

Department of Biotechnology

The Department of Biotechnology at SINTEF Materials and Chemistry is the leading Norwegian research group in development of biotechnological processes for industrial production of drugs and chemicals. Other important research areas are application of microbial and enzymatic processes in the food and feed industries, in petroleum technology and in environmental technology. The Department cooperates closely with The Department of Biotechnology at the Norwegian University of Science and Technology (NTNU).

Core competence:

- Strain evaluation and development
 - Microbial molecular biology
 - High-throughput screening
 - Metabolic engineering
- Fermentation technology
- Product recovery and purification
- Advanced analyses
- Process development and economical evaluation

Strain evaluation and development are carried out in an interaction between the geneticists and fermentation technologists. Strains are generated either by molecular genetic techniques or classical mutagenesis. Their properties are evaluated using an advanced technology platform for strain evaluation, including high-throughput screening, advanced analytical equipment and small-scale fermentors.

Other important research areas

- Biocatalysis
 - Enzyme technology
 - Immobilized biocatalysts
- Food technology
- Environmental and oil microbiology

Research projects

Efficient bioprospecting of marine microorganisms

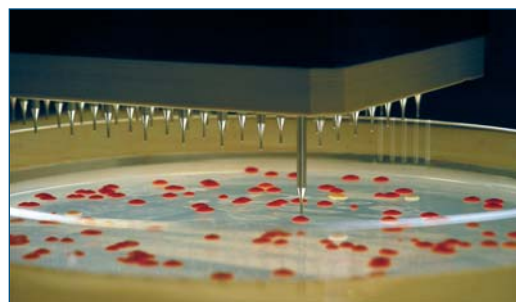
The aim is to isolate microorganisms from marine environment that produce valuable products with an industrial potential. Our current focus is on isolation and characterization of microorganisms that produce antibacterial and anticancer compounds. Several novel compounds with interesting bioactivities have been identified and are currently evaluated for future therapeutic use. This work is carried out as a collaboration between SINTEF, NTNU and the University of Bergen.



One of the two jar fermentor laboratories, each with 16x3 liter-fermentors.

Systems biology of *Pseudomonas* and *Streptomyces* – alginate and antibiotics

The recent technological progress has, for the first time, made it feasible to analyse the complete flow of biochemical compounds and information – DNA, RNA, proteins and metabolites – in a living cell, i.e. the basic defining features of life. Systems biology encompasses the acquisition and integration of these global datasets to yield mathematical models of the cell, with predictive power. We are currently partner in two European projects (ERANET/SysMO) on systems biology of microorganisms; one project on biosynthesis of the industrially and medically important biopolymer alginate in *Pseudomonas fluorescens*, and one on growth-phase related metabolic shifts in the antibiotic producing organism *Streptomyces coelicolor*.



Automated picking of colonies in the high-throughput screening laboratory

Applied Chemistry

Applied Biology

Materials
Technology

Updated
November
2007

Microbial production of L-lysine and L-glutamate from methanol

The essential amino acids L-lysine and L-glutamate are currently produced from low-cost carbohydrates and the global market is rapidly growing. Methanol offers several advantages as an alternative substrate and is produced in large quantities from natural gas in Norway. Based on the thermophilic and methylotrophic bacterium *Bacillus methanolicus*, we are using metabolic engineering towards industrial production of L-lysine and L-glutamate from methanol. The projects are a collaboration between SINTEF, NTNU and The University of Minnesota, USA.



The high-throughput screening laboratory, one of the two liquid handling work stations.

Streptomyces antibiotics

For the last fifteen years SINTEF and NTNU have developed and optimized several fermentation processes for production of antibiotics from *Streptomyces*. The projects have included strain development by classical mutagenesis, high-throughput screening of mutants and optimization of fermentation processes. NTNU/SINTEF has done a complete DNA sequence analysis of the nystatin polyene antibiotic biosynthetic gene cluster (123 580 base pairs) and deduced the biosynthetic pathway (patents granted). In 2005 the new biotech company Biosergen AS was started, which utilizes this knowledge in creating new antibiotic agents by genetic engineering.

Other projects currently in progress or finished during the last years:

- Development of fermentation processes: Antibiotics, vaccines, carotenoids, enzymes, 3-fatty acids and polysaccharides

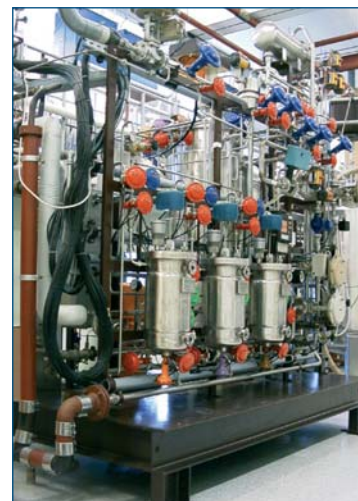
- Biofuels and biorefineries:
 - Strain development
 - Fermentation process development and optimization
- Biocatalytic upgrading and modification of mineral oil
- Oil reservoir microbiology
- Development of large scale processes and equipment for immobilization of cells
- Food technology:
 - Development of new technology for production of starter cultures
 - Development of preservation techniques for food products
 - Improvement of food fermentation and ripening processes

Laboratory facilities

- High-throughput screening laboratory, equipped with a robotic colony picking unit, two robotic workstations for liquid handling and other equipment, such as incubators and microplate readers.
- A well equipped laboratory for advanced analyses, including 6 LC-MS units with different ionization and detection principles (TOF, QTOF, Ion-Trap, Single Quadrupole and Triple Quadrupole), and two GC-MS instruments.
- Fermentors: 32 x 3 l, 3 x 14 l fermentors with extensive logging and control
- Anaerobic workstation
- Equipment for membrane filtration and chromatography

Pilot Plant

The Pilot Plant for Bioprocesses at SINTEF/NTNU is capable of handling liquid volumes in the range of 100 - 1500 l and includes fermentors (300 and 1500 l), centrifuges, cell homogenizer and equipment for membrane filtration and chromatography.



The 300 litre pilot plant fermentor



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Biotechnology

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