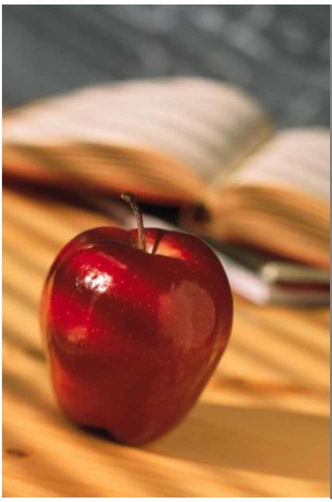
ERASysBio ERA-NET for Systems Biology

BBSRC bioscience for the future



Towards European Standards in PhD Training in Systems Biology

Outcomes of the ERASysBio Workshop
7th March 2009, Alpbach, Austria

Under the auspices of FEBSSysBio2009

Organisers and sponsors

The workshop was organised by the Biotechnology and Biological Sciences Research Council (BBSRC) in the United Kingdom. The event was kindly sponsored by the ERA-NET for Systems Biology - ERASysBio - and BBSRC.

Acknowledgements

We wish to thank Hans Westerhoff, Karl Kuchler and all members of the FEBSSysBio2009 team for their kind hospitality, tremendous support and generosity, both in the run up to the event and at the Congress Centrum Alpbach. We also thank Adam Webb for his invaluable support at the event and for his contribution to the content of this paper. Finally, we are grateful to all our participants, for their contribution, and for their enthusiasm and commitment to the training of systems biologists.

BBSRC in collaboration with ZonMw, 2009

Towards European Standards for PhD Training in Systems Biology

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Introduction

Interdisciplinary scientists are in demand and a new approach to education is needed at all levels. Developing new strategies to interdisciplinary training is vitally important in preparing the next generation of scientists seeking to apply systems approaches to biological research. The inadequacy of the standard ways of teaching to embrace the variety of scientific disciplines involved in systems biology urges the community to take action and to consider practical and economically viable solutions for our European universities. Publicly-funded institutions are at present the best placed to host the breadth of disciplines needed to develop systems biology. These institutions, together with funding agencies and learned societies, have an active role to play.

The workshop was focused on one of the key steps in the training of systems biologists: the PhD curriculum. It represented a first step into exploring the key elements that will bring the European diversity of PhD curricula up to speed and generate the potential for a standard curriculum agreed by all interested parties. The workshop was an initiative of ERASysBio[1] as an action arising from its strategic paper 'Systems Biology in the European Research Area' - www.erasysbio.net – in the topic 'optimising the education and training in systems biology in the European Research Area'. The workshop programme is at Annex 1.

ERASysBio believes that the future of systems biology in the ERA is the responsibility of all - scientific community, academic institutions, industry, funding organisations - and is committed to encourage all to get involved and work together. This workshop was held under the auspices of FEBSSysBio2009, the advanced lecture course of the Federation of the European Biochemical Societies. FEBSSysBio is now established as a reference for the training of early career scientists in systems biology. FEBSSysBio also provides the optimal conditions for the networking of early career scientists, systems biology experts, and funding organisations. The workshop was a collaborative effort of FEBSSysBio2009 and ERASysBio, and attracted the participation of a wide spectrum of expertises and nationalities; their names and affiliations are detailed in Annex 2. This paper provides a summary of the discussions held at the workshop; the active participation of all involved made this a very fruitful event. The outcomes are the result of everyone's ideas and the great consensus that was reached in the discussions.

As a general outcome, it was agreed that the existing structures within the European research community offer an excellent opportunity to develop a common, structured, modular model of

[1] ERASysBio is a transnational funding initiative that brings together 16 ministries and funding agencies from 13 countries in the European Research Area (ERA) to coordinate their national research programmes and agree on a common European agenda. The ERASysBio partners are: Austria - Federal Ministry for Education, Science and Culture (BMWF); Belgium - National Fund for Scientific Research (FNRS); Finland - Academy of Finland (AKA); France - French National Centre for Scientific Research (CNRS) and Agence Nationale de la Recherche (ANR); Germany - Forschungszentrum Juelich GmbH (FZJ) and Federal Ministry of Education and Research (BMBF); Israel - Israeli Science Foundation (ISF); The Netherlands - Netherlands Organisation for Scientific Research (NWO) and Netherlands Council for Health and Development (ZonMw); Norway - The Research Council of Norway (RCN); Russia - Russian Foundation for Basic Research (RFBR); Slovenia - Ministry of Higher Education, Science and Technology (MHEST); Spain - Ministry of Education and Science (MEC); Trento, Italy - Autonomous Province of Trento (PAT); United Kingdom - Biotechnology and Biological Sciences Research Council (BBSRC); Luxembourg and Switzerland are affiliated partners.

postgraduate training in systems biology for the benefit of the students and the academic institutions in the European Research Area.

The view of the experts

A selection of experts was invited to present their experience, describe the current training structures in their institutions, and bring their valuable perspective into the discussions. It is acknowledged that the list of experts invited to this workshop does not represent entirely the expertise available in Europe in systems biology masters and PhD programmes. For this reason, rather than concluding on specific actions, the workshop aimed at initiating the discussion with the community and identifying areas of consensus that can then be examined, tested and fostered widely.

The UK Doctoral Training Centres

In the UK, three doctoral training centres (DTCs) in systems biology were initiated with funding from the Engineering and Physical Sciences Research Council (EPSRC) and the Biotechnology and Biological Sciences Research Council (BBSRC). The DTCs at the Universities of Manchester and Warwick started in October 2006 while the DTC at the University of Oxford started in October 2007. Students at these centres undertake:

- a 4-year PhD course or equivalent where the first year allows time for exploration before deciding on a project;
- a challenging and original research project at PhD level;
- a formal, assessable programme of taught coursework (up to 25% of the time and broadly equivalent to a Masters in level and content) to develop technical interdisciplinary knowledge and broaden skills;
- other activities to develop breadth of knowledge plus transferable skills training including public engagement.

Most students enter the training having a BSc or MSc degree. However, the typical BSc and MSc curricula deliver biologists lacking training in mathematics and mathematicians with no training in biology. This obstacle is encountered in the UK and the Netherlands. The admission to the DTCs varies between selecting students very stringently to having no selection at all. It is recognised that the latter approach requires more training and effort by the trainers.

The DTC in Manchester aims for a wide spectrum of PhDs with the principles that: 1) not every student needs to know everything; 2) the courses are provided on border disciplines; 3) the twinning of dry and wet studies is a condition and allows group problem solving to be nurtured; 4) engagement of industry in teaching is essential.

At present, approximately 30 students enter the systems biology DTCs each year. According to Oxford and Manchester DTCs, this number is insufficient as the estimated demand per year is 100-150 students. Some clear indications of success of the DTCs in training are the production of highly motivated students, the experience in cross-discipline where students from hard sciences get involved in designing and making experiments and viceversa, the appreciation of the international community, and the interest from industry.

The common challenges being faced in the UK are the existing standards and rules in PhD training, an area where universities tend to be on the conservative side; and in getting the funding organisations to collaborate in supporting the training in the long-term.

All DTCs have an outreach programme and an international perspective, teaming up with PhD programmes in the continent, organising summer/winter schools (e.g. FEBSSysBio), attracting non-UK students, and exporting their philosophy and good practice in training systems biologists. The three key strengths of the UK training are in having postdoctoral scientists and staff becoming heavily involved and eager to help in the training; in having national governmental organisations (e.g. BBSRC) that fund PhD students, i.e. students receive an stipend; and in producing excellent science as a result of the training.

Participants discussed the large difference that exists between European countries both in the length as well as the legal status of the appointment of a PhD student. PhD students in UK obtain stipends and receive education, especially during their first year. National regulations require, however, that these stipends are only given to British students. In contrast, in the Netherlands, Austria and Germany, PhD students are employees and as such do not receive education.

MSc and PhD in Germany – training in Heidelberg

The Master programme in Systems Biology at the University of Heidelberg was presented as equivalent to the first year of PhD training. The Master in Systems Biology is a major within the Master in Molecular Cell Biology, starting from autumn 2008. The application procedure for this major includes a selection by a committee of experts.

The bachelor-master system was founded in Germany as a result of the Bologna process. Among the challenges generated by this system are the double booking by the students, and as it is open internationally, the educational background of the students, which proved to be very different. The introduction of an orientation exam and BSc courses in certain areas was suggested to help universities assess applicants' knowledge and background.

The Master consists of a 1st semester, including frontiers in bioscience, computational biology, quantitative biology; a 2nd semester, including modelling, systems cell biology, theoretical systems biology, physics-chemistry training; a 3rd semester including two blocks of six weeks of moving around between different laboratories; and a 4th semester, devoted to writing up the master thesis.

The international student exchange programme was discussed as an excellent way to share expertise and promote good practice. An exchange programme for PhD students was established with Free University of Amsterdam and the Universities of Gothenburg, Luxembourg and Manchester. In addition, Erasmus contracts are established between University of Heidelberg and all of the above mentioned universities. The programme allows German students to spend half or the entire 3rd semester abroad with the possibility of being partially funded. Students from abroad are welcome in Heidelberg. It was suggested that this model could be expanded to include other European institutions and provide a framework for the exchange of students and that ERASysBio could play a role in this.

The PhD training at the University of Heidelberg is hosted by two graduate schools which provide courses and lectures. Monthly meetings, e.g. modelling clubs and workshops, are promoted as well as laboratory rotations to gain experience. A thesis advisory committee is assigned for helping the students throughout their PhD, and scholarships are also available.

In Germany, Austria and The Netherlands, PhD students have the status of University employees. They therefore do not attend courses as they do in the UK - only in special occasions, they are able to attend a short course or training. Their only duty is to perform research. A PhD thesis has to be finished in 4 years and in this period at least 3 scientific papers must be published. Therefore, it is not possible for these PhD students to devote any time in training and most of this is done at the Master level. Participants discussed the insufficient amount of systems biology courses that there exist at the undergraduate level in Germany and the emphasis on research vs. training in the curriculum. It was acknowledged that developing a programme of specific courses is too much of a task for a single institute, and therefore a European effort in training seemed the best option. In addition to courses, it is desirable to take the next step and set up PhD training in systems biology. However, participants recognised that this requires a change in the legal framework of universities and this process is usually slow.

CSBi programme at MIT

The definition of systems biology can differ significantly among US organisations but the overarching concept is that systems biology's building blocks are: 1) horizontal integration, e.g. –omics sciences studying many things at once; 2) intensity and depth, e.g. dynamics in biochemistry and biophysics; and 3) vertical integration, e.g. physiology.

The CSB programme (Computational Systems Biology, www.csbu.mit.edu) at MIT was formed by three founding departments: Electrical Engineering and Computer Sciences, Biological Engineering, and Biology. CSB operates autonomously, has its own budget and its own thesis committee. PhD student classes are rather small, containing maximally 10 students per year. As in Europe, the highly heterogeneous background of the undergraduates joining CSB constitutes a problem that is addressed mainly during the first year. The philosophy in the curricular approach is therefore to provide background in modern molecular and cell biology, to provide a foundation in quantitative disciplines, and to expose the students to a broad range of subjects. The PhD training sits on three pillars:

- description, systematic data collection;
- distillation (modelling) the essential or most important subsystems, components, parameters;
- design perturbations to change system behaviour, e.g. for therapeutic purposes, or create systems composed of comparable biological components, e.g. for environmental purposes.

In the US, doing a PhD usually takes 5-6 years. PhD students must attend a significant number of training courses, mainly during their first year. Year 1 covers biology, computational biology, scientific literature, research rotations in several laboratories (at least 1 dry and 1 wet); in year 2, students enter the lab and there is an advanced elective, coursework depth requirement; during years 3-6, as the work progresses students may become teaching assistant until they finish their PhD with an oral and a written exam.

The type of programme is very heterogeneous, directed at the personal interest of each student. The disadvantage of this is that students all differ in knowledge and have their own focus. The programme therefore includes a thesis committee consisting of 3 experts that can be chosen in the 2nd year and advises on the content and schedule of the PhD. PhD students receive a 30.000 dollar per year stipend on average. All universities in Boston (MIT, Harvard, Harvard Medical, Boston University, TUFFS) have their own systems biology education, although there is some collaboration between them.

Engineering is a very important topic in systems biology in the US, which is not the case in Europe. Engineering in Europe is technical and mostly industrially oriented. For example, engineering in Germany and in the Netherlands is taught at technical universities where the life sciences are excluded.

The role of FEBS in interdisciplinary training

The Federation of European Biochemical Societies – FEBS - is one of the largest organisations in European life sciences, with nearly 40.000 members distributed among 36 Constituent Societies and 7 Associated Member Societies in 43 countries. FEBS seeks to promote, encourage and support biochemistry, molecular cell biology and molecular biophysics in Europe through advanced courses, fellowships, their publications Molecular Oncology, FEBS journal, and FEBS Letters, an annual Congress, and many other relevant activites. FEBS has a strong focus on promoting the career of scientists. The Education on Systems Biology Council, one of the 46 FEBS councils, has identified the pitfalls associated with systems biology development, being: the insufficient integration of biology, mathematics and engineering; the lack of tools, e.g. models, standardization; the lack of widely available student post-doc training; the insufficient interdisciplinary training and student mobility.

FEBS supports scientists through youth travel grants at a total of 500 per year, short and long term fellowships to return home to Europe, the annual FEBS congresses, young scientists' fora.

Marie Curie training sites – NucSys case study

The EC Marie Curie Training Sites give young researchers pursuing doctoral studies the opportunity to receive training within high-level groups in their specialised area of research. All fellows must be nationals of an EU Member or Associated State, or have resided in the EU for at least five years immediately prior to their selection by the institution. They must not undertake their fellowship in the country of their nationality or recent centre of activity. Nationals from an Associated State can only carry out their fellowship in a Member State. The scheme is directed to postgraduate researchers pursuing doctoral studies in a subject area similar to that of the Training Site. The duration of the training ranges between 3 months and 1 academic year.

The NucSys consortium - Systems Biology of Nuclear Receptors: A Nutrigenomic Approach to Aging-related Diseases - has €4 million funding for a 4 year training programme from the EC. The NucSys member institutions are University of Kuopio, FI; University of Birmingham, UK; Erasmus Medical Center, Rotterdam, NL; University of Surrey, UK; Vrije Universiteit Amsterdam, NL; Wageningen University, NL; University of Oulu, FI; Katholieke Universiteit Leuven, BE; Unilever UK Central Resources Ltd, Bedford, UK; Instituto de Investigaciones Biomédicas, Madrid, ES; Max-Planck-Institut für Molekulare Genetik, Berlin, DE; St George's Hospital Medical School, London, UK; Medizinische Universität Wien, AT; and Bioxell S.p.A, Milano, IT. NucSys has been running since January 2006 and has trained 18 PhD students who received €14,000 over 4 years. NucSys is coming to an end in December 2009 and emphasises the need for more students in systems biology in Europe.

NucSys follows the ECTS model. The European Credit Transfer System (ECTS) aims to make teaching and learning more transparent and to facilitate the recognition of studies - formal, non-formal and informal. The system is used across Europe for credit transfer (student mobility) and credit accumulation (learning paths towards a degree). It also informs curriculum design and quality assurance. ECTS aims at harmonisation of PhD standards by making salaries equivalent, by providing a career development plan, and by enforcing the approximately 4 publications with Impact Factor 5 or higher (IF>5) at the end of any PhD. According to this model, a PhD requires 60 ECTS, of which 50 ECTS are to be obtained within a 36 months time frame, like research project presentations and courses.

Although there are many advantages in using this programme, within the systems biology community it is not viable to apply the ECTS criterion of IF>5 to a PhD specialised in systems biology as many top journals in biophysics and bioinformatics often have an IF of no more than 5. In addition, the programme's main weakness appears to be the insufficient contact with industries.

The experience from a typical large pharmaceutical company

AstraZeneca does not have a discipline of systems biology incorporated into its pharma, consumer chemicals and agrotech programmes. Rather, the company focuses on statistics, pharmacokinetics, pharmacodynamics, enzymology, chemistry and bioinformatics. For this company, the industry's wishlist appears to be a list of generic requirements applicable to any area of research.

As an example, a glimpse of AstraZeneca's demands can be seen in its job advertisements. For this company, a bioinformatician should contribute to the definition of the scope and strategy of mathematical modelling projects; provide data, from the literature or by commissioning work, to parameterise models; use advanced bioinformatics; and have knowledge of literature mining. A modeller applying for a job in this company should be an experienced model builder; and have a degree in mathematics, physics, or engineering. It is the opinion of this company that scientific excellence is the main criterion for industry to employ new personnel, and that publications are important, but not crucial in applying for a job and making a career.

Students find strength in diversity

ERASysBio requested FEBSSysBio2009 Advisory Committee to nominate six students registered at FEBS SysBio2009, to represent different models of PhD training. This group of students was then invited to attend this workshop and participate in the discussions:

Jure Acimovic, University of Ljubljana, Slovenia
Yusur Al-Nuaimi, University of Manchester, UK
Marc Goodfellow, University of Manchester, UK
Simon Moon, Imperial College London, UK
Siavash Partow, Chalmers University of Technology, Sweden
Katya Rybakova, Free University, the Netherlands
Ben Small, University of Manchester, UK

It is the view of this group that the aim of PhD training in systems biology should be to allow the student to develop high level skills in one specific discipline, i.e. wet or dry, while acquiring a strong background in the other. The students agreed with the general view of introducing training in systems biology earlier in their academic careers, preferably at the undergraduate level.

Diversity is the strength of systems biology, and the key for a successful PhD programme is precisely to maintain such diversity. Students join their PhD with different training backgrounds. Tailoring the training around the student's specific make-up is highly desirable. The diversity is also linked to differences in their research projects and PhD students wish to play a role in building their own curriculum, which combines optimally their research and training requirements. They find case studies very useful in their training, and consider an important component being the awareness of the limitations and underlying assumptions of techniques.

A good programme should therefore encourage out of the box thinking and making the most of students' different backgrounds. The programme should prepare students in the process of acquiring academic independence. This has an enormous value for PhD students as much as developing good communication and collaboration skills. A strong programme should aim at developing such skills to enable them to collaborate with people from different disciplines and cultures.

The wish list and the challenges

Interdisciplinary research brings together experts from different disciplines to work on a specific research question, which is solved through an iterative process that requires effective interaction and shared understanding.

The success of the team approach in interdisciplinary research relies upon the recognition of the different cultures of disciplines involved; the clear statement of the specific goals of team members early in the process; the investment in interpersonal relationships that promote open and clear communication; and the intention to build on individual talents and interests. The approach therefore requires the training of researchers in effective team working, taking into consideration the specific aspects of the disciplines involved. Issues such as interdisciplinary and personal communication, philosophical models, and boundaries must be addressed early in the process, and an element of trust must be developed within the research team, as team members must be willing to risk following the advice of another without the ability to fully evaluate it. The language barrier encountered in interdisciplinary team work is particularly important in the context of training. The exclusive coded languages developed and used by disciplines often have the potential to confuse others, e.g. some terms and concepts have different meanings to different disciplines.

As expected, biologists and computer scientists participating in the workshop expressed their wish to gain more knowledge from each other's disciplines.

Biologists wish to be able to implement all available knowledge in physics and maths that is relevant to their biological problem. The key is to know where to get the (missing) knowledge and to be able to identify the right people to collaborate with. In addition, there are two main challenges to overcome: the overwhelming amount of data and knowledge in the form of publications that is available, and the time and professional pressure to deliver what researchers are best at.

For biologists, it is still a challenge to find highly skilled people who want to teach systems biology. In order to stimulate interdisciplinarity, these teachers should ideally train and teach outside their own background, i.e. maths should not be taught by a pure mathematician. As an example, for a biologist, a perfect teacher would be a bioinformatician who has studied biology.

Computer scientists wish to find a better way to enter the cycle and, more importantly, to become involved earlier in the cycle of a systems biology project. They find great value in having the opportunity to go through the systems biology iterative cycle at least twice in the life of a project. Lab cycles, as the one at the DTC in Manchester, integrate wet-dry projects where students receiving training as computer modellers work alongside those training as experimentalists. Computer scientists believe that students would benefit enormously if they experienced more how important model driven experimental design is. For this, case studies were suggested among the possible solutions.

Students think that soft skills are very important and find great value in teambuilding and in achieving effective communication. Students claim a more fluid communication between principal investigators, who can be very conservative in their way of thinking about their own discipline. Students also recommend that interdisciplinary individuals are identified early on. Students aspire to become a ‘complete’ systems biologist, who obtains and masters a speciality and has the ability to communicate with students from other specialities. The training should provide the elements to allow these students to reach this goal. In exploring the career options available post-PhD, students aim at developing a range of skills, including the ability to communicate effectively, that would qualify them for careers elsewhere, e.g. (science, project) management. In the meantime, the pressure to generate a significant number of publications as first author remains a requirement for career progression and a strong barrier for collaboration.

Industry looks for skilled interdisciplinary researchers with training in communication and expects these skills to be provided by universities. Science advocates are needed to show companies the potential that systems biology has to offer, specially to the physicists and computer scientists working in those companies. All see the significant value of producing a patent. The group believe that patents have to be seen and valued by the system and by the community as a scientific outcome.

In general terms, the lack of funding security is seen as an obstacle. It is recognised that systems biology requires longer funding cycles. Among the reasons for this is the time that it takes to complete a project with at least two iterative cycles and to release publications. The training provided in systems biology is limited and is considered an important barrier. But it is not all about funding: there is an urgent need to train the systems biology trainers; at present this population is insufficient to satisfy the existing demand.

Steps towards a blue print structure of the European PhD in Systems Biology

As a first step, the group explored some key elements contributing to the design of European model for PhD training in systems biology. The following points were discussed with the pre-assumption that a first year of PhD is equivalent to a MSc.

A good number of institutions share as common elements biology, mathematics, physics, chemistry, omics sciences, wet components, and dry components. The Doctoral Training Centres in UK and GoFORSYS centres in Germany were used as models to focus the discussion. This revealed the need to incorporate widely the following elements, as standards: communication courses; experimental design; statistics; modelling; data analysis; integration wet-dry. A tutorial component, a taught component, exchange programmes, lab rotations, and group work were all considered essential.

The features of current models in continental Europe were contrasted to those available in the UK and the US. The following strengths were identified:

- people diversity, i.e. students, teachers, principal investigators (PIs), tutors with different [academic] backgrounds come and train together, in interactive training, receiving mutual benefit from cumulative and overlapping expertise;
- teaching during a month on a single topic, practically based;
- integration with application, e.g. medical, industry;
- all -omics that are already present, e.g. NucSys.

Some of the weaknesses perceived by participants are related to:

- some programmes having limited interaction between teachers and PIs when designing the programme;
- lack of suitable PhD committees;
- teachers not having yet the right mindset - this needs further development;
- management of the teaching depths;

- the tendency, at the moment, of PIs teaching the basics to be mono- rather than inter-disciplinary;
- limited connections across Europe.

There was strong consensus in the great benefit of maintaining the diversity between and within training centres. The diversity applies to both the scientific area and the methodologies. This consensus was extended to the need to keep attracting the best students.

Ideal model/curriculum

A pre-selection based on résumé and motivation letter was thought to be an essential component of the ideal curriculum. The candidates should be able to express the reasons why they want to do an interdisciplinary PhD.

The selection should be followed by an entry level control, where the candidates are interviewed. The interview should include questions on their past activities, wet/dry background, and the direction that the candidates want to take in the future. The committee should consist of 3-4 people, from each of the appropriate disciplines. The mindset of the PhD students should be interdisciplinary and communicative. Candidates should have excellent qualifications and be diverse in backgrounds.

The model should provide inter-student training, including social aspects and collegiality. It is believed that post-doctoral researchers could play a significant role in mentoring PhD students.

It is proposed that the duration of the PhD should include 1 year entry level or a master, followed by a 3 years project, or longer. Training centres should receive block funds (1+3 or 4 years), as students usually make up their minds after a rotation period. The content should incorporate a minimum percentage of wet components and a minimum percentage of dry components. It seems optimal that the structure includes two rotations of labs (6-10 weeks) in the first year. Alternatively, one rotation plus one extended case study could also achieve the same effect. The incorporation of at least one case study during the taught part of the training seems critical.

Progress is expected to be supervised by a PhD committee. The issue on whether a supervisor should be present in this committee was raised and is subject to further discussions. It was proposed that students participate actively in writing their own PhD proposal. This may be based on an existing proposal and the mentor would play an important role in guiding this process.

Joint teaching through common, web-based platforms

The delivery of training using web platforms seems possible for teaching the basic components of the PhD model. It was thought that developing such tools could be time-consuming and sometimes costly. However, the delivery of core courses combining e-learning, video, and physical teaching was highly supported. The use of tools to connect students through e.g. EU-wide database and the web was considered a positive development.

It was proposed that evolvable standard core courses could be organised in one common facility. This should be supported by e-learning, and partly person-mediated. The inclusion of ECTS credits should be considered. The agreement of standard common courses among the scientific community is seen as a necessary step; a transition phase towards the standardisation of the PhD curriculum in systems biology.

The way forward

As a general outcome, it was agreed that the existing structures within the European research community offer an excellent opportunity to develop a common, structured, modular model of postgraduate training in systems biology for the benefit of students and academic institutions in the European Research Area.

To consolidate the process initiated in Alpbach, it seems timely to invite European academic institutions that are presently - or want to be - involved in systems biology to form a league of training centres to continue this process and to work together towards a common training structure in systems biology.

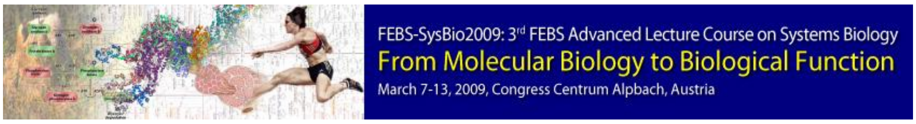
BBSRC, in collaboration with ZonMW, 2009

ANNEX 1

ERASysBio Workshop: Towards European Standards for PhD training in Systems Biology

March 7th 2009

Congress Centrum Alpbach, Austria



Under the auspices of FEBS-SysBio2009, March 7-13, 2009, Alpbach, Austria

Programme

08:30 – 09:00 Registration (Molden Foyer)

Popper Room

09:00 – 09:05 Welcome by ERASysBio
Gabriela Pastori, BBSRC, UK

Session 1 – The experts talk
Chair: Karl Kuchler, Medical University of Vienna, Austria

09:05 - 09.25 Biting bullets: UK Doctoral Training Centres in Systems Biology
Hans Westerhoff, University of Manchester, UK

09:25 - 09:45 Training in Heidelberg
Ursula Kummer, Bioquant, University of Heidelberg, Germany

09:45 – 10:30 Morning keynote lecture: CSBi programme at MIT
Douglas Lauffenburger, Massachusetts Institute of Technology, US

10:30 – 10:45 Morning coffee (Kunst Foyer)

Session 2 – Interdisciplinary/transdisciplinary training
Chair: Stefan Hohmann, Göteborg University, Sweden

10:45 – 11:00 FEBS role
Karl Kuchler, Medical University of Vienna, Austria

11:00 - 11:15 Marie Curie Training Sites & Industry Host Fellowships:
Carsten Carlberg, University of Kuopio, Finland

11:15 – 11:30 Industry's wishlist
Jonathan Swinton, Computational Biology, AstraZeneca

11:30 – 11:45 Students' wishlist
Katya Rybakova, Vrije Universiteit, The Netherlands
Ben Small, University of Manchester, UK
Jure Acimovic, University of Ljubljana, Slovenia
Siavash Partow, Chalmers University of Technology, Sweden
Simon Moon, Imperial College London, UK

Session 3 - The wish list and the challenges breakout session
Chair: Carsten Muessig, Max Planck Institute Golm, Germany

11:45 – 12:30 Breakout groups to discuss:

-Interdisciplinary yet profound; how to get rid of the downward looking of the 'experts' in the mother disciplines (Physics and Molecular Biology)

-Transdisciplinary superficial yet effective knowledge; how to know more of the other disciplines without having the time to completely know them

-Communicative yet excellent: how to pair collaboration with excellence and surmount the barriers imposed by the traditional excellence only through competition

-Biologists' wishlist
-Computer scientists' wishlist
-Students' wishlist
-Industry's wishlist

12:30 - 12:40 Chair's wrap up morning session planning for the afternoon
Chair: Carsten Muessig, Max Planck Institute Golm, Germany

12:45 – 13:30: Lunch (Kunst Foyer)

Session 4 - Blue print structure of the European PhD in Systems Biology
Chair: Hans Westerhoff, University of Manchester, UK

13:45 -15:00 Breakout session – Groups to discuss:

-Program structure
-Program content
-Program organisation and finances

15:00 – 15:30 Afternoon Tea (Kunst Foyer)

15:30 -16:00 **Reporting**

16:00 – 16:45 Discussion and conclusions on blue print structure and content of white paper

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Schrödinger Hall

16:55 – 17:00 Opening of the FEBSSysBio2009
Karl Kuchler and Hans Westerhoff

17:00 – 17:35 Workshop Closing Keynote Lecture / FEBS-SysBio2009 Opening Keynote Lecture:
Yuri Lazebnik, Cold Spring Harbor Laboratory
'Can a [systems] biologist fix a radio?'

17:35 – 17:40 Closure of ERASysBio Workshop
Gabriela Pastori, BBSRC, UK

17:40 – 18:30 Reception: Getting to know each other (Molder Foyer)

END

ANNEX 2

Participants

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