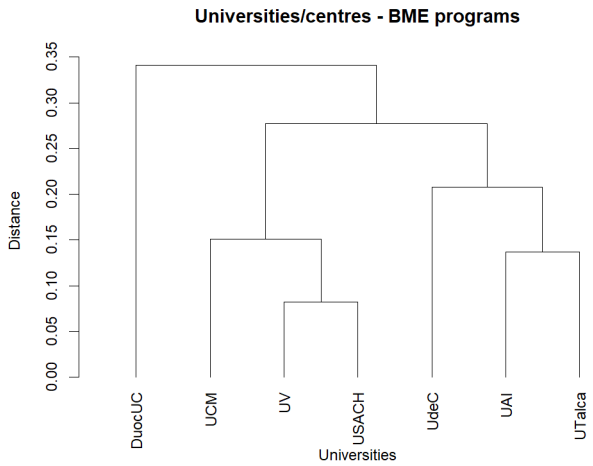
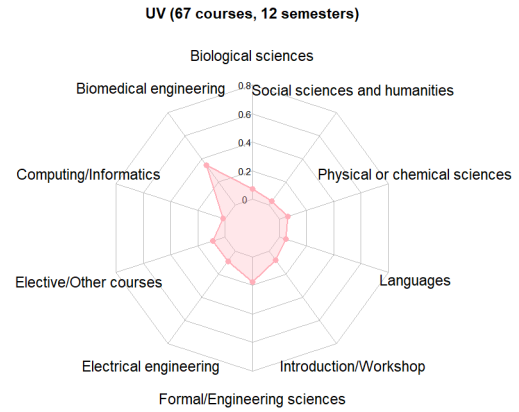


## APPENDIX S. SUPPLEMENTAL MATERIAL

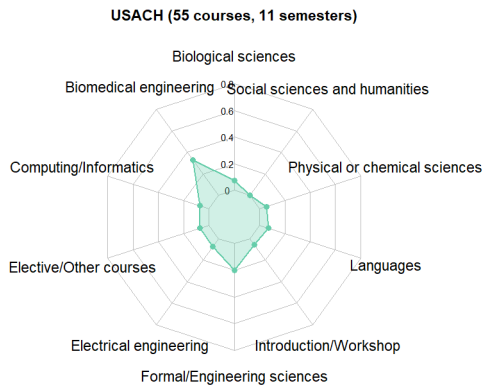
## A. Distribution of engineering courses by area in BME undergraduate programs for Chilean universities/centres



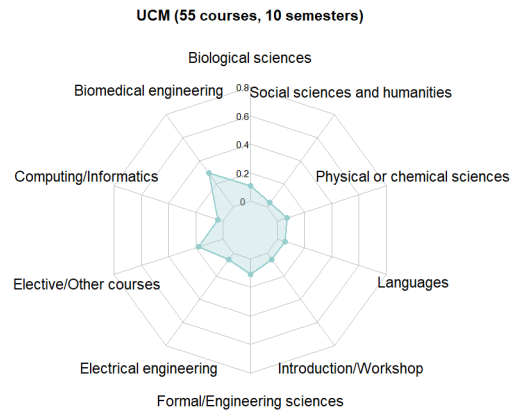
(a) Universities/centres - BME programs



(b) UV (67 courses, 12 semesters)



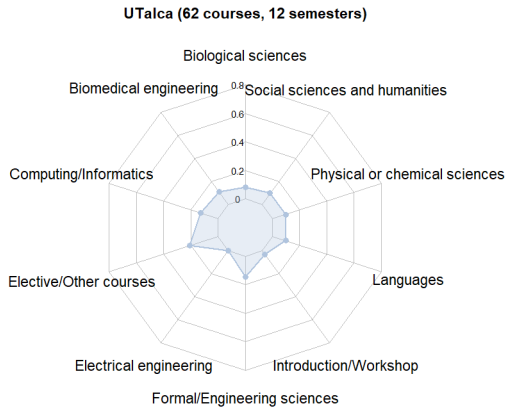
(c) USACH (55 courses, 11 semesters)



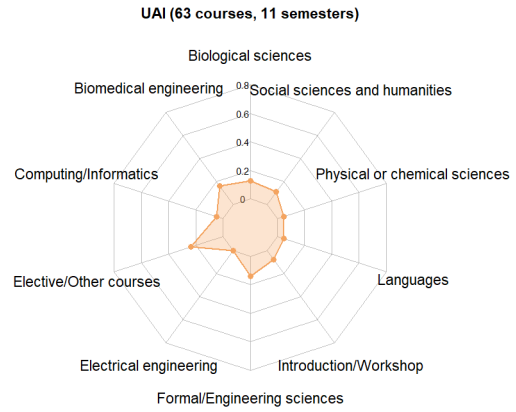
(d) UCM (55 courses, 10 semesters)

Tags in radar charts counterclockwise correspond to:

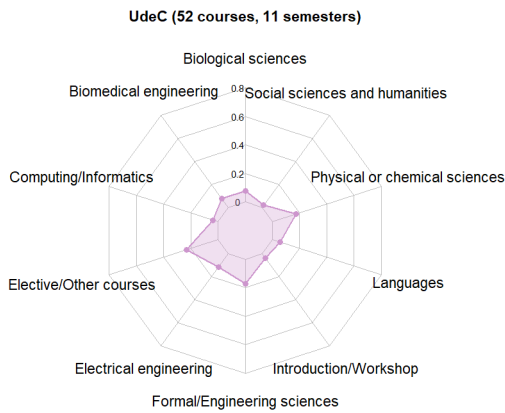
- *Biological science* considers courses such as cell biology, molecular genetics, physiology or anatomy.
- *Biomedical engineering* groups different courses directly associated with BME, such as biomedical signal processing, hospital safety, clinical engineering or bioinstrumentation.
- *Computing/informatics* considers computer science courses such as programming, algorithms, databases or data science.
- *Elective/other courses* includes complementary courses such as sports, philosophy, study techniques, time management, project design or thesis preparation.
- *Electrical engineering* label involved specialised courses such as electrical network theory, digital circuits, power control or advanced electronics systems.
- *Formal/engineering sciences* contains calculus, differential equations, linear algebra or statistics.
- *Introduction/Workshops* includes workshops and introductory engineering courses.
- *Languages* mainly focuses on English learning courses.
- *Physical or chemical sciences* includes courses associated with these areas.
- *Social sciences and humanities* mainly involve courses on developing personal skills.



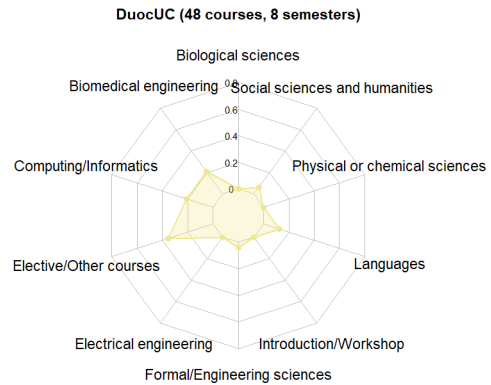
(e) UTalca (62 courses, 12 semesters)



(f) UAI (63 courses, 11 semesters)



(g) UdeC (52 courses, 11 semesters)



(h) DuocUC (48 courses, 8 semesters)

Fig. S1: Radar charts showing the distribution of engineering courses by area in BME undergraduate programs for Chilean universities/centres: UV, USACH and UdeC - Ingeniería Civil Biomédica (Biomedical engineering); UCM - Bioingeniería médica (Medical bioengineering); UAI - Ingeniería Civil en Bioingeniería (Bioengineering); UTalca - Ingeniería Civil en Bioinformática (Bioinformatics engineering); and DuocUC (Biomedical informatics). The dendrogram shows the relationships between programs based on the Euclidean distance.

Regarding student volume, the BME program at UV typically offers around 70 vacancies annually, followed by UdeC with 58 and USACH with 55. Programs at UCM and UTalca typically admit 50 and 40 students, respectively. Additionally, DuocUC provides over 200 vacancies for Medical Informatics Technicians. Unfortunately, there is a lack of available data regarding the UAI program<sup>11</sup>

<sup>11</sup><https://www.mifuturo.cl/bases-de-datos-de-oferta-academica/>

## B. Classification of courses for BME undergraduate programs in Chile

TABLE S1: Classification of courses for BME undergraduate programs in Chile: UV, UdeC and USACH.

Institution	Classification	Courses
UV	Biological sciences	Ciencias biomédicas 2; Ciencias biomédicas 3; Ciencias biomédicas 4; Ciencias biomédicas 5.
	Biomedical engineering	Gestión de datos de salud; Mediciones biomédicas; Seguridad hospitalaria; Procesamiento digital de señales biomédicas; Física para ingeniería biomédica; Fundamentos de salud pública; Equipos médicos 1; Procesamiento digital de imágenes biomédicas; Fundamentos de Ingeniería clínica y hospitalaria; Equipos médicos 2; Equipos médicos 3; Gestión de operaciones y procesos hospitalarios; Gestión de organizaciones de salud 1; Equipos médicos 4; Gestión y operaciones de mantenimiento; Sistemas de información para salud; Gestión de calidad y acreditación; Gestión de organización de salud 2; Proyecto de equipamiento de salud; Diseño y desarrollo de soluciones biomédicas; e-salud y telemedicina; Ingeniería Biomédica 4; Tecnovigilancia y evaluación de tecnologías de salud.
	Computing/Informatics	Programación de computadores.
	Elective/Other courses	Gráfica en ingeniería; Ingeniería biomédica electivo 1; Ingeniería biomédica electivo 2; Ingeniería biomédica electivo 3; Formulación y evaluación de proyectos; Proyecto de ingeniería biomédica.
	Electrical engineering	Electromedicina 1; Laboratorio de electromedicina 1; Electromedicina 2; Laboratorio de electromedicina 2; Electromedicina 3; Laboratorio de electromedicina 3.
	Formal/Engineering sciences	Fundamentos de matemáticas; Álgebra; Cálculo diferencial; Álgebra lineal; Cálculo integral; Ecuaciones diferenciales; Cálculo en varias variables; Métodos numéricos y optimización; Análisis de sistemas lineales; Probabilidades y estadísticas; Ingeniería de control automático; Redes de datos y comunicaciones.
UdeC	Introduction/Workshop	Introducción a la ingeniería biomédica; Taller de integración sello UV 1; Taller de integración sello UV 2; Taller de integración sello UV 3; Taller de integración.
	Languages	Idioma 1. Idioma 2; Idioma 3.
	Physical or chemical sciences	Ciencias biomédicas 1; Fundamentos de Física; Física mecánica; Física electromagnética; Física, calor y ondas.
	Social sciences and humanities	Desarrollo personal 1; Desarrollo personal 2.
	Biological sciences	Biología Celular y tisular; Anatomía humana; Ciencias ambientales; Ciencias biomédica 1; Ciencias biomédica 2.
USACH	Biomedical engineering	Procesamiento digital de señales biomédicas; Procesamiento digital de imágenes; Equipamiento clínico; Diseño en ingeniería biomédica.
	Computing/Informatics	Algoritmos y lenguaje de programación; Sistemas computacionales.
	Elective/Other courses	Gestión y tecnología ambiental; Práctica profesional; Electivo 1; Electivo 2; Complementario 1; Proyecto de Memoria de Título; Formulación y evaluación de proyectos; Proyecto de Ingeniería Biomédica; Electivo 3; Electivo 4; Electivo 5; Memoria de título.
	Electrical engineering	Teoría de circuitos; Laboratorio de circuitos; Electrónica biomédica; Laboratorio de electrónica; Sistemas digitales; Laboratorio de sistemas embebidos.
	Formal/Engineering sciences	Álgebra 1; Cálculo 2; Álgebra 2; Cálculo 2; Ecuaciones diferenciales ordinarias; Bioestadística; Sistemas lineales dinámicos; Sistemas de control; Economía.
	Introduction/Workshop	Introducción a la ingeniería biomédica; Introducción a la innovación en ingeniería.
USACH	Languages	Inglés 1. Inglés 2; Inglés 3.
	Physical or chemical sciences	Física 1; Química general 1; Física 2; Electromagnetismo; Estática; Dinámica; Mecánica de fluidos; Mecánica de sólidos.
	Social sciences and humanities	Gestión de empresas.
	Biological sciences	Biología celular; Biología molecular; Fisiología 1; Fisiología 2.
	Biomedical engineering	Bioética (ingeniería biomédica); Procesamiento de señales biológicas; Biomateriales; Biomecánica; Mediciones fisiológicas y bioseguridad; Ingeniería Clínica; Bioinstrumentación; Informática en salud; Bioinformática; Análisis de sistemas de salud; Gestión de operaciones en salud; Tópico de especialidad 1 (especialidad en Ing. Biomédica); Tópico de especialidad 2 (especialidad en Ing. Biomédica); Tópico de especialidad 3 (especialidad en Ing. Biomédica); Tópico de especialidad 4 (especialidad en Ing. Biomédica); Tópico de especialidad 5 (especialidad en Ing. Biomédica); Tópico de especialidad 6 (especialidad en Ing. Biomédica); Desarrollo e innovación en ingeniería biomédica.
	Computing/Informatics	Fundamentos de programación para ingeniería; Métodos de programación interdisciplinaria; Análisis de algoritmos y estructuras de datos interdisciplinarias; Ingeniería de software interdisciplinaria.
USACH	Elective/Other courses	Evaluación de proyectos; Electivo 1; Electivo 2; Trabajo de titulación.
	Electrical engineering	Redes eléctricas interdisciplinarias; Sistemas electrónicos interdisciplinaria; Electromedicina; Sistemas digitales y microcontroladores.
	Formal/Engineering sciences	Cálculo 1 para ingeniería; Álgebra 1 para ingeniería; Cálculo 2 para ingeniería; Álgebra 2 para ingeniería; Cálculo 3 para ingeniería; Análisis estadístico; Fundamentos de economía; Ecuaciones diferenciales y métodos numéricos para biomédica; Ingeniería económica interdisciplinaria; Bioestadística; Control de sistemas.
	Introduction/Workshop	Introducción a la ingeniería biomédica; Introducción al diseño en la ingeniería; Taller de diseño en ingeniería.
USACH	Languages	Inglés 1. Inglés 2; Inglés 3, Inglés 4.
	Physical or chemical sciences	Física 1 para ingeniería; Física 2 para ingeniería; Electricidad y magnetismo.
USACH	Social sciences and humanities	—

TABLE S2: Classification of courses complementary to BME undergraduate programs in Chile: UCM (Medical bioengineering), UTalca (Bioinformatics engineering) and UAI (Bioengineering).

Institution	Classification	Courses
UCM	Biological sciences	Fundamentos del cuerpo humano 1; Fundamentos del cuerpo humano 1; Estructura y relatividad molecular; Fundamentos del cuerpo humano 2; Fundamentos del cuerpo humano 2; Fisiopatología médica.
	Biomedical engineering	Metrología de variables biomédicas; Sistemas de señales biomédicas; Instrumentación biomédica; Procesamiento de señales fisiológicas; Ingeniería de tejidos y órganos; Gestión hospitalaria y telemedicina; Bioética; Terapia celular y medicina regenerativas; Bioinformática; Neuroingeniería; Biomecánica; Farmacología molecular; Imágenes biomédicas; Nanotecnología; Radioterapia y bioseguridad; Implantología y biomateriales;
	Computing/Informatics Elective/Other courses	Comunicación persona - máquina; Inteligencia artificial. Certificación 1; Certificación 2; Metodología de proyectos; Certificación 3; Electivo I; Práctica 1; Práctica 2; Electivo 2; Electivo 3; Proyecto.
	Electrical engineering Formal/Engineering sciences	Electrónica 1; Electrónica 2; Robótica. Matemática y computación 1; Física aplicada; Matemática y computación 2; Bioestadísticas y metodología de la investigación científica; Empresa y economía; Mecánica de sistemas.
	Introduction/Workshop Languages	Introducción a la bioingeniería médica; Taller de investigación y formación 1; Taller de investigación y formación 2. Inglés 1; Inglés 2; Inglés 3.
	Physical or chemical sciences Social sciences and humanities	Bioquímica 1; Bioquímica 2; Biofísica; Materiales. Introducción a la fe; Ética cristiana.
Utalca	Biological sciences	Organización estructural de la célula; Procesos metabólicos celulares; Expresión génica y su regulación; Análisis de secuencias biológicas; Organización dinámica del genoma.
	Biomedical engineering	Modelos matemáticos y sistemas biológicos; Bioinformática estructural; Ética y responsabilidad social; Ensamblado y anotación de genomas; Simulación molecular 1; Procesos bioindustriales; Biotecnología.
	Computing/Informatics Elective/Other courses	Soluciones algorítmicas; Programación 1; Programación avanzada; Algoritmos y estructura de datos; Sistemas operativos; Bases de datos; Minería de datos; Taller de programación web. Deporte 1; Fundamentos de administración; Responsabilidad social; Deporte 2; Electivo 1; Electivo 2; Gestión de recursos humanos; Electivo 3; Proyecto de memoria de título; Taller de proyectos biotecnológicos; Gestión de la innovación y emprendimiento; Electivo 4; Memoria de título.
	Electrical engineering Formal/Engineering sciences	— Introducción a las matemáticas; Álgebra; Cálculo 1; Álgebra lineal; Cálculo 2; Probabilidad y estadística; Ecuaciones diferenciales; Teoría de sistemas; Ingeniería económica y evaluación de proyectos.
	Introduction/Workshop Languages	Introducción a la ingeniería en bioinformática; Taller de integración. Idioma extranjero 1; Idioma extranjero 2; Idioma extranjero 2; Idioma extranjero 4; Idioma extranjero 5; Idioma extranjero 6.
	Physical or chemical sciences Social sciences and humanities	Química general; Química orgánica; Física General; Electricidad y magnetismo; Termodinámica; Biofísica. Comunicación oral y escrita 1; Comunicación oral y escrita 2; Autogestión del aprendizaje; Trabajo en equipo y desarrollo de habilidades sociales; Comprensión de contextos sociales; Comprensión de contextos culturales.
UAI	Biological sciences	Fundamentos de ciencias ambientales; Ciencias core 1; Biología y ambiente; Biología celular y fisiología; Bioquímica aplicada; Genética molecular; Ingeniería ambiental; Ingeniería genética.
	Biomedical engineering	Ética core; Biomateriales; Biomecánica; Microbiología aplicada; Bioinformática y ciencia de datos; Bioprocesos; Bioingeniería ambiental; Optativo profesional I; Optativo profesional II; Optativo profesional III.
	Computing/Informatics Elective/Other courses	Programación; Fundamentos de ciencia de datos; Optimización. Deporte 1; Deporte 2; Deporte 3; Práctica operativo; Deporte 4; Taller de innovación y emprendimiento tecnológico; Formulación y evaluación de proyectos; Tratamiento de emisiones; Capstone project; Valorización de residuos; Pasantía; Emprendimiento; Ciencias de la ingeniería; Magíster internacional; Proyecto final.
	Electrical engineering Formal/Engineering sciences	— Cálculo diferencial; Álgebra I; Cálculo integral; Álgebra lineal; Cálculo multivariable; Probabilidad y estadística; Ecuaciones diferenciales; Principios de economía; Operaciones unitarias.
	Introduction/Workshop Languages	Taller de Introducción a la ingeniería; Taller de expresión oral I; Taller de diseño en ingeniería; Introducción a la bioingeniería; Taller de expresión oral I. Inglés 1; Inglés 2; Inglés 3.
	Physical or chemical sciences Social sciences and humanities	Física 1; Física 2; Física 3. Civilización contemporánea 1; Escritura argumentativa core; Civilización contemporánea 2; Literatura y humanidades core 1; Literatura y humanidades core 2; Arte y humanidades core; Liderazgo.

TABLE S3: Classification of courses complementary to BME undergraduate programs in Chile: DuocUC (Medical informatics technicians).

Institution	Classification	Courses
DuocUC	Biological sciences	—
	Biomedical engineering	Ecosistema sanitario; Calidad en salud; Terminología clínica; Protocolos de bioseguridad; Modelos sanitarios; Sistemas de información en salud; Reportes de ingeniería biomédica; Ética profesional; Codificación en información clínica; Esp Biomédica.
	Computing/Informatics Elective/Other courses	Introducción a la informática; Diseño y gestión de requisitos; Modelamiento de base de datos; Soporte de software; Diseño de prototipos; Consulta de base de datos; Ingeniería de software; Programación de base de datos; Minería de datos; Big data. Deporte 1; Deporte 2; Deporte 3; Práctica operativo; Deporte 4; Taller de innovación y emprendimiento tecnológico; Formulación y evaluación de proyectos; Tratamiento de emisiones; Capstone project; Valorización de residuos; Pasantía; Emprendimiento; Ciencias de la ingeniería; Magíster internacional; Proyecto final.
	Electrical engineering Formal/Engineering sciences	— Nivelación matemáticas; bioestadística y epidemiología.
	Introduction/Workshop Languages	— Inglés básico 1; Inglés básico 2; Inglés básico 3; Inglés intermedio 1; Inglés intermedio 2.
	Physical or chemical sciences Social sciences and humanities	— Comunicación; Herramientas tecnológicas para la información y comunicación; Habilidades de comunicación efectiva.

*C. General scheme of data processing stage*

## Data processing

### 5. Standardisation

Apply 2023 IEEE Taxonomy and BME areas to classify keywords and papers.

### 4. Researcher Identification

Finalising the list of researchers from program sites, WoS and SCOPUS.



### 1. Comprehensive search

Searching for BME publications between 2000 and 2022 at UdeC, UV, USACH.

### 2. Data processing

Gathering details: authors, titles, publication years, citations.

### 3. Translation

Translate non-English titles and abstracts using Google Translate API.

*D. Researchers considered in the bibliometric analysis*

TABLE S4: Researchers included in the biobibliometric analysis and their respective SCOPUS IDs. The authors are listed based on their SCOPUS IDs, except for 1 and 2, who have not published any works.

Universities	Researchers (SCOPUS ID)
UdeC	Aqueveque Navarro Pablo Esteban (14036817700); Arias Parada Luis Emiliano (26022749400); Espinoza Castro Jose Ruben (35599816000); Figueroa Figueroa Miguel Edgardo (7102732243); Figueroa Iturrieta Rosa Liliana (14631693800); García Santander Luis Claudio (14631878200); Godoy Medel Sebastián Eugenio (22950573600); Guevara Alvez Pamela Beatriz (24766261300); Lopez Parra Enrique Alfonso (7202905732); Medina Carrasco Mario Ruben (57202851301); Moran Tamayo Luis Alejandro (57189078954); Palma Fanjul Leonardo Manuel (14830565600); Peña Guíñez Ruben Sigifredo (7102371917); Pino Quiroga Esteban Javier (23028926500); Roa Sepulveda Claudio Andres (6602259239); Rojas Norman Alejandro Jose (8700108300); Saavedra Mondaca Gabriel Alejandro (57193389959); Salazar Silva Lautaro David (7102692198); Sanchez Schulz Ricardo Washington (7401636823); Sbarbaro Hofer Daniel Geronimo (7003572137); Segovia Vera Juan Pablo (56251299300); Sobarzo Guzman Sergio Kendrick (6504152555); Tapia Ladino Juan Antonio (7005420101); Torres Inostroza Sergio Neftali (7101834722); Valenzuela Latorre Manuel Anibal (35563978200); Wiechmann Fernandez Eduardo Pieter Gonzalo (7003287200).
UV	Arredondo Gamboa Luis Togo (57545616900); Arriola Vera Alexis Alfonso (57203457251); Avendaño Cervantes Guillermo Enrique (36157731300); Blanchard Sanhueza German Osvaldo (36717384300); Buendía Palacios Debora Alicia (57218456896); Chabert Steren (23049450200); Diaz Avila Cristian Eduardo (57197180823); Dimov Ivan Krastev (25654915600); El-Deredy Wael (6603616278); Galindo Viaux Cesar Guillermo (56563022900); Glaria Bengoechea Antonio Pedro (55281257500); Lever Torres Scarlett Andrea (2); Reyes Cabrera Pablo Andres (18435273600); Rienzo Renato Antonio Jose (57189046300); Roncagliolo Benitez Pablo Andres (6506521567); Saavedra Ruiz Carolina Veronica (13609644600); Salas Fuentes Rodrigo Jose (8875435300); Silva Escobar Viviana Margarita (57215525212); Sotelo Parraguez Julio Andres (55331777400); Spencer Yates Eyleen Johanna (1); Veloz Baeza Alejandro Andres (23476128900); Weinstein Oppenheimer Alejandro Jose (57204948489).
USACH	Chacon Pacheco Max Leonardo (36963571000); Garcia Herrera Claudio Moises (35483673000); Gomez Arias Britam Arom (57208341365); Medina Daza Leonel Eugenio (9241524000); Tarride Fernandez Mario Ivan (6506286421); Villalobos Cid Manuel Jose (55114462200); Xavier Aline (57442094800); Bello Robles Felipe Andres Hernan Patricio (57402885400-55391702400-57200695857).

## E. SCOPUS keyword classification

TABLE S5: Classification of SCOPUS keywords according to BME areas.

Area	Keywords
Biofluids	aortic hemodynamics; blood flow; flow velocity; fluid mechanics; haemodynamics; heart hemodynamics; hemodynamics; microfluidics.
Bioinformatics / Genetic engineering	amino acid receptor blocking agent; bioinformatics; biological evolution; biological marker; computational biology; evolutionary history; genetic analysis; genetic database; genetics; genome analysis; microarray analysis; phylogeny; protein; proteins; single cell analysis; structural bioinformatics.
Bioinstrumentation / Biomedical electronics	angioplasty; artificial heart; axial flux machines; ballistocardiography; bioimpedance measurement; biomedical equipment; biomedical technologies; brain-computer interface; cardiopulmonary bypass; cochlea prosthesis; electrocardiography; electroencephalography; electrooculography; electromyography; evoked potentials; home care; human-computer interaction; implantable biomedical devices; mechanical ventilator; medical device; medical devices; medical equipment; medical instrumentation; monitoring device; patient monitoring; polysomnography; spirometry; visual evoked potential.
Biomaterials	biochemical engineering; biochemical engineering; biochemistry; biological materials; biomimetics; biomineralization; biomolecules; biophysics; bioplastics; biopolymers; calcification biochemistry.
Biomechanics	3d printers; 3d printing; accelerometer sensor; accelerometry; anthropometry; biomechanical phenomena; biomechanics; biophysics; biosensors; breathing mechanics; face recognition; mechanical engineering.
Biomechatronics	biometric fusion; biometric fusion; biometric recognition; biometrics; robotic equipment; robotic technology; robotics.
Biomedical engineering	biomedical engineering.
Bionics	prostheses and implants; prostheses and orthoses.
Cellular and tissue engineering	cell engineering; histological analysis; human tissue; tissue engineering.
Clinical engineering	clinical engineering; clinical management; health security; healthy organization; organization and management; preventive maintenance; primary care; public administration; public health systems; public healthcare; public hospital; public management; radiation protection; safety engineering; technical efficiency.
Medical Imaging	4d flow; 4d flow magnetic resonance imaging; angiography; breast images; cardiovascular magnetic resonance; computerised tomography; diagnostic imaging; diagnostic radiography; diffusion magnetic resonance imaging; functional magnetic resonance imaging; magnetic resonance; magnetic resonance imaging; mammography; medical image segmentation; medical imaging; neuroimaging; nuclear magnetic resonance; positron emission tomography; radiographic images; radiography; tomography; x-ray.
Medical Informatics	biomedical informatics; eHealth; health information; hl7; hospital data processing; hospital information system; medical computing; medical informatics; telehealth; telemedicine.
Neural Engineering	computational neuroscience; neural conduction; neuromuscular blockade; neurobiology; neuronal dynamics; neuropathology.
Rehabilitation / Orthopaedic Bioengineering	biomedical implants; patient rehabilitation; physical and rehabilitation medicine; regenerative medicine; rehabilitation; rehabilitation devices; rehabilitation medicine; rehabilitation technology; robotic rehabilitation.
Systems Physiology	autoregulation; biological model; biomedical signal; biomedical signal processing; blood analysis; brain electrophysiology; cell interaction; cerebral autoregulation; cerebral haemodynamics; cerebral hemodynamics; dynamic cerebral autoregulation; electrical stimulation; electrostimulation; electrophysiology; movement physiology; nerve stimulation; pathophysiology; physiologic; physiological; physiology; psychophysiology.

## F. Performance analysis

TABLE S6: Metrics considered in the bibliometric analysis.

Category	Metrics	Description
Performance	Total publications ( $TP$ ).	Total number of publications.
	Total journal publications ( $TP_j$ ).	Total number of journal publications.
	Total conference proceeding publications ( $TP_p$ ).	Total number of conference proceeding publications.
	Percentage of journal publications( $\%TP_j$ ).	$\frac{TP_j}{TP} \times 100$ .
	Percentage of conference proceeding publications ( $\%TP_p$ ).	$\frac{TP_p}{TP} \times 100$
	Average publications by author ( $AP$ ).	Average of manuscripts published by author.
	Average journal publications by author ( $TP_j$ ).	Average of manuscripts published in journals by author.
	Average conference proceeding publications by author ( $TP_p$ ).	Average of manuscripts published in conference proceedings by author.
	Average publications by year ( $APY$ ).	Average of manuscripts published by year.
	Average journal publications by year ( $AP_jY$ ).	Average of manuscripts published in journals by year.
	Average conference proceeding publications by year ( $AP_pY$ ).	Average of manuscripts published in conference proceedings by year.
	Number of active years of publications ( $NAV$ ).	Number of years that research constituent records a publication.
	Productivity per active year of publication ( $PAY$ ).	$\frac{TP}{NAV}$
	Total citations ( $TC$ ).	Total number of citations.
Average citations by publication ( $AC$ ).	$\frac{TC}{TP}$	
Number of cited publications ( $NCP$ ).	Number of cited publications.	
Proportion of cited publications ( $PCP$ ).	$\frac{NCP}{TP}$	
Citations per cited publication ( $CPP$ ).	$\frac{TC}{NCP}$	
Collaboration	Number of authors ( $NA_c$ ).	Total number of authors that publish during the period (Researchers).
	Number of contributing authors ( $NCA$ ).	Total number of different authors that contributed to publications.
	Average contributing authors ( $ANCA$ ).	$\frac{NCA}{TP}$
	Co-authored publications ( $CA$ ).	Total number of co-authored publications.
Percentage of co-authored publications ( $\%CA$ ).	$\frac{CA}{TP} \times 100$	



## G. Frequency analysis - SCOPUS keywords

TABLE S7: SCOPUS keywords that characterise each university with statistical significance according to the chi-square test compared to one or more institutions.

Years	University	SCOPUS keywords (Statistically significant differences based on Chi-square test)
2000-2022	UV	adolescent; aorta; auto-regressive; biomedical engineering; blood; diabetes; electroencephalography; female; haemodynamics; imaging; learning; magnetic resonance; magnetic resonance imaging; male; nuclear magnetic resonance; nuclear magnetic resonance image; pain; resonance; time series; visual.
	All universities	AC; cells; control; control systems; controllers; copper; design; efficiency; electric; energy; estimation; feedback; induction; modulation; noise; optimisation; power; power converters; power electronics; sensors.
2005-2022	UdeC	AC; cells; control; control systems; controllers; copper; design; efficiency; electric; energy; estimation; feedback; induction; modulation; noise; power; power converters; power electronics; reactive power; sensors.
	All universities	animal; aorta; biomedical engineering; blood; blood flow; blood pressure; electroencephalography; female; haemodynamics; human; magnetic resonance; magnetic resonance imaging; male; nuclear magnetic resonance imaging; pain; pressure; resonance; time series; visual.
2020-2022	USACH	Alzheimer disease; animal; auto regulation; blood; blood flow; blood pressure; carbon; carbon dioxide; entropy; evolution; genetic; glutamic acid; hypercapnia; hypoxia; mechanical; mice; mouse; nonhuman; pressure; retina.
	All universities	control; control systems; controllers; copper; cost; diagnostic imaging; diffusion; electric; energy; image processing; imaging; learning; magnetic resonance; magnetic resonance imaging; neural networks; nuclear magnetic resonance; power; radiation; resonance; time.
2005-2022	UV	adolescent; adult; aorta; auto-regressive; biomedical engineering; blood; electroencephalography; female; haemodynamics; human; learning; magnetic resonance; magnetic resonance imaging; male; nuclear magnetic resonance; nuclear magnetic resonance imaging; pain; resonance; time series; visual.
	UdeC	AC; cells; control systems; control; controllers; copper; design; efficiency; electric; energy; estimation; feedback; induction; modulation; noise; optimisation; power; power converters; power electronics; sensors.
2020-2022	UV	aortic valve; cardiovascular; convolution; diabetes; diagnostic imaging; electromyography; forecasting; heart; image processing; imaging; learning; magnetic resonance; magnetic resonance imaging; medical imaging; muscle; neural networks; neuroimaging; nuclear magnetic resonance; nuclear magnetic resonance imaging; rehabilitation; resonance; review; robotics; skeletal.
	USACH	Alzheimer disease; animal; animals; auto-regulation; blood; blood pressure; carbon; carbon dioxide; entropy; evolution; genetic; glutamic acid; hypercapnia; mechanical; mice; model; mouse; nonhuman; optimisation; pressure; retina.
2020-2022	UdeC	automation; control; control systems; controllers; copper; cost; diffusion; electric; energy; image processing; imaging; learning; modulation; permanent magnets; power; power converters; radiation; sensors; spectroscopy; time; topology; visualisation;
	USACH	Alzheimer disease; animal; animals; auto-regulation; blood; blood flow; blood flow velocity; blood pressure; carbon; entropy; flow velocity; genetic; hemodynamics; hypoxia; mechanical; pressure; retina; stress.

*H. Temporal analysis - SCOPUS keywords*

TABLE S8: SCOPUS keywords that characterise each university with statistical significance according to the chi-square test compared in different periods.

University	Years	SCOPUS keywords
All universities	2000 - 2010	AC; active filters; air; electric; electric currents; electric network analysis; electric network topology; electric potential; electric power factor; electric power systems; motion; network topology; power; power electronics; self organising; self organising maps; topology.
	2011 - 2022	adult; aged; blood; brain; computer assisted; female; human; humans; imaging; magnetic resonance; magnetic resonance imaging; male; physiology; procedures; radiation; resonance; muscle; young adult.
UV	2000 - 2010	algorithms; amplification; anfis; anfis models; anisotropic diffusion filters; architectural design; arrhythmia; benchmark site; calibration; computational methods; data reduction; data structures; database systems; estimation; flexible architecture; fuzzy means; fuzzy inference; fuzzy inference systems; fuzzy models; fuzzy spatial growing fsg; glioblastoma; glioblastoma multiforme; kinetics; knowledge; lung; machine ensembles; mathematical models; mechanical; model; neural gas; nonhuman; nonlinear modelling; optimal numbers; parameter estimation; performance criterions; reflex; RNA; robustness control systems; self organising maps; self organising; self-organising mechanisms; synthetic and real datums; topology; training processes; tumours.
	2011 - 2022	adolescent; adult; aorta; blood; brain; electroencephalography; female; haemodynamics; human; humans; imaging; magnetic resonance; magnetic resonance imaging; male; muscle; nuclear magnetic resonance; nuclear magnetic resonance imaging; physiology; resonance; young adult.
UdeC	2006 - 2010	active filters; active filters; air; artificial neural networks; back-propagation; electric; electric currents; electric network analysis; electric network topology; electric potential; electric power factor; electric power systems; fields; motion; network topology; power; power electronics; simulation; system stability; topology.
	2011 - 2022	adult; brain; classification; computer-assisted; diffusion; electrodes; female; hear; human; humans; imaging; magnetic resonance; magnetic resonance imaging; male; model; procedures; radiation; reproducibility; sleep; technology.

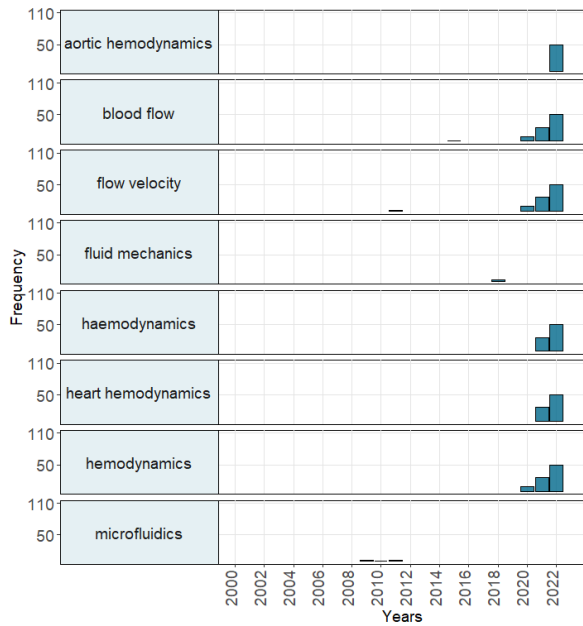
## I. Journals

TABLE S9: Journals with the highest frequency of publication for each university.

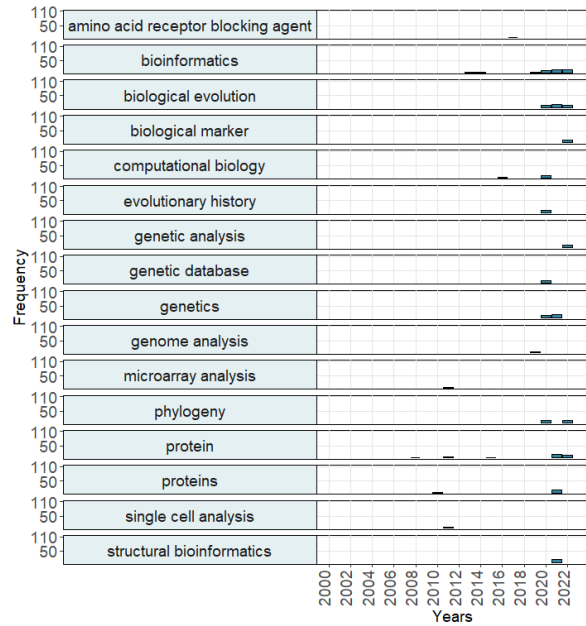
University	2000 - 2010	2011-2019	2020 - 2022
UV	Journal of Physics: Conference Series (3); Lab on Chip (2); Pattern Recognition Letters (2); Visual Neuroscience (1); Revista Chilena de Radiología (1); Neurocomputing (1); IFIP International Federation for Information Processing (1); Developmental Brain research (1)	Computational Intelligence and Neuroscience (4); PloS One (3); Modelling and Simulation in Engineering (3); International Journal of Computational Intelligence Systems (3); Algorithms (3); Scientific Reports (2); Prenatal Diagnosis (2); Pattern Recognition Letters (2); Neural Processing Letters (2); Lab on a Chip (2); Journal of visualized experiments (2); BMC Paediatrics.	Applied Sciences (Switzerland) (5); Magnetic Resonance in Medical Sciences (4); IEEE Transactions on Fuzzy Systems (4); Frontiers in Applied Mathematics and Statistics (4); Revista Chilena de Radiología (2); Ozone: Science and Engineering (2); Frontiers in Human Neuroscience (2); European Journal of Sport Science (2); Computer Methods in Biomechanics and Biomedical Engineering (2); Stochastic Environmental Research and Risk Assessment (2).
UdeC	IEEE Transactions on Industry Applications (21); IEEE Transactions on Industrial Electronics (18); IEEE Transactions on Power Electronics (5); Applied Optics (5); IEEE Transactions on Power Delivery (4); Ingeniare (3); IEEE Transactions on Magnetic (3); Combustion and Flame (3); Wood Research (2); Journal of Process Control (2); IEEE Transactions on Power Systems (2); IEEE Transactions on Energy Conversions (2); Electric Power Systems Research (2); Computers and Geosciences (2); AMIA Annual symposium proceedings (2); Advances in Industrial Control (2).	IEEE Transactions on Industry Applications (54); IEEE Transactions on Industrial Electronics (36); IEEE Latin America Transactions (11); Electric Power Systems Research (10); Electric Power Systems Research (10); IEEE Transaction on Industrial Informatics (9); Applied Optics (8); Infrared Physics and Technology (7); IEEE Transactions on Power Electronics (7); IEEE Access (7); Sensors (Switzerland)(6)	IEEE Access (27); Energies (9); Sensors (5); NeuroImage (5); Ingeniare (4); Sensors (Switzerland) (3); Journal of Cleaner Production (3); IEEE Transactions on Energy Conversion (3); Sustainability (Switzerland) (2); ISA Transactions (2); IEEE Transactions on Power Delivery (2); IEEE Transactions on Industry Applications (2); IEEE Latin America Transactions (2); IEEE Journal of Emerging and Selected Topics in Power Electronics (2); Frontiers in Neuroinformatics (2); Electrical Engineering (2); Biomedical Engineering Online (2); Applied Sciences (Switzerland) (2)
USACH	—	—	Scientific Reports (6); Physiological Measurement (2); Materials (2); Journal of Alzheimer's Disease (2); IEEE Transaction on Biomedical Engineering (2); Frontiers in Bioengineering and Biotechnology (2); Wood Science and Technology (1); Science of the Total Environment (1); Revista Materia (1); Polymers (1); Plos One (1); Microorganisms (1); Journal of the Mechanical Behaviour of Biomedical Materials (1); Journal of Bioinformatics and Computational Biology (1); Biosystems (1); Biosensors (1).



K. Temporal analysis - SCOPUS keywords by area of knowledge



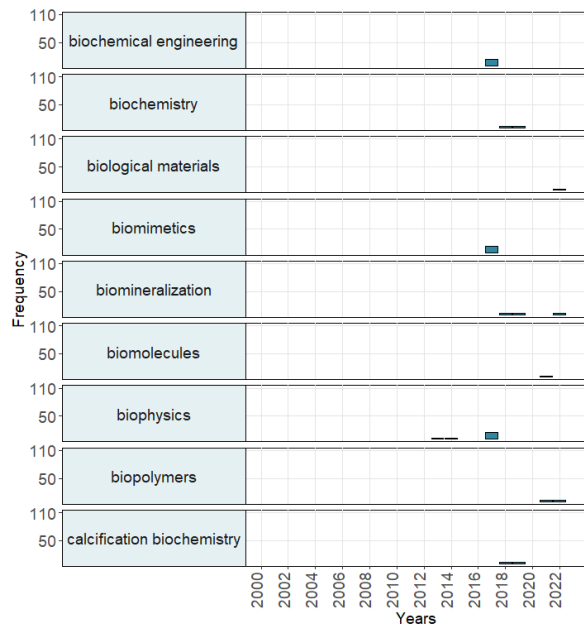
(h) Biofluids



(i) Bioinformatics/Genetic engineering



(j) Bioinstrumentation/Biomedical electronics



(k) Biomaterials

Fig. S2: Frequency of SCOPUS keywords published by academics from BME areas.

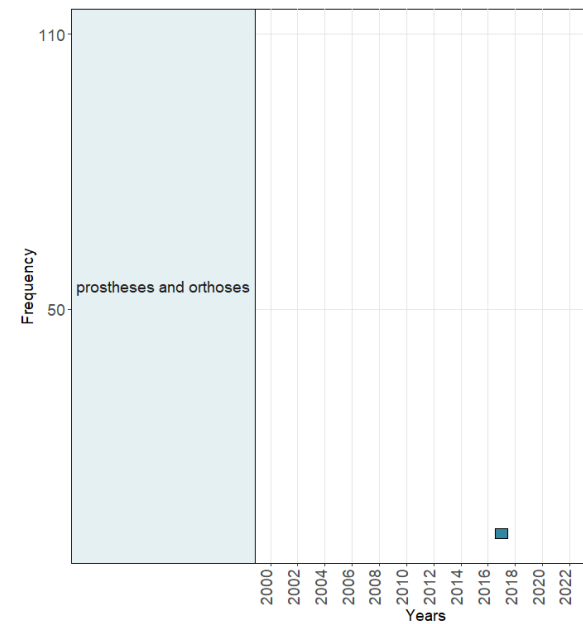
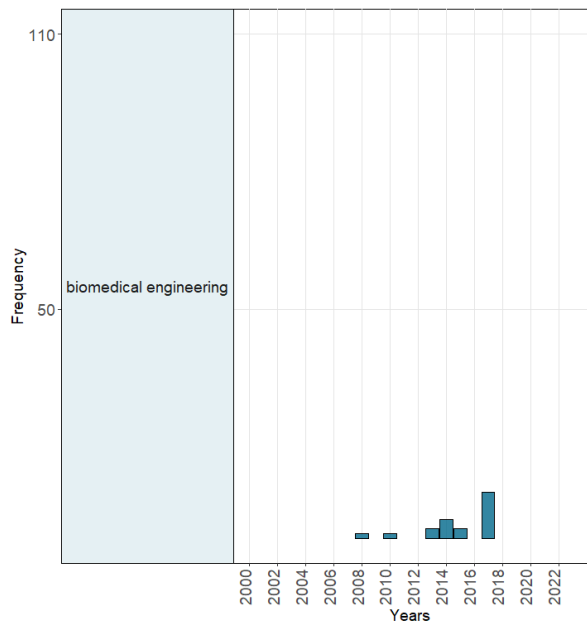
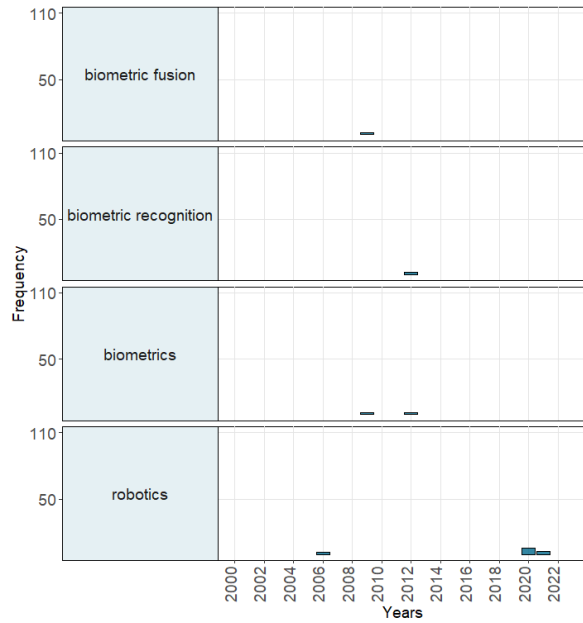
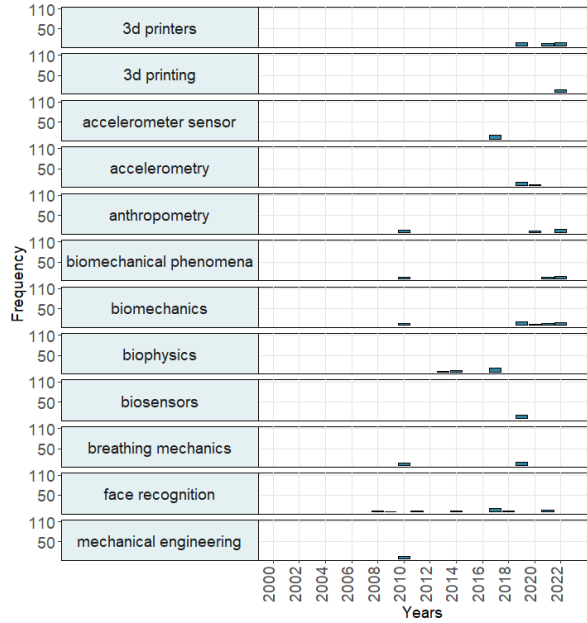
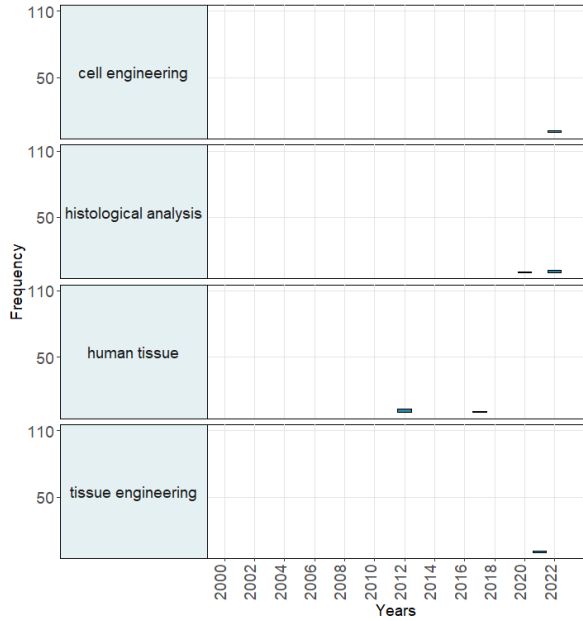
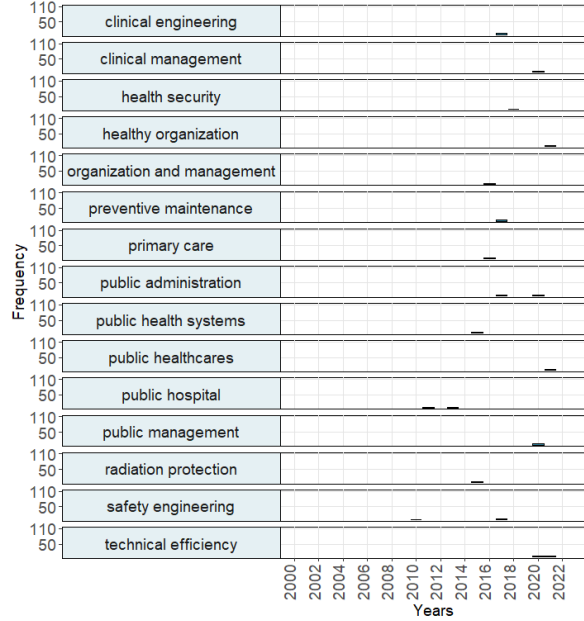


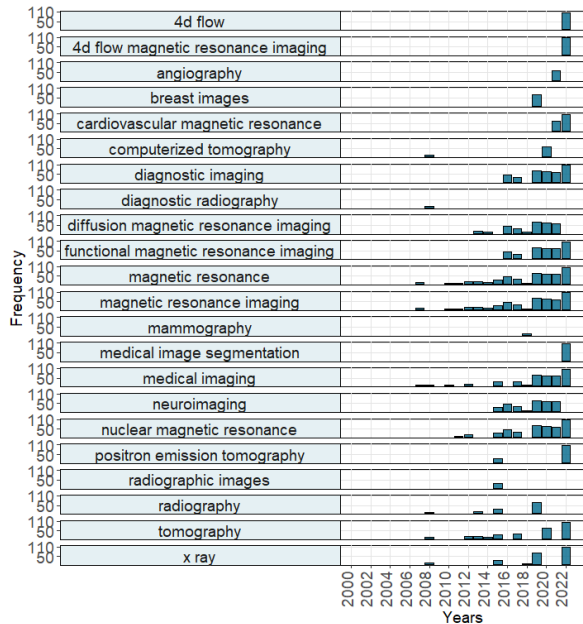
Fig. S2: Frequency of SCOPUS keywords published by academics from BME areas.



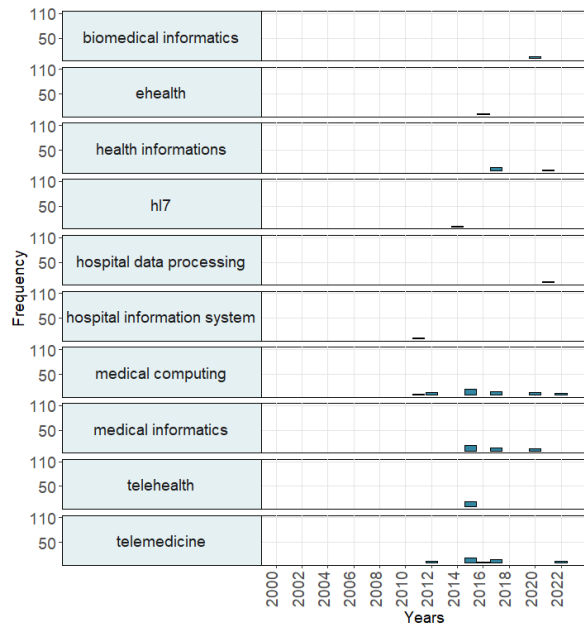
(p) Clinical engineering



(q) Medical Imaging

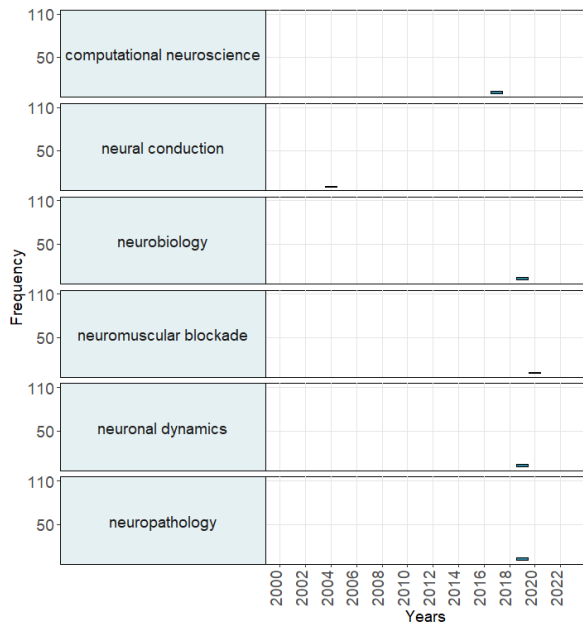


(r) Medical Informatics

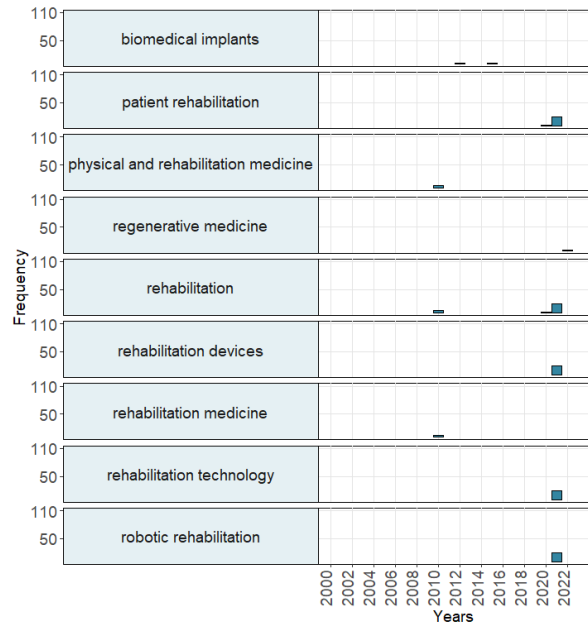


(s) Neural Engineering

Fig. S2: Frequency of SCOPUS keywords published by academics from BME areas.



(t) Rehabilitation/Orthopaedic Bioengineering



(u) Systems Physiology

Fig. S2: Frequency of SCOPUS keywords published by academics from BME areas.



TABLE S10: Frequency of SCOPUS keywords which characterise the production of academics from UV in BME areas

University	Area	2000-2010	2011-2022
UV	Biofluids	microfluidics	aortic hemodynamics; blood flow; flow velocity; haemodynamics; heart hemodynamics; hemodynamics; microfluidics.
	Bioinformatics/Genetic engineering	protein; proteins.	amino acid receptor blocking agent; bioinformatics; biological marker; computational biology; microarray analysis; protein; proteins; single cell analysis.
	Bioinstrumentation/Biomedical electronics	artificial heart; biomedical equipment; biomedical technologies; mechanical ventilator; medical equipment; medical instrumentation.	biomedical equipment; brain-computer interface; electrocardiography; electroencephalography; electromyography; evoked potentials; home care; human-computer interaction; medical device; medical devices; patient monitoring; polysomnography; spirometry; visual evoked potential.
	Biomaterials	–	biochemical engineering; biochemistry; biological materials; biomimetics; biomineralization; biophysics; calcification biochemistry.
	Biomechanics	anthropometry; biomechanical phenomena; biomechanics; breathing mechanics; mechanical engineering.	3d printers; 3d printing; accelerometer sensor; accelerometry; biomechanics; biophysics; biosensors; breathing mechanics.
	Biomechatronics	biometric; biometric fusion.	biometrics; biometric recognition; robotics.
	Bionics	–	–
	Cellular and tissue engineering	–	cell engineering; histological analysis; human tissue.
	Clinical engineering	safety engineering.	clinical engineering; health security; preventive maintenance; primary care; public administration; public health systems; public hospital; public management; radiation protection; safety engineering.
	Medical Imaging	magnetic resonance; magnetic resonance imaging; medical imaging.	4d flow; 4d flow magnetic resonance imaging; angiography; breast images; cardiovascular magnetic resonance; computerized tomography; diagnostic imaging; diffusion magnetic resonance imaging; functional magnetic resonance imaging; magnetic resonance; magnetic resonance imaging; mammography; medical image segmentation; medical imaging; neuroimaging; nuclear magnetic resonance; positron emission tomography; radiographic images; radiography; x ray.
	Medical Informatics	–	ehealth; hl7; hospital data processing; hospital information system; medical computing; medical informatics; telehealth; telemedicine.
	Neural Engineering	neural conduction.	computational neuroscience; neuronal dynamics.
	Rehabilitation/Orthopaedic Bioengineering	physical and rehabilitation medicine; rehabilitation; rehabilitation medicine	patient rehabilitation; regenerative medicine; rehabilitation; rehabilitation devices; rehabilitation technology; robotic rehabilitation.
	Systems Physiology	cell interaction; electrophysiology; physiology; psychophysiology.	biological model; biomedical signal; biomedical signal processing; blood analysis; brain electrophysiology; electrophysiology; electrostimulation; movement physiology; nerve stimulation; pathophysiology; physiologic; physiological; physiology; psychophysiology.

TABLE S11: Frequency of SCOPUS keywords which characterise the production of academics from UdeC in BME areas

University	Area	2000-2010	2011-2022
UdeC	Biofluids	–	fluid mechanics.
	Bioinformatics/Genetic engineering	–	bioinformatics; genome analysis.
	Bioinstrumentation/Biomedical electronics	axial flux machines; patient monitoring.	electrocardiography; axial flux machines; ballistocardiography; bioimpedance measurement; condition monitoring; electromyography; electrooculography; implantable biomedical devices; medical equipment; patient monitoring; polysomnography.
	Biomaterials	–	–
	Biomechanics	face recognition.	3d printers; accelerometry; face recognition.
	Biomechatronics	robotics.	–
	Bionics	–	prostheses and orthoses.
	Cellular and tissue engineering	–	human tissue.
	Clinical engineering	–	organization and management; public administration; public hospital; safety engineering.
	Medical Imaging	computerised tomography; diagnostic radiography; medical imaging; radiography; tomography; x-ray.	diagnostic imaging; diffusion magnetic resonance imaging; functional magnetic resonance imaging; magnetic resonance; magnetic resonance imaging; medical imaging; neuroimaging; nuclear magnetic resonance; radiography; tomography.
	Medical Informatics	–	biomedical informatics; health informations; medical computing; medical informatics; telemedicine.
	Neural Engineering	–	neurobiology; neuropathology.
	Rehabilitation/Orthopaedic Bioengineering	–	–
Systems Physiology	physiological.	biological model; biomedical signal; biomedical signal processing; electrical stimulation; electrostimulation; nerve stimulation; pathophysiology; physiologic; physiological; physiology.	

TABLE S12: Frequency of SCOPUS keywords which characterise the production of academics from USACH in BME areas

University	Area	2000-2010	2011-2022
USACH	Biofluids	–	blood flow; flow velocity; haemodynamics; hemodynamics.
	Bioinformatics/Genetic engineering	–	bioinformatics; bioinformatics; biological evolution; computational biology; evolutionary history; genetic analysis; genetic database; genetics; phylogeny; protein; proteins; structural bioinformatics.
	Bioinstrumentation/Biomedical electronics	–	monitoring device; patient monitoring.
	Biomaterials	–	biomineralization; biomolecules; biopolymers.
	Biomechanics	–	anthropometry; biomechanical phenomena; biomechanics.
	Biomechatronics	–	–
	Bionics	–	–
	Cellular and tissue engineering	–	histological analysis; tissue engineering.
	Clinical engineering	–	clinical management; healthy organization; public healthcares; technical efficiency.
	Medical Imaging	–	–
	Medical Informatics	–	health informations.
	Neural Engineering	–	neuromuscular blockade.
	Rehabilitation/Orthopaedic Bioengineering	–	–
Systems Physiology	–	autoregulation; biological model; biomedical signal; biomedical signal processing; cerebral autoregulation; cerebral haemodynamics; cerebral hemodynamics; dynamic cerebral autoregulation; pathophysiology; physiological; physiology.	