Center for Polar Activities

Center
Short name: Polar DTU
Main Research Area: Technical/natural sciences

Addresses
Type of address: Postal address
Street: Elektrovej
Building: 328
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Organisation profile
DTU has more than 100 years of experience in Arctic and Antarctic conditions. All this experience is being combined in Polar DTU, an interdisciplinary centre that brings together the knowledge and research from departments and centres from all over DTU. The purpose of the centre is to make all of DTU’s research, know-how and new technologies available to private enterprises and international authorities operating in the Polar Regions. This guarantees the provision of research-based services that draw on the interdisciplinary knowledge of the departments involved. In addition to this, Polar DTU can call on a strong international network of research institutions.

Center for Nanostructured Graphene

Center
Short name: Center for Nanostructured Graphene

Web addresses
Web: http://www.cng.dtu.dk/

Organisation profile
CNG – Center for Nanostructured Graphene – is funded by the Danish National Research Foundation (Danmarks Grundforskningsfond), with a 54 mill. Dkr grant, starting in February 2012 and running initially for six years.

The main partners in CNG are DTU Fotonik, DTU Fysik, DTU CEN, Aalborg University and DTU Nanotech which is the main stake-holder. The center is headed by Prof. Antti-Pekka Jauho from DTU Nanotech. The grant from DNRF finances the research carried out by ten junior researchers (ph.d students and post-docs). In addition, many other researchers on the DTU campus are independently financed stake-holders in CNG’s research program, so that all in all more than sixty persons contribute towards CNG’s goals (Oct 2013).

CNG focuses on basic research, but all its research projects have long-time perspectives which the aim at applications. CNG’s research profile has a broad range: it involves polymer chemists, nanofabrication specialists, experimental physicists, and condensed matter theorists using a wide palette of analytical and numerical techniques, including large scale simulations of nanodevices, ab initio electronic structure calculations, and theory of quantum transport.

Centre for Product Modelling

Center
Short name: CPM
Main Research Area: Technical/natural sciences

Addresses
Type of address: Postal address
Building: Building 424
Postal code: DK-2800
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Country: Denmark

Phone numbers
Phone: (+45) 4525 4434
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Web addresses
Web: http://www.productmodels.com/

E-mails
E-mail: csc@man.dtu.dk

Organisation profile
The Centre for Product Modelling (CPM) is a Danish research institution under the Department of Management Engineering at the Technical University of Denmark. CPM is dedicated to researching automation of routine engineering tasks in the product specification process. CPM has recently developed and tested a methodology for designing and implementing product models, which are used as product specification systems in configuration process. By incorporating knowledge of e.g. the structure, function, production, transport, assembly, use etc. of a product into a product model, this knowledge is made accessible to other organisational units and is more easily shared with other units, both in-house and in relation to the customers and suppliers of the company.
CPM is also the driving force behind the Association for Product Modelling in Denmark, which is an association of firms interested in - and using - product models.
Product models can for example be used for:
The configuration of products in connection with sales/biddings. Either directly via the Internet or by using laptop PC’s.
The automatic generating of product documentation for the purpose of company purchasing and production in connection with the executing of orders.
The support of detailed construction of custom-fit product variants.
In the Centre for Industrialisation of Engineering we focus on the construction of product models that can support the sales process.
This task comprises procedures for:
Analysing and developing already existing business processes for sales, biddings, and adaptation/documentation of products for individual customer needs.
Analysing the possibilities offered by product models and their incorporation in the overall business strategy of the company.
Constructing and implementing product models.
The procedures are developed by combining competencies within the business/strategic area, techniques for modelling and implementation of product models and organisational conditions.

UNEP DTU Partnership
Department of Management Engineering
Short name: UNEP DTU Partnership
Main Research Area: Technical/natural sciences

Addresses
Type of address: Postal address
Street: Marmorvej 51
UNEP DTU Partnership is a leading international research and advisory institution on energy, climate and sustainable development. As a United Nations Environment Programme (UNEP) Collaborating Centre, it is an integral part of UNEP’s Division of Technology, Industry and Economics (DTIE) and an active participant in both the planning and implementation of UNEP’s Climate Change Strategy and Energy Programme.

UNEP DTU Partnership comprises two Centres: Centre on Energy, Climate and Sustainable Development, and the Copenhagen Centre on Energy Efficiency. It is located at the UN City in Copenhagen, Denmark and is organisationally a part of the Department of Management Engineering at the Technical University of Denmark.

Centre for Playware
Automation and Control
Center
Short name: Centre for Playware
Organisational unit: Group

Centre for IT-Intelligent Energy System in Cities
Center
Short name: CITIES
Main Research Area: Technical/natural sciences

Addresses
Type of address: Postal address
Building: Building 303
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
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Phone: +45 2275 6975

Web addresses
Web: http://smart-cities-centre.org/

Organisation profile
Centre for IT-Intelligent Energy System in Cities - CITIES
A wide range of research activities have arisen to support the Danish target of a 100% renewable energy system by 2050. Projects focused on individual aspects of the energy system, such as zero emissions buildings or intelligent power systems provide valuable insight, that facilitates flexibility throughout the energy system. CITIES will address this deficiency by establishing an integrated research centre covering all aspects of the energy system, including gas, power,
district heating/cooling and biomass, and most importantly methods to forecast, control and optimize their interactions through the use of advanced ICT solutions.

The high densities of population, energy consumption, and energy and communications networks in cities offer the greatest potential for flexibility at the last cost, and the fact that cities account for 80% of global energy consumption and emissions [1] make the urban environment an ideal setting for energy systems integration research. CITIES will pioneer research into fully integrated city energy systems, building short-term operational models that feed longer term planning models, considering the spatiotemporal variations, interactions, dynamics and stochastics in the energy system. Low level models of system components will inform higher-level aggregate models employed in market and control framework design. The leading position of European academia and industry and the rapidly growing market for smart energy solutions indicates substantial scope for increased competitiveness and job creation within this field. CITIES will, in collaboration with its industrial and academic partners, conduct research with a view to developing tools for the implementation of integrated energy system solutions.

Objectives of the centre project

The societal objective of CITIES is to establish a realistic and concrete pathway to ultimately achieving independence from fossil fuels by harnessing the latent flexibility of the energy system through intelligence, integration, and planning, focusing on city environments and working towards both 2020 and 2050 European [2,3] and Danish goals [4].

The scientific objective of CITIES is to develop methodologies and ICT solutions for the analysis, operation and development of fully integrated urban energy systems. A holistic research approach will be developed that aims to provide solutions at all levels between the appliance and the total system, and at all time scales between operations and planning.

The educational objective of CITIES is to educate a generation of academics, engineers and entrepreneurs on the value and necessity of considering the energy system as a whole in a collaborative, integrated context, rather than focusing on a single facet or component.

The commercial perspective of CITIES is to identify and establish solutions which can form the background for commercial opportunities within the smart cities environment, and to support the development of these and other smart cities demonstration projects, including through a range of decision support tools to be developed as a result of our research efforts.

Key Outcomes of the CITIES

Operational methods and scenarios for energy systems integration and management, paving scenarios towards a fossil free future

Component level, modular and aggregate models of energy supply, consumption, and transmission, suitable for simulation, control and optimisation frameworks

Market structures that support energy systems integration

Modular forecasting and control models for a variety of energy system components, including their interactions

Integration of short-term operational models in models for long-term planning.

Models of energy consumption and production accounting for their stochastic and dynamic features.

Methods for controlling energy consumption and demand side management.

CITIES is aiming at being a leading knowledge centre for Smart Cities development and operational tools.

Synergies with existing and new smart cities development projects

Centre Management

Henrik Madsen  Center Manager  henrik.madsen@smart-cities-centre.org
Alfred Heller  Deputy Center Manager  alfred.heller@smart-cities-centre.org
Ivan T. Herrmann  Chief Operation Manager  ivan.t.herrmann@smart-cities-centre.org

Electricity markets and energy analytics

Center for Electric Power and Energy

Short name: Electricity markets and energy analytics

Main Research Area: Technical/natural sciences

Addresses

Type of address: Postal address
Street: Elektrovej
Organisation profile
Design of electricity markets and socio-economic optimization methods for market analysis and design, including power-system planning and operation analysis considering market aspects. Modeling and simulation of markets are central parts of the area, with emphasis on the stochastic and dynamic features of renewable energy generation and new patterns in electricity consumption at various temporal and spatial scales.
Organisational unit: Group

Electric power systems
Center for Electric Power and Energy
Short name: Electric power systems
Main Research Area: Technical/natural sciences

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Type of address: Postal address
Street: Elektrovej
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Country: Denmark

Phone numbers
Phone: (+45) 4525 3500

Web addresses
Web: http://www.cee.elektro.dtu.dk/

E-mails
E-mail: cet@elektro.dtu.dk

Organisation profile
Electric power system engineering especially addressing the impact of large-scale integration of renewable energy sources on power system stability, security and reliability.
Organisational unit: Group

Energy system operation and management
Center for Electric Power and Energy
Short name: Energy system operation and management
Main Research Area: Technical/natural sciences

Addresses
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Street: Elektrovej
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Phone numbers
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Web addresses
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E-mails
E-mail: cet@elektro.dtu.dk

Organisation profile
Analyses, modeling and development of new solutions for management and operation of future active power distribution systems with high penetration of RES and controllable DER and for integration of large-scale controllable DER into the power system.
Organisational unit: Group

Energy resources, services and control
Center for Electric Power and Energy
Short name: Energy resources, services and control
Main Research Area: Technical/natural sciences

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Street: Elektrovej
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Web addresses
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E-mails
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Organisation profile
Distributed energy resource technologies addressing in particular their properties, their local coordination, their grid integration and the services they provide for the system.
Organisational unit: Group
Electric power components
Center for Electric Power and Energy
Short name: Electric power components
Main Research Area: Technical/natural sciences

Addresses
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Web addresses
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E-mails
E-mail: cet@elektro.dtu.dk

Organisation profile
Analyses, modeling, design and development of electric components based on electromagnetic and circuit theory, physical aspects, materials etc. Furthermore, the area covers the interaction between components and sub-systems.
Organisational unit: Group

Implementation and Performance Management
Production and Service Management
Short name: Implementation and Performance Management

Addresses
Type of address: Postal address
Street: Produktionstorvet
Building: 424
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 4800

E-mails
E-mail: info@man.dtu.dk
Organisational unit: Group
Risk Research Group
Production and Service Management
Short name: Risk Research Group

Addresses
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Organisational unit: Group

Centre for Facilities Management
Production and Service Management
Short name: Centre for Facilities Management

Addresses
Type of address: Postal address
Street: Produktionstorvet
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Postal code: DK-2800
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Phone numbers
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Organisational unit: Group

Section for Diagnostics and Scientific Advice
National Veterinary Institute
Short name: Section for Diagnostics and Scientific Advice

Addresses
Type of address: Postal address
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Country: Denmark

**Phone numbers**
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Phone: (+45) 35 88 60 01

**E-mails**
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Organisational unit: Section

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**CAPEC-PROCESS**
Department of Chemical and Biochemical Engineering

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Building: 229
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

**Phone numbers**
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Fax: +45 45 88 22 58
Organisational unit: Section

---

**A&E Projects**
Novo Nordisk Foundation Center for Biosustainability
Short name: A&E Projects

**Addresses**
Type of address: Postal address
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**E-mails**
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Organisational unit: Section
Engineering Systems Group
Production and Service Management
Short name: Engineering Systems Group

Addresses
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Country: Denmark

Phone numbers
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E-mails
E-mail: info@man.dtu.dk
Organisational unit: Group

Synthetic Biology Tools for Yeast
Novo Nordisk Foundation Center for Biosustainability
Short name: SBTY
Main Research Area: Technical/natural sciences

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Type of address: Postal address
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Organisational unit: Section

New Bioactive Compounds
Novo Nordisk Foundation Center for Biosustainability
Short name: NBC
Main Research Area: Technical/natural sciences

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Organisational unit: Section

---

**CHO Core**

Novo Nordisk Foundation Center for Biosustainability

Short name: CFB

Main Research Area: Technical/natural sciences

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Organisational unit: Section

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**Glyco-Engineering of CHO**

Novo Nordisk Foundation Center for Biosustainability

Short name: GEC

Main Research Area: Technical/natural sciences

**Addresses**

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Organisational unit: Section
iLoop
Novo Nordisk Foundation Center for Biosustainability
Short name: iLoop
Main Research Area: Technical/natural sciences

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Organisational unit: Section

Afdelingen for Produktionsudvikling
Center for Bachelor of Engineering Studies
Short name: AFPU

Addresses
Type of address: Postal address
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Postal code: DK-2750
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Country: Denmark

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Web addresses
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Organisational unit: Section

Afdelingen for Forretningsudvikling
Center for Bachelor of Engineering Studies
Short name: AFFU

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Organisational unit: Section

Afdelingen for Maskin og Design
Center for Bachelor of Engineering Studies
Short name: AFMD

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Organisational unit: Section

Afdelingen for Informatik
Center for Bachelor of Engineering Studies
Short name: AFIN

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Afdelingen for El-teknologi
Center for Bachelor of Engineering Studies
Short name: AFET

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Web addresses
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Organisational unit: Section

Afdelingen for Byggeri og Infrastruktur
Center for Bachelor of Engineering Studies
Short name: AFBI

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Quantum Optics Devices
Department of Photonics Engineering
Short name: Quantum Optics Devices

Addresses
Type of address: Postal address
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Building: 343
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

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Web addresses
Web: http://www.fotonik.dtu.dk/english

E-mails
E-mail: info@fotonik.dtu.dk

DTU National Laboratory for Sustainable Energy
Center
Short name: DTU National Laboratory

Web addresses
Web: http://www.natlab.dtu.dk/english

Organisation profile
DTU National Laboratory for Sustainable Energy is headed by Vice Dean Hans Hvidtfeldt Larsen, who is referring to the Provost. An advisory group has been formed, consisting of the heads of departments from

DTU Civil Engineering

DTU Electro

DTU Energy Conversion

DTU Chemical Engineering

DTU Management Engineering
DTU Mechanical Engineering

DTU Wind Energy

The advisory group advises the DTU National Laboratory for Sustainable Energy and ensures consistency between DTU National Laboratory for Sustainable Energy's activities and the involved institutions' activities.

Organisational unit: Center

Center for Bachelor of Engineering Studies
Technical University of Denmark
Short name: DTU Diplom

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Type of address: Postal address
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Organisational unit: Department

Systems Biotechnology
Department of Systems Biology
Short name: Systems Biotechnology

Addresses
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Web addresses
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E-mails
E-mail: info@bio.dtu.dk
Organisational unit: Section

Proteomics Platform
Department of Systems Biology
Short name: Proteomics Platform

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Organisational unit: Section

Network Engineering of Eukaryotic Cell Factories
Department of Systems Biology
Short name: Network Engineering of Eukaryotic Cell Factories

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Organisational unit: Section
**Natural Product Chemistry**
Department of Systems Biology
Short name: Natural Product Chemistry

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Organisational unit: Section

---

**Metabolomics Platform**
Department of Systems Biology
Short name: Metabolomics Platform

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**E-mails**
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Organisational unit: Section

---

**Metabolic Signaling and Regulation**
Department of Systems Biology
Short name: Metabolic Signaling and Regulation
Infection Microbiology
Department of Systems Biology
Short name: Infection Microbiology

Addresses
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Web addresses
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E-mails
E-mail: info@bio.dtu.dk
Organisational unit: Section

Fungal Physiology and Biotechnology
Department of Systems Biology
Short name: Fungal Physiology and Biotechnology

Addresses
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Web addresses
Web: http://www.bio.dtu.dk/english/Research/Research-groups

E-mails
E-mail: info@bio.dtu.dk
Organisational unit: Section

Fungal Chemodiversity
Department of Systems Biology
Short name: Fungal Chemodiversity

Addresses
Type of address: Postal address
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Web addresses
Web: http://www.bio.dtu.dk/english/Research/Research-groups
Organisational unit: Section

Fermentation Platform
Department of Systems Biology
Short name: Fermentation Platform

Addresses
Type of address: Postal address
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E-mails
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Organisational unit: Section

Eucaryotic Molecular Cell Biology
Department of Systems Biology
Short name: Eucaryotic Molecular Cell Biology

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Organisational unit: Section

Enzyme and Protein Chemistry
Department of Systems Biology
Short name: Enzyme and Protein Chemistry

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Web addresses
Drug Resistance and Community Dynamics
Department of Systems Biology
Short name: Drug Resistance and Community Dynamics

Addresses
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Web addresses
Web: http://www.bio.dtu.dk/english/Research/Research-groups

E-mails
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Organisational unit: Section

Bacterial Ecophysiology and Biotechnology
Department of Systems Biology
Short name: Bacterial Ecophysiology and Biotechnology

Addresses
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E-mails
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Organisational unit: Section
Agricultural and Environmental Proteomics
Department of Systems Biology
Short name: Agricultural and Environmental Proteomics

Addresses
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Web addresses
Web: http://www.bio.dtu.dk/english/Research/Research-groups

E-mails
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Organisational unit: Section

Systems Biology of Immune Regulation
Center for Biological Sequence Analysis
Short name: Systems Biology of Immune Regulation

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Organisational unit: Group

**Regulatory Genomics**
Center for Biological Sequence Analysis
Short name: Regulatory Genomics

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Country: Denmark

**Phone numbers**
Phone: +45 45 25 24 77
Fax: +45 45 93 15 85

**Web addresses**
Web: http://www.bio.dtu.dk/English/Research/Research-groups

**E-mails**
E-mail: cbs@cbs.dtu.dk

Organisational unit: Group

**Molecular Evolution**
Center for Biological Sequence Analysis
Short name: Molecular Evolution

**Addresses**
Type of address: Postal address
Street: Kemitorvet
Building: 208
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

**Phone numbers**
Phone: +45 45 25 24 77
Fax: +45 45 93 15 85

**Web addresses**
Web: http://www.bio.dtu.dk/English/Research/Research-groups

**E-mails**
E-mail: cbs@cbs.dtu.dk
Metagenomics
Center for Biological Sequence Analysis
Short name: Metagenomics

Addresses
Type of address: Postal address
Street: Kemitorvet
Building: 208
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 45 25 24 77
Fax: +45 45 93 15 85

Web addresses
Web: http://www.bio.dtu.dk/english/Research/Research-groups

E-mails
E-mail: cbs@cbs.dtu.dk

Integrative Systems Biology
Center for Biological Sequence Analysis
Short name: Integrative Systems Biology

Addresses
Type of address: Postal address
Street: Kemitorvet
Building: 208
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 45 25 24 77
Fax: +45 45 93 15 85

Web addresses
Web: http://www.bio.dtu.dk/english/Research/Research-groups

E-mails
E-mail: cbs@cbs.dtu.dk
Immunological Bioinformatics
Center for Biological Sequence Analysis
Short name: Immunological Bioinformatics

Addresses
Type of address: Postal address
Street: Kemitorvet
Building: 208
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 45 25 24 77
Fax: +45 45 93 15 85

Web addresses
Web: http://www.bio.dtu.dk/english/Research/Research-groups

E-mails
E-mail: cbs@cbs.dtu.dk

Functional Human Variation
Center for Biological Sequence Analysis
Short name: Functional Human Variation

Addresses
Type of address: Postal address
Street: Kemitorvet
Building: 208
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 45 25 24 77
Fax: +45 45 93 15 85

Web addresses
Web: http://www.bio.dtu.dk/english/Research/Research-groups

E-mails
E-mail: cbs@cbs.dtu.dk
DTU Multi Assay Core
Center for Biological Sequence Analysis
Short name: DTU Multi Assay Core

Addresses
Type of address: Postal address
Street: Kemitorvet
Building: 208
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 45 25 24 77
Fax: +45 45 93 15 85

Web addresses
Web: http://www.bio.dtu.dk/english/Research/Research-groups

E-mails
E-mail: cbs@cbs.dtu.dk

Comparative Microbial Genomics
Center for Biological Sequence Analysis
Short name: Comparative Microbial Genomics

Addresses
Type of address: Postal address
Street: Kemitorvet
Building: 208
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 45 25 24 77
Fax: +45 45 93 15 85

Web addresses
Web: http://www.bio.dtu.dk/english/Research/Research-groups

E-mails
E-mail: cbs@cbs.dtu.dk
Cellular Signal Integration
Center for Biological Sequence Analysis
Short name: Cellular Signal Integration

Addresses
Type of address: Postal address
Street: Kemitorvet
Building: 208
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 45 25 24 77
Fax: +45 45 93 15 85

Web addresses
Web: http://www.bio.dtu.dk/english/Research/Research-groups

E-mails
E-mail: cbs@cbs.dtu.dk

Cancer Systems Biology
Center for Biological Sequence Analysis
Short name: Cancer Systems Biology

Addresses
Type of address: Postal address
Street: Kemitorvet
Building: 208
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 45 25 24 77
Fax: +45 45 93 15 85

Web addresses
Web: http://www.bio.dtu.dk/english/Research/Research-groups

E-mails
E-mail: cbs@cbs.dtu.dk
**Organisational unit: Group**

**Behavioral Phenomics**
Center for Biological Sequence Analysis  
Short name: Behavioral Phenomics

**Addresses**
Type of address: Postal address  
Street: Kemitorvet  
Building: 208  
Postal code: DK-2800  
City: Kgs. Lyngby  
Country: Denmark

**Phone numbers**
Phone: +45 45 25 24 77  
Fax: +45 45 93 15 85

**Web addresses**
Web: [http://www.bio.dtu.dk/english/Research/Research-groups](http://www.bio.dtu.dk/english/Research/Research-groups)

**E-mails**
E-mail: cbs@cbs.dtu.dk
Organisational unit: Group

**Mathematical and Computational Geoscience**
National Space Institute  
Short name: Mathematical and Computational Geoscience

**Addresses**
Type of address: Postal address  
Street: Richard Petersens Plads  
Building: building 305  
Postal code: DK-2800  
City: Kgs. Lyngby  
Country: Denmark

**Phone numbers**
Phone: (+45) 4525 9500  
Fax: (+45) 4525 9575

**Web addresses**
Web: [www.space.dtu.dk/English](http://www.space.dtu.dk/English)

**E-mails**
E-mail: office@space.dtu.dk
Organisation profile
Mathematical and Computational Geoscience primarily deals with mathematical modeling of complex geological structures, in order to uncover an invisible underground without having to dig it up. Structures in the earth is complex and essential to the understanding of the currents of water or oil in underground reservoirs. Mathematical and Computational Geoscience focuses on creating a model that describes the geological structures and how to use seismic and other types of measurements to reconstruct the very fine structures in the ground. Detailed knowledge of the subsurface can be used for resource exploration of minerals, oil, drinking water and hot water (geothermal). Methods used and developed by Mathematical and Computational Geoscience is not only useful on the ground. They can be used to also investigate structures on planets.

Organisational unit: Section

Geomagnetism
National Space Institute
Short name: Geomagnetism

Addresses
Type of address: Postal address
Street: Elektrovej
Building: 327+328
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: (+45) 4525 9500
Fax: (+45) 4525 9575

Web addresses
Web: www.space.dtu.dk/English

E-mails
E-mail: office@space.dtu.dk

Organisation profile
The Division of Geomagnetism uses magnetic field measurements from satellites and ground stations to explore the Earth. The magnetic field provides valuable knowledge about Earth's interior, because its slow variations reflect movements of the material in the core, rapid field changes depend on the electrical conductivity of the upper mantle, and because small wavelengths features can be used to map crustal structures. The magnetic field can also be used to explore the upper atmosphere (ionosphere and magnetosphere) and its connection with processes on the Sun.

The division's activities primarily focus on:

- measuring Earth's magnetic field
- investigating the underlying physical processes producing the field and its variations
- developing methods to separate the different contributions from the core, crust and the Earth's upper atmosphere (ionosphere and magnetosphere)
- developing and calibrating instruments to measure the Earth's magnetic field, which are used in observatories around the world.

Organisational unit: Section
**Genome-Scale CHO in silico Model**
Novo Nordisk Foundation Center for Biosustainability
Short name: GSCiSM

**Addresses**
Type of address: Postal address
Street: Fremtidsvej 3
Postal code: DK-2970
City: Hørsholm
Country: Denmark

**Phone numbers**
Phone: +45 4525 8000

**Web addresses**
Web: http://www.biosustain.dtu.dk/Research/Genome-Scale%20CHO%20in%20silico%20models.aspx

**E-mails**
E-mail: biosustain@biosustain.dtu.dk

**Organisation profile**
This Section aims at developing and constructing Chinese Hamster Ovary (CHO) cell genome-scale *in-silico* models and their applications.
Organisational unit: Section

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**CHO Cell Line Engineering and Design**
Novo Nordisk Foundation Center for Biosustainability
Short name: CLED

**Addresses**
Type of address: Postal address
Street: Fremtidsvej 3
Postal code: DK-2970
City: Hørsholm
Country: Denmark

**Phone numbers**
Phone: +45 4525 8000

**Web addresses**
Web: http://www.biosustain.dtu.dk/Research/CHO%20Cell%20Engineering.aspx

**E-mails**
E-mail: biosustain@biosustain.dtu.dk

**Organisation profile**
This Section will address the desire to obtain high yields and high quality glycoproteins targets in an optimized CHO production host through the following two complementetary genome-scale science methodologies:

Apply genome-scale models and glycoengineering towards rational design of improved production hosts for greater yields and product quality
Alter the processing capability of host cells through high-throughput screening of specific regulatory molecules that may control protein production and processing.

This Section is headed by Prof. Michael Betenbaugh
Organisational unit: Section

Software Engineering
Department of Applied Mathematics and Computer Science
Short name: Software Engineering

Addresses
Type of address: Postal address
Street: Matematiktorvet
Building: 303 B
Postal code: DK-2800
City: Kgs. Lynby
Country: Denmark

Phone numbers
Phone: +45 4525 3031

Web addresses
Web: http://www.compute.dtu.dk/English.aspx

E-mails
E-mail: compute@compute.dtu.dk

Organisation profile
Head of section: Professor Joseph Kiniry
Organisational unit: Section

Scientific Computing
Department of Applied Mathematics and Computer Science
Short name: Scientific Computing

Addresses
Type of address: Postal address
Street: Matematiktorvet
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Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 3031

Web addresses
Web: http://www.compute.dtu.dk/English.aspx
E-mails
E-mail: compute@compute.dtu.dk

Organisation profile
Head of section: Professor Per Christian Hansen
Organisational unit: Section

Statistics and Data Analysis
Department of Applied Mathematics and Computer Science
Short name: Statistics and Data Analysis

Addresses
Type of address: Postal address
Street: Matematiktorvet
Building: 303 B
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 3031

Web addresses
Web: http://www.compute.dtu.dk/English.aspx

E-mails
E-mail: compute@compute.dtu.dk

Organisation profile
Head of section: Professor Bjarne Kjær Ersbøll
Organisational unit: Section

Language-Based Technology
Department of Applied Mathematics and Computer Science
Short name: Language-Based Technology

Addresses
Type of address: Postal address
Street: Matematiktorvet
Building: 303 B
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 3031

Web addresses
Web: http://www.compute.dtu.dk/English.aspx
E-mails
E-mail: compute@compute.dtu.dk

Organisation profile
Head of section: Professor Hanne Riis Nielson
Organisational unit: Section

Cryptology
Department of Applied Mathematics and Computer Science
Short name: Cryptology

Addresses
Type of address: Postal address
Street: Matematiktorvet
Building: 303 B
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 3031

Web addresses
Web: http://www.compute.dtu.dk/English.aspx

E-mails
E-mail: compute@compute.dtu.dk

Organisation profile
Head of section: Professor Lars Ramkilde Knudsen
Organisational unit: Section

Cognitive Systems
Department of Applied Mathematics and Computer Science
Short name: Cognitive Systems

Addresses
Type of address: Postal address
Street: Matematiktorvet
Building: 303 B
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 3031

Web addresses
Web: http://www.compute.dtu.dk/English.aspx

E-mails
E-mail: compute@compute.dtu.dk

Organisation profile
Head of section: Professor Lars Kai Hansen
Organisational unit: Section

Embedded Systems Engineering
Department of Applied Mathematics and Computer Science
Short name: Embedded Systems Engineering

Addresses
Type of address: Postal address
Street: Matematiktorvet
Building: 303 B
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 3031

Web addresses
Web: http://www.compute.dtu.dk/English.aspx

E-mails
E-mail: compute@compute.dtu.dk

Organisation profile
Head of section: Professor Jan Madsen
Organisational unit: Section

Dynamical Systems
Department of Applied Mathematics and Computer Science
Short name: Dynamical Systems

Addresses
Type of address: Postal address
Street: Matematiktorvet
Building: 303 B
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 3031
Image Analysis & Computer Graphics
Department of Applied Mathematics and Computer Science
Short name: Image Analysis & Computer Graphics

Addresses
Type of address: Postal address
Street: Matematiktorvet
Building: 303 B
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 3031

Web addresses
Web: http://www.compute.dtu.dk/English.aspx

E-mails
E-mail: compute@compute.dtu.dk

Organisation profile
Head of section: Professor Henrik Madsen
Organisational unit: Section

Algorithms and Logic
Department of Applied Mathematics and Computer Science
Short name: Algorithms and Logic

Addresses
Type of address: Postal address
Street: Matematiktorvet
Building: 303 B
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 3031
Mathematics
Department of Applied Mathematics and Computer Science
Organisational unit: Section

Head of section: Professor Paul Fischer
Organisation profile

Addresses
Type of address: Postal address
Street: Matematiktorvet
Building: 303 B
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 3031

Web addresses
Web: http://www.compute.dtu.dk/English.aspx

E-mails
E-mail: compute@compute.dtu.dk

Organisation profile
Head of section: Associate Professor Peter Beelen
Organisational unit: Section

Department of Applied Mathematics and Computer Science
Technical University of Denmark
Organisational unit: Section

Addresses
Type of address: Postal address
Street: Matematiktorvet
Building: 303 B
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark
Phone numbers
Phone: +45 4525 3031

Web addresses
Web: http://www.compute.dtu.dk/English.aspx

E-mails
E-mail: compute@compute.dtu.dk

Organisation profile
Management
Head of department: Professor Helle Rootzén
Deputy head of department: Professor Jan Madsen
Professor Mads Peter Sørensen

DTU Informatics and DTU Mathematics merged on 1 January 2013.
The new name is
DTU Compute
Institut for Matematik og Computer Science
Organisational unit: Department

Danish Shellfish Centre
National Institute of Aquatic Resources
Short name: Danish Shellfish Center

Addresses
Type of address: Postal address
Street: Jægersborg Allé 1
Postal code: DK-2920
City: Charlottenlund
Country: Denmark

Phone numbers
Phone: +45 3588 3300
Fax: +45 3588 3333

Web addresses
Web: http://www.aqua.dtu.dk/English.aspx

E-mails
E-mail: aqua@aqua.dtu.dk

Organisation profile
Headed by Jens Kjerulf Pedersen.
Organisational unit: Section
Section for Maritime Service
National Institute of Aquatic Resources
Short name: Section for Maritime Service

Addresses
Type of address: Postal address
Street: Jægersborg Allé 1
Postal code: DK-2920
City: Charlottenlund
Country: Denmark

Phone numbers
Phone: +45 3588 3300
Fax: +45 3588 3333

Web addresses
Web: http://www.aqua.dtu.dk/English.aspx

Organisation profile
Headed by Hans-Erik Mahnfeldt.
Organisational unit: Section

Section for Administration and Service
National Institute of Aquatic Resources
Short name: Section for Administration and Service

Addresses
Type of address: Postal address
Street: Jægersborg Allé 1
Postal code: DK-2920
City: Charlottenlund
Country: Denmark

Phone numbers
Phone: +45 3588 3300
Fax: +45 3588 3333

Web addresses
Web: http://www.aqua.dtu.dk/English.aspx

E-mails
E-mail: aqua@aqua.dtu.dk

Organisation profile
Headed by Hanne Moos.
Organisational unit: Section

Public Sector Consultancy
National Institute of Aquatic Resources
Short name: Public Sector Consultancy

Addresses
Type of address: Postal address
Street: Jægersborg Allé 1
Postal code: DK-2920
City: Charlottenlund
Country: Denmark

Phone numbers
Phone: +45 3588 3300
Fax: +45 3588 3333

Web addresses
Web: http://www.aqua.dtu.dk/English.aspx

E-mails
E-mail: aqua@aqua.dtu.dk

Organisation profile
Headed by Jørgen Dalskov.
Organisational unit: Section

Centre for Ocean Life
National Institute of Aquatic Resources
Short name: Centre for Ocean Life

Addresses
Type of address: Postal address
Street: Jægersborg Allé 1
Postal code: DK-2920
City: Charlottenlund
Country: Denmark

Phone numbers
Phone: +45 3588 3300
Fax: +45 3588 3333

Web addresses
Web: http://www.aqua.dtu.dk/English.aspx

E-mails
E-mail: aqua@aqua.dtu.dk

Organisation profile
Headed by Torkel Gissel Nielsen.
Organisational unit: Section
Section for Marine Ecology and Oceanography
National Institute of Aquatic Resources
Short name: Section for Marine Ecology and Oceanography

Addresses
Type of address: Postal address
Street: Jægersborg Allé 1
Postal code: DK-2920
City: Charlottenlund
Country: Denmark

Phone numbers
Phone: +45 3588 3300
Fax: +45 3588 3333

Web addresses
Web: http://www.aqua.dtu.dk/English.aspx

E-mails
E-mail: aqua@aqua.dtu.dk

Organisation profile
Headed by Stefan Neuenfeldt.
Organisational unit: Section

Section for Monitoring and Data
National Institute of Aquatic Resources
Short name: Section for Monitoring and Data

Addresses
Type of address: Postal address
Street: Jægersborg Allé 1
Postal code: DK-2920
City: Charlottenlund
Country: Denmark

Phone numbers
Phone: +45 3588 3300
Fax: +45 3588 3333

Web addresses
Web: http://www.aqua.dtu.dk/English.aspx

E-mails
E-mail: aqua@aqua.dtu.dk

Organisation profile
Headed by Kai Wieland and Marie Storr-Paulsen.
Organisational unit: Section
Section for Marine Living Resources
National Institute of Aquatic Resources
Short name: Section for Marine Living Resources

Addresses
Type of address: Postal address
Street: Jægersborg Allé 1
Postal code: DK-2920
City: Charlottenlund
Country: Denmark

Phone numbers
Phone: +45 3588 3300
Fax: +45 3588 3333

Web addresses
Web: http://www.aqua.dtu.dk/English.aspx

E-mails
E-mail: aqua@aqua.dtu.dk

Organisation profile
Headed by Henrik Mosegaard.
Organisational unit: Section

Section for Ecosystem based Marine Management
National Institute of Aquatic Resources
Short name: Section for Ecosystem based Marine Management

Addresses
Type of address: Postal address
Street: Jægersborg Allé 1
Postal code: DK-2920
City: Charlottenlund
Country: Denmark

Phone numbers
Phone: +45 3588 3300
Fax: +45 3588 3333

Web addresses
Web: http://www.aqua.dtu.dk/English.aspx

E-mails
E-mail: aqua@aqua.dtu.dk

Organisation profile
Headed by Anna Rindorf.
Organisational unit: Section
Center for Electric Power and Energy
Department of Electrical Engineering

Center
Short name: CEE

Addresses
Type of address: Postal address
Street: Elektrovej
Building: 325
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: (+45) 4525 3500

Web addresses
Web: http://www.cee.elektro.dtu.dk/

E-mails
E-mail: cet@elektro.dtu.dk

Organisation profile
Center for Electric Power and Energy (CEE) addresses one of the major challenges of our modern society: the development of a reliable, cost-efficient and sustainable energy system based on renewable energy. CEE supports the ongoing transformation of the energy system by developing a range of new technologies and solutions as well as the underlying new knowledge, theory and methods.
CEE is a center under DTU Electrical Engineering.
The center holds competences within:

Electric components
Electric power systems
Electricity markets and energy analytics
Energy resources, control and services
Energy system operation and management

Organisational unit: Section

Section for Immunology and Vaccinology
National Veterinary Institute
Short name: Section for Immunology and Vaccinology

Addresses
Type of address: Postal address
Street: Bülowsvæj 27
Postal code: DK-1870
City: Frederiksberg C
Country: Denmark

Phone numbers
Phone: (+45) 35 88 60 00
Fax: (+45) 35 88 60 01

Web addresses
Web: http://www.vet.dtu.dk/English.aspx

E-mails
E-mail: vet@vet.dtu.dk
Organisational unit: Section

Section for Epidemiology
National Veterinary Institute
Short name: Section of Epidemiology

Addresses
Type of address: Postal address
Street: Bülowsvej 27
Postal code: DK-1870
City: Frederiksberg C
Country: Denmark

Phone numbers
Phone: (+45) 35 88 60 00
Fax: (+45) 35 88 60 01

Web addresses
Web: http://www.vet.dtu.dk/English.aspx

E-mails
E-mail: vet@vet.dtu.dk
Organisational unit: Section

Section for Bacteriology, Pathology and Parasitology
National Veterinary Institute
Short name: Section for Bacteriology, Pathology and Parasitology

Addresses
Type of address: Postal address
Street: Bülowsvej 27
Postal code: DK-1870
City: Frederiksberg C
Country: Denmark

Phone numbers
Phone: (+45) 35 88 60 00
Fax: (+45) 35 88 60 01

Web addresses
Section for Virology
National Veterinary Institute
Short name: Section of Virology
Main Research Area: Technical/natural sciences

Addresses
Type of address: Postal address
Street: Bülowsvej 27
Postal code: DK-1870
City: Frederiksberg C
Country: Denmark

Phone numbers
Phone: (+45) 35 88 60 00
Fax: (+45) 35 88 60 01

Web addresses
Web: http://www.vet.dtu.dk/English.aspx

Division of Food Microbiology
National Food Institute
Short name: Division of Food Microbiology

Addresses
Type of address: Postal address
Street: Mørkhøj Bygade 19
Postal code: DK-2860
City: Søborg
Country: Denmark

Phone numbers
Phone: (+45) 35 88 70 00

Web addresses
Web:
http://www.food.dtu.dk/English/Service/About_National_Food_Institute/Organisation/Division_of_Food_Microbiology.aspx

E-mails
E-mail: vet@vet.dtu.dk
Organisational unit: Section
Organisation profile
The Division of Food Microbiology, National Food Institute conducts research with the aim of supporting public and industrial needs concerning microbial food safety.

The focus is particular on foodborne and zoonotic bacteria and virus in primary production, and in food especially meat and vegetables in both conventional and organic farming as well as health effects and consumer protection related to the use of probiotics and prebiotics.

Research
The targeted research is concentrated on detection and characterization of the biology of zoonotic and foodborne zoonotic pathogens through the entire production chain from farm to consumer. The research has an applied basis with a major focus on public and food industrial needs related to food safety. Further, the division gives priority to studies of food-induced effects on intestinal microbial ecology.

Public sector consultancy
The division is counselling international and national authorities on the health risks posed by the presence of pathogenic microorganisms in food and in food processing as well as on safety assessment of microorganisms deliberately added to food and feed.

Additionally, the division assists the Danish Agency for Environmental Protection in risk assessments related to microbiological plant protection products and genetically modified bacteria. Specific advisory tasks for Danish Veterinary and Food Administration on in collaboration with Division for Epidemiology and Microbial Genomics:

Central Coordinated Projects (CKL)

Case-by-case control

Salmonella Source Account

Outbreak investigations

“Strengthened efforts 2011 – 2014” (Styrket indsats 2011 – 2014) on Salmonella and Campylobacter

Qualitative risk assessments on topics that are related to the safety of different foods, microbiological food additives and ingredients (e.g. probiotics and starter cultures) and practices in food production

Surveillance activities performed in collaboration with Division for Epidemiology and Microbial Genomics:
DANMAP (only in danish)

Zoonosis surveillance

Other tasks:
The division has access to several databases. The databases contain data from surveillance, commercial analytical activities and research projects carried out by Division of Food Microbiology.

The division hosts the national strain collection, which include pathogenic bacteria isolated from food and other sources as part of diagnostics, surveillance, control and research.
Quality assurance (QA): Diagnostic core activities are accredited in accordance with ISO17025.

Education
The Division is responsible for the organisation and teaching at the following courses at DTU:
Food Safety in Production Chains (23102)
Biological Chemistry (23932). Only in danish
Basic Food analysis (23901). Only in danish

In addition, the Division contributes to the teaching at the following courses at DTU:
Practical approaches to industrial food production (23101)
Rapid detection, characterization and enumeration of foodborne pathogens (23834). PhD course 10 ECTS.

Collaboration
National
DTU: Chemical Engineering; Systems Biology; Veterinary
KU: Department of Basic Sciences and Environment; Department of Microbiology; Department of human nutrition; Institute for Veterinary Disease Biology
AU: Department of Food Science
Others: Herlev hospital; Vifos; Danish Meat Research Institute, Danish Technological Institute; Statens Serum Institute; Danish Veterinary and Food Administration; The Danish Agriculture and Food Council

International
University of Nebraska, CSIRO Adelaide, University of Ghent, University of Wageningen, BGI-Shenzhen; ANSES; Bonn University; IZSVe; Rutgers University; National Veterinary Institute (Sweden); Swedish Institute for Infectious Disease Control (SMI); NoFima; Lund University; Norwegian School of Veterinary Science; University of Helsinki; MATIS; National Food Administration (Sweden); Centers for Disease Control and Prevention (CDC); Institute for Risk Assessment (BfR); Veterinary University of Vienna; TEAGASC

Industrial collaboration
Taconic; Danisco Innovations; Danisco Finland; Arla Foods; e-smiley; The Danish Agriculture and Food Council (Landbrug og Fødevarer); The Danish Shellfish Centre

Contact
Acting Head of Division Dorte Lau Baggesen
Organisational unit: Section

Neutrons and x-rays for materials physics
Department of Physics
Short name: Neutron og røntgenbaseret materialefysik

Addresses
Type of address: Postal address
Street: Fysikvej
Building: 309
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 3208
Fax: +45 4593 1669

Web addresses
Web: http://www.fys.dtu.dk/English/Research1/Quantum_physics.aspx
The section for Quantum Physics and Information Technology designs quantum physics materials and processes to be used in sensors and information technology. A broad term for the field is “quantum engineering”, which means to use and design methods for the study and utilization of the fundamental laws of quantum physics. Research is carried out in three subgroups:

**Nanostructured materials**

**Optics**

**Quantum Information**

_Nanostructured materials_ are expected to form the basis of a large number of the new technologies which we will see in the coming decades. The group for nanostructured materials is working in part with micro- and nanoelectronics, which can be cooled down to temperatures near the absolute point zero and used in e.g. radio astronomic receivers; in part with magnetic nanoparticles used in storing information and in medicine and biotechnology, and in part with metallic glass whose unusual qualities has many potential usages. The group for nanostructured materials has also intensified its efforts in the field of spintronics where one seeks to utilize the spin of the electrons as a control parameter in various electronic components. This research forms the basis of the development of 'quantum informatics' which, through its use of the spin of the electrons (spin-up and spin-down, is expected to lead to a whole new generation of quantum computers with far more effective data processing. The group is recognized worldwide for its research. Collaborations include the University of Copenhagen and Risø DTU as well as universities and research centres in USA, Great Britain, Sweden, and Russia etc.

_The Optics Group_ conducts research with the purpose of allowing us to utilize the ever faster technological breakthroughs to further fundamental research into the unique quantum mechanical properties of light and use this information for the greater good. Furthermore, the Optics Group is working towards increasing its international collaborations with other groups outside DTU. Photonics represents another possible technology for the design of quantum computers.

_The Quantum Information Group._ Since its inception the group has been active in the study of new quantum plasmonics systems, the study of novel quantum information “cleaning” systems and the production of nonclassical light.

Organisational unit: Section
A broad term for the field is "quantum engineering", which means to use and design methods for the study and utilization of the fundamental laws of quantum physics. Research is carried out in three subgroups:

**Nanostuctured materials**

**Optics**

Quantum Information

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**The Quantum Information Group.** Since its inception the group has been active in the study of new quantum plasmonics systems, the study of novel quantum information "cleaning" systems and the production of nonclassical light.

Organisational unit: Section

---

**Ecosystems Programme**

Department of Chemical and Biochemical Engineering

Short name: Ecosystems Programme

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**Organisation profile**

The research within ECO aims to evaluate the impacts of various energy technologies on the environment and climate, the potentials to promote environmental adaptation to changed climatic conditions and the possibilities to mitigate positive and promote negative feedbacks to the atmosphere through land use and land management. The research is centred within four research areas:

**Effects and Adaptation**
Head of programme: Claus Beier
Organisational unit: Section

Theoretical Nanotechnology
Department of Micro- and Nanotechnology
Short name: Theoretical Nanotechnology

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Organisation profile

Research:
Antti-Pekka Jauho's group focuses on the theoretical aspects of future's nanoelectronic components. We perform calculations of the electronic transport properties of these system using a variety of theoretical methods, such as a
combination of Density Functional Theory and Nonequilibrium Green functions, or Generalized Master Equations, or the Density Matrix Renormalization Group. In recent years a central theme has been the study of vibrations or the mechanical motion of the nanoscale object; the excitation of these vibrations can be caused by the electric current flowing through the system, or by some nonlinear coupling mechanism. We have devoted a considerable effort in trying to understand the noise and other fluctuation properties in these small systems; this is important because a measurement of the current-voltage characteristics does not always yield sufficient information to unravel the microscopic charge transport processes. We are also interested in the possibility of using solid state systems for implementing quantum information processing, and a number of projects are focusing on these issues.

Theory of nanoelectromechanical systems
Transport in strongly correlated quasi one-dimensional nanostructures
Inelastic scattering
Solid state quantum computing
Nanostructured graphene

Education:
A central part of the theoretical nanotechnology group is the undergraduate and graduate teaching. In addition to providing an opportunity for students to find a masters or Ph.D topic, we take great pleasure in introducing students to the quantum mechanical world.

33206 Transport in Nanostructures
33441 Applications of Electron Transport Theory
33442 Quantum mechanical modeling of molecular electronics
We also supervise both master and bachelor (midtvejs) projects. Please follow the links to see if there are any projects that you are interested in.

Masters projects
Bachelor projects
Organisational unit: Section
The theoretical nanoelectronics group headed by associate professor Mads Brandbyge is focused on theory and simulation of electronic transport properties of nano-sized devices based on atomistic descriptions. The Theoretical NanoElectronics Group is closely connected to the Theoretical Nanotechnology Group. We work on common projects, have group meetings together and combine our research and teaching efforts.

**Current topics of interest** include:

- Molecular electronics.
- Combined electron and heat transport of semi-conducting nanosystems.
- Nanoelectronics of carbon based systems (e.g. graphene antidot lattices, carbon chains, carbon nanotube devices).
- Electron-phonon interactions, inelastic transport, and heating in atomic-scale conductors.
- Predicting the stability of molecular conductors in the presence of current.

**Organisational unit:** Section

**Theoretical Microsystems Optimization**

Department of Micro- and Nanotechnology

**Short name:** Theoretical Microsystems Optimization

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**Organisation profile**

Headed by Associate Professor Fridolin Okkels.

The group is established in 2009, the group is the youngest in the Theory Section. The research is based on topology optimization of microsystems in a framework developed at DTU Nanotech since 2003. The current activities in the group comprise structural optimization of fuel cells, magnetic cooling systems, non-Newtonian fluid systems, and surface properties to enhance specific functionalities. The group use structural optimization to improve existing and propose new micro and nanosystems, the vision is to unleash the hidden potential in optimizing the geometry of microsystems, and the strategy is to let structural optimization be a natural part in the design phase of microsystems at DTU Nanotech.

**Organisational unit:** Section

**Theoretical Biophysics**

Department of Micro- and Nanotechnology
Our research group is interested in the fascinating interplay of nano-science, biology and physics. Here we list some selected examples of projects:

**Geometry of Helices**
In a study of DNA we show that the double helix adopt a pitch in agreement with its volume fraction being optimized, i.e. that DNA is close-packed. It is shown that there exist long chiral structures for which the strain-twist coupling vanishes. The same analysis reveals the reason for DNA to overwind when stretched.

**Geometry of the Nucleosome and of Chromatin**
We investigate the intriguing structure of the nucleosome and of the chromatin fiber.

**Cold denaturation**
We calculate phase diagrams for polymers and investigate the peculiar phenomenon of cold denaturation.

Organisational unit: Section

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**Surface Engineering**
Department of Micro- and Nanotechnology
Short name: Surface Engineering

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The ability to customize surface properties is a powerful tool to make the surfaces biologically compatible and to enable biomolecular interactions. Combining chemical surface modifications with patterning techniques enables arrays of miniaturized biosensors to be constructed. The Surface Engineering group is developing and applying surface functionalization protocols that are simple, inexpensive, reliable and cleanroom compatible to obtain highly specific binding of biomolecules while simultaneously providing biocompatibility and minimizing nonspecific adsorption. Further, the group is developing methods to provide spatially addressable chemical patterns, tailoring individual surface areas to the specific surface properties needed. Because micro- and nanostructures controls many of the physical properties of the coatings the Surface Engineering group is actively pursuing research in combining multilayer coatings of inorganic and organic layers with micro- and nanostructures to develop new advanced tribological nano-coatings enabling significant improvements of the coatings mechanical, chemical and optical properties.

Stochastic Systems and Signals
Department of Micro- and Nanotechnology
Short name: Stochastic Systems and Signals

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Organisation profile
Research
People
Publications
Lunch Seminars
Organisational unit: Section

Silicon Microtechnology
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Organisation profile
Microreactors
The team is dedicated to research and development of silicon based micro- and nanofabrication technology, and applications of the technology in various areas such as surface science, chemistry, metrology, and sound and vibration. The Microreactor activity, within the Danish National Research Foundation centre CINF - Centre for Individual Nanoparticle Functionality (PI Professor Ib Chorkendorff), has a fundamental scope; here micro- and nanofabrication technology is applied in two lines of research, which are coordinated with activities within CASE – Catalysis for Sustainable Energy:

- Correlation between structure and reactivity of nanoparticles, where highly sensitive reactivity studies in micro- or nanoreactors are combined with atomically resolved STM studies in an attempt to experimentally determine the details of the structure-reactivity relation, and

- Photo-electro-catalysis with emphasis on applications within renewable energy.

Other activities have an applied scope, the most important of these are:

- MEMS Optical Sensor Systems supported by “Højteknologifonden” and in cooperation with Ibsen Photonics A/S, Brüel & Kjær A/S, and DTU Photonics.
- Vibrational energy harvesting using MEMS and polymer electrets, supported by FTP, and in cooperation with MEMS Applied Sensors.
- Vibrational energy harvesting using MEMS and piezoelectrics, in cooperation with MEMS Applied Sensors.
- Advanced ion etching of metals and polymers.
- Nanomachines, with Martin Dufva Fluidic Array Systems and Technology.
- The Micro and Nanotribology activity addresses stiction control of MEMS materials and devices, where the deposition and properties of fluorinated self-assembled mono-layers are studied with emphasis on their applicability to solve in-use stiction problems in MEMS systems. The activity is supported by The Danish Council for Technology and Innovation (FTP).
- Silicon MEMS Technology, supported by “Højteknologifonden” and in cooperation with Sonion MEMS A/S and Danchip, where more efficient microfabrication technology for silicon based microphones is developed.
- Nanoscopic measurements for the semiconductor industry, supported by “Højteknologifonden” and in cooperation with Capres A/S and Danchip, where probe measurement technology for ultra-shallow junction metrology in future nanometre-scale CMOS fabrication lines is developed. See Micro Sheet Resistance Probing for details.
Self-Organized Nanoporous Materials
Department of Micro- and Nanotechnology
Short name: Self-Organized Nanoporous Materials

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Organisation profile
The self-organized Materials for Nanotechnology has discovered a new procedure for rendering nanoporous polymers by selectively removing silicone from silicone-containing block copolymers. The groups research is carried out in close collaboration with the Danish Polymer Center at DTU Chemical Engineering. Headed by Senior Researcher Sokol Ndoni.

The nanoporous theme has developed around two focus research areas. The mapping of possible physico-chemical states of nanoporous polymers constitutes the first area, while the second area addresses possible applications of the materials. Realizing nanoporous polymers of varying structure, rigidity and surface chemistry have been typical activities of the first kind; typical activities of the second kind have been investigating the application of the materials as ultrafiltration membranes, as simultaneous filters & waveguides or as controlled delivery systems. At present the research barycenter is shifting from the first towards the second area. Expertises covered in the nanoporous group comprise controlled polymerization techniques, electron microscopy, small angle x-ray scattering, rheology and liquid chromatography. The polymeric materials developed by the group offer the very attractive possibility to combine self-organization (bottom-up) with micro and nanofabrication (top-down), the last being the traditional strength of DTU Nanotech. This combination is the bearing principle for the present efforts of the group to create liquid core waveguides for diagnostics applications. Successful preliminary results in using nanoporous polymers as templates for macromolecules, conductors (metals, polymers) and semiconductors have created the basis for expanded activities in this field in the near future.

Organisational unit: Section

Polymer Microsystems for Medical Diagnostics
Department of Micro- and Nanotechnology
Short name: Polymer Microsystems for Medical Diagnostics

Addresses
The PolyMeDiag group is focusing on the development of inexpensive and disposable all-polymer microdevices for Point-of-Care medical diagnostics. The devices will separate and differentially detect chemicals and infectious agents from body fluids based on microfluidics systems employing micro-patterned and functionalized conductive polymers for electrochemical detection.

The PolyMeDiag group is a multidisciplinary research team having experiences in biophysics, medico-technology, microfluidics and chemistry, device fabrication techniques, surface characterization and functionalization and electrochemical detection methods.

The current research projects are:

"Virus fishing": A microchannel-based device to facilitate differential attachment of virus particles on antibody-coated conductive polymer microelectrodes (funded by Danish Agency for Science Technology and Innovation)

Aptamer functionalized conductive polymer electrodes for virus detection (financed by DTU)

Microfluidics based separation and characterization of misfolded amyloid peptide from cerebrospinal fluid for early detection of Alzheimer’s disease (in collaboration with Statens Serum Institut, funded by Danish Agency for Science Technology and Innovation)

Separation and characterization of blood microparticles by nanotechnological methods for diagnosis of autoimmune diseases (in collaboration with Statens Serum Institut)

Organisational unit: Section

**Polymer Micro & Nano Engineering**

Department of Micro- and Nanotechnology
Short name: POLYMIC

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Organisation profile
The POLYMIC group focuses on micro and nano engineering methods based on a polymer materials platform. The group has strong competences in advanced clean room based polymer micro- and nanofabrication techniques. The technology platform includes fabrication of masters for injection molding by means of lithographic techniques, techniques for bonding of polymer parts, patterning of conducting polymer films, and surface modification by plasma polymerization. Polymer microfabrication competences are complemented by sensitive electrical measurements techniques, microfluidic techniques, surface analysis techniques, and Si/glass microfabrication techniques.

Current projects range from electrochemical sensing of neurotransmitter secretion from single cells and ion channels recordings to nanostructural functionalization of injection molded surfaces to obtain effects such as, self-cleaning, antistiction, and color-appearance.

The group continuously strives to identify new application fields for its core technological competences in order to enlarge its portfolio of application driven research projects.

Courses
The POLYMIC group is involved in teaching in the following courses
10030, 33336

POLYMIC project portfolio

<table>
<thead>
<tr>
<th>Project</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIPoC</td>
<td>Center for Integrated Point of Care technologies, grant from Danish Agency for Science, Technology, and Innovation with DELTA and Statens Serum Institut.</td>
</tr>
<tr>
<td>PolyNano</td>
<td>Strategic Research Center with participation of more than 20 industrial and academic partners</td>
</tr>
<tr>
<td>NanoPlast</td>
<td>NanoPlast, DNATF Platform with participation of 4 DTU departments and 11 industrial partners</td>
</tr>
<tr>
<td>PILOC</td>
<td>Low cost, high performance biochip enabling cheaper and faster drug development. DNATF project with Sophion Bioscience</td>
</tr>
<tr>
<td>Wafer based integrated camera module for cell-phones</td>
<td>DNATF project with Kaleido Technologies APS, Nokia Denmark A/S, CemeCon Scandinavia A/S, and DTU-Mechanical Engineering</td>
</tr>
</tbody>
</table>

Organisational unit: Section

Polymer Microsystems for Cell Processing
Department of Micro- and Nanotechnology
Short name: Polymer Microsystems for Cell Processing

Addresses
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The PolyCell group develops advanced polymer microtechnology based tools for the analysis and manipulation of cells and organic molecules. The polymer microtechnology platform being developed addresses time efficient and cost efficient fabrication of highly controlled microenvironments with particularly focus on functional surface chemistry applied by wet chemistry, photochemistry, or plasma polymerization. Targeted surface functionalities include functionalized conductive polymer circuits for stimulation and sensing, and surface chemistry controlling cell adhesion and cell stimulation. The major application area lies within culture or analysis of sensitive human cells that require more accurate microenvironmental control than offered by traditional cell culture. Polymer microfabrication activities are complemented by cell biology and molecular biology competences addressing biological responses to the engineered microtechnology, including targeted differentiation and directed cell migration.

Competences
The group has strong competences within

- fast prototyping of microfluidic devices with particular focus on injection molding,
- surface modification by wet chemistry and plasma polymerization,
- patterning of conductive polymer films,
- chemical and topographical surface analysis,
- automated timelapse microscopy analysis, and
- cell biological analysis.

Research projects
The PolyCell group currently participates in the following externally funded projects:

**IndiTreat:** Individualized chemotherapy treatment of colorectal cancer patient by advanced polymer micro- and nanotechnology technology to test all available combinations of chemotherapeutic drugs on each patient's cancer cells.

**Microshaping hydrogels in 3D:** Two-photon based fabrication of soft hydrogels with 3D structures similar to human tissue for testing the directed motion of dendritic cells used in cell-based cancer immunotherapy.
**PolyNano:** Large-area transfer and patterning of biomolecules during injection molding to support capture, culture, and analysis of immune cells used in cell-based cancer immunotherapy.

**PILOC:** Next generation polymer-based chips for automated patch clamp analysis.

**CELLGIGS:** Technology foundation for next-next generation polymer-based chips for automated patch clamp analysis.

**Courses**
The group contributes to the following courses at DTU:

33236 LabChip-1: Bio/chemical microsystems on chips

33481 Polymer Micro Fabrication

33482 The Biocompatibility of Materials

**Organisational unit:** Section

**Optofluidics**
Department of Micro- and Nanotechnology
Short name: Optofluidics

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**Organisation profile**

**Nano-Optics**
Our nano-optics research focuses on optical approaches for sensing and actuation on the nano-scale. The devices are made in a polymer-based platform to facilitate their integration with our nanofluidic applications.

Dye-doped polymer photonic crystal lasers enable high resolution sensing of biological and other organic compounds via refractive-index-based detection.
Plasmonic V-grooves offer sub-wavelength confinement of light that is interesting for photonic circuit miniaturization and lab-on-a-chip applications. Reconfigurable photonic crystals are light-diffractive elements that can be dynamically tuned in real-time for the purposes of redirecting light in order to adjust room brightness and lighting quality. Random lasers have fascinating emission properties that may find applications for inexpensive remote sensing, vehicle identification and street lighting.

**Nanofluidics**

Nanofluidic devices, fabricated by direct nanoimprint or reactive-ion etching, are used as a platform for analysis of single DNA molecules in solution. In nanoconfinement, DNA molecules will unwind and stretch such that their inherent information is more readily accessible. For the experiments, the DNA molecules are stained and visualized by fluorescence microscopy. We use these techniques to develop a next generation of DNA sequencers based on single molecules. In this path, we study devices and protocols to manipulate and sort single DNA molecules, and investigate the potential of nanoplasmonic resonators for sensing. Light-induced local heating of the nanofluidic devices is used for moving, exciting or trapping individual molecules, or even their parts.

**Nanofabrication**

Our nano-optics and nanofluidics research is supported by technology development in nanofabrication based on electron beam and nanoimprint lithography (NIL) in the DANCHIP clean room at DTU. Our research in nanofabrication is focused on up-scalability of devices for large-scale production. Select materials, such as sol-gels and organically modified ceramics (ORMOCER™), are used to create devices by adding functionality via nanostructuring thin-films using nanoimprint lithography. For some applications we also modify the thin-film materials by introducing organic dyes to provide optical gain and energy conversion (LILH), or nanocrystals to achieve nanoporousity. Examples include nanoimprinted plastic photonic crystal dye microlasers, <all-silica nanofluidic devices fabricated by direct nanoimprint in sol-gel, plasmonic V-groove and metamaterial devices.

Part of our research is targeted toward developing NIL for the nanostructuring of non-planar and free-form surfaces. This research line aims to extend the lateral resolution of injection-molding plastic production technology (NanoPlast) from 50 µm to 100 nm.

Organisational unit: Section
would be interesting for so-called 'point of care' diagnostics.
Organisational unit: Section

Nanointegration
Department of Micro- and Nanotechnology
Short name: Nanointegration

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Organisation profile
Nanointegration group at DTU Nanotech
We develop tools and techniques for interfacing nanostructures to the macroworld. Current research interests and projects include

- Synthesis and engineering of graphene, and integration with silicon microsystems (NANOENGINEERED GRAPHENE DEVICES)
- Nanostructured graphene: fabrication and properties (HOLEY GRAPHENE, GRAFOL)
- Graphene interfaces to molecular electronics (GMOL)
- Micro four point probes for fast characterisation of high performance semiconductor systems (MECNANO)
- Tools and methods for nanoassembly of highly customised scanning probes (NANOBITS)
- Focused ion beam milling: ultrafast prototyping in membrane chips (NANOBITS)
- Insitu TEM: materials science inside a scanning electron microscope (GMOL, GRAFOL)
- We are also involved in other projects
- Topology optimised superhydrophobic surfaces (NANOVATION)
- Carbon nanomaterials for applications in cell-interfaces (TECHNOTUBES)
- As well as collaborative networks:
  - NanoTP (Nano from theory to practice) - European COST action
  - ECNANOMAN (European-Chinese collaboration project on nanomanufacturing)
Read more about our research interests and projects here.

The nanointegration group
We are a tightly nit team working together on many exciting projects. See who we are and our projects.

Students and jobs
Jobs: We have a few open positions, which you can find on the institute homepage from December 1, 2011, in relation to a new basic research center on nanopatterned graphene.

Students: we get a large number of requests from people who are interested in working in the group. We look through all proposals and try to answer as many of them as we can. We do not accept internships (from a limited capacity point only), but we are happy to hear from students interested in master and phd projects.

The Nanointegration research group is headed by Associate Professor Peter Bøggild.

Organisational unit: Section

**Nano Bio Integrated Systems**

Department of Micro- and Nanotechnology  
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**Organisation profile**  
The NaBIS group aims to be the leading authority in integration of micro- and nanoscience in biology. We aim to uncover the physical properties of biological structures in order to learn how to manipulate them in a controlled manner and build lab-on-a-chip systems for their analysis. Our vision is to commercialise our results and create point-of-care medical devices. This we will achieve by doing application-based research, tackling known issues and adapting methodologies to micro- and nanotechnology.

Organisational unit: Section

**Molecular Windows**

Department of Micro- and Nanotechnology  
Short name: Molecular Windows

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Organisation profile
Background:
Biologists, chemists and physicists lack tools to observe the ubiquitous processes in liquids with nanoscale resolution. Our work aims at developing novel tools based on micro and nanofabricated devices for high resolution imaging with light and electron microscopes to provide new insights into biological, physical and chemical processes.

Projects:
In-situ TEM of nanoelectronics: We are working on methods that allow us to follow the creation of nanodevices in-situ TEM by nanowire growth, and also the processes taking place in nanodevices with nanowires during use. See FTP Project “Nano-Live” on Imaging Nanoelectronics Live by Transmission Electron Microscopy. Danish Research Council for Technology and Production Case No. 10-082797

Imaging nanoparticles in food: EU project FP7-Nanolyse - Nanoparticles in Food: Analytical methods for detection and characterisation.

Creation of nanotube electrodes of cellular measurements and characterization of the cell-nanotube interface. EU project FP7-Technotubes (Technology for Wafer-Scale Carbon Nanotube Applications) (2009-2012) - Grant agreement no.: CP-IP 228579-1.

Environmental electron microscopy methods have been developed for mainly studying gas phase reactions, but live imaging of processes in the liquid phase is lagging behind. We are developing microfluidic system with thin membrane windows that are transparent to the electron beam in SEM and TEM. Combining these windows with the diverse functionality of microfluidic chip systems makes it possible to obtain electron microscopic images with nanoscale resolution in liquids to study numerous processes under controlled conditions, such as biological, chemical and electrochemical processes.

DTU PhD project with DTU Center for Electron Nanoscopy (2009-2012), "Electron Microscopy of Liquid Processes". A number of our activities are based on exploring interactions between cells and nanostructures. We are developing focused ion beam milling combined with scanning electron microscopy to provide 3D images of cells based on standard and cryogenic fixation methods. We are also studying how cells move on nanostructured surfaces and how the surface chemistry and geometry influences the cell motility and developing time lapse microscopy techniques for this.

In addition we are working on developing a number of novel imaging and in-situ manipulation and control methods for electron microscopy together with the Center for Electron Nanoscopy (CEN) at DTU.

Organisational unit: Section

MEMS-AppliedSensors
Department of Micro- and Nanotechnology
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E-mail: info@nanotech.dtu.dk

Organisation profile
The MEMS Applied Sensors group at the Department of Micro- and Nanotechnology works on the development of all kind of mechanical sensors based on silicon technologies. This includes theory, design, fabrication, materials, packaging, tests and applications. Our main area of focus is multi sensor systems, biomedical sensing technologies and related materials science.

Multi-sensors are miniaturised sensors capable of measuring several parameters using a single silicon chip. One example of such a device is the sensor used in the Fish & Chips project: This sensor is based on a 3.9 × 7.3 × 1.2 mm3 small silicon chip that provides a pressure sensor, a light intensity sensor, a temperature sensor and a set of electrodes. The sensor allows for measuring the conductivity of the saline sea water. The Fish & Chips sensor is designed to measure essential parameters used to monitor fish behaviour in fisheries research. For this purpose the sensor is optimized for low power operation and designed to operate in harsh saline water.

An emerging research topic is within biomedical technologies, where we in particular investigate ways of making implantable devices such as pressure sensors for bladder control or sensors incorporated in an electronic patch for non-invasive monitoring of various physiological parameters e.g. heart beat rate or oxygen saturation in the human body. In the Electronic Patch project a custom made photodiode is integrated with an autonomous electronic system with the purpose of wireless health care monitoring.

More fundamental research is carried out in the fields of strained epitaxial films of silicon and SiGe as well as in silicon nano-wires. Piezo-electric materials and ways to exploit these materials in new functional sensors are also investigated. All sensors are made using silicon technologies in the DTU clean room facility Danchip, and many projects are carried out in close collaboration with the industry.

On these pages you can read about our research, and educational effort, download publications and look for available master and bachelor projects for students.

Organisational unit: Section

Magnetic Systems
Department of Micro- and Nanotechnology
Short name: Magnetic Systems

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Type of address: Postal address
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Phone numbers

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Web addresses

Web: http://www.nanotech.dtu.dk/Research/Research%20groups/Magnetic_Systems.aspx

E-mails

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Organisation profile

The Magnetic Systems (MagSys) group, led by associate professor Mikkel Fougt Hansen, provides magnetic functionality in lab-on-a-chip systems at the Department of Micro- and Nanotechnology, Technical University of Denmark (DTU) and carries out research in technological aspects of magnetism. Our current primary goal is to make and apply microsystems for manipulating and detecting micrometersized magnetic beads used for bioanalysis. Our approach is to base designs on careful theory and simulations, to quantitatively characterize the obtained results to the extent possible and to apply the systems on relevant biological problems. In addition, we also carry out research in magnetic nanoparticles. For the magnetic characterization, we use a state-of-the-art Vibrating Sample Magnetometer. Please follow the links below to learn about who we are, what we have published, what research we carry out, and which courses and projects we offer to students.

Organisational unit: Section

Fluidic Array Systems and Technology

Department of Micro- and Nanotechnology
Short name: Fluidic Array Systems and Technology

Addresses

Type of address: Postal address
Street: Ørsteds Plads
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City: Kgs. Lyngby
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Phone numbers

Phone: (+45) 4525 5700
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Web addresses

Web: http://orbit.dtu.dk/en/organisations/fluidic-array-systems-and-technology%2045fb2d52-df1c-4645-9cf4-d7255c6b6547%29.html

E-mails

E-mail: info@nanotech.dtu.dk

Organisation profile

The FAST group has the vision of developing practical and reliable methods for biomedical research. The FAST group has two main research areas: cell culture chip and DNA- and protein microarrays. Both methods are fundamental in biomedical research. However, the current technologies of both methods have significant limitation such as specificity and relevance of the results. In order further these technologies we will fuse microfluidics and nanotechnology with standard molecular biology techniques. Specifically we want

• To develop relevant microfluidic tools
To understand cell and molecule interaction with nano- and microstructured surfaces and perfusion flows
To study reaction kinetics of molecular and cells
To develop programmable high-throughput array toolboxes using
  – Shear stress control
  – Combinatorial capabilities
  – Cell programming with feedback
  – patiotemporal chemical control of environments

Organisational unit: Section

Colloids and Biological Interfaces
Department of Micro- and Nanotechnology
Short name: Colloids and Biological Interfaces

Addresses
Type of address: Postal address
Street: Ørsteds Plads
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Postal code: DK-2800
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Web addresses
Web: http://www.nanotech.dtu.dk/Research/Research%20groups/Colloids_and_Biological_Interfaces.aspx

E-mails
E-mail: info@nanotech.dtu.dk

Organisation profile
Chemical biology at nanoscale is a research field in a fascinating development. Nanomaterials are being investigated in connection to multiple new technologies within the fields of drug delivery, diagnostics and biosensors. Biocompatible nanoparticle systems are of particular interest in all these areas. In the drug delivery field, nanoparticles can target diseased tissue through surface functionalization with targeting moieties such as antibodies and peptides. Through this targeting the nanoparticles can carry encapsulated drugs to the diseased tissue and release the payload specifically in the tissue. By similar design, nanoparticles can be used to home tumor tissue allowing utilization as diagnostic markers for visualizing and diagnosing cancer.

Nanoparticle systems also provides new possibilities for diagnosing diseases from blood samples. By coupling antibodies to the surface of nanoparticles it is possible to measure the presence of antigens that are markers for disease, with much higher sensitivity utilizing a number of measuring techniques. Furthermore, nanoparticles have been utilized as sensors for measuring metabolites and pH in tissue, cells and specific cellular compartments.

The CBIO group is focused on nanoparticle design, synthesis, biophysical characterization and biological evaluation within the above mentioned technological areas. However, the focus is on the fundamental properties of these systems from a basic research perspective. Thousands of articles and patents have been published in these areas in recent years showing the great potential of such systems. Even so, there is a fundamental challenge that is not being addressed to the necessary extend, being the basic biological interactions with the artificial nanomaterials. E.g. drug delivery systems are being designed with high complexity where enzymes are activating the drug delivery carrier for drug release specifically at the active site. Before the nanoparticle accumulates at the diseased target site, it has to circulate in the blood stream for hours. This will most likely change the properties of the carrier completely due to protein adsorption, possibly resulting in a carrier that is insensitive to the enzyme that it was designed for. The understanding of how nanomaterials are altered by the biological milieu is completely neglected and needs to be addressed by material technologists and biologists if the highly intelligent designs we are envisaging and engineering are to be successful.

This is the main focus of the CBIO group, where synthetic chemists, biophysical chemists and cell biologists are working together to understand how highly engineered nanosystems are interacting with the biology milieu at protein, organelle
and single cell level. One example is the design of nanoparticle based sensors for measuring pH in intracellular compartments. To make successful designs we investigate the basic properties, such as stability, inertness and toxicity to find materials that are optimal for nanosensor technologies. We further investigate how surface functionalization impacts the internalization by cells and even utilize the sensors to investigate how other nanomaterials are effecting cellular behavior. Furthermore, through collaborations with world leading scientists we push the engineered systems into studies in animal models making new tools for in vivo imaging of cancer and drug delivery systems with improved efficacy compared to the free drug.

Organisational unit: Section

ChemLabChip
Department of Micro- and Nanotechnology
Short name: ChemLabChip

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Phone numbers
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Web addresses
Web: http://www.nanotech.dtu.dk/Research/Research%20groups/ChemLabChip.aspx

E-mails
E-mail: info@nanotech.dtu.dk

Organisation profile
In the ChemLabChip group (former µTAS) we are an interdisciplinary team of scientists combining our knowledge in making smart analytical devices applicable for real world problems. Click on the links below to find out more about our research and available projects.

Quick navigation:
Student projects
Publications

Research

Links

People

How to find us
BioLabChip
Department of Micro- and Nanotechnology
Short name: BioLabChip

Addresses
Type of address: Postal address
Street: Ørsteds Plads
Building: 345 Ø
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Country: Denmark

Phone numbers
Phone: (+45) 4525 5700
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Web addresses
Web: http://www.nanotech.dtu.dk/Research/Research%20groups/Biolabchip.aspx

E-mails
E-mail: info@nanotech.dtu.dk

Organisation profile
The BioLabChip group has expertise in manipulation, sorting and analysis of cells using DNA based techniques. The work involves DNA amplification by PCR chips, sample preparation for PCR based on dielectrophoresis (DEP) or magnetophoresis (MAP), microarrays for DNA analysis, integrated optics for real-time PCR, and optical cell analysis systems (flow cytometers). Other topics include the development of a highly-sensitive DNA hybridization platform using supercritical angle fluorescence measurement, on-chip dried reagents for multiplex genotyping, better dyes for real-time PCR, on-chip mini-sequencing, better DNA probe immobilisation, and solid-phase PCR.

Organisational unit: Section

Bioanalytics
Department of Micro- and Nanotechnology
Short name: Bioanalytics

Addresses
Type of address: Postal address
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Country: Denmark

Phone numbers
Phone: (+45) 4525 5700
Fax: (+45) 4588 7762
Bioanalytical Systems research interest is focused on the development of microfluidic bioassay systems based on enzymes, antibodies and cells, using multi-parameter detection systems (optical and electrochemical) for dynamic monitoring of cellular events in real-time to gain insight into biological processes at cell level.

Organisation profile

Amphiphilic Polymers in Biological Sensing
Department of Micro- and Nanotechnology
Short name: Amphiphilic Polymers in Biological Sensing

Addresses
Type of address: Postal address
Street: Ørsteds Plads
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Web addresses
Web: http://www.nanotech.dtu.dk/Research/Research%20groups/PolSens.aspx

E-mails
E-mail: info@nanotech.dtu.dk

Organisation profile
The research is focussed on utilizing self-organization principles to achieve goals within nanotechnology. The basic competence in the group is the ability to identify and synthesize (polymer) molecules that can solve a specific task. The group seeks suitable tasks through cross-disciplinary collaborations. As described in the discussion of self-organization below it is expected that each new task will require a unique solution.
At present the group is involved in projects on nanoparticle biosensors and on interfaces in composite materials:
In nanoparticle biosensors the goal is to achieve unprecedented spatial and temporal resolution in the study of cellular metabolism and utilize this resolution to gain insight in metabolism and processes at the cellular level. Functional nanoparticles are synthesized in microemulsions. The equilibrium nano-structured oil water microemulsion offers possibility for controlling the size, the surface-functionality and internal functionalities of the nanoparticles. Application of the nanoparticles as metabolite sensors are pursued in the FTP major project LiMeS.

In interfaces in composites materials the goal is to achieve understanding and control of the structures that determine the interfacial strength and the resulting influence of this strength on the macroscopic mechanical properties of the composite. Composite materials are used for a wide variety of application such as wind turbine blades and restorative dental materials.
Self-organization:
Self-organization has been perfected by nature to form the building blocks of living organisms. The present abilities of artificial self-organizing systems are bleak compared to nature and thus there is room for much development. Self-organization is based on a clever combination of incompatibility and connections. In other words, the systems have built-in both driving forces to separate and structures to prevent separation. If these two tendencies - separation and connection - are balanced correctly interesting structures ensue. By definition self-organization is a cooperative process; many molecules must find their position in some structure without actively being placed in the position. Apparently the desired structures are most likely obtained when the driving force for the single molecule are not too strong. In an analogy with landscapes it is easier to find your way to the lowest point in a soft rolling hill landscape than in a ragged mountain chain. You are less likely to get stuck in the wrong valley where steep sides could make it hard to get back out. In physical systems it is the free energy landscape that governs the behavior. Soft contour free energy maps are generally found close to phase transitions and self-organized systems in nature are often close to phase transitions, that is, close to condition where they are no longer stable. A consequence of the need to balance the different driving force carefully is that one cannot expect to build a large variety of things with the same building blocks. The building block need to be fine tuned to the task at hand.

The amphiphilic polymers in biological sensing group is headed by Kristoffer Almdal

Organisational unit: Section

Technology and Innovation Management
Department of Management Engineering
Short name: Technology and Innovation Management

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Fax: +45 4525 4800

Web addresses
Web: http://www.man.dtu.dk/English/Research.aspx

E-mails
E-mail: info@man.dtu.dk

Organisation profile
The Department aims to develop and utilise new knowledge about Systems Analysis, Production and Service Management, Management Science, and Technology and Innovation Management to benefit society. In that way the Department contributes to knowledge based growth and welfare with focus on competitiveness, productivity, sustainability, innovation and entrepreneurship.
Research at DTU Management Engineering is carried out in close cooperation with international research environments and industrial and public partners.
The Department's research is divided in five divisions and one centre with different disciplinary perspectives:

System Analysis

Production and Service Management
Organisation profile
The Department aims to develop and utilise new knowledge about Systems Analysis, Production and Service Management, Management Science, and Technology and Innovation Management to benefit society. In that way the Department contributes to knowledge based growth and welfare with focus on competitiveness, productivity, sustainability, innovation and entrepreneurship.

Research at DTU Management Engineering is carried out in close cooperation with international research environments and industrial and public partners.

The Department’s research is divided in five divisions and one centre with different disciplinary perspectives:

- System Analysis
- Production and Service Management
- Quantitative Sustainability Assessment

Management Science
Department of Management Engineering
Short name: Management Science

Addresses
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Management Science

Technology and Innovation Management

UNEP Risø Centre

Organisational unit: Section

**Production and Service Management**

Department of Management Engineering
Short name: Production and Service Management

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**E-mails**
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**Organisation profile**
The Department aims to develop and utilise new knowledge about Systems Analysis, Production and Service Management, Management Science, and Technology and Innovation Management to benefit society. In that way the Department contributes to knowledge based growth and welfare with focus on competitiveness, productivity, sustainability, innovation and entrepreneurship. Research at DTU Management Engineering is carried out in close cooperation with international research environments and industrial and public partners. The Department’s research is divided in five divisions and one centre with different disciplinary perspectives:

**System Analysis**

**Production and Service Management**

**Quantitative Sustainability Assessment**

**Management Science**

**Technology and Innovation Management**
Transport optimisation and technique
Department of Transport
Short name: Transport optimisation and technique

Addresses
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Web addresses
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E-mails
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Organisational unit: Section

Traffic modelling and planning
Department of Transport
Short name: Traffic modelling and planning

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Fax: +45 4593 6533

Web addresses
Web: http://www.transport.dtu.dk/
**Transport policy and behaviour**

Department of Transport  
Short name: Transport policy and behaviour

**Addresses**

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Fax: +45 4593 6533

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**E-mails**

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Organisational unit: Section

**Data- and Modelcenter**

Department of Transport  
Short name: Data- and Modelcenter

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**E-mails**

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Organisational unit: Section
Division of Epidemiology and Microbial Genomics

National Food Institute

Short name: Division of Epidemiology and Microbial Genomics

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Postal code: DK-2860
City: Søborg
Country: Denmark

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Phone: (+45) 35 88 70 00

Web addresses
Web:
http://www.food.dtu.dk/English/Service/About_National_Food_Institute/Organisation/Division_of_Epidemiology_and_Microbial_Genomics.aspx

E-mails
E-mail: food@food.dtu.dk

Organisation profile
The Division for Microbial Genomics and Epidemiology conducts research with the aim of understanding and predicting the emergence, occurrence and spread of infectious diseases in humans and animals. The division also supports national and global surveillance, detection and control of those infectious agents in humans, food and animals.

Research
The targeted research is concentrated on the evolution, spread and persistence of infectious agents, with a special focus on organisms with multiple transmissions pathways including zoonoses, antimicrobial resistant bacteria and food and waterborne transmitted pathogens.

Public sector consultancy
The division advises national and international authorities on the health risks posed by the presence of pathogenic microorganisms.
Specific advisory tasks for Danish Veterinary and Food Administration in collaboration with Division of Food Microbiology:
Central Coordinated Projects (CKL)
Case-by-case control
Salmonella Source Account
Outbreak investigations
“Strengthened efforts 2011 – 2014” (Styrket indsats 2011 – 2014)
Day-to-day advisory requests
Surveillance activities in collaboration with Division of Food Microbiology:
DANMAP
Zoonosis surveillance

Other tasks
The division maintains and have access to several databases. The databases contain data from surveillance, commercial analytical activities and research projects carried out by Division of Food Microbiology and Division for Microbial Genomics and Epidemiology whereas the Zoonosis Centre is responsible for data handling, maintenance and development of databases.

Education
The Division is responsible for the organization and teaching at the following courses at DTU:
Risk Analysis in Food Safety (23271)

General Medical Microbiology (23258)

Antimicrobial resistance and bacterial typing (23210)

Fighting bacterial Infections (23205)

Quantitative Microbiological Risk Assessment (23231)

Risikoanalyse og modellering - Diplomingeniøruddannelse i fødevareanalyse (23921)

In addition, the Division contributes to the teaching at the following courses at DTU:

Food Safety in Production Chains (23201)

Afgangsprojekt - Diplomingeniøruddannelse i fødevareanalyse (20ECTS)

At Copenhagen University, Faculty of Life Sciences, the Division is responsible for the organization and teaching at two courses that are part of the Master in Food Safety and Food Quality

Risk Analysis of foodborne contaminants (150542)

Investigation of foodborne outbreaks (150553)

The Division is additionally involved in international courses. Teaching takes place mostly in developing countries and is targeted capacity-building courses, workshops and seminars.

Collaboration

National

DTU: Informatics, Systems biology
SSI; KU; The Danish Agriculture and Food Council (Landbrug og Fødevarer)

International

AHVLA; HPA; RVC; RIVM; BfR; ANSES; CDC; USDA; NIPH; NIHS; University of Brasilia
WHO – FOS; WHO – PAHO; The Nordic Zoonosis Centres (in Norway, Sweden, Finland and Iceland);

Contact

Acting head of division Jørgen Schlundt
Organisational unit: Section

Fluid Mechanics, Coastal and Maritime Engineering

Department of Mechanical Engineering
Short name: FVM

Addresses

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E-mails
E-mail: info@mek.dtu.dk

Organisation profile

Education
The Section and the Department offers a Msc in Coastal and Maritime Engineering and other attractive study opportunities, for instance the study to be a Naval Architect.

Research
The research of the section is concentrated on the following subjects:

Stochastic wave loads on ships and offshore structures

Parametric roll of ships

Propeller flows

Wave dynamics

Collision and grounding

Risk models for navigational safety

Monitoring and decision support

Composite materials

Structural mechanics

Sediment transport

Liquifaction

Scour and scour protection
Business
The Section collaborates with national as well as international companies, institutions and individuals, and the section is continuously adjusting and extending this collaboration network.

Organisational unit: Section

Center for Atomic-scale Materials Design

Center
Short name: CAMD

Addresses
Type of address: Postal address
Street: Fysikvej
Building: 311
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 173

Web addresses
Web: http://www.camd.dtu.dk/English.aspx

Organisation profile
The Lundbeck Foundation's Center for Atomic-scale Materials Design aims at developing electronic structure theory to understand the properties of materials and use the insight to design new functional nanostructures.

Organisational unit: Center

BioChemical Engineering

Center
Short name: BioChemical Engineering

Addresses
Type of address: Postal address
Country: Denmark
Organisational unit: Center

Center for Nanoteknologi

Center
Short name: Center for Nanoteknologi

Addresses
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Country: Denmark

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Web: http://www.nano.dtu.dk/English.aspx

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Organisation profile

About Nano•DTU
NANO•DTU is the cross disciplinary center for Nanotechnology at DTU. Research groups from 15 departments participates. More than 600 researchers from DTU are members of Nano•DTU.

Research
Nano•DTU covers the full spectrum from basic research to applications. Nano•DTU is organized in five research themes, spaning from nanobio-technology to energy technology.

NanoDay 1st June
The next Nanoday will be on 1st June 2012. It will be a joint meeting with TUM (Munchen) and TU/e (Eindhoven). The talks will focus on energy related nanotechnology, whereas the poster session will be on nanotechnology in general.

Organisation unit: Center

FoodDTU
Center
Short name: FoodDTU

Addresses
Type of address: Postal address
Country: Denmark

Phone numbers
Phone: +45 4525 2991

Web addresses
Web: http://www.dtu.dk/centre/FoodDTU/English.aspx

E-mails
E-mail: subj@food.dtu.dk

Organisation profile
FoodDTU coorperates with the whole foodsector, delivering research results, innovation, highly educated candidates and research based advice to the authorities.
FoodDTU follow when offered grants for research and research actitivties.
Be updated on new research results, new programmes, education and innovation. We interview researchers and bring about facts and positions.

Organisational unit: Center

Center for Fluid Dynamics
Center
Short name: Center for Fluid Dynamics

Addresses
Type of address: Postal address
Country: Denmark
**Phone numbers**
Phone: +45 4525 3310

**Web addresses**
Web: http://www.fluid.dtu.dk/English.aspx

**E-mails**
E-mail: tbohr@fysik.dtu.dk

**Organisation profile**
Center for Fluid Dynamics at DTU, Fluid•DTU, is a collaboration between five departments at the Technical University of Denmark all working on different aspects of fluid dynamics.
All aspects of fluid dynamics are of interest to Fluid•DTU. Some of the main research themes are: Instability, bifurcation and chaos, drops, bubbles and interfaces, vortex dynamics, fluid dynamics at small length scales, and dynamics of complex fluids.
Organisational unit: Center

**Center for Fysisk Elektronik**
Center
Short name: Center for Fysisk Elektronik

**Addresses**
Type of address: Postal address
Country: Denmark
Organisational unit: Center

**Center for Individual Nanoparticle Functionality**
Center
Short name: CINF

**Addresses**
Type of address: Postal address
Street: Fysikvej
Building: 312
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

**Web addresses**
Web: http://www.cinf.dtu.dk/English.aspx
Organisational unit: Center

**Center for Fast Ultrasound Imaging**
Center
Short name: Center for Fast Ultrasound Imaging

**Addresses**
Type of address: Postal address
**Center for Energy Resources Engineering**

Center
Short name: Center for Energy Resources Engineering

**Addresses**
Type of address: Postal address
Country: Denmark

**Web addresses**
Web: http://www.cere.dtu.dk/

**Organisation profile**
The Center for Energy Resources Engineering was formed in 2009 with Professor Erling H. Stenby as its Director.

**Centre for Applied Hearing Research**

Center
Short name: Centre for Applied Hearing Research

**Addresses**
Type of address: Postal address
Street: Ørsted plads
Building: 352
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

**Phone numbers**
Phone: (+45) 4525 3932

**Web addresses**
Web: http://www.dtu.dk/centre/cahr/English.aspx

**E-mails**
E-mail: cvo@elektro.dtu.dk

**Organisation profile**
CAHR is a centre at DTU Electrical Engineering with the purpose of promoting research and education within the field of acoustic communication with emphasis on:

- Signal processing principles in the human auditory system
- Perceptual consequences of hearing impairment
- Final models of auditory processing and perception
Applications of auditory models in hearing instruments

Measurement and diagnosis of auditory function

Technical audiology and Speech perception

The is supported by three Danish hearing-aid companies Oticon, Widex and GN Resound and their foundations.

Organisational unit: Center

Arctic Technology Centre

Center
Short name: ARTEK

Addresses
Type of address: Postal address
Street: Kemitorvet
Building: 204, 2. sal
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

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Phone: (+45) 4525 2166

Web addresses
Web: http://www.arktiskcenter.gl/English.aspx

E-mails
E-mail: nih@byg.dtu.dk

Organisation profile
Arctic Technology Centre, Artek, was formally established in late summer 2000 to teach and provide in-service training for Greenlandic and Danish students and businessmen in Arctic technology. Artek also runs courses and seminars about Arctic conditions and contributes to research into Arctic technology. As a forerunner to the centre, various courses have been held about Arctic conditions over the last couple of years.
The Arctic Technology Centre is a collaboration between Sanaartormik Ilinniarfik (the Building and Construction School) in Sisimiut and the Technical University of Denmark in Lyngby.

In financial terms, Arctic Technology Centre is considered a DTU department with all the ensuing potential sources of revenue dependent on the number of students. The funding comes from the Greenland Government and from private foundations.

Organisational unit: Center

Center

Technical University of Denmark
Short name: Centre

Addresses
Type of address: Postal address
Country: Denmark
Technical University of Denmark
Short name: Technical University of Denmark
Main Research Area: Technical/natural sciences

Addresses
Type of address: Postal address
Country: Denmark
Organisational unit: Institution

Secretariat, IT
Department of Energy Conversion and Storage
Short name: Secretariat, IT

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Postal code: DK-4000
City: Roskilde
Country: Denmark

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E-mails
E-mail: risoe@risoe.dtu.dk
Organisational unit: Section

Safety & Infrastructure
Department of Energy Conversion and Storage
Short name: Safety & Infrastructure

Addresses
Type of address: Postal address
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Proton conductors
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Short name: Proton conductors

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Short name: Mixed Conductors

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Short name: Management

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Organisational unit: Section

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Short name: Imaging and Structural Analysis

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Organisational unit: Section

Fundamental Electrochemistry
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Short name: Fundamental Electrochemistry

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Organisational unit: Section

Functional organic materials
Department of Energy Conversion and Storage
Short name: Functional organic materials

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Organisational unit: Section

Electrofunctional materials
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Short name: Electrofunctional materials

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Organisational unit: Section

Department of Energy Conversion and Storage
Technical University of Denmark
Short name: DTU Energy

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In a sustainable energy system, with much energy coming from solar energy and wind energy, which by their nature are highly variable, it is essential to transform and store energy. Department of Energy Conversion and Storage focuses on technologies and materials for the conversion of various forms of energy and their subsequent storage. Such technologies will play a major role in an energy system based on renewable energy sources.

Fuel cells, electrolysis cells, batteries, solar cells and thermoelectric components are important examples of the department's research into conversion technologies. Fuel cells and batteries (during discharge) convert chemical energy directly into electrical energy, while electrolysis cells and batteries (during charge) convert electrical energy into chemical energy. Solar cells convert energy from sunlight into electrical energy, and thermoelectric components convert heat into electricity. Common to these technologies is that the conversion happens without ' movable parts', i.e. without using mechanical energy as an intermediate step. This gives potential for high efficiency.

The problem of storage is closely related to conversion technologies: Most of the renewable energy sources, which will be prevalent in the future sustainable energy system, are fluctuating by nature. This applies in particular to solar and wind energy. It is therefore difficult to ensure a balance between production and consumption, if there is no possibility for storing electrical energy. This can be done either in batteries or in the form of an energy rich fuel produced by electrolysis. An obvious candidate for such an energy carrier is hydrogen, which can be stored in solid form in e.g. metal hydrides. Alternatively, it is possible to produce synthetic fuels for vehicles using electrolysis. This will allow renewable energy to be incorporated into the transport sector without costly new infrastructure. Such storage technologies are another key area of focus at the new department.

DTU Energy Conversion has been established by gathering world-class competencies from different departments at DTU. From Risø DTU: Fuel Cells and Solid State Chemistry Division, an international leader in solid oxide fuel cells and electrolysis cells, the Solar Energy Programme, which has a unique position within polymer solar cells and parts of the Materials Research Division, which, among other things, is occupied with batteries, energy storage and superconductivity. From DTU Chemistry comes a strong research group specialising in polymer fuel cells.

Head of Department: Søren Linderoth
Organisational unit: Department
Atomic scale modelling and materials
Department of Energy Conversion and Storage
Short name: Atomic scale modelling and materials

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Organisational unit: Section

Applied Electrochemistry
Department of Energy Conversion and Storage
Short name: Applied Electrochemistry

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Organisational unit: Section
Programmable Phase Optics
Department of Photonics Engineering
Short name: Programmable Phase Optics

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Phone numbers
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Web addresses
Web: http://www.fotonik.dtu.dk/

Engineering Design and Product Development
Department of Mechanical Engineering
Short name: Engineering Design and Product Development

Addresses
Type of address: Postal address
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Web addresses
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E-mails
Organisation profile

Education
The Section offers teaching within the following disciplines:
Conceptualisation
Engineering Design
Product development
Product life and environmental issues
Product/Service-Systems
User interaction
Mechatronics
Computer Aided Design (CAD)
Innovation
The section also plays a central role in the Design & innovation education.

Research
Research groups at the section work with:
Product life
Design
Mechatronics
Engineering Knowledge Management
Multi Product Development
The staff are all part of associations and network cooperations within these areas.

Business
The section has a strong tradition for cooperating with Danish as well as foreign companies about innovation through product and organisation development projects.

Section for Construction Materials
Department of Civil Engineering
Short name: Section for Construction Materials

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The mission of the International Centre for Indoor Environment and Energy (ICIEE) is to serve to achieve healthy, comfortable and productive indoor environments with minimal energy consumption. The activities focus on three critical issues:
1. Impact of indoor environment on health, comfort and performance of people (including buildings and vehicles)
2. Development and study of advanced and energy efficient systems for heating, ventilation, and cooling of spaces
3. Dissemination of results through papers, conferences, education and standardisation

ICIEE will be the world leading research centre on indoor environment and energy. ICIEE will provide planners and producers of buildings and HVAC systems with criteria, methods and tools for achieving an optimal indoor environment by design and during operation of low energy buildings and energy efficient HVAC systems.
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Organisational unit: Section

Section for Building Design
Department of Civil Engineering
Short name: Section for Building Design

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Organisational unit: Section

Section for Geotechnics and Geology
Department of Civil Engineering
Short name: Section for Geotechnics and Geology

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Organisation profile
The vision of the section is to establish a coherent understanding of the interplay between geological and geotechnical conditions and to form the basis for resource utilisation, including exploitation of natural resources from Danish and Greenlandic subsoil.

The research projects taking place currently at the section are focused on the rock mechanical and geochemical behaviour of sediments and sedimentary rocks, design of monopile foundations for offshore wind turbines and constitutive models for soil and rock.

The employees of the Section for Geotechnics and Geology participate actively in the design of large infrastructure projects in Denmark by providing consultant services.

Organisational unit: Section

Section for Structural Engineering

Department of Civil Engineering
Short name: Section for Structural Engineering

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Organisation profile
Welcome to the Section for Structural Engineering!
This site shall inspire you to discover the versatile facets of Structural Engineering at the Department of Civil Engineering. Our activities in research, teaching and collaboration inside and outside Denmark are carried by the personal effort and ambition of our international academic and technical staff. The areas comprise traditional structural engineering disciplines such as materials and designing in concrete, steel and wood, but also specialised areas such as dynamic behaviour under wind and earthquake loading and risk assessment in the perspective of significantly changing environmental boundary conditions.

Our research activities do not stand alone but reflect on our teaching either in courses or through project work. We are proud on the tradition to include our students early on in leading-edge research.
Feel invited to learn more about Structural Engineering at DTU-Byg.

Yours sincerely
Jeppe Jönsson
Section Head
Organisational unit: Section

Section for Building Physics and Services
Department of Civil Engineering
Short name: Section for Building Physics and Services

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Organisation profile
Buildings have to be energy efficient, durable, and have a good indoor climate to meet the users’ demand for functionality and economy and society’s demand for energy conservation and environmental improvements. A holistic approach to the building envelope and installations is the basis for creating buildings with a good indoor climate and low energy consumption. This subject area deals with interaction between the building envelope and installations, and intelligent methods of controlling them. The area is central both in connection with design and operation of buildings and in connection with the development of construction products and system solutions.
The subject area deals with the technical, social and environmental problems that require a development towards sustainable building design based on energy conservation and sustainable energy systems.
The subject area deals with building envelope design including windows and solar shading devices plus building services including solar heating systems.
The subject area combines research into and development of buildings with:

- a good indoor climate (basic needs for humans)
- good functionality (users’ wishes)
- low energy consumption (society’s needs, with regard to environment and resources)
- high durability (of common interest to individuals and society)
- good life cycle cost (of common interest to individuals and society).
The subject area is of relevance to new building as well as to renovation and maintenance of existing buildings. In the light of the great value that buildings and infrastructure represent, the maintenance of knowledge and research in the field is of great economic importance.

The Sections main research topics are Building Physics, Solar Energy, and Building Service and Energy.

Associate professor Carsten Rode, Section Manager

Organisational unit: Section

**Physical and Biophysical Chemistry**

Department of Chemistry

Short name: Physical and Biophysical Chemistry

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Organisation profile

Physical and biophysical chemistry analyzes and applies the general principles determining the properties and behavior of physical, chemical and biological systems. The physical principles range from thermodynamics to laws of quantum physics. A unique feature of physical chemistry is that its methods and results are applicable in all areas of chemistry. In addition, physical chemistry is characterized by the close interaction between theory and experiment, and modern physical chemistry research is dominated by the description of systems on a molecular level.

Research

The research projects in the group are naturally divided into two main areas:

Molecular Dynamics and

Chemical Reactivity

Solid State Electrochemistry.

The research effort in the dynamics and reactivity of molecules is based on theoretical methods and the focus is on an atomistic description of chemical and biological systems. The research in Solid State Electrochemistry is mainly experimental and deals with the electrochemical aspects of the motion of ions in solids.

Organisational unit: Section

**Centre for Catalysis and Sustainable Chemistry**

Department of Chemistry

Short name: CSC

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Organisation profile
Vision
The Centre for Catalysis and Sustainable Chemistry’s goal is to develop novel chemistry and to improve already known processes, toward a cleaner chemical industry thereby securing the future for the next generations in terms of energy, resources and the environment.
Main Tools
• Advanced materials
• Catalysis
• Molecular characterization
• Renewable chemical platforms
• Industrial connections
Organisational unit: Section

Energy Systems Analysis
Systems Analysis
Short name: Energy Systems Analysis

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Organisation profile

In Energy Systems Analysis we combine technical and economic research focussing mainly on quantitative analysis within energy research. We develop methods and models and use these for technical, economic and policy analysis. Research activities are grouped into the four areas:

- Macro-economics, econometrics, and forecast models
- System modelling, optimization, and simulation
- Micro-economics, regulation, and policy analysis
- Evaluation and integration of new energy technologies

New research areas from 2013:

- Analyses and modelling of hourly electricity consumption by individual customers. This will be based on data that is available from hourly electricity meters.
- Analyses of energy savings, behaviour, incentives, policy instruments, and macro-economic effects.

Energy systems are facing a number of challenges, e.g. Internationalisation with more cross-border trade, especially of electricity, Integration of large amounts of variable, only partly predictable renewable energy with low marginal costs, and Investors are confronted with higher risk and uncertainty, partly as a consequence of market liberalisation and partly because of the two above mentioned issues. Moreover, long-term targets of abandoning the use of fossil fuels and improving energy efficiencies is challenging.

Our research is organized in projects, typically interdisciplinary, in collaboration with external partners, and covering several research areas. Most of our research is externally funded and we try to balance funding from Danish research programs, EU-research programs, and commercial contracts.

Last updated by Poul Erik Grohnheit 16.09.2012
Responsible: Poul Erik Morthorst
Organisational unit: Group
models in collaboration with other universities.

**Mitigation**
Global warming affects the climate worldwide. By reducing the CO2 emissions we can slow the progression. That is why we need sustainable energy technologies and intelligent energy systems. In the short term, the upward curve of CO2 emissions needs to be turned downward. In the long term energy system must be changed radically, so that the CO2 emissions by 2050 are lowered by 50%. DTU develops the necessary technologies and systems and work on having them implemented as soon as possible.

**Adaptation**
Adapting the world to a changing climate is a major global challenge, and climate change will increase inequality in the world, since already vulnerable regions in many developing countries will suffer most. Also Europe and Denmark will face threats such as sea-level rise, temperature rise and more extreme weather. DTU contributes to building up the necessary knowledge, so that society can adapt sectors and infrastructure to a changing climate.

Organisational unit: Group

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**Radiation Physics**

Center for Nuclear Technologies
Short name: Radiation Physics

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**Organisation profile**
The aim of the programme is:
to improve knowledge and methods in the field of radiation physics and radiation dosimetry
to develop new radiation measurement instruments and methods for application in research, industry and medicine
to develop methods in radiation protection and in nuclear emergency preparedness
Currently the work includes:
Developing luminescence dosimetry methods for retrospective dosimetry including methods for dating of geological deposits
Developing dosimetry methods for in-vivo medical dosimetry.
Developing models for atmospheric dispersion of radioactivity.
Developing methods for high-dose dosimetry and operating the accredited Risø High Dose Reference Laboratory.
Head of Programme: Bent Lauritzen
Organisational unit: Section
Radioecology and Tracer Studies
Center for Nuclear Technologies
Short name: Radioecology and Tracer Studies

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Organisation profile
The aim of the programme is:
to study the transport and uptake of stable and radioactive substances in the environment,
to develop methods for assessment of the environmental impact of these substances, and
to apply radioecological and radioanalytical methods and principles for the investigation of general environmental problems.
More specific sub-targets of the programme include:
Identification of important mechanisms and physical/chemical forms that determine the transport and impact of radioactive and non-radioactive pollutants in marine and terrestrial ecosystems. The aim is to achieve more realistic risk assessments.
Implementing ICPMS (Inductively Coupled Plasma Mass Spectrometry) for measurement of stable and long-lived isotopes in environmental samples as a supplement to the radiometric methods used in the programme.
Maintaining and further developing radiometric measurement capabilities and radioecological expertise of use for national and international authorities and organisations as well as commercial enterprises.
Developing and applying radioanalytical reference methods for the quantification of elements of significance for health and environment.
Contributing to the scientific background for safe storage and disposal of radioactive waste.
In addition the programme carries out monitoring of environmental radioactivity in Denmark and around Riso in order to take care of national obligations (Euratom Treaty and Helsinki Convention) and requirements from the Danish nuclear and radiation safety authorities related to the nuclear facilities of Danish Decommissioning.
Head of Programme: Sven P. Nielsen
Organisational unit: Section

The Hevesy Laboratory
Center for Nuclear Technologies
Short name: The Hevesy Laboratory

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Street: Frederiksborgvej 399
The Hevesy Laboratory is a radiochemical and radiopharmaceutical facility situated at Risø National Laboratory for Sustainable Energy. The laboratory has a 16.5 MeV proton biomedical cyclotron equipped with a beam-line for in house production of many radioisotopes, most important presently F-18 for PET scanning. The Laboratory has two clean rooms complete with hot-cells for production of radiopharmaceuticals at high activity levels. Other parts of the laboratory are designated for Quality Control, radiochemical and radiopharmaceutical development and for production of radioisotopes and radiotracers for non-medical purposes.

The Hevesy Laboratory participates at many levels in the development of new diagnostic and therapeutic radiopharmaceuticals. The present large scale growth of PET and PET/CT imaging capability throughout the world opens important opportunities for development and clinical dissemination of new diagnostic PET tracers, supplementing the already very successful cancer tracer FDG.

The laboratory has the infrastructure, organization and all necessary permissions for radiopharmaceutical manufacture. FDG is produced large scale on a routine basis and is distributed under the laboratory’s marketing authorization to hospitals in the region and throughout Denmark.

As back-up facility, the Laboratory has been able to deliver large batches of FDG allowing full use of two whole body scanners even as far away as Norway.

The development work is at present concentrated along four major lines of approach:

Development of new diagnostic PET tracers based on F-18
Development of new diagnostic radiopharmaceuticals based on short-lived radioactive metals ions conjugated to biomolecules.
Development and production of new radionuclide therapy agents.
Research in labelling chemistry to expand the radiochemist’s toolbox.

The laboratory is built on a 50 year long tradition of radioisotope work at Risø, but with strong links and many years of practical experience from National and international PET facilities. The laboratory combines competence in cyclotron and reactor isotope manufacture with radiochemistry.

The Hevesy Laboratory will be happy to respond to inquiries for new tracers and radiopharmaceuticals, new or hard-to-get isotopes and radiochemicals or collaborations using our facility and expertise in radioisotope work and labeling.

Head of programme: Dennis Ringkjøbing Elema
The Hevesy Laboratory was inaugurated in May 2005 and is named in honour of the Nobel Laureate George de Hevesy, father of the isotope tracer principle. The John and Birthe Meyer Foundation has donated the cyclotron that has made the project possible.

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Organisation profile
Center for Nuclear Technologies is Denmark’s national competency center for nuclear technology. With roots in research in the peaceful use of nuclear power, DTU Nutech works with the applications of ionizing radiation and radioactive substances for the benefit of society.

The Hevesy Laboratory develops radiotracers for the diagnosing of particularly cancer. The center’s expertise in radiation dosimetry is used both for radiation sterilization, for medical purposes and for dating. A third field of application is the studies and analysis of radioactive isotopes in the environment, in food and in materials. The center also monitors radioactive substances and radiation levels in the Danish environment, contributing to the national nuclear emergency.

DTU Nutech is organised into three departments:

The Hevesy Laboratory
Radiation Physics
Radioecology
The Center includes the former Risø Workshop, which, among other things, produces a so-called Risø TL/OSL Reader. The instrument is developed at Risø DTU and can be used for dating soil and sediments, for controlling any radiation of food and for retrospective dosimetry.

Center for Nuclear Technologies is located at DTU Risø Campus in Roskilde.

Director: Jens-Peter Lynov
Organisational unit: Department

Systems Analysis
Department of Management Engineering
Short name: Systems Analysis

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Country: Denmark
Organisation profile
Systems analysis is based on multidisciplinary research in the border field of physics, mathematics and economics addressing complex interactions and integration of entities within a given system boundary, subject to external conditions such as technological change, innovation, costs and environmental impacts. Quantitative methods and modelling are used to study the interaction between technology, infrastructure and markets - with the consequences for environment and climate.
In Northern Europe electricity demand is largest in the winter, while hydro power is available during the summer. International trade of electricity started nearly 100 years ago and the capacity for trade is increasing. High voltage cables, rather than overhead lines are becoming increasingly important.
The potential for wind power in the North Sea and Baltic Sea is huge, which will require further development of trade and markets. In contrast, the potential for biomass is limited.
Organisational unit: Section

Fluid Mechanics
Department of Wind Energy
Short name: Fluid Mechanics

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E-mails
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Organisation profile
The research of the Fluid Mechanics Section focuses on aerodynamics, aero-acoustics and aero-elasticity of wind turbines and turbulence in wind farms. The fundamental research in fluid mechanics includes laminar-turbulent transition, flow control, aero-acoustics, rotating flows, turbulence, and convection and heat transfer in boundary layers.
In recent years, most activities have concentrated on research in offshore wind energy such as the development of computing codes for predicting the combined loadings from wind and waves, and wake interaction within wind farms.
The research is carried out using Computational Fluid Dynamics (CFD), employing in-house developed as well as commercial computing codes, and experimental fluid mechanics (EFD), employing mostly optical methods, such as Laser Doppler Anemometry (LDA), Particle Image Velocimetry (PIV) and related techniques.
Organisational unit: Section

**Materials science and characterization**
Department of Wind Energy  
Short name: Materials science and characterization

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**Organisation profile**
The research activities of this section deal with light and strong metals, steels as well as nanometals. The objective is to perform materials science and development on a high international level with particular focus on materials and components for wind energy purposes.
The research activities cover:

- Processing of metals and alloys
- Structural and mechanical characterisation and modelling
- Structure, properties and performance

In connection with wind turbines, we characterise the structure of mechanical components before they enter into operation and during service; we quantify damage and characterise nanostructures and mechanical properties of e.g. steel wires for possible reinforcement of polymer composites for blades.

Focal research areas include plastic deformation and thermal treatment of light and strong metals and alloys, nanomaterials and dual phase alloys with high strength and hard nanosurfaces including graded structures for good wear and fatigue resistance.

Advanced characterisation techniques include non-destructive 3D x-ray measurements of internal structures and stresses using international synchrotron facilities in Europe, Japan and USA as well as advanced electron microscopy with high spatial resolution, crystallographic orientation measurements, local chemical analysis and in-situ mechanical testing of miniature samples (while mapping the microstructural evolution).

A common line of these projects is a fine-scaled microstructure in the materials (down to the nanometer range) and a similar fine scale of defects developing during operation which shall be characterised as a basis for modelling and optimisation.

New research areas with the objective of reducing cost and improving reliability and lifetime of metallic components in wind turbines will include wear and fatigue resistance steels, processing of surfaces by mechanical and chemical treatments, non-destructive 3D characterisation by x-ray tomography and quantification of residual stresses in surfaces and welds.

Organisational unit: Section
Composites and Materials Mechanics
Department of Wind Energy
Short name: Composites and Materials Mechanics

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Organisation profile
The research of Composites and Materials Mechanics is particularly relevant for the development of blades for very large offshore wind turbines where weight savings are of great importance.
The section focuses on development of new fiber composite materials and on increasing the knowledge and description of existing composite materials, particularly with respect to strength, fatigue, durability and damage tolerant behavior. The field includes manufacturing and processing, characterisation of microstructures, modelling of materials, and characterisation of mechanical properties, non-destructive evaluation and structural health monitoring.
Key research areas are new composite materials (e.g. biomassbased composites and hybrid composites), process technology, compression, fatigue and fracture, adhesive joints, micromechanical testing with in-situ observations (utilising the electron microscope expertise of the Materials Science and Characterisation Section), micromechanical modelling as well as the development of new advanced mechanical testing methods and structural health monitoring.
The research is applicable for the lifetime of a wind turbine rotor blade, from development of concept, design, manufacturing, quality control, operation and maintenance to decommission.
The section has a laboratory for the manufacturing of fibre composites (materials, test specimens, prototypes) and a DANAK accredited laboratory for mechanical characterisation. The reorganisation is expected to lead to new research projects in the area of connecting macroscale and structural scale modelling and testing. Another new possible area for expansion is the manufacturing of prototype wind turbine blades (e.g. smart blades incorporating shapechanging composite structures and embedded sensors) in close collaboration with the sections Wind Turbines and Aeroelastic Design.
Thus, the section contributes to the focus area “Light and Strong Materials” and provides knowhow to other focus areas such as structural design and safety and aeroelastic design.

Organisational unit: Section

Aeroelastic Design
Department of Wind Energy
Short name: Aeroelastic Design

Addresses
Type of address: Postal address
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Building: 118
The research in the Aeroelastic Design Section is focused on the development of aero-servo-elastic simulation methods, computational fluid dynamics (CFD) codes and software design tools for analysis of airfoils, blades, and wind turbines, and application for design in interaction with the industry. Aeroelastic stability analyses and experiments to determine modal damping properties of a wind turbine, is part of this. The research is going hand in hand with experimental validation and is aiming at continuously extending the design basis for optimisation and up-scaling of existing concepts as well as paving the way for new concepts and principles.

By combining models for atmospheric flow- and wakes, aerodynamics, structural dynamics and control into aeroelastic codes, we can simulate and predict the extreme and fatigue loads that a wind turbine will experience during its lifetime under different complex conditions, e.g. in a wind farm. Offshore operation is also simulated taking wave loadings or floating conditions into account. The tools are used as well for cost optimal layout of wind farms, taking a variety of parameters into account.

New dedicated airfoils like thick high lift- or multi-element airfoils are developed and designed by means of aerodynamic engineering models and the Numerical Wind Tunnel in combination with numerical optimisation. They are verified by wind tunnel measurements and subsequently applied by the industry.

New concepts like individual blade pitch and distributed blade trailing edge control in combination with advanced sensoring technique is also subject to substantial research and development with the perspective of reducing fatigue and extreme loads, and thereby increase rotor size, energy capture and cost efficiency.

To further increase the detailed understanding and modelling capabilities of the complex interaction between terrain wind flow, rotor flow and structure, a full CFD/structure modelling has been performed. This will become part of the future design process.

Organisational unit: Section
The research of the Wind Turbines Section supports the industrial design of wind turbines covering three topics:

**Loads**
We develop methods to determine reliable design loads and structural design of wind turbines with emphasis on reducing the risk of failure. This involves the modelling and analysis of structural components such as blades, drive trains and support structure. We also model and analyse the extreme environmental conditions of waves and wind for offshore turbines. Validations with full scale measurements and lab scale measurements are performed on the predicted loads and structural response.

**Structure**
We develop methods and tools to predict structural response of the turbine and its components. The tools range from coarse beam models to very detailed 3D solid finite element models. Materials include composites and metals with special focus on imperfections and damage initiation/growth. Structural test methods are developed to improve the design process and reduce structural uncertainties. To validate the developed methods and tools we use blade and drive train test facilities.

**Design**
Furthermore, the section develops advanced design methods which can be used in the industry. Part of the research is focused on development and implementation of advanced models and efficient numerical optimisation methods used for rational structural design of wind turbine components. The design criteria in the formulations include weight, cost, stiffness strength etc. Examples of applications are optimal design of jacket foundations for offshore wind turbines and of laminated composite structures such as wind turbine blades where manufacturing limitations are taken into account.

Organisational unit: Section

**Test and Measurements**
Department of Wind Energy
Short name: Test and Measurements

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Evaluation of models and theories based on experimental work is fundamental to research in wind energy. Experimental methodologies are used both to test and evaluate theoretical models and to verify the performance of wind turbine designs and wind turbine component designs. This is a vital element in the understanding and quantification of the uncertainty in wind energy projects, and consequently an essential aspect in securing a competitive advantage of the wind energy industry.

The research of this section is aimed at the development of instrumentation and new methods for experimental determination of wind turbine characteristics, including test methods for the wind turbine industry. Special efforts are focused on remote sensing techniques using wind lidars. A major effort is the development of a new European research infrastructure called WindScanner. It is a laser-based remote sensing instrument for measurements of wind and turbulence in three dimensions around huge wind turbines.

The section also represents expertise in organising and conducting field meteorological measurements (wind resources and siting, boundary-layer meteorology, turbulence and aero-elastic design), and in providing instruments as well as data systems and data management for the Department of Wind Energy and external clients in the global wind industry. Research results are applied in international standards and also in national and international projects.

The Test and Measurement Section operates two test stations for large wind turbines at Høvsøre and Østerild on Jutland’s west coast. These areas have excellent conditions with high wind speeds and flat terrain. Therefore, we can verify both performance and the wind turbine design bases for all operating conditions relevant to large wind turbines up to 250 meters tall.

Organisational unit: Section

Wind Energy Systems

Department of Wind Energy
Short name: Wind Energy Systems

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Organisation profile
The section contributes to the development of better methods to integrate a significant share of wind power into the power system.

The research in wind power integration and control covers a wide range of subjects within these fields:

Wind power plants in the power system

Variability, prediction and predictability of wind power
Integrated design and control of wind turbines and wind farms

Application of advanced materials for wind turbine generators

The work combines theoretical and experimental aspects in time scales ranging from micro seconds to hours, aiming at:
Models and tools for understanding the impact on power systems when you introduce a higher share of the fluctuating wind power. The aim is to contribute to a platform that also integrates prediction, mesoscale modelling and market functionality.

Model development and validation for wind power plant functionality and capabilities.

Integrated electrical and mechanical design methods and approaches that interface the electrical and control tools with the mechanical and aeroelastic tools.

Innovation in wind power integration and control as well as planning and development of wind farms.

Methods and tools for testing grid compliance and power quality of wind turbines and wind farms.

Organisational unit: Section Meteorology

Department of Wind Energy
Short name: Meteorology

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Organisation profile
The research activities of the Meteorology Section are focused on the siting of wind turbines considering the wind resources, turbulence, extreme loads, wind farm wakes, and potential power production – all depending on the local wind climate.
The research areas are:
Boundary layer meteorology
Mesoscale and microscale modelling

Assessment of wind resources for power production

External design conditions for wind loads on turbines and various other structures

The scientific work includes the development of models of the mean flow, turbulence, extreme loads and background climate, wind resource assessment, combining mesoscale and microscale modelling, wake modelling, ranging from single turbine wakes to large wind farm cluster wakes, and weather forecasts on several time scales from short-term to inter-annual.

The modelling activities are closely connected to in-depth analysis of field measurements to further improve our understanding of the physical processes. The field investigations include observations over land and at sea, and encompass data on turbulence, wind profiles, and many other parameters including remote sensing data from ground-based instruments and satellites.

We also study environmental problems related to the transport of airborne pollutants and the turbulent exchange of matter during the interaction between the atmosphere and terrestrial or marine surfaces.

We offer both in-house and externally commissioned assessment studies. We maintain and offer training courses in the software programmes WAsP and WAsP Engineering, that are based on our wind atlas methodology and used all over the world to estimate external design conditions, predict wind climates, wind resources and power productions from wind turbines and farms. We offer courses in remote sensing for wind energy at PhD level.

Organisational unit: Section

Department of Wind Energy
Technical University of Denmark
Short name: DTU Wind Energy

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Organisation profile

Research
The Danish wind energy research environment is internationally recognized as being in the forefront of wind energy technology, and The Technical University of Denmark (DTU) has provided a major part of the wind energy research in Denmark.

Education
Based on intensive efforts in research, development, innovation and transfer of knowledge, the Technical University of Denmark (DTU) has for many years contributed to Denmark’s leading position in wind energy.
Innovation
An important part of the work at DTU Wind Energy is that research results are disseminated and used by Danish industry in order to support and develop the entire sector. DTU Wind Energy contributes to industry and society’s knowledge about wind energy and related areas through innovation, technology transfer and research based services.
Organisational unit: Department

DTU Danchip
Technical University of Denmark
Short name: DTU Danchip

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Organisation profile
DANCHIP is a national facility for producing components based on micro- and nanostructured materials for the use of research and industriel products.
Research and Education
The Unique possibilities for growing materials, micro- and nanostructuring and carachterisation in DANCHIP today is an integrated part of several research- and educational projects.
Industry at DANCHIP
As a partner of industry at DANCHIP you have the possibility to follow your ideas to create knew products and at the same time carry out the first production in a quality secured environment.
Organisational unit: Department

Novo Nordisk Foundation Center for Biosustainability
Technical University of Denmark
Short name: DTU Biosustain

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Country: Denmark
The Novo Nordisk Foundation Center for Biosustainability is an international research center at the Technical University of Denmark. The Center aims at transforming current chemical production to a more sustainable, biobased industry and is funded by a grant from Novo Nordisk Foundation.

The Center conducts research in metabolic engineering and synthetic biology to facilitate the emergence of the next generation of microbial production strains through development and application of new cutting edge technologies.

Two key objectives are:

- identifying the spectrum of chemistry that can be produced biologically
- shortening the time of production strain development through intelligent design of cell factories.

Impact on society by innovation has a high priority and the Center collaborates worldwide with biotech companies and chemical industry to facilitate the dissemination and exploitation of its results.

Organisational unit: Department

Network Reconstructions and in silico Biology

Novo Nordisk Foundation Center for Biosustainability
Short name: NRiSB

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Organisation profile
Network Reconstruction and in-silico Biology The section reconstruct metabolic, protein synthesis, and regulatory networks for industrially-relevant microorganisms and products using bioinformatic approaches and manual curation. We develop constraint-based modeling approaches, reconstruction methods, and omics data integration approaches to understand biological phenotypes. The majority of activities in the section takes place at the Center satellite at UCSD. We use adaptive laboratory evolution to study dynamics of bacterial adaptation, genetic causality, and microbial bioprocessing capabilities. We distribute the reconstructed networks and developed methods to the core team to drive metabolic engineering through modeling.

The section is headed by Professor Bernhard Palsson.
Organisational unit: Section
**Fungal Cell Factories**
Novo Nordisk Foundation Center for Biosustainability
Short name: FCF

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**Organisation profile**
Within this section, that is located at Chalmers University of Technology, we are developing novel technologies to advance the development of yeast cell factories. This involves:
- the construction of detailed metabolic models,
- the development of novel synthetic biology tools that will allow for rapid reconstruction of heterologous pathways in yeast,
- development of yeast cells with an expanded substrate range, i.e. pentoses and carbohydrate polymers, and
- advancement of a pipeline for use of directed evolution to identify metabolic engineering targets.
The section is headed by Professor Jens Nielsen.

Organisational unit: Section

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**High-throughput Molecular Bioscience**
Novo Nordisk Foundation Center for Biosustainability
Short name: HTMB

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The KTH satellite for high-throughput molecular bioscience, situated in Stockholm, is advancing high-throughput technologies to facilitate a shift towards next generation metabolic engineering; where large-scale sequencing & genomics tools, high-throughput microdroplet screening assays, and rapid assembly of DNA vectors aid in rapid development of industrial production strains.

Through deep collaboration with other groups within the center, and by deploying one or several of our core technologies, we aim to rapidly advance metabolic engineering projects.

The section is headed by Professor Mathias Uhlén.

Organisational unit: Section

Bacterial Cell Factory

Novo Nordisk Foundation Center for Biosustainability

Short name: BCF

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Organisation profile

The bacterial cell factories section will deliver the bacterial part of the next generation of cell factories. Initially, this strategy will focus on developing technology for rapid modification and enhancement of bacterial genomes and readout of physiological states and metabolites in vivo.

Specifically, we will focus on:

- Development of modular synthetic networks that can sense metabolites and elicit desired responses.
- Single cell approaches for understanding population responses during fermentation processes.
- Functional metagenomics for identification of biosynthetic pathways for high value compounds.

Our scientific approach combines the principles of synthetic biology with a detailed evolutionary understanding of natural systems.

The section is headed by Professor Søren Molin.

Organisational unit: Section
Institute Management
National Institute of Aquatic Resources
Short name: Institute Management

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Organisation profile
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Vice-director Eskild Kirkegaard
Responsible for administration and Public Sector Consultancy
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Vice-director Helge A. Thomsen
Responsible for education and technical support
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Organisational unit: Section

Research Secretariat
National Institute of Aquatic Resources
Short name: Research Secretariat

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Organisation profile
The Research Secretariat supports the research committee and handles professional assistance in connection with interdisciplinary and research strategic activities. The secretariat assists with the external financing of the institute, including information about application opportunities and project administration. The research committee advises the management concerning research strategy and coordinates interdisciplinary research activities and project administration.
Head of Secretariat: Kirsten Thomsen, tel. +45 35 88 33 79 kth@aqua.dtu.dk
Organisational unit: Section

Section for Aquaculture
National Institute of Aquatic Resources
Short name: Section for Aquaculture

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Organisation profile
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Organisational unit: Section

Section for Freshwater Fisheries Ecology
National Institute of Aquatic Resources
Short name: Section for Freshwater Fisheries Ecology

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Organisation profile
DTU Aqua’s research into Freshwater Fisheries and Ecology is devoted to looking at the behaviour of particular species of fish and their interaction with the environment. We do this by focusing on the behaviour of individual fish as a means towards understanding overall environmental contexts.
The research includes studies of fish habitats in streams, lakes and coastal areas and how the impact of both nature and human activity on water systems affects the conditions under which fish live.
We investigate the effect of the deterioration of fish habitats and the increasing difficulties faced by fish when they migrate, including the effect of physical barriers in streams, nutrient-rich lakes and the construction of new lakes and wetlands in streams.
Research into Freshwater Fisheries and Ecology has three main themes:

The migratory behaviour of freshwater fish
Many species of fish migrate. We examine the extent to which genetic and environmental factors affect whether fish migrate, where they migrate to, and how far they migrate. One method used to investigate this is the development and application of various techniques for tagging fish.

The relationship between predator and prey
Fish hunt and are hunted. Knowledge about different fish and their role in the food chain allows us to re-establish sustainable fish habitats. For example, we look at the distribution and concentration of fish in relation to the seasons, the time of day and the chemical and physical conditions in the water.

Regeneration of natural fish stocks
We monitor selected populations of freshwater fish. The results of this research are used to improve fish habitats and to assess and support fish populations that may have problems surviving on their own.

Why do we do research into Freshwater Fisheries and Ecology?
Up until the 1970s, many streams were straightened, regulated and deepened. This was to increase the capacity of the streams to drain water away from farmland so that it could be cultivated. Over the years, water quality has also deteriorated as a result of human activity, including the discharge of sewage and the overuse of fertilizers in surrounding fields.
The harsh interference in nature has in many cases resulted in degraded fish habitats and had a negative impact on plant and animal life in and around streams and lakes.
In recent years, awareness of environmental issues and sustainable use of resources has increased. At the same time, there is increasing interest in recreational fishing and angling, partly linked to tourism, and this has led to an increased need for knowledge about the aquatic environment and fish stocks.
To safeguard diversity in nature and to ensure the best possible conditions for recreational fishing, DTU Aqua works extensively with the sustainable management of freshwater areas, together with the careful nurturing of fish stocks.
What is the research used for?
The results of our research are used predominantly for advisory purposes. DTU Aqua currently provides consultancy services for the Danish Directorate of Fisheries as well as for a number of municipalities, state environmental centres and several private organizations. We give advice particularly on how selected wild fish stocks can be supported, preserved and used in a sustainable way, while at the same time taking into account important aspects of interest to the public.

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Fish Care Consultant Finn Sivebæk, tel. 35 88 3117, fs@aqua.dtu.dk
Researchers, technicians and students from the research area are based in Silkeborg.
The research team is organised under the Section for Freshwater Fisheries and Ecology, headed by Senior Researcher Anders Koed.

Organisational unit: Section

National Institute of Aquatic Resources
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Organisation profile
DTU Aqua – National Institute of Aquatic Resources – is an institute at the Technical University of Denmark (DTU). DTU Aqua was previously known as DIFRES - Danish Institute for Fisheries Research.

Mission
DTU Aqua’s mission is to conduct research, provide advice, educate at university level and contribute to innovation in sustainable exploitation and management of aquatic resources. We investigate the biology and population ecology of aquatic organism, aquatic physics and chemical processes, ecosystem structure and dynamics, taking account of all relevant natural and anthropogenic drivers.

Vision
The vision of DTU Aqua is to enable ecologically and economically sustainable exploitation of aquatic resources applying an integrated ecosystem approach which utilizes synergies in natural and technical science disciplines. This approach covers all aquatic ecosystem components and trophic levels, and natural (e.g. physics and climate) and anthropogenic (e.g. fisheries, pollution, shipping and offshore energy) drivers of change, and integrates modern technologies. To realize this vision, our research and education must be of the highest international standard and innovative, our advisory services must be relevant and practical, and our communication with users and stakeholders must be open and comprehensible.

To address the environmental consequences and interactions of human activities in the aquatic environment and to resolve the longstanding conflict between aquatic resource exploitation and conservation.
Research

DTU Aqua's research is divided into the following fields:

Oceanography and Climate
Marine Populations and Ecosystem Dynamics
Coastal Ecology
Freshwater Fisheries and Ecology
Shellfish Aquaculture and Fisheries
Individual Biology
Population Genetics
Fisheries Technology
Observation Technology
Marine Living Resources
Fisheries Management
Ecosystem based Marine Management

Aquaculture

DTU Aqua deals with all types of aquatic habitat – from the North Atlantic Ocean and European shelf areas to coastal areas and inner Danish waters, ecosystems in lakes and streams as well as aquaculture. European shelf seas, Danish coastal areas and freshwaters are our main working areas, but we also work on Arctic and sub-Arctic waters, in particular in the North Atlantic surrounding Greenland, and we are involved in research activities in other parts of the world.

The research approach builds upon:

- conducting field and experimental work addressing all temporal and spatial scales using modern technology.
- understanding biological, chemical and physical interactions and processes structuring aquatic ecosystems and their dynamics.
- elaborating models for assessing and predicting the development of fisheries and aquaculture and ecosystems under natural and anthropogenic forcing at both short and long terms.

DTU Aqua's research often involves collaboration with other DTU departments, research environments at other Danish universities as well as a wide range of sister institutes in the EU and worldwide.

Public sector consultancy and business consultancy

DTU Aqua advises the Danish Ministry of Food, Agriculture and Fisheries and other public authorities, the commercial fisheries, the aquaculture industry and international commissions.

Public sector consultancy is a key area of activity for the institute. DTU's contract with the Ministry of Food, Fisheries and Agriculture on research-based public sector consultancy constitutes, together with a number of contracts with other Danish and international authorities, approx. 70 per cent of DTU Aqua's funding. The agreements cover research, development and monitoring activities, advisory tasks for public authorities and the fisheries industry as well as communication.

Education

DTU Aqua offers, in collaboration with the University of Copenhagen, the MSc programme in Aquatic Science and Technology. The first group of students started the study programme in September 2009.

In addition, DTU Aqua has a PhD school which was set up in 2007 and which currently has about 30 students enrolled.

DTU Aqua also designs courses for various BSc programmes and offers BSc and MSc projects for students at DTU and other universities.

Organisation

DTU Aqua has 255 employees, of whom a third are scientific staff. The other employees are assistant biologists, laboratory technicians, IT employees, administrative staff, ship's crew, student assistants etc.

The institute is organised into eight scientific sections which carry out the research, educational and advisory activities. In addition, the institute has a number of scientific and administrative support functions, including the research vessel DANA.

DTU Aqua has employees in Charlottenlund, Silkeborg and Hirtshals as well as on Dana.

Organisational unit: Department
Office for Private & Public Sectors Services

Administration
Short name: Office for Private & Public Sectors Services

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Organisation profile
The office develops the administrative framework for DTU’s public sector consultancy and coordinates central efforts. The office is responsible to the Director for Public Sector Consultancy, Niels Axel Nielsen, who holds the transverse responsibility of the DTU management in the field.
Tasks undertaken by the Office of Public Sector Consultancy include:

Framework agreements with ministries about research-based public sector consultancy

Contact to Danish and international public and private institutions

Concept for the Public Sector Consultancy at DTU

Planning and development of DTU’s Public Sector Consultancy

Contact and coordination with DTU’s departments and contact persons

Secretarial assistance to relevant committees etc.

DTU Climate Change Technologies www.dtu.dk/climate

Office for Research and Relations

Administration
Short name: Office for Research and Relations

Addresses
Type of address: Postal address
Country: Denmark
Organisational unit: Section

IT Service
Administration
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Short name: Administration

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Organisational unit: Department

Campus Service
Administration
Short name: Campus Service

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**Organisation profile**
The Department for Campus Service is responsible for the operation and maintenance of the buildings, technical installations and the surroundings (roads, parking, green areas etc.) at the Technical University of Denmark. The department is planning and leading construction projects and is furthermore responsible for services as telephone, post, cleaning and the allocation of building facilities, labs and offices etc.

**Rector's office**
Administration
Short name: Rector’s office

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Organisational unit: Section

**Office for Finance and Accounting**
Administration
Short name: Finance Division

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Country: Denmark

**Organisation profile**
The Office for Finance and Accounting assists DTU's management in overall financial management, including:

- Preparation of external annual reports and budgets
- Quarterly reports and management information
- Performance of daily accounting routines (creditors, debtors, payments, investment management)
- Guidance and assistance in connection with financial follow-up for DTU's departments and offices
- Guidance and financial management of projects
Management of DTU’s procurement policy

Organisational unit: Section

Office for Study Programmes and Student Affairs
Administration
Short name: Study Division

Addresses
Type of address: Postal address
Street: Anker Engelunds Vej 1
Building: 101A, Ground floor
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: (+45) 45 25 11 60
Fax: (+45) 45 87 02 16

E-mails
E-mail: studvejl@adm.dtu.dk

Organisation profile
The Office for Study Programmes and Student Affairs supports the DTU management in connection with education policy issues. The Office is responsible for DTU’s study administration systems, providing information and guidance to students and providing services to DTU’s departments.
We work with:
Admissions
Grant and loan applications
Course and examination enrolment
Student guidance
Industrial projects and traineeships
Student exchange agreements
Scholarships
International MSc programmes
Continuing and further education
PhD programme
Collaborations with upper secondary schools
Secretariat services for Curriculum Board
External examiners secretariat
Dispensations and credits
Educational statistics and analyses
New educational programmes
For programme and study-related questions, please feel free to contact us.
Organisational unit: Section

Office for HR
Administration
Short name: HR

Addresses
Type of address: Postal address
Street: Anker Engelunds Vej 1
Building: 101A, 1st floor
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 1035

E-mails
E-mail: lte@adm.dtu.dk

Organisation profile
The Office for HR (AHR) is responsible for recruitment, staff and manager development, employee administration and the working environment at DTU.
Organisational unit: Section

Office for Law and Contracts
Administration
Short name: Office for Law and Contracts

Addresses
Type of address: Postal address
Street: Anker Engelunds Vej 1
Building: 101A
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark
Organisational unit: Section

Division of Industrial Food Research
National Food Institute
Short name: Division of Industrial Food Research

Addresses
Type of address: Postal address
Street: Mærkhøj Bygade 19
Postal code: DK-2860
City: Søborg
Country: Denmark

**Phone numbers**
Phone: (+45) 35 88 70 00

**Web addresses**
Web:
http://www.food.dtu.dk/English/Service/About_National_Food_Institute/Organisation/Division_of_Industrial_Food_Research.aspx

**E-mails**
E-mail: food@food.dtu.dk

**Organisation profile**
Division of Food Industrial Research conducts research, education, innovation, collaborative project with industry and public sector consultancy within the field of food quality, food safety and food technology.

The division conducts research in the entire food chain of food from primary agricultural production and industrial processing to preparation in the consumer's home. In several cases the division also works with factors in living animals and plants that have an impact on the final product.

**Contact**
Research director Torger Børresen
Organisational unit: Section

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**Water Resources Engineering**
Department of Environmental Engineering
Short name: Water Resource Engineering

**Addresses**
Type of address: Postal address
Street: Miljøvej
Building: 113
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

**Phone numbers**
Phone: +45 4525 1600
Fax: +45 4593 2850

**Web addresses**
Web: http://www.env.dtu.dk/English/Research/Research%20Themes/Water%20Resources%20Engineering.aspx

**E-mails**
E-mail: info@env.dtu.dk

**Organisation profile**
The section was formed October 2011.
The section publication list is complete from 2014, for earlier years see the publication list for the department or for the individual researcher.
The Section Water Resources Engineering is developing a diverse range of science-based tools for management, protection and remediation of freshwater in its different settings like surface water in rivers and lakes and groundwater in shallow and deep aquifers.

Learn more about the section
Head of Section: Professor Poul L. Bjerg
Organisational unit: Section

CERE – Center for Energy Resources Engineering
Department of Chemical and Biochemical Engineering
Short name: CERE – Center for Energy Resources Engineering

Addresses
Type of address: Postal address
Street: Søltofts Plads
Building: 229
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: (+45) 4525 2859
Fax: (+45) 45882258

Web addresses
Web: http://www.cere.dtu.dk/

E-mails
E-mail: gk@kt.dtu.dk

Organisation profile
Center for Energy Resource Engineering (CERE) is a continuation of Center for Phase Equilibria and Separation Processes (IVC-SEP).
CERE’s main activities lie within applied thermodynamics, interface- and colloidal chemistry, geology and scientific computing. The center combines a range of disciplines of great importance in oil and gas production, CO2 capture and storage (CCS) and geothermal power. Additionally the center carries out generic research within the fundamental disciplines.
Research results are applied to processes and products in the industry with a main focus on energy, environment and advanced materials. A substantial part of the center’s research has been dedicated to Enhanced Oil Recovery (EOR).
Head of CERE per 1.7.2014 is professor Georgios M. Kontogeorgis
Organisational unit: Section

Ultrafast Nonlinear Optics group
Department of Photonics Engineering
Short name: Ultrafast Nonlinear Optics group

Addresses
Type of address: Postal address
Street: Ørsteds Plads
Building: 343
Postal code: DK-2800
City: Kgs. Lyngby
Organisation profile
In our group we work with efficient frequency conversion of ultrashort pulses, and seek to discover novel compression methods for generating even shorter pulses than those delivered by commercial laser systems. In particular, nonlinear optical pulses (solitons) generated in standard nonlinear crystals using cascading (phase-mismatched) frequency conversion processes are exploited to efficiently compress longer pulses towards the single cycle pulse duration limit. Mixing of ultrafast pulses in nonlinear media allows for generating energetic ultra-short few-cycle pulses at longer (mid-IR, 2.5-10 micron) and shorter (visible, 0.35-0.75 microns, upper UV, 0.2-0.35 microns) wavelengths. We work with both state-of-the-art solid state lasers as well as the more compact and rugged fiber laser systems, and our activities are both theoretical and experimental. The overall aim is to have an accessible source of few-cycle pulses anywhere in the optical spectrum.

In the coming years we have particular focus on visible and mid-IR pulses. Such pulses can be used in a broad range of research fields for ultrafast multi-color spectroscopy, coherent excitation and probing of vibrational modes, and ultimately for controlling phase transitions in strongly correlated systems. This could lead to discovery of entirely new properties of matter. We will also expand our focus from purely bulk optics (using high-energy pulses) to also include waveguide optics (using low-energy pulses), which is interesting because the pulses originate from a much more compact laser and the low pulse energies are favorable for fragile biological samples (e.g. for performing nano-laser surgery inside living cells).
Research
The Department of Physics focuses its research on areas of modern physics that we feel combine a major scientific challenge with obvious application potentials in the industry or in the public sector (e.g. in hospitals). Read more on our primary research areas here.

Education
The Department of Physics is responsible for the basic training in physics for most of the bachelor students at DTU. Furthermore, we also cooperate with DTU Nanotech and DTU Fotonik on the new bachelor and masters in Physics and Nanotechnology. Read more on education here.

Collaborations
DTU Physics has an extensive collaboration with national as well as international universities, companies, institutions and individuals, and we are continuously adjusting and extending our network.

Organisational unit: Department

Electronics
Department of Electrical Engineering
Short name: Electronics

Addresses
Type of address: Postal address
Street: Elektrovej
Building: 349 ground floor
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: (+45) 4525 3603

Web addresses
Web: http://www.dtu.dk/centre/ele/English.aspx

E-mails
E-mail: hw@elektro.dtu.dk

Organisation profile

Education
The Electronics Group puts special pride into linking theory and modelling to the experimental test & validation of results. Through this a highly innovative environment has been established, educating engineering students at BEng, BSc, MSc and PhD levels.

Research
Our expertise in solving energy efficiency related problems and presenting innovative solutions is what makes the Electronics Group an essential part of numerous research projects in collaboration with industry.

The Electronics Group is the most innovative group at the department with 13 out of 37 inventions since year 2000.

Organisational unit: Section

Department of Electrical Engineering
Technical University of Denmark
Short name: DTU Electrical Engineering

**Addresses**
Type of address: Postal address
Street: Ørsteds Plads
Building: 349
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

**Phone numbers**
Phone: (+45) 4525 3800
Fax: (+45) 4593 1634

**Web addresses**
Web: http://www.elektro.dtu.dk/

**E-mails**
E-mail: info@elektro.dtu.dk

**Organisation profile**

**Education**
At DTU Electrical Engineering we educate engineers within electrical engineering technologies as well as biomedical engineering.
We offer studies at BEng-, BSc-, MSc- and PhD levels. The department also participates in international master programmes.

**Research**
We conduct research within biomedical engineering, antenna and microwave technology, robot technology, power- and physical electronics, electric technology, acoustic environment, audiology, and electro-acoustics.
A large part of our research is carried out in close interaction with industry and Research institutions in Denmark and abroad.
Organisational unit: Department

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**Department of Civil Engineering**
Technical University of Denmark
Short name: DTU Civil Engineering

**Addresses**
Type of address: Postal address
Street: Brovej
Building: 118
Postal code: 2800
City: Kgs. Lyngby
Country: Denmark

**Phone numbers**
Phone: +45 4525 1700
Fax: +45 4588 3282
Coding and Visual Communication

Department of Photonics Engineering
Short name: Coding and Visual Communication

Addresses
Type of address: Postal address
Street: Ørsteds Plads
Building: 343
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 6352
Fax: +45 4593 6581

Web addresses
Web: http://www.fotonik.dtu.dk/English/Research/CommunicationTechnology/Coding.aspx

E-mails
E-mail: info@fotonik.dtu.dk

Research
Our research focus stretches from fire safety engineering to solar energy and from facilities management to

Education
Get your MSc at DTU
See what the Department of Civil Engineering has to offer
All courses are in

Organisation profile
The Coding and Visual Communication Technology Group focuses on error-correcting coding and image and video coding.

Advanced error-correcting coding is useful for both core and access networks. Applications in radio and satellite communication have been the most important for many years. All present wireless systems apply error-correction and they would not be possible without. In optical communication, it is becoming a strategic discipline for high capacity long distance transmission

The image and video coding activities are directed towards multimedia applications where a variety of image and video data needs to be coded efficiently for optimal use of the available communication bandwidth or storage capacity. An example is MPEG for video. Examples of research activities within the group are: Improving video quality for flat panel displays, Video for satellite and space communication, the newest MPEG-4 (H.264) and applications for that. A new area
is distributed video coding enabling small, but still efficient video encoders, e.g. for wireless communication.
More details on the research activities are found here.

Organisational unit: Section

Fiber Sensors and Supercontinuum Generation
Department of Photonics Engineering
Short name: Fiber Sensors and Supercontinuum Generation

Addresses
Type of address: Postal address
Street: Ørsted Plads
Building: 343
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 6352
Fax: +45 4593 6581

Web addresses
Web: http://www.fotonik.dtu.dk/English/Research/DynamicPhotonics/FiberSensors.aspx

E-mails
E-mail: info@fotonik.dtu.dk

Organisation profile
Our group focuses on fabrication of microstructured plastic fibers for use as waveguides at both optical and terahertz frequencies, and for sound, pressure and biosensors. We also work on supercontinuum generation, and we study compression methods for generating the shortest femtosecond pulses ever observed from fiber lasers.
Our plastic microstructured optical fibers (MOFs) can be used as biosensors to sense, for example antibodies and DNA, for sound, stress, and temperature sensors, and we are currently developing industrial fiber-optical microphones and accelerometers.
Another focus area is supercontinuum generation in MOFs, through which a laser pulse is spectrally broadened to ultimately become white light, brighter than the sun, yet still as powerful as a laser. We develop new fiber materials (polymer, softglass) for novel supercontinuum sources operating, e.g., in the mid-IR.
We also work on novel nonlinear methods for generating ultra-short few-cycle fs laser pulses in the visible and near-IR.
The pulses must be generated with low-cost and stable equipment, such as high-power fiber lasers, and the pulses are compressed in a single quadratic nonlinear crystal.
Our main University partners:

Cornell University (Frank Wise)
Australian National University (Wieslaw Krolikowski)
Université de Franche-Comté (John Dudley)

Organisational unit: Section

Structured Electromagnetic Materials
Department of Photonics Engineering
Short name: Structured Electromagnetic Materials

Addresses
In this group, we focus on the theory and synthesis (design) of structured materials and in particular on new wave phenomena and material properties, not provided to us by Nature herself. The new paradigm of metamaterials is to provide such new advanced or enhanced material functionalities through artificial (sub)wavelength structuring of the material rather than through the individual contributions from the atomic-scale constituents as is the case in most naturally occurring materials. Here is listed some of current research topics in the structured electromagnetic materials group.

**Metamaterial**
Metamaterial is an artificial composite material whose overall optical response is determined not only by its element materials, but also (sometimes more critically) by its geometrical composition. Metamaterials are argued to possess extraordinary optical properties not found in natural materials. Negative index is an example. Our activities on this subject involve transformation optics for designing novel photonic devices (e.g. cloaks), tunable metamaterial, as well as metamaterial for compact antenna design.

While the concept of homogenization theory is easily being applied to the asymptotic long-wavelength limit, e.g. the microwave regime where true sub-wavelength structures may be fabricated with ease, the optical regime challenges the underlying hypothesis of a true subwavelength unit cell. This calls for a deeper understanding of possible ambiguities associated with the propagation of a multiple of branches of electromagnetic states, rather than just a single state as in the asymptotic limit.

**Plasmonics**
The strong enhancement and confinement of the optical field associated with surface plasmon excitation makes such structures important targets for research and advanced technological applications. Engineering, control, and manipulation of the surface plasmons with the aid of nanostructures could, for example, lead to miniaturized photonic circuits with significantly increased functionality and reduced cost. The present project seeks to further advance surface plasmon efforts by employing periodic metallic structures in surface enhanced techniques. Our aim is to explore new nanoplasmonic structures for use in optical techniques in bio-chemical sensing and analysis. Quantum mechanical effects in the metallic response are expected to become important when the mesoscopic unit-cell structures have features approaching the nano regime. The Friedel oscillations and edge-smearing have important consequences for the field enhancement occurring at otherwise geometrically sharp features such as the corners of the triangle. In this project we consider quantum mechanical effects which are hardly addressed in the metamaterial community, where the optical properties are traditionally studied theoretically within the classical framework of Maxwell's wave equations with the material response given by bulk properties, thus neglecting spatial dispersion of quantum mechanical origin.

The SEM group also involves the following research subjects:

- applications of metamaterial concepts for antenna design and wireless-energy transfer
- fundamental limitations of slow-light propagation in photonic crystals
light-matter interactions, quantum dots embedded in a strongly dispersive environment

sensing of chiral molecules in strongly dispersive structured media

quantum optics in disordered and strongly dispersive media

structured low-dimensional electron systems

These research activities are financially supported through a number of national research grants including

The Danish Council for Strategic Research through the
Strategic Program for Young Researchers
(DSF grant #2117-05-0037, PI=Mortensen)

The Danish Research Council for Technology and Production Sciences
(FTP grant #274-07-0080, PI=Mortensen, FTP grant #274-07-0379, PI=Xiao)

The group also participates in the following centres and projects

NATEC
Nanophotonics for Terabit Communications
VKR Centre of Excellence
www.natec.dtu.dk

TOPANT
Topology Optimization of Electromagnetic Metamaterials for Miniaturization of Wireless Communication Antennas
www.topant.dtu.dk

Organisational unit: Section

Department of Transport
Technical University of Denmark
Short name: DTU Transport

Addresses
Type of address: Postal address
Street: Bygningstorvet
Building: 116 B
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 6500
Fax: +45 4593 6533

Web addresses
Web: http://www.transport.dtu.dk/English.aspx

E-mails
E-mail: transport@transport.dtu.dk

Organisation profile
DTU Transport is the biggest transport research community in Denmark and among the biggest university-based communities in the Nordic countries.

DTU Transport participates in a number of national and international as well as EU-funded research projects. DTU Transport offers approximately 20 courses ranging from initial courses in traffic and transport planning to advanced model and method-oriented courses within traffic and transport. Continuously, DTU Transport carries out collaboration projects with the business sector in Denmark and abroad. The projects comprise both short-term and very specific commissioned assignments and long-term developmental assignments.

Organisational unit: Department

DTU Executive School of Business

Technical University of Denmark
Short name: DTU Business

Addresses
Type of address: Postal address
Street: Produktionstorvet
Building: 421
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: (+45) 4525 6111
Fax: (+45) 4588 4337

Web addresses
Web: http://www.business.dtu.dk/

E-mails
E-mail: info@business.dtu.dk

Organisation profile

History
DTU Executive School of Business – DTU Business is a center at DTU, which provides executive programs in the areas of innovation, leadership, global management and corporate entrepreneurship. DTU Business was originally established in 1997 as the ‘Center for Technology, Economics and Management – TEM’. Since then DTU Business has offered the Master in Management of Technology – MMT program, a part-time executive MBA. Since its inception, MMT has graduated more than 200 Danish and international business leaders. This makes the MMT program the largest continuously running eMBA program focusing on innovation and business development in Denmark.

Over the years, DTU Business has developed into an important Scandinavian provider of innovation and corporate entrepreneurship related programs. Since 2006 DTU Business has offered the Certificate in Entrepreneurial Leadership – CEL™ program. CEL™ trains and supports corporate entrepreneurs and their corporate sponsors in discovering, incubating and accelerating new business idea projects. In 2008 this corporate entrepreneurship initiative was extended
by the Leading Innovation for Corporate Growth – LICG program. The LICG program is offered in cooperation with Stanford University. LICG focuses on the New Business Creation management system and NBC processes, including the role of senior management in supporting and orchestrating corporate entrepreneurship initiatives.

**Facilities**
DTU Business is housed in its own department, designed specifically for us. The facilities include an auditorium, designed as an amphitheater to stimulate dialogue, with every modern teaching amenity including a dedicated wi-fi network.

Six separate discussion rooms adjoin the auditorium, as well as a café area with a reference-library. In addition to this DTU Business has a flexible, multi-purpose dining area. All reading materials are provided by the MMT secretariat, for more information please contact either Program coordinator Mette Flindt or Program Coordinator Maria Ingeman, and all meals are served buffet-style in the DTU Business dining area.

**People**
Our professional and courteous staff are here to help make your time studying at DTU Business as rewarding as possible. Read more about our individual staff members here.

Organisational unit: Department

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**Division of Nutrition**
National Food Institute
Short name: Division of Nutrition

**Addresses**
Type of address: Postal address
Street: Mørkhøj Bygade 19
Postal code: DK-2860
City: Søborg
Country: Denmark

**Phone numbers**
Phone: (+45) 35 88 70 00

**Web addresses**

**E-mails**
E-mail: food@food.dtu.dk

**Organisation profile**
We conduct research and provide research-based advisory and risk assessment services on preventive nutrition and health promotion in the general population.

These activities are divided into two main areas: dietary surveys and dietary strategies. Tasks include maintaining and updating food composition databases and measuring the impact of dietary intervention measures. The Danish Veterinary and Food Administration is our principal client.

The division has approximately 40 staff.

**Contact**
Head of Division Gitte Gross
Organisational unit: Section

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**Division of Toxicology and Risk Assessment**
National Food Institute
Short name: Division of Toxicology and Risk Assessment

Addresses
Type of address: Postal address
Street: Mørkhøj Bygade 19
Postal code: DK-2860
City: Søborg
Country: Denmark

Phone numbers
Phone: (+45) 72 34 70 00
Fax: 8+45) 3588 7001

Web addresses
Web:
http://www.food.dtu.dk/English/Service/About_National_Food_Institute/Organisation/Division_of_Toxicology_and_Risk_Assessment.aspx

E-mails
E-mail: food@food.dtu.dk

Organisation profile
The aim of the Division of Toxicology and Risk Assessment, National Food Institute is to prevent illness from toxic effects of chemical compounds in food and environment and to improve public health.

To do this the Division of Toxicology and Risk Assessment produces and uses knowledge on human health effects of natural and synthetic chemicals or GMOs present in food, environment or consumer products.

The division has a unique expertise in performing animal studies, in developing feed compositions, clinical observations and behavioural studies of animals, as well as in the disciplines of pathology, biochemistry and molecular biology - disciplines that are also employed in adjunction to cellular work. The animal facility is also used by other divisions at the National Food Institute and by other universities through collaboration.

Research
Our research aims at understanding the mechanisms behind toxic and beneficial effects of compounds enabling us to predict human effects, to estimate potential combination effects and to choose the best models for investigating human effects.

The ambition is to use a multidisciplinary approach to toxicology using human, animal, in vitro as well as QSAR models to target a given research question, and secondly, using all available research results in risk assessment and modeling.

The research areas are:
Combination effects

Effects of endocrine disrupters

Food allergy

GMO

Novel foods

Cancer and genotoxicity
Alternatives to animal testing, so-called probabilistic risk assessment, nanotoxicology, integrated risk-benefit evaluations, effects of natural toxins, as well as contributions to new risk assessment paradigms are also part of the research areas.

**Public sector consultancy**
Our research environment provides the necessary competences and expertise to provide science-based toxicological advice primarily for the Danish Environmental Protection Agency and Danish Veterinary and Food Administration. The advice service covers a very broad field of human effects of synthetic and natural chemicals and genetically modified organisms as well as testing approaches. Several researchers are internationally recognized by being appointed as scientific experts in regulatory bodies and advisory bodies. The national coordinator of OECD guidelines for human health is a member of the division. High quality advice service is ensured by experts having state-of-the-art knowledge as well as a good feeling for future needs within toxicology. On the other hand research and its impact on society benefits from the close relationship to the regulatory bodies making the research more applied.

**Industrial collaboration**
The Division of Toxicology and Risk Assessment collaborate with national and international companies working within our areas of expertise e.g. food ingredients.

**Education**
Education and training of students is a growing field of expertise. We teach both national and international students and employees from industry and governmental organizations about toxicology.

**Collaboration**
University of Copenhagen, Århus University, University of Southern Denmark, Rigshospitalet, several industries

**Contact**
Head of Division Christine Lydia Nellemann
Organisational unit: Section

**Division of Food Chemistry**
National Food Institute
Short name: Division of Food Chemistry

**Addresses**
Type of address: Postal address
Street: Mørkhøj Bygade 19
Postal code: DK-2860
City: Søborg
Country: Denmark

**Phone numbers**
Phone: (+45) 35 88 70 00

**Web addresses**
Web:
http://www.food.dtu.dk/English/Service/About_National_Food_Institute/Organisation/Division_of_Food_Chemistry.aspx

**E-mails**
E-mail: food@food.dtu.dk

**Organisation profile**
Division for Food Chemistry, National Food Institute strives to increase our knowledge about all aspect of compounds in food and how we are exposed to these compounds through multidisciplinary research and collaboration. The chemical composition of our food is crucial for our ability to sustain good health and to avoid a long list of food related health risks. This forms the core of the activities in Division for Food Chemistry. The focus is on all the chemical constituents in food whether that is the good compound we need, the not so good compounds we try to avoid and the really bad compounds with severe health impact.
Research
The current research in Division for Food Chemistry is focused to solve relevant issues for authorities and industry as well as develop our three platforms: mass spectrometry, food monitoring databases containing information of unwanted compounds and information about the nutrients in the food composition databases and a risk assessment platform. The platforms support the research in:

- Occurrence and sources for residues and pollutants in food. E.g. persistent pollutants, minerals and nano-structures, residues of pesticide and veterinary drug and natural and environmental pollutants. Most of these compounds are responsible for severe long-term effects

- Beneficial compounds in food with focus on vitamins in particularly vitamin D and K, but also other health promoting compounds and minerals. Also development of new technologies is included

- Effects of food production and food preparation e.g. formation of unwanted compounds, migration from food contract materials and the use of nano-structured materials in food production or contact materials

- Authenticity and fraud in food and food production

- Uptake and metabolism of selected compound from food and metabolomics/mechanistic studies

- Development of methods to assess risk from humane exposure to multiple compounds from the diet combining food intake, food monitoring and exposure modelling

The research activities include development of the core platforms in particularly implementing profiling techniques and metabolomics using accurate high resolution mass spectrometry and chemometrics, detection of man-made nano-structures in food.
In parallel development of improved chemical risk assessment to include exposure of combination of compounds using probabilistic modelling and obtaining the needed food monitoring data.

Public Sector Consultancy
Division for Food Chemistry provide public sector consultancy within nearly all areas of food chemistry including analytical services and consultancy to Danish and International authorities and. As a part of the obligation to Danish authorities Division for Food Chemistry compile and report Danish food monitoring data to Danish and international authorities. The division is national reference laboratory for nearly all compounds in food and is EU reference laboratory for pesticide residues in cereals and feed. Furthermore, the division is a part of the Danish contingency plans and is part of the official control in several areas including food contact materials and algae toxins in mussels.

Industrial Collaboration
Division for Food Chemistry is involved in industrial collaboration with the objective to improve food safety, health or develop new products. The development of new product is within as diverse areas as development of safe food production processes, new food contact materials, authenticity of food additives and enhancing vitamins content by bio-fortification. Industrial collaboration and innovation are centred on our three fundamental platforms that allow us to participate in a multitude of different projects of high relevance for society and industry, always maintaining high scientific standards and integrity as an independent research institution.

Teaching and Training
Division for Food Chemistry offers courses and projects on both bachelor and masters level within nearly all area of food chemistry and modern analytical chemistry. The division is a key partner in the diploma programme in Food Control. Diploma, bachelor and master project within food chemistry are most welcome.
The training and course activities include participation in building food safety capability on behalf of authorities and organisations globally through course and training both here and abroad. Other training activities are directed toward industry and laboratories with the latest knowledge and to meet the requirements in recent regulation.

Collaboration
The Danish Food Authorities
EFSA
Acoustic Technology
Department of Electrical Engineering
Short name: Acoustic Technology

Addresses
Type of address: Postal address
Street: Elektrovej
Building: 352
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: (+45) 4525 3949

Web addresses
Web: http://www.dtu.dk/centre/act/English.aspx

E-mails
E-mail: fj@elektro.dtu.dk

Organisation profile

Education
Acoustic Technology educates engineers within the fields of physical acoustics, electroacoustics, architectural acoustics, and sound and vibration at BSc, MSc and PhD level. Together with Hearing Systems we offer the international Master's programme Engineering Acoustics.

Research
The research at Acoustic Technology is focused on generation and transmission of sound, passive and active noise control, advanced acoustic measurement techniques, transducer technology, room acoustic modelling and design, and effects of new building materials on sound transmission.

Biomedical Engineering
Department of Electrical Engineering
Short name: Biomedical Engineering

Addresses
Type of address: Postal address
Street: Elektrovej
Building: 349
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark
Phone numbers
Phone: (+45) 4525 5832

Web addresses
Web: http://www.dtu.dk/centre/bme/English.aspx

E-mails
E-mail: jw@elektro.dtu.dk

Organisation profile

Education
Our group is responsible for the Medicine & Technology program, jointly offered by DTU and the University of Copenhagen, which aims at educating students to participate internationally in biomedical research and product development at universities, hospitals and in the industry.

Research
The Biomedical Engineering group researches in:
Ultrasound - hardware related implementation as well as imaging, flow estimation and ultrasound techniques

Magnetic Resonance Imaging

Signal Processing

Biomechanics and Biomedicine

Organisational unit: Section

Automation and Control
Department of Electrical Engineering
Short name: Automation and Control

Addresses
Type of address: Postal address
Street: Elektrovej
Building: 326
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: (+45) 4525 3576

Web addresses
Web: http://www.dtu.dk/centre/aut/English.aspx

E-mails
Organisation profile

Education
Exciting theoretical and practical courses are combined with projects in the lab or in cooperation with industry to make the best foundation for becoming a successful engineer. We have state of the art facilities for teaching all subjects in automation, control and robotics.

Research
Fault tolerant control, fault tolerant operation and mobile robotics are the focus areas of research with experimental verification in the lab being an important component along with a sound theoretical basis. AutomationDESIGN Centre is a gateway for industry to our automation and control competences.

Organisational unit: Section

Hearing Systems
Department of Electrical Engineering
Short name: Hearing Systems

Addresses
Type of address: Postal address
Street: Elektrovej
Building: 352
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: (+45) 4525 3932

Web addresses
Web: http://www.dtu.dk/centre/hea/English.aspx

Organisation profile

Education
Hearing Systems educates engineers within the fields of speech and hearing science and communication acoustics at B.Sc., M.Sc. and Ph.D. levels. Together with Acoustic Technology we offer the international M.Sc. programme Engineering Acoustics.

Research
The research in hearing systems focuses on auditory and speech processing and perception, functional models of hearing, audiology, physiological acoustics, objective measures of hearing and hearing instrument signal processing.

Organisational unit: Section

Electromagnetic Systems
Department of Electrical Engineering
Short name: Electromagnetic Systems

Addresses
Type of address: Postal address
Street: Ørsted Plads
Education
Electromagnetic Systems offers a diverse study environment with Danish and international students, courses at BEng, BSc, MSc and PhD levels, and special courses/thesis work closely linked to our research within electromagnetics and electronics.

Research
The research in the Electromagnetic Systems group deals with antennas, components and circuits from microwave to terahertz. The applications range from communication systems to imaging, measurement and sensing.

Organisational unit: Section

Quantitative Sustainability Assessment
Department of Management Engineering
Short name: Quantitative Sustainability Assessment

Addresses
Type of address: Postal address
Street: Produktionstorvet
Building: 424
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 4708
Fax: +45 4525 4800

Web addresses
Web: http://www.qsa.man.dtu.dk/English.aspx

E-mails
E-mail: info@man.dtu.dk

Organisation profile
Education
Is biodiesel more sustainable than petrodiesel?
Are nanoproducts friends or foes in the environment?
Learn how to assess a product’s impacts on the environment and learn about tools available for the environmentally oriented engineer in QSA courses.
Read more about our courses here...

Research
We are in the forefront of methodological and applied research in the field of Life Cycle Assessment. Our aim is to develop decision support tools for sustainability assessment, with a focus on environmental and social LCA.
Read more about our research projects here...

Industrial collaboration
We support development of sustainable technology and technical solutions across all domains at DTU through use of engineering tools for environmental assessment. We continuously collaborate with:
Companies
National and international institutions
Peers and professionals
Read more about our collaborations here...

Organisational unit: Section

Department of Micro- and Nanotechnology
Technical University of Denmark
Short name: DTU Nanotech

Addresses
Type of address: Postal address
Street: Ørsteds Plads
Building: 345 Ø
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 45 25 57 00
Fax: +45 45 88 77 62

Web addresses
Web: http://www.nanotech.dtu.dk/English.aspx

E-mails
E-mail: info@nanotech.dtu.dk

Organisation profile
Research
The overall aim of the Nanoprobes group is to develop and investigate high performance mechanical sensors for bio/chemical detection...
Innovation
Nanovi is the lastest spin-off company, based on research conducted at DTU Nanotech.

Education
Students at DTU Nanotech participate in the on-going research in micro- and nanotechnology. You can find exciting research projects in the online project catalogs.

Organisational unit: Department

Communications and Management Secretariat
National Food Institute
Short name: Communications and Management Secretariat

Addresses
Type of address: Postal address
Country: Denmark

Phone numbers
Phone: (+45) 35 88 70 00

Web addresses
Web: http://www.food.dtu.dk/

E-mails
E-mail: food@food.dtu.dk

Organisational unit: Section

National Food Institute
Technical University of Denmark
Short name: DTU Food

Addresses
Type of address: Postal address
Street: Mørkhøj Bygade 19
Postal code: DK-2860
City: Søborg
Country: Denmark

Phone numbers
Phone: +45 35 88 70 00

Web addresses
Web: http://www.food.dtu.dk/English.aspx

E-mails
E-mail: food@food.dtu.dk

Organisation profile
The National Food Institute, Technical University of Denmark works within six technical focus areas: Biotechnology, nutrition, food quality, food safety, food technology and environment & human health. Activities cover a wide range of food products throughout the entire food chain from farm to table, comprising both research activities and research-based consulting and teaching.
The focus of our activities are important aspects related to the impact of food products on human health and disease as well as food quality. The main aim is to help ensure that consumers have access to healthy and safe high-quality food products and to prevent disease in humans related to food products, diet and chemical or microbiological food contamination.

Contact
Director of Institute Jørgen Schlundt
Organisational unit: Department

Technical Information Center of Denmark
Technical University of Denmark
Short name: DTU Library

Addresses
Type of address: Postal address
Street: Anker Engelunds Vej 1
Building: 101 D
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: + 45 4525 7200
Fax: + 45 4588 3040

Web addresses
Web: http://www.dtic.dtu.dk/English.aspx

E-mails
E-mail: dtic@dtic.dtu.dk

Organisation profile
DTU Library, the Technical Information Center of Denmark, contributes to the realization of DTU’s mission and vision by securing an optimum information infrastructure and information service for both scientific and administrative processes and contributes to the study environment at DTU as well as interaction with our surroundings. This challenge comprises the entire information cycle of DTU in which information from all over the world is put at the disposal of and communicated to the users of DTU the information must be applied and utilized so that - together with other scientific activities at DTU – it results in new information being generated by the university this new information is collected, documented, filed and preserved and made public and disseminated via efficient and credit awarding channels after which the impact of the research can be analyzed and estimated.

Mission
The mission of DTU Library can thus be translated into five focus areas:

Securing DTU’s scientific information provision and communication.
Collecting, documenting and filing the information produced by DTU including the appertaining cases and projects.
Contributing to the publication and dissemination of DTU's scientific information and carry out analyses of the output and impact of the university.

Contributing to an inspiring and attractive study environment at DTU.

Contributing to DTU's interaction with the surroundings and public image.

The mission and the four user segments of DTU Library are illustrated below.

Organisational unit: Department

**Department of Chemistry**

Technical University of Denmark  
Short name: DTU Chemistry

**Addresses**

Type of address: Postal address  
Street: Kemitorvet  
Building: 207  
Postal code: DK-2800  
City: Kgs. Lyngby  
Country: Denmark

**Phone numbers**

Phone: (+45) 4525 2419  
Fax: (+45) 4588 3136

**Web addresses**

Web: http://www.kemi.dtu.dk/English.aspx

**E-mails**

E-mail: isc@kemi.dtu.dk

**Organisation profile**

Chemistry deals with the study of the composition, structure, and properties of matter, and with the reactions by which matter may be converted into new forms. Chemistry is, accordingly, a central science with a vast number of applications. The Department of Chemistry takes care of teaching and research within the main areas of chemistry: Physical, inorganic, organic, and analytical chemistry. The teaching encompasses introductory as well as advanced courses which often are related to current research projects.

The Department of Chemistry actively contributes to basic research, where the aim is to develop methods and concepts as well as to enhance the insight into chemical problems. Chemical research goes often across the boundaries between the traditional branches of chemistry, and is often related to neighbouring fields like biochemistry. Several research projects are, in addition, closely related to applications within fields like, medicinal chemistry, catalysis, and materials science, and the research is often carried out in close collaboration with industry and universities around the world.

The scope of the research can be described by the keywords: Biological membranes, molecular dynamics and chemical reactivity, femtosecond chemistry, solid state chemistry, electrochemistry, fuelcells/batteries, X-ray crystallography, Raman spectroscopy, molecular modelling, bio-inorganic chemistry, industriel catalysts, metal-organic chemistry, carbohydrate chemistry, stereo-selective synthesis, combinatoriel chemistry, and flow injection analysis.

Organisational unit: Department

**X-ray Crystallography**

Department of Chemistry  
Short name: X-ray Crystallography
Addresses
Type of address: Postal address
Street: Kemitorvet
Building: 207
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: (+45) 4525 2419
Fax: (+45) 4588 3136

Web addresses
Web: http://www.xray.kemi.dtu.dk/English.aspx

E-mails
E-mail: isc@kemi.dtu.dk

Organisation profile
Using X-ray diffraction it is possible to determine and explore the three-dimensional atomic structure of chemical compounds, materials and proteins. The atomic arrangement is the basis for understanding the properties, whether it is materials properties or reaction mechanisms in enzymes. This combined knowledge is the key to improve and manipulate structures and the design of new pharmaceuticals. Our group covers the full range from small molecule to protein structures. The work is highly interdisciplinary and includes basic chemistry, physics and biology as well as computer programming and biotechnology. The group has state-of-the-art X-ray diffractometers for powders and single-crystals and access to powerful X-ray synchrotron sources around the world.

Main Research Fields
Structures and properties of porous materials as zeolites and metal-organic frameworks (MOF)

New functional materials

Strontium and osteoporosis

Structure of proteins involved in the nucleotide metabolism

Powder diffraction of proteins

Characterising metalloproteins with X-ray absorption spectroscopy (XAFS)

Organisational unit: Section
Organic Chemistry
Department of Chemistry
Short name: Organic Chemistry

Addresses
Type of address: Postal address
Street: Kemitorvet
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Web addresses
Web: http://www.organic.kemi.dtu.dk/

E-mails
E-mail: isc@kemi.dtu.dk

Organisation profile
Organic chemistry research at the Department of Chemistry is focused on various aspects of bioorganic chemistry. The main areas of interest are described in the following.
For more details on the research projects, please visit the group homepages of the individual researchers - here
Organisational unit: Section

Energy and Materials
Department of Chemistry
Short name: Energy and Materials

Addresses
Type of address: Postal address
Street: Kemitorvet
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Postal code: DK-2800
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Country: Denmark

Phone numbers
Phone: (+45) 4525 2419
Fax: (+45) 4588 3136

Web addresses
Web: http://www.kemi.dtu.dk/

E-mails
E-mail: isc@kemi.dtu.dk
NanoChemistry

Department of Chemistry
Short name: NanoChemistry

Addresses
Type of address: Postal address
Street: Kemitorvet
Building: 207
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: (+45) 4525 2419
Fax: (+45) 4588 3136

Web addresses
Web: http://www.nanokemi.kemi.dtu.dk/

E-mails
E-mail: isc@kemi.dtu.dk

Organisation profile
Nanoscale Chemistry is the exciting areas of chemical science and technology where physical and chemical properties of systems addressed depend on their sizes. The size can range from the single molecule (≈ 1 nm) to many thousands of molecules (> 100 nm), with almost macroscopic properties. Chemical properties at the nanoscale are different from those in macroscopic, say molar scales. Studies of nanosystems require high-resolution techniques such as electrochemistry at atomically planar surfaces. Molecules in such environments can be studied by the ultra-sensitive microscopies, scanning tunnelling and atomic force microscopy (STM and AFM). We can, literally see the single molecules in action. Such studies are important because they disclose new chemical behaviour different from the known macroscopic world and they offer perspectives for design and chemical synthesis of novel materials for use in electronics and biological screening at ultra-small scales. DTU Chemistry's NanoChemistry group offers interesting special course, bachelor, master and Ph.D. projects in different areas of chemistry at the nanoscale listed below.

Organisational unit: Section

Metalloprotein Chemistry and Engineering

Department of Chemistry
Short name: Metalloprotein Chemistry and Engineering

Addresses
Type of address: Postal address
Street: Kemitorvet
Building: 207
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark
Phone numbers
Phone: (+45) 4525 2419
Fax: (+45) 4588 3136

Web addresses
Web: http://www.mpc.kemi.dtu.dk/

E-mails
E-mail: isc@kemi.dtu.dk

Organisation profile
Our research concerns the role of metals in biological systems. Focus is on the chemistry of metalloproteins and metalloenzymes. We are part of the Danish graduate school on Metal Ions in Biological Systems (MIBS).

Research
Characterization of metalloenzymes involved in neuropsychiatric disorders
Design of artificial metalloproteins (metalloprotein engineering)
Characterization of ancient iron-sulfur proteins
Metalloproteomics

Education
We are involved in teaching a large number of courses at the department.
Analytical Chemistry
Department of Chemistry
Short name: Analytical Chemistry

Addresses
Type of address: Postal address
Street: Kemitorvet
Building: 207
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: (+45) 4525 2419
Fax: (+45) 4588 3136

Web addresses
Web: http://www.analytisk.kemi.dtu.dk/

E-mails
E-mail: isc@kemi.dtu.dk

Organisation profile
"Analytical chemistry is a scientific discipline that develops and applies methods, instruments, and strategies to obtain information on the composition and nature of matter in space and time"
Robert Kellner,
Analytical Chemistry,
The analytical chemist operates in a wide variety of professions of our society. Many decisions are made on the basis of results obtained by chemical analysis. Think of it! Your health is monitored by clinical analysis, and the level of pharmaceuticals supplied to you at the chemist is decided on the basis of analytical chemistry. In sports, the analyses of blood samples and of urine samples are performed by analytical chemists, who are responsible for reporting the level of doping to the authorities. Such results must be of high quality as to ensure a fair treatment of the people involved. Similarly, the application of analytical chemistry to forensic analysis allows the decision of legal court cases to be made by analytical results. Thus, quality assurance constitutes an integrated part of analytical chemistry.

The application of quality assurance is also important to other fields of chemical sciences because it allows the researchers to decide the correct molar ratios of molecular species for modeling of fundamental mechanisms in nature. An analytical laboratory is equipped with many different technologies that allow analysis of inorganic species, of organic species or of biochemical compounds.

Management
National Veterinary Institute
Short name: Management

Addresses
Type of address: Postal address
Street: Bülowsvej 27
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City: Frederiksberg C
Country: Denmark

Phone numbers
Phone: (+45) 35 88 60 00
Fax: (+45) 35 88 60 01

Web addresses
Web: http://www.vet.dtu.dk/English/About_us/Organisation/Management.aspx

E-mails
E-mail: vet@vet.dtu.dk
Organisational unit: Section

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Quantum physics and information technology
Department of Physics
Short name: Quantum physics and information technology

Addresses
Type of address: Postal address
Street: Fysikvej
Building: 309
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 3208
Fax: +45 4593 1669

Web addresses
Web: http://www.fys.dtu.dk/English/Research1/Quantum_physics.aspx

E-mails
E-mail: info@fysik.dtu.dk

Organisation profile
The section for Quantum Physics and Information Technology designs quantum physics materials and processes to be used in sensors and information technology. A broad term for the field is "quantum engineering", which means to use and design methods for the study and utilization of the fundamental laws of quantum physics. Research is carried out in three subgroups:

Nanostuctured materials
Optics
Quantum Information

Nanostructured materials are expected to form the basis of a large number of the new technologies which we will see in the coming decades. The group for nanostructured materials is working in part with micro- and nanoelectronics, which can be cooled down to temperatures near the absolute point zero and used in e.g. radio astronomic receivers; in part with magnetic nanoparticles used in storing information and in medicine and biotechnology, and in part with metallic glass whose unusual qualities has many potential usages. The group for nanostructured materials has also intensified its efforts in the field of spintronics where one seeks to utilize the spin of the electrons as a control parameter in various electronic components. This research forms the basis of the development of ‘quantum informatics’ which, through its use of the spin of the electrons (spin-up and spin-down, is expected to lead to a whole new generation of quantum computers with far more effective data processing. The group is recognized worldwide for its research. Collaborations include the University of Copenhagen and Risø DTU as well as universities and research centres in USA, Great Britain, Sweden, and Russia etc.

The Optics Group conducts research with the purpose of allowing us to utilize the ever faster technological breakthroughs to further fundamental research into the unique quantum mechanical properties of light and use this information for the greater good. Furthermore, the Optics Group is working towards increasing its international collaborations with other groups outside DTU. Photonics represents another possible technology for the design of quantum computers.

The Quantum Information Group. Since its inception the group has been active in the study of new quantum plasmonics systems, the study of novel quantum information “cleaning” systems and the production of nonclassical light.

Link to the site of Quantum Physics and Information Technology

Organisational unit: Section

National Veterinary Institute
Technical University of Denmark
Short name: DTU Veterinary

Addresses
Type of address: Postal address
Street: Bülowsvej 27
Postal code: DK-1870
City: Frederiksberg C
Country: Denmark

Phone numbers
Phone: +45 35 88 60 00
Fax: +45 35 88 60 01

Web addresses
Web: http://www.vet.dtu.dk/English.aspx

E-mails
E-mail: vet@vet.dtu.dk

Organisation profile
National Veterinary Institute DTU conducts research in infectious diseases in livestock and makes diagnoses in diseased animals. We give advice to public authorities and cooperate with them on the Danish veterinary contingency plan. We are reference laboratory in a number of areas.

National Veterinary Institute DTU encompasses all infectious animal diseases in farm livestock and companion animals. Our main focus is on notifiable diseases, as well as other serious infectious diseases that affect farm livestock. Our tasks concern:

Research

Innovation
Diagnostics

Surveillance

Consultancy

Risk assessment

Production of vaccines and sera

Dissemination of knowledge and education

We do research in diseases
The Institute does research in methods to detect, control and prevent infectious animal diseases. Our research activities cover a wide field, i.e. developmental and application-oriented projects as well as basic research. The institute also hosts an international research centre for veterinary epidemiology, International EpiLab.

We diagnose
Veterinarians can submit samples from diseased animals to be diagnosed. For notifiable diseases the diagnosis is free, whereas we diagnose other diseases on commercial terms. All our diagnostic services are based on accredited or quality-assured analysis methods.

We manufacture vaccines and sera
For some animal diseases commercial vaccines and sera are not available. For the treatment of these diseases the National Veterinary Institute DTU manufactures vaccines and sera, if the disease is significant. Our production of vaccines and sera takes place on commercial terms.

We give advice to public authorities
The National Veterinary Institute DTU provides advisory services and risk assessment to public authorities, the industry and interest groups. Advisory services and risk assessment are both based on robust and sensitive research methods. In addition, we supply data for disease monitoring in Denmark and coordinate the national monitoring of veterinary drug use (Vetstat).

We are responsible for the Danish veterinary contingency plan
The National Veterinary Institute DTU is responsible for the laboratory component of the Danish veterinary contingency plan, which puts emergency procedures into action in the event of suspected or actual outbreaks of serious infectious animal diseases. In these cases our laboratories analyse samples from the animals. The contingency plan is supported by our activities in conjunction with a range of national monitoring programmes on animal diseases and zoonoses. Our research and diagnostics expertise is crucial for maintaining the high quality of the Danish veterinary contingency plan. The Danish Veterinary and Food Administration is responsible for the part of the contingency plan handling infection situations in Denmark.

We are reference laboratory
The institute is the Danish national reference laboratory for a long list of infectious animal diseases, and the EU and OIE reference laboratory for selected fish diseases.

We cover relevant subject areas
Professionally the institute covers all areas important to infectious diseases:

Pathology

Bacteriology

Virology
We are 220
The institute employs about 220 staff members and consists of the management, the secretariat and the service division. Furthermore we have these five sections:

Virology – focusing on serious virus infections, including virus infections transmitted from animals to humans (zoonotic infections).

Immunology and vaccinology – including development and optimization of new vaccines and other biological products.

Epidemiology – including disease modeling and climate-related changes in disease spread.

Bacteriology, pathology and parasitology - focusing on fish bacteriology, non-food-borne bacterial zoonoses and activities with a view to reducing the use of antibiotics. We also work on methods for characterizing multi-bacterial societies.

Public sector consultancy, contingency and commercial diagnostics.

Organisational unit: Department

Environmental Chemistry
Department of Environmental Engineering
Short name: Environmental Chemistry

Addresses
Type of address: Postal address
Street: Miljøvej
Building: 113
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
The section was formed October 2011. The section publication list is complete from 2014, for earlier years see the publication list for the department or for the individual researcher.

The Section Environmental Chemistry is dedicated to basic and applied research in environmental toxicology and chemistry, covering topics like ecotoxicology, environmental analytical chemistry, and risk assessment.

Learn more about the section

Head of Section: Professor Anders Baun
Organisational unit: Section

The section was formed October 2011. The section publication list is complete from 2014, for earlier years see the publication list for the department or for the individual researcher.

The Section Residual Resources Engineering deals with characterization of waste and resources, treatment technologies to extract materials and energy, disposal methods for rejects, and assessment of over-all environmental performance. Special focus is on generation of energy by anaerobic microbial processes (bioethanol, biohydrogen and biogas).

Learn more about the section

Head of Section (acting): Professor Thomas Højlund Christensen
Organisational unit: Section
Urban Water Engineering
Department of Environmental Engineering
Short name: Urban Water Engineering

Addresses
Type of address: Postal address
Street: Miljøvej
Building: 113
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City: Kgs. Lyngby
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Web addresses

E-mails
E-mail: info@env.dtu.dk

Organisation profile
The section was formed October 2011.
The section publication list is complete from 2014, for earlier years see the publication list for the department or for the individual researcher.
The Section Urban Water Engineering aims to manage the urban water cycle with respect to its quantity and quality. It studies processes and technologies across the continuum from raw water, to potable water, to wastewater, to storm water. In all cases, collection, treatment, use, and reuse are considered.
Learn more about the section
Head of section: Professor Hans-Jørgen Albrechtsen
Organisational unit: Section

Sunclimate
National Space Institute
Short name: Sunclimate

Addresses
Type of address: Postal address
Street: Elektrovej
Building: 327+328
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: (+45) 4525 9500
Fax: (+45) 4525 9575

Web addresses
Cloudiness cool the world, while milder intervals like the warming in the 20th Century occur when cosmic rays and cloud particles coming from exploded stars. These cosmic rays help to make ordinary clouds. High levels of cosmic rays and findings reported by him and his colleagues in a dozen scientific papers, to show how the climate is governed by atomic science to cloud microphysics.

Cosmoclimatology is the term coined for this research, involving a range of disciplines from space physics to atmospheric science to cloud microphysics.

**Connection between Solar Activity and Climate Changes**

Climate is subject to influences by both natural and human forces, including greenhouse gases, aerosols, solar activity, and land use change. Changes in the sun contribute to climate change. Solar activity has been exceptionally high in the 20th century compared to the last 400 years and possibly compared to the past 8,000 years. When solar activity is high, the flux of galactic cosmic rays is reduced due to increased magnetic shielding by the Sun. The cosmic rays may influence the Earth's climate through the formation of low-lying clouds.

In 1996 a surprising discovery was announced that the intensity of cosmic rays incident on the earth's atmosphere correlates closely with variations of global cloud cover [Svensmark and FriisChristensen 1996]. Clouds both reflect incoming and trap outgoing radiation, and they thus play an important role in the Earth's radiation budget. A connection between solar activity and the Earth's cloud cover could have immense implications in our understanding of climate and the relevance of processes in space. The evidence from observations warrants a scientific investigation into a possible link between solar activity and the Earth's cloud cover. The reported variation of cloud cover was approximately 2% over the course of a sunspot cycle. This may appear to be quite small; however, the possible consequences on the global radiation (energy) budget are not. Simple estimates indicate that the resultant global warming could be comparable to that presently attributed to greenhouse gases from the burning of fossil fuels. The hypothesis is that solar variability is linked to climate variability by a chain that involves the solar wind, cosmic rays and clouds. The weak link is the connection between cosmic rays and clouds. Recent work has directed attention to a mechanism involving aerosol production and the affects on low clouds. This idea suggests that ions and radicals produced in the atmosphere by cosmic rays could influence aerosol production and thereby cloud properties. Cosmic rays ionize the atmosphere, and an experiment performed at the National Space Institute has found that the production of aerosols in a sample atmosphere with condensable gases (such as sulphuric acid and water vapor) depends on the amount of ionization. Since aerosols work as precursors for the formation of cloud droplets, this is an indication that cosmic rays influence cloud formation. Climate models only include the effects of small variations in direct solar radiation (infrared, visible and UV). The effects of cosmic rays on clouds are not included in models, and the models do a rather poor job of simulating clouds in the present climate. Since cloud feedbacks are a large source of uncertainty, this is a reason for concern when viewing climate model predictions. The climate system is extremely complex and any estimate of the human contribution to climate change is very uncertain.

Cosmoclimatology is the term coined for this research, involving a range of disciplines from space physics to atmospheric science to cloud microphysics.

**Review of the field of Cosmoclimatology**

Summary of a review article on cosmoclimatology by Henrik Svensmark, National Space Institute, published in Astronomy & Geophysics, February 2007.

In this article, the leader of sun-climate research at the National Space Institute, Henrik Svensmark, puts together the findings reported by him and his colleagues in a dozen scientific papers, to show how the climate is governed by atomic particles coming from exploded stars. These cosmic rays help to make ordinary clouds. High levels of cosmic rays and cloudiness cool the world, while milder intervals like the warming in the 20th Century occur when cosmic rays and cloud cover diminish. Here are some of the salient points of the article:
A secure scientific base
For more than 20 years, satellite records of low-altitude clouds have closely followed variations in cosmic rays (diagram 1). Just how cosmic rays take part in cloud-making appeared in the SKY experiment, conducted in the basement of the National Space Institute. Electrons set free in the air by passing cosmic rays help to assemble the building blocks for cloud condensation nuclei on which water vapour condenses to make clouds (Note 1: See also NSI press release, 4 October 2006. Getting closer to the cosmic connection to climate).

1. **Red depicts cosmic-ray intensities and blue, the low-level cloudiness (click for larger image).** Evidence that the Earth’s climate really responds to variations in cloud cover comes from Antarctica. When the rest of the world warms up, the southern continent tends to cool down, and vice versa (diagram 2). This contrary behaviour is predictable, because clouds have an unusual warming effect over Antarctica.

2. **Upper curve shows temperature changes in the Northern Hemisphere, and the lower curve, changes in the Antarctic region (click for larger image).** Cosmic ray intensities – and therefore cloudiness – keep changing because the Sun’s magnetic field varies in its ability to repel cosmic rays coming from the Galaxy before they can reach the Earth. Radioactive carbon-14 and other unusual atoms made in the atmosphere by cosmic rays provide a record of how cosmic-ray intensities have varied in the past. They explain repeated alternations between cold and warm periods during the past 12,000 years. Whenever the Sun was feeble and cosmic-ray intensities were high, cold conditions ensued, most recently in the Little Ace Age that climaxed 300 years ago.

Events around 40,000 years ago posed a difficulty for the new theory. Cosmic rays intensified dramatically then, because the Earth’s magnetic field weakened, but no perceptible cooling resulted. Calculations now show that the cosmic rays involved in cloud formation at low altitudes are produced by particles coming from the Galaxy with such high energy that the Earth’s magnetism scarcely affects them.

‘From this secure base,’ Dr Svensmark writes in Astronomy & Geophysics, ‘we can broaden the horizons of space and time to consider the relevance of cosmic rays to climate change since the Earth was young.’

**Climate change during the Earth’s history**
On long timescales the intensity of cosmic rays varies more emphatically because the influx from the Galaxy changes. During the past 500 million years, the Earth has passed through four ‘hothouse’ episodes, free of ice and with high sea levels, and four ‘icehouse’ episodes like the one we live in now, with ice-sheets, glaciers and relatively low sea levels.

Nir Shaviv of the Hebrew University in Jerusalem, together with Ján Veizer of the Ruhr University and the University of Ottawa, links these changes to the journey of the Sun and the Earth through the Milky Way Galaxy. They blame the icehouse episodes on encounters with bright spiral arms, where cosmic rays are most intense (diagram 3).

3. **The red curve shows changes in tropical sea-surface temperatures over the past 500 million years. In the blue curve, drawn upside down to match, cosmic-rays intensities have varied according to our position relative to the Galaxy’s spiral arms. After Shaviv and Veizer (click for larger image)**

More frequent chilling events, every 34 million years or so, occur whenever the solar system passes through with the mid-plane of the Galaxy. Dr Svensmark has used the climate records to improve our knowledge of important astronomical details about the Milky Way (Note 2: See also NSI press release, 15. November 2006: The microscopic hitchhiker’s guide to the Galaxy).

In Snowball Earth episodes around 700 and 2300 million years ago, even the Equator was icy. At those times the birth-rate of stars in the Galaxy was unusually high, which would have also meant a large number of exploding stars and intense cosmic rays. Earlier still, the theory of cosmic rays and clouds helps to explain why the Earth did not freeze solid when it was very young. The Sun was much fainter than it is now, but also more vigorous in repelling cosmic rays, so the Earth would not have had much cloud cover.

While calculating the changing influx since life began about 3.8 billion years ago, Dr Svensmark discovered a surprising connection between cosmic-ray intensities and a variability of the productivity of life (Note 3: See also NSI press release 15. November 2006: The Milky Way shaped life on Earth).

Near the end of his review Dr Svensmark writes: ‘The past 10 years have seen the reconnaissance of a new area of research by a small number of investigators. The multidisciplinary nature of cosmo-climatolgy is both a challenge and an opportunity for many lines of inquiry.’ Even the search for alien life is affected, because it should now take into account of the need for the right magnetic environment if life is to originate and survive on the planets of other stars.

**Source**

**Experiments**
Click to read about the CLOUD og SKY experiments.

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Organisation profile

Education
Within the M.Sc. in Manufacturing Engineering and Management two recommended study lines related to MPP are found:

Micro/Nano Manufacturing

Process and production technology

Research
Micro/Nano and Precision Manufacturing focuses on developing the basis for industrial production of products and components in metal, polymers and ceramics in micro meter scale. More specifically we focus on product development, materials development and development of process technologies and production systems focusing on micro mechanical systems.

The main activities include design and product development on a micro level, tooling technologies for micro injection moulding and micro forming, methods for mass production (micro injection moulding, micro forming) electro chemical and chemical process technologies, laser technologies and integration of individual processes in continuous process chains.

Business
MPP has a long tradition for collaboration with Danish and foreign industrial companies in the area of manufacturing. Collaboration includes industrial ph.d., research projects, European research projects and consultancy services.

Organisational unit: Section

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Education
The Section offers a wide range of possibilities for students concerning these areas:

Thermodynamics
Research
The Section is doing research in energy and energy systems with focus on especially cooling and heat pumps, engines and power plants.

More information...
Research areas:
Combustion and emissions

Conversion of biomass to fuel, power and heat

Energy systems and alternative power plants

Fuel cell systems and alternative fuels

Gas turbines and waste heat recovery for power generation and ship propulsion
Internal combustion engines and alternative fuels

Refrigeration systems and two-phase flow

Business
The Section is collaborating with many different companies, institutions and universities world wide. Click here for more information.
Organisational unit: Section

High-Speed Optical Communication
Department of Photonics Engineering
Short name: Ultra-Fast Optical Communication

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Organisation profile
The Ultra-high-speed optical communications (UHSOC) group conducts research on ways to increase the serial data rate in optical communication systems. This work involves all aspects from the physical layer with pulse compression and ultra-fast switching to network issues with development of essential network functionalities.

The means to achieve ultra-high-speed serial data is to keep the bit rate upgrade in the optical domain, i.e. relying on optical time division multiplexing (OTDM) techniques, as sketched in Figure 1. In particular, we investigate the use of sub-ps pulses interleaved to 100’s Gigabit/s data streams for ultra-fast optical communications. More specifically, the group is currently working with the activities listed below.

Current activities:
Ultra-fast functionalities for 640 Gbit/s and above:

Optical switching
Add/drop multiplexing
Wavelength conversion
Clock recovery and transmission

Optical sampling techniques
All-optical switches based on:
- Functional fibres / highly non-linear fibres (HNLF) (from OFS Fitel Denmark, http://www.ofsoptics.dk/ )
- Semiconductor optical amplifiers (SOAs)
- Periodically poled Lithium Niobate (PPLN) (from NIMS Japan, www.nims.go.jp/ )

Pulse shaping:
- Pulse compression using various fibre-based techniques
- Flat-top pulse generation using special filters (e.g. from ORC UK, http://www.orc.soton.ac.uk/ )
- optical differentiation ($du/dt = jw F(u)$) with e.g. long-period fibre gratings (from the Academy of Sciences of the Czech Republic, http://www.ufe.cz/ )
- optical Fourier transformation

Pulse sources:
- Using carbon nano-tubes (CNT) as saturable absorbers in modelocked fibre-based pulse sources
Nano-structured photonic bandgap filters for synchronisation
Ultra-fast optical Ethernet

1 Tbit/s Ethernet issues
640 Gbit/s

[Figure 2] Eye diagram of our generated 640 Gbit/s data signal

Track record of group / some key results:

- first ever C-band 640 Gbit/s wavelength conversion
- first ever 320 and 640 Gbit/s add/drop multiplexing
- second ever 640 Gbit/s clock recovery (first with PPLN)
- first in Europe to obtain error-free demultiplexing from 640 Gbit/s
- second ever to demonstrate full 640 Gbit/s transmission system

Links to stories in popular media:
- http://ing.dk/artikel/85532 article
- http://www.computerworld.dk/art/44707 article
- http://www.bulletins-electroniques.com/actualites/54449.htm article
- http://www.abc.net.au/news/stories/2008/07/10/2299688.htm article and radio interview (CUDOS)

Organisational unit: Section

Terahertz Technologies and Biophotonics

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Organisation profile

Terahertz Technology

Light pulses are a perfect tool for studies of ultrafast dynamic processes in nature. In our laboratories we use the terahertz waves to study the behavior of materials on a very fast time scale – vibrations in biological molecules, motion of electrons in semiconductors and polymers, and behavior of charges in such liquids as water.

Terahertz waves are extremely promising for nondestructive analysis in advanced materials, including many types of composites and layered structures. More over, terahertz light can penetrate clothing and packing materials, and can identify dangerous chemicals, such as explosives. In our group develop imaging and sensing technologies using light at terahertz frequencies.
The terahertz frequency range has high potential for use in communications at ultrahigh speed. At DTU Fotonik we develop terahertz photonic crystal fibers for communication and medical application. We also investigate properties of various terahertz waveguides.

**Biophotonics**

We develop and use broadband laser sources for diagnostic and therapeutic applications in biophotonics. Our technology, known as *Optical Coherence Tomography*, allows live imaging of biological processes as they occur inside living animals. We have used this technology to visualize the development of tissue in animal embryos. It is the first time that such delicate processes can be visualized directly, and hence it gives invaluable new information about the development of tissue.

Furthermore, we are developing our invented and patented GPC-platform to be used in a number of applications requiring spatio-temporal light-beam encoding such as the generation of multiple beam optical trapping and manipulation, optical encryption or phase-visualization applications like wavefront sensing. Recently, an all-optical biophotonics workstation has been developed on this research platform.

**Plasmonics and Metamaterials**

Department of Photonics Engineering

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**Organisation profile**

Plasmons are density waves of electrons, created when light hits the surface of a metal. Because these density waves are generated at optical frequencies, they can encode a lot of information. Plasmonics – called "light on a wire," - is thought to embody the strongest points of both optical and electronic data transfer. It would allow the transmission of data at optical frequencies along the surface of a tiny metal wire, despite the fact that the data travels in the electronic form rather than in a photonic form. The strength of plasmonic waves is that they can be easily converted to and from light waves. Main problems: losses and localization of light.

A metamaterial is a material which gains its properties from its structure rather than from properties of materials. In most cases in optics it is a nanostructured metal-dielectric composite. A metamaterial may exhibit some unusual properties, e.g. a negative refractive index, never occurred in nature. In optics metamaterials can help to produce a superlens and hyperlens with resolution beyond the diffraction limit revealing data with nanometer-scale features. Metamaterials are the key players in the new direction of transformation optics (e.g. in cloaking). Main problems: losses, anisotropy and bandwidth.

Plasmons waves exist in metamaterials and actually determine their properties, therefore both directions are intensively interwoven.

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Organisation profile
Organisational unit: Section

Optical Microsensors and Micromaterials
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Organisation profile
Some of our projects

**Back Scattering Interferometri – a new optical in situ method for complete analysis of cardiac markers**
The approach is to include all measurements on a multiple microfluidic channel platform, thus making it an ideal detector for the proposed complete analysis of the cardiac markers in the blood in patients with acute coronary syndromes, e.g., unstable angina pectoris or acute myocardial infarction.
The novelty in the proposed project is the ability to analyze several mixtures of various concentrations with a known concentration of a third analyte on a single chip in near real-time. This embodiment allows binding assays to be done on a single device in a completely label-free format with just nanoliter volumes. Back Scattering Interferometri, an optical technique, can detect minute changes in refractive index at the 10⁻⁹ level in ultra small volumes in situ. Protein binding interactions can be non-invasively monitored on-chip, in free solution, and in real-time using Back Scattering Interferometri.
Back Scattering Interferometri has high sensitivity with detection limits in the low attomole range of proteins like human IgG, corresponding to improved sensitivity five orders of magnitude better than commercially available equipment. This optical method has been developed jointly by the DTU Fotonik and Vanderbilt University groups, which also share joint patents on this technique. In the long term perspective, applying this novel diagnostic tool to coronary artery disease, earlier and better monitoring of patients will potentially reduce the number of deaths, facilitate early risk stratification (e.g., for selection of patients most likely to benefit from high-cost invasive treatment), and hereby improve the life quality of patients.

**Micromaterials acting as sensor layer**
There is a high need for wear indications of tribological layers for tools that are used in industrial production lines. If a tool is worn out without notice, it means delay in the production or exchange of expensive parts. DTU and the company CemeCon Scandinavia A/S has therefore attempted to include a warning layer which can be detected optically in collaboration with University of Copenhagen and Ecole-Centrale Lyon.
The idea is to include an optical warning layer of about 100 nm TiN in the tribological coating of TiAlN which is about 3 micrometer thick. The reflectance from TiN is high compared to the reflectance from TiAIN, so when the reflection increases drastically, the user knows that the TiAIN coating is depleted leaving the remaining TiN layer visible. The sensor device can be a cheap, simple red diode laser directed remotely on the tribological coating.
DTU Fotonik also has the possibility of producing thin layers of these coatings with pulsed laser deposition (PLD) in collaboration with Risø DTU’s Department of Fuel Cells and Solid State Chemistry. Pulsed laser deposition is a technique for thin film production by which the stoichiometry of the film is similar to the target material, even for very complex materials, e.g. oxides.

Organisational unit: Section

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**Networks Technology and Service Platforms**

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The Network Competence Area covers telecommunications activities above the point-to-point systems. This is a much wider definition than the traditional requirement of an OSI layer 3 functionality. This definition is not only made in order to reflect the current activities of the area, but also as an acceptance of the much wider use of the term “network.” The wide scope reflects that the Network Competence Area represents the “glue” in telecommunications and includes both core and access networks as well as the home network and its terminals. A holistic approach is taken, covering software as well as hardware (both electrical and optical) together with a more generic and technology independent conceptual activity on network architectures and functional requirements.

Research is focused within the following main activities:

- Network Elements for All-Optical Networks
- Communication Network Design
- Broadband Access (Wireline and Wireless)
- Resource Management
- Network Interoperability
- Broadband/Multimedia Applications
- High Speed/Capacity Switching

Organisational unit: Section

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**Nanophotonic Devices**

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**Organisation profile**  
We design, fabricate and characterize semiconductor optical devices. This could be new lasers, waveguide devices or detectors. Examples are Photonic Crystal waveguides, filters and lasers, Semiconductor Optical Amplifier/Electroabsorber based devices for slow light, optical regeneration or mode-locked (pulsed) lasers or Vertical Cavity Surface Emitting Laser based sensors.

**The Functionality of Materials**  
Photonic crystals, quantum dots, (ultrafast) dynamics and/or photonic integration are key elements in most projects. We study materials and devices on both a basic level and for applications to increase our understanding of their functionality. The main goal of the work is to achieve new or improved functionality though material and device engineering.

**Cleanroom Work**
Fabrication technology is essential to realizing nanophotonic devices and it is done in the DTU-Danchip (www.danchip.dtu.dk) cleanroom where we have access to a full silicon and III-V process line including MOVPE crystal growth (InAlGaAsP), PECVD, e-beam writing, dry etching, metallization and structural analysis. We also have test stations for characterizing waveguide and surface emitting components including setups for advanced noise and pulse characterization of mode-locked lasers.

Organisational unit: Section

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Organisation profile
The scope of our activities is driven by the challenges facing the global telecommunication network of the future to cope with the increasing demand for instant, reliable, any time, anywhere and affordable delivery of broadband services directly to the end-user. In the search for solutions to those challenges, we pursue research in topics spanning transparent interfacing between the metropolitan and access area network segments, high capacity access (wavelength division multiplexing –passive optical networks: WDM-PON) technologies, converged signal generation, detection and transport of wireless or wireline signals all the way long from the metro to the indoor (in-home) environment.

The group's ongoing research activities can be grouped along the following tracks:

Coherent detection systems supported by DSP techniques and optical sampling for wireless-over-fiber, digital baseband high capacity transmission systems and access applications. A global vision is to strive for universal digital receiver structures.

All-optical envelope detection of wireless signals. Consolidation of baseband and wireless signal transport over a common fibre-to-the-customer-premises infrastructure

Techniques and technologies for metro-access interfacing nodes

Photonic technologies and techniques for high capacity WDM PON systems
High capacity short range networking over multimode and polymer fibres for wireless and wireline signals

Our group has attracted researchers from a wide range of cultural backgrounds to create a dynamic and enthusiastic research environment. Our team members have educational and cultural backgrounds from Denmark, Russia, Colombia, South Africa, China, Jamaica, Australia, and The Netherlands. We foster close cooperation links with other research groups in DTU Fotonik and at other research institutions worldwide. Currently, the group has attracted funded research projects from the Danish research council, European Commission 7FP, Danish private foundations and DTU scholarships schemes.

Organisational unit: Section

Fiber Optics, Devices and Non-linear Effects
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Organisation profile
The main goal of the group is to develop wave guide based components, which can generate or manipulate light. In one of our projects, we utilize liquid crystals placed in microscopic channels around the wave guide core, to filter light or change its polarization properties. The properties can be controlled with temperature or electrical fields, which produces very flexible and compact components.

Another project focuses on utilizing the optical linearity of the wave guide, which makes it possible for different light signals to affect each other. This can be used in transmitting optical energy from one wave length to another, thus strengthening a data signal with pulsating light at another wavelength. Finally, we are working on building lasers with different wave guides, that can send out strong light pulses shorter than a trillionth of a second. These lasers will be more robust and cheaper than today's lasers, which will make them available to many uses within medicine and materials processing.

Organisational unit: Section

Diode Lasers and LED Systems
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Organisation profile
DTU Fotonik's Diode Lasers and LED Systems group carries out research, development and education within new diode laser systems and diode lighting systems. The aim is to increase the competence of Danish companies to compete within the area of high technological laser systems and energy saving diode lighting systems, and to educate new researchers in these fields.

New diode laser systems
The research area includes research, development and education in diode laser systems for both medical and industrial purposes. We carry out fundamental studies as well as applied research where new industrial lasers are constructed. We are currently developing new and improved diode laser systems for medical applications, materials processing, biotechnology and optical sensing.

LED systems
Solid state lighting (SSL) is rapidly emerging as the most energy efficient alternative to traditional light sources. High energy efficiency, robustness and longevity are some of the most important advantages of Light Emitting Diodes (LED). DTU Fotonik's LED Systems group conducts research, development and education within LED technology, which is important for the successful implementation of this new lighting technology in a wide range of applications including general illumination.

LED Devices
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Organisation profile
Main research areas: Solar System Physics relates to planetary and interplanetary magnetic fields. Electrical discharges in the Earth's upper atmosphere.
Electrical Discharges in the Upper Atmosphere
Earth's magnetic field
Electromagnetic Induction Studies
Magnetic fields at Mars

Electrical Discharges in the Upper Atmosphere: The study of Red Sprites, Blue Jets, and Elves
The upper atmosphere – reaching from the top of the troposphere where the weather and climate rule to the bottom of the ionosphere at 100 km altitude – is one of the least explored regions around the Earth. It constitutes a layer in which processes originating in outer space interplay with processes from the troposphere below.

Here, a surprising variety of optical emissions have been discovered above thunderstorms, including the 'Red Sprite', a gigantic electrical discharge in the mesosphere, the 'Blue Jet', a discharge propagating upwards into the stratosphere from cloud tops, and the 'Elf', a concentric ring of emissions propagating horizontally outwards at the bottom edge of the ionosphere. Observations have further documented super discharges with Blue Jets triggering Sprites, creating an electrical breakdown of the atmosphere from the top of thunderstorms to the bottom ionosphere.

The Upper Atmosphere Research Group at the National Space Institute is studying the physics of high altitude electrical discharges, through experimental and modeling activities. We conduct annual summer observational campaigns to Southern Europe under the EU Research Training Network CAL, develop instrumentation for the International Space Station ASIM, simulate sprite ignition using particle codes, and much more.....

Earth's magnetic field
The Earth's magnetic field originates from three main sources, all of which are the subject of research at the National Space Institute. The dominant component is the so-called 'main' or 'core' field, generated by a hydrodynamic dynamo operating in the Earth's fluid outer core. The second contribution comes from the Earth's lithosphere, from magnetised rocks, of typical magnitude hundreds of nT. Core and crustal fields together are denoted as 'internal' fields since their sources are within the Earth.

'External' fields are due to electric currents in the ionosphere and magnetosphere caused by the interaction of the Earth’s main field with the sun. Finally, the time varying external fields produce secondary, induced currents in the Earth’s interior, which in turn cause a secondary, induced, magnetic field. The largest part of the magnetic field at the Earth's surface comes from sources internal to the Earth. By assuming that this field is a potential field, it is possible to construct maps of the spatial structure of the surface magnetic field (wavelengths greater than order 1000 km), for a specific time (epoch).

Unfortunately, potential theory tells us that formally we can say little more about the origin of the field within Earth – whether it originates in the core, mantle of the crust. All we can say for sure is that it originates within the Earth, but where in the Earth cannot be distinguished. However, by looking at the structure of the field – and making assumptions about its sources – we are able to make further inferences. The large-scale part of the field (wavelengths greater than 3000 km) is dominated by sources in the Earth’s core, while the small-scale part is dominated by sources in the crust.

Using data taken by satellites (like Ørsted, CHAMP and SAC-C) and by ground observatories, the Geomagnetism Group at the National Space Institute determines models of the present Earth magnetic field and its temporal change.

Electromagnetic Induction Studies
What is the structure of a planet's interior? A better understanding of the mantle structure will help us learn more about the mechanisms of evolution of our planet. Geomagnetism is a technique that allows us to probe the interior of the Earth.

Introduction
Knowledge of the structure of the Earth's mantle is important for the understanding of the mechanisms of evolution of our planet. Our present understanding of the processes acting in the mantle results from studies which combine the outcomes from various experimental fields like petrology, geochemistry, and laboratory experiments on the physics and chemistry of the Earth materials.

One of the major limitations is the lack of direct observations of the actual structure of the Earth's mantle. Very few techniques provide such data. Geomagnetism is one of them.

The Earth’s magnetic field is due to several sources of internal and external origins. Among these sources, the magnetization acquired by some minerals present in most rocks has been used for the investigation of the structure of the Earth's crust and upper mantle. Another source of magnetic signal is the interaction between the magnetic field of the Earth and the solar wind which contains charged particles emitted by the sun; mainly protons, electrons and helium. This interaction gives rise to time-varying magnetic fields in the Earth's ionosphere at 110 km altitude and in the magnetosphere which is situated at a distance of several Earth radii.
**Electrical conductivity studies at the National Space Institute**

The external time-varying magnetic fields are characterized by a wide spectrum of time variations ranging from minutes to years. Because of an effect known as the 'skin effect', magnetic fields of different periods of variation will induce electrical currents at different depths within the Earth. The longer the period of variation of the magnetic signal, the deeper it penetrates inside the Earth (Figure 2). Long period signals probe the electrical conductivity of deep regions of the Earth's mantle.

The National Space Institute performs electromagnetic induction studies using magnetic field observations either taken by ground observatories distributed on the surface of the Earth or measured by satellites like Ørsted, CHAMP, SAC-C and Swarm. Time-varying external, primary, currents in the ionosphere and magnetosphere induce currents in the interior of the planet, which are responsible for the secondary, induced, magnetic field. The 'transfer function' between external (inducing) and internal (induced) fields allows the estimation of the electrical conductivity of the planet. Transfer functions for different periods of variation of the magnetic signal provide information on the electrical conductivity structure of the Earth at different depths.

**Magnetic fields at Mars**

Magnetic field observations at Mars are used in a wide range of scientific investigations, including:

- study of the interaction between the solar wind and the upper atmosphere of Mars, and processes leading to atmospheric escape
- determination of the structure and thermal evolution of the deep interior of the planet
- recovery of deep sub-surface water reservoirs, by the determination of the planetary electrical conductivity
- study of the effect on the Martian environment of explosive events on the Sun, in particular the propagation and arrival of solar energetic particles at Mars

Hardly any other single physical quantity can be used in such a variety of studies related to planetary research as the magnetic field. At the NSI we study these processes by analyzing magnetic observations from various satellite missions, in particular the Mars Global Surveyor (MGS) in cooperation with NASA's Goddard Space Flight Center. We cooperate with international groups to interpret the observations in terms of theoretical models and computer simulations of solar wind Mars interactions, and with other groups to provide improved models of crustal magnetization.

The Magnetometer Group at DTU has developed a miniaturized version of the Ørsted satellite magnetometer, well suited for operation at the surface of Mars. The NSI is currently leading an international effort to include this magnetometer as part of Geophysics and Environment Package on the ESA mission ExoMars, scheduled to land at the surface of Mars in 2011/2013.

**Contact person**

Head of division Torsten Neubert.

Organisational unit: Section

**Microwaves and Remote Sensing**

National Space Institute
Main research area: Microwave sensors, i.e. both passive (microwave radiometers) and active (radars) sensors.
The work is focused on the development of advanced methods and new techniques for processing of data from airborne and satellite sensors. In this case, it is often a prerequisite to have a detailed knowledge of the function of and the principles behind the sensors.
The activities within Earth observation are in some cases directed towards specific satellite missions, whereas in other cases the methods developed can be used for different missions.
The primary research areas within remote sensing are:

Application areas
- Land ice and glaciers
- Sea ice
- Atmosphere
- Oceans
- Vegetation and mapping
- Geology

Techniques
- Interferometry
- Polarimetry
- Polarimetric SAR interferometry
- Radiometry
- Interferometric radiometry
- Ice sounder

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Organisation profile
Main research areas: Development of concepts, designs, implementations and verifications of the advanced high performance instruments for use on board spacecraft.
The Measurement and Instrumentation division develops high accuracy stellar reference units for spacecraft and science grade vector magnetometers for space and ground use. The division also works on optical detection and tracking sensors for space.
The division also develops optical formation flying sensors and autonomous sensor systems. These systems are refined by calibration techniques enabling full accuracy use. This calibration is done by the Measurement and Instrumentation division.

Research plan
Implementation of formation flying test lab and associated methods and techniques.
Inertial navigation techniques.
Sub-arcsecond techniques.
Interplanetary and planetary stellar magnetic measurement platforms
Planetary lander systems and autonomy

Applications of the technology
In parallel to these general instrument improvements, other applications and technology uses have been pursued. This research has led to several novel measurement principles, which encompass multi-sensor-head star trackers for improved maneuverability, sub-arcsecond accuracy instruments, astronomical telescope field determination, miniature magnetometer packages for planetary landers, autonomous radiation impact handling and guider and rendezvous docking systems.
Examples:
European Space Agency missions: SWARM , PROBA1, PROBA2, SMART1

NASA missions: IBEX, MMS, JUNO

The Swedish National Space Board missions: PRISMA

JAXA missions: SmartSat

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Organisational unit: Section

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National Space Institute
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Organisation profile
Main research areas: Mapping and monitoring of the cryosphere by satellite, airborne and in-situ data, determining and modelling the earth's gravity field in support of global and regional geodynamics, geoid determination and national gravity networks. Geodynamics carries out airborne and satellite projects in geodesy and earth observation, on behalf of ESA, EU and international geodetic organizations, and manages the DTU-Space role in the Danish Continental Shelf Project through provision of relevant geophysical data and geodetic know-how.
Gravity Field Mapping
The Continental Shelf

Gravity Field Mapping
Since 1996, the NSI has carried out extensive airborne gravity campaigns for regional gravity field determination, especially in the Arctic (Greenland, Svalbard and Canada regions), as well as dedicated projects to map the marine geoid for ocean dynamic topography estimation (North Atlantic, Baltic Sea, Azores, Greece and Australia) and minor demonstration projects for oil exploration (Italy and Svalbard). Over the years, the system has been installed in a large number of different aircraft (Twin-Otter, Antonov-38, Cessna Caravan, Fokker-27, Casa-212 and several others), highlighting the versatility of airborne gravity.
Recent major projects include nationwide geoid and regional gravity surveys of Malaysia (2002-3), Mongolia (2004-5), and Ethiopia (2006-7). These are challenging areas with great variations in topography, necessitating special processing for downward continuation of airborne data and existing surface data. The NSI airborne gravity system is based on a Lacoste and Romberg 'S'-type marine gravimeter, modified for airborne use by ZLS Corporation, and augmented by a medium-grade Honeywell inertial navigation system and numerous geodetic GPS receivers. During good flight conditions the system gives an accuracy of 1.5-2 mgal at 5-6 km resolution.

The Continental Shelf
On 29 April 2003 the Danish Parliament decided to ratify the United Nations Convention on the Law of the Sea (UNCLOS). This decision was later also endorsed by the Parliaments of the Faroe Islands and Greenland.

Denmark ratified UNCLOS on 16 November 2004. Denmark has 10 years from this date to put forward any claims to extend the outer limits of its continental shelf beyond 200 nautical miles.

Five potential claim areas have been identified off the Faroe Islands and Greenland, potentially including the North Pole. In order to provide a database of the necessary information, the Danish Continental Shelf Project has been launched by the Ministry for Science, Technology and Innovation in co-operation with the Faroese and Greenland home rule governments. The project is a co-operation between various institutions in Denmark, the Faroe Islands and Greenland.

The main tasks of the Continental Shelf Project are to identify potential claim areas and to acquire, interpret and document the necessary data for a submission to the United Nations. The NSI supports the project by ensuring accurate GPS-measurements and interpreting data from satellites measuring gravity and ice cover.
Contact person
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Organisational unit: Section

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Organisation profile
Main research areas: Maintenance and development of geodetic infrastructure and development of new techniques for surveying and mapping, such as GPS and Galileo. Refinement and improvement of space-based Earth Observation techniques.
Geodetic Infrastructure
GNSS Positioning
Earth Observation
Geodetic Observing System
Permanent GPS Stations

Geodetic Infrastructure
Research in the field of geodetic infrastructure is carried out with the aim of maintaining and developing geodetic reference systems and reference frames so that the national implementation as a basis for the spatial infrastructure, including surveying and mapping, meets its users’ requirements for accuracy and integrity at all times.
An important task is to introduce and define new international standards such as the ITRFs at the national defining points and stations. It is thus our task to facilitate the transformation towards new standards in line with the national official reference frame in ETRS89 called EUREF89.

Our main challenge is to establish a consistent link between the global navigation satellite systems (GNSSs) and the national reference frames so that these GNSSs can be fully utilized in positioning and navigation. An important issue in this context is to define a velocity field that can compensate for continental drift and crustal deformations. Another important challenge is to develop an accurate, long-term, stable reference frame, which is needed in global monitoring to detect changes in e.g. sea level and ice caps. The development of such accurate stable reference frames will also facilitate the use of GNSSs in monitoring deformations in big structures, bridges, harbours, oil rigs etc.

GNSS Positioning
Research in the field of positioning is being carried out with the aim of developing new positioning techniques that can be used by society for surveying and navigation purposes. Particular efforts are being made in research on the use of global navigation satellite systems (GNSSs - mainly GPS) for both static and kinematic positioning and for the determination of
reference coordinates. The classical method of levelling is still used for accurate height determination. Analysis of time series from permanent GPS stations helps to attain accurate coordinate determinations and to extract information about crustal movements. Furthermore, it also makes it possible to monitor the integrity of the satellite systems and detect problems. Issues relating to the stability of the global reference frames are currently being studied to enhance the accuracy of the coordinates, which will facilitate new GNSS applications. A major effort is also being put into the detection of ice load changes in Greenland based on permanent GPS combined with campaign measurements.

The use of kinematic positioning in real time using GNSS has huge potential in navigation and could be used in for a variety of applications in surveying, traffic, farming, and location-based services. Our research aims to enhance kinematic GNSS, which will facilitate these developments and to prepare for GALILEO so that we obtain the full benefits of this investment.

Earth Observation
Our research in Earth observation aims to establish knowledge about new mapping techniques and other Earth observation tasks in order that society can take full advantage of these new technologies. We mainly focus on applications stemming from new Earth observation satellites and the development of data processing and analysis methods related to the mapping of heights and height changes of land, ocean and ice surfaces. For urban mapping, we are developing automatic change detection methods that will enhance the use of remote sensing data in topographic mapping.

One of our core activities is the mapping of marine geodetic quantities based on satellite altimetry. The NSI global marine gravity field, global mean sea surface and ocean tide models are widely-known, widely-used products stemming from this activity. Including satellite gravity from GRACE and GOCE, we are developing methods to enhance the determination of the mean dynamic topography and improve the modeling of ocean currents and transports.

An important challenge is to develop methods for utilizing Earth observation satellites in global change monitoring and observations of the impact of the varying climate. We are helping to develop techniques for the global monitoring of sea level changes and to develop reference surfaces for ocean modeling and forecasting for the European Global Monitoring for Environment and Security (GMES). A pioneering field is to use satellite gravity changes from GRACE to detect changes in ground water storages.

Geodetic Observing System
Geodetic observations are needed to carry out geodetic tasks such as establishing reference frames. Many tasks require standardized globally distributed data that have been quality checked. Furthermore, collocated data of various kinds (e.g. position and sea level or position and gravity) may be required in research. Hence, international collaboration and coordination are needed to develop the observing system, so that the data requirements can be fulfilled. As part of our national responsibility, we supply data from our national territory - Greenland in particular.

One of our core activities is our participation in the international activities to develop a global network of permanent GPS stations; we are developing a network of permanent GPS stations in Greenland to help to meet these international requirements and standards. We also participate in the international development of a network of sea level recording stations, and we are developing a network of such stations in Greenland. These developments are associated with instrumentation and communication and also complement the instrumentation of other geodetic techniques that may be requested.

We contribute to the development of the Global Geodetic Observing System (GGOS) and its regional implementation and densification, the Nordic Geodetic Observing System (NGOS).

Permanent GPS Stations
As part of our national responsibility to supply data from our national territory - Greenland in particular – to the international community we operate a number of permanent GPS stations in Greenland. The data are sent to the International GNSS Service and similar European centers, where data are made available to other users and used for monitoring and improving the performance of the GNSS. Two stations are so-called global stations and used for the determination of new international reference frames.

In Thule we host a DORIS beacon. DORIS is a global satellite tracking system mainly used for orbit determination for Earth observation satellites.

We also operate sea level recorders at specific sites in Greenland – collocated with GPS – to acquire information on sea level to support research and calibration of spaceborne instruments. These stations are operated according to international standards adopted by GLOSS and the European Sea-level Service (ESEAS). Data are made available through ESEAS and the Permanent Service for Mean Sea Level (PSMSL).

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Organisation profile
The astrophysics division studies physical processes in stars, galaxies, galaxy clusters and the universe as a whole, as well as doing research and development of instrumentation that can be used to observe these objects. Research is concentrated in three main areas:

Understanding the large-scale structure of the universe, including the creation of galaxies and galaxy clusters.
Understanding the physical conditions and processes in and around neutron stars and black holes.
Technological development of x-ray and gamma-ray detectors and instruments, as well as mechanical structures for use in space-based observatories.

A selection of our current research projects
INTEGRAL: X-ray images of the universe
DTU Space led the team that designed and built two x-ray telescopes on the European INTEGRAL satellite. These instruments detect x-rays from deep space including supernova explosions, black hole environments and neutron stars. Investigation of this high-energy radiation gives researchers a glimpse into the universe that can't be seen with the naked eye. The two telescopes can also pinpoint the position of gamma-ray bursts, extremely violent cosmic explosions, the origins of which are still hotly debated. Read more here ...

Planck: Light from the creation of the universe
Since August 2009 the European Planck Surveyor Satellite has been mapping the cosmic microwave background (CMB) in unprecedented details. This radiation originated from a time 380,000 years after the Big Bang and contains the answers to many of the fundamental questions we have about the universe, for example, its age, its size and its eventual fate. DTU Space has designed the big mirror-system that capture and focus the first light of Universe. Read more here ...

NuSTAR: The first satellite with focussing high-energy x-ray optics
In February 2012 NASA will be launching the first ever satellite observatory with a focussing mirror system designed for high-energy x-rays. DTU Space has developed the high-energy focussing technique that will be used during this mission to make images of selected areas of the sky, e.g. near black holes, powerful sources in active galaxies and supernova remnants. Read more here ...

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**Organisation profile**

**Education**  
DTU Space offers a number of exciting study lines and courses within space research and space technology. With an education from DTU, you can become one of the people who set the agenda for future space research and contribute to monitoring and understanding climate change and the Earth's environment.

**Research**  
Research at DTU Space is characterised by a strong interaction between basic research and technology development, and the Institute's projects often involve international co-operation.

Organisational unit: Department

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**Department of Environmental Engineering**  
Technical University of Denmark  
Short name: DTU Environment

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Organisation profile
Department of Environmental Engineering (DTU Environment) works at the highest international level to develop new environmentally friendly & sustainable technologies and disseminate this knowledge to society and new generations of engineers. Our activities in research, teaching and innovation is focused on:

Environmental Chemistry
Residual Resource Engineering
Urban Water Engineering
Water Resources Engineering

Read more about the department and its activities at the department homepage.
Head of Department: Professor Thomas Højlund Christensen
Organisational unit: Department

Experimental surface - and nanomaterials physics
Department of Physics
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Organisation profile
The main objective of the Danish National Research Foundation’s Center for Individual Nanoparticle Functionality (CINF) is to explore and understand the fundamental relations between reactivity and surface morphology as well as to examine non thermally activated processes.
Our research will utilize the miniaturization, which is available within microelectronics, to study reactivity on the nanometer scale and to design new, reactive materials and components.
Link to CINF’s site
Organisational unit: Section

Theoretical atomic scale design
Department of Physics
Short name: CAMD
Research in Theoretic Atomic-scale Physics is all about bridging the gap between the basic, atomic description of various materials and their practical applications. Through the help of computer-simulations based on the basic laws of physics the ultimate end goal is - atom by atom - to design materials for specific applications. This would be a major breakthrough in our ability to design new functional materials.

Specific research projects within this area are: nano-plasticity in metals; mechanical and electrical properties of nano-contacts; electrode properties in fuel cells; metal hydrids and metalamins for the storage of hydrogen; metal alloys; enzyme catalysis and heterogeneous catalysts.

An important part of the theoretical research within atomic-scale materials physics is the design of new quantum-mechanical methods of calculation - involving new ways of describing the electronic structure and interaction of nano-structures and including bio molecules and the development of a whole new field: materials informatics. This branch of research includes the design of scanning probe methods, of parallel screening and in situ methods of heterogeneous catalysis.

Link to CAMDs site
Organisational unit: Section

Biophysics and complex systems
Department of Physics
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Organisation profile
We focus on complex structures - both in living organisms and in the inanimate nature. In this context, “complexity” means that many small parts interact to create cooperative structures where new, unexpected features emerge. This field combines elements from many parts of physics: Statistical Mechanics, Irreversible Thermodynamics, Fluid Dynamics, Quantum Mechanics as well as more mathematical areas such as Bifurcation Theory, Boundary Layer Theory and Computational Modelling.

The scientific activity in the section is divided into four main areas: Protein Physics, System Biology, Fluid Dynamics and Nano Spectroscopy.

Our Protein Physics activities are concentrated at the Center for Quantum Protein, QuP. The center is funded by the Danish National Research Foundation and specializes in the quantum mechanical aspects of the structure and function of proteins.

The Systems Biology group coordinates BioSim, the large EU "Network of Excellence" in Bio-simulation and Drug Development.

The Fluid Dynamics group coordinates the efforts of the center Fluid-DTU - a joint DTU initiative in Fluid Dynamics funded by the Danish National Research Foundation.

The Nano Spectroscopy group is a newly started group which explores ultrasensitive spectroscopic tools and optical nanosensors for applications in biophysics, nanotechnology, biomedical research, and in nano-scale physics and chemistry.

Link to the site of Biophysics and Complex Systems

Organisational unit: Section

Nanophotonics Theory and Signal Processing
Department of Photonics Engineering
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Organisation profile
In the Theory and Signal Processing group we emphasize modelling and simulation of nanophotonic structures as well as the theoretical and experimental exploration of devices and structures for all-optical signal processing. The theoretical activities include the development of new methods for analyzing and simulating advanced structures, in particular devices incorporating quantum dots into photonic waveguides or cavities. The basic carrier dynamics and device performance at
 ultra-high speeds (down to 100 fs) are studied experimentally using ultrafast pump-probe techniques. Slow and fast light effects in semiconductor waveguides are investigated in order to understand the relevant physical processes and implement them in various applications, in particular within microwave photonics. The dynamics of quantum dots is central to many of our activities. We aim to fully understand the fundamental properties of light-matter interaction in ultrafast devices, such as photonic crystal lasers and devices for all-optical signal processing, but also for the quantum coherence properties of single-photon sources. Tailoring the electromagnetic properties of the environment embedding the active material is being explored in order to improve the properties of vertical cavity surface emitting lasers as well as the radiation pattern of nanowires. Finally, the use of surface acoustic waves to control light propagation in nanostructured media is being pursued both experimentally and theoretically.

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Organisation profile

Education
We offer a range of courses and programmes within manufacturing, product design, production technology, strategy, economics, management, organisation, sociotechnical design, entrepreneurship and sustainability.

Research
Our main research areas are innovation, product development, production management, sustainability, construction management and operations research.

Industrial collaboration
We emphasise the transfer of knowledge between industry and academia. Research co-operation can take many forms: industrial PhD projects; research consortiums; innovation contracts, and collaboration agreements.

Organisational unit: Department

Administration
Department of Mechanical Engineering
Short name: Administration

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Department of Mechanical Engineering
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Organisation profile
Education
The section offers teaching within the disciplines:
Mechanics
Strength of materials
Mechanical vibrations
Machine elements
Composite materials
Finite elements

Plasticity and fracture mechanics

Research
Research groups at the section work with:
Mechanics and strength of materials
Vibration analysis
Topology optimization
Machine elements

Business
Solid Mechanics has extensive collaboration with companies, institutions and individuals, domestically and abroad, with a continuous adjustment and expansion of the network.

Organisational unit: Section

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Organisation profile

Education
DTU Mechanical Engineering is an internationally recognized Department at the Technical University of Denmark. The Department offers attractive study opportunities for skilled international engineering students.

International students as well as Danish students studying mechanical engineering, energetics and design, attend the same classes and lectures. English is the language of instruction for courses at an advanced level. All textbooks, lecture notes, and exercises are in English; a knowledge of the Danish language is therefore not required. It is a prerequisite, however, that students possess a very good command of the English language.

Internationally well-reputed scientists and engineers undertake guidance and tuition. Most of the teaching at an advanced
level is based on or directly related to ongoing research, to ensure high standards of instruction and to promote the education of highly qualified engineers who are scientifically up to date.

Finance
DTU and DTU Mechanical Engineering are not able to support international students financially, as we do not administer or offer any funds, scholarships, loans or bursaries for international students. Funding to cover their travel, insurance and living expenses must therefore be raised and organized in due time before arrival to DTU.

Practical matters
Relevant and updated information regarding accommodation, residence permit, and health insurance may be found at the homepage of DTU’s International Office: Practical Matters.

The PhD programme
DTU Mechanical Engineering is an internationally renowned department on the cutting edge of research and education in mechanical engineering. Our current research topics include fluid mechanics, solid mechanics, energy technology, maritime and coastal engineering, manufacturing engineering as well as materials and surface engineering.

The staff at DTU Mechanical Engineering includes a large number of PhD students, who participate in the research. As PhD student at DTU mechanical Engineering you will normally be part of a larger research project and/or collaboration with Danish and international companies.

The PhD programme is a 3 year programme designed to train researchers at an international level and interplaying with the international research community. The PhD programme is composed of a learning process where the PhD student learns to perform research under guidance.

Who can become a PhD Student?
National as well as international candidates can apply for the programme. We are seeking highly qualified candidates with good marks and a focused interest in research.

Examples on our present PhD project are found here.
Find out more about the research areas of interest at DTU Mechanical Engineering through the top menus Research and Business.

Business
DTU Mechanical engineering has an extensive collaboration with national as well as international companies, institutions and individuals and the Department is continuously adjusting and extending this collaboration network.

DTU Mechanical engineering is open to research collaboration with any party, when the collaboration is deemed to be mutual benefit.

Please contact Head of Department Henrik Carlsen at the Department address, an established contact with a member of staff or the Head of the section, which covers the topic of collaboration.

The below list of application areas links to our present research:

Manufacturing processes
Surface engineering and materials
Machine elements
Refrigeration
Power plants
Engines
Wind power
Ships
Harbor building
Bridges

Medical and biological applications
Organisational unit: Department

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Department of Transport
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**Department of Photonics Engineering**
Technical University of Denmark
Short name: DTU Fotonik

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In the world class laboratory facilities of DTU Fotonik, the research encompasses a broad spectrum of today’s photonics research, ranging from nanotechnology at one end to complicated network architecture at the other.

**What is Photonics**

The science of photonics includes the generation, emission, transmission, modulation, signal processing, switching, amplification, detection and sensing of light. The term photonics basically covers all technical applications of light over the whole spectrum from ultraviolet over the visible to the near-, mid- and far-infrared. The term photonics developed as an outgrowth of the first practical semiconductor light emitters invented in the early 1960s and optical fibers developed in the 1970s.

Today at DTU Fotonik, we deal with the design, fabrication and characterization of new types of optical devices based on the newest developments in nanotechnology, such as sensors, lasers, LEDs, photovoltaic elements and devices for all-optical signal processing. Novel structures for applications in future quantum information technologies are also being explored. We investigate and demonstrate new techniques for ultra-high speed optical transmission systems and networks for distributing high-speed data to end-users. We optimize network layout and administration, and develop efficient data compression codes that enhance the quality and minimize the resources needed.

**The Light Department**

In one way or another, photons (light) enter into every aspect of the work that takes place at DTU Fotonik. We are working with all the ways in which light can be used, affected, manipulated, and controlled. Technologies based on photonics can replace many of the more resource demanding technologies. Our passion for photonics leads to many exciting and valuable technological developments.

**Light can measure, sense, and identify materials without touching them.** The Terahertz Camera detects faults in the insulation of rocket ships before it is too late. It also detects and identifies potentially explosive liquids in the baggage of travellers. In the health sector, light is replacing and improving current diagnostics and treatment methods. The optical methods are typically non-invasive and more energy efficient than current methods. Within these areas, scientists envision such future advances as the biowatch which senses the status of your health, the optical contact lens which does the same in a different way, and the Sickbay – the bed, that monitors the development of your state of health, when you are ill.

**Light can measure ultrafast phenomena and can be exploited for ultrafast photonic chips.** By exploiting the nanotechnologies of photonic crystals and quantum dots, photons can be guided around on an ultracompact chip and be used for implementing signal processing at speeds far exceeding electronics.

**Light can be the basis for future quantum information technology.** By exploiting the quantum mechanical nature of the interaction between photons and electrons in quantum dots, novel devices can be realized, such as a light source generating a single photon at a time. Such a source can be exploited for secure communication links.

**Light can measure the environment and make the most of it.** The productivity of wind mills can be significantly enhanced if the speed, quality, and direction of the wind are known before it reaches the wind mill. This allows the wind mill to be set for maximum exploitation of the wind’s energy.

**Light can nurture growth very specifically.** Diode lamps in certain colors can be used to control the growth of plants according to specific needs. Targeted control saves energy.

**Light can transport data.** The primary transmission technology for communication networks, such as the internet, is based on optical fibers which can transmit unknown masses of data compared to other media. When routers and switches all become optically based, energy usage and capacity needs will be significantly reduced. DTU Fotonik scientists have broken the world record several times in data transmission speed, most recently bringing it up to 5.2 Tbit/s. Within this area, scientists envision a future with all imaginable communication lines functioning efficiently at top speeds at a fraction of the costs to the environment. Taking this technology to the third world may eventually help bring about world wide equality in living standards as well as opportunities.

**Light entertains.** But before you can be entertained, there is coding and visual technology research. This research is also used in Space technology.
Within this area, scientists envision 3D home theaters with free-view. Each individual viewer can choose his/her own view of the show. **And then there is lighting.** At DTU Fotonik, the researchers are working on developing better, cheaper, and more energy efficient lighting. The technology is called LED. It is based on diodes and lasers. Within this area, scientists envision the ultimate intelligent lighting systems which “know” us or their environment and adjust themselves accordingly, using very little energy. DTU Fotonik’s main areas of research (clusters) are

- Nanophotonics
- Light sources and Industrial Sensors
- Dynamic Photonics
- Communication technology

Each cluster consists of three or five research groups. There are 15 groups in all. About 190 researchers are employed at DTU Fotonik, including about 55 PhD Students. In a typical year, we educate more than 40 MSc students and 75 PhD students and our student numbers are constantly growing.

**Center for Biological Sequence Analysis**

**Department of Systems Biology**

**Short name:** CBS

**Addresses**

- **Type of address:** Postal address
- **Street:** Kemitorvet
- **Building:** 208
- **Postal code:** DK-2800
- **City:** Kgs. Lyngby
- **Country:** Denmark

**Phone numbers**

- **Phone:** +45 45 25 24 77
- **Fax:** +45 45 93 15 85

**Web addresses**

- **Web:** http://www.bio.dtu.dk/english/Research/Research-groups

**E-mails**

- **E-mail:** cbs@cbs.dtu.dk

**Organisation profile**

The Center for Biological Sequence Analysis at the Technical University of Denmark was formed in 1993, and conducts basic research in the field of bioinformatics and systems biology. The group of +90 scientists, working in ten specialist research groups, has a highly multi-disciplinary profile (molecular biologists, biochemists, medical doctors, physicists and computer scientists) with a ratio of 2:1 of bio-to-nonbio backgrounds. CBS represents one of the large bioinformatics groups in academia in Europe.

Bioinformatics is the term used to refer to the combination of methods in biology, computation, and information
management, which are necessary to advance research relating to all aspects of living systems - from individual molecules, cells, and organs to entire organisms.

Today, research in molecular biology, biotechnology and pharmacology depends on information technology all the way from experiment to the publication of the results. Comprehensive public databases of DNA- and protein sequences, macromolecular structure, gene and protein expression levels, pathway organization and cell signalling, have been established to optimise scientific exploitation of the explosion of data within biology. Unlike many other groups in the field of biomolecular informatics, Center for Biological Sequence Analysis directs its research primarily towards topics related to the elucidation of the functional aspects of complex biological mechanisms.

Among contemporary bioinformatics concerns are reliable computational interpretation of a wide range of experimental data, and the detailed understanding of the molecular apparatus behind cellular mechanisms of sequence information. By exploiting available experimental data and evidence in the design of algorithms, sequence correlations and other features of biological significance can be inferred. In addition to the computational research the center also has experimental efforts in gene expression analysis using DNA chips and data generation in relation to the physical and structural properties of DNA.

In the last decade, the Center for Biological Sequence Analysis has produced a large number of computational methods, which are offered to others via WWW servers.

Based on bioinformatics efforts started in the late 1980s, the activity was established formally as a center in 1993 by a grant from the Danish National Research Foundation.

Today, CBS is - in addition to a contribution from the Technical University of Denmark - funded by a multitude of sources including:

- The Danish Research Councils
- The Danish Center for Scientific Computing
- The Villum Kann Rasmussen Foundation
- The Novo Nordisk Foundation
- EU, NIH and Industry

Organisational unit: Section

**Department of Systems Biology**

Technical University of Denmark
Short name: DTU Biosys

**Addresses**

Type of address: Postal address
Street: Seltofts Plads
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**Web addresses**
Web: http://www.bio.dtu.dk/English.aspx

**E-mails**
E-mail: info@bio.dtu.dk
Organisation profile

Education
We offer studies from Bachelor to Ph.D. level, specializing in the areas of Biotechnology and Systems Biology.

Research
A systems approach to Life Science Engineering, Biomedicine, Microbiology and Biotechnology.

How to apply to DTU
Department of Systems Biology offers two English-tutored MSc programs. For more information about DTU and how to apply, please read this
Organisational unit: Department

Department of Chemical and Biochemical Engineering
Technical University of Denmark
Short name: DTU Chemical Engineering

Addresses
Type of address: Postal address
Street: Soltofts Plads
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Country: Denmark

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Web addresses
Web: http://www.kt.dtu.dk/English.aspx

E-mails
E-mail: kt@kt.dtu.dk

Organisation profile

Research and education in a world in motion
We live in a world in constant motion. Global communication and access to information is just a click away, and every new day brings technological advancement with new tools for creating, shaping and developing the world around us. The “global village” has been an actuality for years in the Department DTU Chemical and Biochemical Engineering; We work in a dynamic, international environment and achieve results across disciplinary, geographical and cultural boundaries.

Among our close collaborators are some of the biggest danish companies and a wide range of international corporations engaging in our work area.

In our daily work we are often met by e.g. economic, cultural or environmental challenges, which by far outreaches our core competences. This puts high demands on the professional competence and versatility of all our employees.

In the Department DTU Chemical and Biochemical Engineering, we know that a world in motion calls for engineers and scientists with all-round and up-to-date qualifications. We train the chemical engineers of the future: Engaged and versatile people who are fully prepared to get involved in the world around us.

Department of Chemical Engineering (KT) is part of The Technical University of Denmark (DTU).

The Department offers education and carries out research in the common disciplines of chemical engineering, e.g. fluid mechanics, technical thermodynamics, heat transmission, separation processes, reaction technology, process regulation, process- and plant projecting and chemical product development. In addition we train and do research in fields like polymers, catalysis and aerosol technology, modern separation processes in chemical, biochemical and pharmaceutical industries, combustion and prevention of air pollution, viable energy production, oil- and gas-technology and computerbased process technology.
The Department of Chemical Engineering has approximately 140 employees, 30 of which are full-time scientific staff members. Every year around 15 Ph.D's, 15 Bachelors in Chemical Engineering and 45 MsC's in Chemical Engineering graduate from the department.

Organisational unit: Department

Administration
Department of Civil Engineering
Short name: Administration

Addresses
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Phone: +45 4525 1700
Fax: +45 4588 32 82

Web addresses
Web: http://www.byg.dtu.dk/

E-mails
E-mail: byg@byg.dtu.dk

Organisational unit: Section

Center for Electron Nanoscopy
Technical University of Denmark
Short name: DTU Cen

Addresses
Type of address: Postal address
Street: Fysikvej
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Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 45 25 64 74

Web addresses
Web: http://www.cen.dtu.dk/

Organisation profile
Funded by a generous donation given by the A.P. Møller and Chastine Mc-Kinney Møller Foundation, the Center for Electron Nanoscopy (DTU Cen) at DTU is a state of the art center for electron microscopy.
DTU Cen aims at establishing and operating an internationally lead electron microscopy facility that ensures the balance between advanced research, teaching, service and training, as well as establishing additional collaboration with national and international partners and securing further national and European funding for research purposes.
Organisational unit: Department

Center for BioProcess Engineering
Department of Chemical and Biochemical Engineering
Short name: BioEng

Addresses
Type of address: Postal address
Street: Søltofts Plads
Building: 229
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
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Web addresses
Web: http://www.bioeng.kt.dtu.dk/

E-mails
E-mail: kt@kt.dtu.dk

Organisation profile
The Center for BioProcess Engineering currently hosts and manages three larger research structures:

1. The Novozymes BioProcess Academy was established in 2002 with substantial support from Novozymes A/S. Currently, 8 full-time, post-graduate students studying for the qualification of PhD as well as 4 MSc students are enrolled with the academy.

2. The Research Consortium "Innovative BioProcess Technology" was established in 2005 as a major research collaboration between Center for Biochemical Engineering – a cooperation between the Dept. of Chemical Engineering and BioCentrum, DTU – and the three major Danish biobased companies: Novozymes A/S, Danisco A/S, and Chr. Hansen A/S. The programme will run for at least 5 years and educate at least 5 PhD, 1 postdoc, and 10 MSc candidates.

3. Center for Biological Production of Dietary Fibres and Prebiotics. Started Jan. 1. 2007 via a grant from Danish Council for Strategic Research (Programme Committee on Food and Health) and with main support from Danisco A/S. The Centre will educate minimum 9 PhDs and 4 postdocs.

Organisational unit: Section

Administration
Department of Chemical and Biochemical Engineering
Short name: DTU Chemical Engineering

Addresses
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Web: http://www.kt.dtu.dk/

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E-mail: kt@kt.dtu.dk

Organisational unit: Section

The Danish Polymer Centre
Department of Chemical and Biochemical Engineering
Short name: DPC

Addresses
Type of address: Postal address
Street: Produktionstorvet
Building: 423
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: +45 4525 6800
Fax: +45 4588 2161

Web addresses
Web: http://www.polymers.dk/

E-mails
E-mail: info@polymers.dk

Organisation profile
The Danish Polymer Center is devoted to fundamental research in polymers, soft materials and complex fluids. We also seek to utilize polymer research in education, technological innovation and industrial collaboration.

Organisational unit: Section

CHEC Research Centre
Department of Chemical and Biochemical Engineering
Short name: CHEC

Addresses
Type of address: Postal address
Street: Søltofts Plads
Building: 229
Organisation profile
CHEC is an acronym for Combustion and Harmful Emission Control, referring to the traditional core research area of the group. In recent years, CHEC has also initiated research in the field of chemical and biochemical product design.
Organisational unit: Section

DTU Admission Course
Technical University of Denmark
Short name: ADK

Addresses
Type of address: Postal address
Street: Akademivej
Building: 358
Postal code: DK-2800
City: Kgs. Lyngby
Country: Denmark

Phone numbers
Phone: (+45) 4525 5633

Web addresses
Web: http://www.adgangskursus.dtu.dk/

E-mails
E-mail: adk@dtu.dk

Organisation profile
Adgangskursus
Til dig, der ikke har en adgangsgivende eksamen, men f.eks. er håndværker eller har anden praktisk erfaring.
Adgangskursus til ingenioeruddannelserne
Adgangskursus til maskinmesterskolen

Suppleringskursus
For dig som ønsker en ingenioeruddannelse og har en gymnasiel uddannelse, men mangler de rette niveauer/ karakterer i et eller flere fag.
Der er forskellige muligheder for supplering:
½-årig suppling
1-årig supplering
Turbokursus
Aftenkursus
Fjernundervisning

Værd at vide
På disse sider kan du finde mange nyttige informationer om adgangskursus, hvadenten du overvejer at starte eller allerede er studerende, men mangler overblik over eksamensregler eller lignende.
For nye studerende
For nuværende studerende
Fra håndværker til ingeniør
OBS! Spørgsmål vedr. studiet kan kun besvares af studievejleder på adgangskursus.

Organisational unit: Department