Associate Professor Morten Bjørgen just left his base at the peak of Karlskråtind in Romsdal.

© M. Bjørgen
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**The State of the Department**

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The State of the Department of Chemistry 2008

Introduction.—In last year’s report on the State of the Department, I wrote: “Paradoxically these are turbulent times for university funding despite a booming economy.” How quickly the economic scene has changed from a situation in which economic experts proclaimed a cloudless economic sky to the current picture of global doom and gloom. We can only hope that the situation remains paradoxical but this time in our favour. Hopefully, there is motivation to increase research funding in the university sector from 2009 although according to our omniscient Faculty the forecast for 2009 is that we are in for a rougher ride than in 2008.

Measures to increase income.—Nevertheless, I am impressed with the activities and productivity of some of our researchers who are operating under very trying circumstances. There are bright points that should be emphasised. Bearing in mind that of the three chemically-related departments, the Department of Chemistry’s main role is to take care of basic or curiosity-driven research we have a balanced strategy aimed at increasing external funding that is additional to attempts to acquire support from a cash-strapped Research Council. We have implemented measures to stimulate those activities that generate external income whilst balancing this against the requirement that the Department also carries out basic research. Unfortunately, this process is time consuming. The following example gives some idea of the time scale before a project can be implemented.

An example.—NTNU will soon sign a contract with StatoilHydro on collaboration projects. One of these, which concerns this department, is centred on analytical-environmental aspects connected to extracting oil from Canadian oilsand. The formalities included a visit by NTNU Rector Torbjørn Digernes to Canada to sign a Memorandum of Understanding with our partner Canadian University. This project arose out of a desire to find a niche with Statoil that we could fill. From the initial contact and discussions I had with StatoilHydro (Dr. Christian Collin Hansen) in 2005, the project has been refined and developed between us and StatoilHydro and we are now about to start. In addition to myself (as Project Leader), Øyvind Mikkelsen and Rudi Schmid (Principal Investigators) have enthusiastically played important roles in bringing the project to the contract stage.

International Master Degree.—In order to further develop the environmental collaboration with StatoilHydro we have embarked on a collaboration that also includes the Department of Biology and SINTEF. The result is an International Master Degree in Environmental Toxicology. Sterling work on this has been carried out by Øyvind Mikkelsen, Trond Peder Flaten and Torunn Berg.

Industrially financed Professorship.—In the course of negotiations with StatoilHydro I requested that the company consider the benefits to them of financing an adjunct professor position from 2009 at our department. The response was positive and we are working on a mutually acceptable definition of this position which we anticipate will be ready for implementation in 2009. This position will strengthen the aforementioned International Master Course.

Centre of Advanced Studies.—We are pleased that we were able to contribute to research at the Centre of Advanced Studies in Oslo by granting Professor Signe Kjelstrup leave of absence to work there as a Group Leader. Signe was able to fully concentrate on her research into Nature-inspired Chemical Process Design and achieved interesting results. Accompanying Signe were Professors Dick Bedeaux and Henrik Koch as vice Group Leader (who has a highlight in this report) and PhD students Isabella Inzoli and Kirill Glavatskiy.

The Max IV Project.—In April we organised a conference entitled “the Nordic-Baltic Synchrotron Research Initiative Kick-off Meeting”. The two day meeting was held at Jægeboden some two hours drive north of Trondheim. Representatives from all of the Nordic and Baltic countries attended. The meeting culminated in a unanimous declaration supporting the proposed Swedish Max IV synchrotron project and redefining it as a Nordic-Baltic project. The process further will hinge on intergovernmental contacts in 2009 and a good case from researchers in the different countries. The Norwegian case is being worked out and will be presented in early 2009. This department in partnership with the Department of Physics has the key role here. This project will be the most ambitious research collaboration ever carried out within the Nordic region.

The Swiss-Norwegian Beamlines.—The reason we organised this meeting is grounded on the department’s many years activities within the Swiss Norwegian Beamlines (SNBL) at the European Radiation Facility in Grenoble (ESRF). Partly because this department (together with the Department of Physics) founded the SNBL Consortium, the administrative staff went on a study trip there in April. They found the facility rather an eye-opener because of its technical sophistication and efficient administration and returned much invigorated.

Innovation.—Another aspect of the department’s strategy is to identify and bring forth projects that are innovatively promising. An innovative project in particular that stood out in 2008 is from the group led by Professor Vassilia Partali. Vassilia and her coworkers project concerns gene therapy delivery and has societal relevance.
Bridging Chemistry and Art: The case of Ethiopian works of art

One of the disciplines where art and science meet is conservation science. In this field chemistry plays a great role in the technical examination and conservation of cultural heritage in general and of art objects in particular.

There are various areas where chemistry can be applied in conservation science. It is used in the determination of chemical composition of painting components such as pigments, extenders, binding media, and varnishes. Chemistry is instrumental in characterization of the artists’ techniques employed during execution. Understanding of these materials and painting techniques help conservators to decide on the best approach for conservation and restoration of the artefacts. The material composition can also provide information about the age and origin of art objects, thereby establishing provenance and authenticity. Such technical examination is of great importance to art historians who are concerned with the where, when, why, and how questions of past events and artistic material sources related to the art works. The chemical composition of these objects exposed by scientific analysis gives them historical and cultural meanings.

The other application is in the study of causes for degradation of art objects, the resulting corrosion products, the mechanisms and kinetics associated with the deterioration processes. This greatly aids to plan best interventions to stop, or at least slow down, deterioration. Chemistry is also vital in assessing the effect of materials and methods used in the course of repairing, consolidation, restoration and conservation.

A variety of analytical techniques are used for technical studies of works of art. A paramount requirement for such techniques is that they should be non-invasive and non-destructive with respect to the valuable works of art as much as possible.

Our research project entitled, the study of Ethiopian paintings and illuminated manuscripts from the chemical perspective, is concerned with the technical examination of Ethiopian works of art using a combination of analytical techniques such as XRF, SEM-EDS, micro Raman, IR, XRD, and polarized light microscopy. Attempts will be made to trace the origin of some of the pigments used in the paintings. Changes in the chemical composition of the painting materials attributed to ageing, the impacts of environment and human activity will also be assessed. This pursuit of scientific investigation on artistic objects will contribute to the characterization and documentation of traditional materials, technologies, and knowledge in the production of the cultural heritage.

At the end of 2008, a field work in Ethiopia was carried out. The main objectives were to visit some of the potential research sites, gather preliminary information and conduct analysis on the spot of paintings and illuminated manuscripts with a portable XRF spectrometer. A number of mural paintings, icons and manuscripts were analysed in churches and monasteries located in different parts of Tigray, Lalibela and its vicinity, Gonder and Lake Tana areas. Attempts were also made to work on few of the collections of three museums in Addis Ababa and Tigray region.

Kidane F. Gebremariam, Lise Kvittingen and Florinel G.Banica
Chalcogenide is the collective name ascribed to the compounds of sulfur, selenium and tellurium. Metal chalcogenides are compounds of a great importance for natural environment, biological systems and industry. Thus, metal sulfides are well known raw material for production of a series of important metals. Besides, metal chalcogenides are of a particular relevance to marine chemistry. In this respect, recent research work in this field focuses on the occurrence and properties of metal sulfides as complex compounds or clusters. As a consequence of the extremely low solubility of metal sulfides, Environment Technology resorts to such compounds for removal of toxic metal pollutants. Some chalcogenides are also employed as advanced materials for nano-technology, chemical sensors, and semiconductors.

- Our recent achievements in electrochemistry of chalcogenides can be summarized as follows:
  - Electrochemical preparation and investigation of metal sulfides and thiolates as molecular or thin layers on metal surfaces [1, 2];
  - Self-assembly of bio-compounds on metal surfaces using chalcogenide functions as binding groups [3-7];
  - Application of piezoelectric nano-gravimetry for the investigation of surface layers including chalcogenide-based anchoring groups [5, 7];
  - Investigation of metal ion interaction with sulfide ions (S^{2-} or HS^-) at the concentration level characteristic for ocean water [8].

As a continuation of our previous work in this field, we intend to refine the theoretical approach recently outlined [1] in order to render it suitable for data processing by a multi-variable approach using advanced computer graphing and statistical treatment. Such an approach is more accurate and enlightening as compared to the standard single-variable method. As an example, the Figure displays a 3-dimensional plot and data fitting for the reduction of mercury sulfide in the form of surface layer on a mercury electrode. Data in this graph fits very well the equation of a plane and allow testing the validity of theory assumptions.
Further refinement of theoretical and experimental methods will allow determining important physico-chemical constants of chalcogenide ions, chalcogenide derivatives and their metal salts in natural media such as marine water and biological fluids.

References:
Concrete, presto, and impalpable. Aiming to reach the highest, we are.
Research Projects

The art of making quantum chemistry calculations faster

The field of quantum chemistry deals with the theoretical description of molecular systems at the atomic scale using computer simulations. From being a rather exotic area of chemistry 20 years ago, the methods of quantum chemistry are nowadays widely used in most areas of chemistry. This is due to two main driving factors: the advance of the electronic computer and the improvement of the theoretical formulations and implementations in computer programs.

The theoretical foundation of quantum chemistry is quantum mechanics and the central equation is the Schrödinger equation (1926)

\[ H \Psi = \Psi E \]

where the wave function \( \Psi \) contains all information about the electronic structure of the electrons in the molecular system and \( E \) is the total energy. Only the Hamiltonian operator \( H \) is known and the equation must be solved to determine the wave function and total energy. The wave function is a complicated function of the position of all the electrons and nuclei in the molecule. A solution of the Schrödinger equation amounts to determining the wave functions and even if we restrict our treatment to the electronic structure for a fixed position of the nuclei this equation can only be solve analytically for one-electron. Thus approximations must be introduced and much research in quantum chemistry revolves around developing new and efficient approximations in this way obtaining new insight into the wave function. Over the years many methods have become standards in electronic structure calculations and these are the methods that are most widely used. One problem that remains unsolved for many models is the scaling of computational requirements with respect to the size of the system; ideally we would like this to be linear, such that a system of double size only requires twice the computational requirements. During the stay at CAS we have developed new algorithms for Coulomb and exchange energy contributions to the electronic energy. These methods are based on the Cholesky decomposition that is a very efficient way to remove redundant information in the calculations. The linear dependence in matrices are in this way removed and never need to be calculated explicitly, this together with a straightforward testing for zero’s give the improvement. We have observed three orders of magnitude speedup compared to the standard methods. The algorithms and results are published in Ref. [1] and we refer the reader to this for more detailed information.

Henrik Koch

Reference:
The Fluoro-organic group: Towards Greener Chemistry by Ruthenium Catalysed Asymmetric Transfer Hydrogenation (ATH)

Background

We have recently reported the synthesis, and later the asymmetric reduction, of a series of fluorooacetophenones using Corey’s proline based catalyst (R)-MeCBS. High enantiomeric excess and yield were obtained. However, to develop catalytic and more environmental friendly processes asymmetric transfer hydrogenations (ATH) have now been investigated.

Asymmetric transfer hydrogenation (ATH)

The catalysts were constructed from RuCl₂(mesitylene)₂ and [RuCl₂(p-cymene)₂] complexed with chiral diamine ligands, (Figure 1).

Figure 1. Catalysts used in the study.

The benefits of these reduction systems are that cheap and safe reductive agents as i-PrOH and formic acid can be used. Moreover, reductions can be performed in water and also in the presence of air. The proposed catalytic mechanism is shown in Scheme 1.

Scheme 1. Proposed catalytic mechanism for ATH (Xiao et al.3)

We decided on the use of formic acid as hydrogen donor and explored the ATH of eight different fluorooacetophenones in both water and formic acid/triethylamine using catalyst 1-4 in 1 mol %, see Scheme 2.

The electronic content at the reacting carbonyl carbon was varied to identify possible electronic effects on the enantioselectivity and rate. Table 1 summarises the results using catalyst 3 in the two reaction medias.

Table 1. ATH of -fluoroacetophenones 5a-h.

<table>
<thead>
<tr>
<th>Substrate (R)</th>
<th>Water Conv. (h.)</th>
<th>HCO₂H/NET₃ ee (%)</th>
</tr>
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<tbody>
<tr>
<td>OMe 5a</td>
<td>&gt;99 (5)</td>
<td>91.0 &gt;99 (2)</td>
</tr>
<tr>
<td>OBn 5b</td>
<td>71 (20)</td>
<td>90.0 &gt;99 (2)</td>
</tr>
<tr>
<td>H 5c</td>
<td>&gt;99 (2)</td>
<td>95.5 &gt;99 (2)</td>
</tr>
<tr>
<td>F 5d</td>
<td>&gt;99 (5)</td>
<td>91.0 &gt;99 (2)</td>
</tr>
<tr>
<td>Br 5e</td>
<td>&gt;99 (5)</td>
<td>90.5 &gt;99 (2)</td>
</tr>
<tr>
<td>CF₃ 5f</td>
<td>&gt;99 (5)</td>
<td>96.0 &gt;99 (2)</td>
</tr>
<tr>
<td>CN 5g</td>
<td>45 (20)</td>
<td>84.0 &gt;99 (2)</td>
</tr>
<tr>
<td>NO₂ 5h</td>
<td>99 (20)</td>
<td>76.5 &gt;99 (2)</td>
</tr>
</tbody>
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The (S)-alcohols could be obtained in ee from 97.5 to 85.5. The selectivity was very dependant on both catalyst and substrate structure. The highest enantiomeric excess was obtained for substrates having electron donating substituents using catalyst 1 and 3 in formic acid/triethylamine. Only in reduction of substrate 5f was a higher selectivity observed in water.

Further, comparing the results with rates and selectivity in the acetophenone series, implies that the electronic content of the carbonyl carbon is of minor importance for enantioselection. This effect can rather be explained by other factors such as change in dispersion interactions, solvation effects or dispersion interactions.4

Bård Helge Hoff and Erik Fuglseth (Accepted J. Fluorine Chem. 2009)

References:
Research Projects

Muscular contraction and the calcium pump

As was shown by Huxley (1953), Huxley & Niedergerke (1954) and Huxley & Hanson (1954), the contraction of skeletal muscles is due to the sliding motion of myosin filaments along actin filaments. The interaction between the filaments is created by cross bridges extending from the myosin.

According to the theory by Huxley (1969), the heads of the filaments first attach to the actin and then undergo a conformational change whereby the angle of attachment is changed. This then causes a movement of the myosin along the actin. The energy for this process is derived from the hydrolysis of ATP to ADP and inorganic phosphate Pi. ATP binds to the myosin head and hydrolysis takes place. The calcium ions are stored in the sarcoplasmic reticulum, an organelle made for that purpose. When the nerve releases sodium and potassium ions, the surface of the reticulum depolarizes and the calcium ions are released into the sarcoplasm around the muscle fibers. The calcium then binds to the actin after which the myosin head also binds to the actin. The ADP and Pi then detach from the myosin head which uses the energy for the conformational change to shorten the muscle fibre. When the muscle relaxes, Ca2+-ATPase pumps the calcium ion back to the reticulum, the myosin head detaches itself from the actin, and ATP binds to the myosin head.

An important role in the whole process is played by the calcium pump, the Ca2+-ATPase (a protein), and we will mainly focus on the description of this pump using non-equilibrium thermodynamics. It is...
common to describe how it works by a diagram of the enzyme cycle a so-called Post-Albers diagram, see Fig. 5. The protein has two configurations, E1 and E2. In the first state in the left top corner, the protein is in the E1 configuration and nothing is bound to it. In the first step, two calcium ions are bound inside the protein. In the second step, ATP is bound to the protein and splits into ADP, which goes back into the sarcoplasm, and organic phosphate, Pi, which binds to the protein. In the third step, the Pi changes location in the protein and the energy is used to modify the E1 configuration into an E2 configuration. In the fourth step in the cycle, the high energy of E2 allows calcium ions to go into the reticulum. In the fifth step, Pi unbinds. In the sixth step, the configuration changes back to E1. Depending on the thermodynamic forces involved, all these steps may be in the forward or in the backward direction. The process just described, is completely coupled in the sense that each ATP molecule reacted, leads to transfer of two calcium ions into the reticulum. An alternative process, indicated by step 7 in the diagram, occurs after the second step when inorganic phosphate leaves the protein, while the energy is dissipated as heat. Calcium ion can leave the reticulum when we add a leak pathway to the membrane. This path is parallel to the transport through the protein and is not indicated in the diagram of Fig.5. Both return pathways results in an uncoupled overall process.

The description that follows from this diagram is not satisfactory for one reason in particular. It describes the processes by pure reaction kinetics. Temperature differences and heat flows are not described. As shown by de Meis and others (1997, 2001) the temperature plays an important role (like for instance in thermogenesis), and this description is therefore not thermodynamically satisfactory.

Classical non-equilibrium thermodynamics (de Groot and Mazur 1984, Kjelstrup and others 2006, Kjelstrup and Bedeaux 2008) gives linear relations between the Gibbs energy differences involved and the temperature difference with the reaction rate of ATP, calcium ion flux and heat flux. The linear nature of this description is not satisfactory.

A new methodology has been developed in recent years, with the name of mesoscopic non-equilibrium thermodynamics, to address this problem. Kjelstrup, Rubi and Bedeaux gave in 2005 a first description of the calcium pump, which is nonlinear and contains the temperature as a variable. A short overview of the results is given here, indicating further work in progress.

In equilibrium the reaction Gibbs energy for the ATP conversion, $\Delta G^r$, is zero and the chemical potential and temperature outside the membrane, $\mu^r_{Ca}$ and $T^o$, are equal to those in the reticulum, $\mu^i_{Ca}$ and $T^i$. Away from equilibrium this is not the case, and as a result, a reaction rate, calcium ion flux and a total heat flux develop. Both fluxes are positive when they are into the reticulum. Using mesoscopic non-equilibrium thermodynamics we were able to show that

$$
\begin{align*}
  r &= -D_{rr}[1 - \exp(\frac{\Delta G^i}{RT^i})] - D_{rd}[\frac{\mu^o}{RT^o} - \frac{\mu^i}{RT^i}] - D_{rq}[1 - \frac{T^i}{T^o}] \\
  J^o_{Ca} &= -D_{dr}[1 - \exp(\frac{\Delta G^i}{RT^i})] - D_{dd}[\frac{\mu^o}{RT^o} - \frac{\mu^i}{RT^i}] - D_{dq}[1 - \frac{T^i}{T^o}] \\
  J^q &= -D_{qr}[1 - \exp(\frac{\Delta G^i}{RT^i})] - D_{qd}[\frac{\mu^o}{RT^o} - \frac{\mu^i}{RT^i}] - D_{qq}[1 - \frac{T^i}{T^o}] \\
\end{align*}
$$
Research Projects

In the paper, expressions were given for the elements of the $D$ conductivity matrix in terms of the parameters used in the mesoscopic context. For now it is only needed to know that the matrix is not symmetric.

The important tasks that were solved last year, were to:

- Rewrite the equations using the measurable heat flux $J_q'$ rather than the total heat flux $J_q$ and obtain the $D'$ conductivity matrix using available experimental results. Convert the conductivities into those in the $D$ matrix using the necessary enthalpies.
- Obtain some of these enthalpies from a first law analysis of the experiments.

Two articles and one chapter (Kjelstrup et al 2008a, 2008b and 2009) were accepted for publication. The aim of these investigations is to eventually describe phenomena like thermogenesis and to learn much about this important and highly efficient element of biological systems. Such knowledge may be useful to develop other efficient chemical processes at the nano level.

Dick Bedeaux and Signe Kjelstrup

References:

Ida Tacke Noddack (1896-1978) studied chemistry at the Technische Hochschule in Berlin between 1915 and 1921, and was employed as a chemist at Allgemein Elektrizität Gesselschaft (AEG). She resigned to work for free at Siemens-Halske and at the Physikalisch-Technischen Reichsanstalt in Berlin, searching for missing elements 43 and 75. The head of the chemistry department at the Reichsanstalt, Walter Noddack, came to be not only her collaborator, but also her husband from 1926 on.

As a married woman, Tacke Noddack was not longer entitled to a career of her own. In Germany, as in many other countries suffering economically after the First World War women were to leave their positions for the men. Married women, it was argued, were already supported by their husbands and they were needed as housewives whether they had children or not.

However, Ida Noddack was able to continue doing unpaid scientific work, following her husband wherever he was appointed. Through her career Ida Noddack published about 70 papers, most of them in German and many in collaboration with Walter Noddack. Their most famous joint work dealt with the discovery of elements 43 and 75 and their chemical properties. Eventually the couple was acknowledged for the discovery of element 75 (which they named rhenium after the river Rhine), but their work on element 43 was never recognized.
Ida Noddack is also known for proposing nuclear fission already in 1934, although she never pursued this topic further. This proposal was never taken seriously in the scientific community. The Noddacks joint work on element 75 however led to three joint Nobel nominations, and another two for Walter Noddack. Ida Noddack was the third woman to be nominated for a Nobel prize, in the good company of Marie Curie and Lise Meitner.

Ida Noddack’s career is interesting from many perspectives. She was among the first generation of female students in Germany and among the 1.5% of women that worked in German chemical industry around 1920. As a married woman she had to withdraw from her career, but at the same time, being the wife of a scientist, she enjoyed the privilege of having access to her husband’s research facilities and being part of a group of fellow scientists.

Ida and Walter Noddack add to the many “creative couples” in science,¹ such as Marie and Pierre Curie and many less famous couples. Some couples cooperated on all levels of research and shared the honour equally, whereas others were involved in highly asymmetric collaboration. In this study we look at the professional relationship between Ida Noddack and her husband: Were Ida and Walter Noddack equal collaborators? How did they divide the work between them? Is it possible to identify separate research interests and specialities? How did Ida’s (and Walter’s) work progress as the couple moved from one place (and position) to another?

This research project was initiated in the fall 2007 with Dr. Brigitte Van Tiggelen, research associate of the Université catholique de Louvain, Belgium. The extensive archives of the Noddack couple are held at the Katholieke Universiteit Leuven, Belgium and contain, among other things, correspondence, laboratory notebooks and personal notes. Along with these, we are investigating archives of the places Ida Noddack studied and worked, all of which are located in Germany.

Thanks to a substantial grant from the Chemical Heritage Foundation (CHF) in spring 2008 we stayed for one month at the CHF, Philadelphia, USA, to work on this project. At CHF we benefited from an extensive collection of periodicals and books and enjoyed the opportunity to participate in seminars on the history of chemistry on a regular basis. The sojourn allowed us to extend our network and discuss our research with prominent scholars in the field. In September Brigitte Van Tiggelen came to Trondheim to work and lecture at the department, in November our project was presented at the History of Science Society Annual Meeting in Pittsburgh, USA.

The project has received funding from “Anders Jahres fond til vitenskapens fremme”.

Annette Lykknes

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The new curriculum, Kunnskapsløftet, launched in 2006 (hereafter: LK06), introduced five basic skills or competences to be developed in all school subjects. These are: to be able to read, to express oneself in writing, to express oneself orally, to be able to do mathematics and to use digital tools. For a long time the development of writing skills has been a central responsibility for Standard Language Education (mother tongue education). At the same time, writing has been used for several purposes in other school subjects. Traditionally, however, little emphasis has been placed on the texts, genres and the development of writing competences in other school subjects than standard language education. In Norway, this situation changed with LK06, which, as pointed out above, laid more emphasis on writing across the curriculum.

In 2006 a research project on writing as a basic skill in all school subjects from kindergarten to upper secondary school (hereafter SKRIV) was initiated at Sør-Trøndelag University College (HiST), in collaboration with NTNU and Queen Maud’s College (DMMH). In 2007 the project was awarded three years of funding from the Norwegian Research Council (NFR). In SKRIV, 22 researchers analyse the conception of writing in “Norwegian”, social science/history, religion, mathematics, and science. Special attention is given to the uses and purposes of writing in different subjects at various age levels, drawing on a socio-cultural and social semiotic view of writing.

What does it mean to be able to “express oneself in writing” in science? According to LK06 it includes to present and describe personal experiences of nature, to write experimental reports as well as accounts from excursions and the like, to formulate questions and hypotheses, to employ scientific concepts and expressions, and finally, to present arguments for one’s statements. The experimental report is a well-known genre in secondary school science, but what about other genres? How can writing as a basic competence be developed in science, and in what way might writing activities enhance learning in science?

The aim of SKRIV is twofold: to investigate and analyse current practice and prepare teachers for developing writing skills in all school subjects. To help understand and develop writing as a cross-curricular activity, researchers make up interdisciplinary teams. Science is represented by one researcher from faculty for teacher education at HiST and one from the chemistry education group at Department of Chemistry, NTNU. The study takes a qualitative approach: Each team follows writing activities at different age levels over two years, documenting contexts of writing (including assignments and textbooks) and gathering students’ written texts.

Example of students’ written texts from our material

This year, our part of the project has been presented at the conferences “FoU i praksis” and “Nordisk konferanse om skriving som grunnleggende ferdighet og utfordring i utdanning og yrkesliv” in Trondheim, as well as at the 10th Nordic Teacher Trainer Conference in Reykjavik, Iceland. In February the book “Å skrive i alle fag”, mainly authored by SKRIV collaborators, was published by Universitetsforlaget. It is aimed at teachers as well as students in teacher education and contains three chapters on writing in science at secondary school level.

Annette Lykknes
Energikilder

Ikke-fornybare energikilder

Kjernespalting
Ved hjelp av kjernespalting forvandler atomkraftverkene uranbrensel til høyradioaktivt atomavfall. Er lagret inn i et hvert atom. I fysikk sies loven det at energi ikke kan oppstå eller forsvinne, men kan forandre form.
Fordelene med kjernespalting er at det lages store energimengder ut av lite materie. Anleggene tar forholdsvis lite plass og man sammenligner med dammer osv. Og den siste er at selen reaksjonen ikke forurener.
Den har også sine ulemper, som at det er skadelig stråling fra avfallet. Fartig radioaktivt avfall i mange tusen år fremover.
Dyr i drift og teknologi. Kan være farlig som sikkerheten ikke vektlegges nokk. Og den siste er at den ikke er fornybar, så når stoffet er brukt til fusjon/fisjon kan det ikke nyttes igjen.
Uran:
Dette er et naturlig grunntoff med atomnummer 92. Uran er et uedelt metall.
Det var den tyske kjemikeren Martin Heinrich Klaproth som oppdager uran og døpte den etter planeten Uranus.
Uran brukes som brensel i atomreaktorer i kjørstoffverk og ubåter som er atomdrevne. Det brukes også til atomvåpen og til å fremstille radium og plutonium.

92: Uranium

Fossile energikilder
Kull
Ulempen med kull er at det blir relativt mye støv sammenlignet med andre fossile brenseltyper. Derfor blir det betraktet som stor forurensningskilde og årsaker til sur nedbør.
Gass
Energiverk som brukes gass som energikilde omdanner høyverdig kjemisk energi i gassen til lavverdig varmeenergi som kan rive turbiner som elektriske generatorer.
Gass inneholder mer hydrogen enn olje, og lite svovel og tungmetaller.
Olje

Example of students' written texts from our material
Participation at conferences is a duty for every active chemist as long as NT-faculty grants the money for the expenses. Last June some chemists of the department received some insufficient allocations but with the increment of some legate funds a small delegation was able to undertake the long journey to tropical Okinawa for attending the 15th International Carotenoid Symposium, Fig. 1.

The participants of such conferences generally share the same interest, they more or less know each other, they attend lectures, scrutinize the posters, conduct the usual small talks: nobody is expecting exciting events. Some suspense may arise when it comes to prize distribution for the best poster.

This happened also in Okinawa. And we were, of course, very happy to hear the conference chairman attributing the prize to PhD-fellow Christer Øpstad. However, such incident would hardly be noteworthy unless the prize is spectacular. Indeed, the prize, a crystal, was brilliant, albeit not breathtaking. Worth
Research Projects

Fig. 3 Award to Vassilia Partali

mentioning are the exceptional circumstances of the price distribution. The award was presented by graceful Miss Okinawa, Figs. 3, 4.

Since our delegation comprised two PhD-fellows the other one got increasingly terrified during the awarding ceremony. Would she be distinguished likewise for her lecture? Fortunately, there were no honors for lectures. Gina Sandru would not have survived a great big hug after a possible prize rewarding by Mister Okinawa, Fig. 5.

Fig. 4 The distinguished and the distinguisher

Vassilia Partali
Molecular modelling in terms of quantum chemical calculations and molecular dynamics simulations have become an indispensable tool in the design of novel functional materials. In this project, we have used molecular dynamics simulations in conjunction with the reactive force field Reax to study the interactions between graphite and metal clusters. Carbon-supported metal clusters have demonstrated a large catalytic activity and is an alternative to metal surfaces in for example hydrogen production. Clearly, the strong interaction between the carbon surface and the metal clusters (see figure 1) distorts the geometry of the metal cluster leading to an increased catalytic activity. Information is, however, lacking when it comes to an understanding of the mechanisms at an atomistic resolution.

In this respect, molecular modeling is a useful tool. In quantum chemistry, the Schrödinger equation is solved for the molecular Hamiltonian providing information about molecular geometries, electric and optical molecular properties, etc. In molecular dynamics simulations, on the other hand, ensemble averages are obtained by calculating the forces between thousands of atoms repeatedly. Typically, the integration time-step is around 1 fs and the simulation is carried out for nanoseconds. Consequently, quantum chemical calculations are normally too expensive for evaluating the forces, and we are limited to force-field methods.

In a force field, the interaction energy is calculated as a sum of various terms: electrostatics, polarization, the van der Waals term (short-range repulsion and dispersion), and intramolecular terms (bond stretching, angle bending and torsional terms). Force fields cannot normally handle chemical reactions, i.e. the breaking and formation of covalent bonds unless it includes "reactive" features.

In most reactive force fields, a bond-order approach is employed. The bond order for an atom pair is 0 unless the atoms are covalently bonded, it is 1 for a single bond, 2 for a double bond, etc. The bond order for atom i, BO_i, is given as the sum of atom-pair bond orders, BO_ij.

Since atoms in stable molecules are in an oxidation state, only certain values of the atomic bond order are allowed. For carbon, for example, the expected bond order is 4, whereas platinum may have the bond orders 2, 3, 4 and 6. The bond order enters the energy expression in many ways. Over- and under-coordination terms give an energy penalty for deviations from the expected atomic bond orders, i.e., atoms are reactive. Furthermore, the atom-pair bond order is used to turn on (off) intermolecular energy terms at long (short) distances and turn off (on) intramolecular energy terms at long (short) distances.

The most important term in a force field is the electrostatics since it to a large extent governs the properties of the system (polar vs. unpolar molecules, for example). The electrostatics is in most cases represented by atomic charges, and the electrostatic energy is thereby obtained from Coulomb's law. Atomic charges are, however, not transferable from molecule to molecule. For example, the atomic charges in F_2 are zero by symmetry arguments whereas the fluorine charge in HF is highly negative, which demonstrates the difficulties to get transferable atomic charges.

One method to calculate atomic charges on-the-fly in a simulation is the electronegativity equalization method (EEM). The EEM relies on two atom-type parameters, the atomic electronegativity and the atomic chemical hardness. The electronegativity difference between two atoms gives an inherit potential difference which together with the electrostatic potential gives a charge (electron) flow from one atom to another. This charge flow is counter-acted by the chemical hardness (interpreted as the inverse of an atomic capacitance) which gives the work to charge a particle. The EEM gives a linear set of coupled equations to be solved at each step in the simulation to obtain the atomic charges which thus depends on the chemical environment.

We have used the Reax reactive force field as implemented in a parallel (MPI) version of the GRASP molecular dynamics software. We have studied the interactions between metal clusters (Pt and Ni) and carbon surfaces (carbon platelets (see figure 1) and fishbone carbon nanofibers (see figure 2)). For platinum, the force field has been extended by including extra data points from DFT calculations.
Research Projects

on small hydrocarbon fragments interacting with a platinum surface. The accuracy of the force field as compared to DFT calculations is demonstrated in figure 3. In general, the deviations are small but significant.

Figure 2. Pt100 clusters interacting with a fishbone carbon structures.

Figure 3. A comparison of the interaction energy as calculated by DFT and by the ReaxFF.

Among the properties we have studied, the Pt-Pt bond length distribution (see figure 4) and the Pt bond-order distribution (see figure 5) are of special interest. For the bond-length distribution, we find that it becomes considerably wider when it interacts with a carbon surface. In particular, the average distance has become longer, which is in agreement with experiments. The bond-order distribution, which has no experimental counterpart, gives more explicit information about the reactivity of the Pt atoms. Normally, the Pt bond-order has some well defined (ideally, integer) numbers, which is the case for the isolated Pt cluster. For the cluster bounded to the carbon surface, the bond-order distribution has lost almost all its structure, indicating that many of the surface atoms are in a reactive state. The same conclusion may be drawn from the bond-length distribution, based on the strong connection between the bond order and the bond length.

Figure 4. The Pt-Pt bond-length distribution for an unperturbed Pt cluster for a cluster interacting with carbon platelets.

Figure 5. The Pt bond-order distribution for the surface atoms in a cluster.

Per-Olof Åstrand

Publications


Honoured with the Order of St. Olav

His Majesty the King has honoured Professor Emeritus Synnøve Liaaen Jensen by appointing her Commander of the The Royal Norwegian Order of St. Olav. This is an order of chivalry that was instituted by King Oscar I of Norway and Sweden on August 21, 1847, as a distinctly Norwegian order. It is named after King Olav II, known for posterity as St. Olav. Commander takes precedence Knight First Class and Knight and is therefore a very special honour for a scientist.

The Order was conferred by the County Governor of South-Trøndelag, Kåre Gjønnes, in a ceremony held in the Council Chamber at NTNU on 30th September 2008.

Professor Liaaen Jensen’s extensive and internationally recognised research into the chemistry of natural products and the coloured carotenoids

In addition, Professor Liaaen Jensen’s considerable contribution as a role model for women is recognised by the award.
Activities

Scientific Publications

Chemistry Dissemination


Kvittingen, Lise; Lykknes, Annette; Nordal, Ola. Hurra for 100-åringen! Kjemi 2008; 68(6): 14-16

Environmental and Analytical Chemistry

Andersson, M.; Ottesen, Rolf Tore. Levels of dioxins and furans in urban surface soil in Trondheim, Norway. Environmental Pollution 2008; 152: 553-558

Barandovski, L.; Cekova, M.; Frontasyeva, Marina V.; Pavlov, S.S.; Stafilov, T.; Steinnes, Elliv; Urumov, V. Atmospheric deposition of trace pollutants in Macedonia studied by the moss biomonitoring technique. Environmental Monitoring & Assessment 2008; 138: 107-118

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Organic Chemistry


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Physical Chemistry and Biochemistry

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Sanz-Navarro, Carlos F.; Åstrand, Per-Olof; Chen, De; Rønning, Magnus; van Duin, Adri C. T.; Mueller, Jonathan E.; Goddard III, William A. Molecular Dynamics Simulations of Carbon-Supported Ni Clusters Using the Reax Reactive Force Field. The Journal of Physical Chemistry C 2008; 112: 12663-12668

Sanz-Navarro, Carlos; Åstrand, Per-Olof; Chen, De; Rønning, Magnus; van Duin, Adri C. T.; Jacob, Timo; Goddard III, William A. Molecular Dynamics Simulations of the Interactions between Platinum Clusters and Carbon Platelets. Journal of Physical Chemistry A 2008; 112: 1392-1402

Trætteberg, Marit; Kozhushkov, SI; Yufit, DS; de Meijere, A. The structure of tricyclo[3.3.2.0(2.8)]decane (hexahydrobullvalene) - A gas-phase electron diffraction (GED) study. Journal of Molecular Structure 2008; 885: 18-22


Aarset, Kirsten; Hagen, Kolbjørn. Molecular structure and conformation of phenylacetyl chloride as obtained by gas-phase electron diffraction and theoretical calculations. Journal of Molecular Structure 2008; 892: 373-377
Honours, Extracurricular activities, Participation in courses, conferences, lectures and study visits

B. Alsberg


Linux System Administration Course at LinPro AS, Oslo, Norway, April 21 – 25, 2008.

T. Andreassen


Co-author on Poster Presentation: Asymmetric aza-Diels-Alder Reactions of N-Sulfinyl a-imino Esters.

T. Anthonsen

Editorial Board Member Journal of Molecular Catalysis, B: Enzymatic.

Chairman Management Committee COST Action D25. Applied Biocatalysis, Stereoselective and Environmentally Friendly Reactions Catalyzed by Enzymes. 22 member countries, 50 research groups

Management Comittee Member European Cooperation in Science and Technology. Cascade Chemoenzymatic Processes – New Synergies Between Chemistry and Biochemistry.


F.G. Banica

Norwegian Coordinator for International Co-operation Project “Training and Education of Students in Nanotechnology Focused Bioelectrochemistry and Biophysics”; NTNU and Comenius University, Bratislava, Slovak Republic.


Co-author on Poster Presentation: Thiourea as a Parent Compound for the Electrochemical Generated Sulphid Ion.

19th International Conference on Electroanalysis, Prague, Czech Republic, June 16 - 19, 2008.

Co-author on Poster Presentations: “Cathodic Stripping Voltammetry of Homocysteine and the Respective Thiolactone at a Mercury Electrode” and “Using Thiourea as Source for Electrochemical Generation of Metal Sulfides”.

Research Co-operation at University of Bratislava, Slovak Republic, Nov. 24 – 26, 2008.

D. Bedeaux

Leave of Absence Jan. 1 – July 31, 2008


Co-author on Lecture on: Description of the three Phase Contact Line in Non-equilibrium Thermodynamics.


12th International ATPase Conference, Aarhus, Denmark, Aug. 5 – 10, 2008.

Co-author on Poster Presentations: “The Heat and Ion Transport of the Ca2+-ATPase” and “Heat Transfer through the Ca2+-ATPase/Water Interface”.


Co-author on Poster Presentation: Heat Transfer through the Ca2+-ATPase/Water Interface.
Activities

T. Berg


21st Task Force meeting on the ICP Vegetation, Oulu, Finland, Feb. 26 – 29, 2008.

Co-author on Lecture on: Use of indigenous Moss Samples in Metal Deposition Surveys around Point Sources: Examples from 15 Norwegian Industries.


Co-author on Lecture on: Occurrence and Fate of Springtime Atmospheric Deposition of Mercury at Ny-Ålesund.

2nd Norwegian Environmental Toxicology Symposium, NTNU, Trondheim, Norway, April 2 – 4, 2008.

Co-author on Poster Presentations: “Speciation, Deposition and Post-Depositional” and “Mercury Levels and Effects in Marine Pelagic Food Webs from Svalbard”.


Lecture on: Mercury in the Arctic, Norwegian Chemical Society, Trondheim, May 7, 2008.


NorthPOP Workshop, St. Petersburg, Russia, May 27 – 29, 2008.

Co-author on Lecture on: Hg in the Arctic.

5th SETAC World Congress, Sydney, Australia, Aug. 3 – 7, 2008.

Co-author on Lecture on: Norwegian Measurements of Atmospheric Mercury Depletion Events at Svalbard, Antarctica and the Mainland of Norway.


Guest Lectures on: ”Forurensninger i atmosfæren” and ”Utslipp av luftforurensninger til atmosfæren”, Tromsø, Norway, Sep. 18, 2008.

Guest Lectures on: ”Effekter av luftforurensninger” and ”Ozonlag og klimændringer”, Tromsø, Norway, Sep. 19, 2008.

14th International Conference on Heavy Metals in the Environment, Taipei, Taiwan, Nov. 16 – 23, 2008.

Co-author on Lecture on: Three Decades of Atmospheric Deposition in Norway Studied by Moss Analysis.


Conference Arctic Change, Quebec, Canada, Dec. 9 – 12, 2008.

Co-author on Lecture on: Norwegian Measurements of Atmospheric Mercury Depletion Events at Svalbard, Antarctica and the Mainland of Norway.

M. Bjørgen

Opponent at 3 Doctoral Defences, University of Torino, Italy, Nov. 27 – Dec. 1, 2008.

Visit at University of Oslo, Norway, June 30 – July 4 and Dec. 2 – 9, 2008.

T. Bruvoll


The southbound coastal express has just left Trondheim harbour 21 September

P. – O. Eggen


Co-author on Lecture on: Electrifying Chemistry Education from South to North.


A. Fiksdahl

Section Leader, Organic Chemistry Group, Department of Chemistry, NTNU.

Member of National Committee for 18th International Conference on Organic Synthesis (ICOS-18) in Bergen, august 2010.

Board Member of the KOSK II Research Program, The Research Council of Norway.

Board Member of “Faggruppen for Organisk kjemi” (the Group of Organic Chemistry) of the Norwegian Chemical Society.
Activities


Co-author on Poster Presentation: PdII Complexes of N-aryl-2-Pyridylamines.

E. Fuglseth
Co-author on Poster Presentation: Assymetric Reduction of 4`-Substituted α-Fluoroacetophenones.

O.R. Gautun
Co-author on Poster Presentations: “Asymmetric aza-Diels-Alder Reactions of N-Sulfinyl α-imino Esters” and “Asymmetric Catalytic Aziridination of 1,2-Dihyronaphthalenes”.

K.F. Gebremariam
Co-author on Lecture on: Electrifying Chemistry Education from South to North.


K. Gellein
Co-author on Poster Presentation: Trace Element Profiles in Single Strands of Human Hair.

“En centimeter er nok”, Interview in Gemini, June 1, 2008.

“Hår e meir enn hovudpryd”, Interview on Radio NRK1, June 18, 2008.

K.S. Glavatsky

S.V. Gonzalez


O. – E. Haas
Activities

K. Hagen
22nd Austin Symposium on Molecular Structure, Austin, Texas, USA, Feb. 29 – March 4, 2008.
Co-author on Poster Presentations: “Phenylacetyl chloride – Structure and Conformation” and “Conformational and Vibrational Properties of 1,2-Dibromomethyl-Trichlorosilane”.

Ø. Hestad
Co-author on Poster Presentation: Streamer Inception in Cyclohexane above and below Freezing Point.

B.H. Hoff

Co-author on Poster Presentations: “Regioselective Enzymatic Hydrolysis of Tetrabenzyolated Hexapyranosides” and “Biocatalytic Synthesis of Enantiomerically Pure Halohydrins”.

S. Ingebrigtsen

I. Inzoli


S.L. Jensen
Co-author on Lecture on: Blue Carotenoids.

S. Kjelstrup
Leave of Absence Jan. 1 – July 31, 2008

Guest Lecture on: How Can we Better Describe Coupled Heat and Mass Transfer in Natural Processes?

Seminar at the Centre for Advanced Study, Oslo, Norway, Feb. 6, 2008.
Guest Lecture on: Non-equilibrium Structures: How Can they be Maintained?

Lecture on: Heat Production in Molecular Pumps. How Can we Describe it?

Lecture on: Mesoscopic Non-equilibrium Thermodynamics for Biological Systems.


Lecture on: Local Equilibrium – When Does it Apply?

Meeting at Det Norske Veritas, Oslo, Norway, June 16, 2008.

Co-author on Poster Presentations: “The Heat and Ion Transport of the Ca2+-ATPase” and “Heat
Activities

Transfer through the Ca2+-ATPase/Water Interface”.

Co-author on Poster Presentation: Heat Transfer through the Ca2+-ATPase/Water Interface.

Member Meeting, Norwegian Chemical Society, Trondheim, Norway, Sep. 9, 2008.
Guest Lecture on: Onsager lever!


H. Koch


12th International ATPase Conference, Aarhus, Denmark, Aug. 5 – 10, 2008.
Co-author on Poster Presentation: The Heat and Ion Transport of the Ca2+-ATPase.

T. Kumelj


L. Kvittingen

Co-author on Lecture on: Electrifying Chemistry Education from South to North.

Co-author on Lecture on: e-.


A. Lervik

12th International ATPase Conference, Aarhus, Denmark, Aug. 5 – 10, 2008.
Co-author on Poster Presentation: Heat Transfer through the Ca2+-ATPase/Water Interface.

Co-author on Poster Presentation: Heat Transfer through the Ca2+-ATPase/Water Interface.

S. Lierhagen

Co-author on Lecture on: The Chemical Elements in Sediments and Zoobenthos of the Trondheimsfjord in Relation to Wastewater Load.

14th International Conference on Heavy Metals in the Environment, Taipei, Taiwan, Nov. 16 – 23, 2008.
Co-author on Lecture on: Influence of Atmospheric Deposition on the Concentration of some Trace Elements in Natural Surface Soil.

T. Ljones


A. Lykknes


Activities

Participating in Main Excursion for BSc Chemistry and Biochemistry Students at NTNU, Nice, Marseilles and Monaco, France, March 6 – 12, 2008.


The concave mirror

K. Mathisen


Ø. Mikkelsen

Section Leader, Analytical and Environmental Chemistry Group, Department of Chemistry, NTNU.


Research stay at the European Synchrotron Radiation Facility (ESRF), Swiss-Norwegian Beam Line (SNBL), Grenoble, France, April 15 – 22 and Nov. 10 – 17, 2008.

IFAT Conference, Munich, Germany, May 5 – 6, 2008.


Activities

Conference, Exhibition and Workshops on Water, Wastewater & Environmental Monitoring (WWEM), Telford, UK, Nov. 5 – 6, 2008.
Co-author on Lecture on: Remote and Unattended Monitoring of Heavy Metals in Waters. Requirements for such Monitoring and how this Can be Done Automatically.

Committee Member at Doctoral Defence Ludovic Lesven, University of Science and Technology Lille, France, Dec. 1 – 4, 2008.

From the botanical garden

D.G. Nicholson

Head of the Department of Chemistry
Meeting and Projects at North West University, South Africa, Feb. 1 – 14, 2008.


SNX Council Meeting (SNBL), Annecy, France, June 2 – 6, 2008.


Organising Seminar (SNBL), La Fauvelle, France, Sep. 8 – 15, 2008.


M. Nordløkken

14th International Conference on Heavy Metals in the Environment, Taipei, Taiwan, Nov. 16 – 23, 2008.


V. Partali

Co-author on Lecture on: Carotenoid Compounds Out of the Ordinary.


A.L. Ramstad

Section Leader, Physical Chemistry Group, Department of Chemistry, NTNU.

Excursion Leader, Main Excursion for BSc Chemistry and Biochemistry Students at NTNU, Nice, France, March 6 – 12, 2008.

Research Stay at the European Synchrotron Radiation Facility (ESRF), Swiss-Norwegian Beam Line, Grenoble, France, April 15 – 22 and Nov. 9 – 14, 2008.

E. – M. Sandru

Co-author on Lecture on: Carotenoid Compounds out of the Ordinary.
Co-author on Poster Presentation: Carotenoid Aggregates of Predefined Size.

K. Schrøder

Co-author on Lecture on: Unattended Monitoring of Heavy Metals. New Equipment with Methods Making this Possible.

University of Seoul, South-Korea, Oct. 7, 2008.
Co-author on Guest Lecture on: Unattended Monitoring of Heavy Metals. New Methods Making this Possible with the SensAqua ATMS500 Equipment.

Conference, Exhibition and Workshops on Water, Wastewater & Environmental Monitoring (WWEM), Telford, UK, Nov. 5 – 6, 2008.
Co-author on Lecture on: Remote and Unattended Monitoring of Heavy Metals in Waters.
Requirements for such Monitoring and how this Can be Done Automatically.

N. Simic


S. Skogvold

Research Stay at the European Synchroton Radiation Facility (ESRF), Swiss-Norwegian Beam Line, Grenoble, France, April 15 – 22 and Nov. 10 – 17, 2008.


Co-author on Lecture on: e-.

H.S. Smalø


A.O. Steen


Co-author on Lecture on: Occurrence and Fate of Springtime Atmospheric Deposition of Mercury at Ny-Ålesund.

2nd Norwegian Environmental Toxicology Symposium, NTNU, Trondheim, Norway, April 2 – 4, 2008.

Co-author on Poster Presentation: Speciation, Deposition and Post-Depositional.


E. Steinnes


Lecture on: Atmospheric Deposition of Metals Around some Industrial Plants in Norway Studied by Moss Analysis.


Co-author on Lecture on: The Chemical Elements in Sediments and Zoobenthos of the Trondheimsfjord in Relation to Wastewater Load.

21st Task Force meeting on the ICP Vegetation, Oulu, Finland, Feb. 26 – 29, 2008.

Co-author on Lectures on: “Use of Indigenous Moss Samples in Metal Deposition Surveys Around Point Sources: Examples from 15 Norwegian Industries” and “Experience from the Use of Reference Samples in the 2005/2006 Moss Survey”.


Lecture on: Lead in the Norwegian Environment: Contribution from Natural and Anthropogenic Sources.

2nd International Nuclear Chemistry Congress, Cancun, Mexico, April 13 – 18, 2008.


Activities

Co-author on Lecture on: Geographical Trends in 137Cs Fallout from the Chernobyl Accident and Leaching from Natural Surface Soil in Norway.

Lecture on: Soils and Geomedicine.

Lecture on: Soils and Geomedicine.

Lecture on: 30 years of Air Pollution Studies in Norway Using INAA and ICP-MS.

14th International Conference on Heavy Metals in the Environment, Taipei, Taiwan, Nov. 16 – 23, 2008.

V. Stockmann


K. Strasunskiene

Research Stay at University of Science and Technology of Lille, France, Jan. 7 – 31, 2008.

Co-author on Poster Presentations: “Long Time Monitoring of Zinc and Iron in Waste Water by Use of an Automatic Trace Metal System” and “Nafion Film Coated Silver Amalgam Electrode for Determination of Trace Metals in Presence of Surface Active Compounds”.

C.L. Øpstad

Co-author on Lecture on: Carotenoid Compounds out of the Ordinary.
Co-author on Poster Presentations: “Easy Synthesis of Stable Anionic Carotenoid Radicals” and “Cationic Carotenoid Amphiphiles as Gene Transfection Vectors”.

Research Stay at Weill Cornell Medical College in Quatar, Doha, Quatar, Sep. 27 – Oct. 12, 2008.

J.E. Aaseng

Co-author on Poster Presentation: Asymmetric Catalytic Aziridination of 1,2-dihyronaphthalenones.

Poster Presentation: Substituted (S/S)-2-Aminotetralins from L-Aspartic Acid.

Sky on fire

P. – O. Åstrand

Research Co-operation at Northwestern University, Illinois, USA, March 1 – 9, 2008.


Research Co-operation at The Pennsylvania State University, USA, March 9 – 19, 2008.

Lecture on: Molecular Modelling: Basic Concepts and Applications in Catalysis.


1st Nanotechnology@NTNU, NTNU Nanolab., Trondheim, Sep. 11 - 12, 2008.
Co-author on Lecture on: Engineering of Metal Nanoparticles on Carbon Nanofibers.
## Spring examination

<table>
<thead>
<tr>
<th>Course no.</th>
<th>Course title (credits)</th>
<th>Lectures and exercise coordinators</th>
<th>Candidates/Passed</th>
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<tbody>
<tr>
<td>RFEL1001</td>
<td>Natural Science and World Views (7,5)</td>
<td>Reidar Edvald Stølevik, Karl Erik Zachariassen</td>
<td>72/65</td>
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<tr>
<td>KJ1020</td>
<td>Organic Chemistry (15)</td>
<td>Vassilia Partali, Nebojsa Simic</td>
<td>140/118</td>
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<td>KJ2022</td>
<td>Spectroscopic Methods in Organic Chemistry (7,5)</td>
<td>Reidar Edvald Stølevik</td>
<td>17/15</td>
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<tr>
<td>KJ2041</td>
<td>Physical Chemistry II (7,5)</td>
<td>Astrid Lund Ramstad, Reidar Edvald Stølevik</td>
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<td>KJ2043</td>
<td>Physical Methods in Structural Chemistry (15)</td>
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<td>KJ2051</td>
<td>Analytical Chemistry, Advanced Course (7,5)</td>
<td>Øyvind Mikkelsen, Florinel Gabriel Banica</td>
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<td>KJ2053</td>
<td>Chromatography (7,5)</td>
<td>Anne Fiksdahl, Rudolf Schmid</td>
<td>29/29</td>
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<td>KJ2070</td>
<td>Environmental Chemistry (15)</td>
<td>Torunn Berg, Trond Peder Flaten</td>
<td>39/32</td>
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<td>KJ3055</td>
<td>Analytical Atomic Spectrometry (7,5)</td>
<td>Florinel Gabriel Banica</td>
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<td>KJ3065</td>
<td>Enzyme chemistry (7,5)</td>
<td>Torbjørn Ljones</td>
<td>9/9</td>
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<td>KJ8100</td>
<td>Organic Medicinal and Phararmaceutical Chemistry (7,5)</td>
<td>Derek James Chadwick</td>
<td>8/8</td>
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<td>KJ8106</td>
<td>Advanced Organic Chemistry (7,5)</td>
<td>Per Henning Carlsen</td>
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<td>KJ8200</td>
<td>Spectroscopy and Chemometrics (7,5)</td>
<td>Bjørn Kåre Alsberg</td>
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<td>KJ8204</td>
<td>Quantitative Structure-Activity Relationships (7,5)</td>
<td>Bjørn Kåre Alsberg</td>
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<td>KJ8205</td>
<td>Molecular Modelling (7,5)</td>
<td>Per-Olof Astrand</td>
<td>3/3</td>
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<td>KJ8208</td>
<td>Advanced Irreversible Thermodynamics (6)</td>
<td>Signe Kjelstrup</td>
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<td>TKJ4111</td>
<td>Organic Chemistry, Advanced Course (7,5)</td>
<td>Bård Helge Hoff</td>
<td>17/17</td>
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<td>TKJ4130</td>
<td>Organic Synthesis, Laboratory (7,5)</td>
<td>Odd Reidar Gautun, Anne Fiksdahl</td>
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<td>TKJ4135</td>
<td>Organic Synthesis, Advanced Course (7,5)</td>
<td>Odd Reidar Gautun</td>
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<td>TKJ4145</td>
<td>Industrial Organic Chemistry, Research Projects (7,5)</td>
<td>Bård Helge Hoff</td>
<td>10/10</td>
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<tr>
<td>TKJ4160</td>
<td>Basic Physical Chemistry and Laboratory (15)</td>
<td>Morten Bjørgen, Per-Olof Astrand</td>
<td>84/75</td>
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<tr>
<td>TKJ4166</td>
<td>Chemical Bond Theory and Spectroscopy (7,5)</td>
<td>Mats Linus Henrik, Bjørn Kåre Alsberg</td>
<td>19/15</td>
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<tr>
<td>TKJ4175</td>
<td>Chemometrics, Basic Course (7,5)</td>
<td>Per-Olof Astrand</td>
<td>2/2</td>
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<tr>
<td>TKJ4190</td>
<td>Physical Chemistry, Project Work (7,5)</td>
<td>Terje Bruvoll</td>
<td>5/5</td>
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<tr>
<td>TKJ4850</td>
<td>Experts in Team, Interdisciplinary Project (7,5)</td>
<td>Per-Olof Astrand</td>
<td>18/18</td>
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## Autumn examination

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<tr>
<td>KJ1000</td>
<td>General Chemistry (15)</td>
<td>Lise Kvittingen, Torbjørn Ljones, Annette Lykknes</td>
<td>193/153</td>
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<tr>
<td>KJ1030</td>
<td>Inorganic Chemistry (15)</td>
<td>Astrid Lund Ramstad</td>
<td>32/26</td>
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<tr>
<td>KJ1040</td>
<td>Physical Chemistry (15)</td>
<td>Morten Bjørgen, Astrid Lund Ramstad, Florinel Gabriel Banica</td>
<td>28/19</td>
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<tr>
<td>KJ2031</td>
<td>Inorganic Chemistry, Advanced Course (7,5)</td>
<td>Karina Mathisen</td>
<td>9/9</td>
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<tr>
<td>KJ2050</td>
<td>Analytical Chemistry, Basic Course (7,5)</td>
<td>Øyvind Mikkelson, Florinel Gabriel Banica</td>
<td>25/25</td>
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<tr>
<td>KJ2090</td>
<td>Chemistry Education - Chemistry Dissemination (7,5)</td>
<td>Per Odd Eggen</td>
<td>3/2</td>
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<tr>
<td>KJ2091</td>
<td>Teacher training/dissemination project in chemistry (7,5)</td>
<td>Lise Kvittingen</td>
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<td>KJ3021</td>
<td>Nuclear Magnetic Resonance Spectroscopy (7,5)</td>
<td>Nebojsa Simic</td>
<td>16/15</td>
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<td>KJ3058</td>
<td>Analytical Chemical Separation Techniques (7,5)</td>
<td>Rudolf Schmid</td>
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<td>KJ3071</td>
<td>Applied geochemistry (7,5)</td>
<td>Rolf Tore Ottesen</td>
<td>15/15</td>
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<td>RFEL3093</td>
<td>Episodes from the history of science</td>
<td>Annette Lykknes</td>
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<tr>
<td>RFEL6093</td>
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<td>KJ8021</td>
<td>Stereochemistry and Synthesis of Chiral Compounds (7,5)</td>
<td>Per Henning Carlsen</td>
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<tr>
<td>KJ8052</td>
<td>Analytical Electrochemistry and its Application within Industrial and Environmental Monitoring (7,5)</td>
<td>Øyvind Mikkelson</td>
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<td>KJ8056</td>
<td>Chemical and Sensors and Biosensors (7,5)</td>
<td>Florinel Gabriel Banica</td>
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<td>New Methods in Organic Synthesis (7,5)</td>
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<td>KJ8206</td>
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<td>Henrik Koch</td>
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<td>KJ8207</td>
<td>Advanced Microarray Data Analysis (7,5)</td>
<td>Bjørn Kåre Alsberg</td>
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<td>TKJ4170</td>
<td>Quantum Chemistry, Advanced Course (7,5)</td>
<td>Henrik Koch</td>
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<td>TKJ4180</td>
<td>Physical Organic Chemistry (7,5)</td>
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<td>Irreversible Thermodynamics (7,5)</td>
<td>Sigríður Kjelstrup</td>
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<td>Computational Chemistry (7,5)</td>
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<td>Statistical Thermodynamics in Chemistry and Biology (7,5)</td>
<td>Per-Olof Astrand</td>
<td>24/24</td>
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<td>TKJ4510</td>
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<td>Anne Fiksdahl</td>
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## Re-sit examination

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<th>Course no.</th>
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<td>RFEL1001</td>
<td>Natural Science and World Views (7,5)</td>
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<td>KJ1000</td>
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<td>Biocatalysis in Organic Chemistry (7,5)</td>
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<td>TKJ4166</td>
<td>Chemical Bond Theory and Spectroscopy (7,5)</td>
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</tbody>
</table>

*Wild pansy (Viola tricolor) in May*
Graduate Students

Siv.ing. students

3. year (MTKJ)
Austdal, Marie
Blakstad, Guro
Bøe, Steffen
Bee, Maren Seljenes
Gulbrandsen, Tore Aarhus
Kaasa, Kristin
Nerem, Elisabeth
Solvang, Tina
Tungen, Jørn Eivind
Tveitkrem, Marit Else Endresen

4. year (MTKJ)
Lyngvi, Eirik
Mekki, Miriam
Rognså, Guro Helgesdotter
Seglem, Karen Nessler
Slungård, Sigrid Volden
Takla, Marit
Vågenes, Birgitte Bård
Willassen, Veronica

5. year (MTKJ)
Berg, Michel Brunes
Krakeli, Tor Arne
Kvalvåg, Sondre Schnell
Landsem, Eva
Mui, Vivian Wing Laam
Poon, Cheau Ling
Ringholm, Magnus
Strand, Lilian Helene Sola
Sørensen, Benedicte Riise
Sørum, Christopher
Voldsund, Mari
Wilhelmsen, Øivind
Astrand, Ove Alexander

Master students in progress

Chemistry (MKJ)
Berge, May Britt
Berge, Øystein Rønning
Bøyesen, Katrine Lie
Delic, Asmira
Edvardsen, Tove-Nanny
Egede-Nissen, Cecilie
Grave, Anlaug Haukvik
Haug, Siri
Helgerud, Trygve
Hoftaniska, Ídar
Holt, Yngvild
Hovde, Gunnhild
Hystad, Madeleine
Jonassen, Hilding
Kaspersen, Svein Jacob
Kristiansen, Tina
Lie, Aleksander
Næss, Mari Kirkebøen
Siegesmund, Øyvind Torbjørn
Sivertsen, Sveinung Sundfør
Skorpa, Ragnhild
Sveinhaus, Kristir
Thvedt, Thor Håkon Krane
Tynes, Mari Klevberg
Valvik, Beate
Volynkin, Andrey Sergeiievich
Aaen, Ingrid

Environmental toxicology and chemistry (MFORU)
Ottemo, Vivian Grønhaug

Master of Science Education (MLREAL)
Dahl, Anette
Sæth, Erlend Solveigson

At the laboratory, Photo: Svein Erik Dahl
### The following PhD-projects are in progress:

<table>
<thead>
<tr>
<th>Student</th>
<th>Title</th>
<th>Thesis advisor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angelsen, Ragnhild B. Strand</td>
<td>Heterocyclic synthetic chemistry based on nitropyridine derivatives.</td>
<td>Anne Fiksdahl</td>
</tr>
<tr>
<td>Burheim, Odne Stokke</td>
<td>Elektronisk utfelling av jern. (Electrowinning of iron from chloride melts.)</td>
<td>Signe Kjelstrup</td>
</tr>
<tr>
<td>Chu, Chunmei</td>
<td>Automated <em>de novo</em> optimization of functional organometallic compounds by integrating a QSAR/genetic algorithm method.</td>
<td>Bjørn K. Alsbeg</td>
</tr>
<tr>
<td>Eggen, Per-Odd</td>
<td>Current chemistry – learning and teaching electrochemistry by experiments.</td>
<td>Lise Kvittingen</td>
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<td>Esmurziev, Aslan</td>
<td>Synthesis of new fluorinated uronic acids and total synthesis of new uridine diphosphate fluoro-uronic acids. (Syntese av fluorerte uronsyrer og talsyntes av nye uridine difosfat fluoro-uronsyrer.)</td>
<td>Bård Helge Hoff</td>
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<tr>
<td>Flatberg, Arnar</td>
<td>Simulation of microarray experiments and protsomic 2D gel electrophoresis.</td>
<td>Bjørn K. Alsbeg</td>
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<tr>
<td>Fuglseth, Erik</td>
<td>New chiral and fluorinated aromatic compounds. (Nye kirale og fluorere aromatiske forbindelser.)</td>
<td>Bård Helge Hoff</td>
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<tr>
<td>Gebremariam, Kidane Fanta</td>
<td>Analytical methods for art objects investigation</td>
<td>Lise Kvittingen</td>
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<td>Glavatsky, Kirill Sergeevich</td>
<td>Multi-component evaporation as described using the nonequilibrium van der Waals square gradient model.</td>
<td>Dick Bedeaux</td>
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<td>Gonzalez, Susana Villa</td>
<td>Synthesis of optically active surfactants and the study of their properties.</td>
<td>Per H. Carlsen</td>
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<td>Haas, Ole-Erich</td>
<td>Transport on a nanoscale; at surfaces and contact lines in PEM fuel cells.</td>
<td>Astrid Lund Ramstad</td>
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<td>Ham, Leen van der</td>
<td>Optimising the Second law efficiency of a cryogenic air separation unit</td>
<td>Signe Kjelstrup</td>
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<td>Hestad, Øystein Leif</td>
<td>Elektroniske prosesser i frosne dialektriske væsker under høg elektrisk feltpåkjenning.</td>
<td>Per-Olof Åstrand</td>
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<tr>
<td>Iltekar, Shafia</td>
<td>Trace metals and natural organic matters in rivers.</td>
<td>Torunn Berg</td>
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<tr>
<td>Kumelj, Tjasa</td>
<td>Free energy calculations of ligand-protein interactions.</td>
<td>Per-Olof Åstrand</td>
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<tr>
<td>Lervik, Anders</td>
<td>Energy transfer in biomolecular motors</td>
<td>Signe Kjelstrup</td>
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<tr>
<td>Løkke, Torbjørn Vegard</td>
<td>Analyser av vannduggpunkt og hydro-karbonduggpunkt i naturgass. (Determination of water dewpoint and hydrocarbon dewpoint in natural gas.)</td>
<td>Rudolf Schmid</td>
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<tr>
<td>Melnes, Silje</td>
<td>Rational drug design synthesis of potential selective inhibitors of tyrosin kinase 2.</td>
<td>Odd Reidar Gautun</td>
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<tr>
<td>Post Graduate Students</td>
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<td>Mohsin, Muhammad Ali</td>
<td>Surface functionalization by bio-organic materials.</td>
<td>Florinel G. Banica</td>
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<td>Nordløkken, Marit</td>
<td>Spormetaller i hjortedyr i Norge. (Trace of elements in Norwegian deer).</td>
<td>Torunn Berg</td>
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<tr>
<td>Ryeng, Einar</td>
<td>Analyse av mikromatrisedata med induktiv logikk-programmering.</td>
<td>Bjørn K. Alsberg</td>
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<tr>
<td>Sandru, Eugenia-Mariana</td>
<td>Synthese av høy umettete bioorganiske forbindelser. (Synthesis of highly unsaturated bioorganic compounds.)</td>
<td>Vassilia Partali</td>
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<tr>
<td>Smalø, Hans Sverre</td>
<td>Molecular models of electronic processen in liquids.</td>
<td>Per-Olof Åstrand</td>
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<tr>
<td>Steen, Anne Orderdalou</td>
<td>Atmosfærisk spesiering av kvikksølv i polare områder.</td>
<td>Torunn Berg</td>
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<tr>
<td>Stockmann, Vegar</td>
<td>Synthetic applications of nitropyridine derivates.</td>
<td>Anne Fiksdahl</td>
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<tr>
<td>Strasunskiene, Kristina</td>
<td>Automatically measuring systems for heavy metals and trace metals in waste water from sewage discharge and incineration plants. Early warming systems.</td>
<td>Øyvind Mikkelsen</td>
</tr>
<tr>
<td>Syed, Majid Bukhari</td>
<td>Isolation and structure elucidation of natural Bioactive molecules of plant origin.</td>
<td>Nebojsa Simic</td>
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<tr>
<td>Xu, Jing</td>
<td>A nonequilibrium molecular dynamics simulation study of chemical reactors.</td>
<td>Signe Kjelstrup</td>
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<tr>
<td>Zaidi, Asma</td>
<td>Synthesis of highly unsaturated amino acids.</td>
<td>Vassilia Partali</td>
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<tr>
<td>Zeeshan, Muhammad</td>
<td>Optical resolution by fractional aggregation.</td>
<td>Vassilia Partali</td>
</tr>
<tr>
<td>Øpstad, Christer Lorentz</td>
<td>Synthesis and properties of hydrophilic highly unsaturated amphiphiles for gene transfer.</td>
<td>Vassilia Partali</td>
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<tr>
<td>Aarhaug, Thor Anders</td>
<td>Ny membran for polymer brenselsceller.</td>
<td>Signe Kjelstrup</td>
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<tr>
<td>Aaseng, Jon Erik</td>
<td>Asymmetric synthesis of substituted 2-aminotetralins. (Asymmetrisk syntese av substituerte 2-aminotetraliner.)</td>
<td>Odd Reidar Gautun</td>
</tr>
</tbody>
</table>
Post Graduate Students

**MSc in Chemistry 2008**

Alsvik, Inger Lise  
Inherently colored soaps.  
Supervisor: Professor Vassilia Partali  
Examiners: Associate Professor Birte Sjursnes, HiØ  
Associate Professor Eva Mørkved

Eliassen, Ragnhild Oline  
Epiphytic lawn as indicator on air pollution in Sør-Varanger.  
Supervisors: Professor Eiliv Steinnes  
Research Manager Inga Bruteig, NINA  
Examiners: Professor Else Løbersli, DN  
Professor Øyvind Mikkelsen

Helland, Tone Grangård  
Selected pharmaceutical residues in Norwegian sewage effluent and the adjacent aqueous environment.  
Supervisors: Professor Torunn Berg  
Associate Professor Roland Kallenborn, UNIS  
Examiners: Senior Research Scientist Per Johan Brandvik, SINTEF  
Associate Professor Rudolf Schmid

Hermann, Solveig  
Utvikling av automatisk målesystem for sink, kadmium og kvikkosølv i avløpsvann fra forbrenningsanlegg.  
Supervisors: Professor Øyvind Mikkelsen  
Stipendiat Silje Marie Skogvold  
Examiners: Stipendiat Kristina Strasunskiene  
Professor Emeritus Knut Schrøder

Kjøglum, Kristin Tyldum  
Sensor development for environmental and industrial process monitoring. Development of solid state electrodes for surveillance of scale components in produced water from oil production.  
Supervisors: Professor Øyvind Mikkelsen  
Stipendiat Kristina Strasunskiene  
Examiners: Senior Research Scientist Per Johan Brandvik, SINTEF  
Professor Emeritus Knut Schrøder  
Stipendiat Silje Skogvold

Lorentzen, Marianne  
Stereoselective synthesis of optically active, unmetelled amines and alkoholes from sulfanylsubstances.  
Supervisor: Associate Professor Odd Reidar Gautun  
Examiners: Associate Professor Bård Helge Hoff  
Associate Professor Tore Lejon, UiT

Lystvet, Sina Maria  
Kjemo-enzymatic synthesis of enantiomeric 2-haloalcohols. Study of these as substrates for lipases CALA and CALB.  
Supervisors: Associate Professor Bård Helge Hoff  
Professor Emeritus Thorleif Anthonsen  
Examiners: Associate Professor Eirik Sundby, HiST  
Professor Torbjørn Ljones

Martinsen, Morten  
Utvikling og uttesting av automatisert målesystem for Beinlim i kobberlektroytt.  
Supervisor: Professor Øyvind Mikkelsen  
Examiners: Senior Research Scientist Kalman Nagy, SINTEF  
Stipendiat Silje Skogvold

Martinsen, Thomas  
Innvirkning av redusert forsuring på sporeelementer i jord och planter på Sørlandet.  
Supervisors: Professor Eiliv Steinnes  
Professor Torunn Berg  
Associate Professor Elin Gjengedal, UMB  
Examiners: Chief Engineer Bjørn Ove Berthelsen, Trondheim kommune  
Associate Professor Trond Peder Flaten
Møllegård, Ståle
β-metylamino-L-alanin [BMAA], en av nevrotoksisk aminosyre, i blod, hjernevev og lever hos pasienter med amyotrofisk lateralsklerose og parkinsonisme-demens fra stillehavsøya Guam.
Supervisors: Associate Professor Trond Peder Flaten
Associate Professor Per Bruheim
Examiners: Professor Lars Skjeldal, UMB
Professor Torbjørn Ljones

Neerland, Elisabeth
Utvikling av analytisk metode for automatiske målinger av viktige spometaller i kystvann.
Supervisors: Professor Øyvind Mikkelsen
Stipendiat Kristina Strasunskiene
Examiners: Senior Research Scientist Kalman Nagy, SINTEF
Professor Knut Schrøder

Salomonsen, Silje Naper
Delegering av miljøansvar fra stat til kommune. En case-studie av kommunal iverksetting av forurensningsforskriftens kapittel 2 om opprydding i forurenset grunn ved bygge-og gravearbeider.
Supervisors: Adjunct Professor Rolf Tore Ottesen
Professor Jan Alexander, The Norwegian Institute of Public Health
Examiners: Chief Engineer Bjørn Ove Berthelsen, Trondheim kommune
Associate Professor Rudolf Schmid

Skårn, Jenny Skeide
Kilder for polisykliske aromatiske hydrokarboner (PAH) i jord i Oslo, Norway.
Supervisors: Adjunct Professor Rolf Tore Ottesen
Dr. Pablo Beato, Topsøe A/S, Denmark
Examiners: Chief Engineer Bjørn Ove Berthelsen, Trondheim kommune
Associate Professor Rudolf Schmid

Sørensen, Kari Bjerke
Structural investigations on the hydrolysis of molybdenum oxomethoxide.
Supervisors: Dr. Pablo Beato, Topsøe A/S, Denmark
Professor David Nicholson
Examiners: Research Scientist Bjørnar Arstad, SINTEF, Oslo
Post.doc. Merete Hellner Nilsen, UiO
Associate Professor Morten Bjørgen

MSc in Environmental toxicology and chemistry 2008
Holsen, Aase Marie Hersleth
Sporeelementer i bjørn og ulv i Norge: En landsomfattende undersøkelse.
Supervisors: Associate Professor Trond Peder Flaten
Senior Research Scientist Hans Christian Pedersen, NINA
Professor Eiliv Steinnes
Chief Technician Syverin Lierhagen
Examiners: Senior Research Scientist John Atle Kålås, NINA
Professor Torunn Berg

Master project, exchange students
Ausin Reguera, Maider
Impact of NOM on trace metal speciation. Studies of copper levels and complexing capacity in river water using combination of different analytical techniques.
Supervisor: Professor Øyvind Mikkelsen
Examiners: Professor emeritus Knut Schrøder
Stipendiat Silje Marie Skogvold
Corcóstegui Ruiz-Carrillo, Cecilia
Impact of NOM on trace metal speciation. Quantification of trace metals including mercury in rivers in catchment areas correlated against quantity of NOM and type of vegetation.
Supervisor: Professor Øyvind Mikkelsen
Examiners: Professor emeritus Knut Schrøder
Stipendiat Silje Marie Skogvold
Post Graduate Students

**MSc in Chemistry/Siv.ing. 2008**

**Dahl, Espen Hvidsten**  
Hydraulic permeability of fluoridic solutions in Nation  
Supervisor: Professor Signe Kjelstrup  
Cosupervisor: Research Scientist Thor Anders Aarhaug, SINTEF  
Examiner: Research Manager Ann Mari Svensson, SINTEF

**Høgmoen, Hanne**  
Synthesis of polyfluorinated tertiary amines with potential antifungal activity  
Supervisor: Associate Professor Bård Helge Hoff  
Examiner: Quality Assurance Manager Viggo Waagen, Borregaard Synthesis AS

**Lervik, Anders**  
Energy dissipation in biomolecular motors  
Supervisor: Professor Signe Kjelstrup  
Cosupervisor: Associate Professor Fernando Bresme, Imperial College London  
Examiner: Professor Bjørn Kvamme, UiB

**Melnos, Silje**  
Asymmetric catalytic aziridination of alkenes for the purpose of manufacturing substituted 2-aminotetralines  
Supervisor: Associate Professor Odd Reidar Gautun  
Examiner: Associate Professor Tore Hansen, UiO

**MSc in Education, Chemistry**

**Bjørk, Tine Beate**  
Syntese av crocin-derivater.  
Supervisor: Professor Vassilia Partali  
Examiner: Associate Professor Birte Sjursnes, HiØ  
Dr. ing. Eva Mørkved

**Brimi, Aslak Opsahl**  
Likevekt i læring, læring i likevekt? En studie av kjemisk likevekt i forhold til undervisning.  
Supervisor: Professor Lise Kvittingen  
Stipendiat Per-Odd Eggen  
Examiner: Associate Professor Vivi Ringnes, UiO  
Associate Professor Annette Lykknes

**Elgen, Marianne**  
Fremstilling og karakterisering av potensielle virkestoffer mot sopp og protozoer.  
Supervisor: Associate Professor Bård Helge Hoff  
Examiner: Associate Professor Birte Sjursnes, HiØ  
Professor Torbjørn Ljones

**Frøland, Stine Lindset**  
Barns kjemiske lekemiljø. Nivå og kilder til PAH i barnehagejord i Trondheim.  
Supervisor: Adjunct Professor Rolf Tore Ottesen  
Divisional Engineer Lise Støver, Trondheim Kommune  
Examiner: Chief Engineer Bjørn Ove Berthelsen, Trondheim kommune  
Associate Professor Rudolf Schmid

**Hansen, Mari Roen**  
Likevekt i læring, læring i likevekt? En studie av kjemisk likevekt i forhold til undervisning.  
Supervisor: Professor Lise Kvittingen  
Stipendiat Per-Odd Eggen  
Examiner: Associate Professor Vivi Ringnes, UiO  
Associate Professor Annette Lykknes

**Hole, Marianne Prestvik**  
Miljøgifter i barns lekemiljø.  
Supervisor: Adjunct Professor Rolf Tore Ottesen,  
Divisional engineer Lise Støver, Trondheim Kommune  
Examiner: Chief Engineer Bjørn Ove Berthelsen, Trondheim kommune  
Associate Professor Rudolf Schmid
Valved, Hilde  
**Atmosfærisk kvikksølvspesiering i Ny-Ålesund. Hvor pålitelig er den nåværende metoden?**

**Supervisor:** Professor Torunn Berg  
**Stipendiat Anne Orderdalen Steen**

**Examiner:** Research Scientist Katrine Aspmo, NILU  
**Associate Professor Florinel G. Banica**

---

**PhD in Chemistry**

**Boman, Mats Henrik Linus**  
Cholesky decomposition based methods in electronic structure theory.

**Trial lecture**  
Exchange-correlation density functionals – present status.

**Supervisor**  
Professor Henrik Koch

**Evaluation committee**  
Professor Jeppe Olsen, Aarhus University, Denmark  
Professor Tore Syversen, Department of Neuroscience  
Professor Per-Olof Åstrand, Department of Chemistry, NTNU

---

**Gellein, Kristin**  
High resolution inductively coupled plasma mass spectrometry: Some applications in biomedicine.

**Trial lecture**  
Mulige helseeffekter relatert til utslipp av metaller til luft.

**Supervisor**  
Associate Professor Trond Peder Flaten  
**Co-supervisors**  
Professor Eiliv Steinnes, Department of Chemistry  
Professor Tore Syversen, Department of Neuroscience

**Evaluation committee**  
Professor Gunnar Nordberg, Occupational and Environmental Medicine, Umeå University, Sweden  
Senior Scientist Hilde Thelle Uggerud, Norwegian Institute for Air Research, Kjeller, Norway  
Professor Torunn Berg, Department of Chemistry, NTNU

---

**Ingebrigtsen, Stian**  
The influence of chemical composition on streamer initiation and propagation in dielectric liquids.

**Trial lecture**  
Aging and breakdown of HV solid insulating materials stressed by ns, HV transients.

**Supervisor**  
Professor Per-Olof Åstrand

**Evaluation committee**  
Professor Steven A. Boggs, Institute of Materials Science, University of Connecticut, USA  
PhD Leif A. A. Petterson, ABB Corporate Research, Sweden  
Professor Hans Kristian Høidalen, Department of Electric Power Engineering, NTNU

---

**Inzoli, Isabella**  
Coupled transports of heat and mass at the surface of and inside silicalite.

**Trial lecture**  
Snowflakes.

**Supervisor**  
Professor Signe Kjelstrup

**Evaluation committee**  
Associate Professor dr. Thijs Vlugt, Delft University of Technology, The Netherlands  
Professor dr.ing. Dag Dysthe, Department of Physics, University of Oslo, Norway  
Associate Professor Morten Bjørgen, Department of Chemistry, NTNU

---

**Jartun, Morten**  
Active sources and dispersion mechanisms of pollutants, especially polychlorinated biphenyls (PCBs), in the urban environment.

**Trial lecture**  
Making sense of pollutant levels: Moving from chemical analysis to risk assessment of their significance and potential risk management.

**Supervisor**  
Professor Eiliv Steinnes  
**Co-supervisor:**  
Adjunct Professor Rolf Tore Ottesen, NGU, Norway

**Evaluation committee**  
Professor Kevin C. Jones, Department of Environmental Science, Lancaster University, UK  
Professor Gijs D. Breedveld, Department of Environmental Engineering, Norwegian Geotechnical Institute, Oslo, Norway  
Professor Torunn Berg, Department of Chemistry, NTNU
Nordhei, Camilla

Aspects of electronic and structural properties of nanophase cubic ferrites studied by X-ray absorption spectroscopy. Including the decomposition of carbon dioxide over hydrogen-reduced ferrites.

Trial lecture
Reduced emissions by conversion of carbon dioxide.

Supervisor
Professor Astrid Lund Ramstad

Evaluation committee
Professor Wendy Flavell, School of Physics and Astronomy, University of Manchester, UK
Dr. Nina Aas, StatoilHydro, Trondheim, Norway
Professor Magnus Rønning, Department of Chemical Engineering, NTNU

Svendsen, Monica L.

A study of metal contamination in a natural ecosystem affected by smelter emissions.

Trial lecture
Determination of metal bioavailability and exposure in the environment.

Supervisor
Professor Eiliv Steinnes

Co-supervisor
Hans Andreas Blom, Østfold University College, Sarpsborg, Norway

Evaluation committee
Associate Professor John R. M. Derome, Rovaniemi research Station, Finnish Forest Reasearch Institute, Finland
Associate Professor Elin Gjengedal, Department of Plant and Environmental Sciences, Norwegian University of Life Sciences, Norway
Professor Torunn Berg, Department of Chemistry, NTNU

Yu, Qiang

Synthesis of optically active nucleosides, nucleotides and oligonucleotide analogues.

Trial lecture

Supervisor
Professor Per Carlsen

Evaluation committee
Professor Mikael Begtrup, Department of Medicinal Chemistry, University of Copenhagen, Denmark
Associate Professor Anette Bayer, Department of Chemistry, University of Tromsø, Norway
Associate Professor Odd Reidar Gautun, Department of Chemistry, NTNU

Student Exchange from NTNU, Department of Chemistry 2008

<table>
<thead>
<tr>
<th>Name</th>
<th>Specialization</th>
<th>Level</th>
<th>Institution</th>
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<tbody>
<tr>
<td>Egede-Nissen, Cecilie</td>
<td>MKJ-Analyt.chem.</td>
<td>MSc, 4th yr</td>
<td>Vrije Universiteit Brussel, Belgium</td>
</tr>
<tr>
<td>Grave, Anlaug Haukvik</td>
<td>MKJ-Struct.chem.</td>
<td>MSc, 5th yr</td>
<td>University of Newcastle, Australia</td>
</tr>
<tr>
<td>Hegmoen, Hanne</td>
<td>MTKJ-Org.chem.</td>
<td>MSc, 5th yr</td>
<td>University of California, Berkeley, USA</td>
</tr>
<tr>
<td>Heyvik, Ida-Marie</td>
<td>BKJ-Struct.chem.</td>
<td>BSc, 3th yr</td>
<td>University of California, Berkeley, USA</td>
</tr>
<tr>
<td>Lervik, Anders</td>
<td>MTKJ-Phys.chem.</td>
<td>MSc, 5th yr</td>
<td>University of London, UK</td>
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<tr>
<td>Lyngvi, Eirik</td>
<td>MTKJ-Org.chem.</td>
<td>MSc, 4th yr</td>
<td>University of California, Berkeley, USA</td>
</tr>
<tr>
<td>Serum, Christopher</td>
<td>MTKJ-Org.chem.</td>
<td>MSc, 4th yr</td>
<td>University of California, Berkeley, USA</td>
</tr>
<tr>
<td>Valvik, Beate</td>
<td>MKJ-Struct.chem.</td>
<td>MSc, 5th yr</td>
<td>University of Newcastle, Australia</td>
</tr>
<tr>
<td>Åstrand, Ove Alexander</td>
<td>MTKJ-Org.chem.</td>
<td>MSc, 4th yr</td>
<td>University of California, Berkeley, USA</td>
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</table>

Student exchange to NTNU, Department of Chemistry 2008

<table>
<thead>
<tr>
<th>Name</th>
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<tr>
<td>Akyalcin, Sema</td>
<td>Anadolu University, Eskisehir, Turkey</td>
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<tr>
<td>Breukers, Stefanie</td>
<td>RWTH, Aachen, Germany</td>
</tr>
<tr>
<td>Cabana, Beatriz Louriño</td>
<td>Universidad de la Coruña, Spain</td>
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<tr>
<td>Corcostegui, Cecilia</td>
<td>University of the Basque Country, Spain</td>
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<td>Hocke, Nils</td>
<td>Georg-August-Universität Göttingen, Germany</td>
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<td>Kalz, Kai</td>
<td>Georg-August-Universität Göttingen, Germany</td>
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<td>Lüttschwager, Nils</td>
<td>Georg-August-Universität Göttingen, Germany</td>
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<td>Martin, Daniel</td>
<td>RWTH, Aachen, Germany</td>
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<td>Paul, Jean-Nicolas</td>
<td>Université des Sciences et Technologies, Lille, France</td>
</tr>
<tr>
<td>Reguera, Maider Ausin</td>
<td>University of the Basque Country, Spain</td>
</tr>
</tbody>
</table>
Staff

Academic Staff

Organic Chemistry

Group Leader
Professor, Dr.ing.
Anne Fiksdahl

Adjunct Professor, Ph.D.
(Oxford). Derek Chadwick

Professor, Dr.rer.nat.
(Fribourg). Vassilia Partali

Professor, Ph.D. (Buffalo).
Per Carlsen

Associate Professor, Dr.ing.
Odd Reidar Gautun

Associate Professor, Ph.D.
(Niš), Nebojsa Simic

Associate Professor, Dr.scient
Bård Helge Hoff
Physical Chemistry

Group Leader
Associate Professor, Dr.scient.
Astrid Lund Ramstad

Assistant Professor
Terje Bruvoll

Professor, Dr.philos.
Reidar Stølevik

Professor, Dr.scient.
Bjørn Alsberg

Professor, Dr.techn.
Signe Kjelstrup

Professor, Ph.D. (Lund)
Per-Olof Åstrand

Adjunct Professor, Dr.philos.
(Utrecht). Dick Bedeaux

Professor, Ph.D. (Arhus).
Henrik Koch

Associate Professor, Ph.d.
Morten Bjørgen

Professor, Ph.D. (Madison)
Torbjørn Ljones
Environmental and Analytical Chemistry

Group Leader
Dr. Scient
Øyvind Mikkelsen

Professor, Dr. scient.
Lise Kvittingen

Professor, Dr. philos.
Eiliv Steinnes

Associate Professor, Dr. ing.
Florinel G. Banica

Ph. D.
Karina Mathisen

Associate Professor, Dr. rer. nat.
(즈리히). Rudolf Schmid

Professor, Dr. scient.
Torunn Berg

Professor, Ph. D. (London)
David Nicholson

Associate Professor, Ph. D.
Annette Lykknes

Associate Professor, Dr. ing.
Trond Peder Flaten

Adjunct Professor
Rolf Tore Ottesen
Administrative staff

Head of administration
Anne Langseth

Senior Executive Officer
Lillian Hanssen

First Secretary
Aase Sæther

Executive Officer
Inger Marie Frøseth

Higher Executive Officer
Ingrid Kristine Tømmerdal

Technical staff

Staff Engineer
Stein Almo

Head Engineer
Julie Jackson

Staff Engineer
Nina Klausen
Staff

Head Engineer
Syverin Lierhagen

Senior Engineer
Tron Rolfsen

Engineer
Kari Tanem

Engineer
Kjersti Ljones

Staff Engineer
Gunnar Svare

Staff Engineer
Roger Aarvik

Scientific Assistants
Angelsen, Ragnhild Strand
Braaten, Hans Fredrik
Burheim, Odne S.
Engøy, Ingemund F.
Gebremariam, Kidane Fanta
Holt, Yngvil
Kong, Xiang Yi
Lervik, Anders
Lie, Aleksander
Molnes, Silje
Nordløkkken, Marit
Sandru, Eugenia-Mariana
Siegismund, Øyvind
Skorpa, Ragnhild
Steen, Anne O.
Tværd, Thor Håkon Krane
Øvergård, Tommy

Demonstrators
Berg, Michel Brunnes
Bergersen, Amund Dolva
Braaten, Hans Fredrik
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Høiås, Morten
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Landsem, Eva
Lian, Nikolai
Lieungh, Ida
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Ohm, Ragnhild
Ringholm, Magnus
Selsaas, Eirik
Siegesmund, Øyvind
Sivertsen, Ida Karoline
Skarre, Ragnhild
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Skårn, Jenny Skeide
Slind, Gøril Aasen
Smørvik, Marte Songøygard
Solvang, Tina
Sundrønnning, Silje Beate
Særsland, Anne Lene
Takla, Marit
Tungen, Jørn E.
Vestrum, Magnus Inderberg
Volynkin, Andrey S.
Vågenes, Birgitte Bårdli
Willassen, Veronica
Yttervik, Johan Hatling
Aardal, Eivind

Guest professors/researchers/lecturers

Krzysztof Rokosz
Feb. 11 – 14, 2008
Gabriel Billon
Marine Nalbandyan
June 23 – 30, 2008
Donald L. Macalady
June 30 – July 28, 2008
Jon Pharoah
Daniel Barragan
Sept. 11 – Dec. 28, 2008
Brigitte Van Tiggelen
Irina Shtangeeva
Oct. 14 – Nov. 27, 2008
Levent Akyalcin

Professor Emil Palecek, Institute of Biophysics, Academy of Sciences of the Czech Republic, Brno, Czech Republic: Aug. 19, 2008

Professor Vladimir Vetterl, Centre of Biophysics, Masaryk University and Institute of Biophysics, Academy of Sciences of the Czech Republic, Brno, Czech Republic: Aug. 19, 2008
“Self-assembled layers of nucleic acid components and Oligodeoxynucleotides at the electrodes”

Dr. Brigitte Van Tiggelen, Université Catholique de Louvain, Belgium Sept. 23, 2008
“Closing a Chemical Controversy from the Periphery: J.B. Van Mons and the reduction of calx of mercury”

Professor Daniel Barragán, Chemistry Department, Universidad Nacional de Colombia, Bogota, Colombia: Oct. 21, 2008
“Instabilities in non-equilibrium systems”

Dr. Sudipto Muhuri, University of Barcelona, Spain: Oct. 28, 2008
“Role of molecular motor kinetics in collective vesicular Transport and structural stability in biofilaments”

Professor Steven Boggs, University of Connecticut, USA: Nov. 6, 2008
“Theory for the worst case tolerable conducting defect (particle) in transmission class solid dielectric cables”

Dr. Irina Shtangeeva, St. Petersburg University, Russia: Nov. 24, 2008
“Neutron activation analysis in determination of trace And ultra trace elements in biological material”
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