# Department of Science and Environment
## Interdisciplinary Research Profile

Published 3 November 2026

The Department of Science and Environment (DSE) conducts experimental and theoretical research in physics, mathematics, chemistry, molecular - and medical biology, and environmental science at the highest international level. Our disciplinary research environments are divided into four sections that constitute the foundation of the department. The four sections are Environmental Dynamics, Mathematics and Physics (IMFUFA), Chemistry and Molecular- and Medical Biology.
As a relatively small department, DSE encompasses an unusual breadth of natural science disciplines within a closely connected research environment. Researchers from different fields and sections within natural science work in close physical proximity on a shared campus, and interdisciplinarity is deeply embedded in Roskilde University's tradition of both research and the problem-oriented education model. Together, this creates distinctive conditions for scientific interaction across disciplinary boundaries and for new questions, collaborations, and research directions to emerge.

DSE's Research Profile does not encompass everything we do or aspire to do. Rather, it articulates a particular hallmark of the department: how strong disciplinary research environments connect and create new opportunities for interdisciplinary research. The profile identifies four interdisciplinary research signatures (Figure 1).

**Figure 1. DSE's four interdisciplinary research signatures**

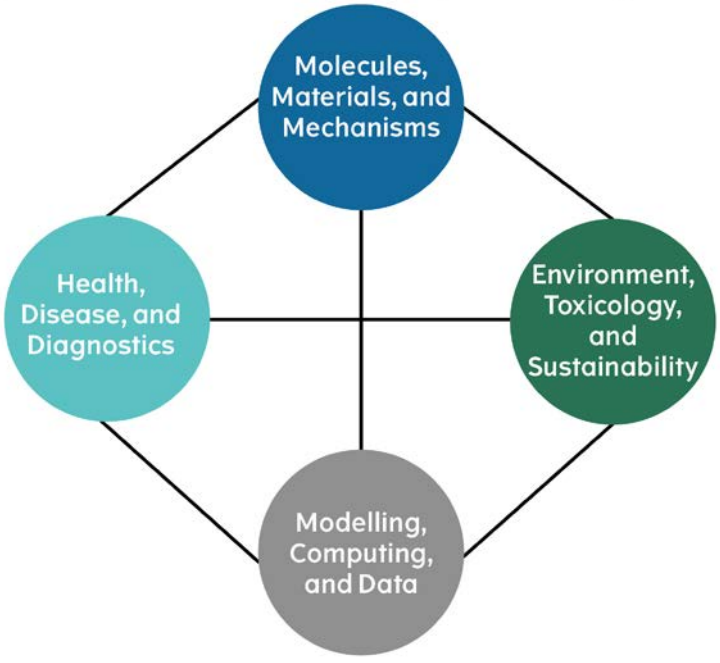



Figure 1. DSE's four interdisciplinary research signatures. The connecting lines illustrate scientific interfaces and collaboration across the signatures.

The four signatures build on established research strengths at DSE and identify areas with particular potential for further interdisciplinary development. They are not organisational structures, but research areas that connect disciplines and scientific approaches across the department. Each signature encompasses both fundamental and applied research and provides opportunities for collaboration within DSE, across Roskilde University, and with external and international research partners.

The four research signatures are closely interconnected. The lines in Figure 1 illustrate scientific interfaces across the signatures, for example where mathematical modelling meets experimental health research, or where molecular biology and experimental physics research connects with environmental science. These intersections are central to DSE's interdisciplinary research profile.

## The four interdisciplinary research signatures at DSE

**Molecules, Materials, and Mechanisms**

Research within this signature seeks to understand why physical, chemical, and biological systems behave as they do by investigating the structures, interactions, and dynamics that determine their properties and function. By bringing together experimental - and theoretical physics, chemistry, molecular and medical biology, and environmental science, DSE develops fundamental understanding of molecular mechanisms and complex materials across multiple scales. Research ranges from amorphous and soft materials and molecular interactions to enzymology, biological mechanisms, and environmental processes. This understanding can, for example, help explain how diseases develop and lead to new treatments, enable the development of new sustainable and hybrid materials, and reveal how molecular processes influence organisms and ecosystems.

**Modelling, Computing, and Data**

Research within this signature seeks to understand the mechanisms and dynamics of complex biological, physical, and environmental systems through mathematical modelling, mathematical analysis, computation, and data-driven research. Bringing together mathematics, theoretical physics, computational science, statistical methods and advanced data analysis, researchers develop new ways of describing, explaining, and predicting complex phenomena. This includes modelling biological and physiological systems and the spread of diseases, developing new mathematical and physical methods, understanding fluid dynamics and molecular systems through simulations, modelling environmental change, and finding patterns in large and complex datasets.

High-performance computing (HPC), advanced computational methods, and the ability to analyse and interpret complex data are increasingly central to scientific research and constitute key strengths within this research signature.

**Health, Disease, and Diagnostics**

Research within this signature seeks to understand the biological and physiological mechanisms underlying health and disease and to translate this knowledge into new approaches to prevention, diagnostics, and treatment. By integrating expertise in microbiology, molecular and medical biology, data science, chemistry and biochemistry with mathematical modelling as a distinctive strength, DSE advances fundamental and applied research into infectious diseases, antimicrobial resistance, fertility, personalised medicine, and non-communicable diseases e.g. cancers, diabetes, inflammatory disorders, neurodegenerative diseases, and mental health.

Long-standing collaborations with hospitals in Region Zealand enable a continuous exchange between fundamental biological research, mathematical modelling, and clinical challenges. Fundamental discoveries inspire new diagnostic and therapeutic approaches, while clinical questions stimulate new avenues of fundamental research.

**Environment, Toxicology, and Sustainability**

Research within this signature seeks to understand how ecosystems function and respond to environmental change and human pressures by investigating how biological, chemical, and physical processes interact across scales. Combining laboratory experiments, field observations, molecular approaches and mathematical modelling, DSE advances fundamental and applied research into environmental contaminants and ecotoxicology, plastic pollution, biogeochemical processes, ecosystem dynamics, biodiversity and restoration ecology. This research provides new knowledge on how pressures such as chemicals, nutrient loading, climate change, and invasive species affect organisms and ecosystems, and contributes to the development of sustainable approaches to environmental protection, restoration, and resource use.