EUROPEAN RESEARCHERS' NIGHT 2015 @FORTH

6 Institutes:

Electronic Structure & Laser

Molecular Biology & Biotechnology

Computer Science

Applied & Computational Mathematics

Mediterranean Studies

Chemical Engineering Sciences

~ 50 demonstrations of

innovative technologies

>1500 visitors

Special Section:

Cultural Heritage @ FORTH

Contents

INSTITUTE OF ELECTRONIC STRUCTURE AND LASER (IESL)

Single photons and interference:

Is light made up of particles or waves? Well, it depends... We present an experiment in which light travels along two different paths and behaves as both, particles and waves.

An acoustic interferometer:

One moment you hear it, one moment you don't. This simple experiment explores the idea of interferometry: sometimes blocking some of the sound makes it possible to hear it.

Optoacoustic microscopy. Listening to light:

Demonstration of optoacoustic imaging on phantom and plant tissue samples.

Unexpected light:

Total internal reflection, inverted images, bouncing light and more light tricks.

Application of Optical spectroscopy for quality control investigation in foods:

We focus on optical spectroscopic methods such as UltraViolet/Visible Fluorescence and Time Resolved Florescence spectroscopy as facile techniques with minimum sample pre-treatment for recording characteristic chemical fingerprints of edible products.

Optical fibers:

Demonstration of manufacture, principle of operation and application filed of optical.

Laser in the sake of Tissue Engineering:

Video demonstration and microscopic observation of the 3D cell cultures.

Metamaterials. New possibilities in light control:

Video demonstration of the properties and possibilities of metamaterials in light-control applications.

Indoor Air quality with the use of Photocatalytic Nanomaterials:

The achievement of Indoor Air Quality with the use of Nanomaterials. Real time experiment on the degradation of various pollutants in Demo houses, with the use of Titanium Dioxide nanomaterial fabricated at FORTH-IESL by the Transparent Conductive materials and Devices group.

Laser Induced Breakdown Spectroscopy:

Demonstration of remote LIBS for assessing the operational quality of outdoor HV polymeric insulators.

Skinakas Observator

Video Presentation.

Crete University Press (CUP)

Mathesis:

Crete University Press presents Greek Massive Open Online Courses (MOOCs) powered by OpenEdX.

INSTITUTE OF MOLECULAR BIOLOGY AND BIOTECHNOLOGY (IMBB)

An in silico tour of the living cell:

The visitor will be guided through the inner life of the cell in a video projection (from BioVisions at Harvard University). They will be shown how macromolecules interact and how this results in the building of subcellular structures and how these function. Three dimensional images of the cell nucleus will also be shown, in which specific DNA areas have been marked with fluorescent dyes. It will be demonstrated how one can follow the movement of these areas inside the nucleus during activation or differentiation of the cells. With the help of the program Volocity the visitor can tour the nucleus of cells which have been processed using DNA Fluorescent In Situ Hybridization (DNA-FISH).

Exploring the amazing fly:

The fruitfly *Drosophila melanogaster* has been at the center of biological research for over a century. Scientists perform fine manipulations on the fly's genes in order to approach basic questions about life and disease. After all, the molecular building blocks of all organisms are very similar and studying the humble fly can open new avenues in the understanding of human diseases. Our research focuses on the genetic pathways orchestrating the physiological development of the nervous system, which are often found implicated in neuronal diseases.

Study of human diseases in a nematode model system:

The Neurogenetics and Ageing lab uses the nematode *Caenorhabtitis elegans* to investigate the molecular mechanisms of neuronal function and dysfunction and the pathways that control ageing. We will describe how mutant nematodes can be used to study human

neurodegenerative diseases such as Parkinson's disease and Alzheimer's disease. The behavior of wild type and mutant *C. elegans* strains will be monitored in the stereoscope. The mutant animals display locomotory defects due to a mutation in a gene encoding a cuticle collagen. This mutant gene is used as a transformation marker to select transgenic nematodes. Images of *C. elegans* models of human diseases will also be shown.

The hidden life of malaria parasites:

Malaria is caused by the protozoan parasite Plasmodium and is transmitted by Anopheles mosquitoes. Malaria is one of the most deadly infectious diseases in the world, with close to 1 million lethal cases and several hundred million cases yearly. At IMBB we study the events taking place when the parasite enters the mosquito which coincides with the sexual stages of the parasite. The parasite undergoes many changes during the three weeks that it lives within the mosquito until it is transmitted to a new person. Both the mosquito and the parasite will be presented and the life of the parasite in the mosquito will be described.

An innovative platform for analysis of mosquito disease vectors:

Insects pose tremendous threats to humans in two main areas. Insect borne diseases cause severe global health problems and insects are responsible for tremendous loss of agricultural production. Control of the insect population largely relies on the use of insecticides. However, insects develop resistance against insecticides. The Molecular Entomology group investigates the mechanisms by which insects (agricultural pests and mosquitoes) develop resistance to insecticides, aiming to develop new means of managing and overcoming resistance. An innovative, fully integrated and automated ("sample to answer") multiplex vector-diagnostic platform (LabDisk) for analysis of mosquito DNA and RNA in field samples will be demonstrated. The platform will monitor the species ID, the infection status and the insecticide resistance profile of malaria vectors. The LabDisk will contribute to improved management of mosquitoes.

Insects and Agriculture:

Besides tourism agriculture is the main source of wealth in Crete. For the traditional crops of olive and fruit two insects, Dacus and Medfly, are major threats, diminishing production and reducing the quality of the produce. The visitors will be shown the different stages in the life cycle of these insects and the damage they do to the crops. Furthermore, they will learn how new eco-friendly methods for the control of these insects are being developed at IMBB.

The structures of natural antibiotic peptides at the atomic resolution:

Structures of molecules at the atomic resolution help researchers understand how the molecules function. A video will be shown with the 3-dimensional structure of the peptaibol trichovirin with its hydrogen-bonding network at the atomic resolution. The structure was

determined from very thin hair-like crystals using intense synchrotron radiation. The structure of the protein Rop, which binds RNA will also be presented. This protein is an example of anti-parallel bundle of 4 alpha helices. The third examples will be the structure of a small metallo-proteins. You will have the opportunity to make your own crystals from proteins and see how the crystals form in a few minutes!

Bacteria-protein factories:

How can a tiny humble bacterium produce high purity products used in scientific research (cloning tools) and biomedicine (identification of DNA samples by PCR)? MINOTECH biotechnology, the production unit of Institute of Molecular Biology and Biotechnology for almost three decades, specializes in isolating high-value proteins with applications in biotechnology and biomedicine. MINOTECH biotechnology members will demonstrate protein isolation techniques.

Modelling the brain:

The Computational Biology Laboratory of IMBB-FORTH will showcase computational models of brain cells and networks and explain their application towards understanding learning and memory formation in the brain. The exhibition will include cartoon-like slide presentations, videos as well as via hands-on experimentation with models.

Genome instability and aging:

Aging in mammals is accompanied by a progressive atrophy of tissues and organs, stochastic damage accumulation in DNA and improper folding of proteins. Accumulating evidence suggests that loss of genomic maintenance may causally contribute to aging. Distinct evidence for a role of imperfect DNA repair in aging is that several premature aging syndromes have underlying genetic DNA repair defects. Our lab is studying the mechanistic role of DNA repair defect in central metabolic organs such as liver and pancreas, as well as in adipose tissue and immune system, using loxP/ Cre recombinase technology to restrict DNA repair deficiency in a single type of tissue while leaving the remaining part of the organism intact. Here we will present examples of a number of advanced molecular, genomics and imaging approaches such as mass spectrometry, next generation sequencing coupled to chromatin immunoprecipitation, transmission electron microscopy and immunofluorescence to investigate the role of DNA repair proteins in progeria and age-related pathologies.

aDDRess:

aDDRess is a Marie Skłodowska-Curie Initial Training Network, funded by the European Commission 7th Framework Programme. The Network of aDDRess establishes a European research platform of excellence in the field of DNA repair and Ageing, builds a well-structured

multi-disciplinary European science area and strong links to the industry, thereby providing young researchers with a unique skill set that enhances their future career prospects.

INSTITUTE OF COMPUTER SCIENCE (ICS)

Studying microcirculation through vessel measurement in retinal images:

The retina comprises an open and easily accessible window for the in-vivo study of microcirculation. Retinal vessels can be non-invasively and cost-efficiently imaged and advances in computational image analysis technologies have made it possible to measure vessel dimension and structure and detect subtle changes. We work on tools to improve image quality and automatic assessment to help clinicians in their diagnosis and monitoring of diseases such as diabetes and hypertension. Such methods include spatial image registration (alignment) as well as super resolution to improve the resolution and definition of an image.

BeanTable:

Beantable is an augmented interactive table, which offers various educative and entertaining applications to children in the age range of 3 to 7 years old. The purpose of Beantable is to support children's development through the monitored use of the embedded applications in an unobtrusive manner. Beantable monitors the children's interactions and extracts indications of the achieved maturity level and skills by taking into account: (a) the way the child plays, (b) the selection of materials and game themes, and (c) the way the child takes part into the activities. Beantable supports a number of alternative natural interaction techniques, integrating facilities such as gestures recording, face tracking, head position estimation, skeleton tracking, and speech recognition. Beantable provides a set of motivating smart games that will attract the attention of children throughout the age range that is targeted by the system, continuously adapted in terms of the interaction modality, content and/or task difficulty to meet the recognized skills and abilities of the child. At the same time, parents are able to get information about the development progress of their child, including performance statistics and general information of the child's skills and abilities. Furthermore, Beantable can act as a diagnostic tool that provides educators and child development experts with extensive data (extracted from the interaction history) that can be used for determining whether the child is meeting developmental milestones.

Virtual Fitting Room:

Virtual Fitting Room is an interactive augmented reality system which allows users to be immersed in a "virtual mirror" where they can try on clothes and accessories. The system adapts and fits on top of the users' bodies 2D and 3D clothes that follow the user's movement. User interaction is accomplished using hand gestures, allowing the users to try on different clothes while manipulating the system at a distance. Furthermore, users are able to

keep their own favorite collections of clothes in a virtual wardrobe and compare different combinations. Virtual Fitting Room also provides recommendations for additional clothes that may be of users' interest, according to their previous selections. Users can take photos of themselves and optionally share them on social networks such as Facebook and Twitter, sharing their experience with their friends but also advertising the system itself. The "Virtual Fitting Room" project constitutes outcome of the applied research conducted by the Institute of Computer Science, Foundation for Research and Technology – Hellas (ICS – FORTH) under the Ambient Intelligence Programme. The project is funded and commercialized by LIATER PC, a Greek innovative startup company in the retail domain with a well-established international presence.

Hippalus - A Preference-enriched Exploratory System:

The Hippalus system is a preference-enriched exploratory system which can be exploited in a number of applications (e.g., e-commerce). The preference actions are given dynamically, in a simple and intuitive way, as the user interacts with the available products / services. As a result, the users of the system are able to successfully select the most preferred product / service for them in an efficient way.

OctoBot. Octopus-inspired compliant-body aquatic robot:

Inspired by the morphology and outstanding locomotor capabilities of the octopus, an 8-arm robotic swimmer was developed, fabricated primarily from compliant materials. Underwater lab experiments and sea trials demonstrate several novel modes of underwater propulsion, by combining various patterns of sculling movements of the arms and the web, an elastic membrane connecting the arms. More information: www.ics.forth.gr/cvrl/octopus

Locomotion and balancing of humanoid robots:

Humanoid robots constitute a particularly modern trend in robotics, since they constitute "mechanical creatures" as close as possible to human morphology. Gaiting and balancing in such systems regard particularly important, yet extremely difficult sectors in robotics research. Appropriate methods for achieving the above have been developed in our lab, and will be demonstrated in the Researcher's Night.

Hobbit - The mutual care robot:

Hobbit is a research project of the EU's 7th Framework Programme to develop a socially assistive robot that helps seniors and old people at home. The goal of the HOBBIT project is "to advance towards a robot solution that will enhance wellness and quality of life for seniors, and enhance their ability to live independently for longer at their homes. The main task of the robot is fall prevention and detection. To achieve this, the robot will clean the floor from all objects and thus reduce the risk of falling. It will also autonomously navigate and patrol in the

domenstic environment to detect emergency situations such that help can be called in time. Two laboratories of ICS-FORTH participate in the project, namely the Computer Vision & Robotics and Human-Computer Interaction laboratories. http://cvrlcode.ics.forth.gr/projects/hobbit

Rapid Emergency Deployment Communication Infrastructure - REDComm:

REDComm is an advanced rapid emergency deployment communication mobile node that offers connectivity both to the general public and the rescue teams. REDComm is able to handle emergency communications, without the need of standard telecom networks with the use of several nodes that provide a resilient and robust network architecture.

Early Warning Intrusion System (EWIS):

EWIS is based on a distributed network of honeypots (computer systems exposed to cyber-attacks), that collect network intrusion statistics and relay them back to a central server for storage and further analysis. It utilizes the passive honeypot approach, monitoring unused Internet addresses (darknets) and capturing all inbound communications. Since these addresses are not utilized, any communication to them is classified as malicious. EWIS is FORTHcert team initiative.

Safeline:

The only Internet hotline in Greece that accepts reports for illegal online content and is an official member of INHOPE (International Association of Internet Hotlines) as from the 18th of October 2005.

INSTITUTE OF APPLIED & COMPUTATIONAL MATHEMATICS (IACM)

Ocean sound lab:

Education software environment (conceived by IACM-FORTH): play and learn activities, presentations of underwater sounds, basic physics, and ocean acoustic propagation effects.

D_Ears (Directional Ears):

Interactive application to test directional hearing.

FLIRE DSS:

A web-based Decision Support System (DSS) for fires and floods in urban and peri-urban areas.

Engage:

Inspiring real-world learning. Innovative teaching/learning materials which gives students opportunity for self-expression and responsibility for coming to informed decisions.

TTNet:

Attractive Science Education for the young learners.

SKINAKAS OBSERVATOR

Video Presentation.

CRETE UNIVERSITY PRESS (CUP)

Mathesis:

Crete University Press presents Greek Massive Open Online Courses (MOOCs) powered by OpenEdX.

CULTURAL HERITAGE @ FORTH

Lasers for Cultural Heritage analysis, diagnosis and conservation:

Laser based systems, developed at IESL-FORTH, for analysis, diagnosis and conservation of artworks and monuments will be presented. Emphasis will be given to videos and photos describing typical examples (IPERION-CH.gr) and in-situ applications (KRIPIS-POLITEIA).

Laboratory of Geophysical - Satellite Remote Sensing and Archaeo-environment:

Presentation of methodological approaches and results on the implementation of ground, aerial and satellite remote sensing prospection techniques and GIS management of CH monuments and sites in the framework of the KRIPIS-POLITEIA research project. (Institute of Mediterranean Studies).

Analysis of ancient DNA. A completely new view of the past:

Can we retrieve DNA from objects found in archaeological excavations such as bones from humans and animals or food residues such as olives and beans? Now, in the first laboratory for analysis of ancient DNA in Greece, which is equipped with specialized and modern technologies (as used in forensic research) we can! With these analyses we can shed light on the origin and migration of populations and for the first time understand in detail how ancient farmers produced and stored food and merchandise. We can open a window to our past.

The Information System for Cultural Heritage. Exploring the Byzantine World:

Targeted digital content showcasing the Byzantine culture will be presented. The e-services created within the "Exploring the Byzantine World" project are designed to inform teachers,

researchers, schoolchildren and interested members of the general public about monuments, persons, historical events, achievements and aspects of daily life in Byzantium. A set of interactive educational activites that will enable students to discover Byzantium by playing, will also be available.

Reasoning on Virtual Reconstruction:

On-going results of the Marie Curie ITN-DCH project, "Initial Training Network for Digital Cultural Heritage (ITN-DCH): Projecting our Past to the Future" which is the first and one of the largest Marie Curie fellowship projects in the area of the e-documentation / e-preservation and CH protection funded by the European Union under the FP7 PEOPLE research framework. The poster will present virtual reconstruction as the basis for understanding the past both by experts and the general public. It discusses the methodolgy for creating 3D models as accurate representations of a monument or an archaeological site. It proposes an information system that supports argumentation and reasoning on the virtual reconstructions and the 3D models.

Initial Training Network for Digital Cultural Heritage:

Rendering and animation in mobile VR and AR: On-going results of the Marie Curie ITN-DCH project. The "Initial Training Network for Digital Cultural Heritage (ITN-DCH): Projecting our Past to the Future" with acronym ITN-DCH, is the first and one of the largest Marie Curie fellowship projects in the area of the e-documentation / e-preservation and CH protection funded by the European Union under the FP7 PEOPLE research framework. The Project started on the 1st of October 2013 and its consortium comprising of 14 full partners and 8 associate members covering the entire spectrum of European CH actors, ranging from academia, research institutions, industry, museums, archives and libraries. In this demo we illustrate recently published, on-going Virtual Reality and Augmented Reality applications for digital heritage preservation and curation that allow real-time simulation of virtual characters, rendering and animation.

Characterization of building elements and materials and methods for historic monuments' conservation:

Recent research and advances as regards the characterization of building elements as well as new materials and methods for historic monuments' conservation will be presented by the Institute of Chemical Engineering Sciences of FORTH.

Climatic changes and coastal monuments:

Presentation of the contribution of the Coastal Research Laboratory in the study of climate change on coastal environment (sea level rising, intensification of extreme weather events, erosion, safety of coastal infrastructure) and its impact on the natural environment and

cultural heritage. Risk assessment from the climatic change can contribute, through smart specialization, in the protection and restoration of coastal monuments, and resilience development of economic activities associated with them, such as tourism.

Interactive systems in the domain of cultural heritage:

The presentation will focus on interactive systems developed by ICS in the domain of cultural heritage. These systems are facilitated for presenting cultural information, allowing the interaction of users with cultural resources in digital form and the augmentation of artefacts with digital information. The presentation will also include content that demonstrates the practical exploitation of these systems within cultural heritage institutions. Furthermore the "TimeViewer" system will be demonstrated. "TimeViewer" is an interactive system that presents information with temporal characteristics in a large scale display, while user interaction is achieved through remote gesturing. Besides representing information as a traditional two- dimensional timeline, the system also supports three- dimensional information representation in a "time - tunnel", i.e., a corridor along which the events are placed with chronological order. User interaction in the time - tunnel is accomplished through full - body kinesthetic interaction.