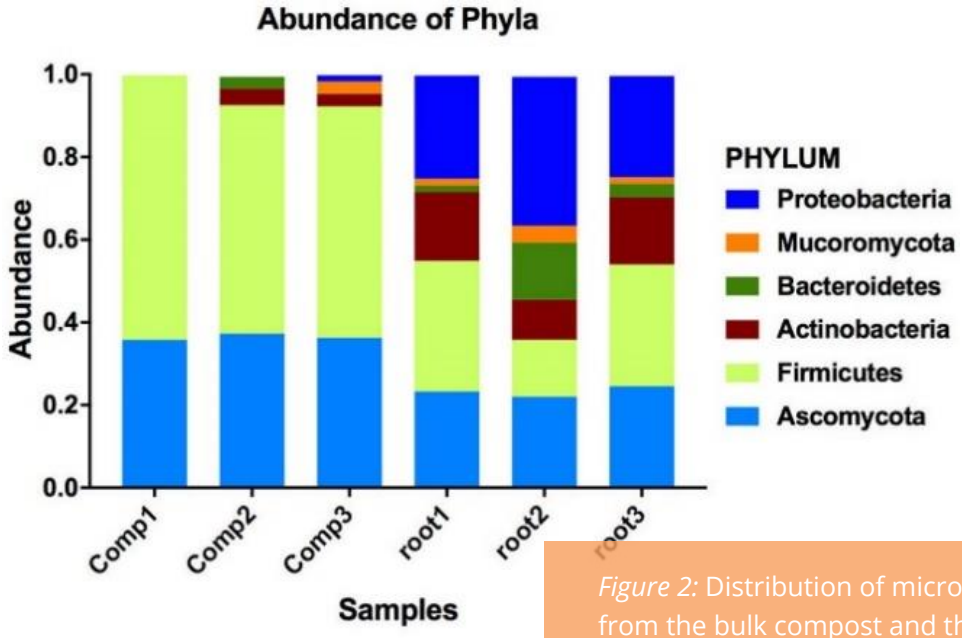


Figure 2: Distribution of microorganisms isolated from the bulk compost and the rhizosphere is altered between the two compartments. Bar plot showing the relative abundance of bacterial and fungal phyla where the isolated microorganisms are classified (comp1, comp2, comp3 = compost; root1, root2, root3 = rhizosphere).

Further, we have established a global network of collaborators including partners at Utrecht University in the Netherlands, Pennsylvania State University in the US and Agricultural University of Athens in Greece.

We have also established collaborations with the local industry in an effort to offer solutions to practical problems encountered. We work in close association with plant protection agronomists of governmental services and the private sector in an attempt to provide appropriate measures and solutions and assist their efforts to monitor and control the diseases caused by plant pathogens.

Selected publications

1. Antoniou, A., Tsolakidou, M.-D., Stringlis, I. A., Pantelides, I. S. 2017. Rhizosphere Microbiome Recruited from a Suppressive Compost Improves Plant Fitness and Increases Protection against Vascular Wilt Pathogens of Tomato. Frontiers in Plant Science 8, 2022.
2. Pantelides, I.S., Aristeidou, E., Lazari, M., Tsolakidou, M.-D., Tsaltas, D., Christofidou, M., Kafouris, D., Christou, E., Ioannou, N. 2017. Biodiversity and ochratoxin A profile of Aspergillus section Nigri populations isolated from wine grapes in Cyprus vineyards. Food Microbiology 67, 106-115.
3. Pantelides, I.S., Tsolakidou, M.-D., Chrysargyris, A., Tzortzakis, N. 2017. First report of root rot of hydroponically grown peppermint (Mentha × piperita) caused by a Pythium myriotylum in Cyprus. Plant Disease 101(9), 1682.
4. Pantelides, I.S., Tsolakidou, M.-D., Chrysargyris, A., Tzortzakis, N. 2017. First Report of Root Rot of Hydroponically Grown Lettuce (Lactuca sativa) Caused by a Pythium Species from the Cluster B2a Species Complex in Cyprus. Plant Disease, 101(4), 636.

Research Area: Genetic Resources & Crop Evolution / Biotechnology

Head: Dr. Nikolaos Nikoloudakis

Team: Apostolis Grigoriou (MSc student), Iliana Charalambous (BSc student) & Filio Athinodorou* (BSc student)
*in collaboration with Dr. Tzortzakis' group on Hydro-Aromatic Plants

Webpage: https://www.researchgate.net/profile/Nikolaos_Nikoloudakis

Preface

Plant genetic resources constitute a protective sheath for crops against the escalating climate change and against biotic and abiotic stresses; mainly since their diverse germplasm acts as a genetic pool of discrete alleles contributing to crop stability. Besides its use as an arsenal for food security, the flora of a region is irreversibly a vibrant component of its cultural history, and needs to be celebrated as such.

Cyprus is an unexploited treasury for diversity, due to its geographic location. The many microclimatic and soil types (in a restricted island area), as well as, to the proximity of eastern Mediterranean continental areas, have shaped a diversification boost. As a result, Cyprus is currently home to more than 1700 plant species, many of them being endemic (140). Besides wild species, plants having an agricultural potential can be classified as Crops Wild Relatives (CWRs) and local populations (Landraces). Hence, the dynamic for researching and exploiting this largely understudied genetic material, seems vast.

Dr. Nikoloudakis is an experienced Agricultural Biotechnologist and was a member (technical manager) of the national reference laboratories of the Hellenic Ministry of Rural Development and Food, regarding (I) GMO detection in seed lots and (II) the control of pathogenic viruses in plant reproductive material. He has also worked as a field-agronomist and has extensive research experience. Hitherto, he has participated in a number of research projects and peer-reviewed publications (22).

Present engagements and future goals

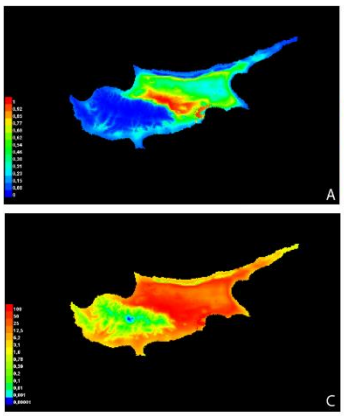
Our recently founded team (2017) aims to decipher the genetic and biochemical conceptions of the above agricultural important species, in correlation to the genomic dissection of the regional genetic structure. Moreover, we aspire to drive robust evolutionary conclusions affiliated to adaptation in specific edaphoclimatic attributes. This will allow as to target specific traits, thus allowing the re-introduction of local neglected germplasm to agricultural production and enhancing the quality of crops. On the other hand, it will deepen our understanding for the genomic interplay of evolutionary versus adaptational forces and promote our understanding for genomic and phenotypic plasticity.

In the current period (2017-2018) previous projects were completed, and novel goals were initiated:

- the molecular and phenotypic characterization of traditional Cypriot tomato varieties (Filio Athinodorou)
- the genomic dynamics of the legume genus *Vicia* in Cyprus (including broad bean and vetch landraces) via flow cytometry (Iliana Charalambous)
- the varietal demarcation of the Cypriot vineyard and the dissection of its genetic/biochemical distinctiveness (Apostolis Grigoriou)

Synergies and funding

We have actively participated in applications for competitive European (5) and national (1) funded research programs and established a local [Agricultural Research Institute (CY)] and an international [Hellenic Agricultural Organization DIMITRA (GR), Technological Educational Institute of Peloponnese (GR), International Center for Biosaline Agriculture (UAE)] network for collaboration



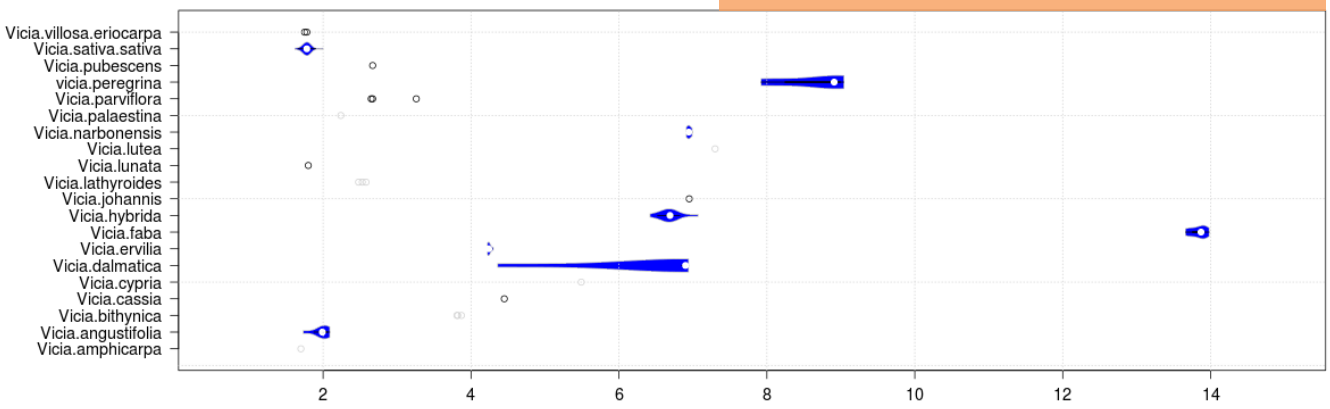
Variable	Percent contribution	Permutation importance
BIO2	64.2	6.9
BIO10	14.2	5.3
BIO8	5.7	5.3
BIO1	4.2	13.1
BIO7	3.4	0.1
BIO5	3.2	64.7
BIO4	3	2.2
BIO11	0.5	0.8

Figure 1. Habitat suitability for *A. ventricosa* determined from 19 environmental variables.

Depiction based on Clogloc (A), Raw (B) and Accumulated (C) outputs. Estimates of the most important relative contributions of the environmental variables to the Maxent model are presented (values shown are averages over replicate runs).

Figure 2. Cross section for the ARI00738 tomato accession. The number of locules and the distinctive pericarp colour are displayed.

Figure 3. Vicia spp genomic dynamics portrayed by 1C values.



Selected publications

1. Constandinou, S., Nikoloudakis, N., Kyratzis, A.C., Katsiotis, A. Genetic diversity of Avena ventricosa populations along an ecogeographical transect in Cyprus is correlated to environmental variables (2018) PLoS ONE, 13 (3), art. no. e0193885.
2. Nikoloudakis, N., Aissat, A., Katsiotis, A. Screening A. ventricosa populations for 2n gametes (2018) Euphytica, 214 (2), art. no. 34.
3. Hussain, M.I., Lyra, D.-A., Farooq, M., Nikoloudakis, N., Khalid, N. Salt and drought stresses in safflower: a review (2016) Agronomy for Sustainable Development, 36 (1), art. no. 4, pp. 1-31.
4. Maria, T., Tsaniklidis, G., Delis, C., Nikolopoulou, A.-E., Nikoloudakis, N., Karapanos, I., Aivalakis, G. Gene transcript accumulation and enzyme activity of β-amylases suggest involvement in the starch depletion during the ripening of cherry tomatoes (2016) Plant Gene, 5, pp. 8-12.

Research at the Faculty:
II. Department of Environmental Science and Technology

Overview

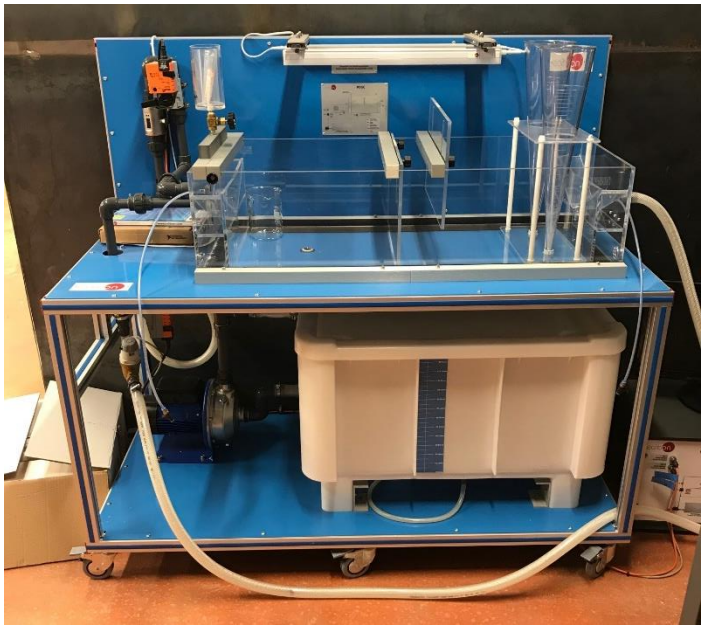
One of the main missions of the EST Department so far has been to promote basic and applied research in the field of Environmental Sciences and Technology, and to facilitate the mobility of its students, researchers and academics through international research cooperation. Having started offering the B.Sc. Programme in Chemical Engineering in collaboration with the University's Faculty of Engineering and Technology, the Department is gradually evolving into a Chemical Engineering Department, recruiting new academic faculty members who specialise in fields of Chemical Engineering, so that by the end of 2019 half of the academic staff is expected to consist of Chemical Engineers.

Despite the small size of the Department and the considerable teaching and administrative workload faced by all academic staff members, EST's collective research output has been very substantial and internationally recognised. The very satisfactory research performance has been acknowledged by the international committee of renowned academics who conducted an external evaluation of the Department in December 2014. In its concluding statement of their evaluation report that was submitted to the University's Rector, the Committee wrote that the University 'should be proud' of the EST Department in view of its research achievements and prospects.

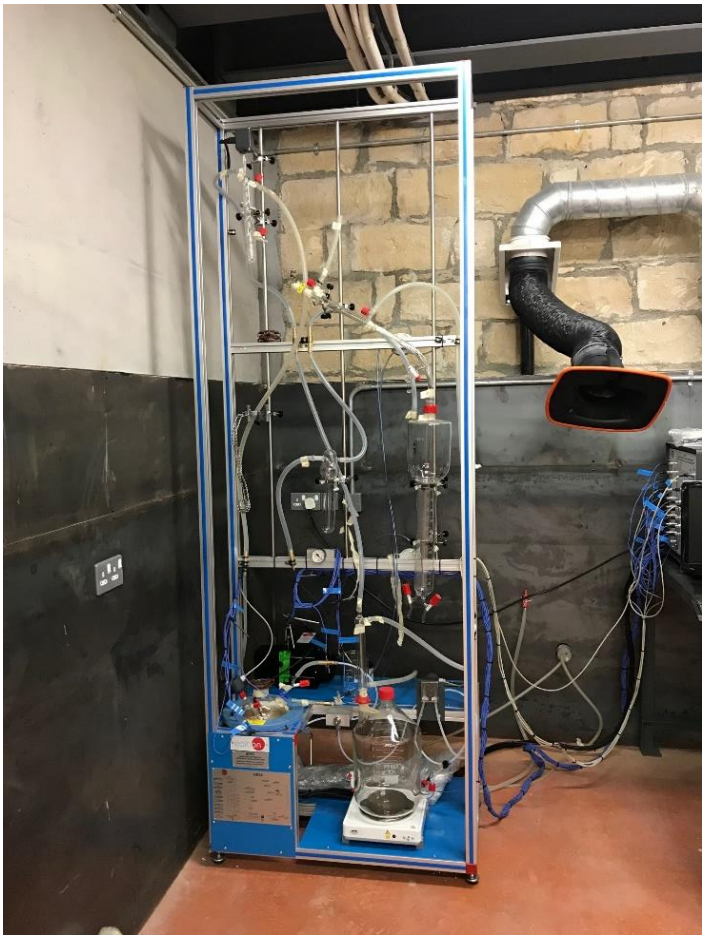
The Department's laboratories possess state-of-the-art equipment such as:

- Atomic Absorption Spectrophotometer (AAS)
- Inductively Coupled Plasma – Mass Spectrometer (ICP-MS)
- Ion Chromatograph (IC)
- High Performance Liquid Chromatograph (HPLC)
- Gas Chromatograph – Mass Spectrometer (GC-MS)
- Surface and Pore Analyser (BET)
- Fourier Transform Infrared Spectrophotometer (FTIR) coupled with DRIFTS Cell
- TOC/TON analyser
- Gas Chromatograph (GC)
- Fermentors
- Ultraviolet-Visible Spectrophotometers
- Microscopes
- Fluorescence Spectrophotometer
- Fats, Oils and Grease (FOG) portable analyser
- Gas emissions analyser
- Material Printer
- Freeze dryer
- Fully automated and computerized gas and liquid flow panels
- Low and High temp ovens
- Incubators
- Portable gas analysers (NO_x, CO/CO_2, VOCs, Microbial load, H_2S, NH_3, O_3, CH_4)
- IR and thermal cameras
- Fast Cameras
- Centrifuges
- Sound meters
- pH meters
- Vortexes
- RO water
- Water distillation system
- Conductivity meters
- Soil sampling equipment
- Refrigerators and freezers
- Equipment for educational laboratories in Physics
- Computer controlled gaseous mass transfer and diffusion coefficient unit
- Computer controlled fixed bed adsorption unit

- Computer controlled chemical reactors (Batch, Continuous Stirred Tank, Plug-Flow and Fixed Bed reactors)
- Computer controlled catalytic reactor
- Corrosion study unit
- Computer controlled sedimentation tank
- Computer controlled continuous distillation unit
- UV/Vis and FTIR spectroelectrochemical cells for REDOX active samples
- Calorimeter set for thermodynamic experiments



The following pages describe in more detail the major activities carried out during 2016-2018 in the Department's research groups and laboratories. Interested readers may obtain more information by accessing the webpages of each group, or the general webpage of the Department: www.cut.ac.cy/est



Laboratory of Environmental Biocatalysis and Biotechnology (LEBB)

Head: Constantinos Varotsis, Professor

Our lab is mainly working on Biosurface Spectroscopy, which is a new research field. In the graph at the top of next page, it is the red area in the centre, which lies at the intersection of three established fields of research – biology, surface science and spectroscopy.

More specifically, work at LEBB focuses on the following topics:

Structure and function of proteins

Electron transfer coupled to proton translocation is the basic mechanism of energy generation in most living organisms, but the molecular mechanism is not understood. A key enzyme in all eukaryotic and most prokaryotic electron transfer systems is cytochrome *c* oxidase, which accepts electrons derived from food and donates them to oxygen, generating a pH and electrical gradient to drive ATP synthesis. We are studying the bacterial cytochrome *c* oxidases ba_3 from *Thermus thermophilus* which differ in peptide composition from the mammalian cytochrome *c* oxidase but carry out the reduction of Oxygen (O_2) to water (H_2O), the oxidation of carbon monoxide (CO) to carbon dioxide (CO_2) and the reduction of Nitric oxide (NO) to laughing gas (N_2O) by using the same metal centres to catalyse the process.

Marine biofilm matrix

Marine microorganisms of the Marine *Roseobacter* Lineage (*Roseovarius nubinhibens, Roseobacter sp, Roseobacter denitrificans, Roseobater litoralis*) have demonstrated a diverse range of physiological and morphological features such as gas vacuoles, sulfur metabolism, secondary metabolite production that suggest unique adaptations to various marine environments. The role of these microorganisms as information carriers in the biotechnology industry is investigated. We are studying by the application of Biosurface spectroscopy the properties and constituents of the self-produced matrix of hydrated extracellular polymeric substances (EPS) that make biofilm the most successful form of life on earth.

Nanobiotechnology: Interaction of nanoparticles with proteins / Relation to bio-reactivity of the nanoparticle

In depth understanding of such interactions which direct towards generating bio-compatible nanomaterials with controlled surface characteristics in a biological environment.

Metal-Bacteria interactions at the mineral surface

The acidophilic iron(II) ion-oxidizing bacteria *Thiobacillus ferrooxidans* and *Leptospirillum ferrooxidans* are the most important mesophiles for the extraction of metals from sulfidic ores. Little is known about the interfacial processes leading to the degradation of metal sulfides because of the complex interaction of electrochemical, biochemical and surface-specific mechanisms. The project involves the study of cellular interactions with metal species in the aqueous environment. Strains of *Acidothiobacillus ferroxidans* have been associated with growth on mineral surfaces showing varying capacities to complex and accumulate metals. It is intended that results obtained from this study would contribute towards a greater understanding of cell-mineral interactions in an aqueous environment, in a simulation of the interfacial forces around bacterial phospholipid bilayers. The microbial oxidation of graphite by *Acidithiobacillus* is probed by FTIR and Raman imaging.

Protein-drug interactions

Cytochrome bc1 is a major drug target for the treatment and prevention of malaria and in the treatment of toxoplasmosis. The interactions of the antimalarial drugs Artemisinin and Artesunate with the bc1 complex are investigated by biosurface spectroscopy.

Glycolysis of plant and food proteins

Heat treatment of foods leads to glycation of individual protein-bound amino acids such as lysine and arginine. Substantial amounts of up to 1000 mg of Amadori compounds (mainly fructodelysine) and up to 75 mg of advanced glycation end products are ingested with the daily diet. The majority of these products cannot pass the intestinal barrier and enter into circulation and could therefore serve as a substrate for bacterial fermentation. Degradation of fructoselysine has already been shown. The characterization of advanced glycation end products as well the antioxidant properties of heterocyclic reaction intermediates and the antimicrobial activity of glucosamine-derived flavour compounds are under investigation by a combination of spectroscopic techniques. The glycation products have a great potential to establish an effective industrial method to generate efficacious antioxidant compounds which can be used in food technology.

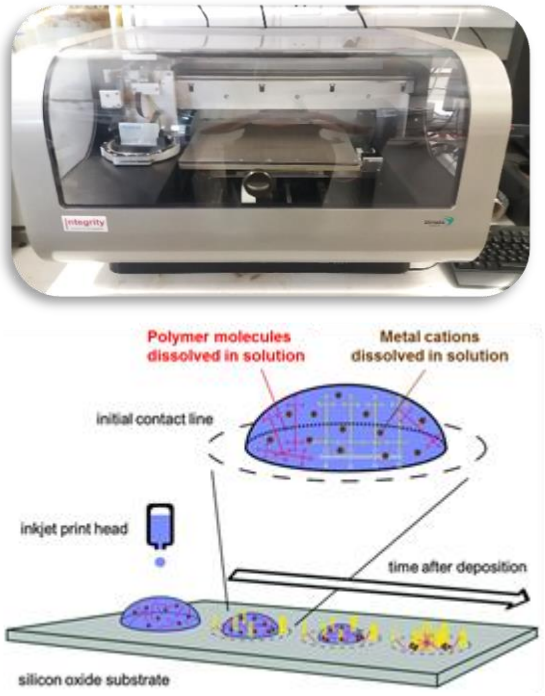
Laboratory of Environmental Catalysis

Head: Costas N. Costa, Professor

Team: Charoula Piskopianou, Barbara Constantinou, Vasiliki Chatziiona, Stathis Theofilou, Nantia Pandelidou

Environmental catalysis has continuously grown in importance over the last 2 decades not only in terms of the worldwide catalyst market, but also as a driver of advances in the whole area of catalysis. The development of innovative "environmental" catalysts is also the crucial factor towards the objective of developing a new sustainable industrial chemistry. In the last decade, considerable expansion of the traditional area of environmental catalysis (mainly NOx removal from stationary and mobile sources, and VOC conversion) has also occurred. The research group of the Environmental Catalysis Lab has extensive research experience in both traditional as well as new areas of environmental catalysis such as: (i) catalytic technologies for liquid or solid waste reduction or purification, (ii) catalysis for greenhouse gas control, (iii) use of catalysts for user-friendly technologies and reduction of indoor pollution, and (iv) reduction of the environmental impact of transport.

Among others, our group is currently investigating novel methods for catalysts development through "Printing". "Catalysts Printing", is a modern method that may be used for the accurate manipulation and tuning of the properties of catalytic materials.

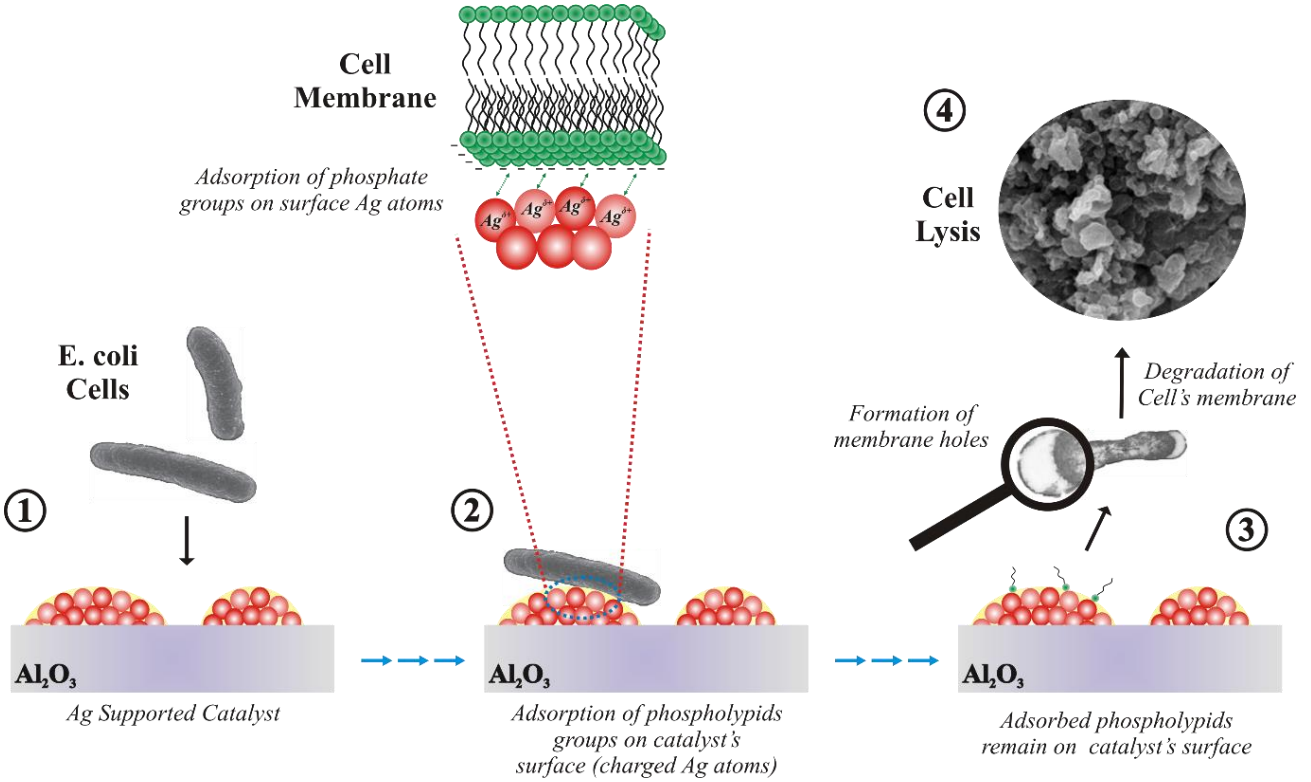


Specialized ink-jet printer for catalytic materials printing (top) and schematic representation of the printing process (bottom).

Very recently, our pioneer research on the bactericidal properties of silver supported catalysts led to some very important findings that may trigger a whole new sector, that of antimicrobial catalysis.

In particular, our work concerns catalytic, kinetic, characterization and mechanistic studies, including the application of novel transient (TPD, TPSR, TPO and TPH) and isotopic techniques (SSITKA) for the elucidation of the mechanism of catalytic reactions (at a molecular level), utilizing the cutting-edge instrumentation that is available at the Lab of Environmental Catalysis.

The Lab of Environmental Catalysis participates in numerous EU-funded and national research projects since its foundation. The lab has been able to attract more than 3 million euro of external funding during the 8 years of its operation. Are senior lab staff are members of international associations and networks such as the European Federation of Catalysis Societies (EFCATS), the International Water Association (IWA), the International Solid Waste Association (ISWA) and Waste-to-Energy Research and Technology Council (WTERT).



Proposed mechanism of bacterial inhibition on Ag-supported catalysts as elucidated by the experiments performed in Environmental Catalysis Lab.

Our network of academic collaborators extends globally, including partners (universities and research institutes) from Spain, Italy, France, Greece, UK, Germany, Slovenia, Latvia, Russia, Israel, Jordan and the USA. In addition, our network of cooperation includes a large number of industrial collaborators such as Linde Engineering AG (Germany-License Agreement), Wartzila (Finland – Research Cooperation), Heraeus Holding GmbH (Germany-License Agreement) and Ricardo Engineering (UK - Research Cooperation).

Selected Publications

1. Vasiliki K. Chatziiona, Barbara K. Constantinou, Petros G. Savva, Georgios G. Olympiou, Konstantinos Kapnisis, Andreas Anayiotos, Costas N. Costa, Regulating the Catalytic Properties of Pt/Al2O3 through Nanoscale Inkjet Printing, Catalysis Communications 103 (2018) 69–73.
2. Christodoulos P. Theologides, Georgios G. Olympiou, Petros G. Savva, Konstantinos Kapnisis, Andreas Anayiotos, Costas N. Costa, Mechanistic Aspects (SSITKA-DRIFTS) of the Catalytic Denitrification of Water with Hydrogen on Pd-Cu Supported Catalysts, Applied Catalysis B: Environmental, 205, 2017, 443-454.
3. C. P. Theologides, S. P. Theofilou, A. Anayiotos and C. N. Costa, Preventing maritime transport of pathogens: the remarkable antimicrobial properties of Ag supported catalysts for ships ballast water disinfection, Water Science & Technology 76 (3), 2017, 712-718.
4. Babatsouli, Panagiota; Palogos, Ioannis; Michalodimitraki, Eleni; Costa, Costas; Kalogerakis, Nicolas, Evaluation of a MBR Pilot Treating Industrial Wastewater with a High COD/N Ratio, Journal of Chemical Technology and Biotechnology, 90(1), 2015, 26-33.

Research Group on Energy and Environmental Economics and Policy (3EP)

Head: Theodoros Zachariadis, Associate Professor

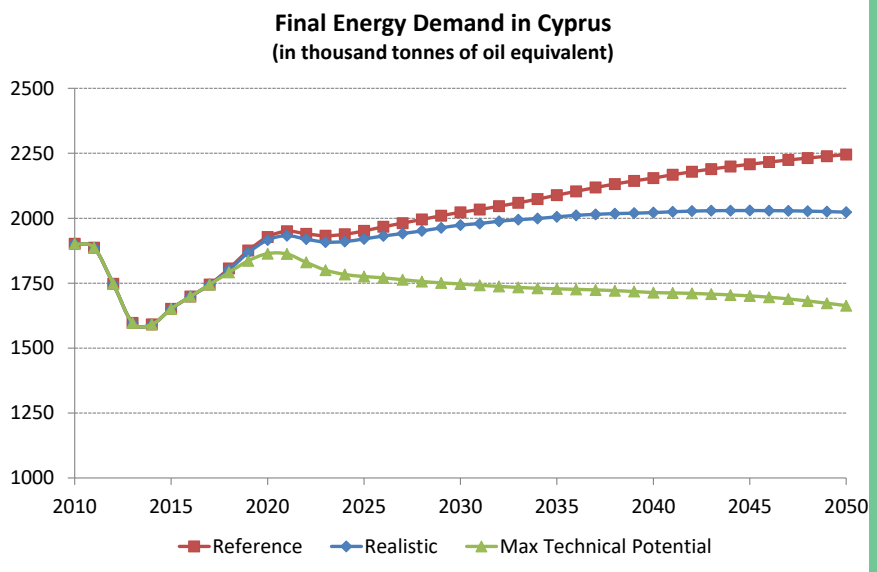
Team: Dr. Apostolos Michopoulos, Dr. Nektarios Michail, Vasiliki Voulgari, Isidoros Ziogou, Chryso Sotiriou

Webpage: 3ep.weebly.com

Energy and environmental policy research needs a mix of engineering and economic approaches to assist decision makers on appropriate sustainability strategies. Our research group performs policy analyses of energy and environmental issues in an essentially interdisciplinary manner. Its staff and collaborators comprise engineers, economists, physicists, hydrologists and climate modellers. Through our work we try to answer questions on the appropriate policy instruments for decarbonising European road transport; environmental tax reforms and their contribution to economic welfare; the optimal combination of conventional and renewable energy technologies to promote sustainability in the buildings sector; and the proper energy mix for Cyprus and the associated costs of attaining it in a carbon-constrained world.

We participate in numerous national and EU-funded projects and are members of international associations and networks such as the European Association of Environmental and Resource Economists, the International Association for Energy Economics and the European Technology Platform on Renewable Heating & Cooling (RHC-Platform). The group leader is a member of the Scientific Committee of the European Environment Agency.

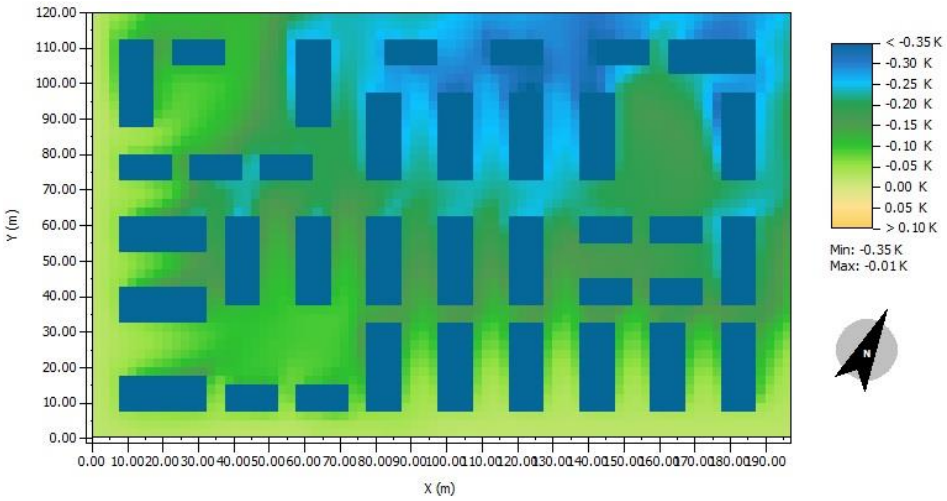
We advise the government of Cyprus on their long-term Energy Action Plans, the economic impacts of climate change and cost-effective greenhouse gas emission abatement strategies. We have been collaborating with the European Commission's Structural Reform Support Service, the International Renewable Energy Agency and the German Organisation for International Cooperation (GIZ) in order to provide long-term analyses of the energy system of Cyprus and the potential for energy efficiency improvements and cost-effective decarbonisation.



Forecast of final energy demand in Cyprus up to 2050, according to three scenarios considered by the European Commission and the national government. Plenty of technical potential is available to improve economy-wide energy efficiency – but in the absence of an ambitious strategy to unlock this potential, realistically achievable energy savings are not sufficient to drive Cyprus to decarbonisation.

We also work on urban energy and environmental modelling as urban activities are major contributors to air pollution and climate change. In this context, we are examining the effect of green roofs in buildings – an appropriate nature-based measure to improve the environmental resilience of cities. We have assessed different types of green roofs in typical urban buildings with respect to energy, environmental, and economic aspects, finding a positive energy and environmental contribution of green roofs, which can improve urban resilience to climate change. We have expanded the analysis from individual buildings to simulations at neighbourhood scale, using appropriate simulation software to evaluate the contribution of green roofs to urban heat island mitigation. Indeed, ambient air temperature at the pedestrian level is found to fall considerably in neighbourhoods of buildings with green roofs.

Green roofs can improve the microclimate of a representative urban neighbourhood (area size: 197 m × 120 m) in Limassol, Cyprus. The figure shows the simulated difference in temperature at pedestrian level at 4 p.m. of a hot summer day (21 July 2017), depending on whether the buildings of the area have been retrofitted with green roofs or not. Simulations were conducted with the three-dimensional non-hydrostatic ENVI-MET model, based on building energy demand simulations with the EnergyPlus model.



In the broader field of economic and environmental policy, we participate in the board of Green Budget Europe, a Brussels-based expert platform on environmental fiscal reforms. In 2015 we formulated a concrete proposal to the government of Cyprus for a Green Tax Reform. Environmental taxes are less detrimental to employment and growth than other direct and indirect taxes, hence we proposed a reform that would reduce social security contributions and implement a carbon tax and other environmental charges. At the initiative of the Finance Minister of Cyprus, we presented this proposal to five Ministers of the government in 2016. The Ministries of Energy and Environment, the Commissioner for the Environment and the largest trade union of Cyprus have openly supported the idea. However, bold steps remain to be taken in order to adopt this reform and enable the transition of Cyprus to a low-carbon, resource-efficient economy.

Selected publications

1. Zachariadis T., Michopoulos A., Vougiouklakis Y., Piripitsi K., Ellinopoulos C. and Struss B. (2018), Determination of Cost-Effective Energy Efficiency Measures in Buildings with the Aid of Multiple Indices. Energies, 11; doi:10.3390/en11010191.
2. Ziogou I., Michopoulos A., Voulgari V and Zachariadis T. (2017), Energy, Environmental and Economic Assessment of Electricity Savings from the Operation of Green Roofs in Urban Office Buildings of a Warm Mediterranean Region. Journal of Cleaner Production, 168: 346-356.
3. Zachariadis T. (2016), After 'dieselgate': Regulations or economic incentives for a successful environmental policy? Atmospheric Environment, 138: 1-3.

Sustainable Energy Laboratory (SEL)

Academics: Alexandros G. Charalambides, Assistant Professor
Stylianos Yiatros, Assistant Professor

Team: Dr. Maria Konstantinou, Orestis Kyriakou, Stefani Peratikou

Webpage: www.energylab.ac.cy

The research work/interests of the Sustainable Energy Laboratory (SEL) lie primarily in three main areas: (a) the effect of cloud presence on energy production from solar systems, (b) the fabrication, combustion and emission characteristics of novel green fuels and (c) on the social aspect of promoting the use of renewable energy and energy saving. Furthermore, the staff members of SEL are actively involved in entrepreneurship, aiming to bring research outcomes to life, through the formation of Start-ups. Over the last five years, the staff of SEL was able to attract more than 20 research projects totalling to about €3,ooo,ooo in funding in the following research areas:

Solar Energy Predictions

One of the major problems of meteorological forecasts, is the low temporal and spatial resolution of solar irradiance forecasts, which are unable to estimate the sudden fluctuations of irradiance over a specific relatively small area, caused by clouds obscuring the sun. So far, traditional approaches regarding forecasting of the state of the sky or incident solar irradiance have been developed using either meteorological data from satellite imagery or specialised equipment. The use of meteorological data cannot give the desired results as it would be required to use real time images from geostationary satellites to cover a specific area. Apart from the high cost of the data, satellite images have very low temporal (~30 min) and spatial (1km^2) resolution which are inadequate for accurate forecasting. Alternatively, incident solar irradiance and cloud/dust motion measurements could be forecasted using accurate specialised equipment such as a grid of ground based cameras or irradiance sensors to record the state of the sky. Contrary to existing methodologies, SEL is working on a novel, innovative approach in nowcasting the state of the sky and incident solar irradiance using data from the metering systems of grid connected PVs, without the necessity of using additional equipment. A dense network of PVs providing continuous data will enable very high temporal and spatial resolution of forecasts. However, due to the nature of clouds, the nowcasting horizon will be intra hour (1-60 minutes).

Wastewater treatment using Macroalgae

There is a need for new, state-of-the-art waste management systems that make animal operations economically viable and environmentally friendly. The farmers have an obligation to ensure that agricultural wastes will not cause pollution to the environment or harm to human health. SEL staff are developing a seaweed-based filtration system for the secondary treatment of livestock wastewater streams, while at the same time generate bioproducts (biofuels, bioplastic, etc) from the excess biomass.

Energy Efficient Buildings

One of the projects of SEL is ENERFUND, funded by the European Union's Horizon 2020 programme and poses itself the ambitious objective to enhance funding investments for deep renovation of buildings, working on three components: public awareness and trust, funding schemes and incentives and trustworthy retrofitting opportunities.

Entrepreneurship

Over the last 5 years, Drs Charalambides and Yiatros have been involved in ClimateLaunchpad, the world's largest green ideas competition organised by Climate-KIC, funded by the European Institute of Innovation & Technology. Furthermore, Dr. Charalambides is an MIT Disciplined Entrepreneurship Certified Trainer, while both of them are familiar in delivering courses based on the Business Model Canvas.

Cultivation of Ulva lactuca, Padina pavonica, Jania rubens and Cystoseira compressa

Selected publications

1. Charalambides, A.G., Maxoulis, C.N., Kyriacou, O., Blakeley, E. and Frances, L.S., 2018, "The impact of Energy Performance Certificates on building deep energy renovation targets", International Journal of Sustainable Energy, online print, https://doi.org/10.1080/14786451.2018.1448399).
2. Tapakis, R. Silas, M. and Charalambides, A.G., 2016, "Computations of diffuse fraction of global irradiance: Part II - Analytical modelling", Vol. 139, pp. 723-732, Solar Energy (http://dx.doi.org/10.1016/j.solener.2015.12.042).
3. Kountouriotis, A., Aleiferis, P.G. and Charalambides, A.G., 2014, "Numerical Investigation of VOC Levels in the Area of Petrol Stations", Vol. 470-471, pp. 1205-1224, Science of the Total Environment (http://dx.doi.org/10.1016/j.scitotenv.2013.10.064).
4. Nisiforou, O., Poullis, S. and Charalambides, A.G., 2012, "Behaviour, attitudes and opinion of employees of a large enterprise with regard to their energy usage habits and acceptance of energy saving measures", Energy and Buildings, Vol. 55, pp. 299-311 (http://dx.doi.org/10.1016/j.enbuild.2012.08.034).

Research Group on Environmental Computational Modelling (CEM)

Head: Vangelis Daskalakis, Assistant Professor

Team: *Ph.D Candidates:* Anastasia Salameh, Sotiris Papadatos, Anastasia Constantinou, *Undergraduate diploma Thesis:* Demetra G. Katechaki

Webpage: https://www.researchgate.net/profile/Vangelis_Daskalakis

The ever-growing environmental concerns push researchers to identify renewable energy resources and satisfy the demand for food, of an increasing global population. In nature, the life-sustaining oxygen cycle: $O_2 + 4e^- + 4H^+ \Leftrightarrow 2H_2O$ is driven by the processes of photosynthesis and cellular respiration (oxidative phosphorylation). In our lab, we are constantly targeting these processes, in cutting-edge research projects, in order to give fundamental insights into their mechanisms of action. For Photosystem-II (PSII) models, this leads to applications in artificial and efficient solar energy harvesting, and can be related, in a timely manner, with the engineering of tolerant plants in a changing climate (light stress, heat waves, increase of salinity in a deteriorating water quality).

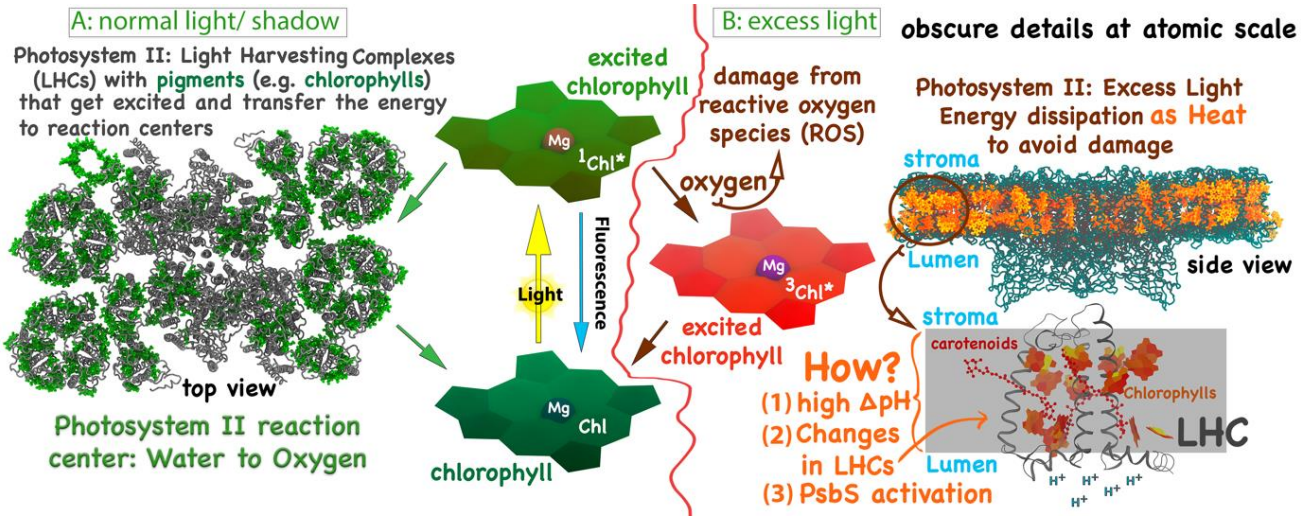


Figure 1. Photosynthesis at normal light-shadow (left) and at excess light (right).

Under excess light conditions, plants activate their photoprotection and disregard a significant amount of photonic energy into heat. This downregulatory mechanism of photosynthesis, called Non-Photochemical Quenching (NPQ) of Chlorophyll fluorescence, is triggered by an excess proton gradient (ΔpH) across the photosynthetic thylakoid membranes, lies within the Light Harvesting Complexes (LHCII antenna) of PSII, and has also been associated with the activity of the Photosystem II subunit S (PsbS) (Fig. 1).

Our projects are established in a "virgin land" for computational probes for NPQ, and currently for the PsbS-major LHCII trimer interactions. Simulations can be the only way in the end that could lead to profound understanding of the mechanism at atomic scale, beyond chemical intuition and experimental evidence. In the following, we present some insight into NPQ from our lab within the fields of Computational Physical Chemistry and Biophysical Chemistry. In fundamental research projects (2016-2018), we have employed cutting-edge computational approaches (large scale Molecular Dynamics,

Metadynamics and ab initio runs) and been granted access to numerous National/ EU-funded High-Performance Computing Facilities (Eastern Mediterranean – CyTera, PRACE – DECI) with millions of cpu standard core-hours among projects: pro16a105, pro16b103, pro17a103, pro17b101, PRACE DECI-13 LHCFlex, and PRACE DECI-14 AIMDPSII as coordinators. The group leader has been awarded the HPC-Europa3 fellowship to visit and collaborate with scientists in Jacobs University (Bremen, Germany), with access to the High-Performance Computing Center (HLRS) of the University of Stuttgart.

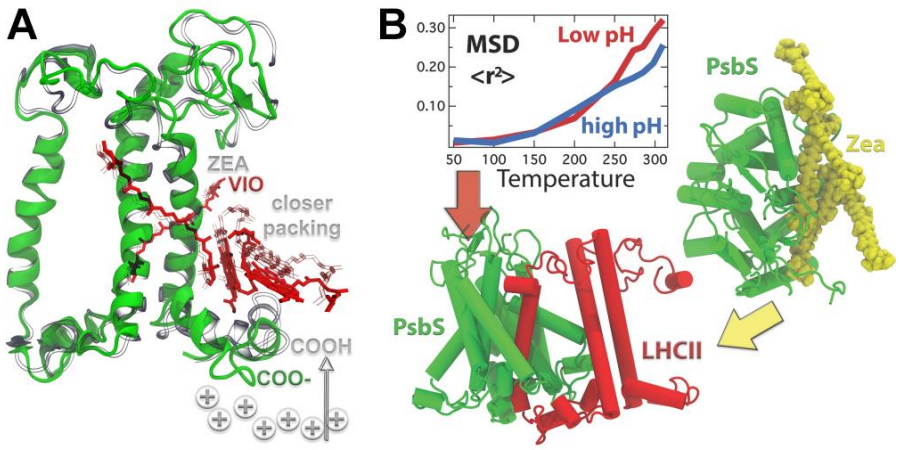


Figure 2. A. Helix-D plasticity influenced by protons in the vicinity of Chl-613/ 614 (red planes). B. PsbS exerts higher flexibility (in terms of the MSD – Mean Square Displacement of hydrogen atoms) at low pH. The transition of PsbS to the active form and in complexation with LHCII is shown.

(1) The results so far demonstrate a complete picture of an elaborate common molecular design. All probed antenna proteins (major LHCII from spinach-pea, CP29 from spinach) show striking plasticity in helix-D, under NPQ conditions. This induces changes in Qy bands in excitation and absorption spectra of the near-by pigment pair (Chl613-614) that emerge as a new quenching site. Zeaxanthin enhances this plasticity even at milder NPQ conditions (Fig.2A).

(2) We have also identified the PsbS dynamics that could be associated with NPQ. We have probed the distinct behavior of PsbS under ΔpH that probes the details of the potential dimer-to-monomer (active form) transition, and in a violaxanthin/zeaxanthin-rich membrane, at an all-atom resolution. The lumen-exposed residues, threonine 162 and glutamic acid 173, form stabilizing hydrogen bonds between the PsbS monomers only at high lumen pH, whereas at excess ΔpH this interaction is lost, and leads to higher flexibility of the protein and potentially to the transition to the active form (Fig.2B).

In the same context, future projects will include simulation studies on water desalination by biologically inspired membranes, containing e.g. aquaporin models. This falls within the fields of Computational Physics and Chemical Engineering in the probe of the interactions between water/ salt and protein-mimetics.

Selected publications

1. Daskalakis V (2018) Phys. Chem. Chem. Phys. 20, 11843 – 11855.
2. Daskalakis V, and Papadatos S (2017) Biophys. J. (Cell) 113 (11), 2364-2372.
3. Papadatos S, Charalambous C A, and Daskalakis V (2017) Scientific Reports (NPG) 7, 2523. doi: 10.1038/s41598-017-02892-w.
4. Ioannidis NE, Papadatos S, and Daskalakis V (2016) BBA – Bioenergetics, 1857 (10), 1643-1650.

Environmental Bioprocessing Group

Head: Michalis Koutinas, Assistant Professor

Team: Dr. Michalis Kallis, Maria Patsalou, Stella Parmaki, Maria Kyriakou, Panagiota Photiou

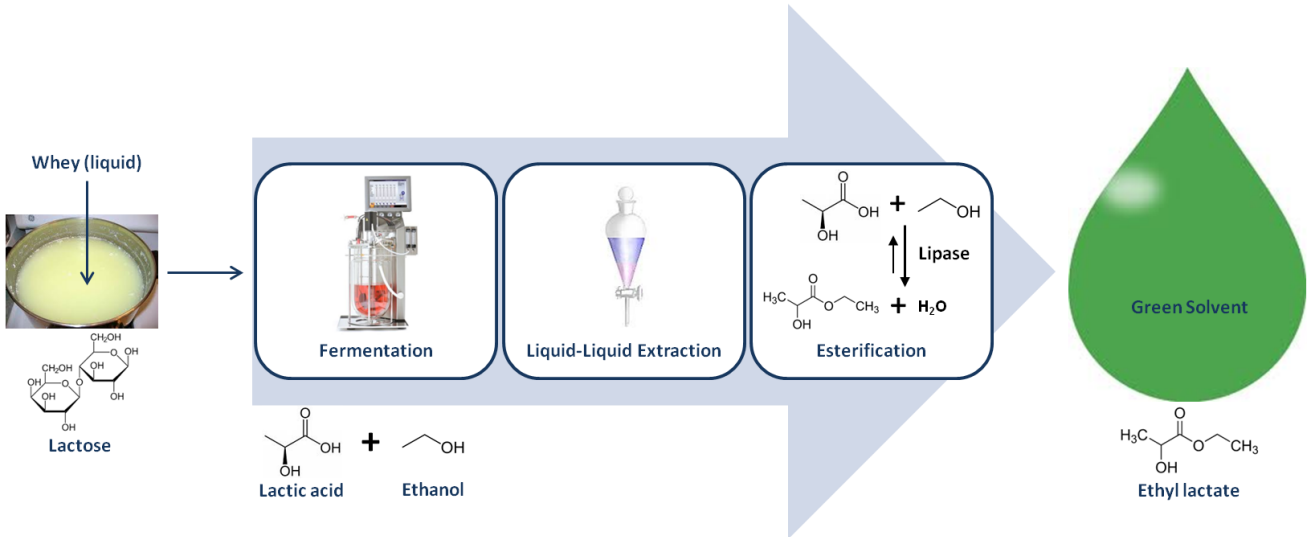
Webpage: https://enblab.weebly.com/

Petrochemical processes have provided low cost production routes for fuels, plastics, and chemicals for over 50 years. Nevertheless, the escalating impact on the environment and the inevitable depletion of fossil feedstocks make it essential that benign, sustainable alternatives be developed commercially in a cost-effective and expedited manner. Biomass-based industrial waste streams could be regarded as sustainable feedstocks for the development of a new industrial sector that integrates chemical and material production into existing industries.

Our group applies advanced experimental and systems engineering techniques in order to provide solutions to important biological problems. Our interests are in line with EU priorities for waste and natural resources, focusing on the following areas:

- Biotechnological applications for the production of added-value chemicals, biomaterials and biofuels from waste;
- Application of biological systems for the treatment of toxic and persistent pollutants from wastewater as well as the treatment of solid waste emitted from natural gas drillings;
- Development of mathematical models for understanding specific metabolic properties of the strains employed and the function of the bioprocess applied;
- Utilisation of advanced molecular techniques for detecting specific microbial strains used in applied bioprocesses and quantification of important metabolic properties.

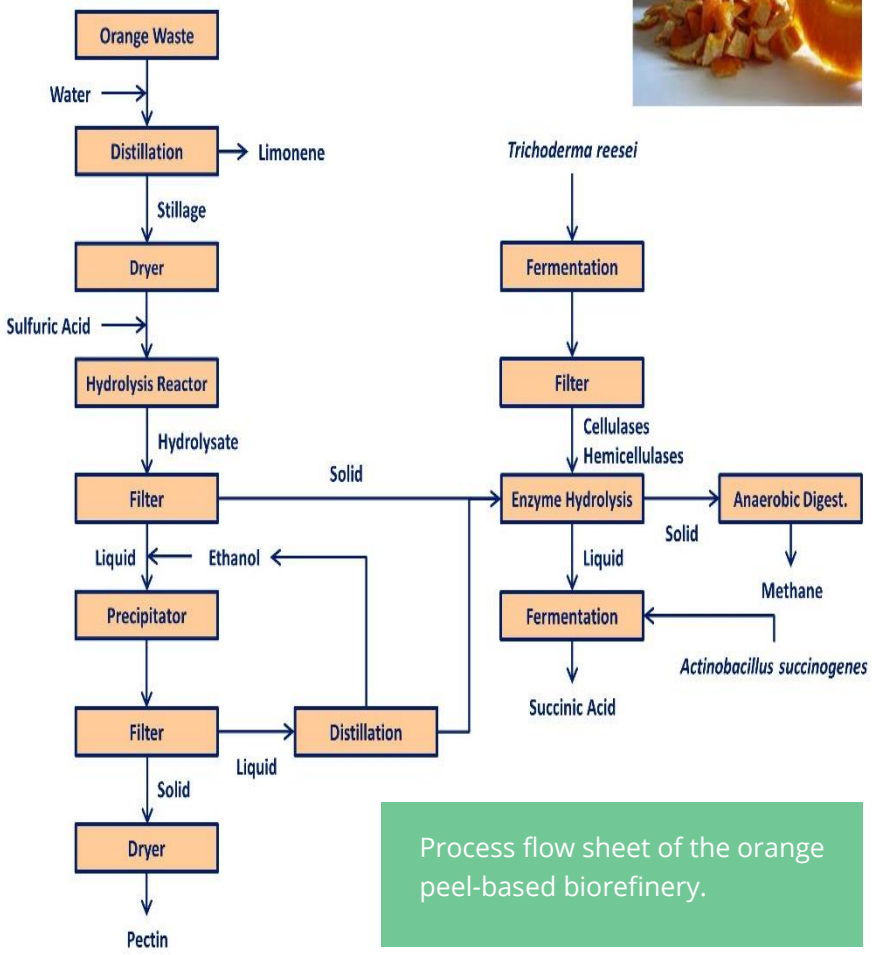
We participate in several national and EU-funded research projects and are members of international associations and networks including the International Forum on Industrial Bioprocesses (IFIBiop) and COST Action TD1203 “Food Waste Valorisation for Sustainable Chemicals, Materials and Fuels (EUBis)”.



Green solvent (ethyl lactate) production bioprocess from dairy waste.

Current research at the Environmental Bioprocessing Lab is evaluating the potential of a bioprocess for the production of green solvents from naturally derived feedstocks. The concept is based on fermenting the organic content of a renewable resource into the targeted alcohol and acid, transfer of the two intermediate products into a suitable solvent via liquid-liquid extraction and esterification into the desired ester employing lipases. We have exemplified this idea through effective production of ethyl lactate from cheese whey.

Another topic of interest involves the development of a citrus peel-based biorefinery for the production of succinic acid, d-limonene, pectin and biogas. Distillation is initially employed for d-limonene extraction, followed by acid hydrolysis and precipitation for pectin isolation, while enzyme hydrolysis of the cellulosic content is conducted to form a sugar rich media employed in succinic acid fermentations. The remaining organic content is fed into an anaerobic digester to produce biogas, targeting a zero-waste process.



Process flow sheet of the orange peel-based biorefinery.

In the broader field of environmental biotechnology and sustainable biorefineries, we participate in a Water Joint Programming Initiative targeting the valorisation of food wastewater containing alkaloids for the production of added-value products (Biorg4WasteWaterVal+), a LIFE project demonstrating a novel technology for the production of biogas from food waste (LIFECAB) as well as in a national project concerned with bioremediation of solid waste emitted from the exploration of natural gas in Cyprus (OzoneBioPro).

Selected publications

1. Koutinas M, Yiangou C, Osório NM, Ioannou K, Canet A, Valero F, Ferreira-Dias S. 2018. Application of commercial and non-commercial immobilized lipases for biocatalytic production of ethyl lactate in organic solvents. Bioresource Technology, 247:496-503.
2. Tsipa A, Koutinas M, Usaku C, Mantalaris A. 2018. Optimal bioprocess design through a gene regulatory network – growth kinetic hybrid model: Towards replacing Monod kinetics. Metabolic Engineering, 48:129-137.
3. Patsalou M, Menikea KK, Makri E, Vasquez MI, Drouza C, Koutinas M. 2017. Development of a citrus peel-based biorefinery strategy for the production of succinic acid. Journal of Cleaner Production, 166:706-716.

Research Group on Environmental Engineering

Head: Ioannis Vyrides, Assistant Professor

Team: Charis Samanides, Maria Andronikou, Panagiotis Charalambous, Yiota Photiou, Efi Drakou, Anthi Kyprianou.

Webpage: https://www.facebook.com/Environmental-Engineering-Lab-Cyprus-University-of-Technology-169868080059059/

Biological or Microbiological ElectroSynthesis (BES or MES) is a biological pathway to convert carbon dioxide (CO_2) into chemical energy carriers such as methane (CH_4) or ethanol using electrical energy and anaerobic microorganisms. BES occurs when a microbial catalyst (e.g. anaerobic sludge) reduces CO_2 into organic commodities with electrons supplied by an external power source and taken from the cathode of a bioelectrochemical system, designed primarily to perform biological reductive reactions (Fig. 1). BES technology can: (1) convert electrical energy from (fluctuating) renewable energy sources into CH_4 or ethanol that can be stored, distributed, and consumed on demand, (2) utilize CO_2 as a sole carbon source for the production of CH_4 (that can be used as fuel or can be transformed to electricity by CHP engines) or ethanol. Under this topic, Environmental Engineering co-ordinates the "BioElectroCathode" (RPF: 2P/M-ERA.NET/0317/0008) project that started in September 2018. The BioElectroCathode project aims to bring innovation on biological electrosynthesis biocatalysts through the manufacture and operation of novel cathodes and a 3D biological electrosynthesis baffle reactor (inoculated with anaerobic sludge) that can transform CO_2 to CH_4 and/or CO_2 to ethanol (Fig. 1). The proposed technology can have potential applications in biogas upgrading (in Europe there are more than 12,400 biogas plants) and in industries that generate high amounts of CO_2.

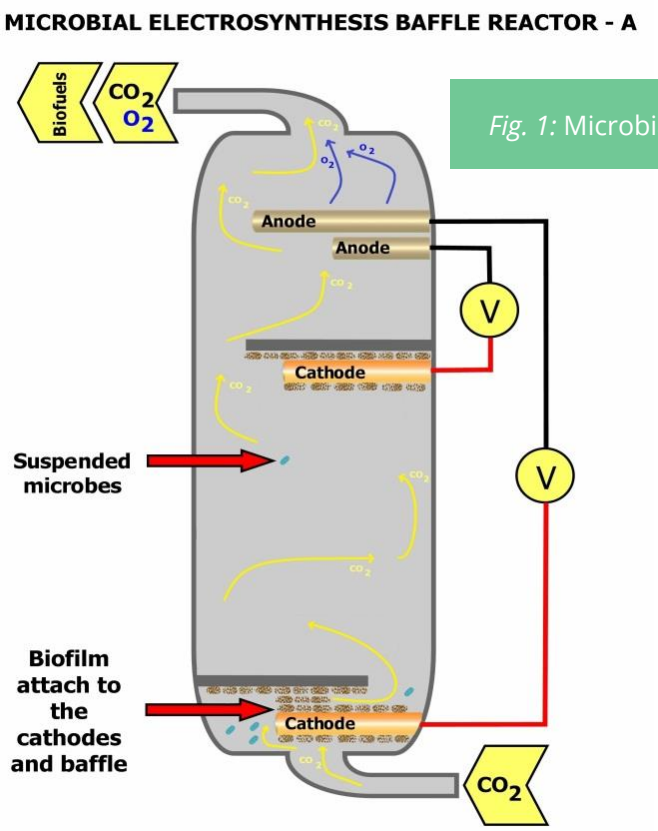


Fig. 1: Microbial Electrosynthesis Baffle Reactor MEBR

Similarly to the aforementioned project we examine how CO_2 and metals such as Fe, Al, Mg or waste iron scrap can be used by anaerobic granular sludge for the production of biofuels. Under anaerobic conditions in water, these metals are oxidized by releasing H_2 and/or electrons. The autotrophic anaerobic microbes can utilize (H2 and/or electrons) with CO_2 and generate CH_4 or VFAs or ethanol. The mechanisms and the engineering potential of these reactions are examined by working in the boundary between scientific fields such as anaerobic microbiology, material science, electrochemistry and environmental engineering.

Apart from these, we are interested in Phosphorus extraction and recovery from anaerobic sludge and/or wastewater. The Phosphorus is one of the main elements for commercial fertilizers and due to the fact that the phosphate rock reservoirs, the main source of P for fertilizers, are reducing and are confined in a few countries, its recovery from wastewater and waste is regarded as a sustainable solution. We study Phosphorous recovery by modifying (thermally or chemically) waste such as egg shells, seagrass, spent coffee waste and others.

We are also work with the biological treatment of recalcitrant wastewater such as dairy and bilge wastewater. Specifically, bilge water is the main pollutant of shipboard wastewater, while discharge of oil residue to marine environments is prohibited. We are co-ordinating the "MicrobEatBilge" project (RPF: OPPORTUNITY/0916/MSCA/0006), in which we will develop an innovative low-cost technology consisting of hybrid bioreactors, Submerged Anaerobic Membrane Bioreactor (SAnMBR) and aerobic Moving Bed Biofilm Reactor (MBBR) for the treatment of real bilge water.

Using the approach of designing a microbial consortium, we will examine the microbial desulfurization of liquid fuels. There are strict regulations for refineries and fuel terminals to produce fuels having ultra-low sulfur content. A promising "Eco Technology" is to employ Bio desulfurization (BDS) which it is a process that bacteria (liquid phase) are mixed with oil and remove selectively organosulfur from oil fractions without degrading the carbon skeleton of the compounds ("OilEcoDesulfur" RPF: POST-DOC/0916/0121).

Other projects in which the Environmental Engineering Lab (EEL) is involved are the following:

Interreg Balkan Med Programme "Optimization of decentralized domestic wastewater treatment and sanitation via Constructed Wetlands" – DOMUS_CW

Interreg Balkan Med Programme "a digital Solid Waste reuse plAtform for BalkaN" – SWAN

Engineering and Industry Innovative Training for Engineers [ENGINITE], Erasmus+ project

Biogas and Digestate with Controlled Ammonia Content by a Virtuous Biowaste Cycle with Integrated Bio&Chemical Processes (LIFECAB)

Selected publications

1. Vardanyan, A., Kafa, N., Konstantinidis, V., Shin, S.G. and Vyrides, I., 2018. Phosphorus dissolution from dewatered anaerobic sludge: Effect of pHs, microorganisms, and sequential extraction. Bioresource technology, 249, pp.464-472.
2. Vyrides, I., Drakou, E.M., Ioannou, S., Michael, F., Gatidou, G. and Stasinakis, A.S., 2018. Biodegradation of bilge water: Batch test under anaerobic and aerobic conditions and performance of three pilot aerobic Moving Bed Biofilm Reactors (MBBRs) at different filling fractions. Journal of Environmental Management, 217, pp.356-362.
3. Panagiotou, E., Kafa, N., Koutsokeras, L., Kouis, P., Nikolaou, P., Constantinides, G. and Vyrides, I., 2018. Turning calcined waste egg shells and wastewater to Brushite: Phosphorus adsorption from aqua media and anaerobic sludge leach water. Journal of Cleaner Production (forthcoming).
4. Vyrides, I. and Stuckey, D.C., 2017. Compatible solute addition to biological systems treating waste/wastewater to counteract osmotic and other environmental stresses: a review. Critical reviews in biotechnology, 37(7), pp.865-879.

Water Treatment Laboratory – AQUA

Head: Maria G. Antoniou, Assistant Professor

Team: Dr. Christine Edwards, Iosif Constantinou, Georgia Hadjiouraniou, Danae Pantelidou, Nikoletta Tsiarta, Iosef Boraei

Webpage: http://WTL-AQUA.weebly.com

Worldwide water shortage increase and water quality depletion from microbial and chemical compounds, pose significant challenges for today's water treatment industry. Emerging Contaminants (ECs) like pesticides, hormones, medical drugs, as well as naturally occurring toxic metabolites, detected at trace concentrations, necessitate treatment and are currently found in monitoring lists of Environmental Agencies worldwide. To adequately address this problem research efforts are currently focusing both on the development of new advanced oxidation technologies, but also the enhancement of existing conventional technologies.

The Water Treatment Laboratory - AQUA research group of CUT engages in activities that seek to provide solutions for ECs removal at source or during water treatment. The majority of group's research activities focus on monitoring, detection, analysis, and treatment of cyanobacterial contaminated water and the toxic metabolites they release (cyanotoxins).

Cyanobacteria (blue-green algae) are phototrophic microorganisms and represent an essential component of the food web in all aquatic ecosystems. However, certain strains form cyanobacteria harmful algal blooms (Cyano-HABs) which directly affect water quality by producing undesirable color, taste, odor and by releasing harmful cyanotoxins into the water. Human activities (i.e., sewer runoffs, overuse of fertilizers) and global warming have resulted in an increasing prevalence and persistence of Cyano-HABs globally. Cyanotoxins can affect mammalian health in an array of ways including dermatotoxicity, cytotoxicity, hepatotoxicity, and neurotoxicity. Their physical-chemical properties and toxicity vary based on their structure. Reported LD_{50} for cyanotoxins can be as low as 50 μg/kg. The European Commission is also taking action against cyanotoxins and has issued in February 2018 a proposal to revise the Directive on the Quality of Water Intended for Human Consumption (Directive 98/83/EC, amended in 2003, 2009 and 2015), to include the hepatotoxic microcystin-LR in the list of pollutants monitored as a "Chemical Parameter", with a parametric value of 1 μg/L (COM(2017)753).

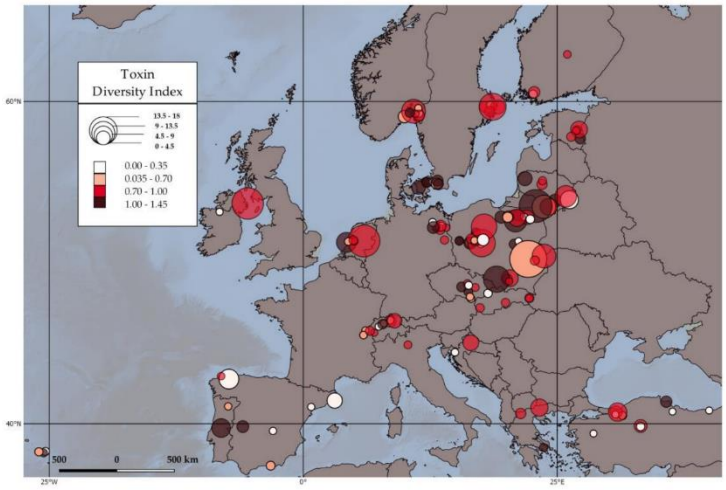
With WTL-AQUA being an active member of COST Action ES1105, CYANOCOST (Cyanobacterial blooms and toxins in water resources: Occurrence, impacts and management) has resulted in the formation of strong collaborations with research groups in Europe, USA, and China. Current group activities related to cyano-HABs include:

- Monitoring of surface water for cyanobacteria and cyanotoxins (in collaboration with WDD and CYANOCOST).
- In-lake treatment of cyanobacteria and cyanotoxins with never before tested oxidants (in collaboration with the IBED group of the University of Amsterdam, the ECOBIO group of the University of Rennes, and Prof. Weihua Song of the Fudan University).
- Enhancing of the photocatalytic degradation of hepatotoxins MC-LR and nodularin with the addition of sulfate-radical generating oxidants (in collaboration with the CyanoSol group of Robert Gordon University).

- Correlation of nutrients and temperature with cyano-HABs formation in the Polemidia dam through multiple linear regression analysis (in collaboration with the Research Group on Computational Environmental Modeling, CEM of CUT)

Based on the above-mentioned collaborations, various scientific papers have been submitted or are under review. Among them is a study on the effects of nutrient and temperature gradients on the variability of cyanotoxins production in Europe. Direct and indirect effects of temperature were the main drivers of the spatial distribution in the toxins produced by the cyanobacterial community, the toxin concentrations and toxin quota. Generalized linear models showed that a Toxin Diversity Index (TDI) increased with latitude, while it decreased with water stability (Figure 1). The study concluded that while global warming continues, the direct and indirect effects of increased lake temperatures will drive changes in the distribution of cyanobacterial toxins in Europe, potentially promoting selection of a few highly toxic species or strains.

Figure 1: Map of the Toxin Diversity Index (TDI) of the 137 EMLS lakes, calculated using the Shannon equation. TDI is categorized in four classes with higher colour density (red) representing higher toxin diversity and lower colour density (white) lower toxin diversity. The radius of the markers corresponds to the total toxin concentration in μg/L. (Note: Cyprus lakes, total 5, were below the method detection limit for cyanotoxins and therefore were not included in the figure)



WTL- AQUA has also started a new collaboration with the ECOBIO "Ecosystems, Biodiversity and Evolution" Institute of the University of Rennes 1, on the monitoring and treatment of cyanobacterial contaminated surface waters in Cyprus and France on the basis of a 2 year funded project CYANOS. (RESTART 2016-2020-BILATERAL/FRANCE/1116 (4/12/2017-3/12/2019). More information on the project can be obtained by following the link https://cyanoscyfr.weebly.com/.

In addition to its research activities, WTL-AQUA advises the Water Development Department (WDD) with in-lake monitoring on the formation of cyanobacterial scum, the detection of cyanotoxins during water treatment, practices for reducing the formation of taste and odor compounds and the effects of using cyanobacterial contaminated water in agriculture. The research activities of the group on a cyanobacterial contaminated site in Cyprus (Polemidia Dam) intrigued the interest of national press which composed an article on the team's research activities. WTL-AQUA group has formed strong collaborations with private companies of the water industry sector to provide advice on specific problems that they are facing and assist on evaluating the performance of their equipment on novel applications.

Selected publications

1. E. Mantzouki, M. Lürling, J. Fastner, L. (...) **M.G. Antoniou, N. Tsiarta**, (...) H.W. Paerl, C.C. Carey, B.W. Ibelings, Temperature effects explain continental scale distribution of cyanobacterial toxins, Toxins. 2018 10 (4) doi:10.3390/toxins10040156
2. **M. G. Antoniou, I. Boraei**, M. Solakidou, Y. Deligiannakis, M. Abhishek, C. Edwards, and L.A. Lawton. Enhancing photocatalytic degradation of the cyanotoxin microcystin-LR with the addition of sulfate-radical generating oxidants. Journal of Hazardous Materials, 2018 360 (15) 1461-470.
3. E. Mantzouki, J. Campbell, E. van Loon, P. Visser, **I. Konstantinou, M. G. Antoniou**, Grégory Giuliani (...) B.W. Ibelings, A European Multi Lake Survey dataset of environmental parameters, phytoplankton pigments and cyanotoxins, Scientific Data: Nature (accepted August 2018).

Research Group on Hydrogen Production and Use in Internal Combustion Engines

Head: Dr. Petros G. Savva, Special Teaching Staff

Scope of Research Activity

The scope of the research performed concerns the production of hydrogen (H2) via electrolysis and further use as a fuel additive for the reduction of fossil fuel consumption in Internal Combustion Engines (ICE). The ICE performance was also studied as well as the gaseous emissions.

Experimental

A fully operational H_2 production engine has been developed and successfully implemented on various stationary power generators (40, 300, 400 and 1707.7 HP) and boilers (7655 kW – producing 1t of vapor/h) in Cyprus. The specific end-of-pipe technology, requires no modifications or interventions on the engine as the feed stream is added to the air supply of the engine (used for combustion). The feed stream that is led to the engine consists of a mixture of hydrogen and air and fuel. The results obtained showed a significant reduction in fuel consumption. It is also known that hydrogen combustion produces 121 kJ/g energy while petroleum 45.4 kJ/g. At the same RPM, the engine produces more torque from less hydrocarbon fuel. More torque from less fuel at the same engine speeds verifies that higher pressure from a faster burn, acting through a longer effective power stroke, produces more torque and thus more work from less fuel. The temperature of the engine is not raised significantly as the amount of hydrogen and gasoline entering the engine can be easily controlled. Added to this, another important fact is that hydrogen is not stored but produced on site (via electrolysis) and used immediately in the combustion process (hydrogen on demand). Combustion of hydrogen produces only pure water thus contributing in the reduction of toxic gaseous emissions such as CO, CO_2, PMs and HCs because the amount of gasoline (hydrocarbon) used is reduced. Moreover, CO, PMs and HCs are further reduced because of the improved combustion of gasoline, which is due to the presence of hydrogen in the cylinder. Reducing hydrocarbons, PMs and CO causes a slight rise in the production of CO_2, but as less fuel is used, the actual concentration of CO_2 in the exhaust stream is reduced by roughly the same ratio as the savings in fuel. This leads to a better compliance with Environmental Regulations concerning greenhouse gaseous emissions. Moreover, the flame initiation is enhanced and subsequently flame propagation reduces the ignition delay and combustion period in both spark ignition (e.g. Petrol) and compression ignition (e.g. Diesel) engines. The chain reaction initiated by hydrogen and oxygen causes a simultaneous ignition of all the primary fuel. As it all ignites at once, no flame front can exist and without it, there is no pressure wave to create knock. Better combustion also leads to reduced carbon build-up in the engine, thus extending the life expectancy of the engine, especially pistons, valves, rings and bearings.

Results

The results of the aforementioned experiments showed a significant reduction of fossil fuel consumption (20-40%) as well as a reduction of greenhouse gas emissions (10-40%), while the performance of all ICE was enhanced (according to the Cyprus Department of labor). Experiments have been also performed in the presence of biofuel in the fuel stream (20%), substantiating even less fuel consumption. The use of electricity to perform the dissociation of H_2O is negligible in all experiments, while experiments are scheduled to perform electrolysis with the use of renewable energy sources.

Collaborations and award

The specific research has drawn the attention of "MAN Diesel and Turbo" in Copenhagen-Denmark, "Ricardo" UK and ALIEN Transfer Technologies, with whom confidentiality agreements have been signed and a fruitful collaboration has been built, since the implementation of the new EU MRV regulations on ships concerning the monitoring, reporting and verification of CO_2 emissions. The research performed concerning hydrogen production and implementation has won the local Climate-KIC competition (2015).

Projects

1. "Hydrogen generator for higher fuel efficiency and lower carbon emissions in maritime transport", Horizon 2020 Framework Program, H2020-SMEINST-1-2016-2017.

2. Project "Pure Cyprus", Collaboration between Limassol Municipality, Green Energy Group Ltd, University of ITMO (St. Petersburg) on "the production of hydrogen with the use of solar energy and its implementation on hydrogen fuel cell vehicles".

Figure 1: The use of hydrogen in the largest steam boiler in Cyprus.

Research Group on Soil Science

Head: Dr. Kostas Andreou, Special Teaching Staff

Current Students: Panayiota Kyriakou

Webpage: https://www.cut.ac.cy/faculties/gem/est/staff/kostas.andreou/

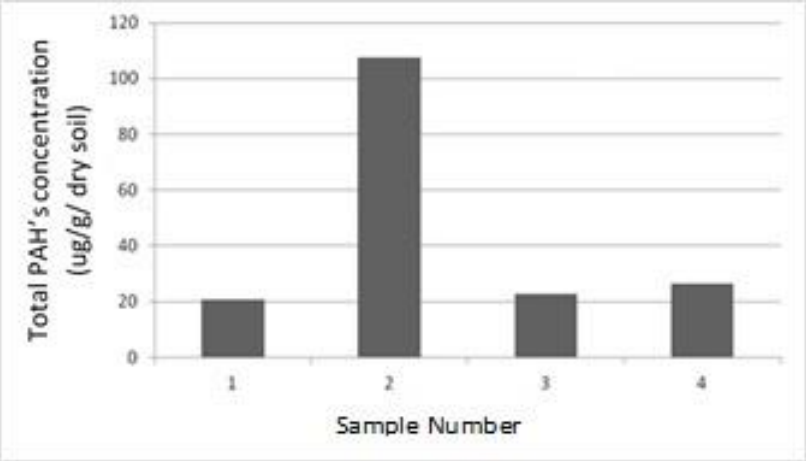
Soil is an essential and non-renewable natural resource in scarcity. Human activity and natural phenomena led to soil degradation that ultimately cause the irreversible loss of the soil. However, the legislative network in Europe regarding the protection of soil is scattered across many European directives and national legislations. In Europe and worldwide there is now a strong movement towards the implementation of a strong legislative framework that will safeguard the soil environment.

Our research team performs research on soil related subjects addressing, amongst others, the following issues:

- Soil pollution and remediation technologies (ex-situ and In-situ)
- Soil in urban areas: Characteristics, Services and Problems
- Soil Organic Matter dynamics in arable land;
- Effects of desertification in Cypriot soils and their characteristics

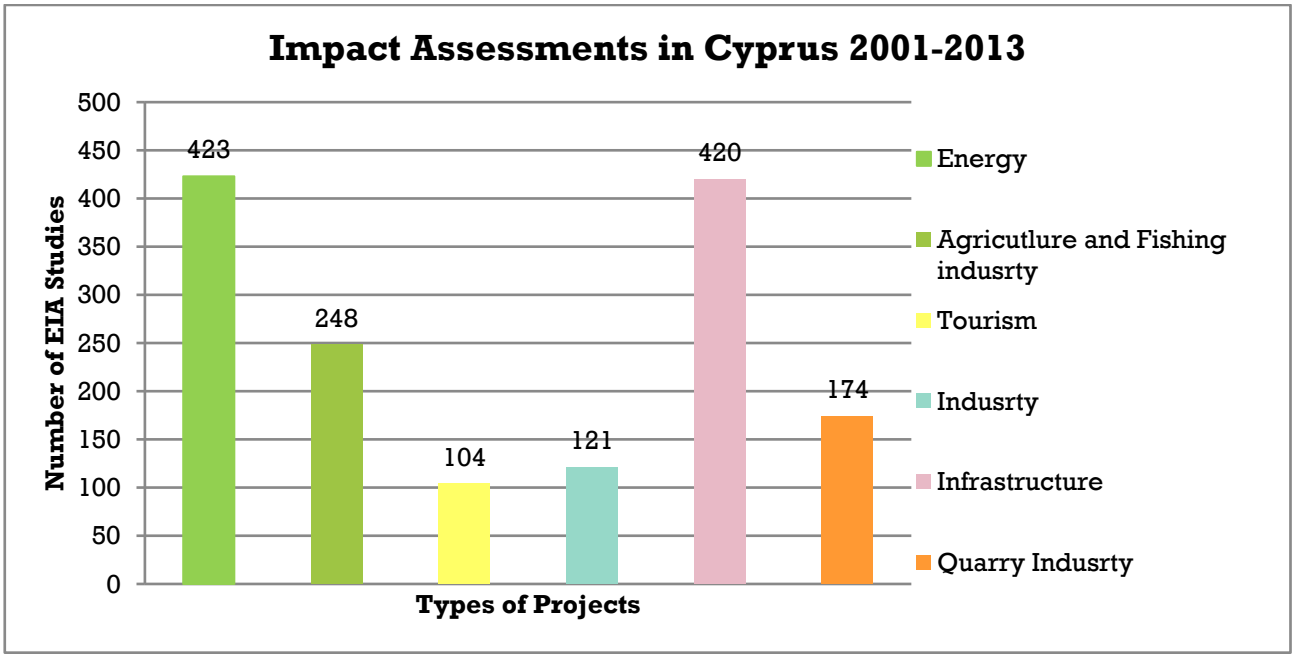
Beyond our core research theme, the soil, another research theme we focus on is the Environmental Impact Assessment from the various projects, plans and programs. Environmental Impact Assessment is a useful tool for the environmental design of projects, plans, programs and even policy that is essential to the lifecycle of aforementioned actions.

We participate in several EU-funded research projects and are members of international networks such as the Global Soil Partnership of the Food and Agriculture Organization of the United Nations. We have a close collaboration with many governmental departments and agencies in Cyprus and academic institutions abroad. We are also involved in various short term projects consulting local authorities, governmental and private organizations on environmental issues related to our interests.



Total concentration of 16 PAH's (Polycyclic aromatic hydrocarbons) in urban soil samples from the Nicosia area, Cyprus.

Environmental Impact Assessment (EIA) studies in Cyprus for the years 2001 to 2013.



Selected publications

1. K. Themistocleous, G. Papadavid, M. Christoforou, A. Agapiou, K. Andreou, D. Tsaltas, D. G. Hadjimitsis., Use of remote sensing and UAV for the management of degraded ecosystems: the case study of overgrazing in Randi Forest, Cyprus. Second International Conference on Remote Sensing and Geoinformation of the Environment (RSCy2014); 08/2014Published, 2014

2. Fenlon, K.A., Andreou, K., Jones, K.C., Semple, K.T., The extractability and mineralisation of cypermethrin aged in four UK soils. Chemosphere 82 (2010), 187-192.

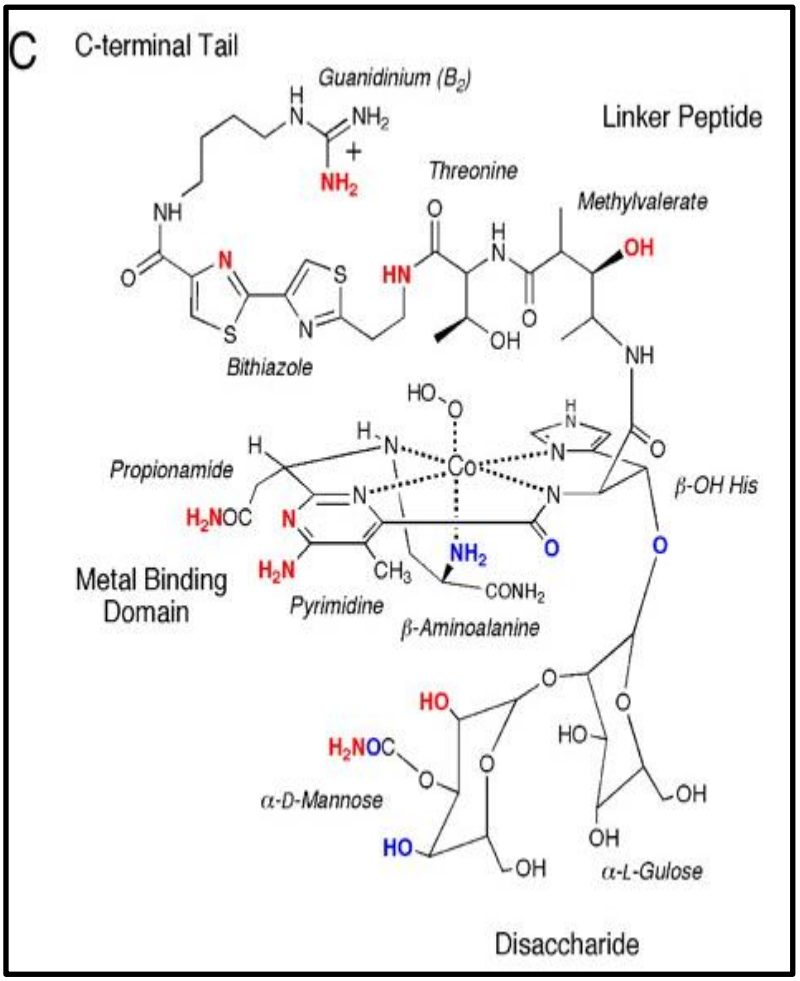
3. Fenlon, K.A., Andreou, K., Jones, K.C., Semple, K.T., The formation of bound residues of diazinon in four UK soils: Implications for risk assessment. Environmental Pollution 159 (2011), 776-781.

Research Group on Environmental Biospectroscopy

Head: Dr. Constantinos Koutsoupakis, Special Teaching Staff

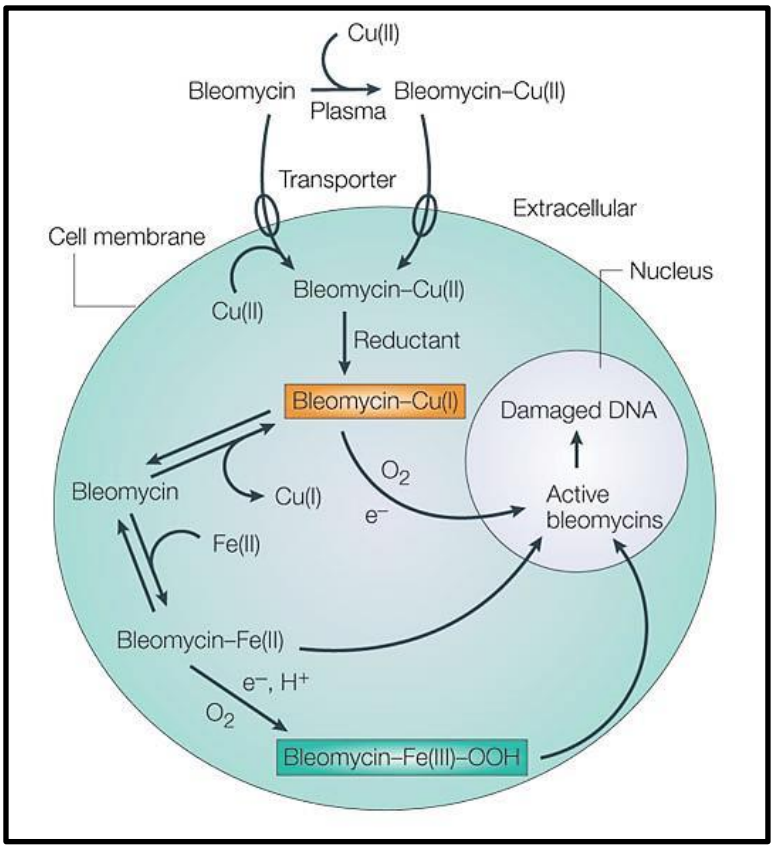
Team: Agathangelos Christoforou, Rafailia Dimitriou, Georgia Demetriou, Iakovi Agathokleous

The bleomycins (BLMs, Figure 1) are a group of natural glycopeptides produced by Steptomyces verticillus that have potent antitumor activity against lymphomas, head and neck cancers and testicular cancer. The BLMs' therapeutic efficacy is proposed to be related to their ability to cause both single-stranded (ss) and double-stranded (ds) DNA damage in the presence of the required cofactors (Fe(II) or Cu(I), O_2 and a one-electron reductant) (Figure 2). The ds-DNA cleavage events have long been believed to be the major source of BLMs' cytotoxicity.



The cytotoxic effect of BLM is believed to result from the drug's ability to bind iron, activate oxygen, and cleave DNA and RNA. Furthermore, the iron complex of the drug (Fe-BLM), is remarkably selective in both the sequences that are cleaved, with a preference for 5′-GyPy-3′ sequences (i.e. pyrimidine bases that lie 3′ to a guanine), and in the chemical mechanism, with the initial event being abstraction of the 4′-hydrogen from the deoxyribose ring (Figure 3). Several features of Fe-BLM have been identified that may explain the ability to activate oxygen, such as the presence of a delocalized π-electron buffer around iron and the strong ironpyrimidine π-backbonding. In contrast, the structural features of Fe-BLM responsible for the sequence and chemical specificity of the DNA degradation reaction remain obscure.

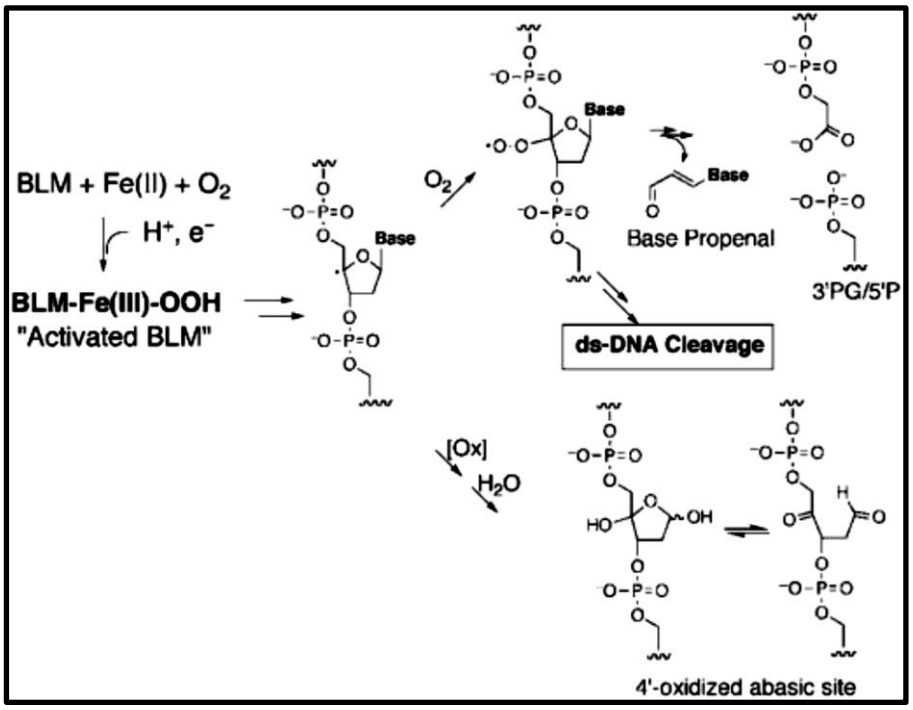
Indeed, there have been reports implicating almost every region of the Fe-BLM molecule, including the C-terminal bithiazole and dimethylsulfonium groups, the N-terminal metal binding site, the primary amine of the β-aminoalanine residue, and the "linker region" that connects the metal binding site with the bithiazole group, as being responsible, at least in part, for the sequence selectivity of Fe-BLM-mediated DNA degradation.



While many of these reports appear to provide conflicting results, the one requirement from all of these studies is that for sequence specific cleavage of DNA to occur, both the metal binding site and bithiazole moiety must be intact.

In our work, we aim to characterize spectroscopically changes in the metal binding site of Fe-/Cu-BLM induced by complexation with DNA, using optical, and Fourier transform infrared (FTIR) spectroscopies. This way we obtain structural information regarding the local environment of the metal site of Fe-/Cu-BLM.

We also extended our studies to Fe-/Cu-BLM bound to the self-complementary hexa-nucleotides, d(CGCGCG) and d(ATATAT), with the intent of detecting structural changes in the metal binding site that correlate with the sequence specificity of DNA cleavage.



Selected Publications

1. Koutsoupakis C., Soulimane T., Varotsis C. Journal of Biological Chemistry 287 (2012) 37495-37507.
2. Koutsoupakis C., Soulimane T., Varotsis C. Chemistry – A European Journal 21 (2015) 4958-4961.

Research Group on Environmental Toxicology (oikotoxicologia)

Head: Dr. Marlen I. Vasquez, Special Teaching Staff

Team: Katerina Drakou (Ph. D.), Elena Tampouri (M.Sc.), Marios Argirides, Angela Christodoulou, Stylianos Kanakaris, Evangelia Leonidou, Thessalia Nikolaou, Andreas Christou

Webpage: http://www.oikotoxicologia.wordpress.com

It is now well-documented that biological ecosystems (including man made ones) are continuously exposed to numerous stressors. These can be physical, chemical and/or (micro)biological ones. The most challenging research questions are centered into how these stressors affect the ecosystems and how they interrelate to effects. The final target would be to evaluate how they can be disentangled to identify the main drivers affecting the quality of the ecosystem and how mitigation measures can be prioritized.

Recent advantages in the 'omics' field give us the opportunity to identify species by knowing the sequence of specific parts of genes (e.g. mitochondrial COI gene). Through barcoding methods reference lists of the fish and mosquito species of Cyprus are under development. This reinforce monitoring schemes in place helping to improve ecosystems and to timely identify the introduction of invasive species to prevent their establishment and spread with unknown risks for the environment and human health.

Traditional ecosystem monitoring of structure and function is often complex and time-consuming. Novel genetic tools can significantly complement these techniques. For instance, mass collections of organisms or environmental DNA can be used for aquatic bioassessment through metabarcoding techniques. These are usually methods of biodiversity assessment that combines two technologies: DNA based identification and high-throughput DNA sequencing. DNA barcodes from target organisms can be mass-amplified using universal PCR primers to evaluate species' existence and distribution.

At present our research group is interested in developing metabarcoding tools to monitor aquatic quality *in situ*. The focus is given on the groups regulated by the Water Framework Directive (WFD) (i.e. macroinvertebrates and diatoms). Furthermore, our interests focus on developing new indices for marine environments. A first study was conducted to compare the microbiome of the native *Posidonia ocenanica* meadows the one of the invasive species of *Halophila stipulaceae*.

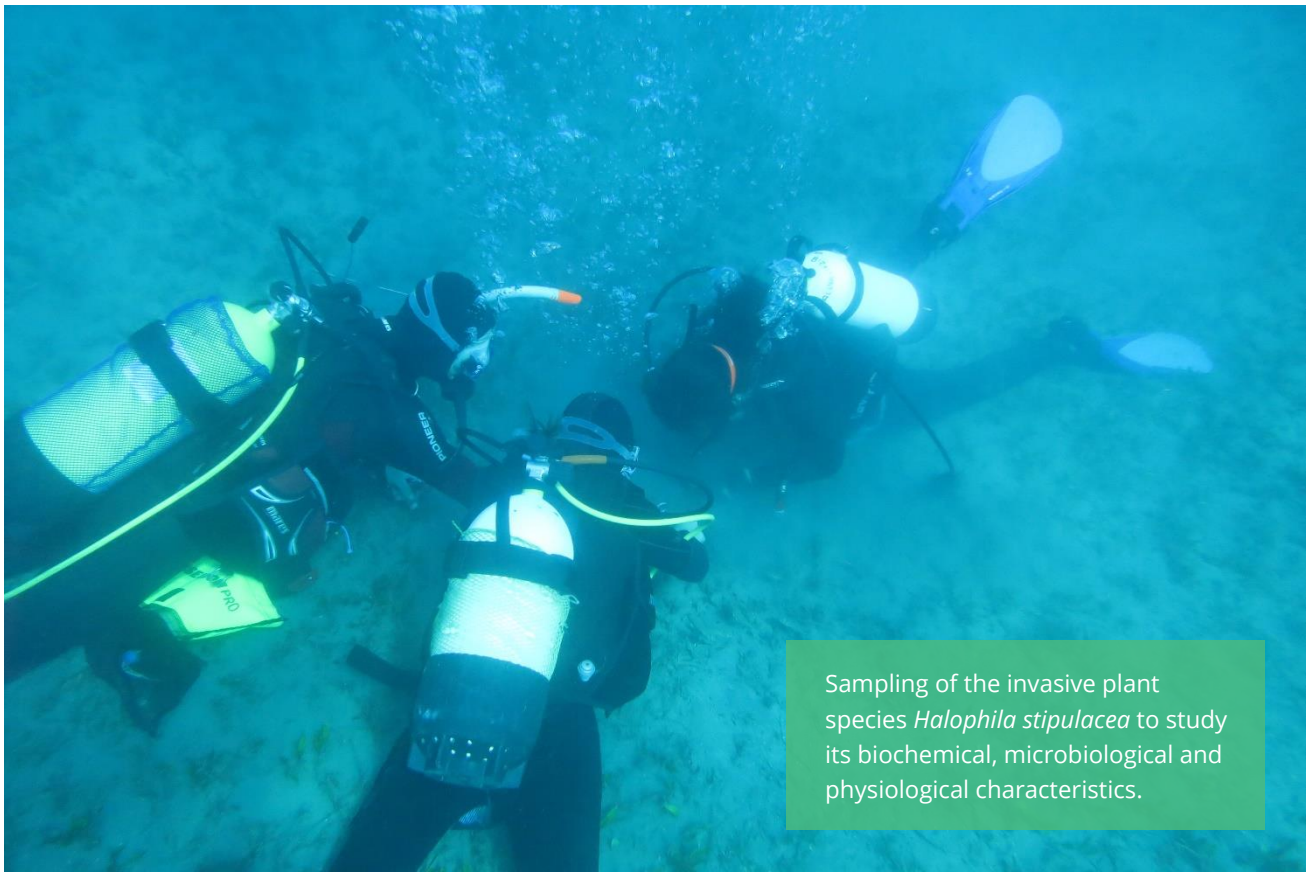
Our group acts as a focal point of the International Atomic Energy Agency (IAEA) of the United Nations for the surveillance of invasive vector species. It actively participates in the project "Establishing genetic control programmes for *Aedes* invasive mosquitoes".

In order to achieve our goals our group cooperates with a multinational, interdisciplinary and intersectoral network of scientists and practitioners that includes biologists, microbiologists, chemists, physicists, environmental engineers, chemical engineers, bioinformaticians, science communicators, etc. We have managed to create collaborations with the governmental, non- governmental and private sector and plan to reinforce them and expand.

During 2016-2018, one Post-Doc project is under development and one M.Sc. and four B.Sc. dissertations have been successfully completed. Apart from this, we have been granted one ERAMUS+ grant and one short-term study mission for training purposes and transfer of knowledge. We have hosted six researchers from various international institutions (i.e. University of Rome Tor Vergata, University of Milano-Bicocca, the Dead-Sea & Arava Science Center and the Yale School of Public Health). Finally we have organised and hosted two workshops in the framework of the COST Action NEREUS and DNAqua-Net. Finally, we have

participated in the organization of a workshop at the 10th YWP IWA conference and a training school for Early Career Investigators under the NEREUS COST Action.

Apart from this, we have an active participation in the transnational Cooperation Programme Interreg V-B Balkan-Mediterranean 2014-2020 through the project entitled "Optimization of decentralized domestic wastewater treatment and sanitation via constructed wetlands (DOMUS_CW)" in collaboration with the Environmental Engineering research group of the Faculty led by Dr. Ioannis Vyrides. We participate in WP3-5 in the activities related to microbial profile analysis, ecotoxicological analysis and wastewater analysis. We also participate in the program Interreg V-A Greece-Cyprus 2014-2020 leading CUT consortium in the project "Development of a novel and integrated cross-border intelligent system for the management of resources, decision making and education to address natural and technological catastrophes and anthropogenic and social crises" (AIGIS).



Sampling of the invasive plant species *Halophila stipulacea* to study its biochemical, microbiological and physiological characteristics.

Selected publications

1. Stylianou K et al. (2018) Diclofenac biodegradation by newly isolated Klebsiella sp. KSC: microbial intermediates and ecotoxicological assessment. Journal of Environmental Chemical Engineering 6:3242-3248.
2. Parmaki S et al. (2018) Bioconversion of alkaloids to high-value chemicals: Comparative analysis of newly isolated lupanine degrading strains. Chemosphere 193:50-59.
3. Patsalou M et al. (2017) Development of a citrus peel-based biorefinery strategy for the production of succinic acid. Journal of Cleaner Production 166:706-716.
4. Leese FGV et al. (2016) DNAqua-Net: Developing new genetic tools for bioassessment and monitoring of aquatic ecosystems in Europe (2016). Research Ideas and Outcomes 2:e11321.

ANNEX I

List of students who graduated in years 2017-2018*

Ph.D. in Agricultural Science, Biotechnology & Food Science

Antoniou, Chrystalla	Aspri, Maria	Chrysargyris, Antonios
Georgiadou, Egli	Kapari-Isaia, Theodora	Kritioti, Angelina
Kyratzis, Angelos		

Ph.D. in Environmental Science and Technology

Ioannou, Aristodimos	Valanidou, Lilian

M.Sc. in Plant Biotechnology

Charidimou, Andreas	Constantinou, Stella	Giannouris, Epaminondas
Kaponas, Chrysos	Lysandrou, Georgios	Xydas, Marios
Sismanidis, George		

M.Sc. in Food Biotechnology

Filippou, Grigoris	Hadjisolomou, Antriani	Hadjivasiliou, Loucas
Michailidou, Eftychia	Neofytou, Agathoklea	Nicolaou, Georgia
Nicolaou, Xenia	Papapanagiotou, Zoe	Polydorou, Styliani
Savva, Chrystalla	Taki, Anastasia	Xantri, Georgia

M.Sc. in Animal Biotechnology

Chatzikosta, Myria	Hadjisavva, Athina	Perikenti, Olga

M.Sc. in Environmental Bioscience and Technology

Andreou, Angela	Themistokleous, Themistoklis	Michael, Kypros
Vouza, Ioanna		

* The list of students who graduated up to summer 2016 can be found in the previous Faculty Report, which is available on the Faculty's webpage: http://www.cut.ac.cy/faculties/gem

M.Sc. in Energy Resource Management

Andronikou, Maria	Chatzikyriakou, Eleana	Chrysanthou, Andreas
Constantinou, Rafaela	Dionysiou, Elena	Drakou, Galatia
Erodotou, Constantinos	Galatarioti, Anthi	Georgiou, Nearchos
Ioannou, Stavros	Isaia, Maria	Kakopetrites, Michael
Mavrogenis, Marios	Menikea, Kristia Karolina	Nikou, Kyriaki
Ntailiani, Paraskevi	Panayi, George	Pantechis, Theofanis
Papaefstathiou, Andreas	Pavlou, Flourentzos	Sotiriou, Chryso

B.Sc. in Agricultural Science, Biotechnology & Food Science

Adamou, Eleni	Anastasiou, Myria	Andreou, Zinonas
Antoniou, Kyriaki	Antoniou, Michalis	Antoniou, Omiros
Antoniou, Orthodoxia	Aristeidis, Stavros	Aristeidou, Anastasia
Avgousti, Fylios	Chatzigiasoumi, Theofilos	Christodoulou, Menelaos
Christofidi, Eleftheria	Damianou, Constantinos	Damianou, Charalampos
Demetriou, Marios	Economou, Florentios	Efstathiou, Epifanios
Efstathiou, Styliana	Egkomiti, Katerina	Eleftheriou, Christodoulos
Eleftheriou, Rafaela	Evangelou, Charis	Georgiou, Maria
Iakovou, Andreas	Ioannou, Christina	Kanaris, Savvas
Karittevli, Varvara	Kasenidi, Katerina	Katsounotou, Maria
Kyriakou, Anna	Loizou, Ioanna	Louca, Giorgos
Mani, Christos	Markides, Charalambos	Michael, Michail
Mouski, Christiana	Neokleous, Ioanna	Nikolaou, Dimitra
Panagiotou, Dimitris	Panayiotou, Constantinos	Panteli, Anastasia
Papacosta, Antigoni	Papakyriacou, Eleftheria	Papaspyrou, Chrysostomos
Paraschou, Anastasia	Pavlou, Jan Julian	Pavlou, Anthoulis
Pempetsiou, Stella	Petrou, Grigoria	Pikardou, Rafaella
Pissidou, Thaleia	Pittara, Marilena	Polyviou, Polyvios
Psara, Christos	Stavri, Christodoulos	Stavrou, Konstantina
Stergiou, Sofia	Synnou, Eleni	Theodorou, Maria
Tsaeras, Georgios	Tsolaki, Amalia	Tzioni, Andreas
Valanides, Nicolas	Vasileiou, Charis	Vassiliou, Nicoletta

B.Sc. in Environmental Science and Technology

Agathokleous, Iakovi	Amiridis, Konstantinos	Aristodemou, Eleni
Asprou, Eleni	Christoforou, Agathangelos	Chrysanthou, Georgia
Demetriou, Georgia	Demetriou, Kyriakos	Filippeti, Andria
Georgiou, Andreas	Giakoumis, Christos	Hadjiouraniou, Georgia
Ioannou, Eleftherios	Ioannou, Elias	Ioannou, Katerina
Ioannou, Stefani	Kampouris, Panayiotis	Katsoni, Panagiota

Kitalides, Dimitris	Konstantinou, Fylaktis	Konstantinou, Giannis
Kyprianidou, Irena	Makri, Eftychia	Michael, Flora
Mikaios, Iosif	Mousikou, Konstantina	Nikolaidou, Maria
Nikolaou, Nikolaos	Palazis, Andreas	Panayiotou, Evaggelia
Panayiotou, Marina	Pantelide, Danae	Pasenidou, Melina
Polykarpou, Anna	Prokopi, Theonitsa	Serafeim, Rafail
Siamtanis, Giannakis	Spyrou, Christina	Tanou, Fokion
Themistokleous, Florentia	Toumazou, Kyriakos	Trattou, Vasilis
Vasiliou, Elena	Zacharia, Irene	Zachariou, Anthousa
Zakou, Panagiota	Zosima, Ioanna	

ANNEX II

List of research projects (ongoing or completed) during 2016-2018

I. Projects funded or supported by European Union programmes

Project Title	Funding Programme	Own Budget (€)	Total Budget (€)	Period	Contact person
AgroLIFE: To promote and enable the conservation of High Nature Value Farmlands in Cyprus	LIFE+ Biodiversity	107,511	575,309	2014-2017	Menelaos Stavrinides
Genomite: New generation sustainable tools to control emerging mite pests under climate change	JPI Agriculture, Food Security & Climate Change (FACCE)	99,000	1,745,000	2014-2017	Menelaos Stavrinides
e-Food Science - Design, development and pilot testing of freely accessible online educational material, for a common group of modules intended for Food Science students	Erasmus+ Programme	28,150	177,000	2014-2017	Photis Papademas
Toward a sustainable viticulture: Improved grapevine productivity and tolerance to abiotic and biotic stresses	FACCE SURPLUS ERA-NET	120,000	2,417,000	2016-2019	Nikolaos Tzortzakis
Sustainable management of livestock waste for the removal/recovery of nutrients (LIVEWASTE)	LIFE+ Environmental Policy and Governance	560,000	2,147,182	2013-2016	Costas N. Costa
European Energy and Environmental Policy at a Crossroads	Lifelong Learning programme – Jean Monnet	28,500	28,500	2013-2016	Theodoros Zachariadis
ODYSSEE-MURE, A Decision Support Tool for Energy Efficiency Policy Evaluation	Horizon2020 programme	31,355	1,795,000	2016-2018	Theodoros Zachariadis
Projects LinkSCEEM & PRACE: High-Performance Computing production grants (5bn total CPU-core hours)	7th Framework Programme	-	-	2016-2018	Evangelos Daskalakis
ENERFUND: Building Retrofit Potential	Horizon2020 programme	154,375	1,539,253	2016-2018	Alexandros Charalambides
Climate-KIC Regional Innovation Scheme - Cyprus	Horizon2020 programme	> 500,000	800 mio	2016-2023	Alexandros Charalambides

Project Title	Funding Programme	Own Budget (€)	Total Budget (€)	Period	Contact person
Evaluation of the Effectiveness of Possible Climate Change Mitigation Policies and Measures	European Commission – Structural Reform Support Service	14,864	14,864	2017-2018	Theodoros Zachariadis
HPC-Europa3 Transnational Access programme	Horizon 2020 research and innovation programme	0	4,316	2018	Evangelos Daskalakis
Enterprise Level Greenhouse Gas Reduction Initiative, Business4Climate	Horizon2020 programme	15,000	63,000	2018-2019	Theodoros Zachariadis
Bioorganic novel approaches for food processing wastewater treatment and valorisation: Lupanine case study (BIOORG4WASTEWATERVAL+)	Waterworks 2014 Cofunded Call	145,000	835,355	2016-2019	Michalis Koutinas / Chrysoula Drouza
A knowledge Alliance in Eco-Innovation Entrepreneurship to Boost SMEs Competitiveness	Interreg Balkan-Mediterranean	101,105	945,510	2017-2019	Alexandros Charalambides
ΑΓΡΟΤΑΥΤΟΤΗΤΑ – AGRO-ID, Identification of authenticity and enhancement of competitiveness of local traditional products of the agri-food sector	Interreg V-A Greece – Cyprus	340,000	1,789,500	2017-2019	Dimitrios Tsaltas
ACUA, Automated Systems of Autonomous Home Composting	Interreg V-A Greece – Cyprus	64,350	1,159,350	2017-2019	Dimitrios Tsaltas
AGROINNOECO, Balkan Med Interregional Innovation Ecosystem for maturing and mainstreaming innovative entrepreneurial ideas in Agrifood sector	Interreg Balkan–Mediterranean	136,610	905,332	2017-2019	Dimitrios Tsaltas
Optimization of decentralized domestic wastewater treatment and sanitation via Constructed Wetlands- DOMUS_CW	Interreg Balkan–Mediterranean	257,380	889,534	2017-2019	Ioannis Vyrides
A digital Solid Waste reuse plAtform for BalkaN- SWAN	Interreg Balkan–Mediterranean	160,000	968,000	2017-2019	Ioannis Vyrides
LIFE Green Grapes, New approaches for protection in a modern sustainable viticulture: from nursery to harvesting	LIFE+	165,090	1,349,354	2017-2021	Dimitrios Tsaltas

Project Title	Funding Programme	Own Budget (€)	Total Budget (€)	Period	Contact person
Improving innovation capacities of private and public actors for sustainable and profitable REcycling of LIVEstock WASTE (RE-LIVE WASTE)	Interreg MED	365,425	1,831,687	2018-2020	Maria G. Antoniou
ASKFOOD, Alliance for Skills and Knowledge to Widen Food-sector- related Open Innovation, Optimization and Development	Erasmus + Knowledge Alliance	56,041	983,623	2018-2020	Dimitrios Tsaltas
Utilization of CO2 through novel BioElectroCathode systems for production of biofuels (CH4 and ethanol)	M-ERA.NET	169,900	670,289	2018-2021	Ioannis Vyrides
Intra-hour prediction of solar electricity generation from Photovoltaics	Solar-ERA.net	168,000	316,500	2018-2021	Alexandros Charalambides
Biogas and digestate with controlled ammonia content by a virtuous biowaste cycle with integrated bio&chemical processes (LIFECAB)	LIFE Environment and Resource Efficiency	232,860	2,462,957	2017-2020	Michalis Koutinas
Development of a novel and integrated cross-border intelligent system for the management of resources, decision making and education to address natural and technological catastrophes and anthropogenic and social crises (AIGIS)	Interreg Greece – Cyprus	125,171	741,171	2018-2020	Marlen Vasquez

II. Projects funded by the Research Promotion Foundation of Cyprus

Project Title	Own Budget (€)	Total Budget (€)	Period	Contact person
PROGNOSIS (Patent Filing)	20,000	20,000	2016-2018	Alexandros Charalambides
Monitoring and Treatment of cyanobacterial contaminated surface waters (CYANOS)	5,000	5,000	2017-2019	Maria G. Antoniou
Development of a hybrid ozone-biological process for the treatment of drill cuttings (OzoneBioPro)	105,670	250,325	2018-2020	Michalis Koutinas
DELIVER: Donkey Milk Bioactive Powder	112,945	156,854	2018-2020	Photis Papademas
Biological treatment of Bilge water using a hybrid system of Submerged Anaerobic Membrane Bioreactor followed by Moving Bed Biofilm Reactor	139,735	149,695	2018-2020	Ioannis Vyrides
Oil Biodesulfurization	24,480	159,840	2018-2020	Ioannis Vyrides
Real time monitoring the nature resources in the Mining Environments of Hellenic Copper Mines	131,520	199,520	2018-2020	Constantinos Varotsis
Chemical mapping of chalcopyrite and secondary mineral tailings by powerful sensing technologies to improve copper recovery in Mining industry	99,960	159,960	2018-2021	Constantinos Varotsis
Production of the bioactive signaling messenger nitric oxide from nitrite: Probing the nitrite reductase activity of heme globins and mitochondrial heme-copper respiratory oxidase	93,451	249,931	2018-2021	Constantinos Varotsis
Triggering Photoprotection in Photosystem II Antenna by Molecular Simulations and Raman Spectroscopy	10,320	159,965	2018-2021	Constantinos Varotsis
Urban Micro-Climate, and the Design of Sustainable Built Environments (SustUrbanClim)	17,280	250,000	2018-2021	Theodoros Zachariadis
Triggering Photoprotection in Photosystem II Antenna by Molecular Simulations and Raman Spectroscopy	159,965	159,965	2018-2021	Evangelos Daskalakis

III. Projects funded or supported by other national and international sources

Project Title	Funding Organisation	Own Budget (€)	Total Budget (€)	Period	Contact person
Selection of autochthonous yeasts from Cyprus vineyards as starter cultures in vinification	Ministry of Agriculture, Natural Resources & Environment of Cyprus	119,040	217,000	2014-2018	Dimitrios Tsaltas
Kyperounda Winery, Microbiological characterization, organoleptic analysis and optimization of Xynisteri fermentation	P. Photiades Group	8,000	8,000	2014-2020	Dimitrios Tsaltas
Support for the formulation of a comprehensive medium and long-term energy efficiency strategy for Cyprus	GIZ - German Organisation for International Cooperation	19,292	19,292	2016-2017	Theodoros Zachariadis
PROMELL, Incorporation of propolis bioactive ingredients in honey	Honeymell Ltd	7,000	7,000	2017-2018	Dimitrios Tsaltas

ANNEX III

Publications of Faculty staff in 2016-2018*

2016

Adamou, A., Manos, G., Messios, N., Georgiou, L., Xydas, C., & Varotsis, C. (2016). Probing the whole ore chalcopyrite–bacteria interactions and jarosite biosynthesis by Raman and FTIR microspectroscopies. *Bioresource Technology, 214*, 852-855. doi:10.1016/j.biortech.2016.04.001

Antoniou, C., Savvides, A., Christou, A., & Fotopoulos, V. (2016). Unravelling chemical priming machinery in plants: The role of reactive oxygen–nitrogen–sulfur species in abiotic stress tolerance enhancement. *Current Opinion in Plant Biology, 33*, 101-107. doi:10.1016/j.pbi.2016.06.020

Antoniou, M. G., Zhao, C., O'Shea, K. E., Zhang, G., Dionysiou, D. D., Zhao, C., . . . Hiskia, A. (2016). *Photocatalytic degradation of organic contaminants in water: Process optimization and degradation pathways* doi:10.1039/9781782627104-00001

Botsaris, G., Nikolaou, K., Liapi, M., & Pipis, C. (2016). Prevalence of listeria spp. and listeria monocytogenes in cattle farms in Cyprus using bulk tank milk samples. *Journal of Food Safety, 36*(4), 482-488. doi:10.1111/jfs.12265

Botsaris, G., Swift, B. M. C., Slana, I., Liapi, M., Christodoulou, M., Hatzitofi, M., . . . Rees, C. E. D. (2016). Detection of viable mycobacterium avium subspecies paratuberculosis in powdered infant formula by phage-PCR and confirmed by culture. *International Journal of Food Microbiology, 216*, 91-94. doi:10.1016/j.ijfoodmicro.2015.09.011

Christou, A., Antoniou, C., Christodoulou, C., Hapeshi, E., Stavrou, I., Michael, C., . . . Fotopoulos, V. (2016). Stress-related phenomena and detoxification mechanisms induced by common pharmaceuticals in alfalfa (medicago sativa L.) plants. *Science of the Total Environment, 557-558*, 652-664. doi:10.1016/j.scitotenv.2016.03.054

Chrysargyris, A., Laoutari, S., Litskas, V. D., Stavrinides, M. C., & Tzortzakis, N. (2016). Effects of water stress on lavender and sage biomass production, essential oil composition and biocidal properties against tetranychus urticae (koch). *Scientia Horticulturae, 213*, 96-103. doi:10.1016/j.scienta.2016.10.024

Chrysargyris, A., Nikou, A., & Tzortzakis, N. (2016). Effectiveness of aloe vera gel coating for maintaining tomato fruit quality. *New Zealand Journal of Crop and Horticultural Science, 44*(3), 203-217. doi:10.1080/01140671.2016.1181661

Chrysargyris, A., Panayiotou, C., & Tzortzakis, N. (2016). Nitrogen and phosphorus levels affected plant growth, essential oil composition and antioxidant status of lavender plant (lavandula angustifolia mill.). *Industrial Crops and Products, 83*, 577-586. doi:10.1016/j.indcrop.2015.12.067

Drogoudi, P., Pantelidis, G. E., Goulas, V., Manganaris, G. A., Ziogas, V., & Manganaris, A. (2016). The appraisal of qualitative parameters and antioxidant contents during postharvest peach fruit ripening underlines the genotype significance. *Postharvest Biology and Technology, 115*, 142-150. doi:10.1016/j.postharvbio.2015.12.002

Faassen, E. J., Antoniou, M. G., Beekman-Lukassen, W., Blahova, L., Chernova, E., Christophoridis, C., . . . Zguna, N. (2016). A collaborative evaluation of LC-MS/MS based methods for BMAA analysis: Soluble bound BMAA found to be an important fraction. *Marine Drugs, 14*(3) doi:10.3390/md14030045

Fantuz, F., Salimei, E., & Papademas, P. (2016). Macro-and micronutrients in non-cow milk and products and their impact on human health. *Non-bovine milk and milk products* (pp. 209-261) doi:10.1016/B978-0-12-803361-6.00009-0

Filippou, P., Antoniou, C., Obata, T., Van Der Kelen, K., Harokopos, V., Kanetis, L., . . . Fotopoulos, V. (2016). Kresoxim-methyl primes medicago truncatula plants against abiotic stress factors via altered reactive oxygen and nitrogen species signalling leading to downstream transcriptional and metabolic readjustment. *Journal of Experimental Botany, 67*(5), 1259-1274. doi:10.1093/jxb/erv516

Georgiadou, E. C., Goulas, V., Ntourou, T., Manganaris, G. A., Kalaitzis, P., & Fotopoulos, V. (2016). Regulation of on-tree vitamin E biosynthesis in olive fruit during successive growing years: The impact of fruit development and environmental cues. *Frontiers in Plant Science, 7* (November 2016) doi:10.3389/fpls.2016.01656

* Based primarily on the Scopus® database as of August 2018.

Goulas, V., Stylos, E., Chatziathanasiadou, M. V., Mavromoustakos, T., & Tzakos, A. G. (2016). Functional components of carob fruit: Linking the chemical and biological space. *International Journal of Molecular Sciences, 17*(11) doi:10.3390/ijms17111875

Hadjimbei, E., Botsaris, G., Gekas, V., & Panayiotou, A. G. (2016). Adherence to the mediterranean diet and lifestyle characteristics of university students in Cyprus: A cross-sectional survey. *Journal of Nutrition and Metabolism, 2016* doi:10.1155/2016/2742841

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Faculty of Geotechnical Sciences and Environmental Management

Cyprus University of Technology

P.O. Box 50329, 3603 Limassol, Cyprus
E-mail: dean.gem@cut.ac.cy
Webpage: www.cut.ac.cy/faculties/gem

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Photo by Mr. Christos Zoumides, who conducted his doctoral research on water resources management at our Faculty. He was awarded his PhD in 2014. More photos by Christos can be found at flickr.com.

Design by: Oxana Bondarenko
oxana@binarymade.com