

Multi, Inter and Trans-Disciplinary Context of Science

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Biography

Dr. Zoran T. Popovski is Full Professor at the Ss Cyril and Methodius University in Skopje Macedonia. He is Head of the Department for Biochemistry and Genetic Engineering at the Faculty of Agriculture and Food Sciences. He is also chief of the Laboratory for Protein and DNA Technology at the Faculty of Technology and Metallurgy where he is also engaged as full professor. His initial background is biology; he obtained master degree in biochemistry, while his PhD thesis was the field of Agrobiotechnology. His scientific interest is focused on recombinant DNA technology and protein chemistry. He spent 10 years as researcher in the Research Centre for Genetic Engineering and Biotechnology in the Macedonian Academy of Sciences and Arts. He was invited as visiting professor at Ohio State University (USA), Lund University (Sweden), Novosibirsk State Agrarian University (Russia) and Sarajevo University (Bosnia and Herzegovina). He has been Member of NATO Scientific Committee in EIPAC format and currently he is member of Executive board of COST in Europe. From 2002 to 2006 he was State Secretary for Education and Science in Macedonia. He is author of more than 60 scientific original papers mostly published in international journals, more than 50 abstracts for scientific events where he is usually invited as keynote speaker, and more than 50 professional papers.

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Introduction

In reality, there is no scientific discipline that can be developed as an isolated island without connections and cooperation with other disciplines. That's why, bringing together experts from different disciplines is an appropriate way to find solutions to today's global challenges. Based on the number of multidisciplinary scientific events taking place around the world, it seems that bringing scientists with a variety of backgrounds together is a crucial part of fixing the world's problems.

Debate about the discipline dimension in research and technology is always present in the scientific community. There are lot of attempts to define the differences, advantages and disadvantages between multi, inter and trans-disciplinarity. Multidisciplinarity could be defined as an approach to a research topic from different disciplines but staying within their boundaries. Interdisciplinarity analyzes, synthesizes and harmonizes links between disciplines into a coordinated and coherent entity. Transdisciplinarity integrates the natural, social and health sciences in a humanities context, and transcends their traditional boundaries. Going in multi, inter and trans disciplinarity does not mean leaving behind personal skills, but it means "traveling" in new scientific directions using your own specialties. The increasing popularity of mixed scientific disciplines such as mechatronics, bioinformatics, biomedical engineering and biophysical chemistry is evidence of the importance of these phenomena of multi, inter and trans disciplinarity (MITD).

One of the main criteria for financial support of research projects from international programs is MITD. Figure 1 shows the example of MITD in the approved actions from Cooperation in Science and Technology (COST) program in Europe.

Example 1

MITD is especially important for the closely related disciplines like biotechnology as an umbrella with agrobiotechnology, food technology, and recombinant DNA technology as disciplines raised by it. Very often, there is an overlap between these branches of biotechnology and it is an argument plus that currently it is very important to provide better connections between complementary disciplines in order to be more efficient in scientific research. For example, dealing with food technology (food processing, food control) means following and using the achievements of agrobio-technology i.e. technologies in food production. On the other hand, recombinant

DNA technology is a set of tools that can be used in food production, food processing, food control, but also in human and veterinary medicine for diagnostic or treatment purposes, in pharmaceutical industry for development of new products, in forensic science for identification purposes, in natural history for evolutionary studies, in forestry and fishery for protection and production purposes etc.

Example 2

In a monodisciplinary research group usually there is a lack of creativity. A multidisciplinary group can combine the expertise of different fields and create a diverse team. Such a combination can lead to more creative and higher impact research. For example, the research related to production of new generation of recombinant proteins applied in medicine needs to involve a molecular biologist to clone and express appropriate gene, microbiologist or zoologist or botanist to grow host transformed cell, biochemist to extract and purify the protein, pharmacist to analyze the activity and impact and finally the medical doctor to apply that as a therapeutical tool. All those researchers are working in their field taking in account the joint purpose – production of new protein and it is an example of multidisciplinary. If just one expertise in this chain of research process is missing, there will be no result. The moment when scientists from different disciplines start to communicate in order to improve the protocols and performances of the novelty, to overcome obstacles during research or to close the circle of production is the moment when interdisciplinarity starts. And finally, when research is going out of the experimental phase and entering the society to face wider challenges, is the moment of transdisciplinarity.

What are the advantages of MITD?

The most exiting part of MITD research is that it opens the possibility to work on projects that involve more than one discipline of science. It means sharing and merging existing personal knowledge and skills with scientists with whom otherwise there would be no chance to interact with. Multidisciplinary research also leads to unusual scientific inventions. A lot of great discoveries have come from robust interactions of researchers from different fields. An independent researcher designing and conducting their own separate experiments probably would never have such great scientific achievements.

Is there any weakness of MITD?

The possible problem of working in a MITD research group is an absence of a “mutual language.” Namely, sometimes it is hard to find a way to start working together on a problem when everyone is approaching it from their own perspective. It can make it difficult to discuss ideas, aims and expectations with team members and to get appropriate feedback. Another challenge of MITD is that there is no substantial criticism and evaluation between the teammates. Very often the ideas and suggestions from each team member could be either accepted without any questions or they could be rejected without constructive criticism. If these challenges are managed well, it can be very rewarding to do MITD science.

Recommendation

Universities, research institutes and companies with research activities should encourage and facilitate MITD research in order to provide interaction between different disciplines where scientists can meet, share ideas and discuss problems. It is non-condition to be more competitive and more efficient in the modern world of science.

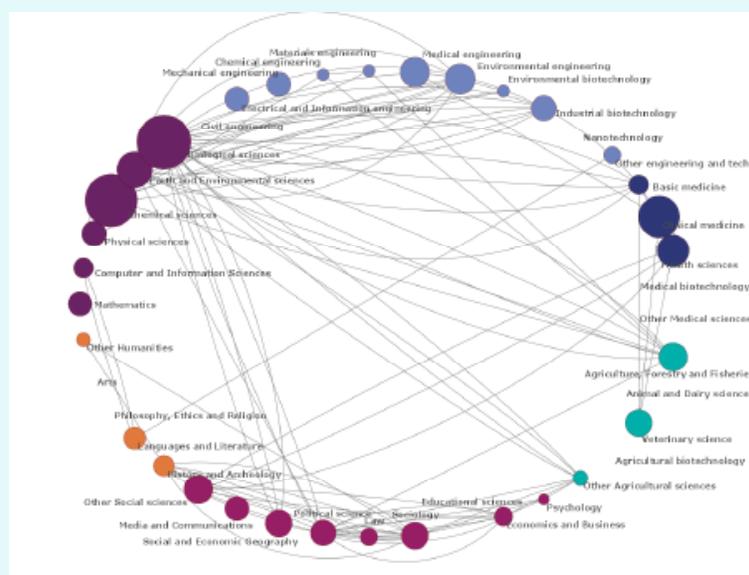


Figure 1: Illustration of the interdisciplinary nature of approved COST actions in 2016.

Source: COST Strategic Plan COST 060/17