UNIVERSITY OF TWENTE.

University of Twente, the Netherlands and Health

Related to

Mexican Government financial support through CONACyT

CONACyT themes for financial support master and PhD studies abroad Spring 2021

Temas indicativos	
1. Virología	13. Análisis clínicos
2. Parasitología	14. Imagenología y microscopía avanzada
3. Enfermedades emergentes y tropicales	15. Biología de sistemas, Investigación Biomédica y salud con énfasis en enfermedades cardiovasculares, crónico-degenerativas con énfasis en cáncer infantil, de mama, próstata, y diabetes, hipertensión y enfermedad renal.
4. Otras enfermedades infecciosas	16. Enfoques moleculares y biotecnológicos para el desarrollo de medicamentos biológicos y otros.
5. Epidemiología médica y teórica	17. Administración de entidades de atención a la salud.
6. Ingeniería Biomédica	18. Políticas públicas en Salud; Educación en Salud.
7. Transferencia tecnológica e innovación en fármacos, vacunas, equipo y materiales o implementos médicos.	19. Investigación en: Salud familiar y comunitaria con medicina preventiva
8. Inteligencia artificial y sistemas de cómputo y salud; Ciencia de datos y salud	20. Antropología médica

9. Agricultura y salud	21. Investigación en organización comunitaria y salud
10. Alimentación y salud	22. Sistemas integrales de salud familiar, comunitaria y preventiva
11. Ambiente y salud	23. Otras disciplinas que estén relacionadas con la salud

Master degree programmes related to Health at UTwente

1. Master Health Sciences, with all the following specialisations:
    - Personalised monitoring and coaching
    - Optimisation of healthcare processes
    - Innovation in public health

2. Master BioMedical Engineering, with all the following specialisations:
    - Bioengineering technologies
    - Imaging and in vitro diagnostics
    - Physiological signals and systems
    - Biorobotics
    - Medical Device Design
    -
3. Master Chemical Engineering with particular specialisation Molecules and Materials Engineering

    (Applications in directions of biosensing, tissue engineering, virus engineering and protein cages or polymeric nanoparticles with customized surfaces as carriers for targeted drug or gene delivery)

4. Master Mechanical Engineering with particular specialisation Personalised Health Technology

    (Study the special mechanical properties of living biological tissue (muscle functioning and tissue engineering), flow problems related to heart and lungs, the dynamics and coordination of the human movement system, and apply this in the development of instruments and methodologies that support the daily life functioning of individuals)

5. Master Mechanical Engineering with particular specialization Robotics

    (Design, model and control a range of medical robotic systems, with the overall aim of improving healthcare with innovative medical devices. Learn to analyse aspects of human functioning and human-robot interactions. As an expert in the mechanical properties of living biological tissue and systems dynamics, you will be well-equipped to develop instruments and methodologies that help patients and clinicians. Examples include rehabilitation robotics, diagnostic robots for (impaired) motor control, surgical robotics, continuum robots, micro-robots, endo- and exoprostheses and wearable exoskeletons.)

6. Master Systems & Control with particular specialization Biomechatronics

   (Deep brain stimulators to suppress the symptoms of Parkinson disease, rehabilitation robotics to enhance neuro-rehabilitation of stroke survivors, wearable exoskeletons for humans that are unable to control their muscles (e.g. Spinal cord injured patients or Duchenne patients), prosthesis, brain-computer interfaces, or support of cardiovascular and pulmonary function in intensive care)

7. Master Industrial Engineering Management with specialization in Healthcare Technology and Management

   (Unique expertise in optimising healthcare processes. It familiarizes the student with systems for healthcare finances, and new developments in healthcare technology: new business process technologies to use in helping healthcare institutions provide high-quality care and engage in continuous innovation at minimal cost. This knowledge enables to bring together technology developers and researchers and new technologies and strategies with the demand challenges faced by care providers and patients)

8. Master Psychology with specialization Health, Psychology and Technology

Research on Health for PhD level students at UTwente

Involved faculties

- Faculty of Science & Technology https://www.utwente.nl/en/tnw/research/research-groups/
- Faculty of Electrical Engineering, Mathematics and Computer Science https://www.utwente.nl/en/eemcs/research/#research-departments
- Faculty of Behavioural, Management and Social Sciences https://www.utwente.nl/en/bms/research/bms-research-themes/health/
- Faculty of Engineering Technology https://www.utwente.nl/en/et/research/#biomechanical-engineering

Relation to CONACyT focus areas:

- **(6.) BioEngineering Technologies**

https://www.utwente.nl/en/techmed/research/domains/bioengineering-technologies/

The domain of BioEngineering technologies performs both fundamental and applied research in order to develop innovative diagnostics and therapeutic strategies for patients. The research spans from injectable hydrogels to battle osteoarthritis, to implantable bioartificial pancreas devices to

help to treat type 1 diabetes and to organs-on-chips to test the safety and efficacy of new drugs and therapies.

- **(6. and 14.) Imaging & Diagnostics**

https://www.utwente.nl/en/techmed/research/domains/imaging-diagnostics/

The **Imaging & Diagnostics research** domain aims to revolutionize the entire medical trajectory from diagnosis to follow-up. Application areas include anatomic and functional imaging of vesicles, cells, tissues, vasculature and organs to diagnose and characterize disease and health. This research focusses on ultrasound, optical, photoacoustic, molecular, magnetic and nuclear imaging for precision medicine.

BIOS: **Lab-on-a-chip group** - https://www.utwente.nl/en/eemcs/bios/research/biomedical/
The focus of this theme is on the development of microfluidic systems for (bio)-medical applications, thereby increasing the knowledge of biological systems and improving the diagnostics and treatment of diseases.

- **(6. and 7.) BioRobotics**

https://www.utwente.nl/en/techmed/research/domains/biorobotics/

The **Biorobotics research** domain develops engineering solutions based on robotic technology to improve the diagnosis, evaluation and treatment of widespread diseases in society. Examples of these widespread diseases are cancer, cardiovascular diseases, strokes and mobility deficiencies.
Developing relevant solutions: In our Robotic Surgery labs, new robotic instruments and methodologies are studied to improve diagnosis and treatments for both patients and healthcare professionals. Multi-disciplinary teams of engineers, clinicians, and industrial collaborators develop solutions for a broad range of clinically-relevant challenges.
We also work on improving the quality of life for humans with a movement disorder. In the wearable robotics lab of the University of Twente, we develop new interventions and diagnostic techniques based on fundamental insight in (impaired) human motor control. The application area is in therapeutic & diagnostic robotics and assistive technologies. These foci cross many diagnostic categories, including stroke, cerebral palsy, and Parkinson's disease. Examples of assistive technologies include exoskeletons that would enable over-ground mobility in the face of paralysis or other disorders.

- **(7.) Early diagnostics of diseases (**Mesoscale Chemical Systems (MCS)**)**

Research focus areas:
- Miniaturized analytical tools and MEMS-based sensors for a variety of application fields (forensics, health, environment, chemical process control)
- Microfluidic systems for life science applications (e.g. drug delivery)

- **(7. and 8.) Biomedical Signals and Systems** (BSS)

The research mission of the BSS group is to:

- enable improved diagnosis and treatment of patients with motor, sensory and cardiopulmonary dysfunction in clinical and home/self-care setting,
- by developing knowledge, methods and tools for identification, control and modulation of neural, muscular and cardiopulmonary systems, cognition and behavior,

- using smart sensing, novel data analysis techniques and selective actuation technology or persuasive coaching technology.

- **(8.) Data Management & Biometrics applied to health** (DMB)

Some current research projects:

- https://www.utwente.nl/en/eemcs/dmb/research/explainable-deep-learning-for-diagnostic-decisions-in-healthcare/
- https://www.utwente.nl/en/eemcs/dmb/research/b3care/, providing an invaluable resource for the accelerated development and implementation of B3 imaging biomarkers and computer aided decision support.

- **(15.) Medical Cell BioPhysics (**Medical Cell BioPhysics (MCBP))

Development of technology for cancer diagnostics and therapy monitoring.
Detection and characterization of cancer biomarkers in liquid biopsies.

- **(15.) Robotics and Mechatronics (RAM)**

https://www.ram.eemcs.utwente.nl/research/application-domains

Medical program developments are taking place which have directly or indirectly to do with the human body. This includes research on robotic surgery in which new robotic instruments and methodologies are studied with projects like Teleflex and Miriam (Next Gen in-vivo cancer diagnostics, Advancing integrated B3 screening: lung cancer, cardiovascular and pulmonary disease, etc) . Also prosthetics is related to the development or artificial limbs like transradial hand prosthesis (MyoPro) and transfemoral leg prosthesis.

- **(15. and 16.) Bioelectric Signaling and Engineering (**BIOEE)

Functioning of membrane proteins at molecular level in health and disease.

- **(15. and 16.) Early diagnostics of diseases**

University of Twente Technical medical centre **Techmed**

The **Applied Stem Cell Technologies (AST)** (incl. organ-on-chip) research group develops technology with which they design, optimize, and characterize stem cells and stem cell-derived tissues, ensuring that the technology has a true impact on understanding human physiology and on treating and preventing diseases.

Optical Science (OS)

The Optical sciences group strives to exploit the creation, manipulation and control of light and its interaction with matter to develop novel techniques and devices. In particular, we are very

interested in the development of novel spectroscopic and microscopic tools and integrated photonic devices to be used for early diagnostics of diseases.

Key words are: sensing, Raman, spectroscopy, microscopy, integration of active-passive material platforms, novel active materials, on-chip amplifiers, novel on-chip lasers.
Applications include label-free imaging of pharmaceutics and tissue, analysis of (ground) water electrolytes, detection of pathogens. Most recently it expanded into pharmaceutical and medical imaging.
In the fast emerging field of Integrated Optics, our research focusses on Active Nanophotonic Devices: development of novel on-chip active devices (lasers and amplifiers) based on heterogeneous integration of rare-earth doped gain materials on passive photonic platforms, Integrated Optical Sensors and novel devices based on the combination of plasmonics and integrated optics.

Medical Physiology

The mission of the medical physiology research domain is to improve diagnostics, therapy, prevention and management of cardiovascular, respiratory and neurological diseases with translational research at the interface of science, engineering and medicine. We aim to further our understanding of normal and pathological function by biophysical and computational modeling, simulation and advanced measurements. This allows us to develop technological solutions which improve healthcare and, ultimately, the daily life of patients. Some of the research groups involved in the TechMed domain Medical Physiology are:

- Clinical Neurophysiology (CNPH)
- Cardio Respiratory Physiology (CRPH)
- Biomedical Signals and Systems (BSS)
- Biomedical Fluid Mechanics (BFM)

- **(17.) Industrial Engineering and Business Information Systems** (IEBIS)

The focus of IEBIS research is on the logistics, healthcare and services sector. We have a special interest in decision support systems and inter-organizational systems connecting networks of businesses and governments. An example of research is focusing on design and optimization of operational processes in the healthcare sector.

- **(21.) Health Technology and Services Research** (HTSR)

  This department investigates the impact of new health technologies to optimize healthcare from the perspective of patients/clients and the health system.

- **(21.) Center for Healthcare Operations Improvement and Research (**CHOIR)

Operations Research and Management in Healthcare

CHOIR research targets problems that are experienced by various care providers at the same time, and problems which encompass the entire patient care path rather than single resource / department problems. Typical problems CHOIR researchers solve are related to waiting time, access

time, cancellations, workload pressure, overtime, utilization, combination appointments (one-stop-shop), inventory costs, and transportation distance.

- **(23.) Clinical Neurophysiology** (CNPH)

Research lines:

1. Cerebral ischemia after ischemic stroke or cardiac arrest
    1. Pathophysiological understanding: biophysical modeling, *in vitro* modeling (electrophysiology and immunocytochemistry), bio-banking of post mortem patient brains. Focus: dynamics of cell swelling and synaptic failure**.**
    2. Diagnosis: advanced EEG analysis (including machine learning) and prediction models
    3. Treatment: multicenter, randomized**,** controlled clinical trials
2. Epilepsy
    1. Pathophysiological understanding: biophysical and *in vitro* modeling, EEG and fMRI in ECT induced epileptic seizures as a human epilepsy model.
    2. Diagnosis: cortical excitability testing with TMS/EEG/EMG for improved diagnosis and monitoring of therapeutic efficacy.
    3. Treatment: proof of principle clinical trials

- **(23)** Health & Wellbeing, Healthcare, Technologies