

## IFMP WORKSHOP IN IONIAN UNIVERSITY, CORFU, GREECE

Monday 6/11/2017 10:00

### OPENING SESSION



Yves Lemoigne, PhD  
IFMP Director  
Co-Chairman of the Workshop

The Talk includes:

- A few words about IFMP and its mission over two decades...
- Why Corfu and Ionian University were chosen...
- An overview about the workshop Time-table
  - Medical Imaging around Hybrid Devices
  - Neurodegenerative diseases studies
  - Radiation Protection in Medical Physics
  - Recent Technical innovations

# IFMP

Institute  
For Medical Physics &  
Biomedical Engineering  
Ambilly, France

## International Medical Physics & Biomedical Engineering Workshop

The Main Topics of the Workshop Include:

- Hybrid Imaging, Personalized Medicine & Neurodegenerative Disease
- Radiation Protection in Medicine (patients, workers, public...)
- Recent Innovations in Technologies for Medical Physics

### ORGANIZING COMMITTEE:

Panayiotis Vlamos, Ionio Uni. Co-Chair  
Yves Lemoigne, IFMP & CERN, Co-Chair  
Katerina Bobori, Ionian Uni, Corfu, Gr  
Patrick Le Dû, IEEE & IPN Lyon, Fr  
Zeta Theocharopoulou, Ionian Uni, Gr  
Albana Topi, INFN, Pisa, It

### LECTURERS:

Panayiotis Vlamos, Ionio Uni. Co-Chair  
Yves Lemoigne, IFMP & CERN, Co-Chair  
David Townsend, IEEE & Singapore Sg  
Palma Altieri, Bari Uni, It  
Antigoni Avramouli, Ionian Uni, Gr  
Claudio Caldera, VARIAN Medical Systems  
Thomas Beyer, Vienna Uni, At  
Vesna Gershan, Skopje Hosp. Mk  
Maria Gonidi, Ionian University, Gr  
Paul Lecoq, IEEE & CERN, Ch  
Patrick Le Dû, IEEE & IPN Lyon, Fr  
Jim Malone, Trinity College, Dublin, Ie  
Antonia Plerou, Ionian Uni, Corfu, Gr  
Sonja Petkovska, ACIBADEM, Skopje, Mk  
Ivo Rausch, Vienna Uni, At  
Svjetlana Sunjic, Sarajevo Hosp. BiH  
Albana Topi, INFN, Pisa, It  
Aris Vrahatis, Patras University, Gr

## CORFU ISLAND, Greece

## IONIAN UNIVERSITY 6-10 November 2017



Centre National à la  
Recherche Scientifique



Association Greise

**VARIAN**  
medical systems



Advancing Technology  
for Humanity



**MEDIZINISCHE  
UNIVERSITÄT WIEN**



Corfu Workshop November 2017 Yves LEMOIGNE / IFMP – Ambilly – France & CERN-Geneva-Switzerland

## A few words about IFMP

IFMP was founded by two associations of physicists mainly from CERN (Geneva, Switzerland) who are:

- "Physique Sans Frontières" founded in 1993 with first president the Nobel 1992 Georges Charpack.
- "GREISE", founded in 1991, is an association of physicists, mainly from CERN, working to disseminate cutting-edge techniques in the field of radiation detection and the use of particle accelerators.
- These two associations wanted IFMP to be their arm in the dissemination of scientific knowledge in the field of Medical Physics and Bioengineering.



# IFMP

Institute  
For Medical Physics  
Institut pour la  
Physique Médicale

## Two Decades of History ... Institute For Medical Physics

More important milestones were:

IT: Trieste 1995

BiH: Sarajevo-PMF 1996

BiH: Sarajevo University 1998

MA: Oujda 2000

GR: Thessaloniki 2002

TR: Istanbul-Bogazici 2004

RO: Iasi 2007

EG: Cairo 2009

EG: Cairo 2011

BiH: Sarajevo 2014

AL: Shkodra 2014

MK: Ohrid 2015

AL: Elbasan 2016

GR: Corfu, Ionian Uni 2017



Physique-Sans-Frontières



Physics-Without-Borders



TERA  
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Adroterapia Oncologica



Advancing Technology  
for Humanity



PARIS FRANCE



IFMP 25-27 Rue Jean Jaurès 74100 Ambilly France <http://www.ifmp.eu>

**Corfu Workshop November 2017 Yves LEMOIGNE /**



**MEDICAL PHYSICS**

**PET-CT & PET-MR**

**BIOENGINEERING**

**NUCLEAR MEDICINE**

Trieste June 25-July 1, 1995

Shkodra 2014

Sarajevo 1998

Sarajevo 2014

**TECHNICAL INNOVATIONS FROM HIGH ENERGY PHYSICS**

**RADIOTHERAPY & HADRON THERAPY**

Istanbul 2004

Ohrid 2015

Sarajevo 1996

Trieste 1995

**RADIATION PROTECTION IN MEDICINE**

**PARTICLE PHYSICS AND MEDICAL PHYSICS**

Elbasan 2016

Corfu 2017

Cairo University 2011

## *Why Corfu?*

- You noted that 2 workshops were organized in Albania: first in the north (Shkoder) and then in the center (Elbasan). It would have been natural to go to the South ...
- We chose to cross the strait to Corfu where we were superbly welcomed by Professor Vlamos director of the BiHE lab at Ionian University.
- Quoting Democritus we can say that some "hooked atoms" were revealed between IFMP and BiHE lab, its director first and then his team among whom we appreciated the organizational talents of Katerine Bobori.
- We shared topics and speaking times between speakers from outside (sometimes very far away) and those from BiHE lab.
- For me, their research in the field of neurodegenerative diseases was welcome, not yet as patient (!), but reminding me my involvement, alas too short, in a project of detection of "beta amyloid plaques" on very old lemurs using a PET camera for small animals ...



**François RIEGER, INSERM (Paris)**  
Directeur de Recherche au CNRS  
Directeur Général, Institut BioPARK

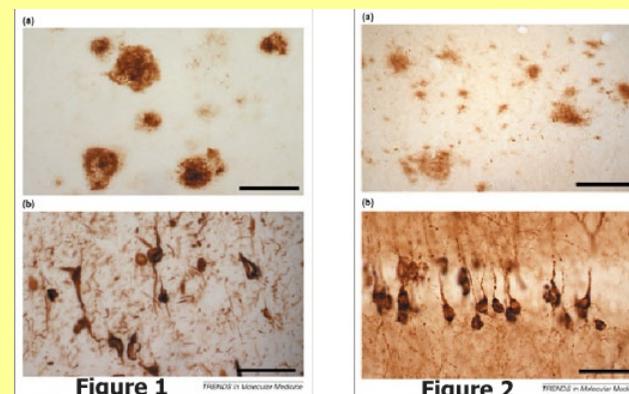
**Yves LEMOIGNE E.S.I./ CERN.**  
Directeur, European School of  
Medical Physics, Archamps

**Stéphane BERARD**  
Directeur, Site d'Archamps  
Coordinateur BioPARK

**A part of the projet was devoted to Alzheimer on Microcèbes (lemurs)**

### Focus sur Alzheimer (suite)

... L'objectif est de mettre au point des radioligands émetteurs de positons, susceptibles de reconnaître certaines composantes des lésions histopatho-logiques associées la MA (plaques amyloïdes et lésions neurofibrillaires), au cours d'examen de tomographie à émission de positons (TEP). Les molécules étudiées, radio-traceurs potentiels des lésions associées à la MA, sont mises au point par des chercheurs du CNRS à Lyon. Ce sont des dérivées para-sulfonato-calix[n]arènes ((3)Perret et al., 2006; (1)Coleman et al.,) qui présentent une très haute affinité pour les sites de reconnaissance de type glycosamino-glycannes. Ces sites de reconnaissance sont présents dans tous les agrégats patho-logiques des maladies neuro-dégénératives. Afin de réaliser les essais biologiques nous mettons actuellement en place un élevage de souris transgéniques qui développent des changements anatomo-pathologiques apparentés à ceux observés chez des patients atteints de MA ((2) LaFerla and Oddo, 2005) (voir figure).



**Plaques et lésions neurofibrillaires dans le cerveau : (1) de patients atteints de la maladie d'Alzheimer, (2) de souris 3xTg AD. D'après F.M. LaFerla et S.Oddo, *TRENDS in Molecular Medecine*, 11(4) : 170-176, 2005.**

### Références:

- 1.Coleman A, Perret F, Moussa A, Dupin M, Yuping G, Perron H (2007) Calix[n]arenes as protein sensors. *Top Cur Chem* In press.
- 2.LaFerla FM, Oddo S (2005) Alzheimer's disease: Abeta, tau and synaptic dysfunction. *Trends Mol Med* 11:170-176.
- 3.Perret F, Lazar AN, Coleman AW (2006) Biochemistry of the para-sulfonato-calix[n]arenes. *Chem Commun (Camb)*:2425-2438

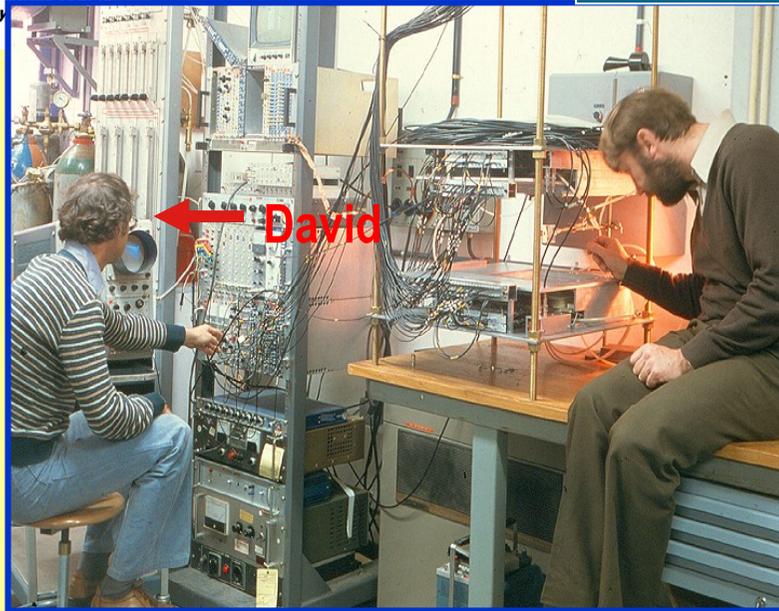


# Workshop Time Table



| CORFU Week               | Monday<br>6 November 2017   | Tuesday<br>7 November 2017  | Wednesday<br>8 November 2017  | Thursday<br>9 November 2017  | Friday<br>10 November 2017  | CORFU Week           |
|--------------------------|---|---|---|--|---|----------------------|
|                          | HYBRID  | HYBRID (cont'd)   | Radiation Protection (RP)   | RP (cont'd) & Innovation   | Innovation (cont'd)   |                      |
| 08:30<br>L1<br>09:30     | Registration ;<br>Opening Session<br>(Rector welcome....)   | PET/CT, PET/MR in RTP<br>Thomas BEYER<br>Vienna Medical University<br>Vienna, Austria                                       | Computational Methods in<br>Alzheimer's Disease<br>Antagoni Avramouli,<br>Ionian University, Corfu, Gr                | Shielding of Diagnostic<br>Imaging Facilities<br>Jim Malone<br>Dublin, Ireland                         | Particle therapy critical<br>issues and challenges<br>Patrick Le Dû,<br>IPN- Lyon & IEEE  | 08:30<br>L1<br>09:30 |
| 09:30<br>L2<br>10:30     | Weekly Programme<br>Introduction by chairmen:<br>P. Vlamos, Ionian University<br>Y. Lemoigne, IFMP & CERN | QC PET/CT and PET/MR<br>Ivo Rausch<br>Vienna Medical University<br>Vienna, Austria  | Ethics for Radiation<br>Protection in Medicine<br>Jim Malone, Dublin, IRL   | Optimization of RP in<br>Medicine<br>Vesna Gershan<br>Skopje, Macedonia                                | Innovation in TOF &<br>improved sensitivity<br>Paul Lecoq,<br>CERN, Geneva, CH  | 09:30<br>L2<br>10:30 |
|                          | Coffee break  | Coffee break  | Coffee break  | Coffee break   | Coffee break  |                      |
| 11:00<br>L3<br>12:00     | From HEP to PET/CT<br>Prof. David Townsend<br>Singapore University<br>Singapore, SG                       | Specific Hybrid Devices<br>PEM-Sonic, EndotofPET...<br>Paul Lecoq<br>IEEE & CERN, Geneva, CH                                | Radiation Protection in a<br>Treatment Centre<br>Sonja Petkovska<br>ACIBADEM, Skopje, MK                              | Radiation Protection and<br>Pregnancy in Medicine<br>Jim Malone,<br>Dublin, Ireland                    | Innovation in<br>Bioengineering<br>Patrick Le Dû, IEEE  | 11:00<br>L3<br>12:00 |
| 12:00<br>L4<br>13:00     | PET Basics<br>Ivo Rausch<br>Vienna Medical University<br>Vienna, Austria                                  | PET-based Therapy<br>Response Assessment<br>Thomas BEYER<br>VMU, Vienna, Austria  | Scenario Analysis in<br>Radiation Protection of<br>Patients<br>Jim Malone, Dublin, IRL                                | Trends & Research in Neuro-<br>cognitive enhancement<br>Antonia Plerou<br>Ionian University, Corfu, Gr | Radiation Phobia: fake<br>news & alternative facts<br>David Townsend, SG  | 12:00<br>L4<br>13:00 |
| 13:15                    |   |   |   |  | Concluding Session<br>Farewell...   | 13:00                |
| 14:45                    | Lunch Break   | Lunch Break   | Lunch Break   | Lunch Break  | End Workshop  | 14:45                |
| 15:30<br>L5<br>16:30     | 15:15 Students' Forum   | Students' Forum   | 14:15 departure to<br>Achilleion Palace<br>and Museum<br>The former Palace of<br>Empress Sissi<br>from Austria)       | Students' Forum  | After workshop:<br>Optional Quiz<br>For junior participants to<br>check their new skills  | 15:30<br>L5<br>16:30 |
| 16:30<br>L6<br>17:30     | 16:00 Specific Imaging<br>Devices<br>Paul Lecoq<br>CERN, Geneva, CH                                       | Dose issues in Nucl. Med.<br>& Hybrid Imaging<br>Ivo Rausch<br>VMU, Vienna, Austria   | Light $\mu$ -scopy, Scanning $\mu$ -<br>scopy in diagnostic procedure<br>Maria Gonidi<br>Ionian University, Corfu, Gr | Hadrontherapy Principles<br>Palma Altieri<br>Bari University, Italy                                    | Lecturers:<br>Co-Chair: P. Vlamos, IU<br>Co-Chair: Y. Lemoigne, IFMP<br>D. Townsend, NUS SG,<br>P. Altieri, Bari Uni, It,<br>A. Avramouli, IU, Gr<br>T. Beyer, VMU, At<br>V. Gershan, SSC&M, Mk,<br>M. Gonidi, IU, Gr<br>P. Lecoq, IEEE,<br>P. Le Dû, IEEE,<br>J. Malone, TC, Dublin, IRL,<br>A. Plerou IU, Gr<br>S. Petkovska, ACIBADEM, Mk<br>I. Rausch, VMU, At<br>S. Sunjic, Sarajevo Hosp, Ba<br>A. Topi, INFN-Pisa, It<br>A. Vrahatis, Patras Uni, Gr | 16:30<br>L6<br>17:30 |
| 17:30<br>L7<br>18:30     | 17:00 International Safety<br>Standards, Units, limits..<br>Yves Lemoigne<br>IFMP-Fr & TERA               | Round Table: Hybrid &<br>Personalized Medicine<br>Chair: P. Lecoq, T.Beyer,<br>D.Townsend, P. Le Dû...                      | Light $\mu$ -scopy, Scanning $\mu$ -<br>scopy in diagnostic procedure<br>Maria Gonidi<br>Ionian University, Corfu, Gr | Fluka Simulation for Medical<br>Physics<br>Albana Topi,<br>INFN, Pisa, Italy                           | Velocity TM: How to Transform<br>Imaging data to knowledge<br>Claudio Caldera<br>VARIAN Medical Systems   | 17:30<br>L7<br>18:30 |
|                          | 18:00 Free  | Reaction-Diffusion models<br>in Computational<br>Neurodegeneration<br>Prof. Vlamos, Ionian Uni.                             | Subpathway-based computa-<br>tional approaches to Network Med.<br>Aris Vrahatis,<br>Patras University, Gr             |  |   |                      |
| 19:30<br>Social<br>22... | 19:30 Welcome Cocktail  | 19:30 Special Public Lecture:<br>Schrodinger Risk, Mystery, Arts..<br>Prof. Jim Malone, Trinity College,<br>Dublin, Ireland |   | 20:00 BANQUET  |   |                      |

Courtesy D. Townsend 2014

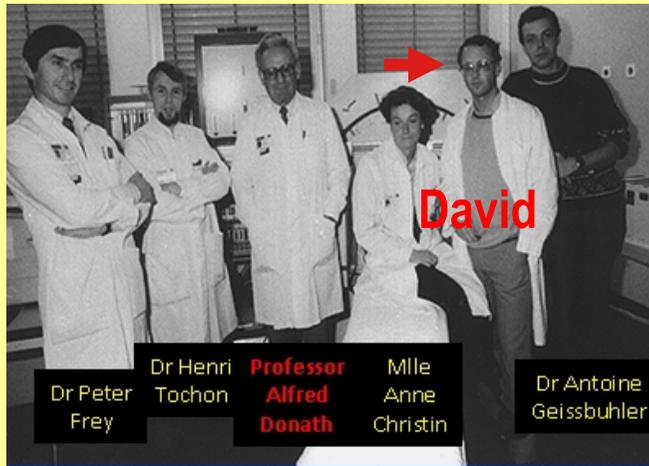
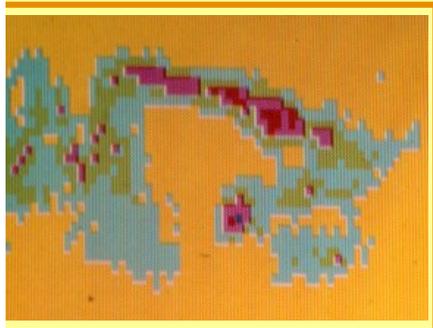


We are pleased to welcome Professor David Townsend from Singapore University.

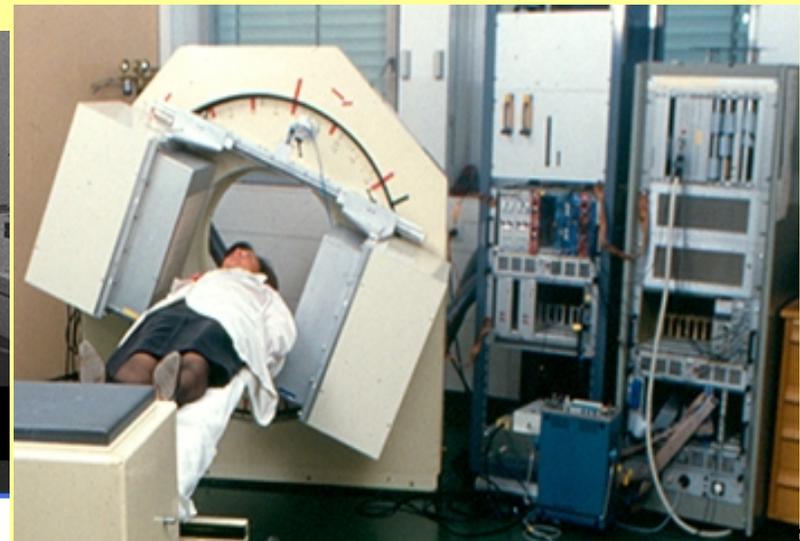
A few words: Arriving at CERN for an experiment on the Omega project, I used a French calculator (CII) managed by an Englishman, David. Curious mixture not at all explosive ... David was (already) always ready to help. Then he built the first PET camera in Europe in the service of Prof Donath in Geneva ... Arrived in Pittsburg, he convinced Siemens to build the first PET-CT machine that is now the norm in modern hospitals ...

First mouse imaged at **1978 at CERN**

CERN with Na-<sup>18</sup>F in 1978



|               |                 |                         |                    |                        |
|---------------|-----------------|-------------------------|--------------------|------------------------|
| Dr Peter Frey | Dr Henri Tochon | Professor Alfred Donath | Mlle Anne Christin | Dr Antoine Geissbuhler |
|---------------|-----------------|-------------------------|--------------------|------------------------|



**Team & HIDAC PET Camera at HCUGE**

Tribune de Genève, January 1988



# Hybrid Imaging Device Program



Tomorrow we will have the pleasure of welcoming Prof. Thomas Beyer from Vienna Medical University. Thomas is the initiator of the "HYBRID Marie-Curie European project (beginning now) in medical imaging.



NCE

IFMP is associated with "HYBRID" for dissemination of scientific knowledge in our area, and we can discuss it with him (or with Ivo). Being candidates, some of our young colleagues may be interested in applying for the top level of R & D in one of the best European institutions.

*Note that a brief presentation (20 minutes) during the "Students' Forum" gives to our young colleagues the opportunity to prove their level and motivation to be "HYBRID" candidate.. For once this is not reserved for Western Europeans (Fr, UK, DE, IT ...). Seniors have to come in forum, Please!*

Medical imaging is also progressing with so-called "specific devices", presented by my CERN colleague Paul Lecoq with its implications in the personalized Medicine.



Courtesy: S. Majewski, West Virginia University

# Radiation protection in Medicine

The expert in this field will be **Prof. Jim Malone** of Trinity College in Dublin Ireland, and Robert Boyle Professor (Emeritus) of Medical Physics. He has been consultant in Radiation Protection at AEIA of Vienna (many years).



*In addition to four classes on Wednesday and Thursday, Jim will give a lecture to a large public Tuesday night (7:30 pm) on the theme "Schrodinger, Mystery, Risks and Arts". We already feel the mystery! During troubled times of the 20th century, Schrodinger was a refugee in Dublin. (many reservations done)*

Testimonials of practical application of the principles of Radiation Protection will then be provided by:

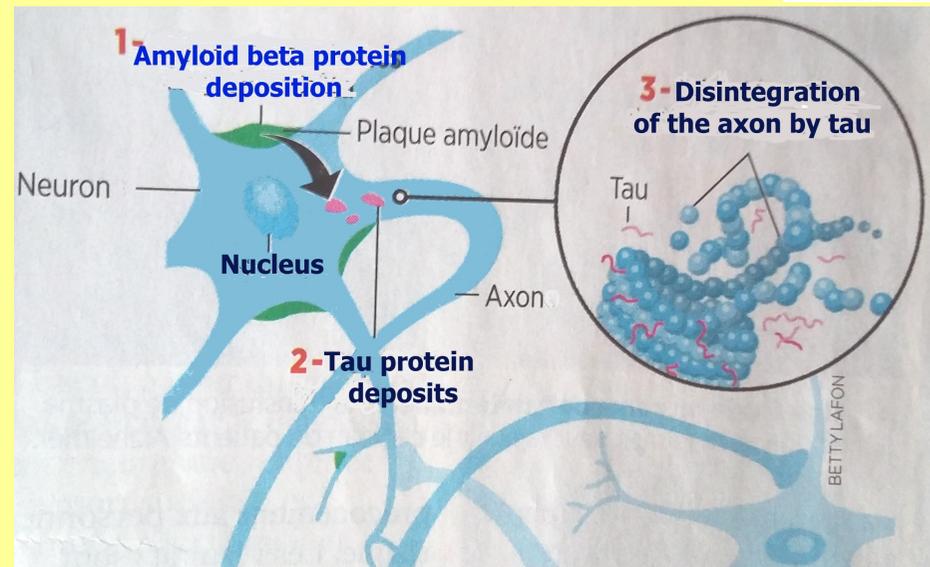
- Sonja Petkovska and Vesna Gersan from Skopje.
- There must have been Svejtlana Sunjic from the Sarajevo Central Hospital but she cannot come at the last minute.
- She has been replaced by Claudio Caldera of **Varian Medical Systems** who will present his software Velocity.

# Come back to Alzheimer Disease

*For those who are almost ignorant (like me) of this disease,  
some simple reminders:*

Twenty-five years ago John Hardy of University College London was already explaining the disease by the accumulation between neurons of abnormal proteins (Amyloid beta), which alter the connections between neurons or synapses.

This leads to the deregulation of another protein (phosphorylated tau) that disrupts neurons until they are killed.



Symptoms occur when the brain's ability to resist aggression decreases. The disease has a silent phase during which it should be detected to stabilize before too many neurons are destroyed.....

## ***But is is not so simple***

- It seems that there is **not only "ONE Alzheimer's disease"** but several types of Alzheimer's diseases
- Alzheimer's **disease is 70% of genetic origin** and only 30% of environmental origins: Genetic sequencing to be made very early ?...

**New insights:** Sacramento Neurovision Imaging company says that eyes open a window for brain disease surveillance. The **amyloid plaques appear first in the eyes (retina)** before being detected in the brain. This has been seen for Alzheimer mice (Cedar-Sinai Medical Center, LA, Ca). But also in retinas of post mortem human patients; this company has launched extensive tests (Retinal Amuloid Imaging) on healthy volunteers and sick patients.... **Is it a dream ?** Results in 3 years ...



**Amyloid plaque**



# Talks correlated neuro-degenerative diseases



5 talks are scheduled:

- Prof. Vlamos: Reaction-diffusion models in computational Neurodegeneration.
- Antagoni Avramouli : Computational Methods in Alzheimer's Disease.
- Maria Gonidi : Light Microscopy, Scanning in Diagnostic Procedure.
- Aris Vrahatis (Patras University) : Subpathway-based Computational Approaches to Network Medicine.
- Antonia Plerou : Trends & Research in Neuro-Cognitive Enhancement.



Antagoni Avramouli



Maria Gonidi



Dr. Antonia Plerou

Aris Vrahatis

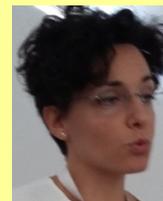




## *Innovations in technical aspects and perspectives*



- It is now a well-established tradition to finish the workshop by presenting some aspects of the development of technological innovations.
- It is still in the field of hadrontherapy (Palma Altieri, Albana Topi, Patrick Le Du).
- But also in the field of imaging with progress in sensitivity and the resolution of radiation detectors (Paul Lecoq, David Townsend).
- Without forgetting Claudio Caldera from Varian Medical Systems, our faithful sponsor without whom this workshop could not have taken place. He will introduce us "Velocity" a powerful system to gather all useful and complementary information.
- At 12:30 Concluding Session then Farewell - End of Workshop



Palma Altieri



Albana Topi



Patrick LeDu



Paul Lecoq



**Thanks a lot for  
the gentle attention!**