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## Workshop

# Bridging the Gap Between Biotechnology and Industry: Integrating Design Thinking and Flipped Learning – BIOTE(A)CH

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On September 28, 2023, a workshop was held at the University of Zagreb Faculty of Chemical Engineering and Technology as part of the BIOTE(A)CH project (2022-1-TR01-KA220-HED-000085597). As highlighted in the invitation to the workshop, the aim of the workshop was to gather information about the challenges encountered in the transition from university to industry and how to solve the related problems:



1. To identify the innovations and challenges in the bioeconomy and biotechnology from the perspective of academics and private sector representatives
2. To understand the current knowledge and skills that university students studying in biotechnology fields should have when they begin their careers
3. To understand the difficulties that university students studying biotechnology will encounter as they begin their careers in industry
4. To contribute to the development of the curriculum for the undergraduate students in biotechnology as an initial project outcome

A total of 15 participants attended the workshop (Fig. 1), one from industry, two students and the rest were academic staff from two faculties of the University of Zagreb, the Faculty of Chemical Engineering and Technology and the Faculty of Food Technology and Biotech-

nology. Anita Šalić was the moderator of the workshop and opened the workshop with a short introduction about the BIOTE(A)CH project in general, the goals and the Project activities so far.

To achieve the goals of the workshop, after the initial discussion and statistical data on how many students are employed in the industry each year, the sectors in which graduates work, whether students receive further training after they are employed, the content of the training, the budget allocated for training new graduates, etc., the first step was to *identify innovations and challenges in biotechnology* nowadays as a basis for advising current students and better preparing them for the job market. Participants cited numerous challenges and innovations (Fig. 2). Most of these are related to waste management, biofuel production, biodegradable plastics, food/resource supply, and ethical and regulatory hurdles.

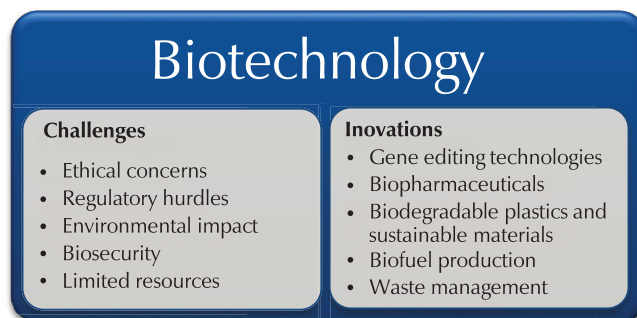


Fig. 2 – Challenges and innovations in biotechnology



Fig. 1 – Workshop opening

When asked about the *knowledge and skills currently required of university graduates in the biotechnology industry*, participants indicated that the biotechnology industry is rapidly evolving and that graduates entering the field are expected to have a variety of skills and a solid foundation of knowledge. All participants believe that graduates have a good educational background, but that more emphasis should be placed on new technologies in lectures. Also, students should do more lab exercises, but unfortunately this is often limited by space in faculty labs. They emphasized that understanding business principles, market analysis and intellectual property rights, and awareness of entrepreneurship and commercialization processes would be good skills. In addition, skills in managing research projects, budgets, and schedules are highly desirable nowadays. They should also be aware of the ethical issues associated with biotechnology, including privacy concerns, the ethics of genetic modification, and the social implications of biotechnological applications. In addition, good written and oral communication skills are essential for presenting research findings, writing reports, and collaborating with interdisciplinary teams. The ability to work effectively in teams often composed of scientists from diverse backgrounds such as biology, chemistry, engineering, and computer science is desirable, as is

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continuous learning and adaptability, as biotechnology is a dynamic field. Graduates should be willing to learn new techniques, keep abreast of the latest research, and adapt to new technologies and methods. They should also be able to critically analyse problems, design experiments, and develop innovative solutions to challenges in the biotechnology industry.

Regarding the challenges/problems of transitioning from academia to industry, participants emphasized that the transition from academia to industry can be a difficult and crucial stage in an individual's career. Several important issues were highlighted. The first is the lack of practical experience, as university education often focuses on theoretical knowledge and graduates lack practical experience in the real world of industry. Therefore, it is important to bridge the gap between theoretical knowledge and practical application. Internships or research projects with industry partners can provide valuable practical experience. The second problem is the mismatch between skills and abilities, when graduates lack certain skills or software knowledge needed in industry. Taking online courses, attending workshops, or being mentored during the first year of employment can help provide the necessary skills. The third problem is that many graduates lack interviewing skills and soft skills such as effective communication, teamwork, and problem-solving in a professional environment. This problem can be addressed by practicing interviewing skills, attending professional development workshops, and obtaining feedback from professionals. The fourth problem is that university graduates may have unrealistic expectations about the job, salary, or work-life balance. However, by learning about the industry and job duties and talking to professionals, they can get a realistic idea of what to expect. Being open to entry-level positions to gain experience is often a necessary step. The fifth challenge is what is known as imposter syndrome. University graduates sometimes feel inadequate or unqualified, even though they have the necessary skills and qualifications. However, finding a mentor, talking to peers, and focusing on successes and skills can help overcome self-doubt.

When asked for examples of knowledge-based challenges and how to overcome them, participants pointed to outdated curricula that do not align with current industry needs or technological advances. Because of this, graduates may lack the skills and knowledge needed in the job market. The problem can obviously be solved by modernizing the curricula in terms of both presentation and content. Limited research funding is also a major problem. Due to the lack of funding, students are unable to conduct additional research in laboratories. As a result, graduates lack the practical skills and experience required by industry.

One possible solution to overcome these challenges is to improve the quality of undergraduate biotechnology education:

1. Curricula should be adapted to the latest developments in biotechnology, including gene editing technologies, synthetic biology, and bioinformatics. Interdisciplinary courses combining biology, chemistry, computer science, and engineering should be introduced to provide a holistic understanding of biotechnology.
2. Students should gain extensive hands-on laboratory experiences that enable them to perform experiments, use advanced biotechnology equipment, and acquire practical skills. Research-oriented projects should be offered that allow students to work on real scientific problems under the guidance of faculty members.
3. Collaboration with biotechnology companies, research institutions, and professionals should be encouraged to expose students to real industry challenges.
4. Students should be offered workshops and seminars on communication skills, project management, and teamwork to prepare them for the professional environment. Students should be encouraged to attend conferences and present research papers in the field of biotechnology.

5. To have good students, faculty members should also continue their education to keep up with the latest advances and teaching methods in biotechnology.

After the discussion ended, Anita Šalić thanked everyone for their participation and fruitful discussion. Participants were also asked to think about five different challenges and five proposed solutions for bridging the gap between university and industry so that graduates can be successful in their careers and adapt their work easily after the workshop. Responses were collected and presented in Table 1.

**Table 1** – Challenges and solutions for bridging the gap between university and industry

Challenges	Solutions
Lack of practical experience	Establish partnerships between universities and industries to create internship and co-op programs. Hands-on experience through internships helps students apply theoretical knowledge to real-world situations
Limited soft skills such as communication, teamwork, and problem-solving are not emphasized enough in the traditional university settings	Incorporate soft skills development workshops into the curriculum. Offer training in communication, teamwork, leadership, and emotional intelligence to prepare students for workplace interactions
Rapid advances in technology and industry often make university curricula outdated	Establish industry advisory boards that regularly review and update curriculum. Professors and industry experts can work together to ensure students are learning the most current and relevant skills
Graduates may not be familiar with the specific tools and software used in the industry	Organize networking events, seminars, and mentoring programs where students can connect with industry professionals. Guest lectures and alumni networks can help students expand their professional contacts
Lack of resourcefulness in finding solutions to new challenges	Challenge students with more project assignments that require students to find solutions on their own, using all available resources
Fear and lack of confidence toward expensive equipment	Encourage and teach students in class to use expensive equipment themselves whenever possible, more time to practice is desirable

The quality of the workshop was assessed using a quality evaluation form, and excellent results were obtained in each category. Some of the participant's comments on organized workshop were:

- "Well organized meeting with constructive discussion"
- "The workshop was stimulating and generated good discussion among the participants. I welcome this type of workshop and wish there were more like it"
- "Great workshop, relaxing, the workshop leader did a good job of introducing the participants to the topic"
- "Excellent workshop, excellent presentation, and discussion about the gaps between faculties and industries, and excellent ideas about future improvements when it comes to connecting students and their professors with the challenges facing the industries"
- "The workshop was really interesting, and it made me think about some important things which I can say or advise to the students"
- "Short but informative, to the point and overall well-rounded"