TUM. The Entrepreneurial University.

Dr. rer. nat. Erika Mustermann
Munich, Date
GOCE: Global Gravity Field

- > 27 000 orbits at 225–255 km
- > 800 000 000 data, 75 000 parameters
- 4 ½-year ESA satellite mission
- Professor Rummel & Satellite Geodesy
First Double-Arm Transplantation in the History of Medicine

Klinikum rechts der Isar: Professor Edgar Biemer, TUM Emeritus of Excellence, and 40 experts on all levels
Russian Baby Maxim rescued – a Medical Sensation

Bypass heart surgery at the German Heart Center Munich

• 6 hours surgery

• Baby heart is walnut-sized

• Surgical needles and strings as thin as a human hair

• Professor Rüdiger Lange
  Heart and Vascular Surgery
Electromobility: Systems Integration • Teamwork

300 Students • 60 PhDs • 21 Institutes • 8 Departments
TUM CREATE Singapore Ltd.

Tokyo Motor Show 2013: EVA Taxicab for Tropical Megacities (TUM & NTU)

100 young TUM researchers on site

- fully electric vehicle
- 200 km – 111 km/h max.
- high-speed recharge (15 min)
- battery cooling device
Visio.M

The Avantgarde TUM Lightweight Electric Vehicle
TUM-Industry Consortium, BMBF Funding

eCarTech 2014

• fully electric vehicle
• 160 km – 120 km/h max.
• 15 kW (21PS), 45 kW peak
• full recharge in 3–4 h
• 450 kg without battery
• battery 85 kg
TUM University Foundation 2010: Network of Alumni and Partners

Scientiis et Artibus
Research Center for Multiple Sclerosis

New Research Building, TUM University Hospital

Klaus Tschira Foundation • €25M • Sept. 23rd, 2015
Partners of Excellence

- Wacker Chemie
- Volkswagen
- Vereinigung der Bayerischen Wirtschaft
- TÜV SÜD
- TRUMPF
- Siemens
- SGL Carbon
- RWE
- Rohde & Schwarz
- Nestlé
- MAN
- Linde
- Airbus
- Altana
- Audi
- Bayerischer Bauindustrie-Verband
- BMW
- Bosch
- Busch Vacuum
- Clariant
- Dräxlmaier
- Evonik Industries
- Google
- Herrenknecht
- Infineon
Servant of the Innovation Society

Scientific Excellence:
TUM Institute for Advanced Study

Excellent Teaching:
Munich School of Engineering

National Education System
TUM SCHOOL OF EDUCATION
Internat. Student Exchange

scientific
entrepreneurial
international

Global Labor Markets
(Science, Industry, Administration)

Society, Politics & Government
Munich Center for Technology in Society
Bavarian School of Public Policy
University: Product of Research and Teaching

• Basic Research
  understanding the world

• Applied Research
  shaping the world

• Method-Oriented Training
  provide theoretical principles
  support practical orientation

• Structured Training for Graduates:
  TUM Graduate School
  reach subject-specific depth
  open a general horizon

• Innovation Culture – TUMentrepreneurship
  acquire entrepreneurial thinking and acting
TUM Key Data

15 Departments
411 Buildings
173 Degree Courses

~ 41,400 Students, 35% female, 30% internat'l
~ 13,300 Freshman Students
~ 9,200 Graduates per year
> 1,000 PhD Theses per year
> 8,000 Publications, peer-reviewed per year
  566 Professors (incl. hospital)
~ 6,600 Scientific Staff (incl. hospital)
~ 3,300 Non-Scientific Staff (not incl. hospital)
117 ERC Grants (since 2008)
  42 Humboldt Senior Research Fellows (2013-17)
  17 Nobel Prize Laureates
  20 Leibniz Laureates (DFG)
  6 Humboldt Professors
> 1,000 Research Agreements p.a.
Financial Structure

Total Budget 2018: 1,553 Mio. € (incl. hospital)

- Bavarian Government Funding: 660 Mio. €
- Third-Party Funding (e.g., DFG, BMBF, EU, Industry): 536 Mio. €
- Own Revenue from Services (e.g., medical care, material testing): 357 Mio. €


- Industry: 135 Mio. €
- Private Persons: 79 Mio. €
Students

- 2000: 19,454
- 2005: 20,458
- 2010: 26,302
- 2018: 41,375

Increase: +113%
Students by Departments

- Mathematics
- Physics
- Chemistry
- TUM School of Life Sciences Weihenstephan
- TUM Campus Straubing
- TUM School of Medicine
- Sport and Health Sciences
- Munich School of Engineering
- Architecture
- Civil, Geo and Environmental Engineering
- Electrical and Computer Engineering
- Mechanical Engineering
- Informatics
- TUM School of Management
- TUM School of Education
- TUM School of Governance
- Munich Center for Technology in Society

German Students WS 18/19
International Students WS 18/19

- Natural Sciences (33%)
- Life Sciences (51%)
- Medicine
- Engineering
- Management
- Education
- Social Sciences
- Humanities
Milestones

1868  King Ludwig II founds the "Polytechnic School"
1877  "Technical University"
1901  Right to Award Doctorates
       First Doctoral Candidate: Georg Hauser (Chemistry)
1905  Admission of Female Students
       First Female Doctoral Candidate: Amalie Baur (Chemistry)
1930  Integration of the College of Agriculture and Brewing in Weihenstephan
1957  First Neutron Research Reactor in Germany
1967  TUM School of Medicine, University Hospital
1970  Presidential Constitution, "Technische Universität München"
1999  TUM's University Reform started,
       Entrepreneurial University Constitution
2000  TUM School of Life Sciences Weihenstephan (Matrix Structure)
2002  TUM Branch in Singapore: TUM. Asia Pte. Ltd.
       TUM School of Management
       Department of Sport and Health Sciences
Milestones

2004  High-Flux Research Source Heinz Maier-Leibnitz
2005  TUM Institute for Advanced Study (IAS)
2006  TUM elected "University of Excellence"
      TUM International Graduate School of Science and Engineering (IGSSE)
2009  TUM School of Education
      TUM Graduate School
2010  TUM University Foundation
      Munich School of Engineering (MSE)
2012  TUM again elected "University of Excellence"
      Munich Center for Technology in Society (MCTS)
2014  Hochschule für Politik München – Bavarian School
      of Public Policy
2015  Munich School of Bioengineering
2018  150 years jubilee Technical University of Munich
2019  TUM remains University of Excellence
Selected Nobel Laureates

Heinrich O. Wieland
1927, Chemistry

Hans Fischer
1930, Chemistry

Rudolf L. Mößbauer
1961, Physics

Ernst Otto Fischer
1973, Chemistry

Klaus von Klitzing
1985, Physics

Robert Huber
1988, Chemistry
Inventors, Engineers, Entrepreneurs

**Oskar von Miller**
- Storage Power Plants
- Walchensee Power Plant
- German Museum

**Carl von Linde**
- Refrigeration Engineering
- Linde's Refrigeration Machines
- Air Liquefaction
- First University Spin-off

**Rudolf Diesel**
- Combustion Engine Development
- Diesel Engine (MAN)

**Claude Dornier**
- Aircraft Construction
- Amphibious Aircraft

**Willy Messerschmitt**
- Aircraft Construction
- First production-ready Jet Aircraft

**Heinz Maier-Leibnitz**
- Neutron Research
- "Atom-Ei"
TUMentrepeneurship

- **Entrepreneurship Culture**
  - Optimized entrepreneurial Support Structures for University Spin-offs

- **Efficient Spin-off-Process**
  - Focus in ICT, MedTech, CleanTech, Life Sciences

- **Entrepreneurship Network**
  - Powerful Network connecting Industry, University and Entrepreneurs

- **Entrepreneurship Research**
  - Transfer of Knowledge for growth-oriented and technology-based University Spin-offs
TUM. Munich Campus

- Civil, Geo and Environmental Engineering
- Architecture
- Electrical and Computer Engineering
- TUM School of Management
- TUM School of Education
- TUM School of Governance
TUM. Garching Campus

Chemistry

Physics

Informatics

Mathematics

Mechanical Engineering
TUM. Weihenstephan Campus

TUM School of Life Sciences
Weihenstephan
TUM. Olympic Park Campus

Sport and Health Sciences
TUM. Campus Straubing

TUM Campus Straubing for Biotechnology and Sustainability
Medicine

University Hospital Klinikum rechts der Isar

German Heart Center Munich
TUM@Ludwig Bölkow Campus: Kerosene from Algae

- Algae cultivation center
- Carbon incorporation from CO$_2$
- Full-range climate and sunlight simulation
- Joint venture TUM • Airbus Group • Clariant
- Prof. Thomas Brück et al.
  Industrial Biocatalysis
TUM Science & Study Center Raitenhaslach
Locations in Bavaria
European Metropolitan Region Munich

Academic Network

Industry Network

Start-up Network

TUM Joint Appointments 51
Collaborative Research Centers DFG

4 CLUSTERS OF EXCELLENCE

e-conversion
ORIGINS Excellence Cluster
SyNerg
MCQST

CRC 1371 • Microbiome Signatures
CRC 1335 • Aberrant Immune Signals
CRC 1321 • Pancreatic Cancer
CRC 824 • Imaging for Cancer Therapies
TRR 128 • Mechanisms in Multiple Sclerosis
TRR 179 • Hepatitis Virus Infection
CRC 1035 • Control of Protein Function
CRC 863 • Forces in Biomolecular Systems
CRC 924 • Molecular Mechanisms in Plants
TRR 109 • Discretisation in Geometry & Dynamics
CRC 1258 • Neutrinos & Dark Matter
TRR 40 • Future Space Transportation Systems
TRR 80 • From Electronic Correlations to Functionality
TRR 110 • Quantum Chromodynamics
CRC 768 • Managing Cycles in Innovation
TRR 235 • Emergence of Life
TRR 89 • Invasive Computing

CRC 1123 • Atherosclerosis: Mechanisms & Targets
CRC 1054 • Cell-Fate Decisions in the Immune System
CRC 870 • Neuronal Circuits in Sensory Processing
CRC 1158 • From Nociception to Chronic Pain
TRR 237 • Nucleic Acid Immunity
TRR 152 • TRiPs to Homeostasis
TRR 127 • Xenogeneic Transplantation
CRC 1243 • Hematopoietic Neoplasms
CRC 1309 • Epigenetic Modifications
CRC 1032 • Nanoagents
CRC 749 • Molecular Transformations
TRR 174 • Dynamics of Bacterial Cells
TRR 165 • Waves to Weather
CRC 1320 • Everyday Activity S&E
CRC 1233 • Robust Vision
CRC 1330 • Hearing Acoustics
Excellence Initiative 2006 – 2011

### Institutional Strategy

**TUM.**

The Entrepreneurial University.

- TUM Institute for Advanced Study
- Comprehensive Support
- Gender & Diversity
- Entrepreneurial Culture
- Sustainability Investments

### Cluster of Excellence

- Cognition for Technical Systems (Speakership: TUM)
- Origin and Structure of the Universe (Speakership: TUM)
- Center for Integrated Protein Science (CIPSM)
- Munich Center for Advanced Photonics (MAP)
- Nanosystems Initiative Munich (NIM)

### Graduate School

International Graduate School of Science and Engineering

- Bridge between Science and Engineering
- Structured Doctoral Education
- Transferable Skills Training
Excellence Initiative 2012 – 2017

Institutional Strategy

TUM. The Entrepreneurial University.
- TUM Faculty Tenure Track
- Integrative Research Centers
- Entrepreneurial University Development
- TUM.Family
- TUM.Global

Cluster of Excellence

- Origin and Structure of the Universe (Speakership: TUM)
- Center for Integrated Protein Science (CIPSM)
- Munich Center for Advanced Photonics (MAP)
- Nanosystems Initiative Munich (NIM)
- Munich Cluster for Systems Neurology (Synergy)

Graduate School

International Graduate School of Science and Engineering
- Bridge between Science and Engineering
- Structured Doctoral Education
- Transferable Skills Training
Exzellenz Strategy from 2019 on

4 Clusters of Excellence

- **e-conversion**
  - Energy Conversion Science & Technology
  - *Reuter/Heiz/Bein*
  - 47.2 M€

- **ORIGINS**
  - Astrophysics Astrobiology Origins of Life
  - *Burkert/Paul*
  - 52.2 M€

- **SyNergy**
  - Neuroscience
  - *Haas/Misgeld*
  - 52.3 M€

- **MCQST**
  - Quantum Science & Technology
  - *Groß/Cirac/Bloch*
  - 52.5 M€
Exzellence Strategy from 2019 on
University of Excellence

TUM. THE ENTREPRENEURIAL UNIVERSITY.
Innovation by Talents, Excellence and Responsibility

1. Gender- & Diversity-Equitable Talent Management
2. Vitalization of “German Engineering”
3. Dynamization of Scientific Interactivity
4. University Governance & Administration
5. Empowerment of the international Network
Exzellenz Strategy from 2019 on
University of Excellence – Bridges to Innovation

TUM Schools
- Engineering
- Humanities, Social Sciences & Education
- Information, Data & Computation
- Life Sciences
- Management
- Medicine & Health
- Natural Sciences

TUM Technology Core Facilities
- TUM Innovation Networks
- TUM Corporate Research Centers
- TUM Integrative Research Centers

Education
- TUM Institute for Life Long Learning
- TUM Institute for Study and Teaching
- TUM Professional Profiles

Research
- TUM EdTech Lab

Alumni & Partner Network
- TUM-IAS Explorative Workshops
Integrative Research Centers
World’s first Mini Particle High-Brilliance X-ray Accelerator

MUNICH SCHOOL OF BIOENGINEERING
A Cross-departmental Integrative Research Center

novel diagnostic approach to cancer, pulmonary diseases, osteoporosis, arteriosclerosis
Corporate Research Centers

- CPA: Center for Functional Protein Assemblies
- CRC: TUM Catalysis Research Center
- FRM II: Research Neutron Source Heinz Maier-Leibnitz
- TranslaTUM: Translational Research in Oncology
- WSI: Walter Schottky Institute – Center for Nanotechnology and Nanomaterials
- World Agricultural Systems Center – Hans Eisenmann Forum for Agricultural Sciences
- ZIEL: Institute for Food & Health
TUMCREATE Campus Singapore

Campus for Research Excellence and Technological Enterprise

Improvement of Singapore’s Public Transportation – Electric and Autonomous Mobility
Singapore: GIST – TUM Asia/ TUM Create

Teaching – TUM Asia

authorized since 2002 as Pte. Ltd.
Accredited private education institution since 2009
Singapore EDB & Industrie

• MSc – ~ 1000 Alumni
  Industrial Chemistry
  Integrated Circuit Design
  Green Electronics
  Aerospace Engineering
  Rail, Transport and Logistics

• BSc (since 2010) – ~ 400 Alumni
  Electrical Engineering and Information Technology
  Chemical Engineering

Research – TUM CREATE

• Research Project funded by NRF
• 2010–2016 "Electromobility in Megacities"
• 2016–2021 "Towards the ultimate Public Transportation System"
• Joint PhD-Programm mit NTU Singapore
• > 100 PhD students from TUM in Singapore
Global: Globalization through Localization
TUM.Global

TUM Locations Worldwide
EuroTech Universities Alliance
Strategic Initiatives
160 Partner Universities
320 ERASMUS Exchange Partners
TUM. Campus Freising-Weihenstephan

Faculty
TUM School of Life Sciences
TUM School of Life Sciences

Bundling of the competencies in the life sciences

Interaction between humans, animals, plants, microorganisms, soil and environment

Focus: „One Health“
Campus Freising-Weihenstephan

- TUM School of Life Sciences
- TUM Institute for Food and Health (ZIEL)
- World Agricultural Systems Center (HEF)
- Center of Forestry Weihenstephan
- University of Applied Sciences Weihenstephan-Triesdorf (HSWT)
- Bavarian State Research Center for Agriculture (LfL)
- Bavarian State Research Center for Forestry (LWF)
- Fraunhofer Institute for Process Engineering and Packaging (IVV)
- Innovation and Start Up Center for Biotechnology (IZB)
Research Departments

Molecular Life Sciences

Life Science Systems

Life Science Engineering
Courses of study - Agricultural and Horticultural Sciences

Bachelor Courses:
- Agricultural and Horticultural Sciences
- Teacher training at vocational schools in the field of agricultural economics*

Master Courses:
- Agricultural Systems Sciences (in English)
- Agricultural Biosciences (from the winter semester 20/21)
- Horticultural Science
- Teacher training at vocational schools in the field of agricultural economics*

* In cooperation with TUM School of Education
Courses of study – Biosciences

**Bachelor Courses:**
- Life Sciences Biology
- Molecular Biotechnology
- Science Education (Biology/Chemistry) (upper secondary school teacher)
- Teacher training for grammar school, science education (first and second subject biology)*

**Master Courses:**
- Biology
- Molecular Biotechnology
- Teacher training for grammar school, science education (first and second subject biology)*

* In cooperation with TUM School of Education
Courses of study – Brewing and Food Technology

**Bachelor Courses:**
- Brewing and Beverage Technology
- Food Technology
- Pharmaceutical Bioprocess Engineering

**Master Courses:**
- Brewing and Beverage Technology
- Food Technology and Biotechnology
- Pharmaceutical Bioprocess Engineering

**Others:**
- Brewing Technology (Diplom-Braumeister)
Courses of study – Nutrition Science

**Bachelor Course:**
- Life Sciences Nutrition Science

**Master Courses:**
- Food Chemistry
- Nutrition and Biomedicine (in English)
Courses of study – Forest Science and Resource Management

**Bachelor Course:**
- Forestry Science and Resource Management

**Master Courses:**
- Forestry and Wood Science
- Sustainable Resource Management (in English)
Courses of study – Landscape Architecture and Landscape Planning

**Bachelor Course:**
- Landscape Architecture and Landscape Planning

**Master Courses:**
- Engineering Ecology
- Nature Conservation and Landscape Planning
TUM School of Life Sciences – First semester students* (without teaching profession)

Freshmen at the TUM School of Life Sciences (without Teacher Training Studies)

- Bachelor of Science
- Master of Science
- Diplom-Braumeister
TUM School of Life Sciences –
Total number of students (without teaching profession)

Students at the TUM School of Life Sciences
(without Teacher Training Studies)
TUM School of Life Sciences – International

International students and exchange programs

- Erasmus
- TUMexchange
- Double Degree

21% international students
TUM School of Life Sciences – International

50 Countries of origin of international exchange students
TUM School of Life Sciences – International

Number of exchange students over the last years

Incomings/Outgoings
at the TUM School of Life Sciences Weihenstephan
TUM Corporate Research Centers on Campus Freising

ZIEL – Institute for Food & Health

Focus: interdisciplinary research of food, nutrition sciences and medicine

• Production of food
• Food processing
• Human physiology
• Nutritional medicine

Development of prevention programs

Co-development of safer and healthy food

Cooperation with industry and authorities
TUM Corporate Research Centers on Campus Freising

World Agricultural Systems Center – Hans Eisenmann-Forum for Agricultural Sciences (HEF)

digital – international – interdisciplinary

- Networking of all agricultural science oriented chairs and institutions of TUM
- Cooperation with external agricultural science institutions
- Provision of professional expertise
- Platform for communication and dialogue with the various fields of agricultural economics and agricultural science
- Knowledge transfer to society

Plants and animals, soil and water, ecology and economy – research ranges from the molecular and cellular level to the agricultural landscape
International Center of Beverage Science
Food Technology
Else-Kröner-Fresenius-Center / Biosciences
Nutrition and Food Research Center
Biology
University Library
Bavarian State Brewery Weihenstephan
Thanks.