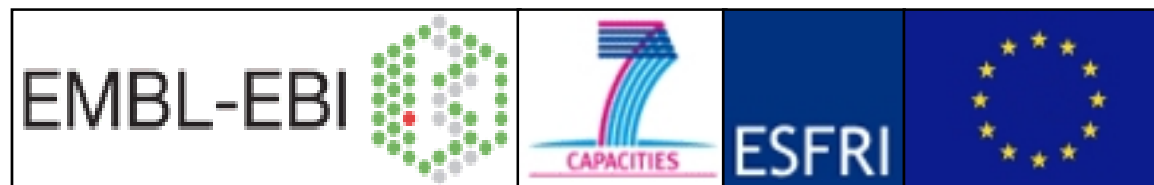


Elixir: Overview

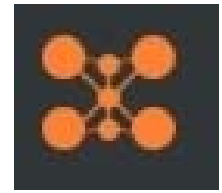
Andrew Lyall, April 2008

Version 0.1

www.elixir-europe.org

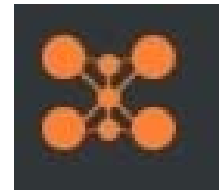


What is Elixir?

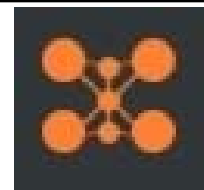


- An EU Framework 7 Preparatory Phase Project
- Coordinated by Prof Janet Thornton, Director EMBL-EBI
- To construct a plan for the operation of a **sustainable** infrastructure for biological information in Europe
- €4.5 million grant awarded May 2007, three year term
- 32 member consortium engaging many of Europe's main bioinformatics funding agencies and research institutes
- Deliverables are memoranda of understanding to fund the implementation phase which could cost €500 million
- Interested parties should register as stake-holders via the ELIXIR Website: www.elixir-europe.org

Contents.

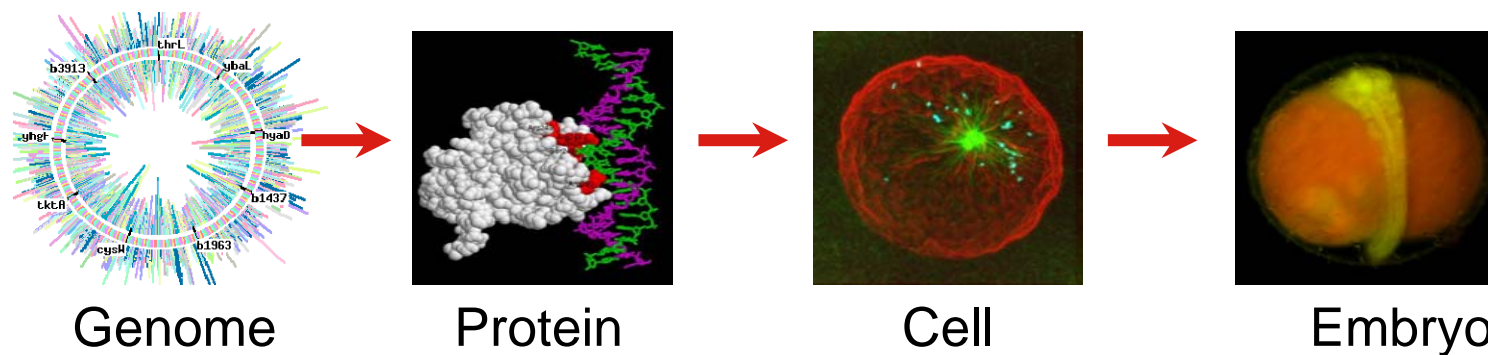
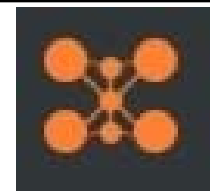


1. Why is ELIXIR necessary?
2. How is ELIXIR organised?
3. Where did ELIXIR come from?
4. What might ELIXIR be?
5. How does ELIXIR relate to other projects?
6. How should I get involved in ELIXIR?



1. Why is Elixir Necessary?

Modern biology requires integration.



Fruitfly

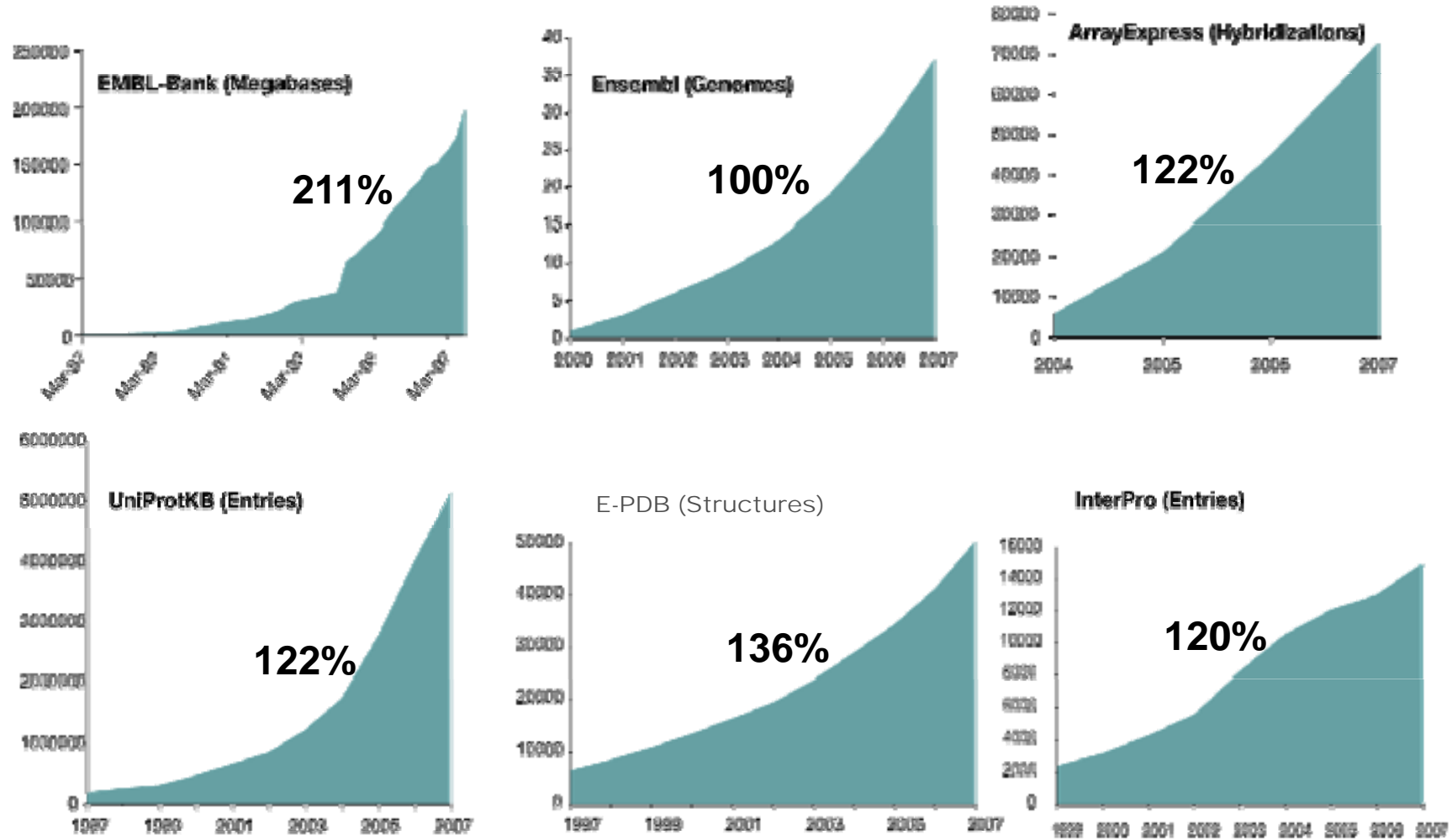
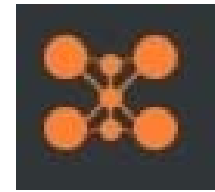


Mouse

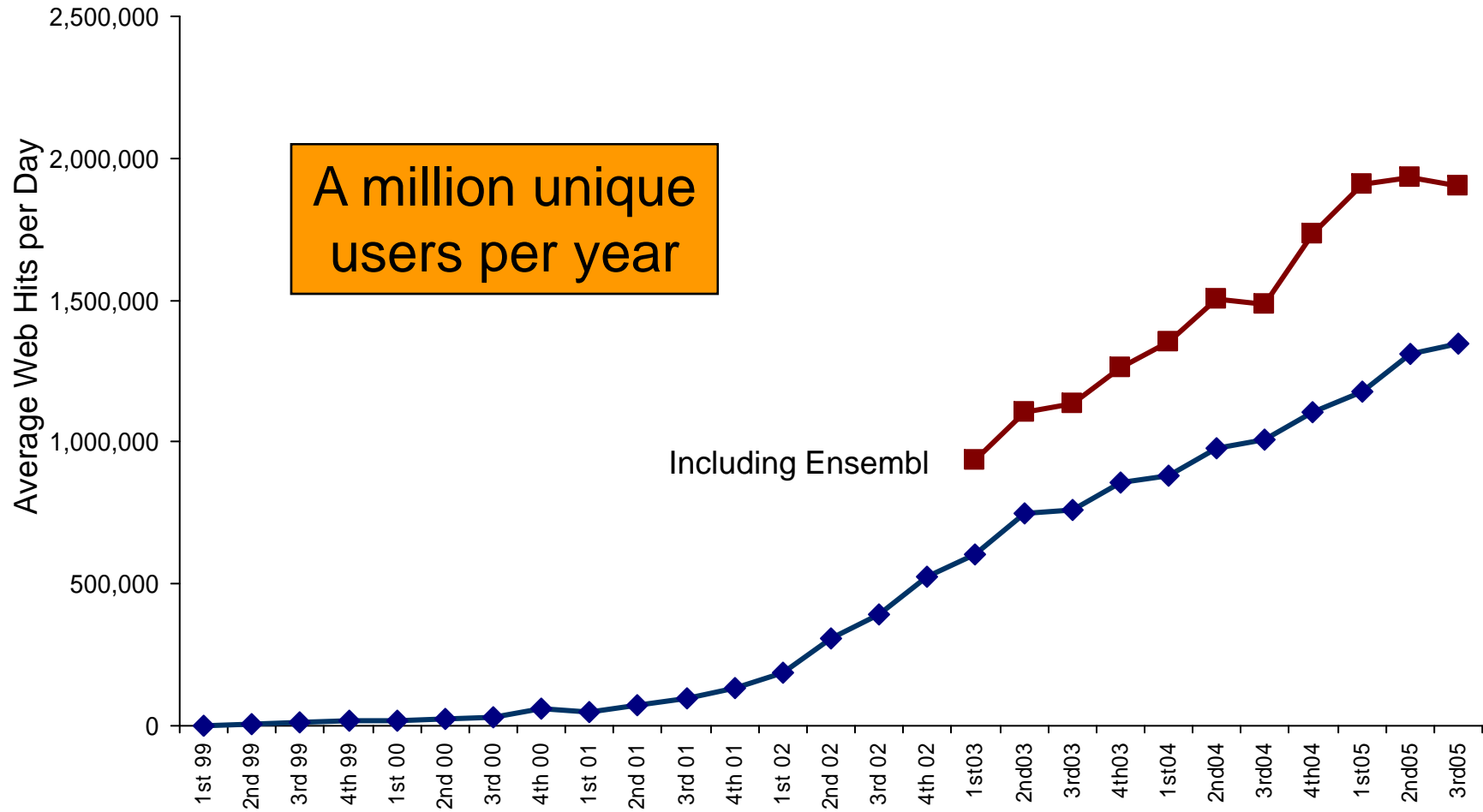
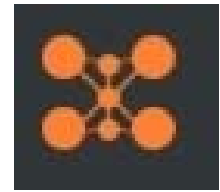


Development,
Ageing, Disease

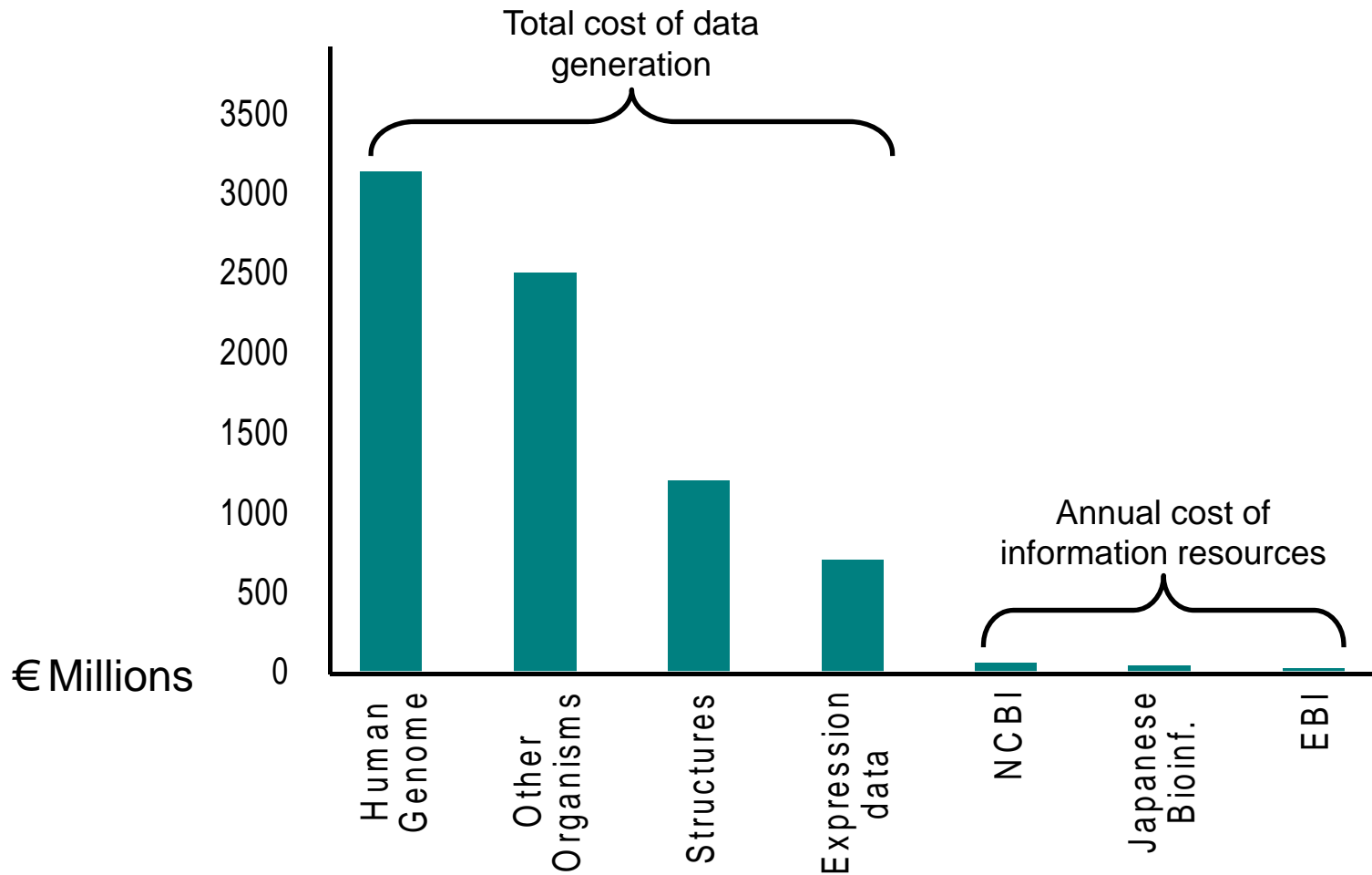
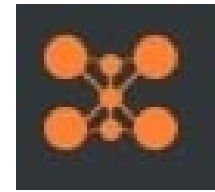
Database growth (2007/2006 %)



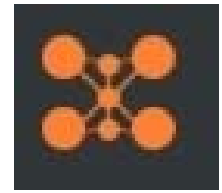
Very large user community



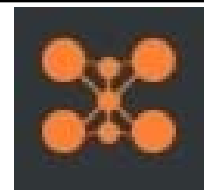
Good value for money



Elixir rationale

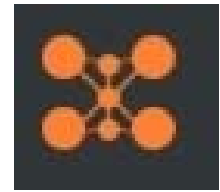


- Optimal Data Management
 - Coordinated data resources with improved access & economy of scale
 - Integration and interoperability of diverse heterogeneous data
- Forge links to data in other related domains
- A single European voice to influence global decisions and maintain open access
- Enhance European competitiveness in bioscience industries
- Address need for Increased Funding & its Coordination



2. How is ELIXIR Organised?

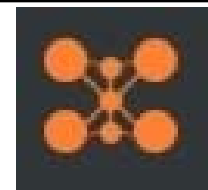
Members of the ELIXIR consortium



- There are 32 partners from 13 member states and associated countries
- 16 of the partners are funding agencies or Government Bodies
- 16 of the partners are scientific organisations or institutes
- There are expressions of interest from many others

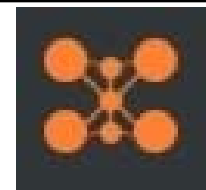


Participants & Contacts 1



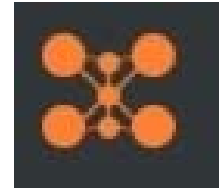
	Participant organisation name (& point of contact)	Short name	CC
1	EMBL - European Bioinformatics Institute (Prof. Janet Thornton, Dr. Dominic Clark).	EMBL-EBI	INO
2	Biotechnology and Biological Sciences Research Council (Dr. Alf Game)	BBSRC	UK
3	Federal Ministry of Education & Research (Dr. Elmar Nimmesgern)	BMBF	DE
4	Barcelona Supercomputing Center – Centro National de Supercomputacion (Prof. Modesto Orozco)	BSC	ES
5	Spanish National Cancer Research Centre (Prof. Alfonso Valencia)	CNIO	ES
6	Council for National Research (Dr. Giuseppe Martini)	CNR	IT
7	Center for Advanced Studies, Research and Development in Sardinia (Prof. Anna Tramontano)	CRS4	IT
8	CSC – Scientific Computing Ltd, Finnish Supercomputing Centre (Dr. Tommi Nyrönen)	CSC	FI
9	German Research Foundation (Dr. Nikolai Raffler)	DFG	DE
10	Danish Technical University (Prof. Søren Brunak)	DTU	DK
11	Erasmus Medical Centre (Prof. Johan van der Lei)	EMC	NL
12	Institute of Enzymology (Prof. Laszlo Patthy)	ENZIM	HU
13	Genome Espana (Dr José Luis Jorcano)	GE	ES
14	Forschungszentrum Fuer Umwelt und Gesundheit GmbH (Prof. Hans-Werner Mewes)	GSF	DE
15	National Institute for Research in Computer Science & Control (Hugues Leroy)	INRIA	FR
16	Linköping University (Prof. Bengt Persson)	LiU	SE

Participants & Contacts 2



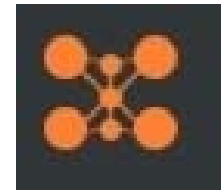
	Participant organisation name (& point of contact)	Short name	CC
17	Ministry Of Science & Technology (Dr. Mahmoud Taya)	MOST	IL
18	Medical Research Council (Dr. Mark Palmer)	MRC	UK
19	Natural Environment Research Council (Dr. Sarah Collinge)	NERC	UK
20	Netherlands Organisation for Scientific Research (Dr. Crétien Herben)	NWO	NL
21	The Icelandic Centre for Research (Dr. Rebekka Valsdóttir)	RANNIS	IC
22	Radboud University Nijmegen (Prof. Gert Vriend)	RU	NL
23	Wellcome Trust Sanger Institute – (Dr. Tim Hubbard)	SANGER	UK
24	Sardegna Ricerche (Dr. Luca Contini)	Sardegna Ricerche	IT
25	Swiss Institute of Bioinformatics (Prof. Amos Bairoch)	SIB	CH
26	Syngenta Ltd (Dr. Mark Forster)	Syngenta	UK
27	Technical University of Braunschweig (Prof. Dietmar Schomburg)	TU-BS	DE
28	University of Bordeaux 2 (Prof. Antoine de Daruvar)	UB2	FR
29	Swedish Research Council (Prof. Bengt Persson)	VR	SE
30	Wellcome Trust (Dr. Deborah Colson/Dr Alan Schafer)	Wellcome Trust	UK
31	Institut National de la Recherche Agronomique (Dr Christine Gaspin)	INRA	FR
32	Institut National de la Santé Et de la Recherché Médicale (Prof. Jean-Louis Coatrieux)	INSERM	FR

ELIXIR preparatory phase



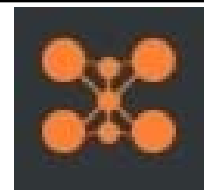
- 1. Mobilisation and planning**, November 2007.
- 2. Committee and recommendations phase** (lasting 18 months), Jan 2008
 - Hold stakeholder meetings
 - Establish working committees to write reports
 - Present the reports at an open stakeholders meeting for wider discussion
 - Define ELIXIR**
- 3. Documentation and negotiation phase** (lasting 18 months). July 2009
 - Consolidate reports into a proposal to be sent to all the member states and funding agencies with a draft Memorandum of Understanding by month 26.
 - Define how or which parts will be funded by whom**
 - Reach agreement after 38 months, so that “construction” can start

ELIXIR Work Packages.



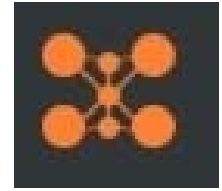
Elixir is organised into 14 work packages which have committees of (mainly) European experts associated with them. It is organising two surveys, one of users and one of data-providers, and five technical-feasibility studies. The Elixir Steering Committee is associated with WP1 and has oversight of the whole project. WP3 has four committees; for Bioinformatics Communities, for Data Providers, for Industry and for Interactions with the rest of the World (International). There will be regular Stakeholder meetings intended to encourage the widest possible participation.

1. Project management
2. Data providers
3. User communities
4. Organisation and Legal
5. Funding
6. Physical infrastructure
7. Data interoperability
8. Literature
9. Healthcare
10. Chemistry & Environment
11. Training
12. Tools integration
13. Feasibility studies
14. Reporting and negotiation



3. Where did ELIXIR come from?

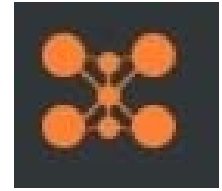
2000: The Lisbon Strategy of the EU



An action and development plan

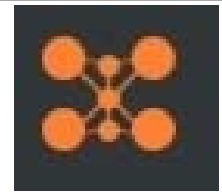
- to make the EU the most dynamic and competitive knowledge-based economy in the world
- capable of sustainable economic growth
- more and better jobs
- greater social cohesion
- respect for the environment
- by 2010
- will be achieved through the formulation of various policy initiatives to be taken by all EU member states

The European Research Area (ERA).



The EU created a unified area all across Europe (2000), the purpose of which it to

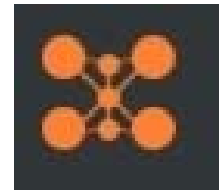
- Enable researchers to move and interact seamlessly
- Benefit from world-class infrastructures
- Work with excellent networks of research institutions
- Share, teach, value and use knowledge effectively for social, business and policy purposes;
- Optimise, open and co-ordinate national and regional research programmes to address major challenges
- Develop strong links with partners around the world
- **Construction of the ERA is the purpose of FP6 & FP7**



The European Strategy Forum on Research Infrastructures

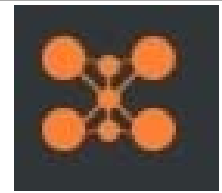
- Created by the Commission in February 2002
- Adopted by the Competitiveness Council in April 2002
- Representatives of EU Member States, Associated States, and one representative of the European Commission.
- Chairman: Prof Carlo Rizzuto (Sincrotrone Trieste S.c.p.A.- ELETTRA, IT)
- To support a coherent approach to policy-making on research infrastructures in Europe
- To act as an incubator for international negotiations about concrete initiatives

Why is ESFRI Important?



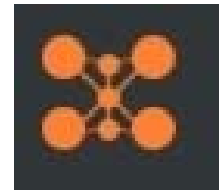
1. The European Commission asked ESFRI to compile a List of Opportunities in order to assist the Commission in the preparation of its proposal for the **Seventh Framework Programme** (FP7).
2. The Council of the European Union mandated ESFRI to create a **European Research Infrastructures Roadmap**

What did ESFRI do?



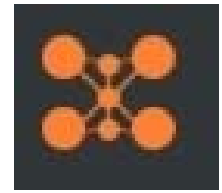
- Set up Roadmap Working Groups to analyse topical issues (Summer 2005)
- Defined and agreed criteria for preparation of The Roadmap
- Identified Expert Groups in thematic fields (2005-2006)
- Received RWG reports & created The Research Infrastructures Roadmap (March 2006)
- Roadmap checked by a 'Review Group'
- Roadmap approved at ESFRI meeting held 28-29 September 2006

European Roadmap for Research Infrastructures.



- 35 'mature' projects for new large scale Research Infrastructures
- Based on an international peer review process
- Covers all scientific areas, regardless of possible location
- Likely to be realized in the next 10 to 20 years
- Supported by a relevant European partnership or intergovernmental research organisation.
- Impact on science and technology development at international level
- Support new ways of doing science in Europe
- Contribute to the enhancement of the European Research Area

Roadmap projects summary.

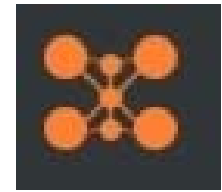


- 6 Social Science & Humanities
- 8 Environmental Sciences
- 3 Energy
- 6 Biomedical and Life Sciences
- 7 Material Sciences
- 5 Astronomy, Astro-, Nuclear and Particle Physics
- 1 Computer and Data Treatment (*transverse*)

<http://cordis.europa.eu/esfri/>

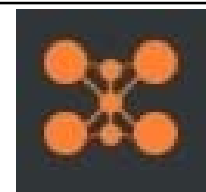


Social Science & Humanities



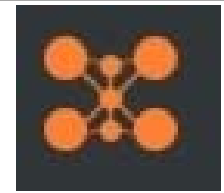
CESSDA	Council of European Social Science Data Archives	30	6	2008	www.nsd.uib.no/cessda
CLARIN	Common Language Resources and technology Initiative	108	10	2008	www.mpi.nl/clarin
DARIAH	DigitAl Research Infrastructure for the Arts and Humanities	10	4	2008	www.dariah.eu
EROHS	European Resource Observatory for the Humanities and Social sciences	43	12	2008	www.erohs.org
ESS	The European Social Survey	9	9	2007	www.europeansocialsurvey.org
SHARE	Survey of Health, Ageing and Retirement in Europe	50	1	2007	www.share-project.org
		250	42		

Environmental Sciences



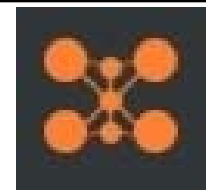
AURORA BOREALIS	European Polar Research Icebreaker	360	18	2010	www.europolar.org
EMSO	European Multidisciplinary Seafloor Observation	150	20	2011	www.ifremer.fr/esonet/emso
EUFAR	EUropean Fleet of Airborne Research	75	3	2007	www.eufar.net
EURO ARGO	Global Ocean Observing in Infrastructure	76	6	2010	www.coriolis.eu.org
IAGOS	In-service Aircraft for a Global Observing System	20	6	2008	www.fz-juelich.de/icg/icg-ii/iagos
ICOS	Integrated Carbon Observation System	255	13	2010	www.carboeurope.org
LIFE WATCH	Research Infrastructures Network for Research in Biodiversity	370	70	2014	www.lifewatch.eu/
		1306	136		

Energy



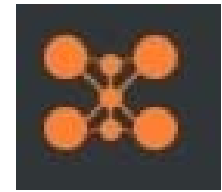
HiPER	High Power Experimental Research Facility	850	80	2015	www.hiper-laser.org
IFMIF	International Fusion Materials Irradiation facility	855	80	2017	www.dapnia.cea.fr
JHR	Jules Horowitz Reactor	500	30	2014	www.cadarache.cea.fr
		2205	190		

Biomedical and Life Sciences



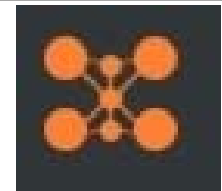
EATRIS	The European Advanced Translational Research Infrastructure in Medicine	255	50	2010	http://www.eatris.eu/
DBBRI	European Biobanking And Biomolecular Resources	170	15	2009	www.biobanks.eu
INFRAFRONTIER	Infrastructure for Phenomefrontier and Archivefrontier	320	36	2007	www.emma.rm.cnr.it
ECRIN	Infrastructures For Clinical Trials And Biotherapy	36	5	2007	www.ecrin.org
INSTRUCT	Integrated Structural Biology Infrastructure	300	25	2007	www.strubi.ox.ac.uk
ELIXIR	Upgrade to European Bioinformatics Infrastructure	550	7	2007	www.ebi.ac.uk
		1631	138		

Material Sciences



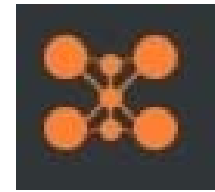
ELI	Extreme Light Infrastructure	150	6	2013	www.extreme-light-infrastructure.eu
ESRF	European Synchrotron Radiation Facility	230	NA	2007	www.esrf.eu
ESS	European Spallation Source for Producing Neutrons	1050	80	2017	http://neutron.neutron-eu.net/n_ess
XFEL	X-ray Free Electron Laser	986	84	2013	http://xfel.desy.de
ILL	Institute Laue Langevin 20/20 Upgrade	160	NA	2012	www.ill.fr/Perspectives
IRUVX-FEL	Infrared to Ultraviolet and soft X-rays Free Electron Lasers	760	70	2006	www.iruvx.eu
PRINS	Paneuropean Research Infrastructures for Nano-Structures	1110	256	2008	www.eniac.eu/web/about/PRINS.php
		4446	326		

Physics



ELT	European Extremely Large Telescope	850	40	2018	www.eso.org/projects/e-elt
FAIR	Facility for Antiproton and Ion Research	1186	120	2014	www.gsi.de/fair/index_e.html
KM 3NeT	Cubic Kilometre Neutrino Telescope	235	NYD	2015	www.km3net.org
SKA	Square Kilometre Array	1150	100	2014	www.skatelescope.org
SPIRAL2	Système de Production d'Ions RAdioactifs en Ligne	137	7	2011	www.ganil.fr/research/developments/spiral2
		3558	107		

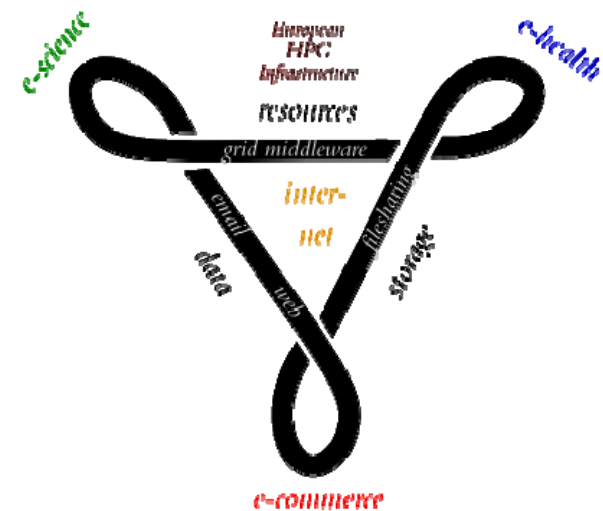
Computing and Data Treatment



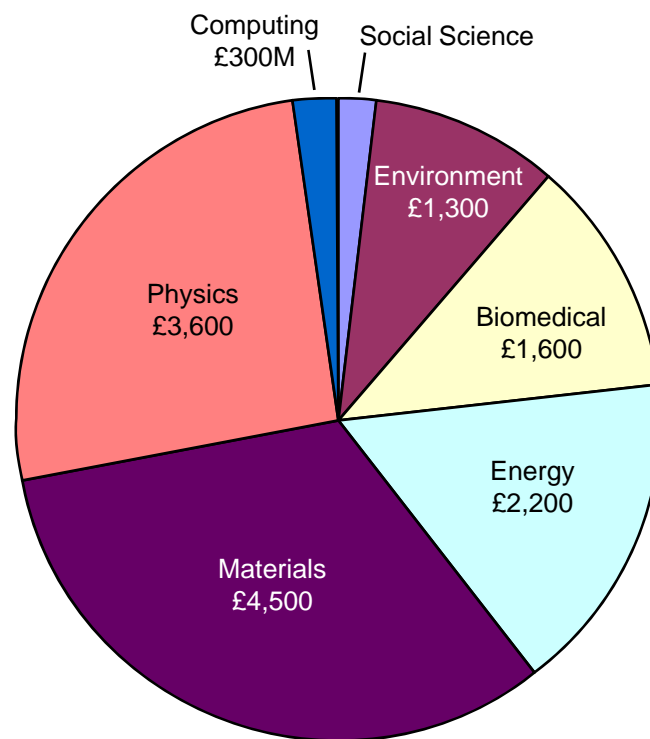
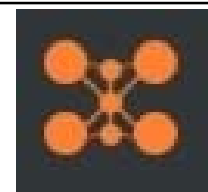
EU-HPC	EUROPEAN HIGH-PERFORMANCE COMPUTING SERVICE	300	150	2008	www.hpcineuropetaskforce.eu
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Life-sciences part of the Science Case Includes

- Systems biology
- Chromatin dynamics
- Large scale protein dynamics
- Protein association and aggregation
- Supra-molecular systems
- Medicine (& bioinformatics!)

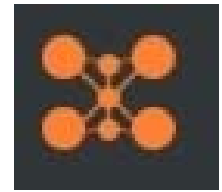


Cost of 35 Mature ESFRI RI Projects



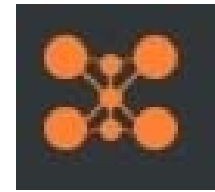
Total Capital Cost = €13,696 Million

But...



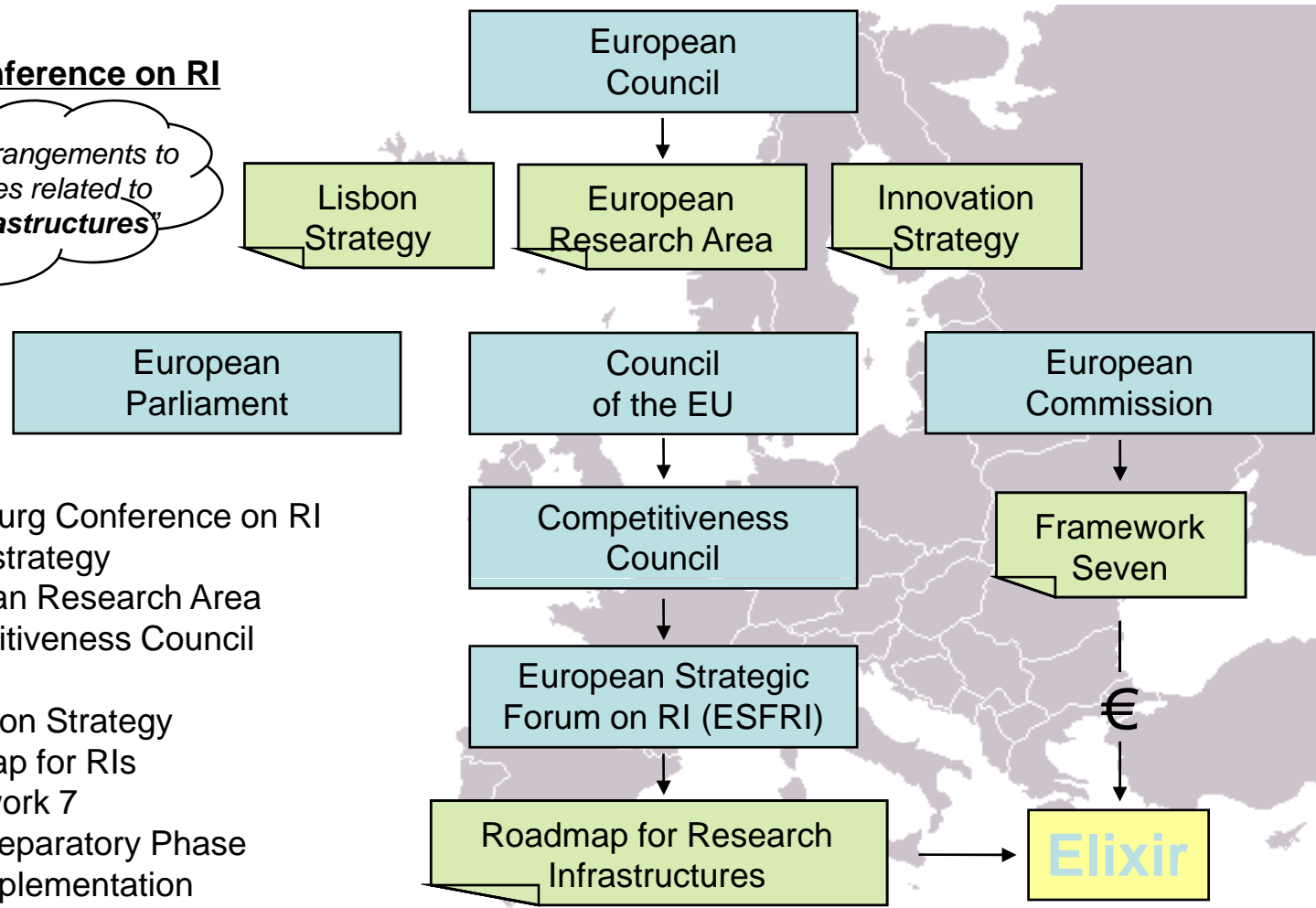
- The commission needed €14 Billion to fund the RIs
- Which the member states refused to provide it
- So, the commission created the preparatory phase projects
- The purpose of which are to create the consortia to fund the construction of the RIs

Where did Elixir come from?



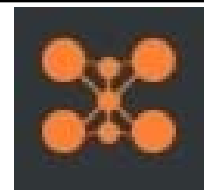
Strasbourg Conference on RI

“...need new arrangements to support policies related to **research infrastructures**”



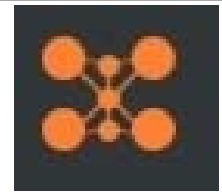
Timeline

- 2000 Strasbourg Conference on RI
- 2000 Lisbon strategy
- 2000 European Research Area
- 2002 Competitiveness Council
- 2002 ESFRI
- 2006 Innovation Strategy
- 2006 Roadmap for RIs
- 2007 Framework 7
- 2008 Elixir Preparatory Phase
- 2011 Elixir Implementation



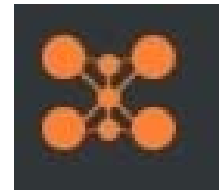
4. What might ELIXIR be?

What might Elixir be?



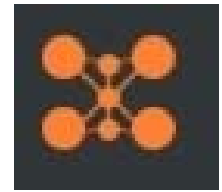
- A reliable ***distributed*** infrastructure to provide equality of access to biological information across all of Europe
- Sustainable funding for the ***core*** European biological data collections (genomes, sequences, structures etc)
- Sustainable funding for the ***global*** biological data collaborations (UniProt, ww-PDB, INSDC etc)
- Processes for
 - developing ***new*** core data collections
 - supporting ***interoperability*** of bioinformatics tools
 - developing bioinformatics ***standards*** and ***ontologies***
- ***Enhanced*** use of biological information in Academic Research, the Pharmaceutical Industry, Biotechnology, Agriculture and for the Protection of the Environment

A Reliable Distributed Infrastructure



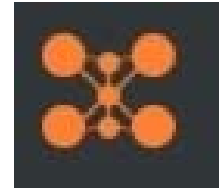
- Elixir will be constructed by enhancing and linking existing infrastructures in the member states.
- It will integrate member state infrastructures into a single infrastructure or a 'Grid'.
- Each member-state will
 - Identify and catalogue its requirements
 - Identify funding agencies that are prepared to fund bioinformatics
 - Identify projects and organisations that could become part of Elixir
 - Include funding for Elixir in its National Research Infrastructure Plan
 - Where appropriate, identify structural funds that can be used for Elixir
 - Once it is constituted, join the Elixir Organisation

Core data collections at EMBL-EBI



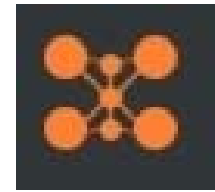
1. **European-PDB** — the European partner in the wwPDB Macromolecular Structures Database.
2. **UniProt** — the world's definitive collection of protein sequence data.
3. **EMBL-Bank** — the European instance of the global archive of nucleotide sequence data.
4. **Ensembl** — a world leader in the provision of annotated eukaryotic genomes.
5. **ArrayExpress** — a major public repository for microarray data.
6. **InterPro** — a database of protein families, domains and functional sites which aggregates such information from a large number of collaborators.

Attributes of core data collections



- Universally relevant to biology and medicine
- Journals insist on data deposition as a condition for publication
- Very, very large user communities
- Aim to be complete collections with Global significance
- Exchange with other data centres ensures completeness
- Science is stable enough to allow standardisation of data structures
- Host institute needs to be involved in standards development
- Support requires substantial institutional commitment

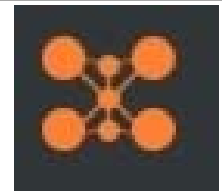
International Collaborations: wwPDB



- World-Wide Protein Data Bank
- Global archive of protein and other macromolecular structures
- In existence for nearly 40 years, currently a collaboration between
 1. EMLB-EBI: European-PDB (Molecular Structures Database)
 2. RCSB PDB: Protein Data Bank of the Research Collaboratory for Structural Bioinformatics (A consortium of US Universities)
 3. PDBj: Protein Data Bank Japan
 4. BMRB: Biological Magnetic Resonance Data Bank (University of Wisconsin-Madison)



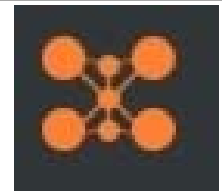
International Collaborations: UniProt



- UniProt
- A collaborations lasting many years between
 1. trEMBL: Translated EMBL at EMBL-EBI
 2. PIR: Protein Information Resource at Georgetown University Medical Centre
 3. SWISSPROT: Swiss Institute of Bioinformatics



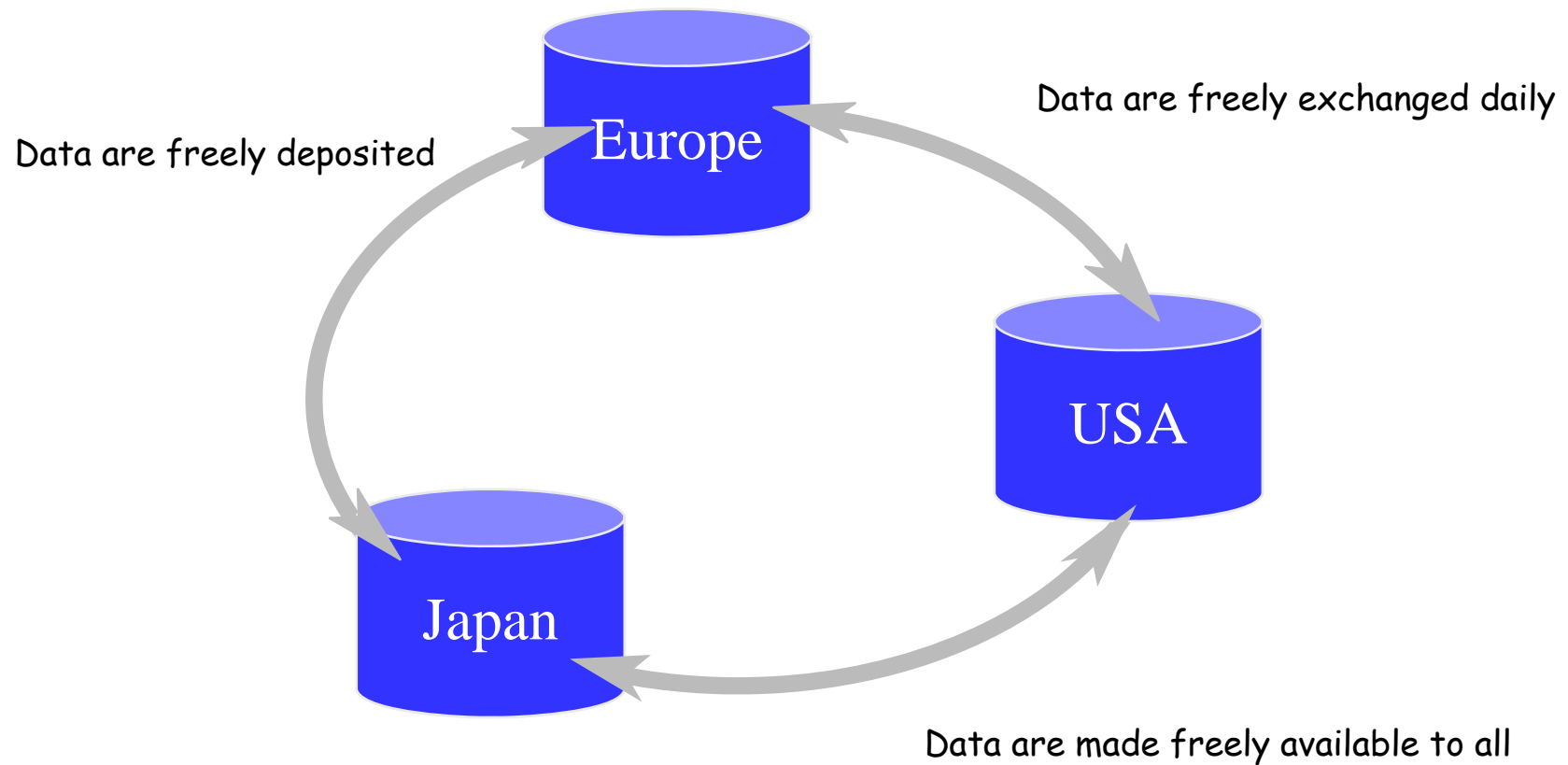
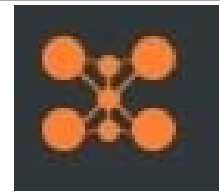
International Collaborations: INSD



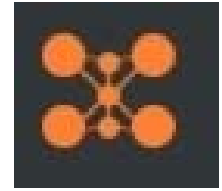
- **I**nternational **N**ucleotide **S**equence **D**atabase
- The worlds archive of Nucleic Acid Sequence Data
- A collaboration lasting nearly 20 years between:
 1. DDBJ: DNA Data Bank of Japan
 2. EMBL-Bank: Nucleotide sequence database of the EMBL-EBI
 3. NCBI GenBank: National Centre for Biotechnology Information USA



Global context

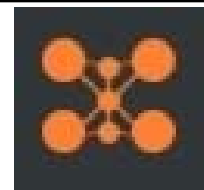


Is Elixir technically feasible?



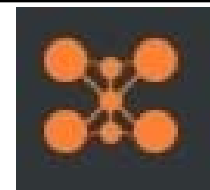
Elixir does not depend for its success on any technology that has not been developed yet. However, it will be providing solutions to very demanding data management problems presented by things such as the 1000-genome project, the great increase in imaging of biological systems and the impending scale-up of structural and systems biology. We are thus conducting five technical feasibility studies that support the more challenging aspects of Elixir. More information on these studies is available from the Elixir Web Site.

1. Strategic Review of Cell Phenotype Image Data Resources.
2. Pilot of the use of European Supercomputing facilities for distributed processing of Bioinformatics data.
3. Assessment of European Resources for Systems Biology.
4. Search across heterogeneous distributed data resources (EB-eye).
5. Safe and ethical use of personal genetic information (European Genotype Archive).

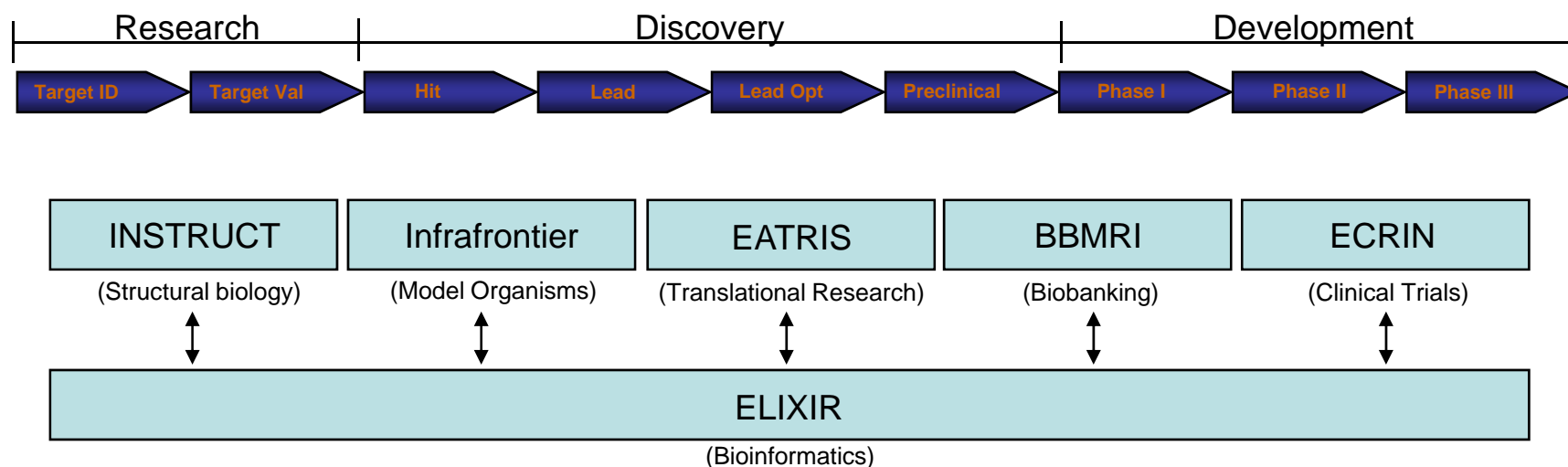


5. How does ELIXIR relate to other projects?

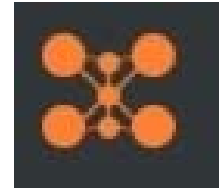
ESFRI Biology RI proposals.



INSTRUCT	Integrated Structural Biology Infrastructure	300	25	2007	www.strubi.ox.ac.uk
Infrafrontier	Infrastructure for Phenomefrontier and Archivefrontier	320	36	2007	www.emma.rm.cnr.it
EATRIS	The European Advanced Translational Research Infrastructure	255	50	2010	http://www.eatris.eu/
BBMRI	European Biobanking And Biomolecular Resources	170	15	2009	www.biobanks.eu
ECRIN	Infrastructures For Clinical Trials And Biotherapy	36	5	2007	www.ecrin.org
ELIXIR	Upgrade Of European Bioinformatics Infrastructure	550	7	2007	www.ebi.ac.uk
		1631	138		



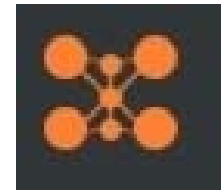
INSTRUCT



Integrated Structural Biology Infrastructure

- To set up a distributed framework of centres, each of which will maintain a set of core technologies.
- These will include protein production, NMR, crystallography and different forms of microscopy, including electron microscopy.
- The centres will have a specific biological focus that will drive the development of technological and methodological expertise.
- A key goal will be the analysis of functional complexes.
- INSTRUCT is necessary because of the escalating cost of the core technologies.
- The long-term vision for INSTRUCT is to combine integrated structural biology with cell biology to create 3D cellular structural biology.

INFRAFRONTIER



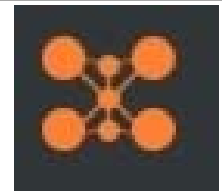
The European infrastructure for phenotyping and archiving of model mammalian genomes.

Phenomefrontier

- To provide a European platform offering access to comprehensive systemic phenotyping; several disease areas at every laboratory.
- To include the latest *in vivo* imaging techniques and non-invasive methods.
- Informatics tools to handle the phenotype data.

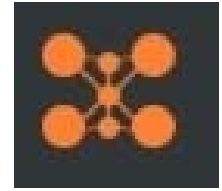
Archivefrontier

- Archiving and distribution of mouse models under highest quality standards.
- Mouse production from ES cells and access to the strain data database.
- Increase mouse mutants archived from hundreds to thousands per year.
- Upgrade to European Mouse Mutant Archive (EMMA).



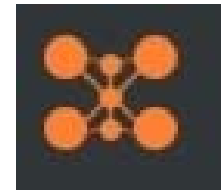
The European Advanced Translation Research Infrastructure in Medicine

- A network of biomedical centres across Europe.
- Efficient national coordination and integration of existing facilities.
- Responsive to national or regional demands.
- Initial focus on Cancer, Cardiovascular Disease, Brain Disorders, Metabolic Syndrome and Infectious Diseases.
- Key components will be: Animal facilities, Small molecule screening facilities, Imaging facilities, Patient and population cohort access ports, Bioprocess and GMP-facilities Facilities for Clinical Phase I studies.



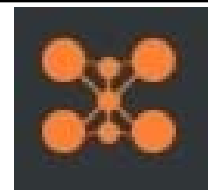
Biobanking and Biomolecular Resources Research Infrastructure

- A Europe-wide infrastructure for data and sample exchange that will provide broad and unified access to samples and data.
- A common set of standards and harmonisation guidelines in sample preservation and analysis, which reflects the state-of-the-art in the field.
- Establishment of an open-source database structure that can guarantee data quality while protecting donors' privacy
- Parallel access to common, validated reference material, genomic and population-genetic data and molecular resources that are too expensive to be created by individual institutions
- Improved reliability and reduced ambiguity in comparing and interpreting results.
- Improved statistical power permitting the investigation of rare diseases and common but highly diverse diseases, such as cancer.



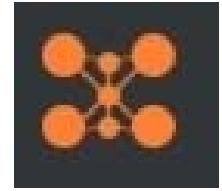
The European Clinical Research Infrastructures Network

- Integrating national clinical research facilities into a pan-European infrastructure.
- Support of multinational clinical research in any medical field, and for any category of clinical research for clinical trials and biotherapy.
- Integrated ‘one-stop shop’ services to investigators and sponsors in multinational studies, with the local contribution of staff embedded in each national coordination
- To include patient recruitment and investigation, data management, GMP manufacturing of biotherapy products, quality assurance, monitoring, ethics, regulation and adverse event reporting.
- Consulting will be provided to investigators and sponsors upstream of the study covering regulation, ethics, centre selection, cost, funding and insurance.
- Particularly relevant for academic clinical research, research on rare diseases, neglected diseases, and for clinical trials sponsored by biotechnology, small drug, and device companies



6. How can I get involved in ELIXIR?

ELIXIR



- In association with colleagues, identify and clearly enunciate
 - (i) your country's **needs** for bioinformatics infrastructure
 - (ii) how your country might best **contribute** to ELIXIR
 - (iii) **synergies** between ELIXIR and other European projects, particularly the other ESFRI BMS Research Infrastructures.
- Establish contact with those in your Government responsible for funding Research Infrastructures and **lobby** them on behalf of ELIXIR.
- Where appropriate, identify projects that could be supported with **Structural Funds** and communicate these to the decision makers.
- Organise a **local** Bioinformatics Communities meeting in your country under the auspices of WP3.
- Where useful, arrange a **visit** by Prof. Thornton (ELIXIR Coordinator) to meet senior scientists and senior member of funding agencies.
- Stay in touch with the ELIXIR team and **contribute** to the ELIXIR Wiki.