First Conference of Scientific Cooperation between Lower Saxony and Israel

organized by Braunschweigische Wissenschaftliche Gesellschaft

Hannover, Germany, October 6th-7th, 2013

Final Program and Book of Abstracts

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Scientific Cooperation between
Lower Saxony and Israel

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and
Book of Abstracts

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Prof. Dr. Joachim Wolschke-Bulmahn, Leibniz Universität Hannover
Prof. Dr. Thomas Scheper, Leibniz Universität Hannover

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Welcome to the First Conference of Scientific Cooperation between Lower Saxony and Israel (2013)

Since 1977 the Ministry of Science and Culture of Lower Saxony has funded research projects between universities and research institutes from Lower Saxony with the Hebrew University or the Technion in Israel. Due to this funding many highly innovative research projects have been initiated and transformed into intensive ongoing research collaborations between both countries. This research funding is the basis of stable and fruitful partnerships between researchers from Lower Saxony and Israel. During the last few years, early-stage scientists from both countries have been involved. The involvement of the younger generation will ensure a fruitful future collaboration between both countries.

The “First Conference of Scientific Cooperation between Lower Saxony and Israel” is intended to be a platform for the presentation of ongoing research collaborations. Here the latest results will be presented and discussed with a broader audience. New collaborations could be initiated and younger researchers attracted to exciting new project ideas. This conference will be set up to show the high scientific level of collaborations in various areas of science and humanities. Additionally, younger researchers will have the opportunity to find partners for future collaborations by presenting their new ideas. The conference will be held every two years and will become a recurring part of the research funding activities of Lower Saxony.

The research partners in each project will have the chance to present results via oral or poster presentations. A certain number of travel grants for oral presenters and young investigators will be available. The submitted abstracts will be evaluated by a scientific committee. During the poster presentation, young researchers from both countries will have the chance to present themselves and their research ideas in order to gain valuable contacts with researchers from the partner country. This partnering will be further developed within the next few conferences. This is envisaged to be the second pillar of the biannual conference.

The “First Conference of Scientific Cooperation between Lower Saxony and Israel” will be organized by the Braunschweigische Wissenschaftliche Gesellschaft (President Prof. Dr. Joachim Klein). The scientific organizing committee of the first conference consists of Prof. Dr. Yuval Shoham, Technion, Haifa; Prof. Dr. Shimshon Belkin, Hebrew University Jerusalem; Prof. Dr. Joachim Wolschke-Bulmahn, Leibniz Universität Hannover and Prof. Dr. Thomas Scheper, Leibniz Universität Hannover.

General Information

Congress Venue

Sessions, Poster Exhibition and catering will all take place in the
Leibnizhaus
Holzmarkt 4-6
30159 Hannover, Germany

Registration and Service Desk

Desk will operate as follows:
Sunday, October 6th, from 11:00-21:30
Monday, October 7th, from 8:00-18:30

Congress Kit and Badges

You will receive your congress kit, containing the program and abstracts and name badge at the service desk. Please wear your name badge to all sessions and events.

Information for Presenters

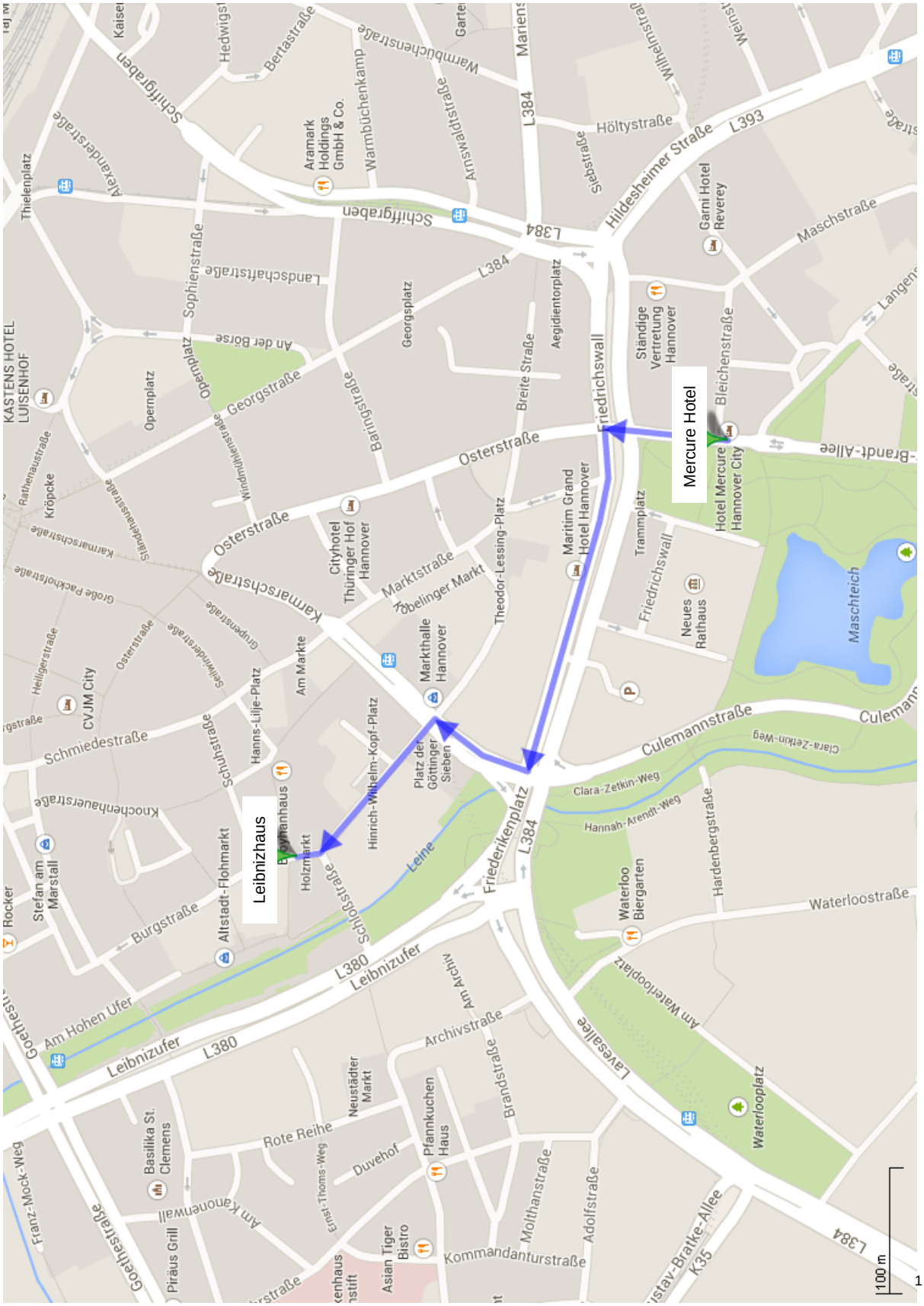
All speakers are requested to provide a copy of their presentation upon registration at the service desk.

Poster Set-up

Organizers are available on Sunday 6th of October to help installation of posters; tools (scissors, tapes etc.) are provided at the congress venue.

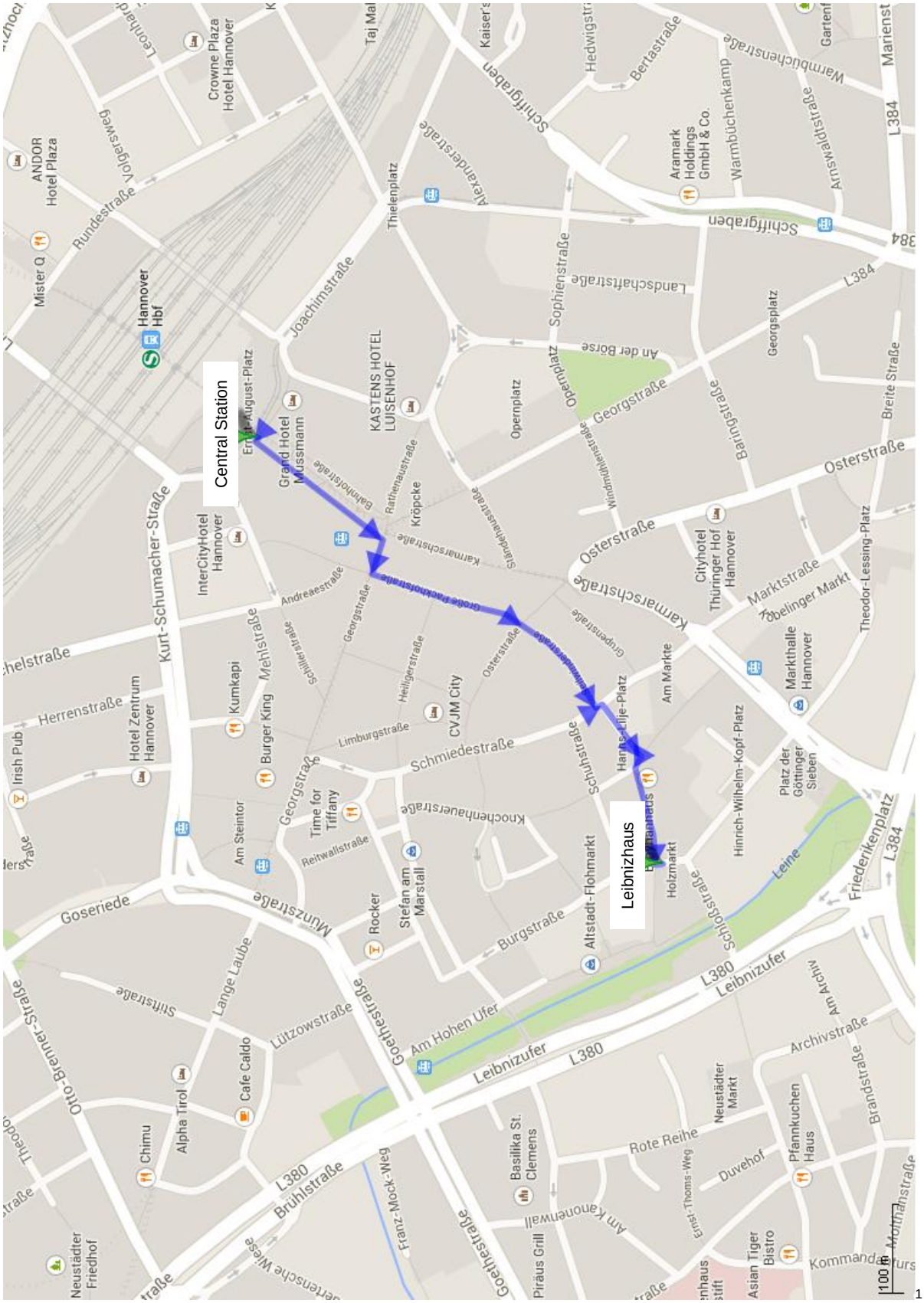
Poster presenters should refer to the list of poster presentations (page 12) for their board numbers. Authors of posters are requested to be present at their posters during the poster lunch.

Map- Hotel Mercure - Congress Venue



[1] Google Maps, 2013

Map- Central Station (“Hauptbahnhof”) - Congress Venue



[1] Google Maps, 2013

Scientific Program – Sunday: October 6th 2013

09:30 Pre-conference Sightseeing
Meeting Pont: Tram Station “Herrenhäuser Gärten”

11:45 Registration and Lunch Buffet
Leibnizhaus Hannover

12:45 Welcome Notes
Prof. J. Klein, Braunschweigische Wissenschaftliche Gesellschaft

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Abstracts

Oral Presentations

Uncovering the regulatory network controlling aggressive breast cancer subtype identity

U. Lehmann[2], J. Rößler, R. Z.[2], Granit[1], I. Ben-Porath[1]

[1] Department of Developmental Biology and Cancer Research, Institute for Medical Research – Israel-Canada, Hadassah School of Medicine, The Hebrew University of Jerusalem, Israel
[2] Institute of Pathology, Medizinische Hochschule Hannover, Hannover, Germany

The mechanisms underlying aggressive tumor growth and metastatic spread, which lead to cancer patient mortality, are poorly understood. The differentiation state of cancer cells is a major parameter affecting these tumor traits: poorly differentiated tumors grow rapidly, are more likely to be metastatic, and contain higher numbers of cancer stem cells. The elucidation of factors controlling differentiation state is essential for the development of drugs that can specifically and effectively combat aggressive disease. In this study we aim to uncover molecular regulators controlling the differentiation state of basal-like breast cancers, tumors that present poor differentiation, poor patient outcome and are phenotypically linked to progenitor cells in the normal breast. We have found that EZH2, the catalytic subunit of the Polycomb repressive complex, which is central in maintaining stem cell function, regulates the identity of basal-like tumors: in the absence of EZH2, breast cancer cells undergo a differentiation shift, losing their progenitor traits and metastatic ability. Furthermore, we found that EZH2 controls the composition of basal-like breast cancer cell populations, acting to increase the numbers of progenitor-like, bi-lineage cells within tumors. GATA3, a master regulator of mammary cell differentiation counteracts EZH2, reducing the numbers of progenitor-like cells within the cancer cell population. These findings indicate that tumor composition, which dictates overall subtype identity, is controlled by the interplay between EZH2 and GATA3. However, the activity of additional regulators, among them master regulatory microRNAs, is most likely central in regulating cancer differentiation state. To identify such miRs we have conducted detailed analysis of breast cancer miR expression data and have identify a series miRs specifically downregulated or upregulated in basal-like tumors. These miRs are central candidates to play a central role in the regulatory network controlling the gene expression program active in basal-like breast cancer. In parallel, we performed genome-wide profiling of DNA methylation patterns employing Illumina 450k arrays as well as MBD affinity enrichment of methylated DNA and subsequent array hybridization. This approach lead to the identification of genes epigenetically inactivated in different breast cancer subtypes, among them several microRNA genes. We are conducting a functional screen in which the effect of these candidate miRs on breast cancer differentiation state is directly tested. This screen will reveal which miRs control the expression of master regulatory transcription factors and lineage markers active in these tumors.

Our study provides highly valuable insights into the mechanisms by which breast cancers acquire stem-like traits and aggressive properties, revealing the action of central miRs in this process and shedding light on the mode of action of Polycomb complexes in cancer.

Publications:

Granit RZ, Gabai Y, Hadar T, Karamansha Y, Liberman L, Waldhorn I, Gat-Viks I, Regev A, Maly B, Darash-Yahana M, Peretz T, Ben-Porath I. (2012). EZH2 promotes a bi-lineage identity in basal-like breast cancer cells. Oncogene. 2012 Sep 17 [Epub ahead of print]

Slyper M, Shahar A, Bar-Ziv A, Granit RZ, Hamburger T, Maly B, Peretz T, Ben-Porath I. (2012). Control of breast cancer growth and initiation by the stem cell-associated transcription factor TCF3. Cancer Res. 72(21):5613-24.

Ben-Porath I, Thomson MW, Carey VJ, Ge R, Bell GW, Regev A, Weinberg RA. (2008) An embryonic stem cell-like gene expression signature in poorly differentiated aggressive human tumors. Nat Genet. 40(5):499-507.

Roessler J, Ammerpohl O, Gutwein J, Hasemeier B, Anwar SL, Kreipe H, Lehmann U. (2012). Quantitative cross-validation and content analysis of the 450k DNA methylation array from Illumina, Inc. BMC Res Notes. 5:210.

Bockmeyer CL, Christgen M, Müller M, Fischer S, Ahrens P, Länger F, Kreipe H, Lehmann U. (2011). MicroRNA profiles of healthy basal and luminal mammary epithelial cells are distinct and reflected in different breast cancer subtypes. Breast Cancer Res Treat. 130(3):735-45.

Lehmann U, Hasemeier B, Christgen M, Müller M, Römermann D, Länger F, Kreipe H. (2008). Epigenetic inactivation of microRNA gene hsa-mir-9-1 in human breast cancer. J Pathol. 214(1):17-24.

Novel phosphorylation sites on immune adaptor proteins fine tune immune responsiveness

[1] D. Yablonski, J. Wienands

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T lymphocyte development and function are profoundly influenced by signaling through the clonotypic T cell antigen receptor (TCR). Within the cell, TCR signals are interpreted by a signaling complex that is nucleated by three hematopoietic-specific adaptor proteins: SLP-76, Gads and LAT. Upon TCR stimulation, cytoplasmic SLP-76 and Gads are recruited to membrane-bound LAT, where they bind and regulate a large complement of enzymes and other proteins, to trigger appropriate TCR responses. Given their central role, we hypothesized that SLP-76 and Gads are dynamically regulated by phosphorylation at multiple positive and negative regulatory sites, only a few of which are currently known.

In collaboration with our partners from the University of Göttingen, we conducted a phospho-mass spectrometry analysis of SLP-76 and Gads, isolated from TCR stimulated cells. In this way, we identified 20 previously uncharacterized phosphorylation sites on SLP-76, and an additional 16 uncharacterized sites on Gads. Follow up experiments using a SILAC approach are in progress, in order to characterize the kinetics of TCR-induced phosphorylation of Gads and SLP-76, on a site-by-site basis, with subsequent functional analysis focusing on those sites that are TCR-inducible.

Functional characterization will be performed in the SLP-76-deficient, J14 background, and in SLP-76- or Gads-deficient murine bone marrow-derived mast cells (BMMCs). Using this approach, we have already characterized SLP-76 Y173, which was found to positively regulate TCR-induced PLC-γ1 phosphorylation and subsequent downstream responsiveness (Sela et al. EMBO J. 2011). Preliminary characterization of two additional SLP-76 phosphorylation sites suggests that they negatively regulate TCR-induced calcium flux.

Characterization of Gads phosphorylation sites has so far relied on overexpression experiments, due to the lack of a tractable, Gads-deficient T cell line. To remedy this situation, we used a TALEN-mediated genome editing strategy to create a Gads-deficient, Jurkat-derived T cell line, a novel experimental reagent, which we shall use for functional characterization of Gads mutants, thereby revealing novel ways in which T cell activation is dynamically regulat

RNA-protein interactions during viral infections and inherited immuno-deficiencies

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[2] Prof. Yael Mandel-Gutfreund, Technion Insitute, Haifa, Israel

The complexity of an organism does not correlate with the number of genes, but rather depends on the complex regulation of gene expression. Research in molecular genetics revealed that the fine tuning of gene expression is RNA-based. Messenger RNA is subjected to multiple quality control mechanisms and processing steps. Both processing and surveillance mechanisms are controlled by RNA-binding proteins. Thus, to understand the regulation of gene expression in its complexity and to ultimately decode all genetic information, a detailed understanding of the RNA-protein interactions is essential. Our laboratories seek to understand and predict these RNA-protein interactions using viral and disease-related model systems. Mutations in the untranslated regions (UTRs) of mRNAs are rare causes for monogenetic diseases whose mechanisms remain poorly understood. We investigated a 3'UTR mutation resulting in a complex immunodeficiency syndrome caused by decreased mRNA levels of a gene involved in signaling. We showed that mRNA suppression correlates with a mutation creating a 5' splice site (SS) and that its recognition by the spliceosomal component U1 snRNP causes mRNA degradation. Moreover, our data endorse the recently described role of U1 snRNP in a quality control mechanism, which monitors mRNA length and integrity. In the future we plan to analyze more non-coding mutations in three different inherited diseases.

Viruses rely on the cellular machinery to express their genes. A general polar opposite is that cellular genes harbor many regulatory sequences, however, viruses depend on a compact genome for efficient replication and thus viral regulatory sequences are dense and sparse. In order to overcome these limitations, viruses encode viral adaptor proteins, which ensure expression via interaction with cellular factors. We show that the multi-functional regulatory protein of a human herpesvirus also facilitates the expression of intron-containing genes. The molecular mechanism how the regulator induces viral RNA export and efficient translation of viral mRNAs has been elucidated in the past decade. However, the question how the regulator distinguished between cellular and viral mRNA remains completely elusive. Based on the distinct nucleotide bias of herpervirus genes and motif search for RNA-binding proteins we postulate a new trimeric complex consisting of viral RNA, a cellular RNA-binding protein and a viral regulator protein. We believe that our future research will uncover new modes of RNA-protein interactions and new regulatory pathways.

Perturbation of intestinal epithelial homeostasis by enteropathogenic *E. coli*

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The human intestine is one of the busiest fronts of microbe-host interaction. A single epithelial cell layer separates a vast microbial community termed microbiota from deeper tissues. In addition to its barrier function, the epithelial monolayer plays a key role in sensing and controlling the delicate balance between the microbiota and the immune system. These epithelial cells must distinguish commensal bacteria from pathogens in order to help maintaining tolerance towards the beneficial commensal bacteria, while promoting inflammatory response against pathogens. A fundamental matter that remains poorly understood is the process by which epithelial cells differentiate pathogens from commensal bacteria. We hypothesize that this recognition might involve specific perturbation of the epithelium homeostasis by the pathogen. To test this hypothesis we use as a model interaction of the human-specific pathogen enteropathogenic *E. coli* (EPEC) with tissue culture human epithelial cells. EPEC employ an organelle termed type III secretion system (TTSS) as a syringe to inject the host cell with a set of ~ 25 effector proteins that function together to subvert host function in order to the benefit of the pathogen. We investigate how these effectors perturb intestinal homeostasis and how the host cell senses these perturbations interpret them, and act to restrict the infection.

Mechano-sensitivity of human mesenchymal stem cells

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It is now well accepted that the mechanical properties of the cellular environment play an important role in the determination of cell morphology, function and fate. Extensive research has been devoted in recent years to elucidate the mechanisms involved in the *mechano*-sensitivity of cells, however, many fundamental questions remain open. An intriguing recent study has shown that the differentiation of human mesenchymal stem cells (hMSCs) to various lineages can be directed by the elasticity of the substrate on which the cells are cultured on.

A combined theoretical and experimental study provided important first insights into the mechanical interplay of hMSCs with their environment. We demonstrated, both theoretically and experimentally, that the elasticity of the environment dictates the amount and orientational order of acto-myosin stress fibers in stem cells. The quantification of the stress fiber structure by an order parameter *S* leads to an early morphogenetic marker of stem cell differentiation that will be used to better understand the *mechano*-sensitivity that leads to distinct differentiation. The understanding of how cells adapt their morphology and internal structure to the mechanical nature of their environment has tremendous implications in developmental biology, tissue engineering and regenerative medicine.

Personal care products as source for micropollutants in Greywater- Identification, quantification and on-site treatment

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Population growth and urbanization has increased the demand for freshwater. Conveyance of water from distant sources, deeper wells, large dams and desalination plants are being developed in order to meet this growing demand. Development and exploitation of these new water sources are usually costly, and in many cases not environmentally sustainable. Decentralized greywater (GW) treatment and reuse can contribute to more sustainable use of water within urban areas.

GW is defined as household wastewater excluding the contribution from toilets and kitchen. Thus, it includes wastewater from showers, baths, hand-basins and washing machines, and comprises 50–70% of domestic wastewater. This wastewater may contain pollutants such as detergents, personal care-products (e.g. soaps, shampoos and creams), other cleansing agents, skin tissue and some pathogenic microorganisms. After treatment, GW can be reused for landscape irrigation, toilet flushing, and other cleaning uses (e.g. window, laundry and vehicle washing). GW reuse for toilet flushing and landscape irrigation alone can reduce domestic water consumption by up to 50%. On the other hand, GW can pose risks to human-health and the environment. GW irrigation may contaminate surface- and ground- water. Thus, it has to be treated before reuse. Combined biological and physical treatment and disinfection can reduce the levels of pollutants and pathogen bacteria to levels that allow safe reuse. As residual concentrations of micropollutants are present in “conventionally-treated” GW the proposed study intends to investigate the removal of the selected micropollutants by a combined V-UV/UV-C radiation process in spiked distilled water, spiked treated GW and treated GW. As long as full mineralization is not achieved, the proposed photo-oxidation process can result in the formation of transformation products that may continue to pose environmental or health concerns. Sustainable water treatment technologies have to ensure degradation of pollutants into non-toxic compounds. Therefore, comprehensive analysis of degradation efficiency as well as risk assessment of possibly formed transformation products that are resistant to further degradation will be performed

The effect of biofilms on hydraulic properties of porous media

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Water is essential for life and terrestrial biomass production relies heavily on underground water resources. As these waters are under increasing contamination threat the understanding of water flow and transport processes in the groundwater-soil-plant-atmosphere continuum is of great importance. The interaction of subsurface water with microbial life in the soil has so far been largely ignored, and this is particularly the case for soils as three-phase systems, i.e. solid porous materials which contain air and water in temporally varying amounts.

The soil contains billions of microbes that often “coat” themselves by extra cellular substance (EPS) forming biofilms. These biofilms have a non-negligible size that changes the geometry of soil pores and therefore induce changes in the hydraulic properties of soils, i.e. their capacity to store and conduct water. In this ongoing research we address the question of microbial effects on the soil hydraulic properties and their impact on major processes of the terrestrial water cycle like groundwater recharge and evapotranspiration. Since water flow is the driver for solute transport in soil, the environmental fate of nutrients and contaminants is also influenced. Great practical relevance is evident in the fields of irrigation management, in particular in cases where low-quality water or intensively fertilized water is applied to soils, soil aquifer treatment, constructed wetlands, and contaminant remediation.

The major goal of the project is a quantitative understanding of these effects and their implementation in numerical simulation tools for water and solute movement in soil. Our research therefore combines laboratory work with real microbes and analog media with numerical modeling techniques. By combining these methods we set the ground for this new fascinating interdisciplinary research field that combines soil physics and microbiology.

Real-time monitoring of N-species isotopologues by FTIR spectroscopy – a novel tool to investigate short-term isotopic dynamics and N_2O formation in soil

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[2] Institute of Grassland Science, Georg August University, Göttingen, Germany
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Nitrogen (N) derived from agro-ecosystems poses severe threats to the environment via nitrate leaching and emission of N_2O that contributes to global warming. Knowledge regarding the pathways and microbial communities involved in N_2O production is still limited and better understanding is essential for developing mitigation measures. In this project we developed a novel integrative method based on Fourier transform infrared (FTIR) spectroscopy for continuous monitoring of isotopic nitrogen species in soil and gas phases to investigate short-term isotope and isotopologue dynamics and N_2O formation. The presentation will include an overview of the project motivation and objectives, a brief description of the FTIR-based monitoring method that has been developed and a summary of the results and their implications.

The role of dispersive stresses in canopy flow models

K. Koll[1], U. Shavit[2], S. Asher[2], S. Niewerth[1]

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For the assessment of environmental quality the prediction of flow and transport phenomena are of high interest. These predictions are important for the analysis of heat, water vapor, and CO_2 in forest canopies, pollution and risk assessment in urban areas and ecological sustainability of wetlands and coral reefs, to name a few. However, terrestrial and aquatic regions are covered by obstacles in the form of vegetation (individual plants, patches, plant stands and forests), manmade structures (e.g., buildings) and natural benthic organisms such as coral reefs. Modeling the concentration fields of particulate matter or dissolved components requires highly detailed measurements or accurate modeling of the flow field. Without such a description of the velocity field, no transport prediction can be obtained.
Existing canopy flow models are derived by averaging the momentum equations over time and space. While the temporal averaging generates the Reynolds stress terms, spatial averaging generates the drag term and the dispersive stress terms. Dispersive stresses are ignored in almost all reported studies although it is known that they are very large in both the roughness layer and canopy entry regions. Ignoring these stresses results in an incorrect modeling of the velocity inside the vegetation region. One of the reasons for neglecting dispersive stresses is the lack of closure models.

The objective of the project, which started in January 2013, is to test a closure model that we hypothesized and to close important knowledge gaps in flow modeling through the described environments. The experiments will be conducted in hydraulic flumes with arrays of coral skeletons and thin glass plates that will be installed on the bottom of the flumes. The drag forces are measured directly using the unique facility available at the TU Braunschweig and the Technion Particle Image Velocimetry system is used to independently measure and calculate the dispersive stresses.

The presentation will introduce the general problem. The methodology used to solve the problem will be explained on the basis of a brief description of the theoretical background. First results of the experiments carried out in the two flumes will be presented.

Cities, nature and life between them: the dynamics of human and natural ecosystems and the interrelationships between them

R. Prasse, D. Malkinson, D. Czamanski, M. Toger

Our research is an empirical analysis of the interaction between urban sprawl and nature in cities and in peri-urban areas. It is motivated by our recent effort to map out the relevant existing knowledge, to identify critical gaps and to synthesize a conceptual framework for explaining the driving forces operating on the dynamics of urban spatial structures, agriculture and natural systems at the urban edge. While much is known about the dynamics of each of these systems separately, there are major gaps in the existing knowledge concerning their interactions.

We are constructing an integrated model of high-resolution dynamics at the urban fringe – the ever increasing interface between the urban and non-urban land uses. It is our intention to identify evolution pathways and critical "hot spots" of land transformation under a variety of environmental conditions and management regimes. These are essential to reconstruct, analyze and predict land system dynamics over longer time periods (decades to centuries) and for integrating natural resource management into spatial planning.

The model is intended to account for economic, demographic, legal, social, and cultural factors that govern urban expansion and create significant variability in the rate and spatial-temporal patterns of sprawl. We measure and model the resulting landscape of shifting mosaic of patches, of intertwined "porous sponges". The use of high resolution data enables the identification of fuzzy boundary regions at the urban edges and of extensive pockets of percolating open spaces and extant biodiversity. In our modeling we take into account phenomena that occur outside the cities' edge, including the reciprocal relationships between agriculture and ecosystems and the adjacent built-up areas.

We are collecting data that will serve the calibration of our model. The empirical analyses, based on extensive measurements, are based on two case studies of peri-urban areas – Haifa and Hannover. It focuses on cross-sections of tens kilometers in length and several in width. The spatially explicit model will be evaluated on the basis of a sample of cross-sections and then used for the landscape dynamics predictions for other cross-sections in the two regions.

Heroes and role models in Germany and Israel

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In prior eras, Germany and Israel used collective heroes to uphold shared values and for orienting students toward national ideals. This paper reports findings from a study of collective ideals of 220 high school students in 22 schools in Germany and Israel, representing schools from formerly East and West Germany, and Arab, religious and secular Jewish schools in Israel. We used small group interviews to learn about the criteria that students use in defining heroes and role models. The analyses explicate those criteria - differentiating between character traits and modes of action - and disclose three major themes that German and Israeli students share and another where they differ. Overall, students in Germany and Israel agree that they "do not need another hero": They often criticized the use of collective heroes, pointing out that worshiping heroes poses a threat to democracy and to their own autonomy. Furthermore, when asked about their role models, students in both countries often chose their parents, seeing them as anchors for stability and trust. The German and the Israeli students also shared a critique of celebrity culture. In contrast with those agreements, significant differences came up in discussions of specific heroes. German students often picked global figures that they associated with peace or humanitarian activities. Their Israeli compatriots, in contrast, brought up Israeli names that were often associated with military or national contribution. We discuss those results by referring to the trauma of the Third Reich and the Holocaust, on the one hand, and to contemporary critiques of leaders and collective heroes on the other.

Development of relationships during infancy – Risk and protective factors in minority and majority families in Germany and Israel

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Our study aims to identify context informed and culturally sensitive notions of relationship formation during infancy and how these are applied in defining risk and protective factors across different cultural environments.
The study draws on observing, documenting and analyzing early social experiences of infants during their first year of life growing up as members of a minority group (Russian Jews in Germany and Israel,) and in mainstream German and Israeli families. It also includes interviews with care givers in order to identify conceptions of relationship development that reflect the ideas and practices of families within each cultural group as well as the conceptions that professionals apply to their work.
A second, parallel line of research identifies cultural notions surrounding risk and protective factors through interviews and behavioral observations.
Since our study is in its first stage, we will discuss in our presentation the ideas and theoretical foundations of our study with demonstration of pilot study examples.
Another aim of the study is to build capacity of Israeli and German graduate students, doctorate and post-doctoral scholars; this project is a true example of a collaborative effort to form the new generation of researchers in Israel and Germany. In the presentation we will describe the formation of the collaboration and the outstanding German –Israeli research team of students and scholars that developed with the help of this project.

Transfer between parents and adult children in migrant families from the former Soviet Union – Germany and Israel compared

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In modern ageing societies, families face new challenges regarding care for the growing elderly population and exchange of support between generations. Until now intergenerational support in European countries among the native population has been characterized by the downward flow of financial support mainly from parents to children. Does the same pattern appear among migrant families? Whereas the possibility to exchange instrumental help between family members is primarily dependent on geographical proximity, the giving and receiving of monetary transfers depends on the resources of the givers and the needs of the recipients, but not necessarily on living close to each other.

Our analysis focuses on migrants from the former Soviet Union (FSU). For the representative analysis of the intergenerational relations within families of FSU migrants in Germany, we use data of the postal Survey on Ageing of Soviet Union Migrants (ASUM 2011) conducted in the rural region of the Oldenburger Münsterland in 2011 among FSU migrants aged 40 years and above. Since the 1990s FSU migrants have become one of the largest migrant population groups in Germany. On contrary to labor migrants, the majority of FSU migrants are ethnic Germans (Aussiedler) and mostly immigrated with all their family members, which often comprised several familial generations. This led to a relatively low spatial distance between children and parents resulting in a similar opportunity structure for intergenerational support compared to non-migrants in Germany. However, about 22% of ASUM respondents with parents still alive had at least one parent living abroad. In addition, we analyze data of the Survey on Health, Ageing and Retirement in Europe (SHARE) for both, Israel and Germany.

The ASUM-findings on financial transfers in migrant families show that whereas parents living in Germany behave similar to the host population and more often are the givers of financial support to the younger generation, parents living abroad are in most cases the recipients of financial support. We interpret these findings as a result of different welfare systems with different levels of provision for old age. A plausible explanation for financial support to parents left behind in the countries of origin could be lower pensions for elderly in the countries of the former Soviet Union compared to Germany. The welfare system hypothesis will be further discussed on the basis of the contrasting findings for FSU migrants in Germany and in Israel.

Project: Ageing and Intergenerational Relationships in Migrant Families – A Comparison of Russian-speaking Immigrants in Israel & Lower Saxony

Bridging between homogeneous and heterogeneous catalysis

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Catalysis play a central role in the chemical industry as it is reflected in the fact that more than 90 % of the industrial chemical transformations involve the use of catalysts. The importance of catalysis in not limited to the chemical industry, and it can be also applied in other areas such as energy production and environmental protection. There are two types of catalysis, homogeneous catalysis and heterogeneous catalysis. The homogeneous catalysts require mild operation conditions and they can usually offer excellent reactivity and high selectivity. However, this type of catalysts has limited application in the chemical industry due to the difficulties in their separation and recovery, which can increase the costs of their application in industrial processes. On the other hand, the heterogeneous catalysts can be separated and recovered easily but they need harsh operation conditions due to their reduced reactivity and they usually lead to less selective transformations.

In our research we focus on developing a method for creating new catalytic materials that can combine the advantages of homogeneous catalysis (reactivity and selectivity) and heterogeneous catalysis (recovery and recyclability). This method involves the encapsulation of homogeneous catalysts in silica nanoreactors. In this talk, we will present the basic principles of catalysis and its applications in addition to our achievements in developing a new generation of catalysts.

Investigation of novel titanium compounds as potential anticancer drugs

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Nowadays platinum-containing metallodrugs are among the most efficient drugs for the treatment of several types of tumors. However, the toxicity of platinum based cytostatics causes severe side effects such as hair loss or nephrotoxicity. Moreover, resistance phenomena limit their clinical application. Therefore, increasing efforts are devoted to the development of novel non platinum metallodrugs with a different mode of action.

Among the new metal based drugs two titanium-based compounds (namely budotitane and titanocene dichloride, see figure) have reached the clinical trial stages in the 1990s, but finally they failed due to hydrolytic stability issues as well as drug formulation problems.[1] Based on the promising preliminary clinical results on titanium based complexes, new better stabilized Ti-based compounds were investigated and seem to hold a high potential for anticancer therapy. Within our joint collaboration project we have studied a titanium salan complex in comparison to the new titanocene derivative titanocene Y.[2,3] Our results show that titanium salan and titanocene complexes differ in their biological properties concerning toxicity, binding to biomolcules and intracellular distribution.

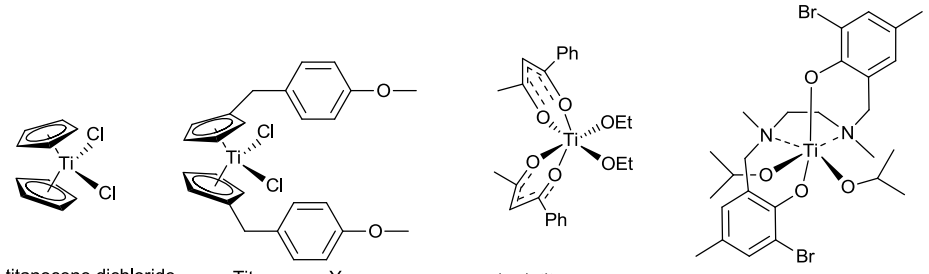

Figure: examples for titanium metallodrugs

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Development of drugs against malaria and leishmaniasis, two fatal tropical infectious diseases

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Development of medicines is not only an extremely expensive and time-consuming process; it also requires impact from various scientific disciplines. The talk will outline two projects directed to find new molecules suitable for the development of drugs against malaria and leishmaniasis, two fatal diseases threatening millions of people in poor developing countries. The research projects were based on the close collaboration of partners with complementary expertise in medicinal chemistry on the one hand and parasitology on the other hand. Two substantially different approaches were used: For identification of new molecules against malaria, inhibitors against an isolated biological target of the parasite were developed. In the case of leishmaniasis, compound collections were directly screened for growth inhibition of cultivated parasites. Both campaigns led to chemotypes hitherto unknown for antiparasitic activity which now can be developed further towards drug molecules.

Cardiac tube morphogenesis: what can we learn from flies

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We are using Drosophila melanogaster, the fruit fly, to investigate cardiac diseases. Biologists love fruit flies because they allow deep insights into the principles of genetics, cell biology and development. Many human diseases have a counterpart in fruit flies which simply means that in many cases, appreciation of the principles in flies results in a better understanding of the corresponding processes taking place in the human body. About 75% of the genes that cause a human disease are known in flies as well. Fruit flies harbor a very simple heart that promotes circulation in the body. It is built during embryonic development and maintained functional for the whole lifetime. The anatomy of the fly heart is much simpler compared to its human counterpart, which makes the fly heart a perfect model to investigate the principles of, e.g., congenital heart diseases. We have been able to show that a particular group of proteins is fundamental for maintaining heart integrity. The proteins we are working on are collagens present in all connective tissues in the body. Collagens cover the surface of cells and organs and provide a variety of important functions such as protection or the controlled release of signaling molecules. I will give a brief outline on how we use the Drosophila heart to learn more about the function of connective tissue in organ integrity.

Title of the funded project: Cardiac tube morphogenesis: matrix reloading and mechanisms of action of the two Drosophila collagens Pericardin and Multiplexin

Identification and characterization of novel factors required for the formation of functional cilia

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Cilia are hair-shaped organelles at the surface of many cell types and play various roles in motility or signal recognition essential during embryonic development and adult tissue homeostasis. Several factors important for the formation of functional cilia have been identified in the past; loss of such factors can cause cilium-related diseases (ciliopathies) in humans and similar phenotypes in model organisms such as the mouse or the frog. However, a comprehensive understanding of ciliogenensis and its regulation is still missing and the number of factors involved is estimated to be much higher than the number known so far. In a set of several microarrays comparing immature, unciliated and mature, ciliated fetal mouse lungs as well as mouse tissues mutant for known key factors for ciliogenesis (FOXJ1, NOTO) or wildtype, we were able to identify a list of 342 candidates for novel ciliary factors.

The aim of our collaboration is the validation and characterisation of particularly promising candidates from our list, thereby combining the advantages of our respective model organisms, i.e. the mouse (that can be genetically engineered in subtle ways and is evolutionarily closely related to man) and the frog (that forms easily observable cilia on the larval epidermis and allows for short-term genetic manipulation). About 18 % (61/342 genes) of our candidates are conserved between mouse and man but have not been identified in frog or fish suggesting that these genes are relative evolutionary novelties, perhaps reflecting specific requirements of mammalian ciliogenesis; some examples from this group of candidates will be presented. 25 % (85/342 genes) of candidates are conserved throughout vertebrates and form the pool of genes from which we will draw the candidates for our joint analyses; some of these genes and their validation as candidates will be highlighted in our presentation.

The different roles of the ubiquitin-like protein SUMO in cellular regulation

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The ubiquitin protein family is involved in virtually every aspect of cellular function in all eukaryotic cells. A significant portion of cellular proteins, at some point in their life-cycle become the targets of ubiquitin ligases, which covalently attach to them ubiquitin or ubiquitin-like proteins, leading to changes in the target proteins' turnover, cellular localization or activity. A major and intensively studied function of ubiquitin is protein quality control, in particular marking misfolded proteins for degradation by the proteasome. Misfolded proteins continuously arise in cells, due to synthesis errors or various external and internal stresses and failure to eliminate them can threaten cell viability. While ubiquitin's importance in stimulating misfolded protein degradation is well known, the role of related ubiquitin-like proteins, such as the Small Ubiquitin like MOdifier (SUMO) in protein quality control is yet unclear. Here we describe a novel method for studying the function of SUMO in the cell under normal and stress conditions. Using a *titratable* promoter for the yeast SUMO-conjugating enzyme, Ubc9, we are able to shut off SUMO conjugation in a controlled manner, allowing us to evaluate the role of SUMOylation in the cellular localization and abundance of all of the proteins in the yeast proteome under normal and stress conditions. So far we have identified several new protein targets of the SUMO pathway and our current focus is on studying how SUMO conjugation affects the fate and function of these newly identified SUMO substrates.

Interfacial oxygen transport in metal oxide superlattices

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The increasing energy demand in industrial and domestic applications as well as environmental concerns and diminishing fossil fuel reserves require the development of new materials for energy conversion and storage. Special interest is paid to ionic nanomaterials, which hold great promise for advanced batteries with high storage capacity as well as to solid oxide fuel cells operating at economically viable temperatures. In order to improve the latter, a model system consisting of different oxide thin films is regarded. By careful engineering of such film sequences it is possible to enhance the oxygen mobility and thus the ionic conductivity in the vicinity of the interface to achieve either higher ionic conductivity or to enable operation of those devices at lower temperatures.

The aim of this project is to develop such nanoscaled systems and to investigate the ionic transport in the alternating metal oxide films showing oxygen excess and deficiency. The preparation and the properties of thin SrTi1-xFexO3 (STF), niobium-doped SrTiO3 (STO) films and of multilayer structures of those films are presented. They are deposited by pulsed laser deposition on slightly iron-doped STO substrates. Strained epitaxial films with homogenous concentrations of point defects and dopants are obtained as long as the thickness of the layer does not exceed 200 nm. The deposition conducted under oxygen flow reveals considerably higher concentrations of point defects compared to the deposition in vacuum. Further, the ionic transport is investigated using several techniques such as impedance spectroscopy and tracer diffusion. The latter is done using 18O at temperatures ranging from 500 to 700 °C and analyzed using secondary ion mass spectroscopy. Depth profiles acquired parallel to the direction of diffusion show an 18O distribution, which depends on the distance from the interface. The analysis of 3D scans points to increased oxygen diffusivity in the vicinity of the STF/STO interface.

Physical phenomena related to the adsorption of self- assembled-monolayers (SAM) on the surface of liquid metals

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Self-assembled monolayers (SAMs) are formed by small amphiphilic molecules that strongly adsorb to surfaces. These organic coatings have the potential for precise control of surface properties (like, e.g., surface tension and rigidity, wettability, and friction) in a reproducible, flexible, and tailored fashion. In our joint project we study the kinetics of adsorption of amphiphiles from solution and the concomitant formation of organic SAM on the surface of a liquid metal (mercury) drop in water by experiment and computational modeling. This system is characterized by an extremely high adsorption affinity of the SAM to mercury. As the SAM forms, the surface tension of the mercury-water interface is reduced, the contact angle of the drop decreases and, additionally, the area of the interface, onto which the amphiphiles can adsorb, increases. The reduction of the surface tension depends on the specific arrangement (crowding and packing) of the amphiphiles at the surface of the mercury drop. The situation is additionally perplexed by the possibility of micelle formation in the bulk solution. Comparing experiments with a phenomenological description of adsorption and molecular simulations of the structure and thermodynamics of the organic molecules at the liquid-metal/water interface we want to understand and control the properties of the SAM.

Production of algal biomass from industrial CO2-rich flue gasses for biofuel and valuable compounds

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Microalgae provide a broad range of valuable compounds, e.g. unsaturated fatty acids, pigments, essential amino acids, vitamins and other bioactive substances. High-value biofuels derived from algal oil as well as methane produced by anaerobic digestion can be produced from algal biomass. Algae accumulate these substances through photosynthesis, i.e. the conversion of carbon dioxide (CO_2) and water into carbohydrates using light energy. Therefore, the key objective of our project is to use CO_2 rich flue gasses from industry and power plants to produce algal biomass most efficiently and economically using photobioreactor technology.

A broad range of strains from the SAG culture collection at Göttingen (which is one of the world's largest culture collections for microalgae) covering almost all evolutionary lineages (classes) of microalgae incl. cyanobacteria, supplemented by new isolates from Israel is being tested. For the screening unicellular or colonial algal species suitable for growth in photobioreactors and promising for high biomass and valuable compound yield were selected. So far, about 150 strains were grown on agar plates in dedicated CO_2 light incubators at constant temperatures with 25% and ambient (0.037%) CO_2 concentrations in air. These gas phase experiments avoid fluctuations in CO_2 supply and pH which can be problematic in liquid phase and enable a fast screening. Enhanced growth under 25% CO_2 in air compared to ambient CO_2 concentration was found for 30 strains, i.e. many green algae and few Stramenopiles (Diatoms, Eustigmatophyceae). Tolerance to the high CO_2 concentration in air but no growth enhancement was found in 18 other strains. Growth was suppressed or stopped under the elevated CO2 concentration in about 80 strains, i.e. all tested strains from Xanthophyceae (Stramenopiles), Rhodophyta and cyanobacteria. So far a selection of 17 SAG strains were tested for growth in photobioreactors under various CO_2 concentrations in liquid phase. A CO_2/nitrogen mixture was introduced as continuous flow at the surface of the cultures. Algal growth was measured using optical density, chlorophyll fluorescence and from dry weight of samples grown in two types of photobioreactors at lab scale. From nine strains with optimal biomass yield *Chlorella sorokiniana, Bracteacoccus minor* and *Radiosphaera negevensis* were selected for further tests. The addition of CO_2 up to 10% induced a significant acceleration of growth, but at higher concentrations no further growth acceleration was observed in the photobioreactors.

Rust to riches: Iron oxide photoanodes for solar-powered water splitting

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Semiconductor photoelectrodes for sustainable hydrogen production by solar-powered water photoelectrolysis must employ stable, non-toxic, abundant and inexpensive visible-light absorbers. Iron oxide (□-Fe_2O_3) is one of few materials meeting these requirements, but its poor transport properties present challenges for efficient charge-carrier generation, separation, collection and injection. We explore an innovative solution to these challenges by means of resonant light trapping in ultrathin films designed as optical cavities. Interference between forward- and backward-propagating waves enhances the light absorption in quarter-wave or, in some cases, deeper subwavelength films, amplifying the intensity close to the surface wherein photogenerated minority charge carriers (holes) can reach the surface and oxidize water before recombination takes place. Combining this effect with photon retrapping schemes, such as using V-shaped cells, provides efficient light harvesting in ultrathin films of high internal quantum efficiency, overcoming the trade-off between light absorption and charge collection. A water photo-oxidation current density of 4 mA cm^{-2} was achieved using a V-shaped cell comprising ~26-nm-thick Ti-doped □-Fe_2O_3 films on back-reflector substrates coated with silver–gold alloy.* This sets a new record in water photoelectrolysis by abundant and stable photoelectrodes, paving the road towards potentially affordable large scale production of hydrogen using abundant and renewable sources: water and sunlight. The iron oxide photoanodes can be combined with photovoltaic cells to create tandem systems for solar energy conversion to electricity and storage in the form of hydrogen. The hydrogen may serve as feedstock for sustainable production of methanol or other liquid fuels for transportation by reaction with CO_2 from the atmosphere.

* H. Dotan, O. Kfir, E. Sharlin, O. Blank, M. Gross, I. Dumchin, G. Ankonina and A. Rothschild, Resonant light trapping in ultrathin films for water splitting, *Nature Materials* 12, 158-164 (2013).

Abstracts

Poster

Bombarding Cancer Biolistic Delivery of Therapeutics using Porous Si Carriers

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Much effort is directed at developing new drug delivery methodologies, focusing on specificity and accuracy aspects. This work presents a new concept for a highly controlled delivery of therapeutic payloads into cancer cells. Degradable porous silicon carriers, tailored to carry and release a model anticancer drug, are biolistically bombarded into in-vitro cancerous targets. Biolistics, which was originally developed for gene expression manipulations, has emerged in recent years as a promising non-invasive route for delivering payloads into both cells and tissue. In conventional biolistics, molecules coated onto metal particles are accelerated to high speeds by flow of a gas and launched into the target tissue. Herein, we show for the first time the application of biolistics for launching highly porous silicon particles (65% porosity), which are significantly lighter than the previously used heavy metal particles, into two- and three-dimensional (2D, 3D) targets. Optimization of the gene gun system parameters allows us to adjust the particle penetration depth, demonstrating the ability to reach targets deeper than previously reported and to cross a skin barrier in a highly spatial resolution. Biolistically-mediated administration of porous silicon particles, loaded with mitoxantrone dihydrochloride, into breast carcinoma cell cultures reveals significant cytotoxicity towards the cancer cells. While, administration of empty particles results in no effect on cell viability, demonstrating that cell death is solely induced by the released drug and not by the bombardment assay. Thus, thes combination of biolistics with tunable porous silicon carriers presents a powerful non-conventional platform for the delivery of payloads in a highly controlled manner. This proof-of-concept study paves the way for designing new therapeutic strategies to allow both spatial and temporal control of payload release.

Dendrimer modified Quantum Dots conjugates for cancer cell imaging

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Quantum dots (QDs) play important roles in imaging science with their charming optical properties. Their size-dependent unique optical characteristics attract researches in order to incorporate those nano- sized particles in biological applications. Several strategies are being applied to manipulate surface structures of QDs to use them as a molecular nanoprobe. After the synthesis process, they are modified with surface functional groups which provide water solubilization and stabilization of QDs. Later, those modified QDs can be coupled with specific ligands that target the molecule in interest [1-2].
In this study, CdSe/ZnS quantum dots with an emission at 560 nm were modified with amine-terminated polyamidoamine (PAMAM) dendrimers with controllable ligand molar ratios. The surface modification process provided phase-transfer of QDs into aqueous phase by electrostatic stabilization. Furthermore, high cell association capability, improved membrane permeation ability [3] and high buffering capacity of PAMAM promotes endosomal escape of ingested QDs which are normally not accessible to cytosol [4-5].

After the characterization of PAMAM/QDs conjugates, in terms of fluorescence and UV-Vis profiles, hydrodynamic size, number of surface dendrimer groups, and stability, cytotoxic effects of PAMAM/QDs conjugates were assessed using MTT assay for MCF-7, A-549 and HEP-G2 cancer cells. In vitro evaluation of PAMAM/QDs conjugates in targeting cancer cells was tested by labeling conjugates with HER2 receptor specific antibody (anti-HER2). HER2 receptor-mediated targeting efficiency of antibody labeled PAMAM/QDs conjugates was demonstrated with fluorescence microscopy of the MCF-7 breast cancer cells stained with conjugates. The obtained images illustrated effective cell internalization of well-characterized antibody labeled PAMAM/QDs in contrast to antibody free PAMAM/QDs conjugates. In summary, PAMAM-derivatized QDs nanoparticles show great potential in the areas of cellular imaging and targeted therapy [6].

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Diminished Memory T-cell Expansion due to Delayed Kinetics of Antigen Expression by Lentivectors

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Memory $CD8^+$ T lymphocytes play a central role in protective immunity. In attempt to increase the frequencies of these cells, repeated immunizations with viral vectors are regularly explored. Lentivectors have emerged as a powerful vaccine modality with relatively low pre-existing and anti-vector immunity, thus, thought to be ideal for boosting memory T cells. Nevertheless, we found that lentivectors elicited diminished secondary T-cell responses that did not exceed those obtained by priming. By dissecting the mechanisms involved in this process, we demonstrate that lentivectors trigger exceptionally slow kinetics of antigen expression, while optimal activation of lentivector-induced T cells relays on durable expression of the antigen. These qualities hamper secondary responses, since lentivector-encoded antigen is rapidly cleared by primary cytotoxic T cells that limit its presentation by dendritic cells. Taken together, while low antigen expression is expected during secondary immunization with any vaccine vector, our results reveal that the intrinsic delayed expression kinetics of lentiviral-encoded antigen, further dampens secondary $CD8^+$ T-cell expansion.

The Rat Implant Model at Hannover Medical School

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A model to study implants in small animals is highly desirable because of various genetic and phenotypic backgrounds and of multiple ways for interventions and outcome analyses.

We used female Spraque-Dawley rats (200-300g) that were anaesthetised for implant placement. Using a scalpel an incision was made in front of the molar teeth of the upper jaw and a mucoperiostal flap was removed. A pilot whole was prepared and a titanium implant of 3.5 mm length and 1.3 mm diameter was inserted. The flap was put back and the animals received antibiotics for 7 days. The healing period took 3 weeks and was followed by micro-CT imaging. Thin-grounded sections, immunohistology or standard histology were used to investigate soft tissues, bone and implants. The response (mRNA expression) of the tissues was investigated by whole genome microarrays. Bacterial communities on the implant surfaces as well as in the oral cavity of the rat were detected by single strand conformation polymorphism (SSCP) analyses.
The insertion of titanium implants did not has adverse effects for the rats and the implants stayed in the oral cavity for at least 3 months. The bone level after a 3-week healing period was significantly reduced by 0.101 mm ($p=0.01$) compared to the situation immediately after implant insertion. Six weeks after implantation the bone level changed by 0.022 mm, which was not significant ($p=0.577$). Osseointegration was observed at different implant surfaces and diverse bacterial species, rat-specific and accessory, were found by SSCP analysis.
Using this rat model it is possible to investigate the biological processes of bone and soft tissue healing after implant placement, the effects of systemic disorders (e.g. diabetes mellitus) or medications (e.g. bisphosphonates) and of local inflammatory processes. Pathogenic bacteria could be used to induce inflammation of the periimplant tissues. The rat implant model is therefore highly useful for preclinical testing not only in implant dentistry but also in other fields of medicine.

Isotopomer analysis of N_2O after selective inhibition to estimate fungal N_2O formation during denitrification in soil

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N_2O predominantly results from microbial communities in soil. However, the contribution of microbial groups (e.g. bacteria or fungi) to N_2O formation during denitrification is not sufficiently investigated yet. Understanding sources and sinks of N_2O production could help to find mitigation strategies for N_2O emissions.

The site preference (SP= difference between $\delta^{15}N$ of the central and terminal N-position of the asymmetric N_2O molecule) of ^{15}N in N_2O is a clue as to whether fungal or bacterial metabolism was involved in its production. Bacteria and fungi produced different SP of N_2O in pure culture studies, resulting in 0 to -11 ‰ for bacterial N_2O and ~37 ‰ for fungal N_2O. Additionally, it became apparent in pure culture studies that most fungi lack N_2O reductase, resulting in N_2O as the end product of denitrification rather than N_2. This enables fungi to potentially produce more N_2O than bacteria and might influence SP in N_2O. N_2O reduction leads to a preferred cleavage of N-O bonds including lighter isotopes, which results in remaining N_2O with ^{15}N enrichment at the central N position as well as ^{18}O enrichment. Studies combining the analysis of SP and N_2O production from selective groups of the microbial community to distinguish between fungal and bacterial N_2O are lacking so far. Here, the method of substrate induced respiration with selective inhibition was modified to (i) determine the fungal contribution to N_2O production in a sandy arable soil at two different seasons, (ii) determine the effect of N_2O reduction on SP and (iii) to verify if the contribution of bacteria and fungi to N_2O emission can be assessed by analyzing SP.

We conducted two incubation experiments with a sandy arable soil (sampling time summer 2011 and winter 2012) with 80% WFPS and purged the headspace with N_2 to achieve denitrifying conditions. Four treatments were established to quantify the N_2O production by bacteria or fungi: a) control without growth inhibition, b) inhibition of bacterial growth, c) inhibition of fungal growth and d) inhibition of bacterial and fungal growth. In addition, all treatments were analyzed with and without blocking the N_2O reduction by acetylene. Treatments without N_2O reduction show the net production of N_2O and its isotopic signature, due to avoided isotope effects by N_2O reduction to N_2. NO_3^--fertilizer was supplied ^{15}N-labelled to check the amount of N_2O reduction, or non-labelled in parallel treatments to measure SP of N_2O.

The expected inhibition effect was visible for each experiment, where N_2O production was largest in control (a) and smallest with both growth inhibitors (d). In the experiment with soil samples from summer, bacterial growth inhibition (b) resulted in higher N_2O production than fungal growth inhibition (c), whereas treatments with soil samples from winter with fungal growth inhibition produced more N_2O than bacterial growth inhibition. Acetylene amendment resulted in almost complete blockage of N_2O reduction in all treatments (a, b, c, d).

Treatments with acetylene thus showed SP for N_2O without N_2O reduction: In treatments with soil samples from summer and winter, SP was negative for every treatment (-1.0 to -4.9 ‰ in treatments with soil samples from summer, and -0.4 to -2.3 ‰ in treatments with soil samples from winter). Growth inhibition of bacteria even resulted in a more negative SP compared to fungal growth inhibition treatments. SP results of pure culture studies could thus not be verified for the fungal or bacterial community under soil conditions.

Detection and Quantification of Heavy Metals in Water by Label-Free Optical Biosensors

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The objective of this research is to develop a generic integrated biosensing platform for detection of heavy metal pollutants in aqueous solutions. Heavy metals are one of the most serious pollution problems of our time, which threatens global sustainability as being non-biodegradable. Increasing industrial activity and the use of metallic constituents of pesticides leads to the accumulation of heavy metals in the food chain. Long-term exposure to these highly toxic pollutants may result in severe physiological and neurological damage and may even cause cancer. Consequently, growing environmental awareness has resulted in strict regulations for reducing heavy metals presence in the environment. Thus, we have designed and fabricated a simple optical biosensing platform based on porous Silicon (PSi) nanostructures that allows for real-time monitoring of heavy metal pollutants in aqueous solutions by enzymatic activity inhibition.

An oxidized PSi optical nanostructure, a Fabry-Pérot thin film, is synthesized and is used as the optical transducer element. Immobilization of specific enzymes, e.g. horseradish peroxidase (HRP), onto the nanostructure is performed through standard silane chemistry and is confirmed by fluorescent labeling, Fourier transform infrared spectroscopy, and Refractive Interferometric Fourier Transform Spectroscopy (RIFTS) experiments. Preliminary optical studies exhibit high specificity towards three metal ions (Ag^{+}>Pb^{2+}>Cu^{2+}), with a detection limit of 0.1 ppm. Additionally, we demonstrate detection and quantification of metal pollutants in real water samples (e.g. surface and ground water) with results comparable with gold standard analytical techniques such as ICP-AES.

The Jewish Ritual Bath in Germany

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The joint research project on mikva'ot in Germany, carried out by the Bet Tfila – Research Unit for Jewish Architecture in Europe/Technische Universität Braunschweig and by the Zinman Institute of Archaeology/University of Haifa, aims to research the Jewish ritual bath in Germany and its development from the Middle Ages until the destruction of Jewish communities by the National Socialists. As an important tool to regain purification the mikveh had a crucial significance in Jewish ritual life. Based on a comprehensive overview and detailed research on selected examples a typology of Jewish ritual baths is (being) elaborated to reveal why and how different types were developed in different regions and different times. To shed light on the halakhic background of the mikveh, the related responsa literature will be researched to provide information on the problems that occurred during the planning, building, and use of mikva'ot and how the communities tried to solve them. The results of our project, granted by the G.I.F. and carried out between 2011 and 2014, will be published in form of a comprehensive annotated catalogue with introductory articles on different aspects. This way, our research will direct the attention to this important piece of Jewish built heritage that was rather neglected by scientists for a long time.

The Buildings of the Jewish Communities in Berlin until 1945

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Jews already settled in Berlin during the Middle Ages. After their expulsion, a new community was re-established from 1671 on and prospered until the hiatus of the Nazi era. Its built Jewish heritage throughout the centuries, preserved and destroyed structures (synagogues, mikva'ot, schools, hospitals, orphanages, etc.) created a unique Jewish topographic net that is now researched for the first time in a cooperation project of the Bet Tfila – Research Unit for Jewish Architecture in Europa (TU Braunschweig and Hebrew University of Jerusalem) and the Stiftung Neue Synagoge Berlin – Centrum Judaicum. The project aims to reveal the Jewish topography of Berlin and its development through the times as well as to research the architectural history and features of the different building types. Research is carried out in German archives (Landesarchiv Berlin, many Bauaktenarchive, Centrum Judaicum, etc.) and in Israel (Central Archives CAHJP, Leo Baeck Institute, National Library, Bet Hatefutsot, etc.).

The results of our project, granted by the DFG for six years (2006–11, 2013–14), will be published in form of a comprehensive annotated catalogue (two volumes), completed by introductory articles and several maps. It will reveal the rich building activities carried out by the different Jewish congregations in Berlin before WW II : 343 synagogues and prayer rooms, 169 temporary prayer rooms, 9 mikva'ot, 11 cemeteries with 6 structures, 25 sukkot, 272 schools, 260 religious schools, 70 Kindergartens, 35 youth centers, 38 hospitals, 68 asylums/hostels, 28 orphanages, 127 soup kitchens, as well as 9 theatres and museums, 40 libraries, 22 gyms and sports fields.

Bet Tfila – Research Unit for Jewish Architecture in Europe

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The Bet Tfila is an interdisciplinary research unit situated with two departments at the Technische Universität Braunschweig and the Center for Jewish Art at the Hebrew University of Jerusalem. Since the early beginning of their close cooperation in the initial project on Jewish Ritual Buildings in Lower Saxony in winter 1993/94, Bet Tfila-partners dedicated themselves to the documentation and preservation of and research on the architecture of Jewish communities (like synagogues and prayer halls, Jewish cemeteries, ritual baths and other buildings and facilities related to Jewish religion and culture).

During the last twenty years, various projects on different regional topics and scientific objectives have been conducted. The integration of students of both institutes, the joint supervision of dissertations, as well as the mutual exchange of researchers and scientists are major aims of Bet Tfila's work.

Bet Tfila publishes two acknowledged series of publications, in which nine volumes have been released yet, two additional volumes will follow until the end of this year. In order to impart the gathered knowledge, Bet Tfila organizes a series of public lectures and international conferences like the upcoming conference "Jewish Architecture – New Sources and Approaches" in 2014. In addition, Bet Tfila also organizes traveling exhibitions that, with the help of the Central Council of Jews in Germany, have been on display in various cities in Germany.

For future interdisciplinary projects on local, German, and European level, Bet Tfila seeks for new partners in Germany and Israel.

Understanding fundamental aspects of heterogeneous nanocatalysis: Steps towards molecular beam-surface scattering experiments from size selected nanoparticles

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Surface science and especially surface chemistry and heterogeneous catalysis represent an important and challenging frontier of modern science with vast potential for industrial applications. Unfortunately, even today fundamental processes underlying heterogeneous catalysis in general and heterogeneous nanocatalysis in particular are far from being fully understood. While there is an ample experimental evidence for the significant role that electron-hole pair vibrational-coupling (that is Born-Oppenheimer Approximation breakdown) plays in the scenario of gas surface interaction, its importance in heterogeneous nanocatalysis remains unclear. Molecular beam–surface scattering experiments have proven to deliver experimental data enabling quantification of electronically non-adiabatic influences in interaction of gas-phase molecules with bulk surfaces [1,2] and providing stringent tests for cutting edge first principle theories [3,4]. It is conceivable that state-resolved molecular-beam nanoparticle surface scattering experiments, providing quantitative estimates of vibrational excitation, de-excitation and survival probabilities of impinging gas-phase molecules vs. nanoparticle size, have the potential to generate a unique new understanding of the relationship between heterogeneous catalytic activity and size-dependent electronically nonadiabatic coupling on metallic nanoparticles. The recent pre-requisite experiments aiming to address this goal via production of metallic nanoparticles of accurate size using flame-assisted particle synthesis and size-selective deposition on inert substrates using molecular beam sampling combined with particle mass-spectrometry and quartz crystal microbalance detection are presented [5-6]. Experiments, illustrating the quantitative information retrieved by scattering of gas-phase molecules from bulk metal surfaces [1-4] are highlighted and prospects of their extension to nano-sculpted surfaces are discussed.

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TiO_2 Coating on Metal Surfaces: Preparation and Photocatalytic Activity

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Titanium dioxide (TiO_2) is one of the most widely studied and applied photocatalysts. Nevertheless, the enhancement of its activity is still an active research field. The photocatalytic properties are derived from the formation of electron/hole pairs (e-/h+), i.e., charge carriers upon the absorption of UV-light corresponding to the band gap energy (3.2 eV). Any recombination of these charge carriers leads to a decrease of the photocatalytic activity. Aiming to extend the lifetime of the charge carriers, TiO_2 layers were prepared on different metal substrates. The metal-semiconductor interface forms to a depletion area leading to a better conductivity of the electrons and holes. This should increase the lifetime of the photogenerated e-/h+ pairs. Nevertheless, the photocatalytic activity should show dependence from (i) the used metal substrate, and (ii) the thickness of the coating.

TiO_2 layers were prepared using the well known sol-gel (SG) method. Initially, the SG samples were prepared following a previously established path.1 The samples were deposited on different metals and on glass as a reference. Self-cleaning tests following the degradation of methylene blue were performed. The coatings on glass and on the various metals showed comparable photon efficiencies regarding their self-cleaning ability. Nevertheless, changing parameters such as the calcination temperature (varied from 150-450°C), the pH, the amount of the binder and the thickness of the films has a big influence on the activity of the coated samples.

For example, decreasing the temperature to 250°C and the concentration of the employed binder (Levasil 200/30%) from 20 mL to 15 mL results in an increase of the efficiency while with a low concentration of the binder no stable films could be obtained. Increasing the pH from 1.7 to the neutral to slightly basic region also increases the photon efficiency and the prepared suspensions and films are more stable.

The photocatalytic activity of the thus prepared TiO_2 layers is also evaluated for the degradation of acetaldehyde in the gas phase (ISO 22197-2). While the pure photocatalyst powders exhibit the highest activities in these tests, the SG layers also showed considerable activities under UV-illumination.

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Preventing Reckless Mutation: Probing substrate selectivity and allosteric control in dCMP deamination and the implications for the wider family of cytidine deaminases.

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Zinc dependent cytidine deamination is a physiologically essential process important in diverse biological activities from pyrimidine salvage pathway and lipid metabolism to the antibody diversification process and innate immune defense. Since the deamination of cytidine equates to a C to U mutation in the genetic code, these powerful enzymes are potentially lethal without strict regulation of activity. Given that the various family members target cytidine within different substrate contexts including DNA/RNA strands and dCMP or free cytidine, substrate recognition is an important aspect of this regulation.

dCMP deamination is unique due to its strict allosteric control and we have elucidated mechanistic details of this control by obtaining the first reported crystal structure of a deoxycytidine monophosphate deaminase in complex with the allosteric inactivator dTTP. Our crystal structures together with a thorough analysis of activity on a range of substrates have also provided a basis for understanding substrate specificity.

Taking advantage of the structural homology between the different cytidine deaminase family members, careful structural analysis hinted to the possible zinc binding ability of a loop in APOBEC3G equivalent to the allosteric zinc-binding loop in dCMP deaminases. The ability of this loop to bind zinc in APOBEC3G and the subsequent increase in deamination activity has been shown experimentally. This until now unnoticed unique feature of APOBEC3G may have important implications for the way this protein interacts with binding partners involved in inhibition and regulation.

Further taking advantage of the structural homology between the different cytidine deaminase family members, we have constructed mutants and chimeras with the aim of defining and manipulating substrate recognition on different cytidine deaminase family members.

Ice binding proteins and their interaction with ice

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Ice-binding proteins (IBPs) include proteins that can stop ice crystal growth and inhibit ice recrystallization. These capabilities imply on their great potential in cryopreservation of foods, cells, tissues, and organs. It has been argued that IBPs adsorb directly onto surfaces of ice crystals, thereby depressing the freezing point below the melting point noncolligatively, a phenomenon named thermal hysteresis (TH). We investigate the interactions of various IBPs with ice to elucidate the mechanism by which these proteins promote ice growth modifications and to understand the differences between IBP types. In our recent work using a temperature controlled microfluidics apparatus we were able to exchange the IBP solution surrounding an IBP-bound ice crystal held in the TH gap with buffer, without losing the bound IBP or the TH activity. These results imply that IBP adsorption to the ice surface is irreversible and that TH is a function of the absorbed proteins on the surface and only indirectly a function of the concentration of IBPs in the solution. A study of ice shaping during growth and melting by a variety of IBPs showed a correlation between the ice shapes, the shaping process and the basal plane affinity of some IBPs. This study demonstrates a simple and useful tool for characterization of the influence of IBPs on ice crystals, a far less time consuming method as compared to the common tools of measuring thermal hysteresis or ice recrystallization inhibition. In addition, we have shown a clear difference in the ice shaping mechanisms of moderate and hyperactive IBPs. We anticipate that better understanding the mechanism of IBP activity will contribute to their use in cryopreservation applications
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Identification and characterisation of potential FOXJ1-dependent regulators of ciliogenesis

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Motile cilia, organelles that protrude from the cell surface, fulfill several functions during embryogenesis and in adult tissue homeostasis of the mouse. For example, rotation of cilia in the node generates left-right asymmetry of the embryo, and ciliary beating in the lung secures airway clearance of the adult respiratory epithelium.
FOXJ1, a transcription factor highly conserved throughout vertebrates such as mouse and frog, has been identified as a key regulator of the formation of motile cilia. However, downstream targets and processes regulated by FOXJ1 remain largely unknown.
In order to understand FOXJ1-dependent regulation of cilia formation and function, our group has performed microarray screens. These screens compare the transcriptomes of *Foxj1*-deficient and wildtype mouse lung tissues (E16.5) as well as unciliated (E14.5) and ciliated (E18.5) lung epithelial tissues. Genes that are downregulated in the absence of FOXJ1 and upregulated in the ciliated lung epithelium are candidates for FOXJ1-dependent regulators involved in ciliogenesis. Here we present the initial analysis of eleven of those candidates. Section in situ hybridisation of mouse embryos (E18.5) shows that all eleven candidate genes are expressed in several multiciliated tissues (e.g. olfactory, lung and ependymal epithelia), consistent with a potential function during ciliogenesis. Localisation studies in cultured murine IMCD3 cells with GFP-tagged versions indicate that several of the candidates tested are expressed throughout the cytoplasm or restricted to the nucleus. Intriguingly, two tagged proteins localise near the base of the cilium. Neither global cytoplasmic distribution nor localisation in the nucleus is inconsistent with a candidate's function in ciliogenesis.
The latter two candidates, however, appear particularly interesting for further analysis because their specific localisation implies a distinct role in cilia formation or function.

Biosynthetic Investigation on the Middle Fragment of Ambruticins

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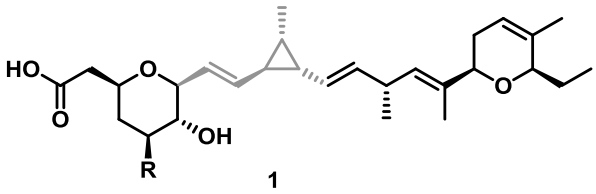
Ambruticins (**1**) belong to a class of potent fungicides, isolated from the myxobacterial strain *Sorangium cellulosum*10 (SoCe10).[1,2] Comparative gene cluster analysis suggests the biosynthesis of the linear backbone by a type I polyketide synthase (PKSI), involving enzymes with novel and outstanding modes of action.[3]

The enzymes involved in the formation of the cyclopropyl moiety in the middle fragment (light grey) are of particular interest. Crossing the border from fundamental biological research to synthetic chemistry, those enzymes can potentially be used as tools for natural product chemistry, which might enable mild chemoenzymatic transformations of complex substrates in late steps of total syntheses.



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For the envisioned elucidation of the ambruticin biosynthesis, a highly interdisciplinary approach that combines molecular biology, enzymology and organic chemistry will be followed. *In vitro*-studies of PKS domains, entire modules and distinct enzymes will give detailed insight into the biosynthetic machinery. Therefore, ambitious genetic engineering, careful expression optimisation as well as challenging syntheses of appropriate precursors are required. These *in vitro* studies will furthermore be complemented by trapping experiments in which PKS intermediates are isolated and their structure determined.[4]

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Pore-scale study of drying granular media

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Drying is crucial to many natural and industrial situations, such as drying of coatings and paints, curing cements and ceramics, agricultural use, and food storage and preparation. In all these cases, fluid moves through some rigid porous body, during drying. Its transport depends on porescale processes (typically, acting over length scales of micrometers), which then impact on much larger length scales, of centimeters to meters. Despite recent progress, fundamental understanding of pore-scale effects on drying is lacking, even for simple idealized cases. We are approaching this problem from two perspectives. Numerically, we construct a 2-D pore-scale model that describes the coupling of fluid transport and mechanical deformation of the solid body. Based on preliminary simulation results, we hypothesize a transition in the drying patterns from crack-like to more diffuse percolation-like behavior, as a soil becomes more disordered.

Experimentally, we are testing our model by direct comparison to drying in custom-made soil analogues of similar geometry. We use soft lithography techniques (commonly used for microfluidics), allowing us to control the pore sizes, elasticity, and wettability of the porous body.

Our ultimate goal is the quantitative understanding of how a material's pore-scale properties and disorder affect macroscopic drying behavior such as the drying rate, extent and residual water content. Our model, once validated by experiments, will also provide quantitative insight into other pore-scale-dominated processes, such as the setting of cement, the freezing of soils, carbon capture and storage, gas hydrate dynamics, and bio-fouling of filters.

Tuning the properties of rare-earth oxides for advanced nano-electronic applications

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Recent years have opened the door to several novel devices concepts and the hope of their successful integration with conventional microelectronics. In parallel, increasingly complex oxides are being incorporated into high performance logic and memory devices. Therefore the development of oxides is required with a quality comparable to that of high-purity semiconductors to create systems with novel functionalities for a broad range of electronic applications.
A very promising way to realize advanced future devices is using epitaxial (single-crystalline) oxides. These oxides enable controllable interface properties and will also make epitaxial growth of semiconducting layers on the oxide itself possible, allowing the introduction of novel devices, such as resonant tunnelling diodes or quantum-well devices.
Due to the lattice misfit of rare earth oxides to silicon substrates, strain is generally induced into epitaxially grown oxide layers. It is known, that strain in epitaxial layers has an impact on the properties of the material itself. One thing that can be affected by strain is the dielectric constant of the rare earth oxide. In this poster we will present possibilities of tuning the properties of these oxides by changing the amount of strain induced in the layer itself. A fundamental understanding of the modulation of the dielectric properties again is a basic requirement for advanced nano-electronic applications.

Fabrication of scaffolds via two-photon polymerization and microreplication technique

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Biomedical applications of 3-D structures produced by two-photon polymerization and microreplication molding technique are studied. We demonstrate that by these methods arbitrary three-dimensional scaffolds for tissue engineering can be produced and replicated in different bioactive and biodegradable materials without losing their original geometry [1,2]. Two-photon polymerization with femtosecond lasers provides many advantages for the fabrication of high quality 3-D microstructures with complex geometries. It allows the fabrication of 3-D master structures with a resolution down to 100 nm. Numerous photosensitive polymers have been used to make 3-D microstructures with this technique, including Ormocers®, polyethylene glycol diacrylate, zirconium propoxide co-polymers, and biodegradable triblock polycaprolactone–polyethylene glycol co-polymers. One drawback of the two-photon polymerization technique is that processing is done serially, which leads to relatively long processing times. A possible solution to this problem is in the development of a two-step replication technique for the production of multiple copies of laser-generated 3D microstructures in parallel. Two-step replication enables mass fabrication of different 2D and 3D geometries in diverse polymeric materials with varying properties, which can be selected for defined biomedical applications [3]. Furthermore, this method allows the production of scaffolds from natural proteins such as fibrin, alginate, etc. The design of these scaffolds, with a total height of 300 μm and pore diameters of 100 μm, is well suited for the replication approach. Due to its vertical pore orientation, the scaffold can be accessed from above to introduce the silicone mold precursor and the conditions are also favorable for mold removal. The biomedical applications of all replicated structures are investigated. It is shown that cells are able to adhere on the lateral surfaces and penetrate into 3D scaffolds produced by the microreplication technique. This method provides high flexibility in terms of material choice and is very promising for scaffold-based tissue engineering.

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Functionalized surfaces by ultrashort-pulse laser structuring

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In this presentation we will report on the planned cooperation project between the Laser Zentrum Hannover e.V. (LZH) and Technion devoted to the functionality of technical and biomedical devices which can be significantly improved by changing their surface topography by ultrashort-pulse laser structuring.

Femtosecond lasers are perfect instruments for high resolution structure fabrication in almost all solid materials. These lasers enable fabrication of user-defined topographies (e.g. lines, holes etc.) and self-organized topographies (e.g. spikes, ripples, and different types of roughness). The structuring does not considerably change the chemistry of materials, and therefore is suitable for biomedical and foodstuff applications. Moreover, this technique is very flexible and can be used for structuring complex 3D surfaces.
One laser structuring technique, developed at the LZH, enables fabrication of super hydrophobic surfaces on different metals, using self-organized topographies – spikes. Also slanted spikes can be fabricated. Since super hydrophobic states may be metastable, it is important to understand their suitability for different applications under specific conditions (e.g. immersion in a liquid, temperature and pressure changes, etc.).
Theoretical modelling will complement experimental investigations and give input for further improvements and optimization of structure designs. This will be based on initial modelling already done at Technion for some basic surface structures. This modeling consisted of minimizing the Gibbs energy of the system as a function of liquid spreading and penetration. The minima points that are found indicate the equilibrium states of the drop, and whether these states are stable or metastable. In addition, a theoretical model of anisotropic wetting will be developed.

T-spline surface design in engineering

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Several applications in engineering are based on modeling curves, free form surfaces or solid volumes. Components can be set up with NURBS surfaces, which are a wellresearched tool in geometric modelling. A strong conflict between numerical complexity and model size arises from the handling of free-form NURBS surfaces: models can be blended and merged with conventional CAD tools into a consistent model, but with the disadvantage of global refinement and extensive global parameterizations of the control meshes. One solution is the concept of T-spline surfaces, which are a generalization of NURBS surfaces and as such modifications only affect locally bounded areas.
Furthermore, the continuity of the surfaces remains untouched, i.e. surfaces support locally bounded smoothness.
The resulting models can be used for exemplary applications in engineering, e.g. computational fluid dynamics, automotive body design, hydrographical mapping and building construction. Cooperative work will be focused on finding and supporting various areas of application.

Predicting affinity- and specificity-enhancing mutations at protein-protein interfaces

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Identifying affinity- and specificity-enhancing mutations in protein-protein complexes is useful for many biotechnological applications. Yet, accurate prediction of such mutations is a very challenging task. We developed an efficient computational method for such predictions based on the framework of a protein design program ORBIT. As a start, we optimized the energy function of this program to reproduce favorable interactions across the binding interface. We then developed an in silico saturated mutagenesis protocol that allows us to scan any binding interface with all natural amino acids and within minutes to predict the change in free energy of binding for each of the mutation.
Mutations with the most favorable change in free energy of binding are selected for experimental testing. We experimentally validated our computational protocol in two biological systems that exhibit high and medium binding affinity. In the high-affinity complex between the enzyme acetylcholinesterase (AChE) and a snake toxin fasciculin (Fas), we identified a few Fas mutants that experimentally show even higher affinities for the enzyme and in some cases enhanced binding specificity towards one species of AChE. In a medium-affinity complex between matrix metalloproteinase (MMP) and its inhibitor, tissue inhibitor membrane protein 2 (TIMP-2), we identified a considerable number of mutations that enhance TIMP-2 binding affinity to a particular type of MMP, MT1-MMP and show reduced affinities to another type of MMP, MMP-9. Overall, our computational protocol greatly facilitates the discovery of affinity- and specificity-enhancing mutations and thus could be applied for design of potent and highly specific inhibitors of any proteinprotein interaction.

Developing Cognitive Cyber Terror Attack Detection

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Internet society has created new human life, real and virtual life. Large number of people practice their lives in a virtual world such as SecondLife-protal. Besides that many people have abused or misused the internet society. For example, in recent years, Cyber crime and cyber terror attacks have increased exponentially. The notion of Cyber attacks refers to actions that attempt to bypass security mechanisms of computer systems. Cyber attack detection has been defined as “the problem of identifying individuals who are using a computer system without authorization and who have legitimate access to the system but are abusing their privileges. In order to save innocent people lives we suggest to setup ethical rules for the virtual world as the rules of the real life. Furthermore new security actions are required to protect people’s private life in virtual world. This project aim is to propose a solution to detect cyber terror attack. Our solution is combining of three layer architecture that is motivated by properties of cognitive systems. The three layers are: environment sensing (data collection), local tracking detection layer and the learning layer. The novelty of this proposal is in its multi-layered solution such as cyber attack detection as a base, home agent for monitoring, social agent for suspect objects detection and the mobile agent for tracking of suspect objects. The scope of detection spans over multi layers: cognitive systems based cyber terror attack approach that takes into consideration cognitive radio in cellular system to locate the position of wireless mobile devices in vertical direction. For example high- rise building. The final outcome of this project will be cognitive cyber attack detection system for wireless networks that is implemented in mobile devices. The cognitive cyber attack detection system is adaptive for various fields cyber terror attacks in the society, cyber violence attacks families, cyber crime attack in mobile business, cyber fraud in education.

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The Economic Integration of Agriculture in Israel and Palestine

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The project is a trilateral cooperation (Germany, Palestinian Territories and Israel) in economics with research partners in Israel (Hebrew University of Jerusalem, Rehovot campus, Prof. Dr. Finkelshtain) and Lower Saxony (Georg-August-Universität Göttingen, Chair of Agricultural Policy, Prof. Dr. von Cramon-Taubadel) and Al-Quds University (Palestinian Territories, Prof. Dr. El-Jafari) and the University of Hohenheim, Germany (Agricultural and Food Policy Group, Prof. Dr. Grethe). It started in April 2010 and will be funded by the German Research Foundation (DFG) until March 2014.

The context of the project are the effects of the Israeli-Palestinian conflict on the agricultural sectors and food markets of both sides because agriculture plays a special role in the Israeli political discourse and is of considerable importance for the Palestinian economy. One result of the conflict are restrictions on the movement of people and goods. Despite that Israel and Palestine maintain a customs union vis-à-vis third countries and can therefore not realize potential gains from trade in inputs and final products with each other. The objective of this project is to foster cooperation between Palestinians and Israel by analyzing the potential benefits of removing these restrictions for agriculture and the economy as a whole.

The project involves in total app. 15 scientists from the four participating universities cooperating in four subprojects on the analysis of impacts of the restrictions on food prices and welfare (prices), on the economic impact of removing restrictions and considering various scenarios in trade policy (simulation), on options for peaceful cooperation in the areas of food production (cooperation) and trade and on prospects for agricultural policy changes in Israel and the Palestinian Territories (political economy). We are planning to briefly present examples of research results of various subprojects.

The sub-project on prices, e.g., examined the effects of one measure implemented by the Israeli army in order to increase security for Israeli citizens which consisted in closures of the barrier constructed around the West Bank. These were occasionally implemented in order to curb the risk of terror attacks but also had comprehensive side effects regarding the movements of food which stirred up prices. The major wholesale markets of Israel and the Palestinian Territories are found to be integrated in 2007 and 2008 for major products, but the closures temporarily cut off markets from each other which entailed welfare losses both for Palestinians and Israelis.

One topic of the cooperation sub-project is the willingness to pay of European consumers for food products which are jointly produced by Israeli and Palestinian farmers and processors. The potential demand for such peace-enhancing cooperation is assessed by looking at olive oil and cherry tomatoes in Germany, Great Britain, Poland and France by using discrete choice experiments in an online survey. European consumers are found to be willing to pay price premiums for this kind of products compared to products which are produced by Israelis or Palestinians, respectively. They would, however, sell at a discount in comparison to European brands.

The political economy sub-project looks, e.g., at charges of non-competitive prices in the Israeli dairy sector which became a major topic during the extensive social justice protests in Israel in summer 2011, in particular at the suspicion that the industry was successful in lobbying even for products whose prices are controlled by the government. A discrete-choice

equilibrium model with product differentiation and a political-equilibrium model are used for analysis. It finds evidence for political power and exploitation of market power together with considerable welfare effects of the prevailing price control system and the highly concentrated structure of the dairy industry.

How to create fair and objective performance targets? A Data Envelopment Analysis application in a cooperative Bank

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The poster addresses an issue, which is regarded with ambiguity by most managers and employees: The process of determining performance targets. Especially when target achievement is linked to pay or rewards, target agreements must meet objective standards. In practice, there are many obstacles to the creation of fair and objective target agreements. This accounts in particular for the service sector industry, where many non-financial figures (e.g. quality of advice, experience) have a major effect on the quality and outcome of the service process. Furthermore, not all factors that affect the achievement of targets can be entirely influenced by the employees themselves. To be perceived as achievable and fair, targets need to consider multiple and non-financial figures as well as uncontrollable factors. Additionally, they should be determined in a non-biased manner. A promising approach to meet those requirements is the Data Envelopment Analysis (DEA), a mathematical-based instrument, that has widely been applied on institutional or branch level. Yet, there is still little experience about its application on an individual level. An empirical example of a German cooperative bank with a cohort of 44 employees illustrates the application of DEA with the purpose of determining individual target agreements. The results indicate that DEA is a suitable method to provide valid and adequate results on an individual basis. Furthermore, it enables managers to give detailed feedback information. Finally the need and fields of further research are being indicated.

Generation of endothelial cells from scalable cultures of undifferentiated human pluripotent stem cells

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Full endothelialisation of gas exchange membranes in extracorporal membrane oxygenation (ECMO) devices for improved hematocompatibility, or cell therapy of pulmonary hypertrophy requires large amounts of (patient-specific) endothelial cells (ECs). ECs can be isolated from peripheral blood or explanted vessels, however, success rates of EC isolation from blood are low and especially ECs from older individuals show a limited proliferation capacity. Patient specific ECs from pluripotent stem cells (hiPSCs) might be an alternative cell source. The opportunity to generate large amounts of undifferentiated hiPSC in defined media and under scalable monitored conditions [1, 2] allows for the generation of cell numbers in dimensions which are suitable for cellular therapies. By differentiation of these well monitored cell populations a virtually unlimited number of autologous ECs may become available for disease modelling, drug screening and biofunctionalization of ECMO devices.
Utilization of BMP4 and VEGFA for the differentiation of the scalable suspension cultures resulted in up to 12% of CD31 positive cells [3, 4]. With substitution of BMP4 by a small molecule GSK3ß inhibitor the amount could be increased to 20% of CD31 positive cells on day 10 of differentiation.
FACS-sorted CD31+ iPSC derivatives are currently characterized in detail with respect to their molecular phenotype, proliferative capacity and functionality. In addition, the generation of transgenic hiPSC reporter lines, which express a fluorescence reporter / antibiotic resistance under the control of EC specific promotors (VE cadherin or CD31) for further improvement of differentiation is in progress.
Resulting patient- (and lung disease-) specific iPSC-derived ECs will represent a novel cell source for disease modelling or biofunctionalization of gas exchange membranes. In addition, TALEN-based gene correction in iPSCs might enable novel concepts of ex vivo gene therapy for respiratory diseases.

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Real-Time Impedance Analysis of the Toxic Effect of Nanoparticles on Mammalian Cell Lines

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Nanoparticles are widely used for many applications nowadays. Therefore the amount of technological products becoming available to the customers has been increased constantly. On the other hand concerns have been raised regarding the harm and the potential health risk of nanoparticles. Hence the determination of the toxic effect of nanoparticles is both scientific and public interest. Especially it needs further investigation which potential risk nanoparticles pose to humans and to the environment. Previous studies showed possible hazardous effects of nanoparticles therefore it is important to get a better knowledge of the potential risks.

In this study titanium dioxide and zinc oxide nanoparticles were examined for their toxic effects on different cell lines. Concentrating on the possible adsorption of the nanoparticles into the human organism, via the skin and via the respiratory tract, commonly used cell lines such as fibroblasts (NIH-3T3) and human lung adenocarcinoma epithelial cell line (A549) are tested. To measure the active metabolism indicating cell viability the MTT assay is a standard photometric endpoint assay. Therefore the viability of the cells cultivated with different concentration of nanoparticles in the medium was determined by MTT assay. Based on the results dose-dependent curves were approached and the inhibitory concentration (IC_{50}) values were calculated. Afterwards the observed IC_{50} values via endpoint assay were used for electric cell-substrate impedance sensing (ECIS). Clearly the advantage of this method is the on-line and continuous monitoring of the cellular behavior.

First results demonstrate a significant deterioration of the cell viability after cultivation with zinc oxide nanoparticles. NIH-3T3 cells with an IC_{50} value of 12 ppm are more sensitive than A549 cells with 67 ppm. Moreover ECIS shows an impedance signal decrease after addition of zinc oxide nanoparticles. This indicates that the toxic effect occurs immediately. Up to now both cell lines exhibited no significant cytotoxicity up to 80 ppm with TiO_2 nanoparticles.

Development of different cell culture models for *in vitro* biocompatibility testing

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Synthetic materials as well materials of natural origin, must fulfill certain criteria of safety and biocompatibility when used in tissue engineered products. Hereby they are subject to different guidelines as the German “Arzneimittelgesetz” (AMG), the medical product law, the “Good Manufacturing Practice” (GMP), the „Quality by Design“ (QbD) and the „Process Analytical Technology“ (PAT). Against this background, our working group develops standards to prove the innocuousness of components of these chemical or biotechnological products for humans. An uncritical use in patients comprises e. g. a lack of cytotoxicity, low immunological and allergenic properties, sufficient durability after implantation, regenerative properties, anti-infectious properties and no carcinogenic or genotoxic effects. A combination of conventional test systems as well as newly developed analytical methods will be defined as standard operating procedures and used as preclinical experimental tests supporting the targeted use of these biotechnological products in clinical studies. On a scientific level, we work on features of components of biotechnological products for optimization of cell-cellcontact and cell adherence with the purposed localization in the host including sufficient vascularization and nutrition of the implanted cells or tissues. Here, specific cell signals as well as material properties might be important. For this purpose, especially 3D cell culture models including endothelial cells, fibroblasts or osteoblasts have an outstanding importance to simulate the microenvironment of the implanted product in a patient. Different approaches to create *in vitro* 3D cell cultures are investigated to obtain high throughput, low-costs and reproducible test systems.

Cultivation of Mammalian Cells in Hydrogels for 3-D Cell Culture

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Traditionally, the culture of mammalian cells has been done on two-dimensional (2-D) substrates such as tissue culture flasks. However, the growth in a monolayer affects intracellular signaling and changes the phenotypic appearance of the cells. Thus the investigation of three-dimensional scaffolds that recapitulate aspects of the native cellular microenvironment for in vitro cell culture is necessary.
Hydrogels that possess high water contents highlight efficient matrices for 3-D cell culture and range from purely natural (e.g. sodium alginate) to purely synthetic materials (e.g. PEG).
With regards to the realization of stem cell therapies an efficient bioprocessing methodology is necessary to produce high biomass. These could be created by cultivating cells in small microspheres in a suspension bioreactor.
Different adherent cell lines were encapsulated into sodium alginate, sodium cellulose sulfate and a biocompatible PEG fibrinogen-based hydrogel. The production of microspheres with a syringe and a commercial encapsulation device will be compared to each other.

Development of target-oriented screening systems

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Targets recombinantly expressed and purified were transferred into optical screening assays for target oriented screenings to identify novel drugs. Target proteins like heat shock proteins (HSPs) are molecular chaperones, which help other proteins to mature and fold to their native structure even under extreme environmental conditions. In diseases such as cancer, Alzheimer's diseases or malaria, disease-related proteins take advantage of the HSP control system for their own activation or maturation. There is a quest to find inhibitors that bind to the HSPs of the harmful cells with high specificity. Here we show a novel multiplexed assay for inhibitor screening based on a protein microarray technique developed for routine applications with storable chips. Purified HSPs are printed as full-length proteins on microarrays and used as a drug target for the screening of new inhibitors. GA derivatives obtained by a combination of biological and chemical synthesis were selected novel compounds with a high affinity for Hsp and HtpG. Some novel synthesized compounds were selective between both heat shock proteins. In addition initial data reveal that elevated heat-shock protein levels in cancer cell lysates could be identified on microarray by a competition assay by using novel synthesized geldanamycin derivative. We suggest that thisapplication can be developed on the basis of novel derivatives and could serve as an stress test to identify high heat shock protein levels in vitro and in situ.

Aptamer-Based Optical Biosensors

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A label-free and reagent less optical biosensing platform based on nanostructured porous silicon and well-characterized model aptamers is presented in this work. Nucleic-acid aptamers have attracted intense interest due to their many advantages as recognition elements in biosensing when compared to traditional antibodies. Herein, aptamers directed against the Fc-fragment of human Immunoglobulin G as well as an aptamer against his-tag (6H7) are successfully used as the recognition elements. Porous silicon (PSi) thin films, fabricated by electrochemical etching, are thermally oxidized and functionalized to immobilize the amino-terminated aptamer via one-step carbodiimide coupling chemistry. Aptamers immobilization is confirmed by attenuated total reflectance Fourier transform infrared spectroscopy and refractive interferometric Fourier transform spectroscopy (RIFTS). Exposure of the aptamer-modified PSi to its target proteins results robust and well-defined change in the PSi optical interference spectrum, ascribed to specific aptamer-protein binding events within the nano-scale pores. Target protein capture within the pores is also confirmed by confocal microscopy, revealing the presence of the fluorescently-labeled target protein on the biosensor's surface and throughout the porous layer. The high specificity of the biosensors to their targets is demonstrated by exposure a variety of proteins and their mixtures.

This proof-of-concept study demonstrates the great flexibility in design of new aptamer-based PSi biosensors with high detection sensitivity and selectivity. Moreover, as aptamers can be synthesized against virtually any target, these biosensors can be designed towards a wide range of targets from small molecules to whole cells.

Aptamers as tailored ligands for affinity separation

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Aptamers are single-stranded synthetic DNA or RNA oligonucleotides that are able to capture their target molecule with high affinity and specificity. Therefore, they can be thought of as nucleic acid-based alternatives to antibodies, which have several advantages over their amino acid-based counterparts. In the context of affinity separation, the main advantages of aptamers are their high stability, the possibility to select aptamers that are functional under desired conditions and to design suitable methods for the elution of the target during the selection process of the aptamer [1].

To demonstrate the applicability of aptamers for the purification of proteins, we have used two different aptamers. Utilizing an aptamer directed against the His-tag we have developed an aptamer-based purification method for His-tagged proteins. The aptamer-based purification resulted in purification effects comparable to conventional immobilized metal chelate affinity chromatography (IMAC) [2].

In order to develop a gentle purification strategy for antibodies that does not involve harsh acidic elution conditions that are used during protein A-based affinity chromatography, we have used aptamers directed against human IgG. During the selection of the aptamers, a selection buffer containing divalent cations was used in order to generate aptamers with binding properties that depend on the presence of these ions. As a result, bound IgG could be eluted with the chelating agent EDTA and human IgG was successfully purified from serum.

Moreover, we have investigated the possibility to exploit aptamers for the purification of small molecules utilizing an aptamer directed against theophylline. These aptamer was used for successful isolation of theophylline from equimolar mixtures with the closely related xanthines theobromine and caffeine.

In summary, we have demonstrated that aptamers are valuable alternative affinity ligands in diverse downstream processing tasks including the purification of proteins as well as small molecules. Within these processes, aptamers exhibit several advantages over conventionally applied affinity ligands. E.g., the aptamer-based purification of IgG does not require acidic elution conditions that are used in the protein A-based purification process. Thus, aptamers enable the isolation of the target under gentle conditions that do not interfere with the activity of the target to be purified.

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