



**Instituto Superior Técnico
University of Lisbon
Center for Nuclear Sciences and Technologies
(C²TN)**

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CONCERT Info day
Munich, 27 January 2016

Nuclear and Technological Campus (CTN):

- **Departments:**
 - Department of Engineering and Nuclear Sciences (DECN)
- **Research Units:**
 - Center for Nuclear Sciences and Technologies (C²TN) <http://c2tn.tecnico.ulisboa.pt/en/>
 - **Radiological Protection and Safety Group (GPSR)**
 - Institute of Plasmas and Nuclear Fusion (IPFN)
- **Technological Development Laboratories:**
 - Laboratory for Radiological Protection and Safety
 - Laboratory of Nuclear Engineering
 - Laboratory of Accelerators and Radiation Technologies

Radiological Protection and Safety Group

- **Main research areas:**
 - Dosimetry and Radiobiology
 - Metrology of Ionizing Radiation
 - Emergency Preparedness and Management of Radiological & Nuclear Accidents
 - Radioactive Waste Management
 - Environmental Radioactivity and Radioecology

Nuclear and Technological Campus (CTN):

- **Infrastructures (1):**
 - Laboratory for characterization of radioactive compounds (radiochromatograph and radio-HPLC)
 - Laboratory for radiobiology and cytogenetics
 - Laboratory for biochemical and molecular biology studies
 - Laboratory for biodistribution studies of radioactive compounds
 - Laboratories for cell culture and *in vitro* studies
 - Facilities for animal housing

Nuclear and Technological Campus (CTN):

- **Infrastructures (2):**
 - Laboratories and infrastructures of support to dosimetry and metrology activities, including individual monitoring and a WBC
 - Portuguese research reactor (thermal, epithermal and fast neutron beam lines)
 - Van der Graft and Tandem accelerators
 - Irradiation facilities (Co and Cs)

Research interests (1):

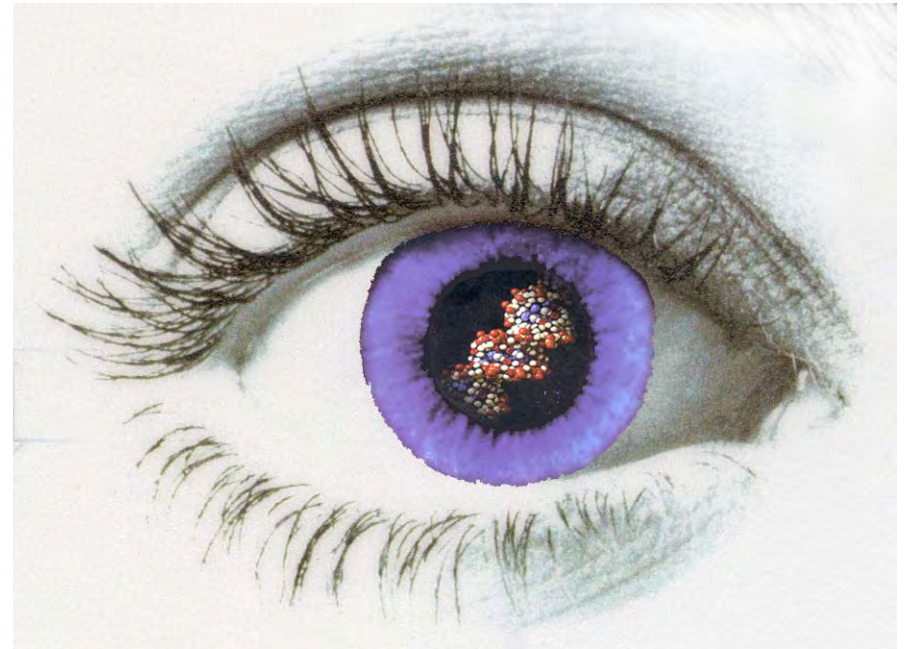
- Radiation Protection
- Radiological and nuclear emergencies
- Radiobiology
- Exposure to low doses of ionizing radiation
- Radiopharmacy
- Design and biological evaluation of novel target-specific radioactive compounds for nuclear imaging (PET or SPECT) and targeted systemic radiotherapy
- Thyroid cancer patients - effects of ^{131}I treatment

Research interests (2):

- Cytogenetic methods
 - chromosomal aberrations, micronuclei, γ -H2AX
- Molecular biology studies
- Biological dosimetry
- Dosimetry studies, applied to medical physics, using Monte Carlo codes
 - MCNPX, PENELOPE, GEANT, FLUKA

Some research projects at GPSR:

- BioQuaRT – Biologically weighted quantities in radiotherapy
- RENEb – Realizing the European Network of Biodosimetry
- CATHyMARA – Child and Adult Thyroid Monitoring After Reactor Accident
- Improvement of image quality and dose reduction in digital breast tomosynthesis using statistical image reconstruction algorithms
- Euraloc – European epidemiological study on radiation-induced lens opacities among interventional cardiologists
- PREPARE – Innovative integrative tools and platforms to be prepared for radiological emergencies and post-accident response in Europe
- CERN research projects
- ...



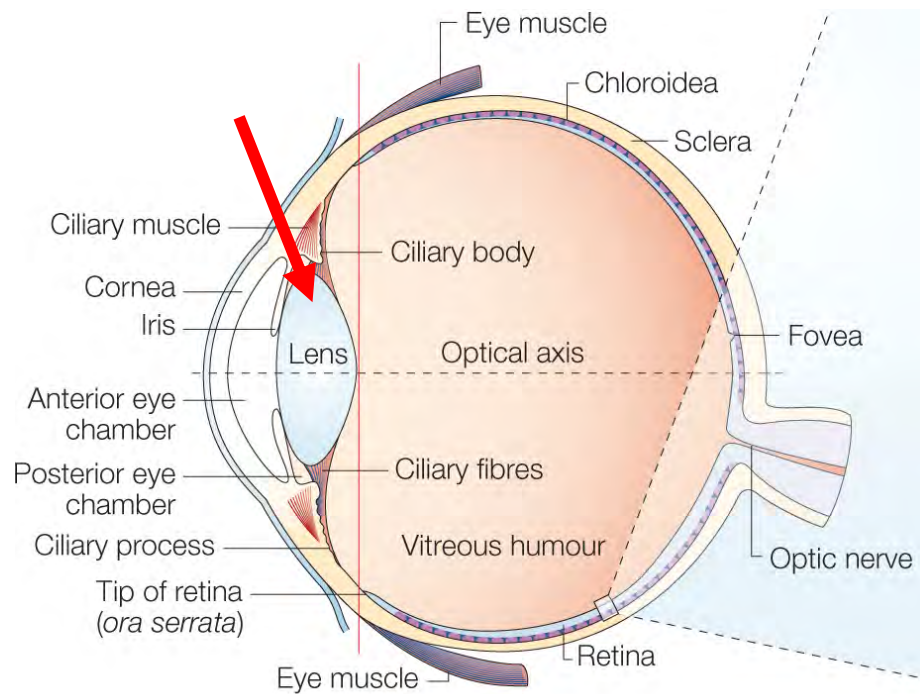
Investigating the Ocular Lens

Jochen Graw

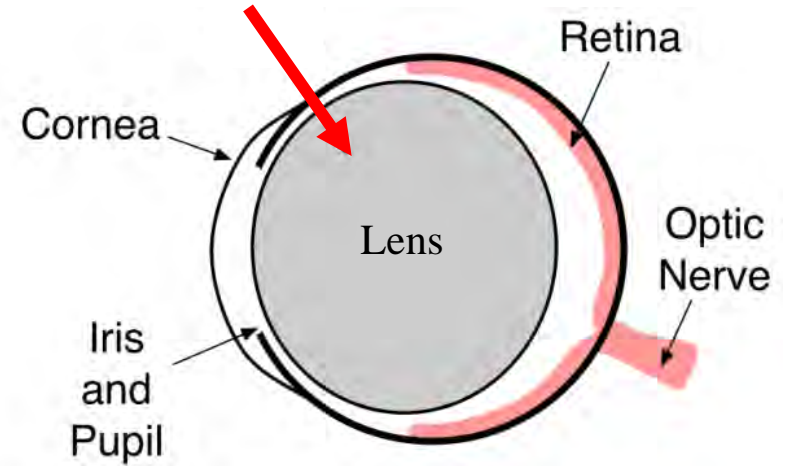
Helmholtz Zentrum München
Institute of Developmental Genetics
Research Group Eye Diseases

The Eye

Human eye



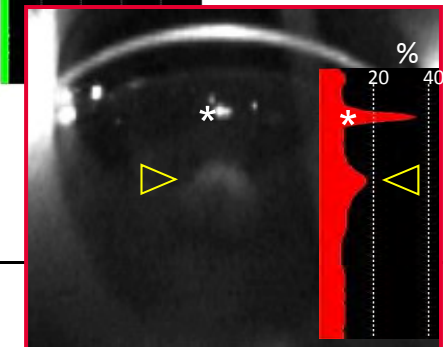
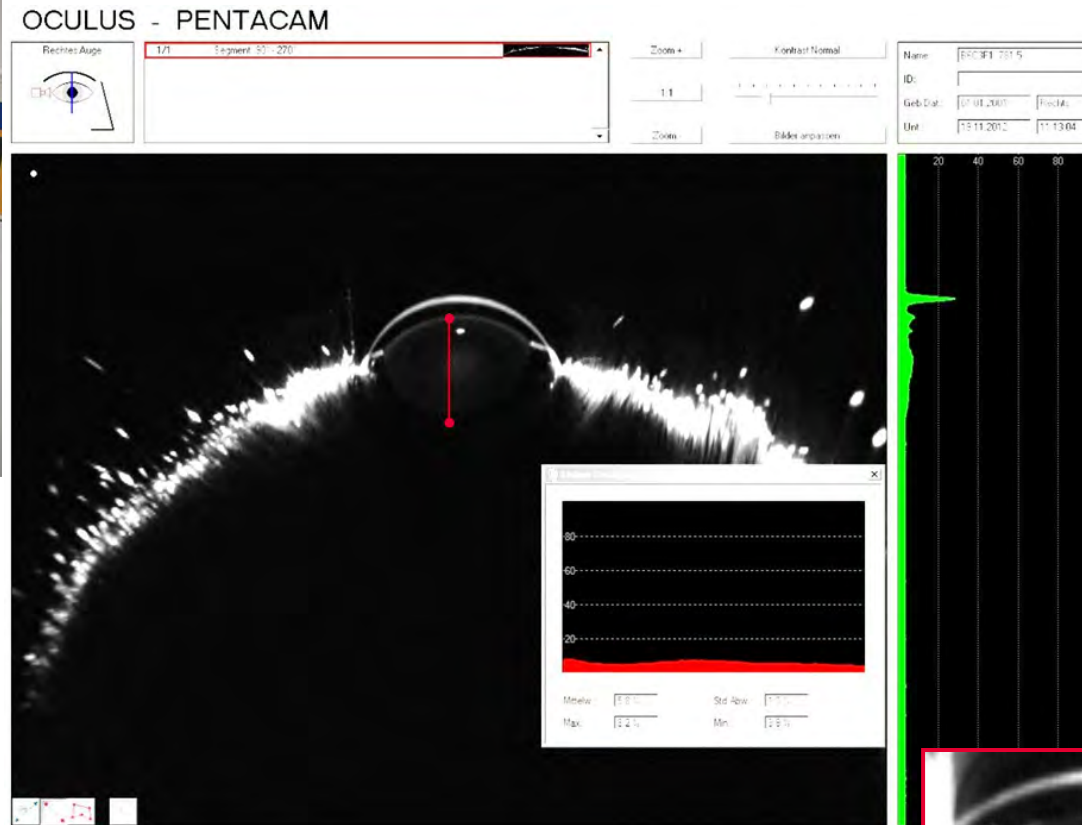
Mouse eye



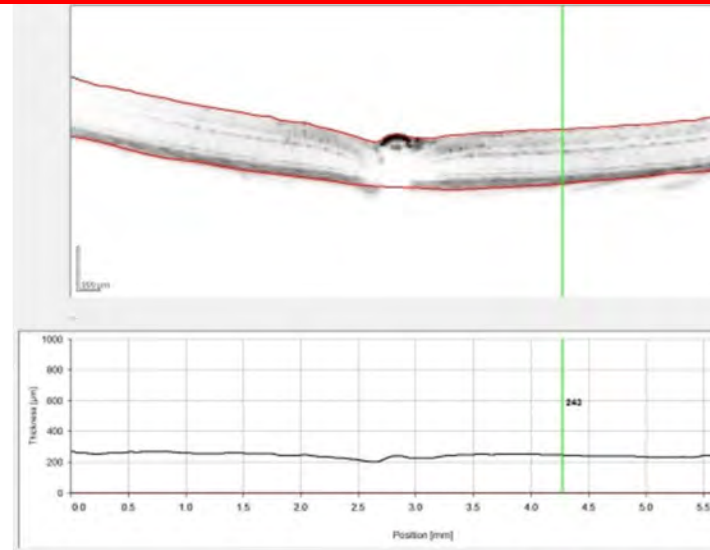
Graw, Nat. Rev. Genet. 4, 2003, 876-888



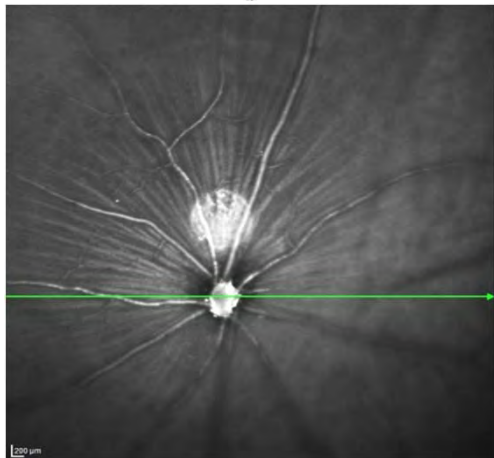
Scheimpflug imaging: non-invasive *in-vivo* analysis of lens opacification



OCT (optical coherence tomographie): non-invasive *in-vivo* analysis of the retina



Measuring the retinal thickness



Counting the vessels

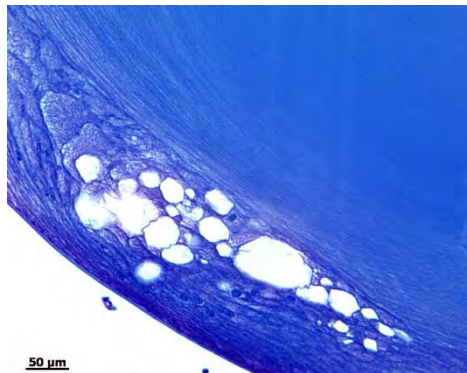
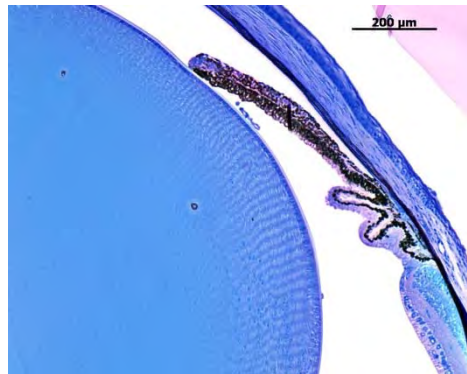


Analysis of the retinal layers



Histology and immunohistochemistry

Histology

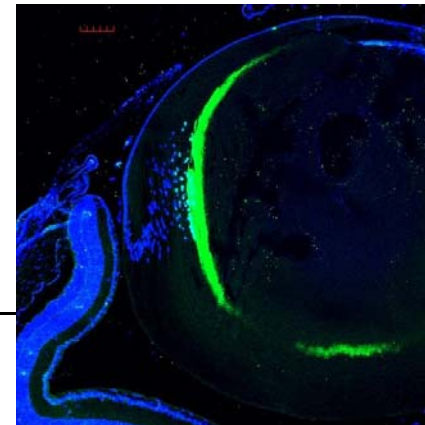
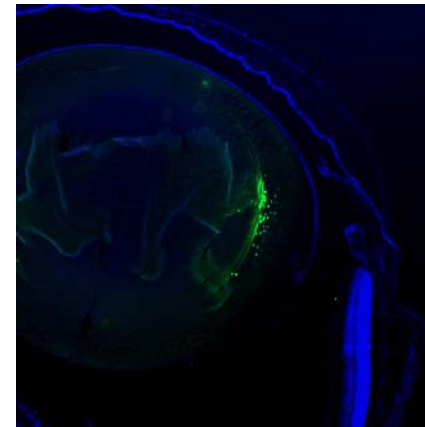
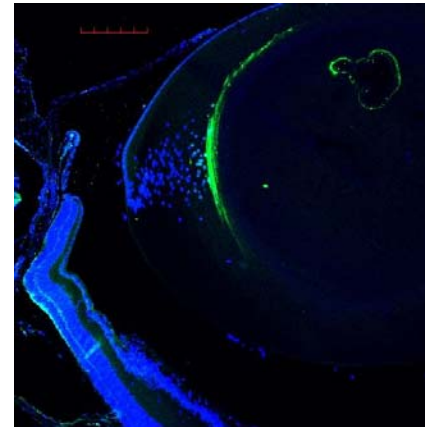


γ H2AX during lens differentiation

P14
C3H

Ercc2
het

Ercc2
Hom



Kunze et al., 2015





Current projects on Biomarker and molecular epidemiology

Biological bank of the FCCSS

Inserm U1018 « Centre de recherche en Epidémiologie et Santé des Populations »

Équipe 3 « Epidémiologie des radiations », F de Vathaire

Nadia Haddy

Previous work: Secondary cancer

Repair of ionizing radiation-induced DNA damage and risk of second cancer in childhood cancer survivors

Whether individuals who developed a second cancer after treatment for a first malignant neoplasm had a lower DNA double-strand breaks repair capacity?

This case-control study shows that higher baseline and post-irradiation levels of DNA DSBs, as measured by γ H2AX intensity, are associated with the risk of SMN in childhood cancer survivors.



Haddy et al.2014

Current work: Cardiac diseases

Predictive biomarkers of cardio-vascular diseases following childhood cancer treatment: Case-control study



Case-control study in FCCSS

Cardiac cases (n=456)

Deaths (n=163)
Leave outside of France (n=23)

Invited to participate (n=253)

Death before blood collection (n=3)

Refusal (n=8)

Consent not returned (n=35)

Agreed (n=207)

**Blood samples
183 cases**

**BioF-FCCSS : 3 429 Samples
2 742 Patients**

2 243 Salivary
sampels

1 186 Blood
sampels

687 both



What we suggest for INTIGRAD (1)

Transcriptome of human lymphocytes and CD susceptibility

GeneChip Human Transcriptome Array 2.0:

285,000 full-length transcripts covered

245,000 coding transcripts

40,000 non-coding transcripts

339,000 probe sets covering exon-exon junctions

Gustave Roussy Platform

What we suggest for INTIGRAD (2)

The Reverse Phase Protein Array (RPPA)

- Quantify the abundance of protein levels and post-translational modifications
- The main advantages of RPPA are (i) the large number of samples that can be analyzed simultaneously, (ii) the little amount of biological material that is required, (iii) the high sensitivity and (iv) excellent reproducibility (<10% Coefficients of Variation).
- The Reverse Phase Protein Array (RPPA) Platform has been set up at Institut Curie in the Department of Translational Research in 2009, by Thierry Dubois and Leanne de Koning.
- The platform is supported by Cancéropôle Ile-de-France funding and is open for national and international collaborations.

What we suggest for INTIGRAD (3)

Understanding the biological mechanisms underlying the radiation effects on the cardiovascular system:

In collaboration with radiobiologists, the cells responses to the radiation will be studied using the co-cultures system between cardiac fibroblasts and human lymphoblastoid cell lines from patients.

