



ISBE Infrastructure
for Systems Biology
Europe

ISBE

Infrastructure for Systems Biology - Europe

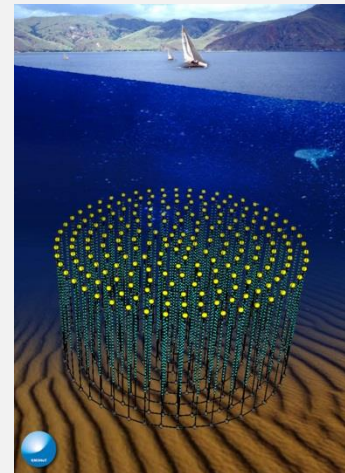
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- **European infrastructure**
 - *expensive equipment, facilities, expertise*
 - *e.g. high energy physics (LHC) and astronomy (KM3)*

- **the life sciences are changing**
 - *expertise and facilities become expensive*
 - *not broadly available*
 - *EC opens **ESFRI** for the life sciences*

- **this presentation**
 - *building a life sciences infrastructure: systems biology*
 - *involve life scientists in and outside SB field*
 - *get feedback and advice*





European research infrastructures

ESFRI in control

- **ESFRI: European Strategy Forum on Research Infrastructures**
 - *develop effective European research infrastructures*
 - *tens of RIs in all sciences*
 - *EC is driver*

- **research infrastructure**
 - *provide facilities, services and expertise*
 - *enable high quality and cost-effective research*
 - *NOT research networks...!*

- **twelve ESFRIs in the life sciences**
 - *in preparation or running*
 - *e.g. ELIXIR, Euro-BioImaging, BBMRI*
 - *new: Infrastructure for Systems Biology – Europe (ISBE)*





ISBE

Infrastructure of Systems Biology - Europe

- **what**
 - *Europe-wide easy access to systems biology expertise*
 - *advise, facilities , services*

- **why**
 - *model-driven analysis of complex biological systems*
 - *cf. the other sciences*
 - *health, biotech, bio-economy, sustainability*
 - *SB expertise not widely available*

- **for whom**
 - *academia, industry*
 - *funders*
 - *publishers, policy makers, patient organisations, etc.*



building infrastructures takes time

ISBE: 2008 - 2018

■ six-steps in ten-years

• *step #1*

- initiative of group of 23 life scientists from 12 countries (2008)
- in NL: Hans Westerhoff, Vitor Martins dos Santos, Frans van Nieuwpoort, Martijn Moné, Garry Corthals, RvD
- coordinator: Richard Kitney (Imperial College, London)

• *step #2*

- application to ESFRI (2010) → on ESFRI Road Map (2011)

• *step #3*

- FP7 grant for Preparatory Phase (2012 – 2015)
- comprehensive ISBE business plan
- deadline August 2015

• *step #4*

- approval ESFRI (2016)
- funding (primarily) by member states

• *step #5 and #6*

- building phase (2016 – 2017) → running phase (2018 – 2019)



building ISBE: broad range of issues

- **core infrastructure**
 - *overall Infrastructure, eligibility and accessibility*
 - *expertise and services*
 - *model and data management*
 - *standardisation*

- **training and education**

- **governance, finance and legal (BBSRC, NWO/ZonMW)**

- **mapping the science landscape**
 - *community building*
 - *user needs: industry and academia*
 - *innovation, impact and exploitation*
 - *synergise with other research infrastructures in the life sciences*



ISBE users and services

- **ISBE users**
 - *academia, industry*
 - *medical field: clinicians, etc.*
 - *funders*
 - *others: publishers, policy makers, patient organisations, etc.*

- **user-driven services**
 - *consultancy, support*
 - *model building*

- **community-driven services**
 - *stewardship: enable re-use of data, maps, models, tools*
 - *develop community standards*
 - *education and training*



ISBE is an infrastructure, not a network

■ infrastructure

- ***Webster's dictionary***
 - basic equipment and structures that are needed for an organisation to function properly
- ***research context***
 - enable research projects carried out by others
 - offer expertise, data, etc. to do research

■ research network

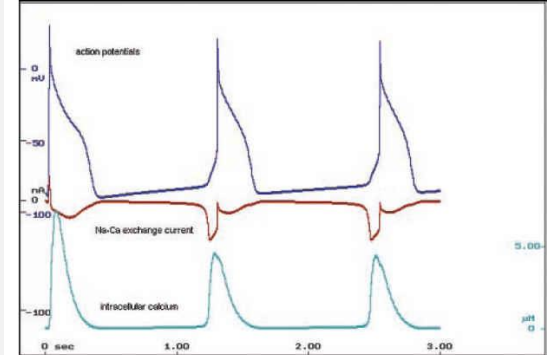
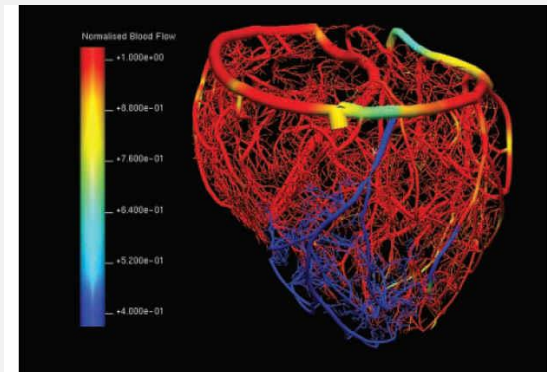
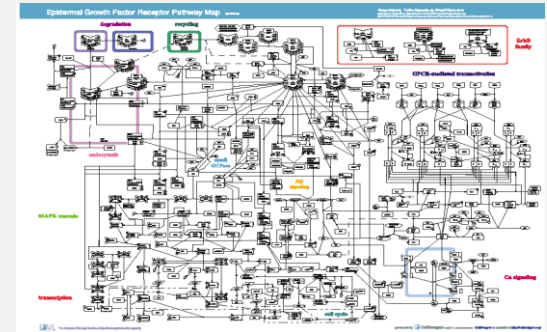
- ***Webster's dictionary***
 - group of people that are closely connected and do research together
- ***research context***
 - carry out goal-oriented research projects
 - use expertise, data, etc. to do research



ISBE

core infrastructure

- **National Systems Biology Centres (SBCs)**
 - *tightly linked to relevant expertise*
 - *often distributed*
- **matrix of interconnected SBCs and central office**
 - *synergistic and complementary expertise*
 - *coordinated community services*
 - *small central office*
- **what expertise will be offered...?**

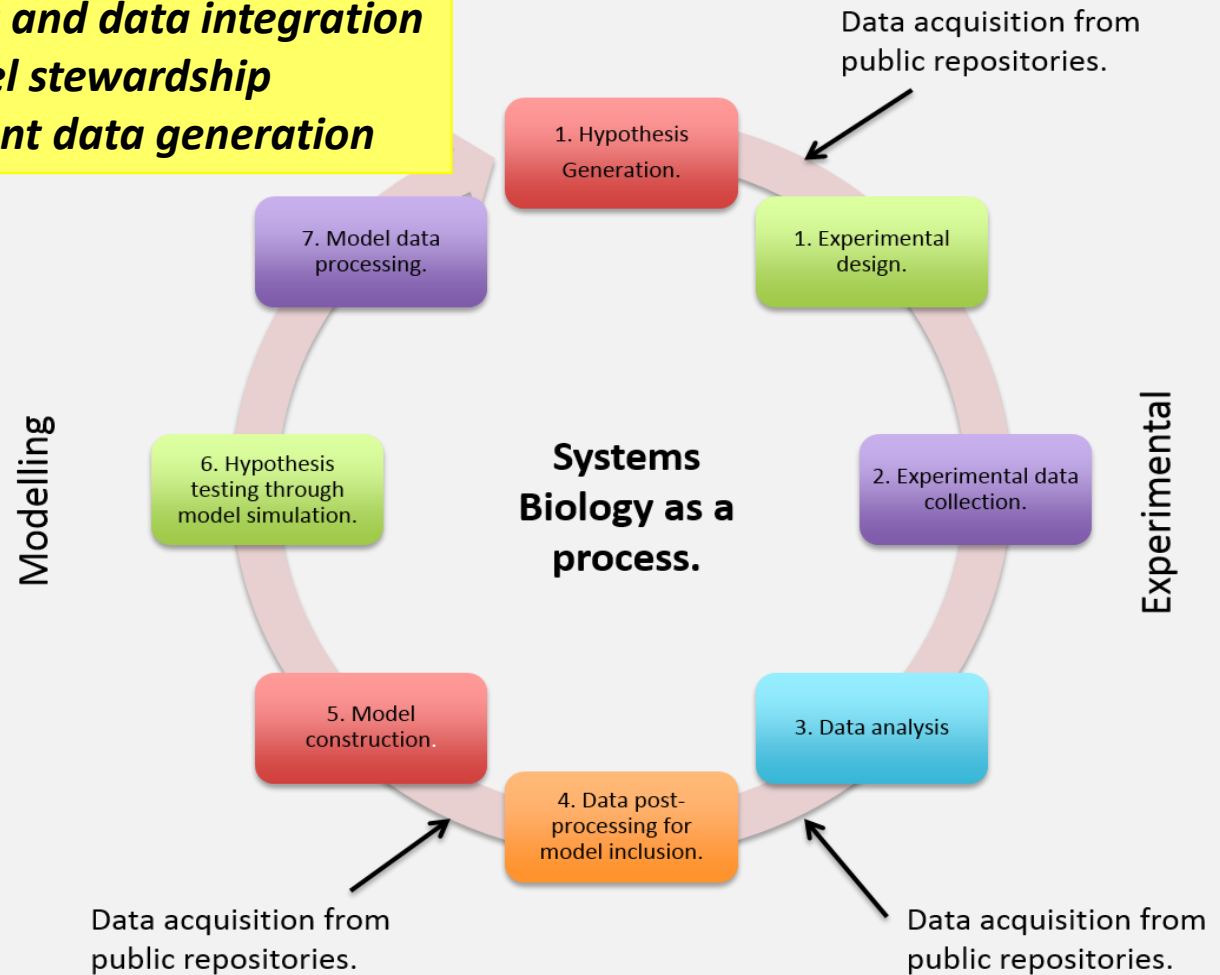




ISBE the research process

three fields of expertise

- *model building and data integration*
- *data and model stewardship*
- *model-compliant data generation*





SBC expertise: modelling and integration

user-driven and community-driven

- **modelling**
 - *diverse approaches, wide range of biological systems and application frameworks*
 - *molecular up to physiological level*
 - *link biological systems to theory and models*
 - *parameter estimation, sensitivity and uncertainty analysis, identifiability, etc.*
- **planning**
 - *experimental design vis-à-vis modelling strategy*
- **workflows**
 - *data acquisition – modelling – simulations – validation*
- **integration**
 - *integrate diverse experimental/literature data and theory*
- **standardisation**
 - *experiments, data, models, maps, tools*
 - *re-usable and linkable*



SBC expertise: stewardship *user-driven and community-driven*

- **preservation and migration**
 - *SB-related data, models and maps*
 - *transform existing data to formats that can be used in systems biology projects*
 - *established dedicated archives and repositories*
- **linking data to models**
 - *data, SOPs and experimental descriptions, tools, models*
- **standardisation**
 - *community standards and formats for exchange of data and models*
 - *interoperability, harmonisation, curation, re-use*
 - *make adoption of standards and compliance easy*
- **develop**
 - *formats, ontologies, minimum information checklists*
- **curation**
 - *experimental protocols, data, models, maps, tools*



SBC expertise: data generation

- **user-driven data acquisition**
 - *data fit for integration and modelling*
 - *careful planning: experimental design*
 - *standardisation: data acquisition and reporting protocols*

- **associate with existing national data generation infrastructure**
 - *many countries have invested in data generation centres*
 - *omics, imaging, etc.*



ISBE and ELIXIR: different and synergistic

■ ISBE

- infrastructure to enable European life scientists to tackle complex biological problems from a systems perspective
- offer multidisciplinary research expertise, modelling facilities and repositories of system data, models and maps that can be re-used and that are essential for systems biology research
- establish a pan-European web of interconnected expertise centres
 - modelling and experimental design
 - acquisition of data fit for modelling
 - stewardship of models, maps, tools and systems biology-specific data
- offer training in the analysis of biological systems and in converting information into system understanding

■ ELIXIR

- infrastructure to orchestrate in Europe the collection, quality control and archiving of large amounts of data produced by life science experiments
- make biological data easily accessible via a central hub and local nodes
- build bioinformatics capacity by establishing a robust, sustainable and distributed infrastructure of throughout Europe
- establish a scalable, distributed compute infrastructure to cope with the exponential growth of data
- offer training of data management and bioinformatics for life science data



ISBE: user access

- **single web-based entry point**
- **simple procedure**
 - ***short description of support needed***
 - *user is linked to most relevant Systems Biology Centre (SBC)*
 - *default: national SBC*
 - ***consultancy***
 - *one-to-one contact*
 - ***support***
 - *feasibility and quality check*
 - *agree on ISBE Project Plan: science, partners, finance, IP and other formal issues*
 - *align with judgement of funders*
 - ***start***



governance and finance

- **possible governance models**
 - *loose network of national SBCs*
 - *combination of EU-level and national activities*
 - *ISBE as a European legal entity*
 - ERIC format: European Research Infrastructure Consortium

- **financing ESFRI infrastructures**
 - *national funding*
 - *fee for services*
 - academia (e.g. via project grants of users)
 - industry
 - *European funding*
 - *other...*

teaming-up of research infrastructures



- **12 ESFRI life sciences research infrastructures**
 - ***essential: teaming up of the 12 RIs in life sciences***
 - research often involves combinations of expertise
 - ***INFRADEV-4 call: thematic harmonisation of RIs***
 - ***towards a federation of ESFRI RIs in health and biotech***
 - build on FP7 programme BioMedBridges
 - harmonised access procedures
 - shared services
 - integrated training programmes
 - ***EC deadline September 2, 2014***