



Highlights and Editorial

CITAB Strategic Plan: meeting stakeholder needs and staking a claim in the International research arena

Two core aims of the CITAB 2015-2020 Strategic Plan (PEst) are to boost internationalisation and to strengthen ties with stakeholders by developing projects that meet their specific needs based on the centre's key areas of expertise. PEst focuses on 2 thematic areas: (i) Sustainability of Agri-food and Forestry Ecosystems in a changing environment and (ii) Technology & innovation in Agri-food and Forestry chains for a more competitive bio economy in agri-food and forestry chains. Each thematic area comprises a set of tasks specifically designed for developing stakeholder focused innovative scientific and technological knowledge in order to make Agri-food and Forestry chains more competitive, sustainable and environmentally friendly, coining what could be the AgriFood and Forestry 4.0.

The content of this newsletter highlights the growing success of our strategy. CITAB which already coordinates a FP7 project (EUROLEGUME) is now an active project partner in two European Horizon 2020 projects – EURODAIRY and SCILIFE – both linked to the transfer of scientific knowledge, and a SUDOE project – TuRBO SUDOE – aimed to the technology transfer between R&D centres and companies, in the SUDOE region. CITAB researchers are also forging ahead with national projects – funded by the Rural Development Programme and Regional Funds (COMPETE) – some of them developed in collaboration with key stakeholders in the agricultural sector.

As a result of CITAB expertise on change and sustainability in ecosystems affected by agricultural and forestry activities, our Centre has joined the European Long-Term Ecological Research LTER network to carry out long-term ecological investigation monitoring and collation of relevant data at sites situated across a large geographic scale as part of the International network of sites (ILTER).

CITAB researchers kept its long term interaction with non-scientific audiences, in several outreach activities such as the European Researchers' Night, cooking sessions and workshops for Secondary Schools and UTAD kitchen staff and

Eduardo Rosa, CITAB's Director

CITAB forges a new generation of agricultural production chains scientists



Agrichains students and Directors, Prof. Eduardo Rosa and Prof. Amélia Silva.

CITAB launched the 3rd edition of "AgriChains – Agricultural Production Chains: from fork to farm" Doctoral Programme with 12 new students. Similar to previous years, AgriChains continues to respond to consumer demands and concerns by focusing on training doctoral students in each step of the agricultural production chain. Students from the 1st and 2nd editions of the AgriChains programme are carrying out research for their theses in different areas of agro-food chain science that are relevant to regional interests such as classical aspects of production, molecular and biochemistry characterization, consumer acceptance, climate change impacts in food quality, genetic diversity and agro-food co-products valorization. This third edition Agrichains grants were funded by FCT - as in the previous editions - and also by the North Portugal Regional Operational Programme – through the Northern Portugal Regional Coordination and Development Commission, which represents a very important contribution to the training of a new generation of highly skilled scientists.



In this edition



INTERACT - Integrative Research in Environment, Agro-Chains and Technology



INTERACT Coordinators, Henrique Trindade, Rui Cortes, Luís Sanches Fernandes, Moutinho Pereira and Fernando Pacheco.

The project INTERACT, anchored in CITAB, aims to improve the agriculture by developing new scientific and technological knowledge that may allow higher yields of important crops, for new market segments, and is oriented towards the preservation of natural resources, integrated management and valorization of agrarian chain production facing new challenges. To address these issues, INTERACT is divided in 3 research strands: Innovation for Sustainable Agro-food Chains (ISAC); BioEconomy and Sustainability (BEST); Sustainable Viticulture and Wine Production (VitalityWine). Financed for a total of € 3.508.607 by FEDER, INTERACT started in May 2016 and will run for a period of 3 years. Presently, nearly 100 UTAD researchers and 33 fellowships (mainly with MSc. and Ph.D. degrees) take part in INTERACT, a project that is contributing significantly to scientific employment in North Portugal. Northern Portugal has several opportunities and a high economic potential based in local-economy exploitation, particularly agro-food resources from animal production (meat and milk), vegetables, fruits, olives, nuts to wine and native flora & medicinal plants. The efforts of CITAB UTAD researchers, as well as others from public and private R&D institutions over the last decades have been fundamental to boosting the technological value of the region mainly through the development and dissemination of innovation and know-how. Regional competitiveness has been improved via new methods, technologies and more environmental friendly and efficiently processes. Nonetheless, this achievement implies continuous efforts in research and development, particularly concerning the adaptation of agro-forestry to climate changes. INTERACT's first project workshop took place in November 2016 with 29 oral presentations that provided a window on research development in the different strands. The workshop brought together the diverse research lines and provided a forum for further collaboration between INTERACT members.

CITAB researchers collaborate in the International Long-Term Ecological Research (ILTER) network

The December 2015 newsletter edition reported how CITAB researchers are monitoring a range of compensatory measures following the construction of the Lower Sabor Hydroelectric scheme in north-eastern Portugal. The Lower Sabor environmental monitoring programme – called PIMA for short – is coordinated by João Cabral, Head of the Laboratory of Applied Ecology (LEA) at CITAB-UTAD.

Despite these impacts, the lower Sabor catchment has high conservation value with Rede Natura 2000 status that includes a Special Protection Area (SPA; 79/409/EEC,) and Sites of Community Importance (SCI; 92/43/EEC). These classifications are based on the presence of habitats and wildlife species of conservation concern, such as, among others, endangered populations of birds of prey, Iberian wolf, the endemic desman, otter, black stork, aquatic and plant communities. The high conservation value of the Baixo Sabor has led to this region being included in the European Long-Term Ecological Research network of sites (LTER network) listed for Portugal. The aim of the LTER network is for research institutions to carry out long-term ecological investigation monitoring and collation of relevant data at sites situated across a large geographic scale. LTER is part of an International network of sites (ILTER).

Starting in early 2016, João Cabral has been spearheading an initiative to integrate CITAB researchers involved in PIMA into LTER Sabor programme. This has resulted in the signing of a collaborative protocol between CITAB, the Associate Laboratory InBIO (a partnership between the Research Centre in Biodiversity and Genetic Resources and the Centre of Applied Ecology 'Prof. Baeta Neves' of the University of Lisbon - CEABN) and CIMO at Bragança Polytechnic.

As a LTER delegate, João Cabral also attended the first global Open Science Meeting of the ILTER Network which took place in the Kruger National Park (Skukuza), South Africa in October 2016, where he gave a talk on "Predicting the vertebrate communities' trends facing the long-term impacts of a recent hydropower reservoir installed in a South European watershed (LTER Sabor, Portugal)" in the session on "Data integration and interoperability linking global scale ecosystem



ILTER Network Open Science Meeting in Kruger National Park, South Africa.



Eurodairy - A Europe-wide Thematic Network on improving resource use efficiency in dairy farming

Starting in February 2016, the new EU Horizon 2020 project entitled "Eurodairy - A Europe-wide Thematic Network on improving resource use efficiency in dairy farming", involves researchers from 19 European institutions (www.eurodairy.eu). Coordinated in CITAB by the senior researcher Henrique Trindade, this 36 month project aims to develop a Europe-wide thematic network for dairy farming to enhance economic, social and ecological performance. A regional-based multi-actor groups will be formed where farming organisations, the dairy industry, extension services and research organisations will participate to ensure a continuous two-way flow of information between practice and science.



The TuRBO SUDOE - development, validation and demonstration of a model based on a network of 'Transference Brokers' for a direct technology transference between R&D centres and companies in the SUDOE territory



TuRBO SUDOE meeting in Málaga - Spain, November 2016.

CITAB is part of a nine partner consortium, including R&D institutions, from the SUDOE region. The consortium will support companies to improve their technical and scientific capacity via knowledge transfer in three main strategic areas (i) agrifood, (ii) automotive and (iii) energy/ICT. An innovative approach, using a dedicated Transference Broker to foster the transference process, will allow the consortium effectively exploit the knowledge generated from the strategic areas in the market. This will be done via a harmonized and coordinated effort between R&D (OFFER) and business activities (DEMAND).

TuRBO SUDOE kicked off in July 2016 and will end in June 2019. The consortium comprises 5 Centre that OFFER knowledge – CITAB-UTAD, the University of Burgos, the University of Malaga, the University of Aveiro, and the Fundación Centro Tecnológico de

Efficiency and Energy Sustainability – (EnergyLab), and 3 DEMAND Entrepreneurial Technology Clusters -(Agribusiness Business Federation of the Valencian Community - FEDACOVA, Asociación Cluster de Automoción de Aragón - CAAR and Mecanic Vallée). The Barcelona Knowledge Innovation Market (KIMbcn), a world expert in Training in the area of Technology Transfer, is also a TuRBO project partner. The CITAB researchers involved in this project are senior researchers Professor Ana Barros, Professor Carla Amaral, and Professor Eduardo Rosa, who is also the project coordinator.

Deus ex Machina – Symbiotic Technology for societal efficiency gains

CITAB is a member institution of Deus ex Machina (Symbiotic technology for societal efficiency gains), a project funded by NORTE 2020 - North Portugal Regional Operational Programme – which has as an objective to create a symbiotic relationship of humans with technology. This project is coordinated in CITAB by the senior researcher Pedro Melo Pinto, and CITAB's task includes the development of technological applications for use in agriculture, which will also allow information access using the most suitable interface. This project is led by Fraunhofer Portugal Research and includes as partner institutions UTAD (where CITAB is included) and the Universities of Porto and Minho.



Deus Ex Machina research team.



EUROLEGUME project and the International Year of Pulses



Researchers from CITAB & Eurolegume project were involved in several activities over 2016 including workshops and outreach activities that fully met project long term objectives. The Eurolegume project visited different secondary schools in Vila Real and Lamego to show the students how important legumes are such as lentils, faba beans, cowpeas, chick peas and beans! The Eurolegume project also promoted the "Legumes workshop" week in October 2016, a joint collaboration between CITAB, UTAD and the Lamego Hotel and Tourism training School in the Douro. The objective of the workshop was to disseminate the EUROLEGUME project to secondary schools during the World Food Week and to encourage the consumption of legumes. For this initiative a Chef from the hotel school was invited to develop new and delicious legume based recipes. Students from several High schools, UTAD and Lamego Hotel and Tourism training School had the opportunity to learn from the health benefits of leguminous plants and their importance in our diet.

Science Happens!

Organized by members of the CITAB pole at the University of Minho, in March 2016, "Bate Bate Coração" invited children from 11 to 12 years old to know how the heart works, what it looks like and how a graphic of heart beats can be constructed and read. A second activity "Criar, Perder ou Tudo Transformar" allowed children aged 6 to 10 to become scientists and in 2 hours they were able to transform different types of material to better understand that "In nature nothing is created, nothing is lost, everything is transformed". The action "Micróbios de fugir a 7 pés!" allowed children aged 11 to 12 to observe some of the microbes that surround us. Conscious of the existence of pathogenic microbes, the initiative further challenged children to test the antimicrobial action of several products of daily life. All these actions were organized under the "Ciência Acontece!" or "Ciência p'ra que te quero..." programs, promoted periodically by the project Scientia.com.pt of the School of Sciences of the University of Minho at the Biblioteca Lúcio Craveiro da Silva in Braga.



**CIÊNCIA
ACONTECE!**



European Researchers' Night



Prof. Eunice Bacelar during the demonstration «In my garden there is no STRESSE».

The European Researchers' Night took place on the 30th September in over 250 cities across Europe. A total of 20 CITAB researchers brought science and learning to the general public at the Crystal Palace in Porto and the Science School of the University of Porto. Visitors saw how to turn vegetable oil into biodiesel, learned about protecting species and the environment, made recycled paper, and even discovered that plants can suffer from stress. In the words of CITAB researcher Valdemar Carnide "outreach activities are a way for secondary school students in particular to have a first contact with research which can awaken vocations. Science is not only carried out in the laboratory but also in the field and in the street. It is everywhere." Lav Sharma, a PhD student reinforces this idea stating that "Not everyone will be able to grasp all of the concepts we present, but if they understand about 50%, then our work is done. It is about creating enthusiasm that may help them decide on their vocation in the future".

Protocol with the National Entity for the Fuel Market

CITAB is collaborating with the National Entity for the Fuel Market (ENMC) on the study and development of biofuels, with a view to transposing community directives into national law.

The collaboration will focus on the study of the emissions of gases from road transport fuels that are harmful to the environment and the use of biofuels as an alternative to fossil fuels. The research will contribute to greenhouse gas emission reduction targets and will be carried out in line with EU Directive 2015/513 - on the increased sustainability of biofuels and will be coordinated by the CITAB researcher Professor Amadeu Borges.

The collaborative protocol was signed on June 8 at UTAD by the President of ENMC and the Rector of UTAD. An outreach session followed, outlining the presentation of the challenges of the 2015/513 Directive, as well as some work already carried out by CITAB / UTAD researchers on biofuels, both liquid and gaseous. A visit was also made to the Thermal Engineering Laboratory of Mechanical Engineering of UTAD.



Signature of the Protocol by the President of ENMC and the Rector of UTAD, June 2016.

CITAB´s involvement on national environment Programs



CITAB is participating in the "Agriculture and Forestry (GTT AGF)" thematic network. This network is part of the Portuguese Coalition to Green Growth ("Crescimento verde"), which was created by the EU endorse a long term aim towards a better, green and a sustainable economy, based on a circular economic paradigm that embraces higher productivity, the production of less residues and wastes, higher recycling rates and lower CO₂ emission levels. The Green Growth Group will support green activities to promote environment protection, to create and promote employment, to stimulate sustainable management tools with a maximum respect for the

nature resources, water quality and biodiversity. Network actions started in April 2016; the major objective is the definition of a framework to help meet objectives and Green Growth Group strands in the agro-food sector.

Within the national strategy for the adaptation to climate changes, CITAB was also involved as rapporteur of the Group focused on improving the resilience, reduce the risks and keep the capacity to produce goods and services.



Data-driven solutions for smart viticulture

Spectroscopic techniques have been showing great potential due to their quick response, cost-effectiveness, non-destructive and non-invasive nature, and environmental friendliness. Such features make this technology very attractive for an overall sustainable industry and research development, in which agri-food is included. Within this sector EU is the world's leading producer with almost half of the global vine-growing area and about 65% of production by volume. Thus, taking spectroscopic techniques applied to viticulture are an appealing alternative for ripeness assessment and harvest date determination offering also a great potential for plant variety and clone determination.

Recent works have clearly demonstrated that there is a great advantage to process the high dimensionality spectroscopic data using soft computing or multivariate analysis techniques such as Partial Least Squares (PLS), Neural Networks (NN) or Support Vector Machines (SVM).

At CITAB, and in cooperation with Universidad de la Rioja, it was started a pioneering research work of using grapes image based data and machine learning approaches to address two fundamental questions:

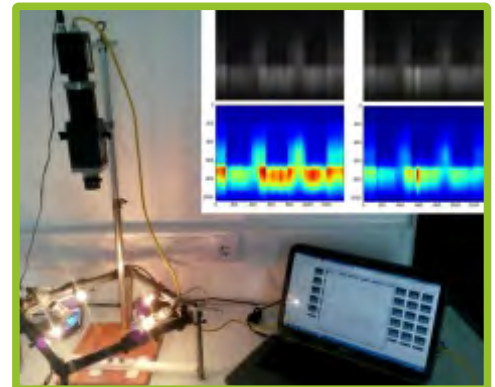
Which computational learning models are better for prediction of oenological parameters and for grapevine varieties (and clones) classification? Which models better cope with the generalization problem?

Oenological parameters estimation and grapevine classification using intelligent machine learning methods

The research activities at CITAB have been supported by several projects: Hyper - Application of Hyperspectral Imaging and Neural Networks to Viticulture (PTDC/ PTDC/EEA-AUT/121056/2010) and ENOEXEL, From Vineyard to Wine (NORTE-01-0124-FEDER-000033) focused on the application of hyperspectral imaging and machine learning algorithms to the estimation of the chemical composition of grapes without destroying the grapes. A secondary objective was to explore the same approach for the classification (discrimination) of grapevine varieties and/or clones.

The results achieved support that the hyperspectral image based novel methodology is a feasible nondestructive way of estimate enological parameters, with a performance that match or even surpass the available methods. For the first time ever, pH, sugars and anthocyanin concentration were simultaneously estimated, using spectroscopic measurements in reflectance mode for a small number of whole berries. The use of other machine learning approaches have been studied, particularly the use of support vector machines. The results have shown that SVMs may increase the estimation method performance.

The methodology was successfully adapted to grapevine varieties classification and a patent on the resulting method was granted (Fast Clone ID. Patente de Invenção Nacional 106253).



Spectral image acquired and processed at the laboratory.

The problem of generalization in machine learning methods



Grape berry imaging collected at the vineyard.

These kind of methods are based on model training using a set of known examples. Overtraining is to be avoided in order to prevent overfitting and consequently failure when presented with new data. This problem is even more important when dealing with grape berries and grapevines, with so many varieties of great impact (plus climate conditions, terroir, etc.) in wine making, and which has never been addressed before.

While the first R&D approach was focused on the general ability of machine learning approaches we kept an eye in the generalization problem, with results better than anticipated considering the particular nature of grape berries and similar situations using different methodologies, representing a striking innovative result.

CITAB is currently involved in 3 R&D projects (VITINOV. 2014-2017. PRODER 52306; INTERACT. 2016-2019. NORTE-01-0145-FEDER-000017; and Deus ex

Machina. 2016-2019. NORTE-01-0145-FEDER-000026) designed to identify if computational learning methods generalize well with data from vintages and new varieties not employed in the model's training and to evaluate the impact of doing field imaging measurements instead of the ongoing process where the grapes are imaged in laboratory.

These are key aspects for smart viticulture where remote sensing or the use of unmanned aerial vehicles (UAVs) are established practice (generating high-quantity of more complex and variable data) and data-driven solutions are required to cope with such challenge.



Fábio Pereira

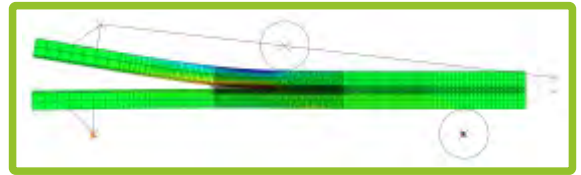
Identification of cohesive laws of cortical bone under mode I, mode II and mixed-mode I+II

CITAB researcher Fábio Pereira obtained his PhD degree on November 2015, with a thesis on the "Identification of cohesive laws of cortical bone under mode I, mode II and mixed-mode I+II". The prediction and knowledge of cortical bone fracture risks is a relevant topic, with a significant socio-economic impact in an increasingly ageing population. Fabio's CITAB

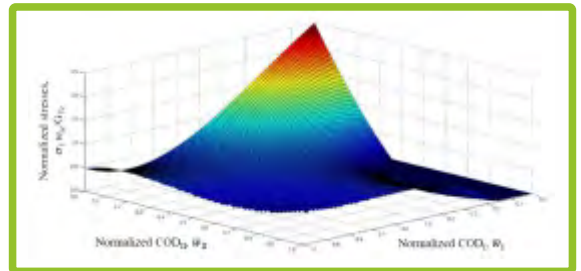
supervisor was Professor José Joaquim Lopes Morais.

Fracture characterization of cortical bone under traction (mode I) and shear (mode II) loading modes were performed. Damage initiation and propagation in cortical bone tissue is characterized by the existence of a so-called Fracture Process Zone (FPZ) that develops in the vicinity of the crack tip. An effective way to deal with the complex phenomena that occur in this non-linear domain consists in applying cohesive models by means of interface finite elements.

The typical cohesive laws of cortical bone were identified by direct and inverse methods, allowing the numerical simulation of cortical bone behaviour under more complex loading conditions that are common in human's daily activities. Fabio's research provides valuable contributions to identifying suitable procedures in appropriate fracture characterization of cortical bone. Fabio's research was based on bovine bone as test material. However the developed processes and procedures can be extended to humans and human health purposes. Fabio's doctoral research was funded by CITAB and FCT, through a PhD grant.



Numerical model for the Mixed-Mode-Bending test simulation.



Normalized mode I cohesive law.



Mixed-Mode-Bending experimental test.



Sofia Santos

Mechanisms of Cadmium Toxicity in Fish - Osmoregulatory Responses

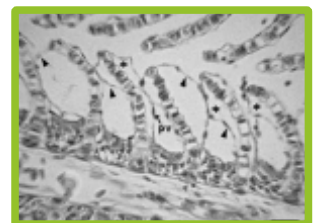
CITAB researcher Sofia Santos, successfully defended her doctoral thesis "Mechanisms of Cadmium Toxicity in Fish - Osmoregulatory Responses" in April 2016. Cadmium is a non-essential metal, whose occurrence in environment is cause of concern due to its toxicity to both, aquatic organisms and humans. High cadmium levels in the environment arise from various anthropogenic sources.

Fish are useful experimental models to evaluate the health of aquatic ecosystems and toxicological mechanisms of different contaminants. Sofia studied two euryhaline species (*O. niloticus* and *S. aurata*) to waterborne and intraperitoneally exposure to different concentrations of cadmium, over different time periods and at different salinities. Results provided some insights into physiological and biochemical Cd toxicity mechanisms. Disruption of ion homeostasis, alterations in Na^+/K^+ -ATPase activity and oxidative damage are effects of Cd exposure that can be integrated in a comprehensive model for Cd impacts. Sofia published 5 articles in JCR Journals and 2 articles in ISI Index proceedings.

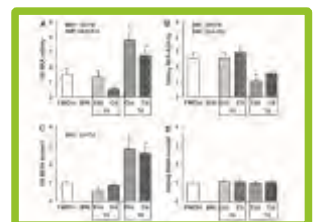
The study was funded by an FCT individual PhD grant (PhD grant SFRH/BD/22750/2005) and by the European Regional Development Fund through the COMPETE — Operational Competitiveness Program and national funds through FCT (PEst-C/MAR/LA0015/2011). The supervisors were Professor Jonathan Mark Wilson (Wilfrid Lauriel University, Waterloo and CIMAR, Porto), Professor António Fontainhas Fernandes and Professor Sandra Mariza Monteiro (CITAB, UTAD).



Tilapia waterborne exposed to Cd.



Gills of fish exposed to Cd showing some histological changes.



Effect of salinity alone and salinity + Cd exposures.



Irene Gouvinhas

Impact of genetic background, maturation, and infection by *Colletotrichum acutatum* on the phytochemical composition of olives and olive oils: implementation of faster infrared screening tools

CITAB researcher Dr. Irene Gouvinhas successfully defended her doctoral thesis "Impact of genetic background, maturation, and infection by *Colletotrichum acutatum* on the phytochemical composition of olives and olive oils: implementation of faster infrared screening tools" in March 2016. Classified as "Outstanding"

by the jury, the study was funded by the FCT (PhD grant SFRH/BD/78013/2011). The olive tree can be affected by several diseases, conditioning yield and final product quality.

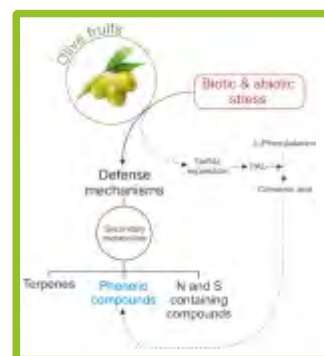
The main objectives of this study was to evaluate the phenolic composition in diverse infection degrees in three different olive cultivars characterized by distinct susceptibility to *C. acutatum* or 'Galega Vulgar' (highly susceptible), 'Cobrançosa' (moderately susceptible), and 'Picual' (tolerant). Furthermore, the expression of OePAL gene, was investigated to better understand the relationship between OePAL expression, phenylalanine ammonia-lyase (PAL) activity, and the (poly)phenolic content.

The use of spectroscopical (FTIR and Raman) and classical methods for determining phenolic compounds and quality parameters of olive oils, combined with Partial Least Square regression identified cultivar and the distinct infection stages, and helped create models to predict the chemical characteristics of this food matrix.

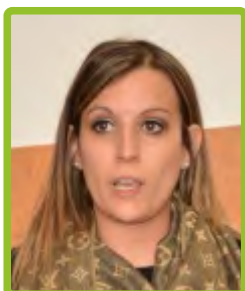
Irene's supervisors were Professor Ana Barros (CITAB/UTAD), Professor Paula Martins-Lopes (UTAD/BioISI), and Dr. Sónia Gomes (UTAD/BioISI). Irene Gouvinhas concluded the course on Food Science in 2011 with 17 values, winning three merit awards during this course. She then took a post-graduate course on Biotechnology and Food Quality before embarking on a PhD in Chemical and Biological Sciences. To date, Irene Gouvinhas published a total of twelve articles in high impact journals and several oral communications in national and international congresses.



Infection of olive trees with *Colletotrichum acutatum*



Defense mechanisms of plant to stress



Ana Catarina Luzio

Enlightening the complex sex determination and differentiation of zebrafish (*Danio rerio*)

CITAB researcher Ana Catarina Luzio successfully defended her doctoral thesis "Enlightening the complex sex determination and differentiation of zebrafish (*Danio rerio*)" in May of 2016. Her supervisors were Professor António Fontainhas-Fernandes (CITAB-UTAD), Ana Maria Coimbra, PhD (CITAB-UTAD) and Professor Eduardo Rocha (ICBAS-UP). Zebrafish (*Danio rerio*; family Cyprinidae), a small

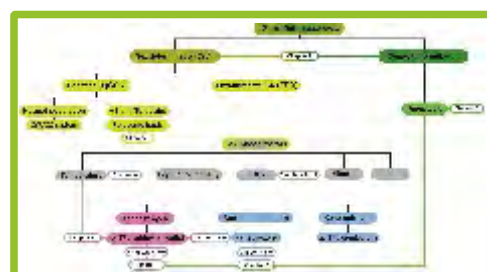
freshwater teleost, has been extensively used as animal model in several research areas. However, how sex is determined on this species is a long-standing question. This thesis results indicate that zebrafish sex determination (SD) has a polygenic genetic basis (GSD), although environmental sex determination (ESD) mechanisms may also be involved.

This PhD thesis raise some concerns regarding the impact of environmental contamination and global warming on fish populations, using zebrafish as model. Ana's research studied the impact of two pharmaceutical compounds, alone and combined (17A-ethinylestradiol and fadrozole) and how water temperature can change the effect of 17A-ethinylestradiol exposure.

Results from Ana's doctoral research showed that studies on sexual development processes still need to be addressed and that processes are temporarily or permanently disrupted by environmental contaminants or temperature shifts. In addition, the pattern emerging from mixtures of EDCs clearly indicates the modulation of novel responses when compared to individual chemical's exposure. Ana was funded by the FCT PhD individual grant SFRH/BD/44794/2008 and funded the project PTC/CTV/102453/2008 (FCOMP-01-0124 FEDER-009527) through ERDF - European Regional Development Fund and COMPETE - Operational Competitiveness Programme.



Adult wild-type zebrafish (*Danio rerio*).



Schematic representation of zebrafish sex determination and gonad differentiation.

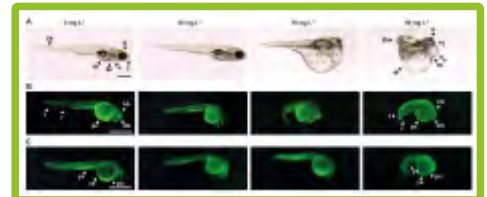


Luis Félix

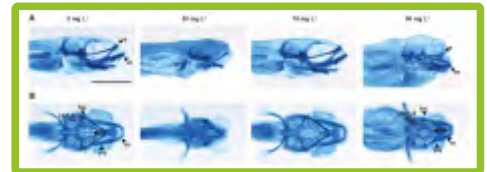
Towards an understanding of ketamine teratogenicity in zebrafish early development

CITAB researcher Luís Félix successfully defended his doctoral thesis "Towards an understanding of ketamine teratogenicity in zebrafish early development" in July 2016. Ketamine, a non-competitive antagonist of the receptor N-methyl-D-aspartate (NMDA), is a dissociative anaesthetic and analgesic, used clinically in humans and animals for over 40 years. Over the years, data has suggested that ketamine may cause neuronal

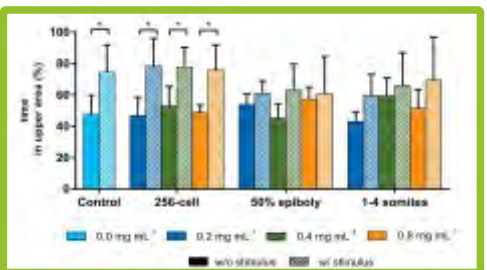
death during the early stages of brain development. Moreover, the risks of its improper use, including as a drug of abuse, have been linked to environmental contamination and potential ecotoxicological risks. In this context, this thesis, conducted under the supervision of Ana Maria Coimbra, PhD (CITAB-UTAD) and Professor Luís Antunes (CITAB-UTAD), aimed at contributing to the embryological approach within the toxicological profile of ketamine using zebrafish embryos as an alternative model. The results showed severe morphological and physiological effects that may reflect neurodevelopment vulnerabilities to ketamine during early development which were independent of the NMDA receptor. In addition, the results raises awareness to the use of this anaesthetic during early vertebrate development suggesting caution in the use of ketamine during the early stages of vertebrate development. Luís was funded by "Fundo Europeu de Desenvolvimento Regional" through the Operational Competitiveness Programme and by National Funds through "Fundação para a Ciência e a Tecnologia" under the project FCOMP-01-0124-FEDER-028683 (PTDC/CVT-WEL/4672/2012).



A) Malformations observed at 144 hours post-fertilization (hpf) after early exposure to ketamine. B) Apoptosis visualization at 24 hpf by acridine orange staining. C) Oxidative-stress was visualized at 24 hpf by using



Skeletal development was affected by ketamine



Ketamine effects were also observed at the behavioral



Rose Marie Sousa

Plant-Based Pesticides: Potential of Apiaceae Essential Oils

CITAB researcher Rose Marie Sousa has successfully defended her doctoral thesis entitled "Plant-Based Pesticides: Potential of Apiaceae Essential Oils", in November 2016. The study was funded by the Portuguese Foundation for the Science and Technology (FCT) through an individual Doctoral Grant PhD grant (SFRH/BD/66041/2009). Her doctoral research was achieved under the supervision of Professor Manuel Fernandes Ferreira (CITAB-UP) and Professor Ana Cunha (CITAB-UM) and developed in collaboration with researchers at the CBMA (University of Minho), CBA-UAc (University of Azores), and

UEIPM/UPM (Universidade Nova de Lisboa). The study has delivered a scientific basis to the use of four Apiaceae species as sources of biochemical biopesticides and contributed to the state of the art with one chapter review and four research papers published in international peer-reviewed journals.

The development of biopesticides follows a strong rising trend over the last two decades, and a continued growth of the global biopesticides market is forecasted. Plant-based products, namely essential oils (EOs) and plant volatile compounds, are a good alternative to synthetic pesticides, being currently incorporated into crop protection products as well as repellent formulations. In this context, the research was conceived in the perspective to evaluate the biopesticidal potential of EOs from four economically important Apiaceae species (bitter fennel, cumin, dill and parsley), and substantiate their use in integrated pests and vectors management.

Eos from the studied Apiaceae species and some of their volatile compounds, displayed moderate to strong anti-insect and molluscicidal properties. It was concluded that the characterized EOs and their compounds may exhibit distinct level of bioactivity depending on the type of assay, the exposure period, the tested organism, and/or its developmental stage. Furthermore, dose-dependent and time-dependent studies were performed in order to differentiate treatments' performance. The results demonstrate that bitter fennel, cumin, dill and parsley EOs are promising sources of botanical biopesticides in the context of the biochemical control of phytophagous insects, and vectors of human and animal diseases.



Essential Oils from Apiaceae species



Organisms used in bioassays.



IX SPEA Ornithology Conference/VI Iberian Ornithology Conference



The University of Trás-os-Montes e Alto Douro, in Vila Real, was the site chosen for the "IX SPEA Ornithology Conference/VI Iberian Ornithology Conference", between 23 and 25 of April 2016. This is the largest national and Iberian ornithology event, involving more than 200 participants, mostly researchers, ornithologists and students from Spain and Portugal, by promoting the exchange of ideas, experiences and knowledge. The program included, among other initiatives, guest speakers, oral communications, posters, workshops, field trips, thematic demonstrations and stores.

The meeting is a joint organization of the Portuguese Society for the Bird Study (SPEA) and the Spanish Society of Ornithology (SEO/BirdLife), in partnership with the CITAB-UTAD, through its Laboratory of Applied Ecology (LEA), and has the support of Naturlink and Loving the Planet as media partners.

"River Catchment Management: new challenges Workshop"

CITAB researchers Luis Filipe Fernandes, Simone Varandas and Rui Cortes were organizers of the "River Catchment Management: new challenges" that was held on 5th July 2016. This workshop showcased how invited speakers from Brazil, who are collaborating with CITAB researchers, deal with catchment planning and management issues in the states of São Paulo and Minas Gerais.

Professor Renato Valle Junior demonstrated how GIS is a vital tool for catchment level environmental diagnosis and water resources planning. Professor Teresa Pissarra gave a talk on the implications of global soil erosion problems and Dr Carlos Valera gave a juridical overview on environmental licensing in relation to soil occupation and use and how this relates to the Brazilian Constitution.



X Biology Journeys from UTAD



The Graduation in Biology, at the University of Trás-os-Montes and Alto Douro, with the support of the Biology Core Students and in collaboration with CITAB, organized the 10th edition of the Biology Journeys. This two-day conference, which took place on October 12 and 13, was a meeting of scientific nature with lectures in areas as diverse as molecular biology, microbiology, medicine, agriculture and environment. As in previous editions, the meeting counted this year, with the presence of speakers of recognized scientific merit, such as Professor Antonio Amorim, Senior Researcher of IPATIMUP and professor at the faculty Science of University of Porto and the Professor Mário de Sousa, from the Institute of Biomedical Sciences Abel Salazar, University of Porto, addressing current issues in the areas of Biodiversity and Forensic Genetics, and Medically Assisted Reproduction. It is also worth mentioning the presence of other names, such

as Prof. Ângela Cunha, from the University of Aveiro, in environmental microbiology thematic, and Dr. Vilma Sardão from the Neuroscience and Cell Biology Centre of the University of Coimbra, addressing the osteoporosis associated with menopause. Topics of general interest such as the problem of wildlife recovery and nature photography were also addressed, arousing the interest of all participants.

During the Biology meeting, undergraduate, Master's and PhD students in Biological Sciences, from UTAD and other Institutions, also had the opportunity to present their research work, providing moments of discussion and sharing of knowledge, bringing senior researchers and students together in a multidisciplinary approach.

Thus, the journeys of biology have been constituting a space for debate on emerging areas of Biological Sciences, being an event of undeniable value for students, researchers and the academic community.

Did you know that?



Eduardo Rosa, the Director of CITAB was nominated for the Scientific Advisory Committee (SAC) of Science Europe in July 2016. Science Europe is an association of European Research Funding Organizations (RFO) and Research Performing Organizations (RPO), aiming to promote the collective interest of its members organizations from 27 countries in their endeavour to fund and perform excellent research in a world where scientific communities are less and less shaped by national borders.

The SAC activities comprises: providing expert opinions on relevant European policies impacting research; and providing independent scientific advice and support for SE's policy activities including support for policy statements to the European institutions and national governments.

CITAB researcher Paulo Fernandes has been recognised as a highly cited scientist. Published by Elsevier, the 2013 article "Fire-smart management of forest landscapes in the Mediterranean basin under global change" is among one of the 5 most highly cited articles in the last three years since its publication, with over 3000 citations. Paulo works on the forest fire ecology, behaviour and management. His particular interest is on the use of controlled fire in fire management. Paulo is also joint director of the International Association of Wildland Fire.



CITAB researcher Helder Viana is co-author of the article "Positive biodiversity-productivity relationship predominant in global forests". Published in Science (impact factor 34.661), the article presents results from a study involving 85 researchers and led by Jingjing Liang of the University of West Virginia (USA). Data was analyzed from 777 thousand forest plots in 44 countries, on all continents. A total of 30 million trees comprising over 8,000 species were studied.

CITAB researchers Pedro Mestre and Carlos Serôdio were co-authors of the Best Paper "Using Propagation Models to Build Fingerprint Maps and Assess Location Estimation Algorithms Performance" at the "The 2016 International Conference of Wireless Networks" which was held in London UK, from 29th June to 1st July, 2016. The conference is part of The World Congress on Engineering, organized by the International Association of Engineers.



Research carried out by CITAB researcher Changhe Zhang on microbial induced dragon's blood production and the biosynthesis mechanism" in collaboration with Prof Xinghong Wang at Yunnan University, China has won the Yunnan Province Science and Technology Prize as part of the Natural Science Prize. The Natural Science Prize represents the highest academic level in the prizes. A total of 5 SCI papers and 3 papers in Chinese have been published on this work and 2 Chinese patents have been authorized.



Short notes & Upcoming events

"Pure and Bizarre" in National Geographic Portugal



The May 2016 edition of "National Geographic Portugal" published an article that refers the research of the CITAB Fluvial Ecology Group and in particular that of Professor Simone Varandas.

Written and illustrated with fantastic photos by Luís Quinta, the article "Puros e bizarros" (Pure and bizarre) points out the importance of aquatic insects as indicators of river health. The article focused on the fauna and ecology of the Olo River, an almost pristine aquatic ecosystem situated in the Transmontano Alvão Natural Park. The article also mentions that CITAB researchers are taking biomonitoring techniques to the next level by assessing the suitability of organism based biomarkers and facets of ecosystem function such as leaf decomposition rates as integrated indicators of environmental change as a result of human impacts.

Cooperation with Argentina in fire research priorities

Paulo Fernandes, one of CITAB's most highly cited researchers, was invited by the Universidad Nacional de La Patagonia San Juan Bosco to attend the Ecofuego II Conference in Esquel, Argentina in November this year. Paulo gave a keynote talk on fire management in shrub-dominated ecosystems and taught postgraduate field and classroom training in fire ecology and prescribed burning. Paulo was part of an international group comprising researchers invited from the United States Forest Service Missoula Fire Lab and the University of Washington, USA. The group participated in two meetings, addressing fire research priorities for Argentina and future cooperation in fire danger rating.



Upcoming events



International Conference «Advances in grain legume cultivation and use», 27-28 September 2017, Hotel Park, Novi Sad, Serbia.

This conference marks the final year of two EU FP7-KBBE projects devoted to Grain Legumes, LEGATO and EUROLEGUME, More information available at: <http://www.legato-fp7.eu/FinalConference/index.html>



Advanced Course «Advances in breeding and agronomy for improving sustainability and quality of grain legume crops», 16-20 October 2017, CIHEAM IAM, Zaragoza, Spain.



Agrichains Spring Conferences
May 2017, UTAD, Vila Real, Portugal.

Location and contacts



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