Infrastructures for radiation protection research

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Original WP4 tasks

• Task 4.1 Survey of existing facilities for low dose risk research
  – Two reports (Survey of existing facilities, Report on research needs)
  – Listing of irradiation facilities
  – Publication on epidemiological cohorts (CREAL) pending
  – General information available on public DoReMi website

• Task 4.2 Characterization of infrastructure needs and roadmap of implementation
  – Survey sent out on irradiation facilities – poor response
  – Recent short survey on all infrastructures sent to all DoReMi scientists

• Task 4.3 Implementation of DoReMi support activities for shared infrastructures
  – External calls based on survey of existing facilities
  – Ad hoc funding (STORE)

• Task 4.4 Development and implementation of access to Infrastructure
  – With the help of the MELODI Infrastructures working group
  – Major output of this workshop → roadmap document
Summary of Report on Infrastructure needs for low dose research (2011)

- **Irradiation facilities**
  - Large selection of facilities, but some limiting factors (not always adapted to low doses, access, support facilities for handling biological samples)
  - Shortage of low dose/dose rate facilities
  - Lack of facilities to address radiation quality (Below 20MeV/u and above 100 MeV/u, microbeams)
  - Internal contamination – difficult to assess needs → small number of facilities, but not clear if optimally used

- **Epidemiological cohorts**
  - Large number of available cohorts (59)
  - Challenges (variable dosimetry quality, biological material available for about 25%, access to samples difficult)
  - National birth cohorts provide interesting opportunities

- **Databases and biobanks**
  - STORE identified as a potentially interesting resource
  - BBMRI → would be interesting to establish collaboration to assess feasibility

- **Analytical platforms**
  - National hubs
  - ESFRI platforms
Addressing the RI needs of low dose research

1st competitive call (2011)

• Task 4.5 – Open access to the FIGARO low dose rate facility
  – Upgrading of existing facility for the irradiation of fish for mouse studies at the Norwegian University of Life Sciences
  – Validation of dosimetry (NRPA), Acquisition of authorisation for animal studies (NIPH)
  – Access to DoReMi members for pilot experiments, and through internal calls resulting in two projects (OSTINATO: Parkinsons Disease, CLOGIGAT: Gastrointestinal tumors)

• Task 4.6 - Low dose/dose rate radiation effects in brain cancer risk
  – Collaboration between the ENEA (Italy) and IES (Japan)
  – Ptch1+/− model transferred to IES for low dose rate exposure, samples harvested and sent back to the ENEA for analysis
  – Effects on CNS tumorigenesis (rate, pathophysiology, DNA methylation)

• Task 4.7 - Low dose/dose rate gamma irradiation facility for in vitro biological systems
  – Construction of a low dose gamma irradiation facility for in vitro studies
  – Located at the ISS in Rome
Addressing the RI needs of low dose research

- **Task 4.8 – Integrating STORE into DoReMi**
  - Task established with Ad hoc funding to provide sustainability until the end of DoReMi
  - Continued improvements and upgrades of the database
  - Establishment of contracts to expand content
  - Additional Ad hoc funding to inventory and upload animal studies (CEA, SCK-CEN, HMGU)
  - Inclusion of cohort survey data upon publication of review article

- **Task 4.9 - Provision of ion microbeam irradiation facility SNAKE**
  - Funded by the second competitive call
  - 150 hours of beam time, use of associated biological facilities and access to expertise and support at the SNAKE facility (UBWM - Munich)
  - Two projects ongoing (IC: recruitment of chromatin remodeling factor ALC1 to sites of DNA damage after irradiation, USAAR: TEM studies following high LET irradiation)

- **Task 4.10 – Laboratory Infrastructure for retrospective radon and thoron dosimetry**
  - Funded by third competitive call
  - Facility for retrospective dosimetry using CDs and DVDs located at Sofia University (Bulgaria)
Creation of an infrastructures roadmap

Elements of the roadmap for research infrastructures to support radiation biology research

- List of the selected facilities/infrastructures
- Description of the process (and criteria) used to select the infrastructures
- Proposed funding strategies to promote their use and support research projects that use the qualifying facilities/infrastructures
- Procedure for the inclusion of additional facilities/infrastructures to the list of qualifying facilities/infrastructures
 Associations of research institutes  
Major aim is to publish Research Agendas and to propose Priorities lists  
NO FUNDS
Projects selected and funded by Euratom Research, Coordination, call for proposals, FUNDING

- **European Joint Program:** 2015 - 2020

  - Network of excellence: 2010 - 2015
  - Preparatory actions: 2011 - 2014
  - Preparatory actions: 2013 - 2016
  - Preparatory actions: 2013 - 2016

  - **Low doses**
  - **emergency situations**
  - **Radioecology**
  - **Dosimetry**
  - **Medical Use**
SRA - Research Infrastructures

- Irradiation facilities
- Epidemiological cohorts, Databases and Biobanks
- Analytical platforms
Subtask 4.2.3: Surveying the infrastructures in the new Member States and facilitating access to core radiobiology research facilities available in the old Member States (lead: CEA).

Task 4.4 – Interactions with ESFRI platforms & large EU consortia to support research in the field of radiation protection (lead: CEA)
Maximising the use and access to Europe-wide research infrastructures within and outside the radiobiology community will be promoted by reaching out to and integrating with flagship projects of the EC, ESFRI, and major networks of excellence outside radiobiology and radiation protection, which can move radiobiological research forward and assist EU Member States, including the newest, to realise their research objectives.
Subtask 4.4.1: Maximising access to Europe-wide resources within and outside the radiobiology/radioprotection field (lead: CEA).
Subtask 4.4.2: Promotion of education and training in new technologies and the use of large European infrastructures (lead: UNIPV).
Subtask 4.4.3: Develop quality standards for infrastructures for inclusion in H2020 calls and facilitate the creation of EU multiply funded trans-disciplinary projects around radiobiology and radiation protection (lead: CEA).
Roadmap 2006

- **BBMRI** - Biobanking and Biomolecular Resources Research Infrastructure
- **EATRIS** - Translational research facilities
- **ECRIN** - Clinical trial platform
- **ELIXIR** – Data repositories
- **Infrafrontier** - Mouse archives and clinics
- **INSTRUCT** - Structural biology facilities

+ Update 2008

- **EMBRC** - Marine biology resources
- **ERINHA** - High-security labs
- **EuroBioImaging** – Imaging facilities
- **EU-Openscreen** - Chemical libraries

+ Update 2010

- **ANAE** - Analysis and experimentation on ecosystems
- **ISBE** – Infrastructure for systems biology
- **MIRRI** – Microbial resources
Rapid Decrease in Cost

- The Human Genome Project: 13 years and $3 billion.

- Sequencing of the Watson Genome by 454 in 2007: $2 million

- Illumina: eight days at a cost of about $10,000.

- $10^3$ reduction in 5 years

- Claims: a full human genome in 15 minutes for $1000?
## "Oomics" platforms

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<tr>
<th>Infrastructure</th>
<th>Technical Characteristics</th>
<th>Example Platforms/Facilities</th>
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| Transcriptomic | mRNA expression, alternative splicing (Microarray, NGS, qPCR) | **ESGI partner labs:** Max Planck Institute for Molecular genetics, Christien-Albrechts University-Kiel, Welcome Trust Sanger Institute, CEB/Centre de Regulacio Gènomica (CRG), Uppsala University  
**MERIL database:** Campus Science Support Facilities GmbH – Austria, France Génomique (CEA), GRN-Hungarian Genomics Research Network, NICB - National Institute for Cellular Biotechnology Core Facilities – Dublin, CFGBC - Center for Functional Genomics and Bio-Chips-Ljubljana |
| Epigenomic | microRNA, lincRNA, CpG island, methylation (Microarray, NGS, qPCR) | **MERIL database:** Campus Science Support Facilities GmbH – Austria, France Génomique (CEA), GRN-Hungarian Genomics Research Network, TGAC - Genome Analysis Centre |
| Proteomic | 2D gel-based (DIGE), gel-free (SILAC, ICPL, iTRAQ etc., label-free) | **Prime-XS partner labs:** Netherlands Proteomics Center, VIB Proteomics Unit (Belgium), CRG/UPF Proteomics Unit (CRG), Cambridge Center for Proteomics, CEA Proteomics technological platform – Grenoble. **MERIL database:** Campus Science Support Facilities GmbH – Austria, PCF-PLUS Proteomics Core facility – Austria, NICB - National Institute for Cellular Biotechnology Core Facilities – Dublin, RNEM - Portuguese Mass Spectrometry Network, |
| Metabolomic | nature of biological samples (urine, blood, tissue) | **MERIL database:** METABOHUB, PCF-PLUS Proteomics Core facility - Austria |
54 Partners
- 32 (POM) including the 4 associations
- 23 countries (22 + Norway)
- 22 LTP
CONCERT WP6 (Infrastructures)

- Task 6.1 Promote the visibility of selected infrastructures for R&D (NMBU)
- Task 6.2 Harmonize practices and protocols (RIVM)
- Task 6.3 Strategy for facilitating access to infrastructure (CEA)

MELODI  
Alliance  
EURADOS

Medical Use  
NERIS
Infrastructures for radiation protection research

Need to identify and promote high quality infrastructures best suited to serve the needs of radiation biology research

=> Crosstalk with scientific priorities

• Improve access by focusing on selected infrastructures and facilities
• Better rationalize the use of existing infrastructures and available financial resources
• Improve reproducibility by supporting infrastructures that meet necessary quality criteria (ex. ‘omics)
• Improve sustainability of rare but essential infrastructures (ex. internal contamination facilities (radon))
Infrastructures for R&D

- Technical characteristics
  - Irradiation facilities
  - Epidemiological cohorts,, Databases and Biobanks
  - Analytical platforms

- Listing the infrastructures exhaustive list
  - Eurados database, DoReMi database, Meril, STORE, (ELIXIR?) compare database
  - Structured the information, speciation “very detailed information”
  - Include DOREMI data set into STORE (can be an umbrella) or other database

- Develop quality criteria (Melodi, Alliance, Neris, Eurados, Medical Use)
  - Selection Criteria (access, support staff, management, supporting labs, location, administration, logistics,etc.)
  - Quality criteria (samples used for such or such purposes)
  - Dosimetry, experimental design, statistics (Frederica criteria for animals studies)

Lists of recommended infrastructures

Promote the visibility of recommended infrastructures for R&D

Informing the radioprotection research community about the infrastructures which are available and modalities for access is the first critical step to increase accessibility and long-term sustainability

- in a searchable database, structured information
- In ESFRI databases
- Newsletters
- Tutorial
- Training
• **Harmonize practices and protocols**
Inter-laboratory comparison exercises are an important tool to ensure harmonisation between different laboratories and the data which they produce.

• Maintaining STORE (and radioecology databases) (clarify / ELIXIR)

• Incrementing databases
  – H2020 OPEN ACCESS Mandatory
  – Retrospectives studies
  – New studies => ESFRI quality standard (ex: biobanking)

• Harmonization and exercises (Training)

• For “omics” should we include only those that already have harmonisation practices in place as “reference core-facilities”? For those without, could we ask the proposal to include the participation in an inter-laboratory comparison exercise as part of the project?

• Set of cell lines “experiments” to be used as controls?

• Education and training in bioinformatics is crucial
• Strategy for facilitating access to infrastructure
  • Identification of the needs to support sustainability of critical (including rare) facilities
  • Developing training
  • Existing procedures (calls, funding…)
    – Some large infrastructure launched their own calls (to be listed)
  • Funding scheme (within infrastructure/within project)
    • Through the use of discretionary project funds (such as DoReMi)
      – Two adhoc: STORE / SU low dose facility
      – No individual request
    • specific facilities could be directly provided “inkind” (EJP –partners).
  • receive funds to support projects via calls.
    – Helpful to promote integration inside and outside EJP partners
    – Implement a CONCERT call on using data and biobank from archives
    – EJP calls must require that data obtained be implemented on open access on STORE (or other database)
    – EJP Calls: two steps process 1° scientific evaluation 2) Technical/feasability at an infrastructure
  • specific EJP calls/projects could include funding for the use of specific facilities.
    – Ex 150h SNAKE 8 weeks FIGARO…
Thank you