

N2L curriculum

Nanobiotechnology is a multidisciplinary research field, merging knowledge from many disciplines, e.g. physics, chemistry, biology, material sciences, molecular engineering. The importance of Nanobiotechnology as an emerging and very promising scientific field and the need for the development of a flexible multidisciplinary education to meet the challenges of the 21st century motivated the development of a complex curriculum, which can easily be adapted by interested institutes at masters and/or PhD level. The proposed curriculum comprises a pallet of complementary education forms, combining interactive sessions, with lectures and hands on experiments, e-based platforms, and joint activities. Much attention is focused on human resources, gender issues, ethics, IPR-thinking, business development and research support acquiring skills.

The recommended N2L curriculum is guided by the recommendations/results of the Bologna process and is combining existing network resources with newly developed educational forms to assure excellence and multidisciplinary. The curriculum recommends a masters/PhD education structure with a modular structure grouped around four major topics/areas: (i) basics, (ii) systems, (iii) integration, and (iv) experimental work/project. The N2L database on existing courses offers an exceptional source to fill in the content of the first three modules, according to the targeted educational form (Msc or PhD), main profile (material sciences, chemistry, biology medicine, etc), and local resources. The nature of the research project is defined by the profile of the individual institute and the interest/funding of the supervisors.

This recommended formal education is accompanied by a series of other actions such as: (1) tutorials, (2) N2L summer school, (3) N2L Research school, (4) PROGRESS course, (5) awards rewarding excellence in science (Best article), presentation skills (Best poster) and communication ability with the society (Best Public article), (6) technical workshops and (7) EVNU, the virtual N2L university.

Tutorials are given at large network meetings on scientific topics of the first three modules, IPR, ethics, gender policy, emerging new topics, and challenges in medicine and technology. Network resources and local expertise are assuring a variety of very interesting topics.

The N2L summer school is a multidisciplinary, 2 week long education form targeting PhD students. It is focused on: “*Methods in micro-nanotechnology and nanobiotechnology*” and combines theoretical lectures and associated hands-on moments. It has been designed to bridge the gap identified after the analysis of existing summer schools, and to meet the needs of a modern education in nanobiotechnology. Its structure follows the recommended N2L curriculum and the topics of the various modules were carefully selected to avoid duplication and to complement already existing (other) summer schools and technical workshops.

The N2L Research School is an innovative and interactive education form, targeting last year PhD students, and post docs. The school follows the spirit of the N2L curriculum in its structure and strategy, and participants are motivated to adapt a new thinking strategy when analysing their research not only as ways to address key challenges of science, technology

and society, but also from exploitation point of view, ethical aspects and/or fundraising. The school gives an insight to both SMEs start-up policy and the framework programmes of the European Union. Use of local resources/expertise/industry and a flexible structure, makes the focus of the school very different every time and thus, permanently attractive even for the same community.

The PROGRESS course is a specially developed human resource management course, open for all network partners with responsibility. It is an interactive course giving understanding and management skills via “learning through experience”. It gives experience in important aspects such as understanding group dynamics, gender, multidisciplinary, multinationality.

Awards for young scientists aim at supporting PhD students and post docs to present their science/work to different audience, to improve their presentation skills, both scientific and public, and to motivate and train them for a competitive approach. The awards are very different in nature; (i) the best scientific publication, (ii) the best poster presentation and (iii) the best public article, are all evaluated by different panels, have different prizes and are all awarded at large N2L meetings (annual and autumn scientific meetings).

Since the field of nanobiotechnology is very wide and multidisciplinary, the N2L education board decided to not to develop an own workshop, but rather to support already existing ones. Technical workshops identified as being relevant for the N2L community, are supported by the network, via fellowships awarded to eligible networks members to cover their participation fees. A number of Technical workshops are open for participation every year, and young scientists are actively supported to attend them in order to learn new skills in a particular technique.

EVNU is another recent innovative approach aiming at integrating the N2L community and assure a platform for better use of resources. It is envisaged as a joint educational venture of Nanobiotechnology researchers and e-learning experts aiming at sharing knowledge and expertise. EVNU will serve as the Nano2Life’s Educational Portal, offering a collection of on-line learning materials and Instructional Modules included in N2L recommended curriculum. EVNU will facilitate the diffusion of knowledge among researchers and students thus promoting Research & Development in Nanobiotechnology subjects. Researchers and instructors of participating Nano2life's institutes/universities will contribute with learning materials from their unique areas of research and expertise. These learning materials will be available to the N2L community, and can be integrated into their academic courses.

The interactive e-platform established at network level allows the video recording of any major education event, such as the tutorials, plenary lectures, selected parts of the Summer- and Research schools, and thus creating the possibility of virtually attending the event via a computer link. The attendance is “real”, since questions can be forwarded to the lecturers during their presentations. The platform also offers some tutorials only in e-form, such as, Basics IPR, biochemistry for beginners, or the recently published Bioelectroanalysis.

In order to inform and “educate” the outside world about nanobiotechnology, its goals, and application possibilities, several actions have been developed and applied. The above-

mentioned "Best public article" prize is one, but also local events are organised for the information of the interested ones (e.g. last year gymnasium students, see "Abi, und was dann?" event organised in Saarbruecken in June 2006, or the virtual Olympics targeting school children of age 12-14 in topics related to nanobiotechnology. The publication of a guiding e-book on nanobiotechnology is in progress.