Integrating sustainable innovation, research and education across academia and industry

CHALMERS

Anne-Marie Hermansson and Maria Knutson Wedel, Birmingham 30.3 2012

Departments

- Applied IT
- Applied Mechanics
- Applied Physics
- Architecture
- Chemical and Biological Engineering
- Civil and Environmental Engineering
- Computer Science and Engineering
- Earth and Space Sciences
- Energy and Environment
- Fundamental Physics
- Materials and Manufacturing Technology
- Mathematical Sciences
- Microtechnology and Nanoscience
- Product and Production Development
- Shipping and Marine Technology
- Signals and Systems
- Technology Management and Economics

In collaboration with the University of Gothenburg:

- GMV, Centre for Environment and Sustainability
- IT University

Areas of advance

Chalmers has eight areas of advance where the aim is to bring together research, education and innovation across departmental boundaries and to co-operate with bodies and organisations outside Chalmers.

- Built Environment
- Energy
- Information and Communication Technology
- Life Science
- Materials Science
- Nanoscience and Nanotechnology
- Production
- Transportation

The eight key areas also have a firm foundation in the Basic Sciences. Sustainability, Innovation and Entrepreneurship are strong driving forces.

AREAS OF ADVANCE

Our strategy for the Areas of Advance is to match scientific excellence, education and innovation towards sustainable technology shifts and global changes where we can make a difference.

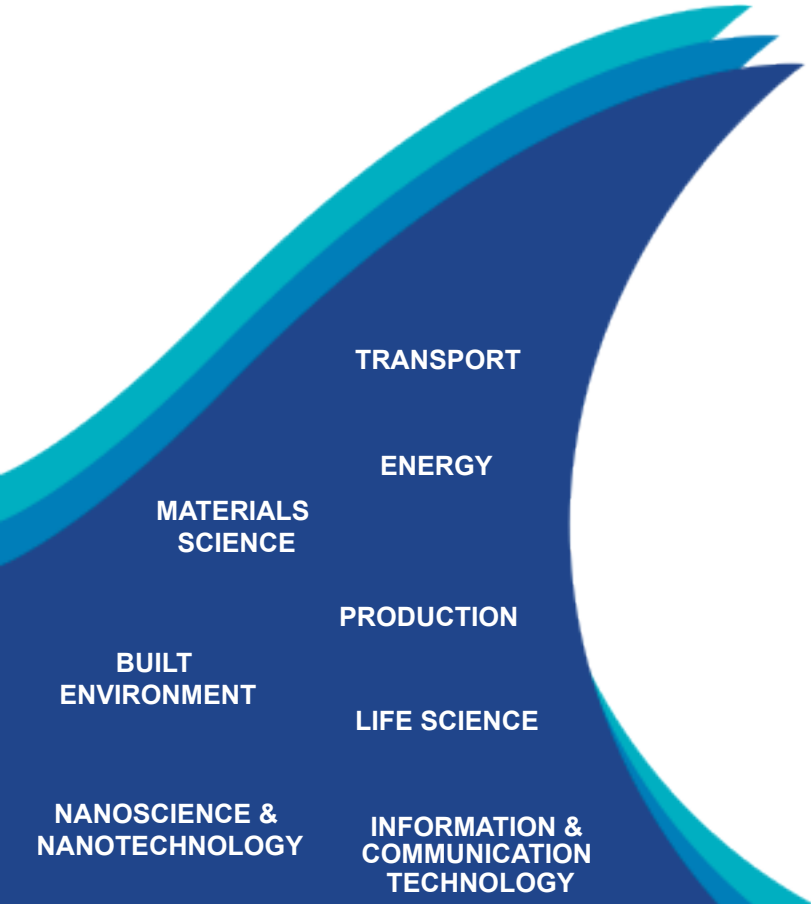
AREAS OF ADVANCE

Collaboration means power

The areas of advance merge basic sciences into powerful constellations, capable of advancing research, innovation and education towards solutions to complex global issues

CHALMERS – FOR A SUSTAINABLE FUTURE

Ultimately our vision is about using science to make a difference in the world.



Roadmap for scientific excellence

- Visibility and focus
- Interaction across the knowledge triangle
- Meetings across boundaries
- International alliances
- Impact on society

BASIC & APPLIED SCIENCE

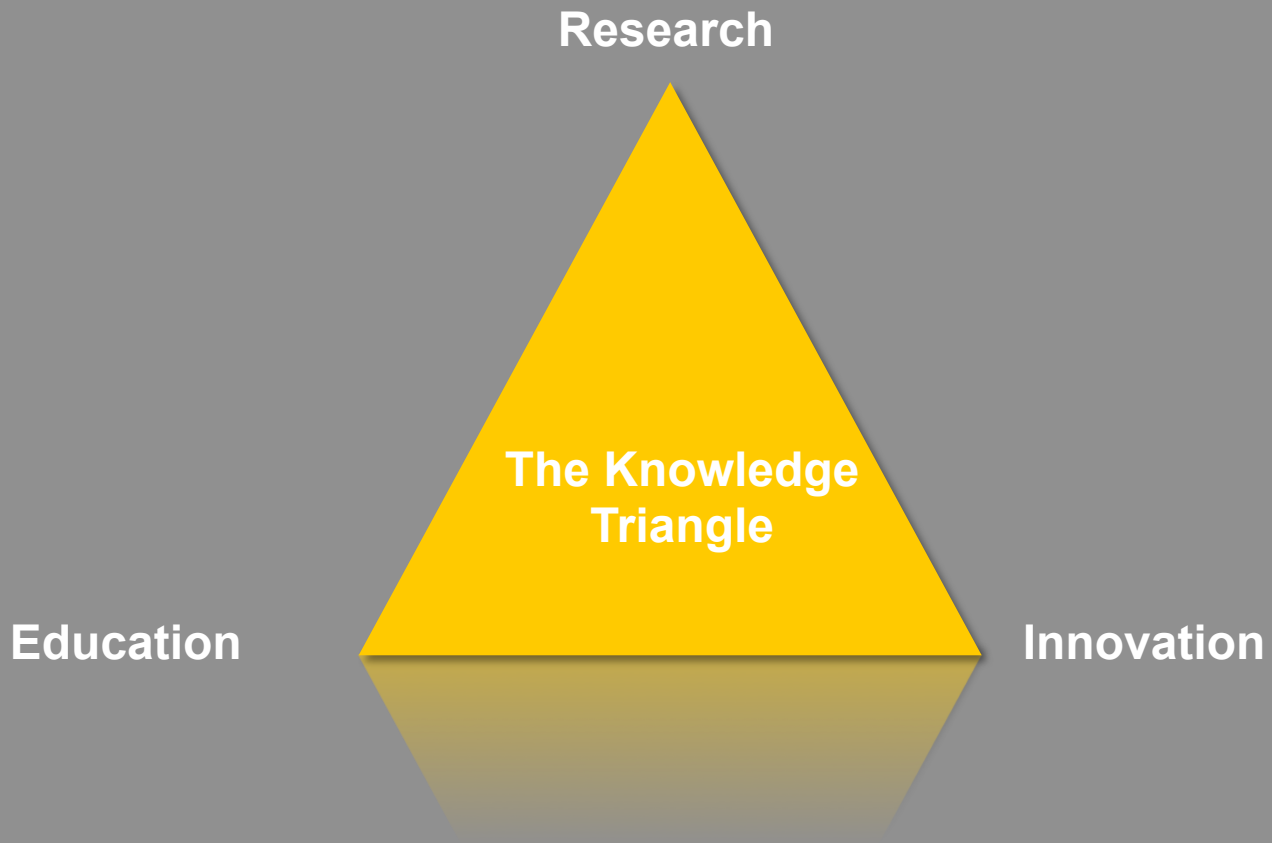
CHALMERS
UNIVERSITY OF TECHNOLOGY

VISIBILITY AND FOCUS

Our driving forces

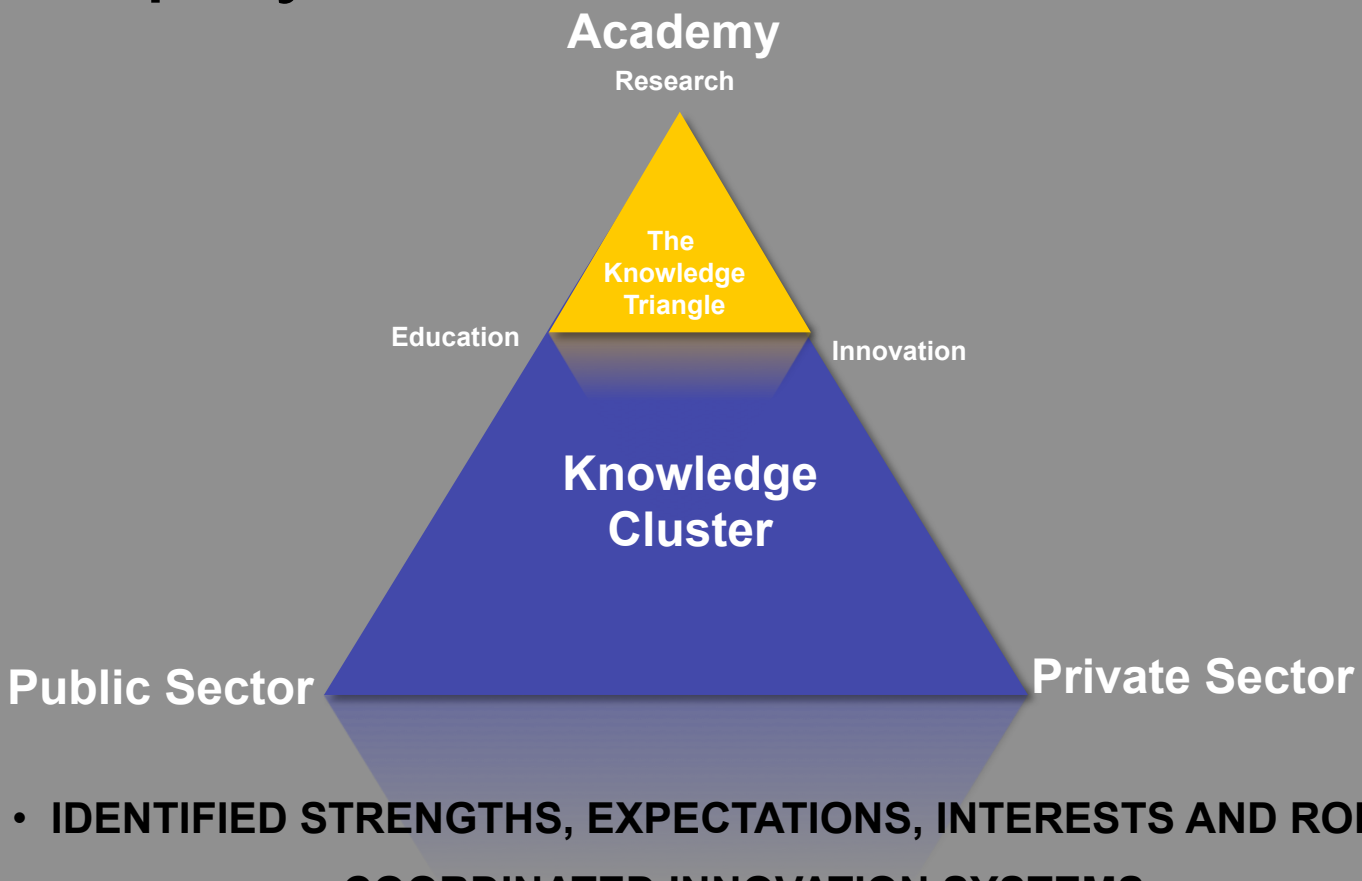
- Entrepreneurship
- Innovation
- Sustainable future

How can Areas of Advance contribute



- INTEGRATION OF RESEARCH-EDUCATION-INNOVATION
- NEUTRAL MEETING PLACES WITH NEW OPTIONS FOR INTERACTION
- THRUST WORTHY DEVELOPMENT OF LOCAL-GLOBAL KNOWLEDGE CLUSTERS

Interplay for Growth and Attraction



- IDENTIFIED STRENGTHS, EXPECTATIONS, INTERESTS AND ROLES
- COORDINATED INNOVATION SYSTEMS
- UNIVERSITIES AS NODES IN GLOCAL KNOWLEDGE CLUSTERS
- ATTRACT COMPETENCE AND INVESTMENTS

FiveClusters

FIVE CLUSTERS IN WEST SWEDEN WITH STRENGTH AND POTENTIAL FOR THE FUTURE

CHALMERS
UNIVERSITY OF TECHNOLOGY

Science Parks in Gothenburg

Integrated with Stakeholders and Chalmers Areas of Advance

All Areas: Sustainable development, Entrepreneurship & Innovation

MATERIALS SCIENCE

A CHALMERS AREA OF ADVANCE

MATERIALS SCIENCE OVERVIEW

EXCELLENCE PROFILES

ACTIVE FIELDS

MATERIALS FOR HEALTH	MATERIALS FOR ENERGY APPLICATIONS	SUSTAINABLE MATERIALS	EXPERIMENTAL METHODS	THEORY AND MODELLING
Tissue and cell engineering	Energy supply and energy transfer	Materials from renewable raw materials	Advanced characterization tools and methods	Ab-initio modelling
Materials for pharmaceuticals and personal care	Energy storage	Recycling and long term behavior of materials	Instrumentation projects at large scale facilities	Nano-scale modelling
Materials for biosensing	Energy conversion	Reduction of environmental impact through materials research	Infrastructure for new materials synthesis	Macro/meso scale modelling
Materials for food technology				

BASIC SCIENCE

Materials for Energy Applications:

Solar cells of the future

- New conductive organic polymers
- Thin and flexible films

Materials for Health:

Control of immune response to implant surface

- Titanium in implants
- Lowered immune activation may result in improved implant integration

The AoA Materials Science has allocated funding for

- Young researchers, in particular assistant professors
- New research ideas (twin PhD projects, seed projects)
- Interactions with external universities
- Interactions with industry and research institutes

- *and from 2012...*
- Selected top scientists
- Master and PhD education
- Working towards a better infrastructure at Chalmers

- *and later ...*
- Collaboration with large scale facilities (MAX IV, ESS, ...)

BUILT ENVIRONMENT

A CHALMERS AREA OF ADVANCE

BUILT ENVIRONMENT OVERVIEW

EXCELLENCE PROFILES

ACTIVE FIELDS

WATER QUALITY AND SCARCITY	INFRASTRUCTURES	PLANNING FOR BUILDING PERFORMANCE	ENERGY USE AND EFFICIENCY IN BUILDINGS	SUSTAINABLE URBAN DEVELOPMENT
Water treatment	Geotechnical-structural interactions	Architectural research	The building as a system	Peak Oil challenges
Protection of water sources	Design, planning and production	Ageing and healthcare	Energy use and technology integration in buildings	Urban resilience
Infrastructure for sewerage	Noise mitigation	Human Perception	Construction and management processes	Transitions towards positive change
	Sustainability	Building materials		Urban qualities, rights and cultures

BASIC SCIENCE

Water Quality and Scarcity

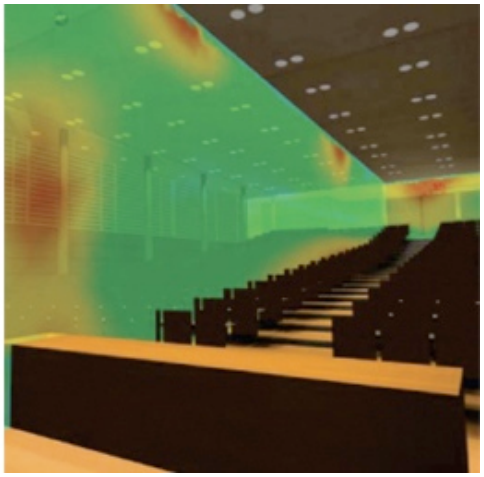
- Groundwater
- Wastewater
- Water sources
- Urban rivers
- Infrastructures for sewerage

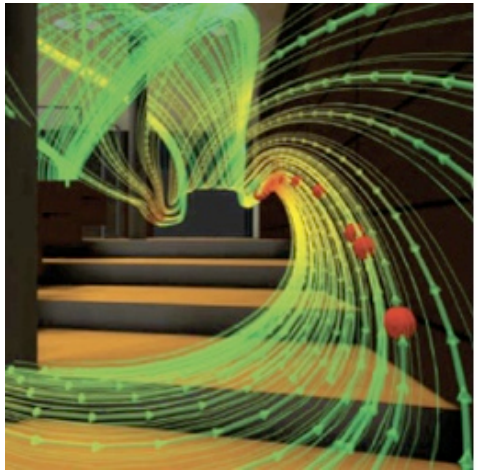
Strategic AoA recruitment
Assistant professor
Yuliya Kalmykova

at the department of
Cilvil & Environment
Engineering is financed by AoA

Buildings – Energy & use

- Building as a system
- Processes
- Energy use & technology integration





Cross connecting with AoA Energy: **Urban Energy Systems**

ENERGY

A CHALMERS AREA OF ADVANCE

ENERGY OVERVIEW

EXCELLENCE PROFILES

ACTIVE FIELDS

HEAT AND POWER GENERATION	COMBUSTION AND GASIFICATION	MATERIALS FOR ENERGY CONVERSION/ APPLICATION	TRANSPORT SYSTEMS AND INFRASTRUCTURE	BUILDINGS – ENERGY USE AND EFFICIENCY	INDUSTRY – ENERGY USE AND EFFICIENCY	ENERGY SYSTEMS
Smart Grids	Biomass gaasification	Materials for energy production and transfer	Combustion engines research	The building as a system	Energy efficiency and process integration	Global sustainable systems and bridging technologies
Wind Power	Carbon capture technologies	Materials for energy storage	Electric and hybrid vehicles	Construction and management processes	Industrial biorefineries	Technology impact assessment and innovating processes
Energy Storage	Combustion and corrosion using biomass and waste fuels	Materials for energy conversion	Renewable fuels	Energy use and technology integration in buildings	Process technologies	Local and regional energy systems planning
Solar Heating and heat pump Technologies			Sustainable transport solutions			
Nuclear Physics & Chemistry						
Fusion						

Applied Mechanics — BASIC SCIENCE — Applied Mathematics

LINKS TO OTHER AREAS OF ADVANCE

Energy efficiency and energy technologies in buildings

Energy efficient wireless communication

Smart Grids

Research on high temperature corrosion for efficient energy production and industrial processes.

Efficient batteries/energy storage and solar cells

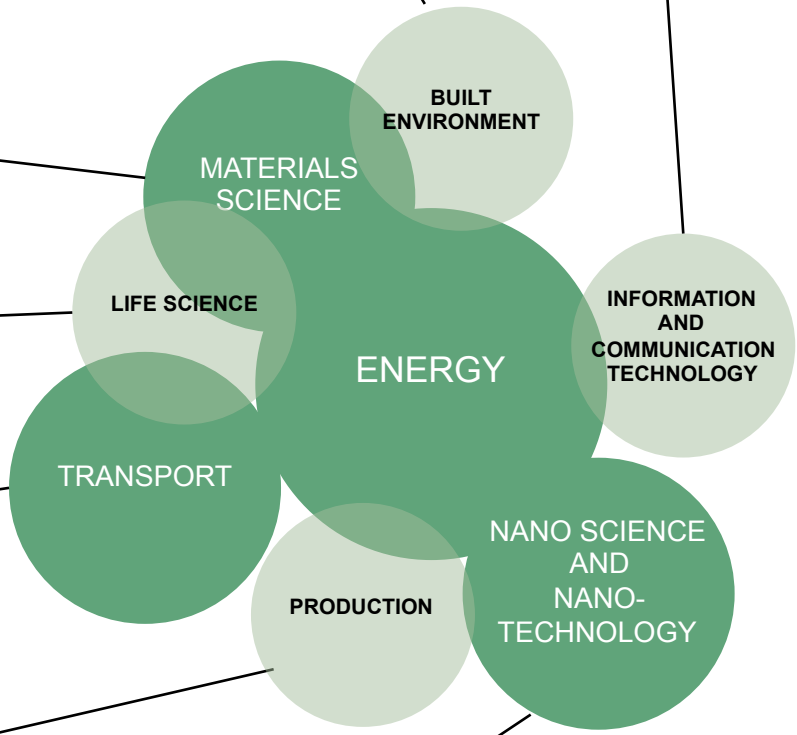
Catalysis and catalysts for sustainable energy systems

Biofuels and biochemicals

Co-operation in Swedish Hybrid Vehicle Centre - efficient engines, new power trains and technology for electric vehicles

Alternative fuels with regard to production and use

Development of sustainable energy efficient products and production systems for manufacturing and process industry



Basic photovoltaic research for efficient technology and materials

CHALMERS
UNIVERSITY OF TECHNOLOGY

Visibility and focus

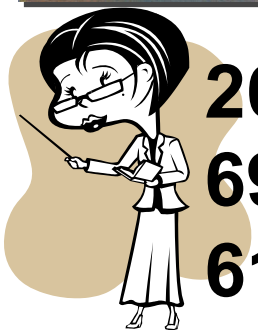
Chalmers education in figures

9000 students

Civilingenjör (3+2), MArch	*3 116 students*
MSc	*2 776 students*
BEng	*1 121 students*
Naval	*541 students*
BSc	*89 students*
Basic Introductory year	*191 students*

29,2% female

774 PhD-students

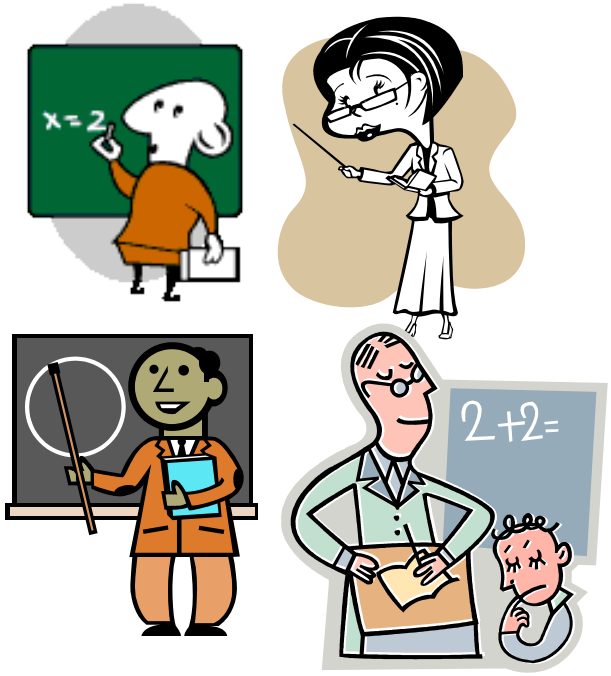


2650 employee
693 teachers:
612 PhD,178 professors

Our education– buyer and seller

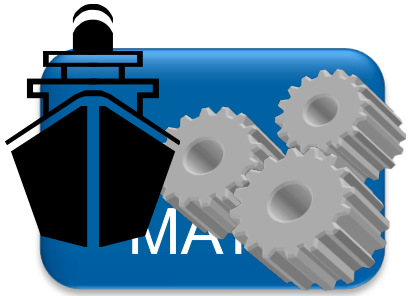
Programme head designs programme and buy courses..

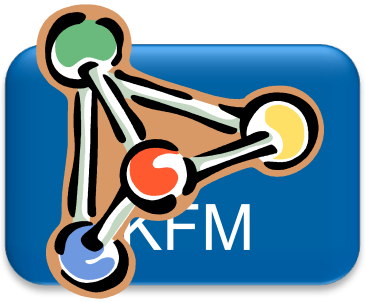
.. from several Department heads..

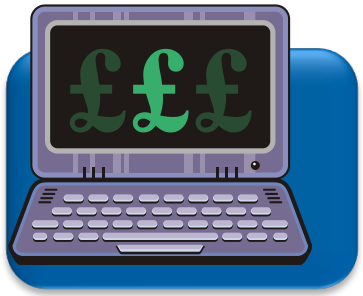


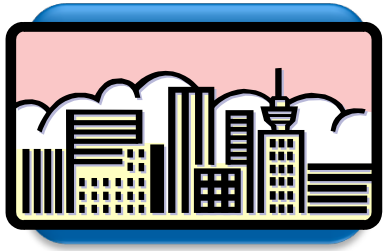
.. who assigns courses to faculty

Our education – organisation





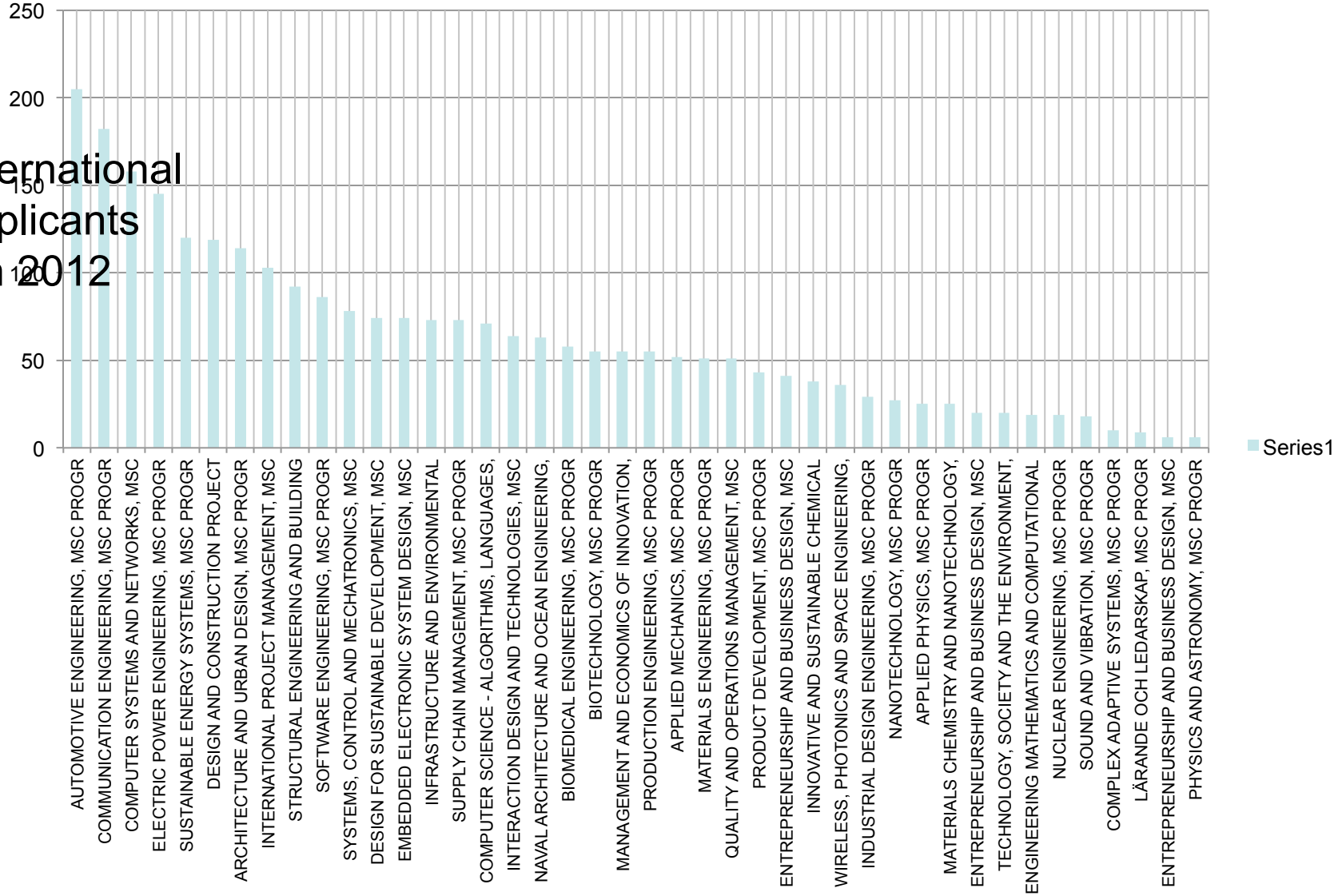




Mechanical eng **Industrial design** **Automation & mechatronics**	**Chemical eng** **Chem eng & phys** **Eng physics** **Eng mathematics** **Biotechnology**	**Electrical eng** **Computer eng** **Industrial eng &management** **Information eng**	**Architecture** **Architecture eng** **Civil eng**
Mechanical eng ***Design eng*** ***Mechatronics eng*** **Naval captain** **Naval eng** **Naval och logistics**	***Chemical eng***	***Electrical eng*** ***Computer eng*** ***Industrial & prod.eng***	***Civil eng*** ***Business and entrepreneur-ship***

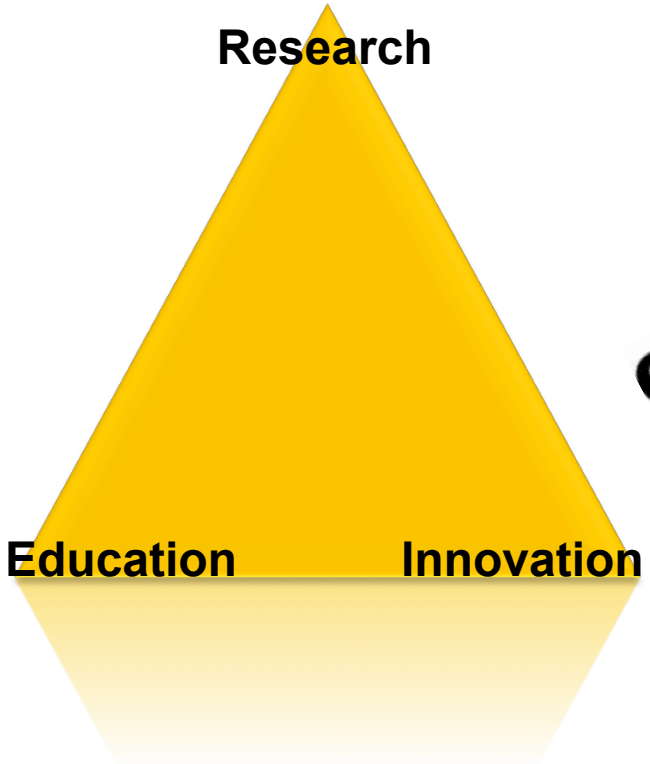
Master's Programmes

International applicants jan 2012



Education – Examples in the knowledge triangle

Lecturers = researchers
Master's programmes



Programme design matrix

Steering committee
Guest lectures
Projects
Entrepreneur school

How can the Areas of Advance contribute to strengthen the Triangle?

CHALMERS
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Architecture and engineering

BUILT ENVIRONMENT

A CHALMERS AREA OF ADVANCE

BSc Architecture and Engineering

MSc Civil Engineering
Design and Construction Project Management
Sound and Vibration
Structural Engineering and Building Technology
Technology, Society and the Environment
Learning and Leadership

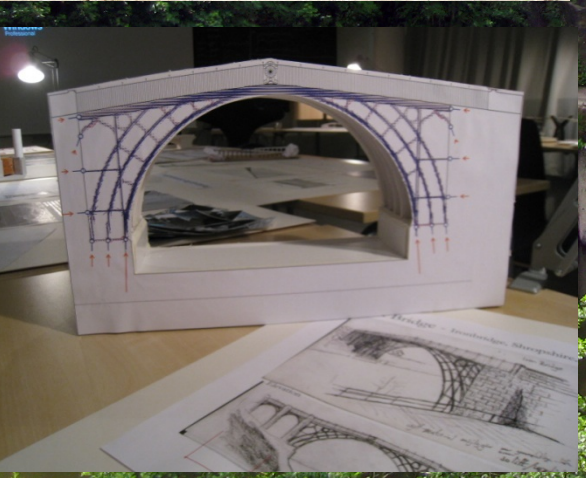
Master of Architecture
Architecture and Urban Design
Design for Sustainable Development

STRUKTUR-MEKANIK

MODELLERING OCH ANALYS AV RAMAR OCH FACKVERK

OLA DAHLBLOM
KARL-GUNNAR OLSSON

Studentlitteratur



INITIATIVE SEMINAR:

NOVEMBER 28-29, 2011

DESIGN-OCH KONSTRUKTIONSDAGEN 2011

Computational Design

Towards a responsible architecture and engineering

The tools for architecture and engineering are developing rapidly and the cooperation between architects and engineers becomes integrated. With arenas for the Olympic games in London 2012 and the planning of the Olympic games in Rio de Janeiro 2016 as examples, the seminar shows the role and importance of the computer tools, particularly for early design stages. At the seminar you can listen to some of the world's leading architects and structural engineers within the field.

The first afternoon of the seminar consists of **the Structural Design Day (Design- och Konstruktionsdagen)**. Here, Conceptual Design is introduced, inspiration is given and possibilities are shown through large ongoing projects. The second day of the seminar gives deepening and, in dialogue with representatives from Chalmers and institutions and industry of the region, development and possibilities for the future are discussed.

November 28-29, 2011 in Runan, Chalmersplatsen 1, Gothenburg, Sweden
Register to one or two days (no participation fee) latest on November 18, 2011: www.chalmers.se/built-environment/

AREA OF ADVANCE BUILT ENVIRONMENT CHALMERS

Solar Decathlon

Team Sweden 2013

International student competition by US Dept of Energy:

Draw and Build a self-contained house

Team Sweden

(BSc+MSc)
Mechanical Enginering
Chemical Engineering
Engineering Physics

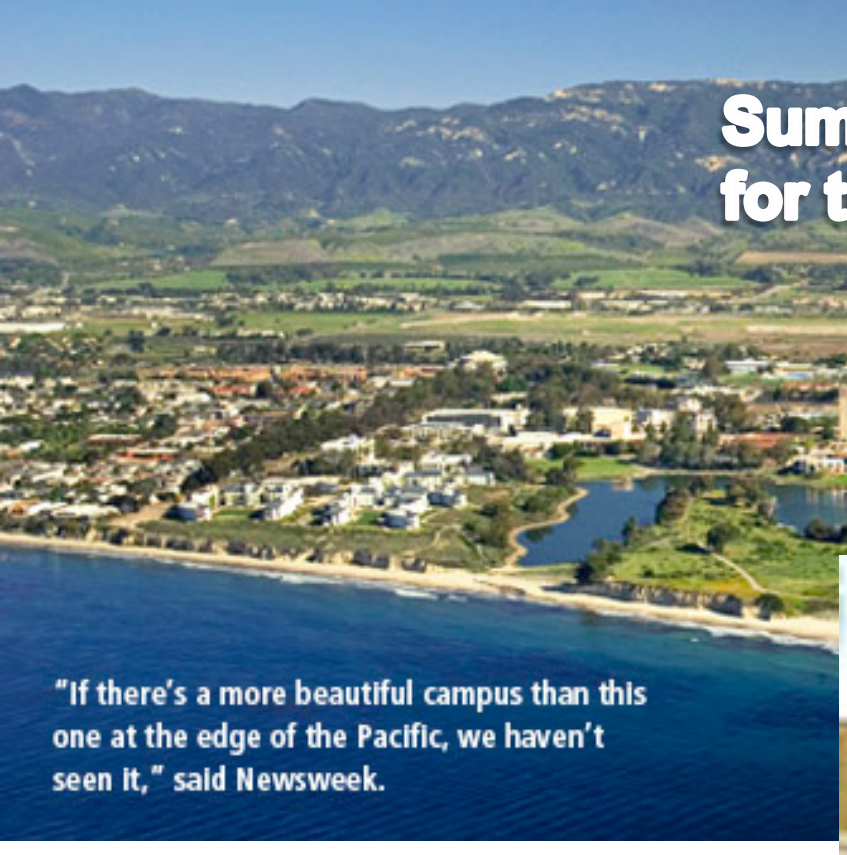
MATERIALS SCIENCE

A CHALMERS AREA OF ADVANCE

MSc
Materials Engineering
Materials Chemistry and Nanotechnology
Applied Physics

PhD
National Graduate School in Materials Science

Summer school in UC Santa Barbara for the best students



Seminar series:

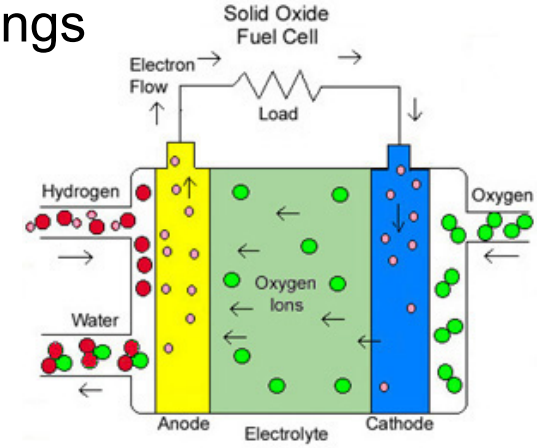
Materials for Tomorrow
Materials in Sports
Materials in Health

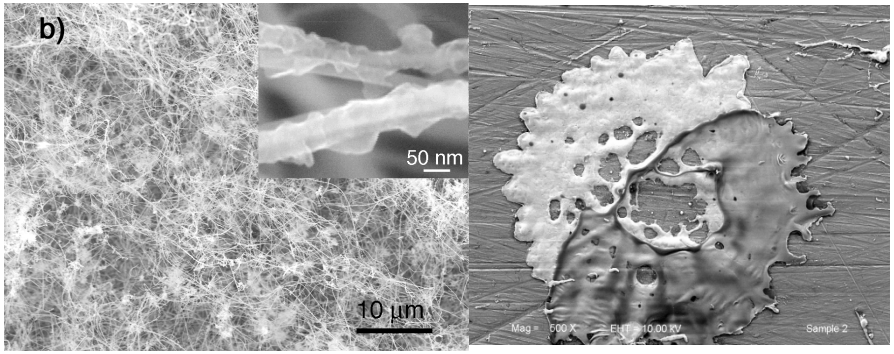
Tailored Materials and Commercialization Aspects

A New Course

Materials Lectures

- Nanostructure
- Catalysts
- Bulk-amorphous
- Ti as bio-/aero- material
- Metallic foams
- Metal coatings
- Fuel Cells





Commercialization Aspects

Protection strategies

Intellectual properties, patent

Business idea identification

Exercise/workshop (by companies/ entrepreneur)

Expectations and commercial aspects

How do I start a business?

CHALMERS innovation Business Incubator

Education – Examples in the knowledge triangle

Lecturers = researchers
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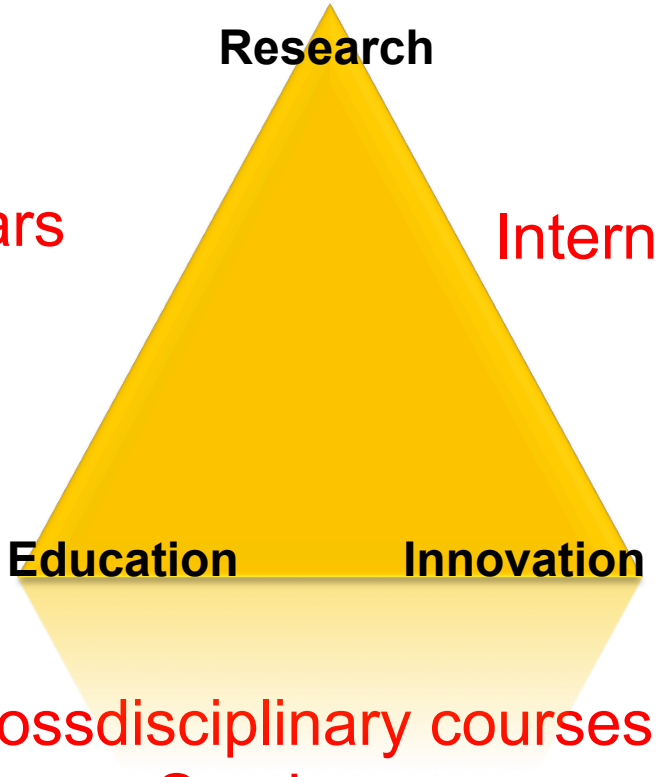

Seminars

International exchange

Programme design matrix

Steering committee
Guest lectures
Projects
Entrepreneur school

Crossdisciplinary courses
Seminars
Matchmaking with industry

Interactions across the knowledge triangle