

SELF-EVALUATION REPORT FOR MODULE 3

THE NAME OF THE UNIT BEING EVALUATED: Faculty of Biomedical Engineering

FORD: 2 - Engineering and technology

SOCIAL CONTRIBUTION OF THE EVALUATED UNIT

3.1 Introductory information about the unit under evaluation

The evaluated unit will describe its mission and vision and provide a general self-reflection of the societal contribution of R&D&I, along with its long-term goals in the fields it develops. The distribution of research activities by type of research will also be commented on.¹ The evaluated unit will describe its organisational structure and size (staffing, number of students, number of study programmes implemented, etc.) based on the data provided in annex tables 3.1.1 to 3.1.6.

Maximum 1000 words.

This is a non-rated indicator that serves as an introduction to the evaluated unit, providing context for data in indicators 3.2-3.7.

Self-assessment:

Mission of the Faculty of Biomedical Engineering

The Faculty of Biomedical Engineering (FBME) at CTU is a significant center of interdisciplinary education, science, research, development, innovation and creative activity. It has respected results at the national and international level. It focuses on promising fields of the future, technical, natural science, health, management and security, which are associated with high societal demand, especially in non-medical health professions, but also components of the integrated rescue system. With a significant interdisciplinary approach in areas such as biomedical engineering, technology, informatics, cybernetics, healthcare, crisis management and population protection, it contributes to solving current challenges and societal problems for the benefit of an increased quality of life and population protection.

Vision of FBME

The FBME of CTU will continue to be a respected centre of interdisciplinary education, science, research, development, innovation and creative activity, whose significant results will be disseminated by our students and graduates, as well as by academic staff concentrated in scientific teams, both nationally and internationally. It will focus on promising future fields with added value of technical development, which are linked to high societal demand. The faculty wants to be a respected and reliable partner in addressing current challenges and societal problems in the region, as well as in the national and international context.

¹ Basic, applied, contract, artistic research (see Definition of Terms in Methodology HEI2025+).

Organisational structure of FBME

The academic bodies of FBME are the Dean, the Academic Senate (AS), the Scientific Council, the Disciplinary Committee, and the Secretary. The AS is the self-governing representative body of FBME. The AS approves, among other things, the strategic documents of FBME, internal regulations and the budget, decides on the proposal for the appointment of the Dean, and expresses its opinion on proposals for study programmes implemented at the faculty. The Dean is the supreme representative of FBME and the representative in relation to other bodies. The Scientific Council expresses its opinion mainly on matters submitted to it by the Dean. The Disciplinary Committee hears disciplinary offences of students and proceeds in accordance with the Disciplinary Regulations for Students of CTU, which are given by the internal regulations of FBME. The Secretary heads the Dean's Office and manages the management and internal administration of FBME within the scope set by the Dean's measure. The Ethics Committee oversees the preservation of ethical principles of research and creative activities carried out at FBME, cooperates in the unification of national and regional approaches with international ethical standards containing ethical principles and applies these standards to its practical activities.

The faculty has five separate departments and a dean's office. The departments are

1. Department of Biomedical Informatics,
2. Department of Biomedical Technology,
3. Department of Health Care and Population Protection,
4. Department of Information and Communication Technologies in Medicine,
5. Department of Natural Sciences.

FBME currently has a total of 14 research teams whose focus covers a large part of the areas of biomedical engineering:

1. Bio-Electromagnetism,
2. Bioreactors for tissue and organ replacements,
3. Biotelemetry systems,
4. Brain Team FBME,
5. Cardiac Electrophysiology team,
6. Health technology assessment for medical devices,
7. Health technology for space applications,
8. Interaction of XUV radiation with biological objects,
9. Nanocomposite and nanocrystalline materials for implantology and biomedicine,
10. New trends in disaster medicine,
11. Non-conventional Ventilatory Team (NVT),
12. Rehabilitation process quantification,
13. Team of Biomechanics and Assistive Technology,
14. Telemedicine and diabetes.

Size of the Faculty

The numbers of FBME staff, students and study programs for the monitored period are summarized in Tables 3.1.1-3.1.5.

Staffing

Between 2019 and 2023, the number of faculty staff (full FTE) ranged from 160 to 180 persons. Based on the recommendation of the international evaluation panel to support employees in habilitation and appointment procedures, the faculty has introduced a new incentive system that is oriented towards the results required from candidates in the respective procedures. In the reporting period, a total of 12 staff members were habilitated (all in the age range 30-50 years) and 2 were appointed full professors (in the age of 40 and 41).

Number of students

The total number of faculty students in bachelor's, master's and doctoral studies increased from approximately 1,500 to 2,000 between 2019 and 2023.

Number of study programs implemented

In total, the faculty runs 8 bachelor's, 6 master's and 3 doctoral study programs.

Bachelor's degree study programs (3 years)

- Biomedical Technology (in Czech and English)
- Optics and Optometry
- Informatics and cybernetics in healthcare
- Physiotherapy
- Radiological assisting
- Laboratory diagnostics in healthcare
- Paramedics
- Public safety and security

Master's degree study programs (2 years)

- Biomedical and Clinical Engineering (in Czech and English)
- System Integration of Processes in Healthcare
- Biomedical and Clinical Informatics
- Civil Emergency Planning
- Applied Physiotherapy
- Biomedical Laboratory Methods

Doctoral study programs (4 years)

- Biomedical Engineering (in Czech and English)
- Civil Emergency Preparedness
- Assistive Technology (in Czech and English)

We Are Unique in the World

- **in developing equipment for artificial pulmonary ventilation.** We are one of the world's top workplaces in this field, which is working on optimizing the high-frequency pulmonary ventilation used in neonatology and for adults. This team is behind the rapid development of the lung ventilator CoroVent during the COVID-19 pandemic.
- **in having our applications-oriented facility in Prague Albertov,** which links the innovative potential of the university environment with professional commercial implementations. The potential of the facility is focused on projects linking technology, medicine, health care services and social services together with elements of safety, security and rescue teams.
- **in developing microwave-based diagnostics and therapy.** A well-established team in the European community is working on EC projects such as H2020, MSCA, COST Actions, Interreg CE and prestigious national projects from the Czech Science Foundation. The

team founded the first spin-off at CTU in 2023 according to the new CTU concept and its first product is aimed at electroporation research, especially for cardiology.

Table 3.1.1 - Staffing per FTE²

Academic/ Professional position	Total / Of which women					
	2019	2020	2021	2022	2023	Total
Professor	8,5/0,8	8,8/1,0	10,4/1,0	10,4/1,0	9,6/0,8	47,6/4,4
Associate Professor	14,7/2,7	16,6/3,5	16,1/3,9	21,2/4,1	20,9/4,1	89,3/18,3
Assistant Professor	52,4/24,1	49,0/21,9	47,8/20,8	45,3/23,2	46,4/23,4	240,8/113,4
Assistant	35,3/16,8	35,6/15,5	38,9/17,4	38,4/17,5	36,1/17,0	184,1/84,0
R&D Personnel ³	8,8/3,9	20,5/11,1	20,3/11,1	15,8/7,9	12,2/5,4	77,5/39,4
Researchers in other categories ⁴	9,7/1,3	14,1/4,6	15,3/5,5	13,2/2,6	15,2/3,7	67,5/17,7
Technical and economic staff ⁵	31,3/23,6	31,5/22,9	31,3/23,0	28,7/21,3	31,1/24,1	153,8/114,8
Scientific, research and development staff involved in teaching activities	69,2/21,6	72,7/23,2	72,4/22,8	70,4/22,5	67,0/22,0	351,6/112,0
Early career researchers ⁶	41,9/11,9	46,0/16,6	42,3/16,3	34,1/11,4	33,4/11,7	197,5/67,7
Total ⁷	160,5/73,1	176,0/80,3	179,9/82,6	172,8/77,5	171,2/78,4	860,5/391,8

Note: The categories professor, associate professor, assistant professor, assistant, other scientific, R&D personnel, researchers in other categories and technical and economic staff are mutually exclusive, i.e. one staff member is reported under one category only. Scientific, research and development staff involved in teaching activities, as well as early career researchers are reported collectively for all the above-mentioned categories.

3.1.2 Age structure of R&D&I personnel of the evaluated unit and their structure by job title and gender in the year 2019 (numbers of physical employees and personnel)⁸

Academic/ professional position	Under 29 years	30-39 years old	40-49 years old	50-59 years old	60-69 years old	70 years and older
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² The average number of hours worked is calculated as the ratio of the total number of hours actually worked during the reference period, from 1 January to 31 December, by all staff (including agreement on work activity, excluding agreement on work performance) to the total annual working time pool per full-time employee. The full-time status of the worker in the evaluated unit is always reported. If an employee holds more than one type of full-time job within the evaluated unit, the total sum of the two shall be reported.

³ The category "R&D Personnel" includes technical and professional personnel who are not directly involved in R&D&I but are indispensable for the research activity (e.g. operators of research facilities).

⁴ The category "Researchers in other categories" includes all other staff who cannot be classified under any of the above categories (e.g. independent researcher/scientist).

⁵ Who participates in the management and support of R&D&I in the institution.

⁶ See Definition of Terms in Methodology HEI2025+.

⁷ Total is the sum of the categories: professor, associate professor, assistant professor, assistant, R&I personnel, researchers in other categories and technical and economic staff.

⁸ The total number of employees/workers as of 31st December of the calendar year in question is to be entered, irrespective of the level of time worked, but only in an employment relationship (including agreement on work activity, excluding agreement on work performance). Other types of contractual relationships under the Civil Code that involve purchase of services are not included.

	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women
Professor	0	0	0	0	1	0	0	0	4	1	6	2
Associate Professor	0	0	2	0	4	0	3	1	7	1	5	1
Assistant Professor	2	1	24	7	12	4	2	2	4	2	0	0
Assistant	6	2	16	7	5	1	2	0	2	0	0	0
R&D Personnel ⁹	7	6	9	3	3	1	4	3	3	1	2	0
Researchers in other categories ¹⁰	8	1	5	1	11	7	0	0	3	0	0	0
Technical and economic staff ¹¹	0	0	1	0	1	0	0	0	0	0	0	0
Scientific, research and development staff involved in teaching activities	11	5	43	15	23	5	7	3	17	4	12	3
Early career researcher ¹²	16	4	47	15	0	0	0	0	0	0	0	0
Total ¹³	23	10	57	18	37	13	11	6	23	5	13	3

Note: The categories professor, associate professor, assistant professor, assistant, other scientific, R&D Personnel, Researchers in other categories and Technical and economic staff are mutually exclusive, i.e. one staff member is reported in only one category. The categories of scientific, research and development staff involved in teaching activities and early career researchers are reported collectively for all the above-mentioned categories.

3.1.3 Age structure of R&D&I personnel of the evaluated unit and their structure by job title and gender in the year 2023 (numbers of physical employees and personnel)¹⁴

Academic/ professional position	Under 29 years		30-39 years old		40-49 years old		50-59 years old		60-69 years old		70 years and older	
	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women
Professor	0	0	0	0	2	0	1	0	2	1	5	1
Associate Professor	0	0	4	1	5	0	5	0	4	1	5	1
Assistant Professor	0	0	12	6	13	3	4	3	3	1	0	0
Assistant	4	3	13	2	8	4	2	0	0	0	1	0
R&D Personnel ¹⁵	9	4	7	3	4	2	1	0	0	0	2	0

⁹ The category "R&D Personnel" includes technical and professional personnel who are not directly involved in R&D&I but are indispensable for the research activity (e.g. operators of research facilities).

¹⁰ The category "Researchers in other categories" includes all other staff who cannot be classified under any of the above categories (e.g. independent researcher/scientist).

¹¹ Who participates in the management and support of R&D&I in the institution.

¹² See Definition of Terms in Methodology HEI2025+.

¹³ Total is the sum of the categories: professor, associate professor, assistant professor, assistant, R&I Personnel, Researchers in other categories and technical and economic staff.

¹⁴ The total number of employees/workers as at 31.12. of the calendar year in question is to be entered, irrespective of the level of time worked, but only in an employment relationship (including agreement on work activity, excluding agreement on work performance). Other types of contractual relationships under the Civil Code that involve purchase of services are not included.

¹⁵ The category "R&D Personnel" includes technical and professional personnel who are not directly involved in R&D&I but are indispensable for the research activity (e.g. operators of research facilities).

Researchers in other categories ¹⁶	7	3	18	3	8	1	3	1	2	0	1	0
Technical and economic staff ¹⁷	0	0	0	0	0	0	1	0	0	0	0	0
Scientific, research and development staff involved in teaching activities	6	4	31	10	29	8	12	3	9	3	12	2
Early career researcher ¹⁸	11	6	47	12	0	0	0	0	0	0	0	0
Total ¹⁹	20	10	54	15	40	10	17	4	11	3	14	2

Note: The categories professor, associate professor, assistant professor, assistant, other scientific, R&D personnel, researchers in other categories and technical and economic staff are mutually exclusive, i.e. one staff member is reported under one category only. Scientific, research and development staff involved in teaching activities, as well as early career researchers are reported collectively for all the above-mentioned categories.

Table 3.1.4 – Students

Type of study	2019		2020		2021		2022		2023		Total	
	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women
Undergraduate	972	650	1062	688	1276	803	1198	751	1200	767	5708	3659
Master's ²⁰	383	211	394	202	479	285	427	256	440	261	2123	1215
Doctoral	130	50	151	65	158	63	154	63	172	77	765	318
Lifelong Learning Courses	13	10	53	42	181	98	282	193	246	180	775	523
Total	1498	921	1660	997	2094	1249	2061	1263	2058	1285	9371	5715

Table 3.1.5 - Study programmes in Czech/English

Type of study programme	Total ²¹ / Of which professional study programmes											
	2019		2020		2021		2022		2023		Total	
Undergraduate	6/1	2/0	11/2	4/0	15/2	4/0	15/2	4/0	15/2	4/0	62/9	18/0
Master's	10/2	3/0	12/3	4/0	12/2	4/0	9/2	4/0	8/1	5/0	51/10	20/0
Doctoral	9/0	0/0	10/0	0/0	11/1	0/0	12/2	0/0	10/2	0/0	52/5	0/0
Lifelong Learning courses	1/0	0/0	11/0	2/0	9/0	1/0	9/0	0/0	9/0	1/0	39/0	4/0
Total	26/3	5/0	44/5	10/0	47/5	9/0	45/6	8/0	42/5	10/0	204/24	42/0

¹⁶ The category "Researchers in other categories" includes all other staff who cannot be classified under any of the above categories (e.g. independent researcher/scientist).

¹⁷ Who participates in the management and support of R&D&I in the institution.

¹⁸ See Definition of Terms in Methodology HEI2025+.

¹⁹ Total is the sum of the categories: professor, associate professor, assistant professor, assistant, R&I personnel, researchers in other categories and technical and economic staff.

²⁰ All master's degree students are listed, regardless of the length of their programme of study.

²¹ The total number of study programmes for which admissions have been announced in a given academic year.

Note: For each SP type, enter the number of SPs in Czech language in the first cell and insert the number of SPs in English language after the slash in the same cell (e.g. 15/3), enter the number of professional SPs in Czech language in the second cell and insert the number of professional SPs in English language after the slash. Follow a similar procedure in the last column of the table (Total).

3.1.6 – R&D&I capacities

R&D&I field	FORD	FORD share [%]	Predominant type of research	Total share of industry group [%]
1. Natural Sciences	1.1 Mathematics	0,00%	Zvolte položku.	16,95
	1.2 Computer and information sciences	5,79%	Balanced basic and applied research	
	1.3 Physical sciences	3,02%	Balanced basic and applied research	
	1.4 Chemical sciences	1,18%	Balanced basic and applied research	
	1.5 Earth and related environmental sciences	1,37%	Balanced basic and applied research	
	1.6 Biological sciences	4,60%	Balanced basic and applied research	
	1.7 Other natural sciences	0,99%	Balanced basic and applied research	
2. Engineering and Technology	2.1 Civil engineering	0,08%	Balanced basic and applied research	46,37
	2.2 Electrical engineering, Electronic engineering, Information engineering	6,38%	Balanced basic and applied research	
	2.3 Mechanical engineering	1,57%	Balanced basic and applied research	
	2.4 Chemical engineering	0,00%	Zvolte položku.	
	2.5 Materials engineering	1,21%	Balanced basic and applied research	
	2.6 Medical engineering	31,28%	Balanced basic and applied research	
	2.7 Environmental engineering	0,00%	Zvolte položku.	
	2.8 Environmental biotechnology	1,09%	Balanced basic and applied research	
	2.9 Industrial biotechnology	0,00%	Zvolte položku.	
	2.10 Nanotechnology	2,40%	Balanced basic and applied research	
	2.11 Other engineering and technologies	2,44%	Balanced basic and applied research	

3. Medical and Health Sciences	3.1 Basic medicine	2,21%	Balanced basic and applied research	28,06
	3.2 Clinical medicine	14,41%	Balanced basic and applied research	
	3.3 Health sciences	11,44%	Balanced basic and applied research	
4. Agricultural and veterinary sciences	4.1 Agriculture, Forestry, and Fisheries	0,00%	Balanced basic and applied research	0,00
	4.2 Animal and Dairy science	0,00%	Balanced basic and applied research	
	4.3 Veterinary science	0,00%	Zvolte položku.	
	4.4 Other agricultural sciences	0,00%	Zvolte položku.	
5. Social Sciences	5.1 Psychology and cognitive sciences	1,63%	Zvolte položku.	8,29
	5.2 Economics and Business	0,07%	Zvolte položku.	
	5.3 Education	1,57%	Zvolte položku.	
	5.4 Sociology	0,27%	Balanced basic and applied research	
	5.5 Law	1,77%	Balanced basic and applied research	
	5.6 Political science	1,61%	Balanced basic and applied research	
	5.7 Social and economic geography	0,01%	Balanced basic and applied research	
	5.8 Media and communications	0,16%	Balanced basic and applied research	
	5.9 Other social sciences	1,20%	Balanced basic and applied research	
6. Humanities and the Arts	6.1 History and Archaeology	0,00%	Balanced basic and applied research	0,25
	6.2 Languages and Literature	0,00%	Balanced basic and applied research	
	6.3 Philosophy, Ethics and Religion	0,00%	Balanced basic and applied research	
	6.4 Arts (arts, history of arts, performing arts, music)	0,00%	Zvolte položku.	
	6.5 Other Humanities and the Arts	0,25%	Zvolte položku.	
Total		100,00 %	-	100,00 %

RECOGNITION BY THE RESEARCH COMMUNITY

3.2 Recognition by the research community

The evaluated unit will briefly comment on its position in the research community. It shall consider individual and other prestigious R&D&I awards, participation of its academic staff in the editorial boards of international scientific journals, elected membership in professional societies, major invited lectures given by the evaluated unit's academic staff abroad or by foreign scientists and other relevant guests at the evaluated unit. Additionally, it will address the involvement of staff in the evaluation of national or European project/programme calls over the period of 2019–2023 based on the data provided in annex tables 3.2.1 to 3.2.5 (max. 10 most relevant items). If necessary, the evaluated unit shall list any additional services to the scientific community that it considers relevant.

Maximum 1000 words.

Self-assessment:

Selected individual examples are presented in Tables 3.2.1-3.2.5.

Prestigious R&D&I awards are regularly won not only by the faculty staff members but also by its students. In the overview of the 10 most important ones in Table 3.2.1, the results of both groups were purposely listed. It is worth to mention awards of Prof. Karel Roubik related to the rapid development of a lung ventilator during the global pandemic COVID-19.

Regarding the participation of the academic staff in the editorial boards of international scientific journals, it is evident from Table 3.2.2 that the staff of the faculty participate in the activities of high-quality scientific journals of prestigious publishers such as Springer (4x), Elsevier (1x) and IET (1x). In addition, the faculty self publishes a peer-reviewed journal Clinician and Technology (ISSN: 0301-5491) indexed in the SCOPUS database. It is also worth mentioning the involvement of our employees in the review process of peer-reviewed journals with an impact factor. According to the internal database of CTU (V3S), our employees elaborated more than 625 reviews in the monitored period.

Table 3.2.3 shows a selection of the 10 most important invited talks given by our employees at international conferences and workshops.

Table 3.2.4 lists the 10 most important lectures by foreign experts at the faculty. During the given period, faculty staff organized several international conferences with significant foreign participation. One such conference was the Photonics and Electromagnetics Research Symposium (PIERS) in 2023 in Prague, with the participation of around 1,200 people from approximately 80 different countries. Students and faculty staff had free admission to the conference. Also, every year, faculty staff participated in the organization of the Nanocon conference held in Brno, which is typically attended by 200 to 300 experts, including Nobel laureates, from around 30 countries.

The 10 most significant involvements of faculty staff in the evaluation of national and international project calls are listed in Table 3.2.5. It is worth mentioning the evaluation of projects for Swiss and Slovak agencies. Among the national agencies, the membership of our employees in the Czech Science Foundation and Czech Health Research Council panels can be highlighted. These two agencies are among the most prestigious agencies funding basic research and applied health research in the Czech Republic, respectively.

Furthermore, the faculty is a member of the European Alliance for Medical and Biological Engineering and Sciences (EAMBES) and a member of the Association of University Educators of Non-Medical Health Professions in the Czech Republic. This membership enables us to participate fully in the activities of this Association, to get acquainted with the knowledge accumulated in other medical and

health facilities in the Czech Republic, where study programs focused on health issues are also accredited, and to participate in changes resulting from the amendment to the Higher Education Act.

FBME academic staff are elected members of committees of national and international professional societies. The faculty records a total of 23 such memberships. Among the professional societies whose committees include FBME staff are e.g.:

- Czech Medical Association of J. E. Purkyně
 - o The Czech Society of Biomedical Engineering and Medical Informatics, FBME is represented by the President, Assoc. Prof. Ing. Jiří Hozman, Ph.D., the Scientific Secretary, Assoc. Prof. Ing. Lenka Lhotská, CSc., and three members of the Committee, Assoc. Prof. Ing. Martin Rožánek, Ph.D. and prof. Ing. Karel Roubík, Ph.D. and Assoc. Prof. MUDr. Jan Bruthans, Ph.D., MBA,
 - o Society for Radiobiology and Crisis Planning, FBME is represented by the Vice-chairman, prof. MUDr. Leoš Navrátil, CSc. and one member of the committee, Mgr. Renata Havráňková, Ph.D,
- Engineering in Medicine and Biology Chapter of the Czechoslovakia Section of IEEE, where FBME is represented by the President, prof. Ing. David Vrba, Ph.D., and one member of the Committee, Assoc. Prof. Ondřej Fišer, Ph.D.,
- International Academy of Laser in Medicine and Surgery – one member of the committee, prof. MUDr. Leoš Navrátil, CSc., MBA, dr.h.c.,
- IMEKO International Measurement Confederation – two members of the committee, prof. Ing. Peter Kneppo, DrSc., Dr.H.C., prof. Ing. Karel Roubík, Ph.D.,
- International Union for Physical and Engineering Sciences in Medicine – one member of the committee, Assoc. Prof. Ing. Lenka Lhotská, CSc.,
- European Association for Education in Electrical and Information Engineering – one member of the committee, Assoc. Prof. Ing. Lenka Lhotská, CSc.,
- European Federation of Medical Informatics – one member of the committee, Assoc. Prof. Ing. Lenka Lhotská, CSc.,
- International Federation for Medical and Biological Engineering– one member of the committee, Assoc. Prof. Ing. Lenka Lhotská, CSc.,
- Slovak Society for Biomedical Engineering and Medical Informatics – one member of the committee, prof. Ing. Peter Kneppo, DrSc.

Table 3.2.1 - Prestigious R&D&I awards granted during the evaluation period

Name, surname and title(s) of the evaluated unit's staff member	Name of the award	Awarding institution
Ing. Ondřej Fišer, Ph.D.	Best dissertation thesis	Engineering in Medicine and Biology, Chapter of CS IEEE, 2019.
Mgr. Anna Kmecová	Winner startup - RescueRoom	Social Impact Award Slovakia 2019/ https://slovakia.socialimpactaward.net/Slovakia.
Assoc. Prof. RNDr. Pavla Bojarova, Ph.D.,	The best review article	2019 Award of the Institute of Microbiology of the Academy of Sciences of the Czech Republic.
prof. Ing. Karel Roubík, Ph.D.	Innovators 20 (20 best innovators of the Czech Republic in 2020)	Hospodářské noviny (a well-known economic national daily newspaper published in the Czech Republic, www.hn.cz) and server CzechCrunch, Czech Republic.

prof. Ing. Karel Roubík, Ph.D.	2nd prize of "Hack the Crisis" with financial price for further research of 2 000 000 CZK for design of CoroVent.	CzechInvest and Ministry of industry and trade. 2020. Czech Republic.
Ing. Hana Mózerová	Best Master's Thesis	IEEE MTT-S International Microwave Biomedical Conference (IEEE IMBioC) held December in 14 - 17, 2020 in Toulouse, France.
Prof. RNDr. Evžen Amler, CSc.	Honorary recognition of the Minister of Health for medical research and development for the year 2020	2021, Ministry of Health of the Czech Republic.
Ing. Ondřej Klempíř, Ph.D.	Josef Hlávka Award	Foundation "Endowment of Josef, Marie and Zdeňka Hlávka", for outstanding creative thinking, Czech Republic.
prof. Dr.-Ing. Jan Vrba, M.Sc.	Session Organizer Award	The Electromagnetic Academy. Awarded for organization of Special Session at Photonics and Electromagnetics Research Symposium, PIERS 2023. Prague, Czech Republic.
Bc. Ksenia Kulaková	Best Poster Award in a common category to bachelor's, master's and doctoral students	Society of Women Engineers (SWE), WE Local Conference 2023, Barcelona, Spain.

Note: Provide up to 10 examples.

Table 3.2.2 Participation of academic staff of the evaluated unit in editorial boards of international scientific journals during the evaluation period

Name, surname and title(s) of the evaluated unit's staff member	Name of scientific journal, ISSN
doc. Ing. Lenka Lhotská, CSc.	Engineering Applications of Artificial Intelligence, Elsevier Science, ISSN 0952-1976, IF = 7.5.
doc. Ing. Lenka Lhotská, CSc.	Transactions on large-scale data- and knowledge-centered systems, Springer. ISSN 1869-1994.
doc. Ing. Lenka Lhotská, CSc.	Health and Technology, Springer. ISSN 2190-7188, IF = 7.5.
prof. MUDr. Leoš Navrátil, CSc., MBA, dr.h.c.	Acta medica, Faculty of Medicine in Hradec Kralove of Charles University, ISSN 1211-4286.
doc. MUDr. Ján Lešták, CSc. MBA	Biomedical papers, Medical Faculty of the University Palacký, ISSN 1213-8118, IF = 0.7.
prof. Ing. Peter Kneppo, DrSc., Dr. H. C.	American Journal of Biomedical Science & Research, BiomedGrid LLC, ISSN 2642-1747.
doc. MUDr. Jan Bruthans, Ph.D., MBA	Journal of Medical Systems, Springer Nature, ISSN 0148-5598, IF = 3.5.
Ing. Petra Hospodková, Ph.D., MBA	Technology and Health Care, IOS Press, ISSN 0928-7329, IF = 1.4.
doc. RNDr. Pavla Bojarová, Ph.D.	Folia Microbiologica, Springer. ISSN 0015-5632, IF = 2.4.
prof. Ing. et Ing. Fabian Khateb, Ph.D. et Ph.D.	IET Circuits, Devices & Systems, The Institution of Engineering and Technology (IET). ISSN 1751-858X, IF = 1.0.

Note: Please provide up to 10 examples of academic staff participation in editorial boards of international scientific journals (e.g. editor, editorial board member, etc.).

Table 3.2.3 The most important invited lectures delivered by the academic staff of the evaluated unit at foreign institutions during the evaluation period

Name, surname and title(s) of the evaluated unit's staff member	Invited lecture title	Name of host institution, or name of conference or event	Year
Ing. Yulia Efremova, Ph.D.	Effects of laser on reparation of damages in gamma-irradiated mice	Laser Florence 2019, Laser biomodulation from scientific research to clinical practice, Italy.	2019
prof. MUDr. Leoš Navrátil, CSc.	The use of hplt in the methodical approach to the treatment of vertebrogenic disorders in patients in outpatient rehabilitation care	Laser Florence 2019, Laser Rehabilitation, Italy.	2019
Ing. Václava Piorecká, Ph.D.	Extraction and evaluation of EEG covariates and their influence on GLM model	2021 International Symposium on Biomedical Engineering and Computational Biology, Nanchang, August 13 - 15, 2021, China.	2021
prof. Ing. Karel Roubík, Ph.D.	Opportunities in Technical Sciences in the Central Bohemia Region	Imperial College London with the Central Bohemian Innovation Center. Online workshop that has the aim of presenting research conducted in Central Bohemia Region. Great Britain.	2021
Assoc. Prof. Pavla Bojarová, Ph.D.	Glyconanomaterials and galectins in biomedicine. Invited plenary lecture IL1.	15BSS - 15th Bratislava Symposium on Saccharides, 20.6.-24.6.2022, Smolenice, Slovakia.	2022
prof. Ing. Anton Fojtík, CSc.	Nanotechnology and inter-disciplinary branch of Science	II. Scientific and Practical Conference. Invited speaker, opening lecture. Bukovinian Sate Medical University, Chernivtsi, Ukraine.	2022
Ing. Petra Hospodková, Ph.D., MBA	Overcoming the Challenges of Physical Inactivity: Do We Know the Solutions	Soochow University Sports Science Research Forum, Soochow University, China.	2023
Ing. Ondřej Klempíř, Ph.D.	1. Acquire the information on the current available open-source brain image database 2. Understand how to properly use or collect open brain image data ethically and legally 3. Adopt value-added strategies and infrastructure to achieve data sustainability	Human Brain Mapping Annual Meeting, Montreal, Canada.	2023
doc. Ing. Lenka Lhotská, CSc.	Ethics and Regulation of Artificial Intelligence	DigiHealthDays 2023, Deggendorf Institute of Technology, Germany.	2023
prof. Ing. Anton Fojtík, CSc.	NANO for Biomedical. Laser for NANO	III. Scientific and Practical Conference. Invited speaker, opening lecture. Bukovinian Sate Medical University, Chernivtsi, Ukraine.	2023

Note: Provide up to 10 examples.

Table 3.2.4 - The most important lectures by foreign scientists and other guests relevant to R&D&I at the evaluated unit during the evaluation period

Name, surname and title(s) of the lecturer	Lecturer's employer at the time of the lecture	Invited lecture title	Year
Prof. Paul Stauffer (H-index = 40)	Director of Dept. of thermal oncology at Thomas Jefferson University Hospital in Philadelphia, USA	Applications of Electromagnetic Energy In Thermal Therapy for Cancer	2019
Prof. Jacob Peleg (H-index = 11)	Head of the Disaster Medicine Department at Tel Aviv University (TAU) School of Public Health	Optimizing Medical Response to Large-scale Disasters	2019
Prof. Gunnar Hartvigsen (H-index = 20)	Department of Computer Science, Faculty of Science and Technology, University of Tromsø – The Arctic University of Norway	The digital health revolution started almost 50 years ago in Northern Norway	2019
Prof. Dr. rer. nat. Knut Möller (H-index = 26)	Furtwangen University, Faculty III: Health, Medical & Life Sciences, Germany	Mechanical lung ventilation and clinical studies	2021
Assoc. Prof. Paolo Maccarni, Ph.D. (H-index = 18)	Department of Electrical Engineering at Duke University and Duke University Medical Center, Durham, USA	Optimization of thermal medicine using the latest technical tools: from multiphysical parametric modeling to photothermally enhanced immunotherapy	2021
Prof. Dr. rer. nat. Knut Möller (H-index = 26)	Furtwangen University, Faculty III: Health, Medical & Life Sciences, Germany	Electrical impedance tomography and its usage on patients with COVID-19	2021
prof. RNDr. Emil Kormuth, MSc., Ph.D. (H-index = 5)	Mangosuthu University of Technology, South Africa	Biomedical Science - Radiation Biology	2022
Assoc. Prof. Bor Kos, Ph.D. (H-index = 26)	Laboratory of Biocybernetics, Faculty of Electrical Engineering, University of Ljubljana	Five lectures and exercises at FBME CTU – Electroporation from cell to body level	2022
Dario Rodrigues, Ph.D. (H-index = 21)	University of Maryland School of Medicine, Baltimore, Maryland, USA	Electromagnetics-based hyperthermia therapy for treatment of brain cancer	2022
Prof. Gunnar Hartvigsen (H-index = 20)	Department of Computer Science, Faculty of Science and Technology, University of Tromsø – The Arctic University of Norway	Technology for (self-management of) diabetes	2023

Note: Provide up to 10 examples.

Table 3.2.5 - Involvement in the evaluation of national/European research project/programme calls relevant to the R&D&I area at the unit during the evaluation period

Name, surname and title(s) of the evaluated unit's staff member	Name of the research project/programme call	Name of the contracting authority/guarantor of the project/programme call	Year
Assoc. Prof. Jan Muzik	Excellent research, Pre-application research	Operational Program Research Development and Education, Ministry of Education, Youth and Sports (Czech Republic)	2016-2020

Assoc. Prof. Jan Muzik	Application, Potential, Digital enterprise	Operational Program Entrepreneurship and Innovation for Competitiveness, Ministry of Industry and Trade (Czech Republic)	2019-2022
prof. Dr.-Ing. Jan Vrba, M.Sc.	Standard grant projects, Lead Agency grant projects, POSTDOC projects	Czech Science Foundation, Panellist and since 2023 Vice-Chairman of the Electrical and Electronic Engineering Panel - P102	2020-2023
prof. Ing. Peter Kneppo, DrSc.	Design solution and biomechanical analysis of personalized instruments for arthroscopic applications/ standard science project	VEGA - Scientific Grant Agency Ministry of Education, Research, Development and Youth of the Slovak Republic and the Slovak Academy of Sciences	2021
doc. Ing. Lenka Lhotská, CSc.	Standard grant projects, POSTDOC projects	Czech Health Research Council, Panellist in Biomedical Technologies Panel - P08	2021-2023
doc. Ing. Lenka Lhotská, CSc.	Interdisciplinary and collaborative projects	Swiss National Science Foundation, Panellist and Referee	2022-2023
prof. Ing. Peter Kneppo, DrSc.	Surface modification of 3D printed titanium spinal implants to improve functional properties/standard science project	VEGA - Scientific Grant Agency Ministry of Education, Research, Development and Youth of the Slovak Republic and the Slovak Academy of Sciences	2023
Doc. Ing. Karel Hána, Ph.D.	Technological incubation	CzechInvest	From 2023
prof. Ing. Peter Kneppo, DrSc.	Bioprinting of spheroids from chorionic and adipose mesenchymal stem cells as building blocks in tissue bioengineering of cartilage and bone tissue.	VEGA - Scientific Grant Agency Ministry of Education, Research, Development and Youth of the Slovak Republic and the Slovak Academy of Sciences	2023
Doc. Ing. Karel Hána, Ph.D.	The Country for the Future	Ministry of Industry and Trade, Czech Republic	From 2023

Note: Provide up to 10 examples.

RESEARCH PROJECTS

3.3 Research projects

The evaluated unit shall list at most 10 (considered most significant by the evaluated unit) research projects/activities (regardless of whether they are supported by public funds or based on contract research²²) that it has implemented or participated in during the period of 2019–2023²³. This should be done from the full list in annex tables (Table 3.3.1-3.3.2)²⁴, regarding particularly the results achieved or the application potential of the projects. The unit should also describe how the research projects contributed to the mission and purpose of the evaluated unit. If the evaluated unit has been a participant in listed project, it shall indicate which other entities were involved and describe its contribution to the project. The interdisciplinary aspects of the projects will also be commented on, along with any collaboration with other units of the evaluated HEI.

Maximum 300 words per project.

Self-assessment:

In the period 2019-2023, the faculty staff was solving a total of 62 projects with a total volume of funds equal to 304 mil. CZK / 11.98 mil. EUR. In the previous evaluation period, the amount of FBME funding received for research projects was 3.88 mil. EUR.

Most of the FBME projects, both in terms of the amount of funds and the number of projects, were supported by national providers.

In the Czech Republic, the excellent basic research and excellent applied medical research is supported by the Czech Science Foundation and the Czech Health Research Council, respectively. The success rate of acceptance of project proposals is usually around 15% only. The FBME is proud of the fact that a total of 6 Czech Science Foundation projects and 8 Czech Health Research Council projects were solved in the reporting period. The total amount of funds obtained from Czech Science Foundation and Czech Health Research Council, in the given period, amounted to 13.7 mil. CZK / 542 thous. EUR and 13.2 mil. CZK / 523 thous. EUR, respectively.

Applied research projects with a higher emphasis on rapid application in practice and positive impact on society were most often obtained from the Technology Agency of the Czech Republic and relevant ministries and government institutions. Without a doubt, these projects bring the highest number of resources to the faculty due to the high costs of prototype implementation and sub-projects. The total amount of funds obtained in this category of projects amounted as follows

Funding provider	Support (in mil. CZK)	Support (in mil. EUR)
Technology Agency of CR	54.966	2.168
Ministry of Education, Youth and Sports CR	8.823	0.348
Ministry of Interior of CR	49.328	1.946
Ministry of Industry and Trade of CR	45.727	1.804
Prague Municip	59.991	2.367

In connection with the projects implemented at the faculty, it is important to mention that the faculty staff were also very successful in obtaining and solving several development projects. Thanks to this

²² For the definition of contract research for the purposes of evaluation in the HE segments, see Article 2.2.1 of the Community Framework for State Aid for Research, Development and Innovation 2014/C 198/01.

²³ Regardless of whether the projects are completed or still ongoing, provided that at least part of the project was implemented during the evaluation period.

²⁴ The evaluated unit shall only fill tables that are relevant to it.

important initiative and great effort, the faculty has high-quality and modern equipment, which is necessary for current and future excellent research of our staff and Ph.D. students. The total amount of funds obtained in this category of projects amounted to 51.4 mil CZK / 2.03 mil. EUR.

FBME was also involved in several international projects supported by the European Commission. Specifically

- H2020, Fast track to Innovation, Left atrial appendage electrical Isolation via bio-photonics optical confirmation to treat persistent atrial fibrillation, 2019-2022, this project is one of the 10 selected projects, which are described in more detail below,
- H2020, Marie Skłodowska-Curie Actions, ElectroMagnetic imaging for a novel genERation of medicAL Devices, 2018-2022, the project supported 14 PhD students, FBME was in the role of a participant, which provided mandatory internships for the students, <http://www.msca-emerald.eu/>.
- ERASMUS+, Innovative Teaching Education in Mathematics, 2018–2022, the project was concerned with the development of new effective teaching methods in mathematics, <https://item.uni-pr.edu/>
- COST Action (CA17115 - European network for advancing Electromagnetic hyperthermic medical technologies, 2018-2023), <http://www.cost.eu/actions/CA17115/>
- Euramet (Affordable low-field MRI reference system, 2023-2025), <https://www.euramet.org/>.

In the 2019–2023 period, the FBME implemented contract research projects with a total volume of 10804 thous. CZK / 423 216 EUR, mainly in research and construction of new biomedical devices, development of diagnostic algorithms and introduction of new methods of telemedicine into clinical practice. In the previous period, the total amount of funds raised for contract research was approximately 462 thousand EUR. This is a decrease of approximately 9%.

The list of contract research is given in Table 3.3.2. The table does not include contract research under NDA and small contracts up to 50 thousand CZK for clarity. The total amount of contracts under NDA and small contracts was 1533 thous. CZK/60038 EUR and 118 thous. CZK/4690 EUR, respectively.

The 10 most significant Research projects solved during the monitored period:

1) Technology for eHealth on CTU (Prague the capital, UH0834, 2019-2021, 25 319 thous. CZK / 998 777 EUR, Assoc. Prof. Ing. Karel Hána, Ph.D.)

The project focused on supporting the transfer of technologies and knowledge from CTU to the field of social and healthcare services in the capital city of Prague. The goal was to assess the feasibility and commercial potential of the following innovative concepts for improving public services.

The first concept was “Telemedicine System for Pediatric Diabetes Treatment”. This concept was aimed at a technological platform for children with type 1 diabetes, with its key component being a mobile diabetes diary application. The app enables the recording of blood glucose levels, insulin doses, carbohydrate intake, and physical activity, with data automatically synchronized across devices used by the patient, parents, and teachers. An integral part of the system is an interactive Furby toy, which helps children better understand their glucose levels.

The objective of the second concept “Enhanced Home Care for Seniors” was to improve existing technologies for remote senior care, particularly in medication management. The system provides advanced medication reminders and offers 24/7 continuous assistance, reducing the burden on

families and caregivers. The technology is designed to help individuals with reduced self-sufficiency manage daily medication-related tasks.

Both technologies were tested for user-friendliness and efficiency and subsequently commercially implemented at the Institut zdravotně sociálních služeb, z.ú. The results are validated technologies that enhance the quality of healthcare and social services provided.

2) Modular multisensory clothing for risk management, health protection and safety of IRS members using artificial intelligence methods (Ministry of the Interior of Czech Republic, VJ02010031, 2022-2025, 12 440 thous. CZK / 49 072 EUR, Assoc. Prof. Ing. Pavel Smrčka Ph.D.)

The project team is multidisciplinary: principal investigator, Czech Technical University in Prague - Faculty of Biomedical Engineering is responsible for the coordination of the project, and for the design and implementation of the subsystem for monitoring health parameters and for the aggregation/analysis of results. The second participant, University of West Bohemia - Faculty of Electrical Engineering works on special flexible connecting structures that can be embedded in clothing, as well as on the development of sensors for hazardous substances in the environment. The third participant, National Institute for Nuclear, Chemical and Biological Protection is responsible for the implementation of system tests in the climate chamber under conditions close to operational deployment. The last participant, Technical University of Liberec - Faculty of Textile Engineering, is responsible for the selection and testing of suitable underwear for the installation of sensors. Main result of the project will be solution of the multisensory monitoring system that will allow monitoring the physiological state of the wearer using methods of artificial intelligence based on adaptive individualized evaluation of parameters such as body temperature, heart rate, breathing activity, physical activity, etc. (inner layer of the garment) and monitoring of the wearer's chemical, thermal etc. burden by evaluating parameters such as temperature under clothing, humidity under clothing and measuring the concentration of selected CBRN substances (outer layer of garment). The system will be designed to reduce risk, protect the health and safety of members of the IRS in real time and will also enable wireless remote monitoring of wearers at the commander's station during routine and CBRN incidents in difficult to access terrain to improve the commander's decision-making process.

3) Therapeutic rehabilitation robot controlled by brain signals (Technology Agency of the Czech Republic, FW03010025, 2021-2025, 11 652 thous. CZK / 459 645 EUR, Assoc. Prof. PhDr. Ing. Jaroslav Průcha Ph.D. et Ph.D.)

The project is focused on the development of a therapeutic neurorehabilitation robot capable of being controlled by the patient's mental intention to perform the desired movement, or rather by the patient's concentration on performing the required movement task, which will significantly increase the efficiency of re-education, "re-learning" the movement of a paretic or plegic limb with the help of a robot whose activity will be directly controlled by signals from the brain. The project applies to the results of practically focused research on the BCI (Brain Computer Interface) method associated with the application of neural networks and artificial intelligence to control a rehabilitation robot. As part of the project, the BCI approach was researched with these goals in several neurorehabilitation robots and an active robot providing treatment for upper limb movement disorders was chosen as the target solution, for which a unique kinematic mechanism, active drives, a sensory network with position and moment sensors of forces and movement scenes, implemented both on a monitor and in virtual reality glasses, were developed. The capture of EEG recordings from relevant electrodes and their processing, including the use of a

neural network, the created classifier and AI training, was solved. The project is close to successful completion.

FBME CTU is in the position of another key participant in the solution. The main recipient of the subsidy was Foton s.r.o. FBME created 2 functional samples, 1 prototype and one utility and one industrial design. Commercialization of the developed solutions is already being ensured in cooperation with Ing. Jan Urban, Ph.D., LL.M., Head of the Technology Transfer Department of the CTU Rectorate, as well as with investors, without whose participation it is not possible to secure the financial resources necessary for the certification process according to the requirements of the MDR Directive.

- 4) Temporal context in the task of analyzing a long-term non-stationary multidimensional signal focuses on the development of semiautomatic and automatic methods for improving EEG data processing** (Czech Science Foundation, GA17-20480S, 2017-2021, 6 144 thous. CZK / 242366 EUR, Assoc. Prof. Ing. Vladimír Krajča CSc.). Key outcomes include enhanced techniques for detecting sleep spindles and artifacts removal from EEG signals. The results have practical applications in both medical and bioinformatics fields, particularly in improving the accuracy of sleep disorder diagnostics and EEG-based analysis tools.

The results achieved have been published in major scientific journals and proceedings, including 11 articles in WoS (Web of Science), 3 articles in Scopus and 20 articles in proceedings.

The project initiated an interdisciplinary collaboration linking informatics, medical engineering, and bioinformatics, which resulted in long-term collaboration on sleep research and the transfer of sleep monitoring technologies for use by the wider public. The work also paved the way for advanced diagnostic tools that could have clinical applications in sleep medicine.

Additionally, the project supported the integration of machine learning techniques with EEG data analysis, which represents a critical step toward more automated and accurate health monitoring systems.

- 5) Development of metamaterial applicators for the regional hyperthermia system and evaluation of the accuracy of treatment planning algorithms** (Ministry of Education, Youth and Sports, LTC19031, 2019-2022, 4 990 thous. CZK / 196 844 EUR, Prof. Dr.-Ing. Jan Vrba, M.Sc.)

The aim of this project was to develop a complete functional laboratory prototype of a hyperthermic regional system enabling hyperthermic heating in the pelvic area and abdominal cavity, consisting of: 1. a technically advanced and clinically usable prototype of a regional hyperthermic system with metamaterial antenna elements including a system for controlling the amplitudes and phases of individual channels, monitoring incident and reflected powers and measuring temperature, 2. software for planning hyperthermic treatment, 3. tools for quantitative verification of the functionality of regional systems. The results are 5 publications in impacted journals, 3 conference papers, one chapter in a book, a synchronous RF signal generator with amplitude and phase adjustment, modules for measuring amplitudes and phases of signals entering the antenna elements and metamaterial antenna elements.

Furthermore, a universal tool for creating hyperthermia treatment planning, enabling easy and reproducible creation of simulation models was developed. This tool allows the

automatic generation of complete simulation models for regional hyperthermia treatment planning. It is currently being implemented in the clinical planning process at the University Hospital Hyperthermic Department of the Erasmus MC Cancer Institute, Rotterdam, The Netherlands.

6) Functionalized nanofibers as a cover of colorectal anastomosis (Ministry of Health, NV16-29680A, 2016-2019, 4394 thous. CZK / 173333EUR, Prof. RNDr. Evžen Amler CSc.)

The project is a natural continuation of previous projects awarded by the Award of Ministry of Health for best research results. The main result of the Project was description and optimization of fractionalized nanofibers for injectable systems. This has opened a door for laparoscopic surgery and solves the problem of aseptic inflammation evoked by a larger nanofiber membrane that had been used for intestine cover after colonoectomy. The main contribution of FBME has been production of functionalized nanofibers for regenerative medicine and nanotheragnostics. Results led to several completed PhD. theses and also deepening of the international cooperation, namely with University of Naples, Milano and Sassari, as well as of the cooperation on the national level (2nd Faculty of Medicine, Charles University at Prague, Veterinary and Pharmaceutical University, Brno).

The Project has led to dozen publications in impact journals and to continuation of the research on the Czech as well as international level. The main implication for the years 2019-2023 was pavement of the way towards modern nanotheragnostics and personalized medicine. There were also performed first steps towards technological transfer of obtained results on the market level. Unfortunately, there is an obvious lack of enthusiastic donors and/or investors on the Czech market. Consequently, alternative steps have been taken which, however, hinders and slows down the technological transfer.

7) Multiphysical Study of Superposition of Electromagnetic Waves in Human Head Model to Verify the Feasibility of Microwave Hyperthermia of Brain Tumors (Czech Science Foundation, GA21-00579S, 2021-2023, 4 621 thous. CZK/ 182 288 EUR, Prof. Ing. David Vrba, Ph.D.)

Microwave hyperthermia is a cancer therapy. State-of-the-art microwave hyperthermia systems are based on active phased antenna arrays and use the superposition of electromagnetic waves to increase the temperature in the treated area. Given the clinically proven benefits of hyperthermia in combination with standard therapies for various tumor locations and the recent development of 3D non-invasive temperature measurements using MRI systems, the hyperthermia community believes that the time has come to apply regional microwave hyperthermia to brain tumor patients as well. Because brain tissue is very sensitive to elevated temperature, conformal heating of the treated area, as well as accurate non-invasive 3D temperature monitoring, are key to effective and safe microwave hyperthermia for brain tumors.

This interdisciplinary research project has provided new insights into the feasibility of superposition of electromagnetic fields in the human brain region, its limitations as well as the quality of the achievable temperature distributions. The project considered different parameters such as operating frequency, number of antenna elements, geometry, position and polarization of the antennas, as well as patient variations, variations in tissue material parameters, and others. The results are 8 publications in impacted journals, and one chapter in a technical book. The results are being developed and improved with the aim developing a regional microwave hyperthermia for brain region.

- 8) New materials for cardiovascular surgery based on modified decellularized tissues** (Ministry of health, NV18-02-00422, 2018-2022, 3 038 thous. CZK / 119 842 EUR, prof. Ing. Peter Kneppo DrSc., dr. h. c.)

Interdisciplinary project realized by 4 partners: IKEM– tissue harvesting and implantation into animal model, FBME CVUT – decellularization and cultivation technology developments, preparation of implantable matrices, FGU AV CR – cellular biology and substrate modification, PrimeCell Bioscience a.s. – technology traslation.

A novel and efficient methodology for decellularization of biological matrices for vascular tissue engineering was developed, specifically of planar matrices (pericardium) for vascular patches and tubular matrices (porcine arteries) for small- and medium-diameter vascular replacements. For the decellularization of both planar and tubular matrices, new bioreactors have been developed in the framework of this project. Techniques for further modification of the decellularized matrices were also developed - firstly, their reinforcement by cross-linking, and secondly, their functionalization with fibrin with heparin to reduce the thrombogenicity of the surface, and with growth factors (VEGF, FGF-2) to increase their attractiveness for cell colonization. For matrix recellularization, both already differentiated endothelial cells and mesenchymal stem cells derived from adipose tissue (ASC) or Wharton's jelly of the umbilical cord (WJSC) were used. The matrices were recellularized not only in a classical static culture system, but also in dynamic systems - bioreactors newly constructed in the framework of this project. Recellularized matrices, in particular vascular patches, were tested in a large animal model - the laboratory pig. The results showed that the presence of stem cells, particularly WJSCs, facilitated the acceptance of the implant by the host organism, mainly by reducing the inflammatory response and neointimal hyperplasia compared to commercially available synthetic or biological cell-free vascular patches. Results consist of 6 papers published in journals with impact factor, 1 utility model, 5 functional samples, 2 software, 2 bachelor and 2 diploma theses, part of 2 dissertation thesis and 1 habilitation.

- 9) Bioartificial cardiovascular patches and vessels from porcine collagen reinforced with nano/microfibers using stem cells and dynamic culture** (Ministry of health, NV19-02-00068, 2019-2023, 2 626 thous. CZK / 103 590 EUR, Assoc. Prof. Ing. Roman Matějka Ph.D.)

Interdisciplinary project realized by 4 partners: IKEM – tissue harvesting and implantation into animal model, FBME CVUT – 3D bioprinting optimization, preparation of collagen based implantable substrates, cultivation in bioreactors, USMH AV CR – isolation of collagen from porcine skin and its modification towards castable/printable bioink, FGU AV CR – cellular biology and substrate modification. In this project standardized protocol for the preparation of highly concentrated porcine collagen hydrogels (up to 50 mg/ml) including optimal sterilization procedure for further processing. These gels were then transformed into castable and then printable collagen bioinks with incorporated cell culture. To obtain these a unique mixing system was developed utilizing controlled mixing of multiple bioink compounds with precise adjustments of pH and maintaining maximum cell viability and bioink printability. These gels were then printed on decellularized and modified tissue scaffolds and cultured in dynamic bioreactor systems. To promote cell differentiation was supported either by adding growth factors into cell culture medium (TGFB and BMP4), or by controlled release of platelet lysate components from PVA nanofibers. Endothelialization was supported by the release of VEGF or FGF2 from microparticles. We developed nanoparticles releasing VEGF, FGF2, CXCL12 or TGFB, as well. Prepared planar and tubular

substrates were then implanted into large animal model (pig) and observed for 1 and 3 months. Implanted replacements remained uniformly patent, endothelialized, and covered by an adequate layer of neointimal hyperplasia. Results consist of 8 papers published in journals with IF, 2 utility model, 6 functional samples, 1 software, 2 bachelor and 3 diploma theses, part of 2 dissertation thesis and 1 habilitation.

10) Left atrial appendage electrical Isolation via bio-photonic optical confirmation to treat

persistent atrial fibrillation (EU H2020, Fast track to innovation, Grant agreement ID: 831117, 2019-2020, 2 025 thous. CZK / 79 905 EUR, Prof. Dr.-Ing. Jan Vrba, M.Sc.)

An international consortium of companies (AuriGen Medical, Ireland, Medibran LTD, Israel, Teleflex Medical Europe Limited, Ireland) and universities (National University of Ireland, Czech Technical University) was awarded a grant in the amount of more than five million EUR (three million EUR subsidy, the Czech Republic's share was 80 thousand EUR) to complete the development of a system that will reduce the risk of stroke and heart failure in patients with irregular heart activity caused by atrial fibrillation.

The Irish company AuriGen Medical has designed a concept and developed a unique prototype of a minimally invasive cardiac implant that permanently electrically and mechanically isolates the auricle of the so-called left atrium in a single procedure. This is a very common site for blood clot formation in patients with chronic atrial fibrillation, which can cause stroke or heart failure. This affects approximately more than 10 million patients in the EU and the US.

The aim of the grant was to complete the development of this system with subsequent implementation into practice and thus minimize the formation of blood clots and thus fatal damage to the patient's brain and heart.

The main task of the FBME team was to contribute to the design of the electrical part of the system. Specifically, the design of the applicator was improved in terms of shape, dimensions and number of electrodes using numerical calculations. Realistic models of the left atrial appendages and surrounding structures were considered in the modeling. This made it possible to predict the shape of the ablated zone and the risk of phrenic nerve damage. Within the duration of the project the new applicator was tested on animal models. Company AuriGen Medical recently announced the first-in-human procedure of their related product Zenith.

Table 3.3.1 Projects supported by public funds

In the role of beneficiary						
Provider ²⁵	Project name	Support (in thousands CZK/EUR) ²⁶				
		2019	2020	2021	2022	2023
Ministry of interior	VK01020078 - Smart system for wearable protective equipment enabling telemonitoring and planning of police and military					9830/387771

²⁵ If the provider is from abroad, please indicate the provider's country of origin in brackets. For the determination of the country of origin of the provider, the place of residence of the provider is decisive.

²⁶ Indicate the total amount expressed in thousands of CZK and the conversion of the total amount into Euro.

	interventions (2023-2026)					
Ministry of health	NV16-29680A - Functionalized nanofibres for external coating of colorectal anastomoses (2016-2019)	2460/97041				
Ministry of health	NV16-28784A - Affection of the locomotive apparatus degenerative diseases symptoms by means of high-induction magnetic stimulation (2016-2019)	1553/56016				
Czech Science Foundation	GJ17-00477Y - Physical nature of interactions of EM fields generated by MTM structures with human body and study of their prospective use in medicine (2017-2020)	1377/54320				
Czech Science Foundation	GA17-20480S - Temporal context in analysis of long-term non-stationary multidimensional signal (2017-2021)	1642/64773				
Prague the capital	UH0834 - Technology for eHealth on CTU (2019-2021)	14608/576252	8179/322643	2532/99882		
Ministry of interior	VI20192022117 - Detection of Radicalisation in the context of population and soft targets protection from violent incidents (2019-2022)	1094/43156	1571/61972	1745/68836	1945/76726	
Technology Agency of the Czech Republic	TJ02000092 - Inertial system for pig walking measurement and analysis (2019-2021)	1316/51913	1263/49822	381/15030		
Ministry of Education,	LTC19031 - Development of	816/32185	1531/60394	1572/62012	1071/42249	

Youth and Sports	metamaterial applicators for the regional hyperthermia system and evaluation of the accuracy of treatment planning algorithms (2019-2022)					
Ministry of Education, Youth and Sports	LTAIZ19008 - Enhancing Robotic Physiotherapeutic Treatments using Machine Learning (2019-2022)	661/26075	1278/50414	1168/46075	726/28639	
Czech Science Foundation	GA20-28980S - Electrically-read quantum diamond sensors for nuclear magnetic resonance and chemical sensing (2020-2022)		1289/50848	1591/62761	1855/73176	
Technology Agency of the Czech Republic	TJ04000176 - Simulation of real force effects during shooting on a shooting simulator and influence on shooting accuracy (2020-2022)		553/21815	1715/67653	597/23550	
Czech Science Foundation	GA21-00579S - Multiphysical Study of Superposition of Electromagnetic Waves in Human Head Model to Verify the Feasibility of Microwave Hyperthermia of Brain Tumors (2021-2023)			1535/60552	1543/60868	1543/60868
Technology Agency of the Czech Republic	TL05000480 - Improving the quality of life in homes for the elderly during a state of emergency (2021-2023)			805/31755	1419/ 55976	1458/57515
Ministry of interior	VJ02010031 - Modular multisensory professional clothing for risk management, health protection				9445/372584	10305/406509

	and safety of IRS members using artificial intelligence methods (2022-2025)					
Ministry of Education, Youth and Sports	EF16_018/0002360 -Assistive Technology for Sustainable Development and Active Life of Seniors and Handicapped Persons (2017-2022)	1299/51243	877/34596	728/28718	1/39	
Prague the capital	NeuroTechnology to Improve Quality of Life and Prevention of Cyberbullying in the Society 4.0 (2019–2021)	10303/406430	11240/443393	6557/258659		
Ministry of Education, Youth and Sports	Modernization and adaptation of laboratories in the field of assistive technologies (2017–2022)	1840/72584	1230/48521	1230/48521	1229/48481	
Ministry of Education, Youth and Sports	Biomedical engineering for knowledge based economy (2017–2023)	2545/100394	1300/51282	1300/51282	1037/40907	
Ministry of Education, Youth and Sports	Instrumentation and computer aided processes in medicine (2017–2022)	5020/198028	225/8876	1/39	1/39	
Ministry of Education, Youth and Sports	Modernization of Laboratories for Biomedical Engineering (2017–2023)	16150/637081	5500/216963	5500/216963	4348/171519	
Total		<u>69775/275246</u> <u>5</u>	<u>38632/152394</u> <u>5</u>	<u>30079/118654</u> <u>8</u>	<u>25650/101183</u> <u>4</u>	<u>23136/912663</u>
In the role of another participant						
Provider	Project name	Support (in thousands CZK/EUR)				
		2019	2020	2021	2022	2023
Ministry of health	NV18-02-00422 - New materials for cardiovascular surgery based on modified decellularized tissues(2018-2022)	874/34477	836/32978	679/26785	91/3590	

Ministry of health	NV19-02-00068 - Bioartificial cardiovascular patches and vessels from porcine collagen reinforced with nano/microfibers using stem cells and dynamic culture (2019-2023)	474/18698	708/27929	739/29152	705/27811	
Ministry of interior	VK01010037 - Methodology of fast non-contact and non-destructive detection of gunshot residue (2023-2025)					2602/102643
Ministry of interior	VK01020181 - Research, development and streamlining of advanced measurement and warning terminal elements for population protection (2023-2025)					3195/126036
Ministry of interior	VK01020196 - Innovative system of virtual reality and simulated model cases of security character facilitating training and treatment of police officers in risky situations (2023-2025)					2560/100986
Technology Agency of the Czech Republic	FW06010087 - Devices for advanced medical administration of drugs by transdermal route mediated by multifrequency focused ultrasound (2023-2027)					1809/71361
Technology Agency of the Czech Republic	FW06010271 - MIHRIL II - progressive ballistic armor for defense forces (2023-2025)					1354 / 53412

Technology Agency of the Czech Republic	TM04000062 - Development of the platform for maintaining and monitoring the physical conditions in isolated, confined and extreme environments(2023-2025)					1311/51716
Ministry of interior	VI20152020019 - Research on critical information structures of the state, focusing on a unified system of warning and informing the population (2015-2020)	2368/93412	1968/77633			
Ministry of health	NV16-28119A - Analysis of movement disorders for the study of extrapyramidal diseases mechanisms using motion capture camera systems (2016-2019)	892/35187				
Ministry of industry and trade	FV20422 - Development of nanofibrous scaffolds ensuring application of cellular products, including physical stimulation effect, with the intended purpose of the treatment of chronic wounds(2017-2020)	1850/72978	1215/47929			
Ministry of industry and trade	EG16_084/0009888 - Complex software and hardware system for heartbeat monitoring (2017-2020)	1437/56686	458/18067			
Ministry of industry and trade	FV30393 - Therapeutic ultrasound fully new parameters (2018-2022)	1700/67061	1650/65089	2490/98225	2490/98225	

Czech Science Foundation	GA17-15319S - Diamond based microelectrode arrays for dual mode neural recording (2017-2019)	1355/53452				
Technology Agency of the Czech Republic	TJ02000036 - Back behind the Wheel - Diagnostic and rehabilitation tool for people after brain injury (2019-2021)	1274/50256	1269/48008	227/8955		
Ministry of industry and trade	FV40295 -Inteligent robotic devices for effective limb movement disorders home rehabilitation utilizing of the neuroplasticity and the feedback (2019-2022)	875/34517	1750/69034	1750/69034	1750/69034	
Ministry of industry and trade	FV40187 - New methods of preparing highly sophisticated wound dressings optimisation and validation for use primarily in healthcare (2019-2022)	610/24063	720/28402	609/24024	345/13609	
Ministry of industry and trade	FV40189 - Innovative cartridges for manipulation and activation of functionalized nanofibrous wound covers in healthcare(2019-2022)	930/36686	1077/42485	1098/43314	324/12781	
Ministry of industry and trade	EG17_176/0015688 - Systems of database (2018-2022)			2302/90809	1053/41538	
Prague the capital	UH0365 - Concept Prague - Personal health systems (2018-2020)	5666/223511	906/35740			
Technology Agency of the Czech Republic	FW01010106 - Development of new generation medical devices by		3038/119842	3116/122919	3116/122919	2205/86982

	means of the translational medicine and physical interventions principle (2020-2024)					
Ministry of health	NU20-04-00327 - Disorders of gait, postural stability and cognition in Parkinson's disease: presymptomatic detection and targeted rehabilitation (2020-2024)		618/24379	922/36371	922/36371	922/36371
Technology Agency of the Czech Republic	FW01010463 - MIHRIL (Multi Impact Hybrid Layers) - protection against street threats (2020-2022)		1075/42406	1142/45049	1188/46864	
Technology Agency of the Czech Republic	FW01010218 -Fast detectors for harsh operating conditions(2020-2023)		481/18974	481/18974	481/18974	481/18974
Technology Agency of the Czech Republic	TL03000611 - Intelligent Senior Care System (2020-2023)		481/8974	1021/40276	914/36055	205/8087
Ministry of industry and trade	EG19_262/0020005 - Fascia lubrication and regeneration by hyaluronan (2020-2023)			667/26312	796/31400	1422/56095
Ministry of interior	VH20202021051 - The working safety improvement of workers at the risk of exposition to CBRN materials (2020-2021)		299/11795	401/15819		
Technology Agency of the Czech Republic	FW03010025 - Therapeutic rehabilitation robot controlled by brain signals (2021-2025)			2295/90533	2351/92742	2351/92742
Technology Agency of the Czech Republic	FW03010094 - New generation modular equipment for the production of innovative medical devices and			762/30059	575/22682	551/21736

	protective tools (2021-2023)					
Ministry of industry and trade	EG20_321/0024565 - Telerehabilitation system for the support of patients in distance care (2021-2024)				584/23037	2628/103669
Technology Agency of the Czech Republic	FW03010194 - Development of a System for Monitoring and Evaluation of Selected Risk Factors of Physical Workload in the Context of Industry 4.0. (2021-2024)			482/19014	602/23748	593/23393
Technology Agency of the Czech Republic	FW04020071 - Smart Mobility for children with disabilities - therapeutics, lifestyle and leisure (2022-2024)				1659/55464	1675/68146
Ministry of industry and trade	EG21_374/0026959 - Healthy diet - Healthy pregnancy (2022-2023)					1268/50020
Ministry of industry and trade	EG21_374/0026762 - Integrated spa information system with support for eHealth and telemedicine processes (2022-2024)				6695/264103	
Ministry of industry and trade	EG20_321/0024518 - Development of a robotic workplace for packaging goods (2021-2023)					1265/49901
European Commission	Left Atrial Appendage Electrical Isolation via Bio-photonics Optical Confirmation to Treat Persistent Atrial Fibrillation, Horizon 2020, Fast Track to Innovation (FTI), LAA-START, 831117 (2019-2022)	1006/39687	502/19815	350/13820	167/6583	

Ministry of industry and trade	Extension of telemedicine technology for care of patients with diabetes mellitus (2020-2022)		285/11236	1060/41832	574/22642	
Ministry of Labour and Social Affairs	Using social innovations with the help of assistive technologies in the Zlín Region		4395/173387			
Total		<u>15645/617160</u>	<u>22773/898343</u>	<u>22593/891243</u>	<u>27129/1070178</u>	<u>28196/111226</u> 8

Table 3.3.2 - Contract research activities

Client ²⁷	Activity name	Revenue (in thousands CZK/EUR)				
		2019	2020	2021	2022	2023
Applied Sunrise Technologies PLC (Czech Republic)	Long-term telemedical monitoring of patients with chronic and civilization diseases in their natural environment		68/2684			
CEEOR, LLC (Czech Republic)	Web portal for displaying and continuously updating cardiovascular risks by region of the Czech Republic. Methodology for analyzing direct and indirect costs in Myasthenia Gravis disease. Proposal for the structure of the Cost of Disease model of HPV disease in the entire spectrum of the adult population					83/3260
Mebster, LLC	Integration and testing of a rotary encoder into the medial hip joint			290/11440		
Medicalc software, LLC (Czech Republic)	Development and implementation of clinical data import	95/3742				
Numerus game, LLC (Czech Republic)	Algorithms for processing measured data to determine			490/19329		

²⁷ If the client is from abroad, indicate in brackets the country of origin of the client.

	activity parameters and psychological state of the subject Creation of procedures for processing data from monitoring systems					
Samsung Electronics (Czech Republic)	Measuring functionalities with Samsung Galaxy Watch 2, 3 and 5 smartwatches (ECG, blood pressure - 2021, blood saturation - 2023)			72/2840		84/3314
Škoda Auto, PLC (Czech Republic)	Possibilities of safety monitoring and automatic evaluation of the health status of the driver and passengers (2022) Project Smartwatch connection with glycemia ind. (2023)	3272/129066	1889/74522	177/6994	1013/39968	981/38687
AuriGen Medical Limited (Ireland)	Expert consultations – optimization of electrode system			144/5669	138/5439	
General University Hospital in Prague (Všeobecná fakultní nemocnice), (Czech Republic)	Expert assessment for the acquisition of tomotherapy	96/3787		124/4874	132/5212	300/11834
Institute for Clinical and Experimental Medicine (IKEM) (Czech Republic)	Preparation of implantable tissues					54/2130
Total		3463/136595	1957/77206	1297/51146	1283/50619	1502/59225

Note: List and describe contract research activities with a revenue in a given calendar year, regardless of the amount of financial revenue.

3.4 Research results with existing or prospective impact on society

The evaluated unit shall briefly comment on a maximum of 10 (considered most significant by the evaluated unit) research results already applied or realistically heading towards application during the period of 2019–2023, based on the overview annex table 3.4.1 (it is recommended to indicate results with a link to projects listed in indicator 3.3). The evaluated unit must demonstrate in its description that the research results have led or will soon lead to positive impacts²⁸, on society (e.g. description of how the results are used by various users, the range of persons/institutions for which the result is relevant, measurable economic impacts, etc.). The evaluated entity shall indicate in its

²⁸ See Terms definition.

commentary whether the gender dimension is considered in these results and discuss the impacts of the results regarding sustainability.

Maximum range 300 words/result.

Self-assessment:

1) Lung ventilator CoroVent

During the COVID-19 pandemic, many research teams around the world attempted to develop a lung ventilator in response to their shortage. However, the research team from FBME CTU was one of the few in the world to develop such a ventilator and deploy it in regular clinical operation, mainly thanks to its unique solution, which is protected by a Czech patent from the Industrial Property Office [1] and described in detail in the prestigious international scientific journal Scientific Reports [2]. In record time, CoroVent was also approved by the US Food and Drug Administration [3] and subsequently by the Ministry of Health of the Czech Republic for emergency use in hospitals. At the end of 2020, CoroVent was used for the first time in the Ústí nad Labem Hospital [4]. In the winter of 2020 and spring of 2021, emergency lung ventilators were distributed to 27 Czech hospitals. The clinical usability and correctness of the lung ventilator design were confirmed by an analysis of medical data from patients ventilated with CoroVent. The huge interest of the population in CoroVent was underlined by a public collection, during which 12.5 million CZK were collected in just 18 hours on the website donio.cz/CoroVent.cz [6]. The CoroVent lung ventilator has also received several significant awards, such as second place at the prestigious hackathon "HACK THE CRISIS CZECH REPUBLIC" [7,8], or the award of the head of the development team, Prof. Roubík, among the top 20 innovators of 2020 in the Czech Republic [https://archiv.hn.cz/c1-66876020-20-nejlepsich-inovatoru-roku-2020-nejen-cupr-s-prusou-zabodoval-i-prvok-mikroelektrarna-ci-it-gympl].

[1] Czech Patent No. 309212. Registered on 25.05.2022. [2] ROUBÍK, Karel, et al. Novel design of inspiratory flow generation and gas mixing for critical care ventilators suitable for rapid production and mass casualty incidents. Scientific Reports, 2023, 13.1: 7153. [3] Czech lung ventilator developed during the coronavirus pandemic has received certification from the US government agency FDA <https://www.mpo.cz/cz/rozcestnik/pro-media/tiskove-zpravy/cesky-plicni-ventilator-vyvinuty-behem-pandemie-koronaviru-ziskal-certifikaci-od-americke-vladni-agentury-fda--256517/> [online]. [cited 2023-05-10]. [4] Doctors of the Regional Health Service were the first in the Czech Republic to use the CoroVent lung ventilator <https://www.kzcr.eu/cz/kz/o-spolecnosti/tiskove-zpravy/41/#ca10654> [online]. [cited 2023-05-10]. [6] CoroVent. Donio. <https://www.donio.cz/CoroVent> [online]. [cit. 2023-05-10]. [7] Hack the Crisis knows its winners, it has helped more than a hundred projects in total. The new Crisis Response Hub will follow it. <https://www.mpo.cz/cz/rozcestnik/pro-media/tiskove-zpravy/hack-the-crisis-zna-sve-viteze--celkem-pomohl-vice-nez-stovce-projektu--navaze-na-nej-novy-crisis-response-hub--255350/> [online]. [cit. 2023-05-10]. [8] COROVENT LUNG VENTILATOR PLACED 2ND IN THE HACKATHON HACK THE CRISIS CZECH REPUBLIC. <https://aktualne.cvut.cz/stalo-se/20200624-plicni-ventilator-corovent-se-umistil-na-2-miste-na-hackathonu-hack-the-crisis> [online]. [feeling. 2023-05-10].

2) Intelligent Sensor Subsystem for Sensing Selected Biological Quantities, Integrable into the First Layer of Clothing, Functional Sample, 2023 (main result of the project VJ02010031)

Proposed functional sample includes intelligent sensor nodes for sensing biological variables (heart rate, cardiac arrhythmia, movement and breathing activity, multi-point sensing of skin temperature

and relative humidity and temperature under clothing), integrated into the first layer of clothing and connected using a flexible system. The solution also includes adaptive algorithms for calculating diagnostic symptoms. The first layer of clothing is designed with optimal properties to transport liquid and gaseous moisture and heat away from the wearer's skin. The functional sample of the sensor subsystem for sensing selected biological quantities is designed so that its parameters correspond to the medical quality of sensing biological signals and enable the direct application of advanced data segmentation methods from built-in wearable biological sensors in real time at the level of sensor nodes.

Functional sample can be directly used by all components of the Integrated Rescue System during training and intervention (firefighters, police officers, paramedics), but also in other areas such as sports medicine, where top sportsmen also need monitoring physiological functions. An example of the real contemporary deployment of one application variant of the proposed functional sample is the monitoring of soldiers during training (in cooperation with the company CASRI).

The solution is gender neutral and the inner layer of the garment with built-in sensors can be customized according to the individual needs of the IRS member. The system will allow individualized real-time monitoring the effect of long-term physical and mental stress in combination with exposure to harmful substances from the environment - this aspect is related to the increase of health safety of IRS members at work, thereby potentially reducing the costs of subsequent medical care and therefore the presented solution has a positive long-term impact on sustainability.

3) Techniques for the classification of long-term PSG and EEG signals (main result of the project, GA17-20480S).

The project focused on developing methods that integrate temporal context into active learning approaches to improve predictive performance and reduce labeling costs. The main objective was accomplished, with several methodologies designed, implemented, and tested on real, long-term data, particularly in the fields of polysomnographic (PSG) and electroencephalographic (EEG) signal analysis. The project led to the creation of semi-automatic techniques for the classification of long-term signals, which provide faster, and more objective evaluations of PSG data compared to traditional manual scoring by certified experts.

The proposed active learning approach is particularly beneficial for healthcare providers, including sleep clinics, where the efficiency of signal analysis is critical. By reducing the reliance on manual scoring, the method allows healthcare institutions to process large volumes of data more quickly and at a lower cost. The technique's robustness to noise and artifacts enhances the accuracy of diagnoses, particularly in sleep disorders. These advances could also lead to improvements in personalized healthcare, as the method can adapt to different types of EEG signals without needing specific electrode configurations or training data, making it broadly applicable across varied medical contexts.

The project's results are relevant for a wide range of users, including medical professionals, researchers, and healthcare technology providers. They have the potential to significantly impact the efficiency and accessibility of sleep disorder diagnostics, with measurable economic benefits, such as reducing labor costs and increasing diagnostic throughput.

Regarding gender considerations, the project does not mention gender-related factors in its results, but the method applies to all patients regardless of gender.

As for sustainability, the methods developed promote greater efficiency and resource utilization, contributing to more sustainable healthcare practices by reducing unnecessary manual effort and the environmental footprint associated with traditional diagnostic methods.

4) Compact system for automated decellularization of tissues (main result of the project, NV18-02-00422)

To ensure the homogeneity of the decellularization process, we have constructed a compact system that allows automated control of the decellularization process, including cyclic exchange of decellularization reagents and rinse water, while minimizing the negative impact on the tissue. The system includes special chambers for tissue attachment. In this way, 3 generations of the system have been successively designed during the project. The first experimental generation used two peristaltic pumps and a set of clamp valves. This solution required specific hoses and couplings which were complicated in relation to the regulatory conditions and therefore the concept was abandoned. In the second generation, we replaced the pinch valves with infusion three-way valves, or an assembly of these valves, and the overall concept was modified for use with disposable infusion material - tubing, couplings, reagents and water in bags, etc. In the third generation, the entire system was simplified to use with only one peristaltic pump and a five-element three-way valve assembly allowing the use of up to 4 different reagents. The latest generation is also optimised in terms of design for potential use in cleanrooms and production (disposable consumables, optimised ergonomics in terms of cleaning and handling). The system control is implemented via a microcomputer and allows programming of individual process cycles, number of repetitions and duration. The system also includes special chambers to accommodate planar and tubular tissue, which are optimized in terms of process efficiency - minimizing tissue damage from handling, minimal reagent volume, and in terms of materials used for potential production applications - biocompatible resins. The design solution is included in two functional samples (FVZ NV18-0200422-3, FVZ NV18-0200422-5) and published (10.3390/App10165473). The system was also modified for further usage – cleaning of amniotic membrane – as contract research (BioHealing s.r.o.)

5) TonaPulse

TonaPulse is a generator of intense and short electrical pulses developed by Tonegena s.r.o., a spin-off of CTU, in 2023 for in-vitro electroporation studies. This device allows us to adjust the electroporation pulse parameters (amplitude, width, number of pulses in the pulse train and time between pulses and pulse trains) over a wide range to test different electroporation protocols for different cell types. The system can be extended with a switch matrix and electrode system (both also from TonaGena) so that protocols can be tested directly in standardized 96-well plates. This then greatly simplifies the evaluation of experiments. The system is currently being tested at the University Hospital Královské Vinohrady. The subject of the studies is transfection of cardiomyocytes. The system is currently certified and will be launched on the market in 2025. The solution is intended for in-vitro studies and thus gender neutral.

6) Optimized procedure for producing high concentration, bio-printable cell laden collagen bioinks (result of a research project NV19-02-00068)

Collagen provides an advantage, as it is the most common extracellular matrix present in all kinds of tissues and is, therefore, very natural for cells and the organism. Hydrogels with highly concentrated collagen make it possible to create 3D structures without additional additives to crosslink the polymer, which could negatively affect cell proliferation and viability. The method is based on two successive neutralizations of the prepared hydrogel using the bicarbonate buffering mechanisms of the 2x enhanced culture medium and pH adjustment by adding NaOH. To ensure these results a unique

multicomponent mixing system was created. The bioink preparation process is automated, including colorimetric pH detection and adjustment in sterile conditions. Results were published in 3 Q1 impacted papers and are used with ongoing research project. This custom mixing system together with 3D bioprinted with custom extruders and special fixtures for tissue samples is prepared for translation into commercial products.

7) A prototype of the modular production line (result of a research project FW03010094)

The prototype of the modular production line has been integrated into the producer's (main investigator's) operations, primarily for the manufacturing of medical devices, and is also being offered in customized modifications to other producers with compatible production profiles. The acquired know-how from developing sample medical devices has already been utilized in the recipient's own production too, with preparations in place for technology licensing—either as a comprehensive system (including production technology) or through the manufacture and sale of tailored production equipment in collaboration with both project participants. Additionally, the research partner (co-investigator) involved in the project applies the developed expertise to new research projects and educational activities, where knowledge of advanced processing techniques related to nanotechnology implementation and personalized care concepts are highly relevant.

The societal impact of these innovation spans both economic and non-economic domains. Hard-to-heal wounds, particularly infected and chronic wounds, represent a major socio-economic burden, and solutions that accelerate healing provide significant benefits for healthcare systems and patients alike. With an aging population and a rising prevalence of chronic conditions, there is an increasing need for advanced, personalized wound care technologies that improve treatment efficacy and cost-effectiveness from the perspectives of healthcare providers and reimbursement systems. A key demonstrable output in this regard is the “Wound dressing in a functionalization cartridge”, a core component of a long-term system for personalized wound care.

The gender dimension is inherently embedded in the personalization concept, as it ensures that individual patient factors—including biological, physiological, and sex-based differences—are systematically considered in medical treatment, leading to more accessible and effective care. The project also contributes to sustainability by optimizing production technologies, leading to more efficient and cost-effective manufacturing processes for medical devices, ultimately reducing material waste and resource consumption.

8) Universal software tool for creating hyperthermia treatment planning (result of a research project LTC19031)

A universal tool has been developed for hyperthermia treatment planning that allows easy and reproducible creation of simulation models. These consist of 3D patient models created by segmenting a series of CT scans and then an applicator model. This tool allows the automatic generation of complete simulation models for planning regional hyperthermia treatment. In the proposed treatment planning tool, we have programmed all clinically available regional microwave systems worldwide, as well as the possibility of automatic regional applicator placement, which is performed so that the treatment target is in the middle of the applicator model. Furthermore, this tool allows for placement of the applicator in the desired position during treatment using two control distances in the longitudinal (craniocaudal) and horizontal (frontal) directions and rotation in the sagittal plane. This tool is from 2020 implemented in the clinical planning process at the University Hospital Hyperthermia Unit, Erasmus MC Cancer Institute, Rotterdam, The Netherlands. The solution is gender neutral.

9) Improving the success and safety of left atrial appendage catheterization by creating patient-specific 3D heart models

Since 2021, members of the Bioelectromagnetism team have been collaborating with physicians at the Cardiology Clinic of the University Hospital of Královské Vinohrady (FNKV) and the Karlovy Vary Regional Hospital to improve the success and safety of left atrial appendage catheterization closure. This type of procedure is indicated for patients suffering from atrial fibrillation with an increased risk of thrombus formation, in whom anticoagulation therapy fails due to a high risk of internal bleeding. These patients are thus at significant risk of stroke. The most common site of possible thrombus formation is the left atrial appendage, from where the thrombus travels directly to the brain. Closing the left atrial appendage prevents thrombus formation and reduces the risk of stroke. Before the actual cardiac procedure, physical models of the patient's heart are prepared at FBMI. Specifically, computer models are created from CT scans of the patient's heart and then the model is produced using 3D printing. Doctors use this model as a basis for planning the procedure.

Thanks to the possibility of "in vitro" simulation, the course of the procedure is individualized with respect to the anatomical conditions of the patient's heart, which is important not only for the efficiency but also for the safety of the procedure.

By 2023, 70 patients have been operated on in this way. The success rate of the procedure increased from 70% to 99% and the duration was halved.

This result can be classified as an indirect result of research, development and creative activity with a documented societal impact. The Bioelectromagnetism team uses segmentation procedures in other research activities and has experience with the treatment of fibrillation from a H2020 project. The solution is gender neutral.

Table 3.4.1 - Overview of research results in the period under evaluation

Type of result ²⁹	Year of application	Name
Software	2020	Universal software tool for creating hyperthermia treatment planning (a result of a research project LTC19031), in use at University Hospital Hyperthermia Unit, Erasmus MC Cancer Institute, Rotterdam, The Netherlands.
Set of advanced techniques for processing of biosignals	2021	Advanced techniques for the classification of long-term PSG and EEG signals (main result of the project, GA17-20480S).
Indirect results of research, development and creative activities with documented societal impact	2021	Improving the success and safety of left atrial appendage catheterization by creating patient-specific 3D heart models. By 2023, 70 patients have been operated on in this way. The success rate of the procedure increased from 70% to 99% and the duration was halved.
CZ patent	2022	CoroVent, a lung ventilator, Czech Patent No. 309212, in the winter of 2020 and spring of 2021, emergency lung ventilators were distributed to 27 Czech hospitals.
Functional Sample	2022	System for automated decellularization of tissues (main result of the project, NV18-02-00422). The system was also modified for further usage – cleaning of amniotic membrane – as contract research (BioHealing s.r.o.).

²⁹ Specify the specific type of result. Add rows as needed.

Functional Sample	2023	Intelligent Sensor Subsystem for Sensing Selected Biological Quantities, Integrable into the First Layer of Clothing (main result of the project VJ02010031). The current deployment of one variant of the application of the proposed functional sample is the monitoring of soldiers during training (in collaboration with CASRI).
Prototype	2023	A prototype of the modular production line (result of a research project FW03010094)
Procedure	2023	Optimized procedure for producing high concentration, bio-printable cell laden collagen bioinks (result of a research project NV19-02-00068)
Prototype	2025	TonaPulse, an electrical pulse generator for in-vitro electroporation studies equipped with an electrode plate. Developed by CTU spin-off Tonegena s.r.o. First prototype developed in 2023, from that was used for different clinical studies at the University Hospital Královské Vinohrady. In 2025 is being certified and is going to be launched on the market.
Spin-off	2023	Foundation of spin-off Tonagena s.r.o a Czech Technical University spin-off company focused on development of novel solutions for electroporation, radar sensing and microwave hyperthermia. A prototype electroporation device TonaPulse for in vitro studies is currently being certified.

Note 1: Please list and describe the results already applied in practice or heading towards application in practice with existing or prospective impact on the society (e.g. domestic or foreign patents, sold licenses, spin-offs, prototypes, varieties and breeds, methodologies, significant analyses, surveys, expert outputs for policymaking or other forms of non-publication outputs, etc.). Indirect results of research, development and creative activities with documented societal impact, e.g. expert activities, services to the public/government/scientific community, may also be reported.

TRANSFER OF RESULTS INTO PRACTICE

3.5 Transfer of results into practice

The evaluated unit shall briefly describe its system for transferring results into practice. It shall also indicate up to five of the most typical users of its results, whether in the university environment or in the non-university application/corporate sphere, detailing how it collaborates with them and how it seeks out new users (using a maximum of five specific examples).

It will also indicate whether and how it commercialises R&D&I results (e.g. selling licences, setting up start-up or spin-off companies, etc.)³⁰, providing brief description of the commercialisation methods used. The effectiveness of the transfer of results and the commercialisation of R&D&I results will be described using a selection of results (max. five) listed in annex table (Table 3.4.1).³¹

Additionally, the evaluated unit shall briefly comment on the funds received during the period of 2019–2023 from non-public, non-grant sources (e.g. licences sold, spin-off revenues, donations, etc.). A full summary shall be provided in annex table (Table 3.5.1).

Maximum 500 words plus 200 words for each provided example of finding a new user of results and commercialization.

Self-assessment:

Most typical users of FBME results

The most typical users of FBME results are hospitals, universities and private companies. The faculty is actively seeking opportunities for cooperation. Before 2022, it advertised its competencies on the public portal <https://www.cvut.cz/en/database-of-ctu-offers-experts-and-devices-dnep>. Since 2022, it is possible to find a relevant academic partner by entering keywords at <https://results.cvut.cz/>.

FBME regularly organizes conferences and excursions with the participation of companies and institutions, where participants can get to know the research teams and their laboratories and the opportunities for collaboration (e.g. State Institute for Drug Control, ...).

It concludes memoranda of cooperation with companies and institutions (e.g. with GUBI Group, a. s., Medirecord CZ, s.r.o. in 2020, Krajská zdravotní, a. s. in 2021, Středočeské vodárny by Veolia) and organizes meetings between faculty members and representatives of hospitals and companies, where collaboration is offered. In the monitoring period, such meetings were, for example, with representatives from Klaudian Hospital in 2022 and from APAG in 2023.

Brief description of the commercialisation methods

Until 2023, the commercialization of research results at FBME was mainly initiated by the originators themselves and supported by the faculty. In October 2023, a meeting was organized with representatives of the CTU department for technology transfer and fundraising, specifically with its head, Mr. JUDr. Ing. Jan Urban, Ph.D., LL.M. The meeting included consultations in the areas of electroporation, non-contact glycemic sensing, stroke detection, automatic systems for oxygen dosing, fast thermal humidifier, magnetic resonance imaging (speeding up, simplification, lower cost), 3D printing applications in medicine, including substitutes, specialized devices for tissue engineering, tissue incubators.

³⁰ In the case of military HEIs, their specific position is taken into account when evaluating the commercialisation/evaluation of R&D&I results.

³¹ If the commercialisation of R&D&I results is carried out in this way.

The results of the above-mentioned consultations then led to selected activities. The most significant result was the establishment of TONAGENA s.r.o. as a prerequisite for the creation of the first ever spin-off company at CTU with a commercial share of CTU according to the new framework of the Department for Technology Transfer and Fundraising.

Currently, as mentioned earlier, two other spin-offs from FBME are being established.

Transfer of results and the commercialization of R&D&I results is documented with selected results described in Table 3.4.1. The most important five examples are the Czech patent for the invention CoroVent, System for automated decellularization of tissues, Sensor Subsystem for Sensing Selected Biological Quantities, development of the TonaPulse electroporator and the establishment of the spin-off Tonagen.

Funds received during the period of 2019–2023 from non-public, non-grant sources

The amount of funding received from non-public, non-grant sources is shown for each year in Table 4.5.1. During the monitoring period, these funds were made up entirely of donations. With the establishment of the Tonagena spin-off and the two other spin-offs currently being established, we hope to see an increase in these funds in the form of spin-off revenues and licenses sold in the future period.

Table 3.5.1 - Summary of non-public revenues received during the period under evaluation

Type of revenue	Revenue (in thousands CZK/EUR)				
	2019	2020	2021	2022	2023
Donations	<u>50/1950</u>	<u>1505/56020</u>	<u>854/33180</u>	<u>493/20340</u>	<u>1080/45740</u>
Spin-off revenues	0/0	0/0	0/0	0/0	0/0
Licenses sold	0/0	0/0	0/0	0/0	0/0
Total	<u>50/1950</u>	<u>1505/56020</u>	<u>854/33180</u>	<u>493/20340</u>	<u>1080/45740</u>

Note: Enter funds raised for R&D&I from non-public sources besides grants or contract research (e.g. licences sold, spin-off company revenues, donations, etc.) in the calendar year.

POPULARIZATION OF VAVAI

3.6 The most important activities in the field of popularization of R&D&I and communication with the public

The evaluated unit shall briefly describe its main activities related to the popularisation of R&D&I and communication with the public (e.g. popularisation lectures, citizen science initiatives, etc.) during the period of 2019–2023 and provide up to 10 examples that it considers the most significant.

Maximum 500 words plus 200 words for each example given.

Self-assessment:

Popularization of R&D&I and communication with the public by FBME can be divided into two main groups.

- 1) Annual participation of the faculty in important popular science events organized in the Czech Republic,
- 2) Appearances of FBME experts in various Czech media programs, presenting the results of their research or commenting on new or future trends and technologies.

Ad 1) Popular science events in which FBMI participated or organized in 2019-2023

The Faculty of Biomedical Engineering regularly participated in many popular science events such as:

- **FESTIVAL OF SCIENCE** (FESTIVAL VĚDY renamed VědaFest in subsequent years) - the largest open-air popular science festival in the Czech Republic. For pupils, secondary school students and the general public. The event is organized by the Youth and Young People of the City of Prague, CTU and University of chemistry and technology Prague.

- **FESTIVAL ABC** - (only in 2019) - fun science for children of all ages.

- **RESEARCHERS' NIGHT** (NOC VĚDCŮ) - an event bringing to life in one evening hundreds of scientific buildings that one can't just walk into. In the Czech Republic, the event has been held since 2015 and is represented by Czech universities, scientific institutes, observatories and other institutions.

- **SCIENCE FAIR** (VELETRH VĚDY) - is the largest popular educational event in the Czech Republic, organized by the Academy of Sciences of the Czech Republic since 2015. The fair offers visitors the most interesting from the world of natural, technical, humanities and social disciplines. It is visited annually by about 50 000 visitors.

Thousands of visitors annually attend these popular science events.

At the FBMI, the Halda Association, in cooperation with the **FBMI SCIENCE CAFÉ**, organized a series of informal discussions with scientists.

In addition, we held an **OPEN DAY at FBME** twice a year, where those interested could find out information about the studies, see the laboratories and short experiments. There were about 600 visitors per year.

We regularly organise excursions and one or two-hour scientific experiments for high school students and excursions for primary school pupils. Hundreds of pupils and students take part in these excursions and experiments every year.

In 2020, we filmed a series of spots about FBME's science teams.

Ad 2) Appearances of FBME experts in various Czech media programmes

Between 2019 and 2023, FBME experts have been invited to appear on programmes on Czech Television and Czech Radio. Interviews with them were printed in the Czech press such as Hospodářské noviny, Vesmír, Chemické listy, Paraple Magazine, Senior Fitness, Technicall, Pražská technika and others.

Below are 10 of the most important examples of Popularization of R&D&I and communication with the public.

- 1) **FESTIVAL OF SCIENCE** – 2019, 2021, 2022, 2023
- 2) **RESEARCHERS' NIGHT** – 2019, 2021, 2022, 2023
- 3) **SCIENCE FAIR** – 2022, 2023
- 4) **Science café** at FBME – 2019, 2020, 2022, 2023
- 5) **OPEN DAY** at FBME – 2019-2023
- 6) Příhoda, A., With the ease of an astronaut (S lehkostí astronauta), Innovation at universities, **Hospodářské noviny (Economic newspaper)**. 2020-01-29.
- 7) Böhm, P., Instrumentation in emergency medicine (Přístrojová technika v urgentní medicíně), Káva o čtvrté, **Český rozhlas (Czech Radio)**. 2019-01-22.
- 8) Matějka, R., Tissue engineering (Tkáňové inženýrství) - pořad ČT Sama Doma, **Česká Televize (Czech TV)**: 2022-03-29.
- 9) Piorecký, M., Pink sound for better memory (Růžovým zvukem k lepší paměti), **Vesmír**. 2022, 101 614-616. ISSN 1214-4029.
- 10) Michálek, J.; Podešva, J., Polymer implants in human medicine (Polymerní implantáty v humánní medicíně), **Chemické listy**. 2021, 115(6), 289-290. ISSN 0009-2770.

IMPLEMENTATION OF RECOMMENDATIONS

3.7 Implementation of the recommendations in Module 3

The evaluated unit will briefly describe how it has implemented the recommendations for Module 3 from the previous evaluation period, if applicable.

Maximum 1000 words.

Self-assessment:

In Module M3, the Evaluation Panel (IEP) rated FBME as "very good" in six categories and "excellent" in five. Thus, the overall rating of our faculty was at the upper end of the "very good" rating. The FBME management has implemented the MEP recommendations to the maximum extent possible and has taken steps to improve the working conditions of its staff and to support their R&D activities so that future evaluations will also be as good as possible.

The MEP recommendations can be summarised in the following points:

- A. Increase publications in prestigious international scientific journals and intensify scientific activities in international journals,
- B. increase activity in cardiovascular research,
- C. focus on fewer topics such as cardiovascular system, lung, sensors and telemedicine,
- D. to expand its activities to other research topics and to recruit new staff for this purpose,
- E. encourage the creation of spin-off companies,
- F. intensify FBME research cooperation in the EU,
- G. intensify collaboration with other faculties of CTU in the field of non-Newtonian fluids and advanced turbulent flow modelling for cardiovascular modelling.

Ad A: A motivation system has been prepared and implemented at FBME, which allows to reward faculty staff for their research and development activities in a simple and transparent way, for the preparation of manuscripts printed in prestigious scientific journals. Please note that the number of articles in journals with impact factor (Web of Science) increased from 224 to 465 compared to the previous evaluation period. At the same time, the share of prestigious publications in journals from the 1st and 2nd quartiles (Web of Science, IF) has increased from 46.9% to 70.1%. In addition, the system also supports e.g. membership on the editorial boards of prestigious journals and international professional societies. In addition, it introduces rewards for other achievements that are assessed in the habilitation and appointment procedures. Therefore, we believe that it helps in meeting the conditions for upgrading the qualifications of our staff. As mentioned in the first part of this report, 12 associate professors were habilitated and 2 professors were appointed during the monitoring period. In the period 2014-2018, 5 FBME employees were habilitated only. Furthermore, the faculty management has introduced a special incentive system for PhD students to improve their financial situation, accelerate their publication activity and thus increase the success rate of PhD completion.

Ad B: The cardiovascular system is currently the focus of three research teams at FBME: the "Bioreactors for tissue and organ replacement" team, the "Bio-electromagnetism" team and the "Cardiac Electrophysiology team". The first mentioned team mainly in terms of tissue substitutes for cardiac surgery, the latter in terms of design of electrodes and device for electroporation and blood

flow modelling in the heart, and the third in terms of cardiac activity mapping using multichannel ECG.

In the framework of the LAA-Start Horizon 2020 project (2019-2020), the "Bio-electromagnetism" team, in collaboration with the Irish company AuriGen Medical, has been involved in the design of the ablation part of an innovative implant for electrical and mechanical isolation (by RF ablation and electroporation) of the left atrial appendage, which is the site of frequent blood thrombi causing heart failure and strokes.

Another collaboration in the field of cardiovascular system was established with the University Hospital Královské Vinohrady. The collaboration is currently developing in planning mechanical left atrial appendage (LAA) isolation using patient-specific heart models. More than 70 patients have already been successfully operated after planning the procedure using models of their own heart. With model-based planning, the success rate of the procedures has increased from the original 70% to almost 100%.

Together with colleagues from the Faculty of Engineering, the Bio-electromagnetism team is working on numerical simulations of blood flow in the heart and LAA. Based on the results of the simulations, the risk of blood thrombus formation can be assessed in the future.

Ad C: FBME currently has a total of 15 research teams with very attractive and smart specialisations. The scope of research is determined by the expertise of the individual staff members. It would only be possible to change or expand the research focus of the faculty by employing additional experts in the relevant field.

Ad D: Recruitment of additional experts is a matter of available funding and may be relatively slow. However, the faculty continuously adds staff according to the current needs. This is supported by the implementation of a staffing strategy at CTU based on the principles of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers. CTU in 2019 received the prestigious "HR Excellence in Research Award" from the European Commission.

Ad E: The faculty management supported the establishment of spin-off companies. As already mentioned, the Department of Technology Transfer and Fundraising of the CTU created in 2023 a new framework for the establishment of spin-off companies with the financial participation of the CTU. The FBME also had a certain share in the preparation of this framework. The first company that was established according to this new concept was company Tonagena from FBME. The last details of the framework were thus set when the company Tonagena was founded. Please note, that two other spin-off companies of FBME are currently being established. It is also worth mentioning that Tonagena's main activity is the design, manufacture and sale of electroporation equipment for in vitro studies. It is currently used to study the effect of electroporation parameters on cardiomyocyte electroporation and transfection.

Ad F: Faculty employees were informed about COST projects and encouraged to participate more in these projects. The management considers this activity to be essential for presenting results to the European professional community, gaining international contacts and cooperating with European workplaces. Finally, participation in COST projects provides an ideal opportunity for submitting joint Horizon 2020/Horizon Europe projects with project partners. In 2023 and 2024 FBME employees participated in preparation of a new COST Action EM-based medical technologies to advance the technology and accelerate their translation (EMBRACE), which has been evaluated since 10/2024. In 2022 and 2023, an international project proposal was prepared and accepted for funding from the Interreg Cetrál Europe call <https://www.interreg-central.eu/projects/medwaveimage/>. It started in 7/2024.

Ad G: Faculty management supports the cooperation of its employees with colleagues from other CTU faculties. In addition to the above-mentioned cooperation with colleagues from the Faculty of

Mechanical Engineering on modeling of blood flow in human heart, cooperation with the industrial design studios of the Faculty of Architecture began in 2023. Students in 2024 and 2025 are working on their final theses on the design of medical devices.

A LIST OF SUPPORTING DOCUMENTS/LINKS FOR MODULE 3

Document name	No. criteria	Location (link in HTML)
Information about the R&D etc. of the Faculty (on the University Website)	3.1	Information about the R&D etc. of the Faculty (on the University Website)
Faculty Website (en)	3.1	https://www.fbmi.cvut.cz/en
Annual reports 2019 - 2023 (in Czech)	3.1	Annual reports 2019 - 2023 (in Czech)
Scientific teams at FBME	3.1	https://www.fbmi.cvut.cz/en/research/teams
	3.1	
PRESTIGIOUS R&D&I AWARDS GRANTED DURING THE EVALUATION PERIOD		
Best dissertation thesis	3.2.1	https://www.fbmi.cvut.cz/index.php/cs/verejnost/fotogalerie/uspech-studentu-v-soutezi-ieee-embs
Winner startup - RescueRoom	3.2.1	https://slovakia.socialimpactaward.net/alumni-projekty/ https://youtu.be/zGtJwg3BuqM
Innovators 20 (20 best innovators of the Czech Republic in 2020)	3.2.1	https://archiv.hn.cz/c1-66876020-20-nejlepsich-inovatoru-roku-2020-nejen-cupr-s-prusou-zabodoval-i-prvok-mikroelektrarna-ci-it-gyml
2nd prize of "Hack the Crisis" with financial price for further research of 2 000 000 CZK for design of CoroVent.	3.2.1	https://czechinvest.gov.cz/en/For-Startups/Other-activities/Hack-the-Crisis-Czech-Republic
Best Master's Thesis	3.2.1	https://www.fbmi.cvut.cz/cs/verejnost/fotogalerie/nejlepsi-na-konferenci-ieee-mtt-s
Josef Hlávka Award	3.2.1	https://www.fbmi.cvut.cz/cs/verejnost/fotogalerie/ceny-josefa-hlavky-predany

Session Organizer Award	3.2.1	https://piers.org/awards/soa.html
Best Poster Award	3.2.1	https://www.fbmi.cvut.cz/en/public/news/gallery/best-student-poster
SELECTED RESEARCH PROJECTS		
Technology for eHealth on CTU	3.3	https://starfos.tacr.cz/en/projekty/UH0834
Modular multisensory clothing for risk management, health protection and safety of IRS members using artificial intelligence methods	3.3	https://starfos.tacr.cz/en/projekty/VJ02010031
Therapeutic rehabilitation robot controlled by brain signals	3.3	https://starfos.tacr.cz/en/projekty/FW03010025
Temporal context in the task of analyzing a long-term non-stationary multidimensional signal focuses on the development of semiautomatic and automatic methods for improving EEG data processing	3.3	https://starfos.tacr.cz/en/projekty/GA17-20480S
Development of metamaterial applicators for the regional hyperthermia system and evaluation of the accuracy of	3.3	https://starfos.tacr.cz/en/projekty/LTC19031

treatment planning algorithms		
Functionalized nanofibers as a cover of colorectal anastomosis	3.3	https://starfos.tacr.cz/en/projekty/NV16-29680A
Multiphysical Study of Superposition of Electromagnetic Waves in Human Head Model to Verify the Feasibility of Microwave Hyperthermia of Brain Tumors	3.3	https://starfos.tacr.cz/en/projekty/GA21-00579S
New materials for cardiovascular surgery based on modified decellularized tissues	3.3	https://starfos.tacr.cz/en/projekty/NV18-02-00422
Bioartificial cardiovascular patches and vessels from porcine collagen reinforced with nano/microfibers using stem cells and dynamic culture	3.3	https://starfos.tacr.cz/en/projekty/NV19-02-00068
Left atrial appendage electrical Isolation via bio-photonics optical confirmation to treat persistent atrial fibrillation	3.3	https://cordis.europa.eu/project/id/831117
POPULARIZATION OF VAVAI		

Science Café Kladno (web pages, in Czech)	3.6	https://www.sciencecafe.cz/kladno/
With the ease of an astronaut	3.6	https://archiv.hn.cz/c1-66711400-s-lehkosti-astronauta
Instrumentation in emergency medicine	3.6	https://dvojka.rozhlas.cz/pristrojova-technika-v-urgentni-medicine-7733751
Tissue engineering	3.6	https://www.ceskatelevize.cz/porady/1148499747-sama-doma/222562220600050/cast/902905/
Pink sound for better memory	3.6	https://vesmir.cz/cz/casopis/archiv-casopisu/2022/cislo-10/ruzovym-zvukem-k-lepsi-pameti.html
Polymer implants in human medicine	3.6	http://www.chemicke-listy.cz/ojs3/index.php/chemicke-listy/article/view/3855