



BIOS POLICY BRIEF

Bioinformatics in Life and Medical Science Education.
Changes and Trends for Proceeding toward a sustainable
and effective Digital Health Culture, Expertise and Health
Systems.

12/2020

Highlights

The BioS- Erasmus Plus Project and Course are mainly digital objects. They are aimed at the innovation and at the developments of higher ranked scientific and professional profile of the current and future health care. While enhancing knowledge, skills and interest for scientific knowledge, a greatly valuable result is the ongoing training of contributors and developers, continuously challenged by new tasks and experiences.

Future developments and the background of bioinformatics and computational methods in life and health science, with economic, social and political implications, call for appropriate consideration of Artificial Intelligence (AI) methods, and, namely, of deep learning and machine learning. It should include also the use of block-chain and cloud technologies and should be built within a frame of an explicit theory of change. Building an inclusive community delivering information and advertisement in social networks, groups of interest and by scientific publications, calling for survey participation and ideas are some of the Bios dissemination strategy actions. These interventions are and will be self-maintained by the feedback of managers, contributors, followers and remote contacts. We have the need of looking with open minds and disposition to new ideas and to the abstract, mathematical reasoning, coping with the current and forthcoming challenges and opportunities.

Concept and mission

The BioS Project Consortium has a strong awareness and share the strong commitment to working closely with the European Parliament and Commission on defining the issues of our generation: health care promotion and equity harmonization, fighting climate change, harnessing digitalization, building a social market economy for today's world. Scientific activities require faster and effective collaborations, so that we need to strengthen the European Research Area. Such Area is embracing all of Europe, because knowledge has no territorial boundaries, scientific knowledge grows with collaborations and knowledge is trusted if there is open scrutiny of its quality. ([Gabriel](#)).

We share the need for Europe to show leadership in the World to care for the things Europeans cared and care for and to find common solutions to shared ideals and challenges. We want to take pride in our work and to find new ways to make this possible, building the world we want to live



in: a Union of vitality in a world of fragility ([Van Der Leyen](#)).

A sustainable roadmap of clearly defined 2030 digital targets is related to connectivity, skills and digital public services, with a focus on the right to privacy and connectivity, freedom of speech, free flow of data and cybersecurity. All these will encompass areas covering safety, liability, fundamental rights and data aspects of artificial intelligence.

These policy briefs strive to be in line with the [2021 European Commission work programme – from strategy to delivery](#) -, addressing unmet needs in Europe, suitability of e-learning for teaching bioinformatics, realistic targets with a sufficient flexibility to respond to the needs of the target group as well as fostering wider developments in policy and practice built within a frame of an explicit theory of change ([Trovato](#)).

Facts, barriers and fiction must be clearly detected, or debunked if needed. Building an inclusive community delivering information and advertisement in social networks, groups of interest and by scientific publications, calling for survey participation and ideas are some of the dissemination strategy actions that can be self-maintained by the feedback of contributors, followers and remote contacts ([Marsden](#)).

Few lessons from the Bios project

The Bios Project was planned, approved, developed and now concluded delivering the wished live instrument for teaching and learning bioinformatics by a vocational scientific e-learning course, hosted by a friendly and comprehensive edX platform. The Bios course has several interactive features, and implies blended components with instructors, tutors, external webinars, practical training webinars and social media networks (BIOS Twitter, Facebook and LinkedIn pages and groups). All these are

allowing interactions with the responsible dissemination managers, followers participating to the BioS course, other followers interested in Bioinformatics and in the course itself. Such forums strive to be a flywheel for facilitating or triggering interest and knowledge in science, namely in the most related fields i.e. computational biology, genetics and multiomics, molecular biology and epidemiological models, AI and deep learning, Block-chain and clouds, with practical applications in any fields of medicine (Trovato). The overall participation reached about five thousand followers, interacting and engaged by one thousand posted document and information in the three years (2018-2020). The fallout in related groups is great, mostly in LinkedIn and Facebook, reaching repeatedly more than one millions of contacts.

The main effects of this intense campaign of dissemination are:

1. Information of the steps of development of the BioS Course, flagging since December 2019 the opening of enrolments with a sufficiently friendly submission procedure, encouraging some of them exclusively by this way.
2. Stepwise increasing interest and literacy of the followers, with daily information on the most attractive advancements in the above listed field and in the societal and ethical implications.
3. Enhancement of the public awareness of the interest and commitment of the European Commission, namely of the Erasmus Plus actions, in the topics of advanced education in Science and of innovative teaching tools.

These actions were professionally managed by the dissemination partner in charge, with some contributions from side of the other Partners.



Participation and interactions of learners with BioS social media networks are limited, seemingly as a consequence of a rigid educational roadmap of the course for outreach learning. By the comparison with a parallel institutional national academic LinkedIn page, >50.000 followers with the same page-manager, we can claim a good success for the BioS pages, considering the narrow focus of the topics involved.

Planning forthcoming initiatives: A sketch

The overlap between advanced training courses in science and Horizon Europe calls that incorporate research and innovation missions be wide. The shared need is to increase the effectiveness of funding by pursuing clearly defined targets analyzing and forecasting, as much as possible, how a mission-oriented policy approach will work. The Digital Education Action Plan (2021-2027) outlines the European Commission's vision for high-quality, inclusive and accessible digital education in Europe. It is a call to action for stronger cooperation at European level to:

- learn from the COVID-19 crisis, during which technology is being used at an unprecedented scale in education and training
- make education and training systems fit for the digital age.

Equally, in this case the overlap with EU policy in the field of vocational education and training is present.

This key element of lifelong learning systems aims to equip citizens with knowledge, skills and competences required in particular occupations and on the labour market.

When dealing with healthcare work-forces, and in general with actual services or industries, the need of planning and operating inside the real world is extremely important. A different, abstract approach will build systems adherent with some formal

requirements, but essentially no more than empty boxes.

More comprehensive approaches are needed for managing big-data for the health of great populations, such as all Europe and individual member States health systems. This vision is currently used and developed, and requires a good understanding of the general concepts of neural networks, i.e. basically non-linear statistical data modeling or decision making tools. They can be used to model the complex relationships between inputs and outputs or to find patterns in data. In other words, the use of artificial intelligence tools is a need. The implicit step forward relies on deep learning algorithms, which can implicitly learn the distribution function of the observed data. Learning in neural networks is particularly useful in applications where the complexity of the data or task makes the design of such functions by hand impractical.

In addition, the widespread use of Artificial Intelligence (AI) could have unintended consequences that are dangerous or undesirable. This is one of the reasons of the AI winter, i.e. is a period of reduced funding and interest in artificial intelligence research and application, cyclically appearing, from one decade to the other, happening when it fail to fulfill the very public promises it was making. Nonetheless, this is not influential on the trend toward a greater scientific, technological and societal networking that needs interpretation and drive in a very comprehensive and expert way.

The social and political control relies greatly in the trust of most persons in the work of true experts: this may not counteract the widespread hostility based on the Dunning-Kruger effect. People are typically overly optimistic when evaluating the quality of their performance on social and intellectual tasks. In particular, poor performers grossly overestimate their performances. The expertise in the use of social medias and of validated e-learning platforms as strategic tools must be empowered, particularly in the



current scenario of possible European shortages of resources and findings. The requests of easy to understand proof of the evidence for the benefits of modern technology often hidden a true hostility vs. evidence based medicine and science. The best answer is to spread actively well-supported information and studies within the culture of acknowledging the need of expertise, research and ethics ([Trovato](#)).

Exploitation of a comprehensive strategy: performance and scenario

It is getting evident globally that the predictive approach, targeted prevention and personalisation of medical services are the optimal paradigm in healthcare, demonstrating a high potential to save lives and to benefit the society as a whole. It is based on bioinformatics and on established, innovative, advanced or experimental evidences: such approach is rich in achievements ([Costigliola](#)). Robust culture, knowledge and skills in Computational Sciences – namely in medicine and molecular biology – and suitable strategies for disseminating validated information are cornerstone pillars against anti-science social and economic-driven activities and against fake-beliefs. The BioS Course is a paradigm of basic open educational resource, with translational implications in all science domains and in all fields of life, health and medical sciences ([Trovato](#)). Knowledge of and about science are integral to preparing our population to be actively engaged and responsible citizens, creative and innovative, able to work collaboratively, and fully aware of and con- versant with the complex challenges facing society. It helps us to explain and understand our world, to guide technological development and innovation, and to forecast and plan for the future. The report to [the European Commission of the expert group on science education](#) is a detailed roadmap in this regard.

The EU funding and proposal of future e-learning courses in science and, namely, in Computational Life and Medical Sciences application are hoped for. The effective BioS course opportunities would ultimately contribute to enhance quality of health-care, professional attractiveness to service providers, industry, and applied research and innovation.

Ten new technologies are deemed to greatly promote scientific and economic progress and the level of civilization and social justice. In particular: Artificial intelligence, Blockchain, Open-source technologies, Telemedicine technologies. Three-dimensional printing, Gene editing technologies, Nanotechnologies, Synthetic biology, Drones and Robots ([Mihalis Kritikos](#)). Synergy and overlap are evident, but more important, we have the need of looking with open minds and disposition to new ideas and to the abstract, mathematical reasoning, coping effectively with the current and forthcoming challenges and opportunities.

The BioS Course is a paradigm of basic open educational resource, with translational implications in all science domains and in all fields of life, health and medical sciences. The Bios Project, with its experience searching solutions to obstacles and various limitations, and with the different performances of the single actions, assessed by narrow but flexible indicators, may become a reference for the development of the forthcoming actions with similar goals and resources.



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BioS at a glance

BioS: Digital Skills on Computational Biology

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