

# Technical Medicine: Training truly interdisciplinary professionals

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# Program

- Presentation (25 minutes)
  - What is Technical Medicine?
    - Overview
    - Examples of TM graduates
    - Curriculum
  - Analysis of interdisciplinarity in Technical Medicine
    - Framework
    - Success factors
- Analysis of own interdisciplinary education case (30 minutes)
- Wrap-up (15 minutes)

# What is technical medicine?

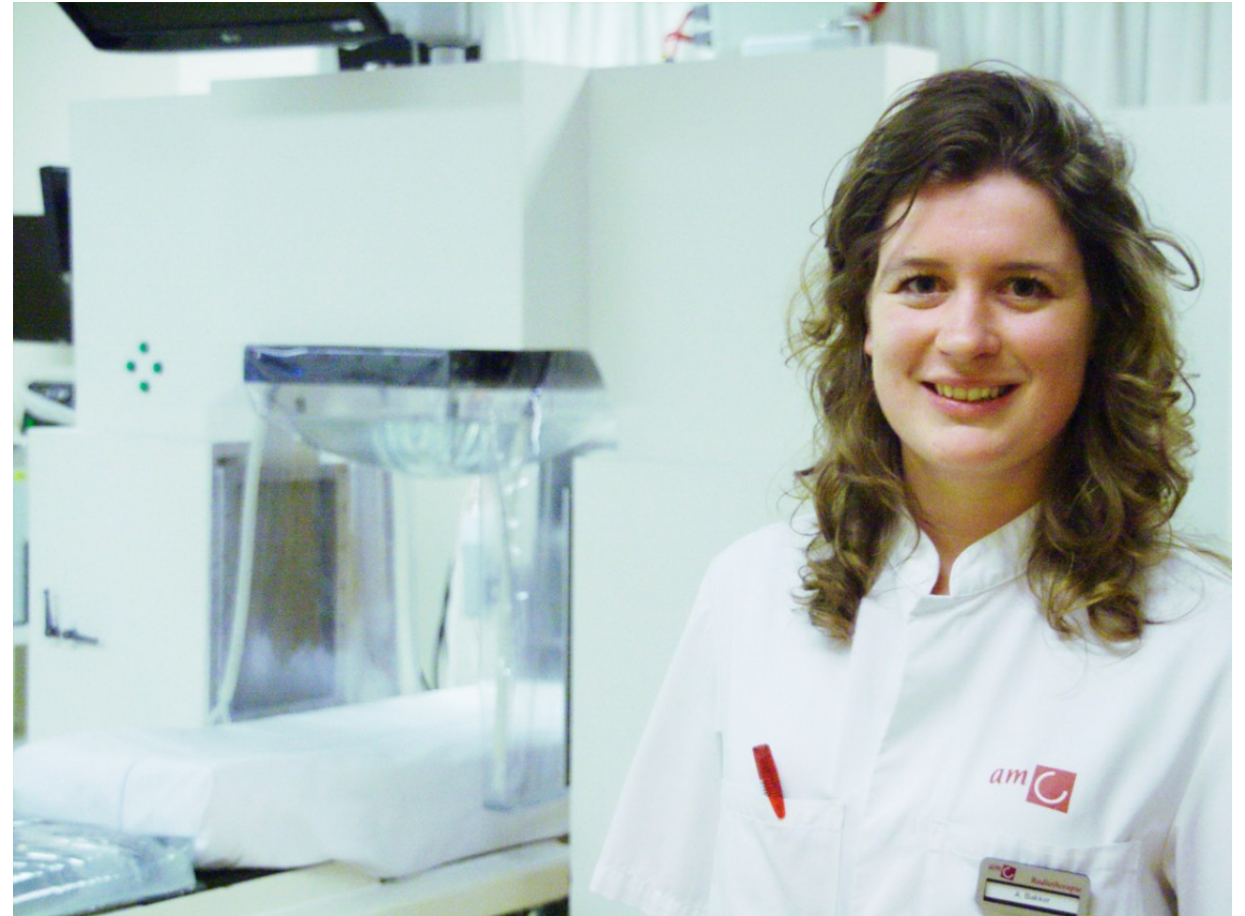
- Since 2003 at University of Twente
- Since 2014 at TU Delft, Erasmus MC, LUMC (“Clinical Technology”)
- Bachelor (3 years)
  - Integration of medical and technical knowledge and skills
  - Professional development
- Master (3 years)
  - Specializations: medical sensing & simulation, medical imaging & intervention
  - Two years of internships

# What is technical medicine?

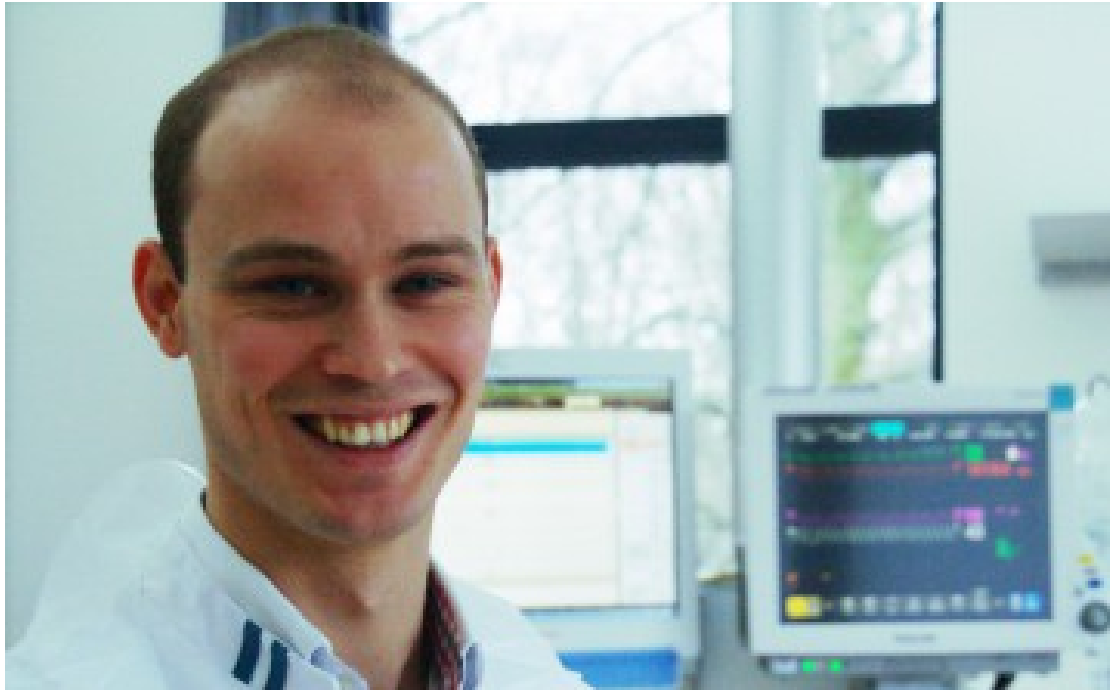
- Technical Medicine graduates work in clinical practice, applying, improving and developing medical technologies for the individual patient.
- Examples:
  - Hyperthermia treatment
  - Artificial ventilation
  - More examples at: [www.nvvtg.nl](http://www.nvvtg.nl) (in Dutch)

# Hyperthermia treatment

“I work at the department of radiotherapy on hyperthermia as a Technical Physician, heating tumors to 41-43°C using microwaves, in order to increase the effect of radiotherapy and chemotherapy on these tumors. The microwaves enable a very local and controlled heating of the tumor so that the patient is less burdened compared to earlier treatment methods. Hyperthermia is applied in for example recurring breast cancer, metastasized melanoma and cervical cancer. No one patient is the same, and therefore I work out the method of treatment together with the physician, I perform the technically complex treatment and analyze the effect of the treatment.”



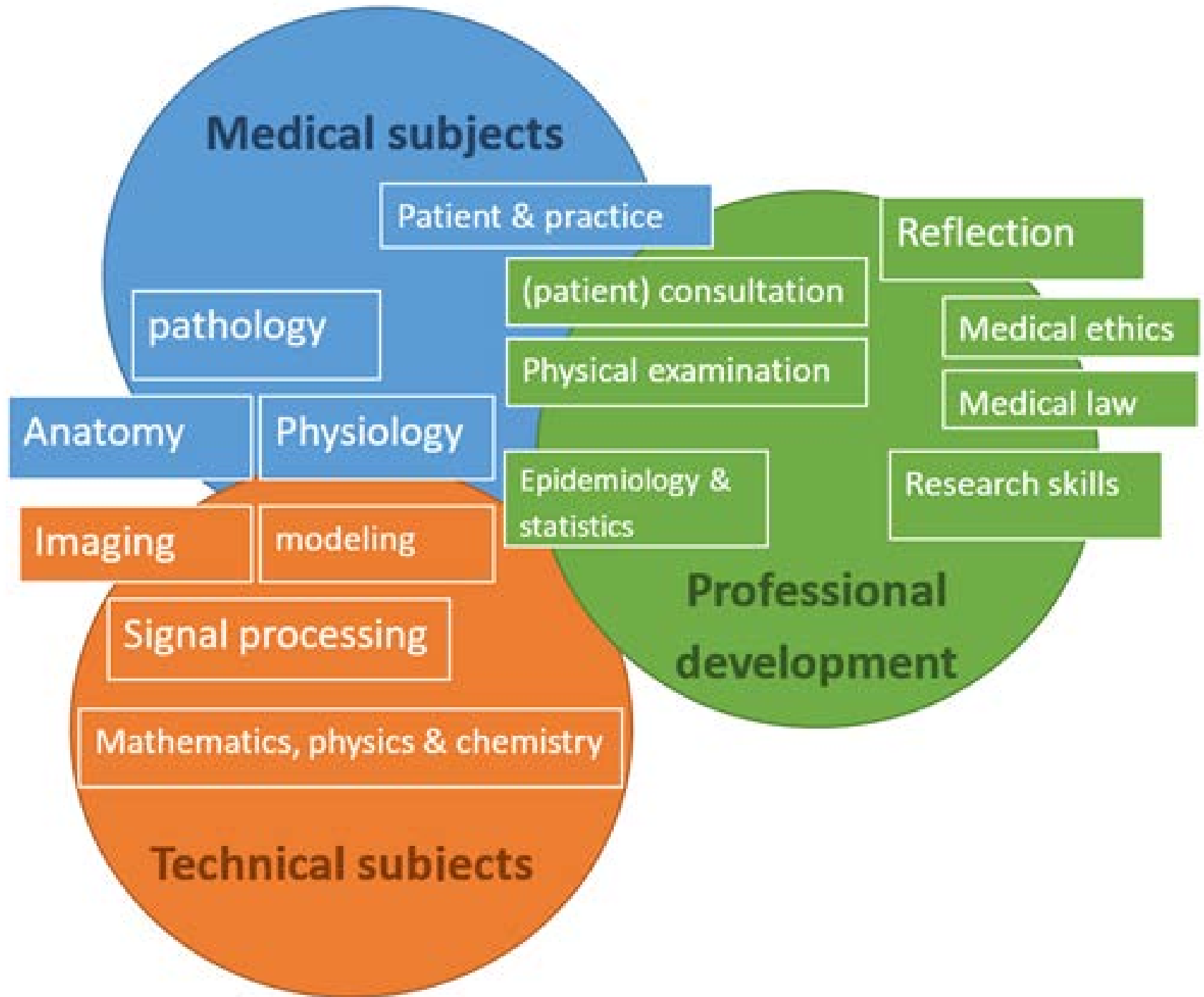
# Artificial ventilation



“At the intensive care unit I have specialized in artificial ventilation of patients that are seriously ill. After treatment of the illness, artificial ventilation will be terminated as soon as possible. However, independent breath is challenging for some patients because long term ventilation has weakened the respiratory or damaged the lungs. Finding the cause requires performing technically complex measurements of the body. As technical physician I perform these measurements and analyze the results, in order to develop a patient-specific treatment plan in our multidisciplinary team. So that we can get the patient to breath independently again”

# Curriculum

- Bachelor: Twelve ten-week modules (420 hours/ 15 ECTS)
- Central topic: system of human body, e.g. immune system, urogenital system, neurological system, cardiorespiratory system, etc.
- For each topic/ module: Anatomy, physiology, pathology and technology
- Professional development
- Project





# Our case study

- Two second year modules: neurological system and cardiorespiratory system
- Interdisciplinary goals in curriculum design (intended)
  - Educational director
  - Curriculum manager
- Implemented curriculum
  - Module coordinators
  - Teachers
  - Materials
- (Appraised curriculum)

# Framework

Main theme	Main question
<b>Topics integrated in program</b>	<i>What research topics are integrated in the program/ course?</i>
<b>Cognitive- epistemological issues</b>	<i>How are concepts, theories and methods from different disciplines related to each other and how can they be integrated?</i>
<b>Education</b>	<i>1. How to successfully adopt an interdisciplinary approach in teaching?</i>  <i>2. How to assess these learning outcomes?</i>
<b>Social aspects</b>	<i>How can people with different areas of expertise exchange and develop knowledge together?</i>
<b>Organisation/ institutional aspects</b>	<i>How can the development, implementation and execution of an interdisciplinary course be organised?</i>

# Topics integrated in program

- Technical, medical and “professional development”
- Goal = total integration of technical and medical (“technical doctors”)
- Module teacher teams: multidisciplinary → broad range of disciplinary experts
- Modules “multidisciplinary” rather than “interdisciplinary”
- Integration of topics in project
  - Separation of report for assessment
  - Medical or technical character

# Cognitive-educational issues

- Subsystems are focal point of module, key concepts per topics
- Disciplinary teachers: goal bachelor = acquiring basic knowledge in technical and medical domain
- TM teacher: low integration of topic not necessarily a problem, students encounter different professionals and approaches they need to collaborate with in their future profession
- Program manager: danger is that integration step is left to students themselves

# Education

- Interdisciplinarity explicit goal of education program, not of modules
- Teacher with background in technical medical as role model
- Explicitness
- Skills: competence and reflection
- Assessment

# Social aspects

- Multidisciplinary coordinators
- Disciplinary teachers assume that “the other knows best”
  - Exchange to find links and translations between disciplines
  - Come up with good interdisciplinary projects

# Organizational/ institutional aspects

- Blackboard
- Teacher availability
  - Recruited from research groups → TM dependent on people hired by research groups, hired for research abilities
  - Teachers are busy researchers or clinicians, little time to discuss curriculum
  - continuity

# Success factors

- Structure of modules (systems)
- Module coordinators
- Teachers
- Explicitenes



# Challenges

- Project assignments
- Assessment

# Analyze own interdisciplinary education

- Split up in groups of 3-4
- Use framework to analyze own case of interdisciplinary education
  - Discuss among each other which case will be analyzed
- Define success factors and ‘challenges’
- Be prepared to present the analysis in a few minutes
- Wrap up: short presentation of cases, feedback

# Wrap-up

- Presentations
  - Points per level of framework
  - Success factors
  - Challenges, room for improvement
- Thoughts, comments, questions, feedback

<b>Theme</b>	<b>Main question</b>	<b>Subthemes</b>	<b>Concepts</b>
<b>[1] Topics integrated in program</b>	What research topics are integrated in the program/ course?	Scope (what is integrate) Type (degree of integration) Goals (why is integrated)	Narrow or broad Multi-, or interdisciplinary Epistemic, instrumental or mixed goals
<b>[2] Cognitive-epistemological issues</b>	How are concepts, theories and methods from different disciplines related to each other and how can they be integrated?	What intellectual skills are required? Reflection on own discipline? Reflection on other disciplines?	Communication and translational skills, critical thinking, meta-reflective skills
<b>[3] Education</b>	1. How to successfully adopt an interdisciplinary approach in teaching? 2. How to assess these learning outcomes?	Interdisciplinary goals Student skills Assessment	
<b>[4] Social aspects</b>	How can people with different areas of expertise exchange and develop knowledge together?	(Epistemic) dependence Patterns of collaboration	Uni-or bilateral Integration by leader, common group learning, negotiation among experts, modeling.
<b>[5] Organization/ institutional aspects</b>	How can the development, implementation and execution of an interdisciplinary course be organised?	Degree of institutional/ organizational support.	Physical or virtual meeting space Infrastructure implementation