



Life Sciences and
Facility Management

TRANSFER

english edition
2018

**News from research,
education and
continuing education**

Applied Simulation

Facility Management

Food and Beverage Innovation

Natural Resource Sciences

ZHAW LSFM – Dealing with societal challenges



Cathy Kroll
Head of Technology Transfer Office

We proudly present the first English edition of our research newsletter TRANSFER and would like to take advantage of the pdf, electronic version to introduce the ZHAW School of Life Sciences and Facility Management in a short video: <https://youtu.be/j0qO9XyWqBs>

Shaping the future

Our approach to the challenges of the future is creative, applied, passionate and reflective, as is demonstrated by the ongoing development of our academic programmes, continuing education and research. National and international competition is strong, the fight for talent is on, and being aware of and making use of societal and technological developments to sharpen our toolbox is key.

Some examples: The new research-based Master's degree in Environment and Natural Resources focuses on the interface between nature and society, while our newly established Applied Computational Life Sciences Master's programme, taught in English, caters for the growing demand for specialists in the management of huge data sets in the life sciences.

Our researching teachers and our teaching researchers are actively involved in transferring their knowledge into new education formats, implementing more and more e-learning content including social media. Our researchers give their Bachelor's and Master's students the opportunity to combine learning and research in industry-driven projects.

Exchanges are enriching: guest students, researchers and lecturers bring the world to Wädenswil and increase the cultural diversity on our campus. Whether coming to or from Wädenswil – we promote international student exchanges and also support mobility for our employees.

ZHAW students have the opportunity to spend a semester abroad to prepare themselves for international competition in their future careers. In addition, many of the Institutes' research projects and specialist conferences at the LSFM, as well as their Summer and Winter Schools, are internationally orientated. The specialised foci of these events bring scientists and students from around the world to Wädenswil.

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International cooperation in education, research and continuous education

The initiation of international collaborations usually starts with a personal relationship followed by a Memorandum of Understanding between institutions. However, these agreements only survive through the personal contacts and initiatives of our employees in research and education, and their drive to improve and to solve problems. The exchange of students and staff initiates discussions on joint projects, which may at first be financed internally by the institutions; interesting and relevant topics then require external funding for further development and implementation. Bi-national project funds or multinational programmes, such as ERA-Net or large collaborative Horizon 2020 research and education projects, are of utmost importance strengthening collaboration and enabling joint development projects.

The scientific or educational content might be universal common ground; however, acknowledging cultural differences, accepting different viewpoints, and using another language to communicate, learn and teach are at the basis of solving societal challenges. With this English edition of TRANSFER we hope to demonstrate our willingness to shape the world.

Some facts and figures

Organisation:

5 Institutes

Topics in research:

nutrition/food, health, society and environment

Education:

5 Bachelor's degree programmes,
3 consecutive Master's degree programmes

Continuing education:

3 Masters of Advanced Studies (MAS),
2 Diplomas of Advanced Studies (DAS),
over 30 Certificates of Advanced Studies (CAS).
In 2016 total 3663 participants in continuing education and symposia.

Students (autumn 2016):

1365 Bachelor's, 196 Master's

Employees (autumn 2016):

605, of whom 161 are professors and lecturers

News

International participation

Twenty students commenced their Master's studies in autumn semester 2017. They come from backgrounds in facility management, business administration, architecture, engineering and hospitality management, and some of them already have relevant professional and managerial experience. The students originate from eleven different countries (Europe: Switzerland, Germany/Americas: USA, Mexico, Dominican Republic/Africa: Cameroon, Nigeria, Ghana, Egypt/Asia: Turkey, India), and more than half of them are German-speaking. zhaw.ch/ifm/master



FM Master's students from 11 countries

New Master's specialisation launched

The new academic year has seen the successful launch of the Applied Computational Life Sciences (ACLS) programme, part of the Master's programme in Life Sciences, with 12 full-time and 4 part-time students. This internationally-oriented programme, taught entirely in English, gives participants the opportunity to

apply the digital skills they acquire in one of four fields. Students have the opportunity to complete their Master's thesis as part of a ZHAW research group or with an external partner. zhaw.ch/lstm/master

A high-tech camera trap to detect weasels

ZHAW engineers have developed a novel camera trap tube for small mammals. With this method, endangered species, such as least weasels, can be documented more easily and with the help of non-specialists. Previous methods have been very complicated and only partly feasible. The camera trap consists of a T-shaped plastic tube or «tunnel». In one arm of the tunnel there is a heat sensor, a camera and a small computer, all packaged in waterproof material.



Weasel in the tube

When an animal passes through the tunnel, the sensor registers the rise in temperature, whereupon the camera takes a series of photos and the processor uploads them automatically to the internet via the mobile network. A TubeCam typically takes thousands of pictures in just a few days, only very few of which actually contain weasels. This is why the project depends upon the help of private individuals who volunteer to evaluate the images.

zhaw.ch/en/lstm

Project week: Wind Energy with the University of Highlands and Islands in Scotland

– Christoph Koller, lecturer, kolk@zhaw.ch

We were able to hold an international project week with the topic of wind energy in cooperation with the University of the Highlands and Islands (UHI) at the start of autumn semester 2017. UHI covers the entire area of North and West Scotland and has, amongst others, a Renewable Energy Department. Due to the excellent wind conditions there, the Western Isles are considered the wind capital of Europe. The UHI focuses on renewable energies in Stornoway, located on the island Lewis and Harris, the largest island in the Outer Hebrides. The island was powered by a 20-MW line from mainland Great Britain in the past.

However, over the last ten years two wind energy farms with nine large wind turbines have been built. On average, these wind farms generate so much energy over the course of a year, that the entire island with 20000 inhabitants can be supplied autonomously, with surplus energy passed on to the mainland.



Erecting Beinn Ghrideag Wind Farm in Lewis
(pointandsandwick.co.uk)

New CAS: Digital Basics for Life Sciences

To exploit the potential of ever-growing digitalization, experts need to understand underlying basic concepts and processes. This includes both a technical understanding of modern data structures and how to use scripting languages. The new CAS covers these aspects in three modules: Algorithms and Programming, Modern Data Analysis, Data Engineering. The course is directed at professionals in the Life Sciences who want to expand their knowledge in digital data processing. The CAS starts for the first time in February 2018.



ZHAW Master's in Environment and Natural Resources Double Degree

The Institute of Natural Resource Sciences (IUNR) and the Faculty of Civil and Geodetic Engineering of the University of Ljubljana in Slovenia have launched an international double degree as part of the Master's Programme in Environment and Natural Resources (MSc ENR). Students are given the opportunity to obtain a full university Master's degree by completing an additional fourth semester, thus qualifying them to continue their studies at doctoral level (PhD). The MSc ENR is the first environmental Master's programme at a Swiss university of applied sciences and has been offered since September 2017. It provides three main specialisations: Agrofood systems, Biodiversity & Ecosystems and Ecological Engineering.

zhaw.ch/iunr/master



University of Ljubljana, Slovenia

Phylogenetics reveals competition of human flu subtypes

Research Group Applied Computational Genomics



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Using phylodynamic and phylogeographic modeling we analysed molecular sequences from around 3000 influenza strains isolated from patients participating in the global prospective clinical study IRIS. We were able to infer alternating patterns of effective reproductive numbers and migration between influenza subtypes after the 2009 pandemic. For the first time, this demonstrates that cross-protective immunity (i.e., competition between viral subtypes) is an important driver of influenza seasonality.

Influenza is a common viral respiratory infection, which often causes epidemics. Seasonal patterns of influenza infections have been studied extensively. Better understanding of influenza dynamics helps to guide efficient vaccine development and fight new highly contagious strains spreading through human populations. Yet, the dynamics of flu circulation remain difficult to predict.

Reconstruction of an evolutionary history

In collaboration with scientists from the University of Veterinary Medicine of Hannover and F. Hoffmann-La Roche AG, we have applied computational methods to analyse complete protein-coding influenza sequences from surface proteins hemagglutinin (HA)

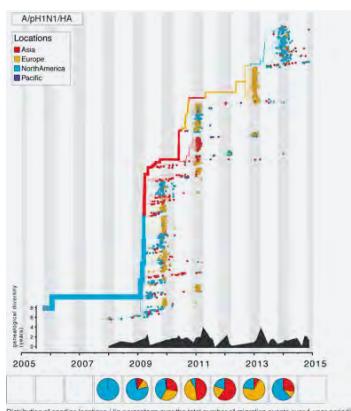


Fig. 1: The inferred spatio-temporal phylogeny with migrations shows evolutionary dynamics of flu; extract from Gatti et al. (under review).

and neuraminidase (NA). Sequences from approx. 3000 influenza A and B strains were collected over 5 years as part of the Influenza Resistance Information Study (IRIS), starting with the 2009 pandemic, and were extended with public data spanning a longer time period.

The main expertise of the Applied Computational Genomics Team is the development of computational methods for the reconstruction of evolutionary history (including multiple sequence alignment and phylogeny). This includes modelling sequence evolution over time, for example to evaluate the impact of natural selection and other evolutionary forces that shape genomics sequences and drive changes in fitness. In this project, the team's own software was first used to construct multiple sequence alignments and viral phylogenies. These were subsequently used to perform further inferences of viral phylodynamics based on modelling of underlying population dynamics and discrete trait migrations between geographical locations (for example see Fig 1.).

Quantifying global virus migration pattern

As a result we are able to quantify global virus migration patterns with high spatio-temporal resolution, while estimates of global effective reproductive numbers R were used to evaluate herd immunity. Since some individuals are immune (e.g., due to prior infection or immunisation), not all contacts can lead to new infections. This decreases the numbers of secondary infections in partially susceptible populations. The host-pathogen dynamics are summarized by R , computed as the ratio between secondary infections and recovered individuals. The herd immunity threshold can be described as the fraction of a population that has to be immune to stabilise the disease in this population, which corresponds to $R=1$.

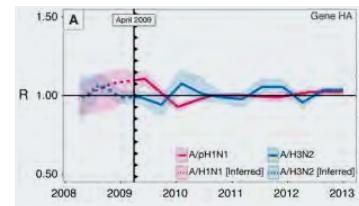


Fig. 2: Estimated R for influenza A/HA phylogenies; extract from Gatti et al. (under review).

New insights contribute to a better understanding

Two influenza A subtypes H1N1 and H3N2 showed alternate phases of growing and declining R estimates, suggesting a global pattern oscillating around $R=1$ (Fig. 2). Similarly, we observed alternation of the numbers of migration events of influenza A, indicating that herd cross-immunity is an important determinant of global circulation of the flu virus. Alternation patterns for influenza B subtypes were less pronounced, but nevertheless also significant. These new insights contribute to a better understanding of influenza seasonality. A follow-up study will involve using Markov models of codon substitution to evaluate changes in natural selection over time and at different positions on the surface proteins. This approach will help to identify hotspots of diversifying selection that favour viral escape from a host's immune system, which will facilitate the prediction of future «escape routes». ■

Reference: «Global phylodynamics reveals competition between co-existing influenza A subtypes». Gatti, Zhang, Anismova, Schutten, Osterhaus, van der Vries (manuscript under review).

Predictive and Prescriptive Maintenance



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Predictive Analytics Group

We all know the inconvenience and annoyance caused when our car's engine decides to stop and die in the middle of the road, or it won't start in the morning and we have to wait for the bus, nervously typing apologetic messages on a cell phone because of the meeting we will certainly be late for. Wouldn't it be nice if we knew the evening before that the car won't start next morning? Predictive maintenance might be just the right tool for the job.

Predictive maintenance

Every device or machine has only so much life in it. Mechanical wear, material degradation and aging, and other factors decide how long the device can perform reliably and safely before it must be serviced or replaced. Traditionally, the manufacturer provides a maintenance schedule to accompany the device, which specifies what must be serviced and when to ensure flawless operation. However, not all devices and machines age and deteriorate at the same rate. Factors such as usage type and intensity, environmental factors etc. can extend or shorten the average lifespan de-

clared by the manufacturer. In the first case, we send our car to the mechanic too early. The later ... well, we wait for the bus.

Predictive maintenance is a technique of collecting a device's or machine's operating data and modeling them in order to predict how soon the machine's vital parameters are likely to exceed manufacturer's tolerances, entailing the need for maintenance actions. In complex engineering systems the number of observed parameters and the complexity of their interactions call for the deployment of machine learning techniques to predict necessary maintenance interventions.

In many cases, changing the way the device is operated may drastically change the expected periods between required maintenance. Of course, it would be desirable to choose a set of operating parameters that are likely to extend the lifespan of the device as much as possible. Searching through the parameter space in pursuit of the optimal combination to yield the longest predicted lifespan of a device is referred to as *Prescriptive maintenance*.

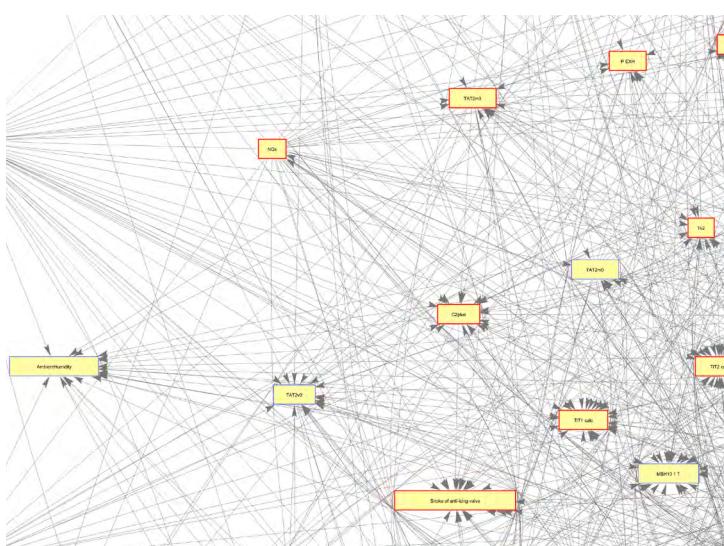


Fig. 1: Complex relationships between gas turbine parameters, modeled using a Bayesian Network.

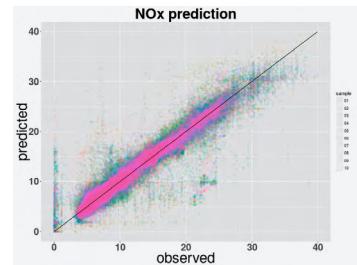


Fig. 2: Predicted versus actually recorded turbine gas emissions (NOx).

Predictive and prescriptive maintenance for combustion monitoring in gas turbine

General Electric In is one of the major international suppliers of modern power generation equipment and operates a fleet of combined-cycle gas turbines all over the world. GE and the Predictive Analytics Group of the IAS ZHAW are currently collaborating on a project to devise a prescriptive maintenance system for GE turbines. A gas turbine is an extremely complex piece of machinery, whose components must withstand high mechanical loads, extreme temperatures and intense vibrations, while remaining in uninterrupted operation for periods that can extend to months or even years. Due to their mission-critical role in providing electrical power, each maintenance stoppage is a costly necessity.

A maintenance intervention is required when the gas emissions of a gas turbine exceed legally permitted thresholds. At the Predictive Analytics Group, we analyze large historical data sets consisting of readings from more than 180 sensors collected every 4 seconds over years operation to best model and predict future gas emission levels, and to prescribe the optimal parameter for the maximum delay until the next required maintenance. ■

Tools for FM in Healthcare



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Research project
Development of an IT-based assessment tool and a corresponding introduction manual for relevant facility management process applications in hospitals on the basis of an adaptive reference model

Leadership:

Nicole Gerber,
Prof. Dr. Susanne Hofer

Project duration:

February 2015 – January 2017

Partners:

Deloitte Consulting AG, SAP (Schweiz) AG, conrealis ag, Cantonal Hospital Aarau, Cantonal Hospital Graubünden, University Hospital Basel, University Hospital Zurich, ZHAW IWI, ZHAW WIG

Funding:

CTI, Commission for Technology and Innovation

Hospitality Management and Consumer Science Competency Group

The RemoS reference model RemoS shows the relationships between the results-oriented services listed in the Performance Catalogue for Non-medical Support Services in Hospitals (LekaS), the underlying processes in the process model PromoS, the related parameters in the Key Figure Catalogue KenkaS, and the corresponding software applications in ApplikaS. The reference model is the basis for the Guide to using SAP for Facility Management in Healthcare (LesapS) and the IT-based Assessment, Simulation and Benchmarking Tool for FM in Healthcare (ASBT-FM).

The provision of services in hospitals is a complex interaction at various levels. This also applies to the non-medical support area – FM in Healthcare (FM in HC) – with its at times very differently focused areas of logistics, infrastructure, facility services and hotel provision. Thanks to a successfully completed CTI Reference Model project, managers responsible for FM in HC and consulting now have a systematic basis for more transparency and easier decision-making. Its central output is the reference model for Non-medical Support Services in Hospitals (RemoS), where the relationships between services, processes,

sub-processes, process steps, key figures, parameters and memory application are shown systematically (see Figure).

Detailed information for hospitals

All sub-topics were developed iteratively and details are available to the industry:

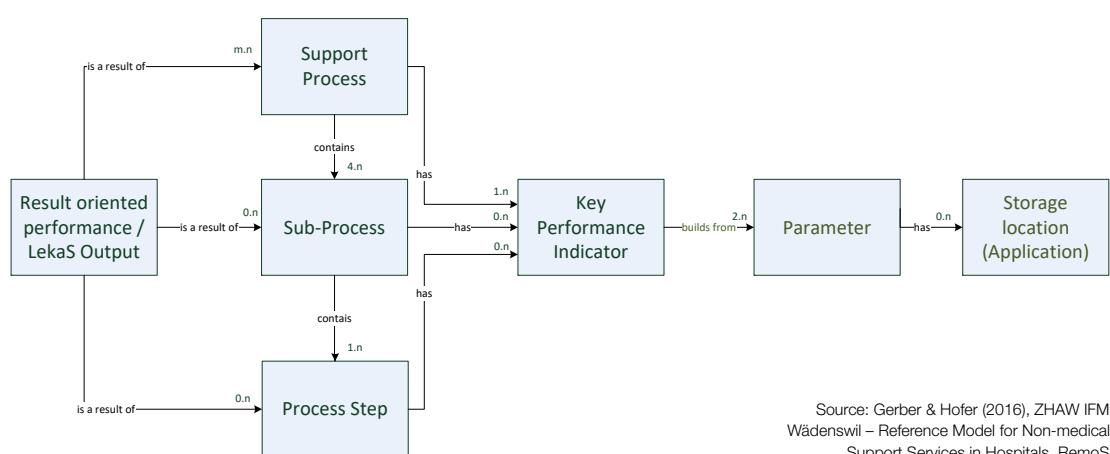
- KenkaS, the Key Figure Catalogue for Non-medical Support Services in Hospitals, which consists of the key figure model in which the individual services have been clustered and prioritized, and the key figure catalogue itself, which lists key figures and their parameters taken from the literature and practice, were developed and prioritized for all FM in HC subject areas
- PromoS, the Process Model for Non-medical Support Services in Hospitals, which shows the demarcation of all FM in HC processes into specific sub-processes and process steps
- ApplikaS, the Application Catalogue for Non-medical Support Services in Hospitals, which shows the results of surveys concerning software used in the field of FM in HC

Foundation for FM in Healthcare

RemoS also forms the basis for the Assessment, Simulation and Benchmarking Tool for Facility Management in Healthcare (ASBT-FM) used by our

business partner Deloitte, which now employs an intuitive user interface to systematically and comprehensively analyse and develop the application portfolio for FM in HC. In addition, thanks to the LesapS guideline developed for the use of SAP for FM in HC, the potential use of SAP in all FM in HC subject areas will be easier to plan and coordinate.

On this basis, additional topics will continue to be explored, such as the development of a good practice approach for SLAs, the establishment of a benchmark for technical FM, and the development of a Rekole-compliant cost allocation methodology. The corresponding project descriptions, publications and news can be viewed at: zhaw.ch/ifm/fm-healthcare/remos/en



Source: Gerber & Hofer (2016), ZHAW IFM, Wädenswil – Reference Model for Non-medical Support Services in Hospitals, RemoS.

Guidelines for health-promoting office spaces



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Research project
Offices, Change & Health –
health-promoting offices
and workplace change
management

Leadership:
Prof. Dr. Lukas Windlinger

Project duration:
January 2015 – December 2017

Partners:
Health Promotion Switzerland, Witzig the Office Company, University of Applied Sciences Northwestern Switzerland; 5 research partners from industry

Funding:
CTI, Commission for Technology and Innovation

The three fields of action of workplace management in relation to health-promoting office space

Business Economics and Human Resources Expert Group

In office planning, the main focus in terms of employees' health has to date been on ergonomics. New studies show, however, that the impact of office space on the mental health and well-being of employees is considerable. These guidelines are intended to support facility/workplace managers, office planners, change- and HR-managers as well as workplace health management (WHM) experts in the planning and implementation of health-promoting office spaces and the associated change process.

The working environment in today's offices is characterized by mobility and constant changes between «individually focused» and «collaborative/communicative» activities. The juxtaposition of many different activities in the office requires new approaches to office design. With the proliferation of open, flexible office space concepts, the impact of office space on health is increasingly being discussed. However, although stress-related illnesses have continued to increase in recent years, office space is still being designed with insufficient focus on the users' health. The existing focus on physical-ergonomic aspects (ergonomics, lighting, climate, etc.) is not sufficient to ensure a health-promoting

work environment. New studies show that the previously underestimated influence of office space on the mental health and well-being of employees is considerable.

The question therefore arises as to how office space should be designed so that the health of employees is specifically promoted or at least maintained. These guidelines for health-promoting offices and workplace change management discuss three areas of workplace management related to health:

Office design

In terms of health effects, three factors can be examined when designing and laying out offices:

- Material environment: layout, work and storage surfaces, quality of workplaces, colours, plants and natural elements, rest and regeneration areas
- Indoor environment: acoustics, air quality and climate, daylight and artificial lighting
- Social-spatial environment: privacy regulation, territoriality, interruptions and disturbances, experience of feeling constricted

Elements of these factors can either have a negative impact as stressors or work positively as resources to strengthen the health of employees. It is of paramount importance that the office environment suits the organisation as well as the characteristics

of its employees and culture. The office space environment should support the activities taking place in the best possible way and therefore be adapted to an organisation's tasks, processes, communication structures and management style. To achieve this fit, comprehensive analysis is required.

Workplace change management

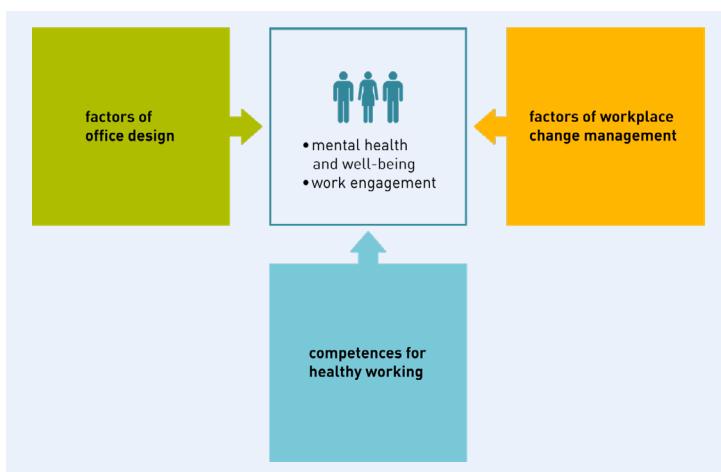
Changes in office space can be experienced as stressful, which is why it is important to involve and support the employees in the change process. A number of influencing factors such as a sense of purpose, transparency, control, social support, perception of personal benefits, and trust are important for employees to be able to manage change processes successfully and healthily. It is therefore necessary to have a planned procedure which coordinates roles/responsibilities, communication, participation and the steps to be taken, as part of a change process.

Competences

In order for offices to promote health, it is important that the relevant skills (such as spatial competence, self-competence, media literacy) are developed and promoted in employees and managers. These competences can be specifically trained as well as integrated into existing management tools.

In the guidelines the contents of the three fields of action are set out for practical application, and corresponding recommendations and example illustrations are provided. For further information, see:

**gesundheitsförderung.ch/
offices-change-health**



An Applied Study of Viral Microbial Source Tracking of Faecal Contamination in Danish Bivalve Molluscs (Bachelor-Thesis)



Prof. Dr. Corinne Gantenbein-Demarchi

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With the increase in worldwide farming intensity due to population growth, water quality has become a major public health issue. Microbes from faecal matter pollute waterways directly or by percolation, contaminate drinking and irrigation water and as a result crops and livestock as well. Faecal contamination in the food chain is of concern, because humans and livestock can also harbour major reservoirs of pathogenic viruses and bacteria. The use of highly host-specific viruses as microbial source tracking (MST) tools provides a library-independent method for the detection of faecal contamination and its origin.

This large-scale survey of Denmark's main bivalve mollusc farming area seeks to investigate the relationship between the prevalence of pathogens and faecal indicator viruses found in various kinds of bivalves. The main goal of the project, however, is to establish the origin of current faecal contamination through the use of viral MST tools and to map detected viruses against adjacent sources of pollution. The project involves the dissection of digestive glands from bivalve molluscs, the extraction and qPCR analysis of viral nucleic acid, data modelling and map rendering. All results are confidential. ■



Growth of mould fungi on DRBC (pink) and DG18 (beige) after active air examination with an air sampler (MBV, MAS100 NT)



Source tracking of faecal contamination through the environment by means of qPCR detection of host-specific viral indicators.

BreadMold – building a collection of moulds relevant to baking



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For a number of years, researchers at the Centre for Microbiology have been working intensively on the development of antifungal protective cultures for food fermentations, in particular for sourdoughs. The development of these highly specific cultures requires that the lactic acid bacteria are adapted to their environment, for example the grain/sourdough, and the antagonists (the moulds) used in the screening and challenge tests come from the environment in which the protective cultures are to be used.

A collection of moulds relevant to baking is being built up as part of the BreadMold start-up project. Approximately 700 moulds have been collected from bakeries (isolated from ambient air and from bread) for subsequent identification. In addition, the ability of the isolated moulds to form food-relevant mycotoxins (e.g. aflatoxin, ochratoxin A, fumonisin) will also be assessed. ■

Ohmic heating of gluten-free dough

Authors: Mathias Kinner, ZHAW,

Regine Schoenlechner, University of Natural Resources and Life Sciences, Vienna (BOKU)

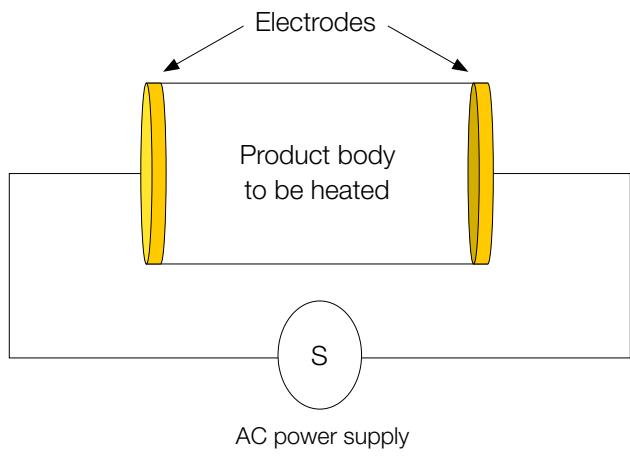


Dr. Mathias Kinner,
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The demand for gluten-free foods is increasing worldwide due to coeliac disease and other wheat-induced disorders. However, gluten is an important functional ingredient in

many bakery products since it imparts mechanical stability and gas retention capacity to the dough. Thus, the production of gluten-free bakery goods of similar quality to their gluten-containing counterparts is a continuing challenge. The focus of research and development to date has been on optimisation of product formulations.

The objective of the collaboration between the ZHAW and the University of Natural Resources and Life Sciences, Vienna, is to accelerate the baking process through the application of ohmic heating, thereby overcoming the problems of dough instability during baking, which is particularly relevant in the case of gluten-free products. The principle of ohmic heating is that the electrical resistance of the product will cause an elevation in temperature when an electrical current is passed through it, ensuring that the food is heated evenly and quickly. Initial results have indicated that the ohmic heating process imparts great benefits in crumb structure and appropriate process parameters have been identified. Further research is being undertaken to optimise the ohmic heating process and to identify other related factors that influence product quality in preparation for commercial application. ■



yeast

Impact of yeast on bread quality

Authors: Mathias Kinner, Anika Wolter, Marie-Louise Cezanne, Martin Popp, Irene Chetschik, Michael Kleinert

Yeast is known to play a critical role during the bread making process and influence the quality characteristics of bread. Depending on the bread formulation and process, the metabolic activity of the yeast generates differing quantities of carbon dioxide and various volatile components, which influence the specific volume and aroma profile of the bread. An investigation of the impact of yeast on bread quality was carried out at the ZHAW on behalf of the Confederation of European Yeast Producers (COFALEC).

Selected European bread varieties were produced with and without yeast, or with baking powder to evaluate the influence of these ingredients on flavour development and the sensory qualities of the final product. Representative European bread types included in the study were the French baguette, Polish bulka wroclawska, British sandwich bread, German spelt wholegrain bread, Spanish pages and Italian ciabatta. Skilled bakers from the respective countries produced the breads. The influence of yeast on product quality was determined through analysis of the specific loaf volume, crumb texture (crumb hardness, chewiness and springiness), crumb structure (number of cells, cell diameter and volume, porosity and wall thickness) and sensory attributes (visual appearance, texture, mouthfeel, taste and aroma). Chemical analyses of the key aroma components of crumb and crust were conducted using gas chromatography-mass spectrometry after solvent extraction with dichloromethane. The inclusion of yeast resulted in a higher specific volume, a softer crumb, larger cells and a crispier crust for all bread varieties. Furthermore, the number of the bread aroma components and their concentration were found to be a function of the length of the fermentation when yeast was included in the formulation.

It was concluded that yeast strongly influences the overall character of European bread types when used as an ingredient, irrespective of the production process. ■

Top-quality jam – cleverly packaged



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Research Group for Life Cycle Assessment

Individual jam portions, such as those used in gastronomy, are packaged in either aluminium or glass. But which packaging variant performs better from an ecological point of view? Is aluminium packaging as harmful to the environment as its reputation suggests? This question was addressed by the Life Cycle Assessment Research Group at the IUNR, which concluded that, in addition to the material itself, distribution and transport also play a decisive role.

One product – several packaging variants

Hero AG, headquartered in Lenzburg, produces over 100 different varieties of jams, which are sold in containers of different materials and sizes, such as large jars or individual portions. Individual portions are used in restaurants, airlines and retail outlets, and are either made of aluminium (AluCup) or glass (MiniJar).

Using a life cycle assessment of strawberry jam as an example, the Life Cycle Assessment Research Group at the IUNR assessed the environmental effects of individual portion containers made of both glass and aluminium. Life cycle assessment is a standardised method and quantifies the environmental impact of products

over their life cycle. In the case of strawberry jam in individual portions, this included the production and filling of the jam, use of materials for packaging, distribution to the end customer, and disposal of the packaging after consumption of the jam. The assessment was carried out using a set of different indicators that take climate change, resource consumption and pollutant emissions into account.

What influences life cycle assessment?

Jams in portion packs were found to have many negative effects on the environment – from irrigation of the strawberries to energy consumed in jam cooking, particle emissions from the combustion of fuels during distribution, to carbon dioxide emissions during disposal of the packaging. The origin of the strawberries, the material and weight of the portion packaging, as well as the transportation distance to the final consumer are the most important influencing variables.

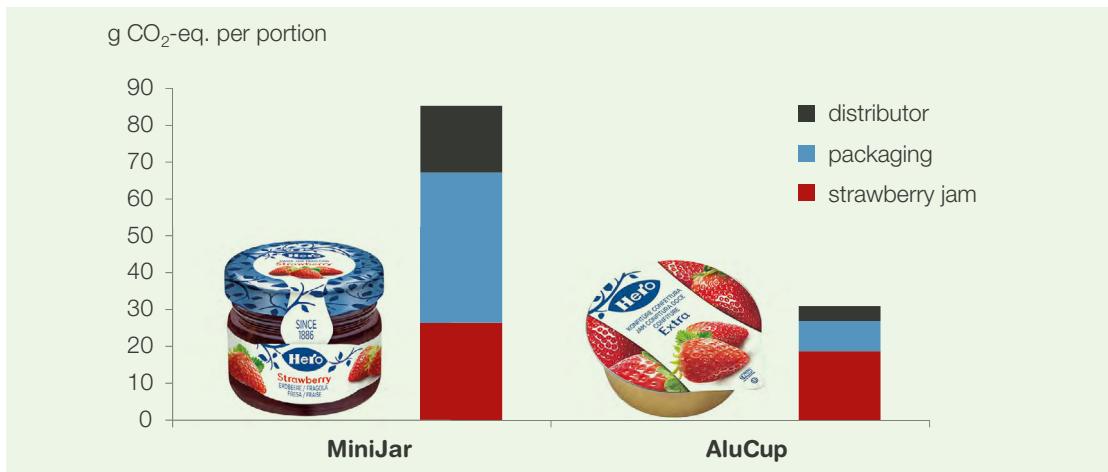
The size of the container is decisive

The environmental impact of individual portions decreases as portion sizes become smaller, because the packaging used is less. On the other hand, the environmental impact for each kilogram of jam increases with the

number of portions it is divided into. It is therefore crucial to optimise the size of the individual portion, depending on the intended use, in order to improve the ecological balance. If the portion is too small, more than one portion is opened and the packaging quantity increases. If, however, the portion is too large, this leads to food waste.

Environmentally friendly: minimal packaging and consumed locally

A comparison of the two packaging variants shows that jam portions in AluCups cause 3.5 times less environmental impact than jam portions in MiniJars, as the production of glass MiniJars is energy-intensive. In addition, AluCups are lighter than MiniJars, and use less aluminium per portion of jam than the glass used for MiniJars. The low weight of AluCups results in lower greenhouse gas emissions: the lighter the goods transported and the shorter the transport distance, the lower the emissions. ■



Greenhouse gas emissions [g CO₂-eq./portion] of a single jam portion in a MiniJar and AluCup



NOVANIMAL Innovations in nutrition



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People are eating more and more meat and dairy products worldwide. However, the production of animal-based food has a greater impact on the environment than plant production. In addition, animal foods can contribute to being overweight and some types of meat are thought to increase the risk of cancer and cardiovascular disease.

Another global trend is the increase in eating out. In Switzerland these two global tendencies can also be seen: per capita consumption of animal products is significantly higher in Switzerland than the global average, and an increasing proportion of main meals is now being consumed away from home. NOVANIMAL addresses both of these ecologically- and health-related trends. The focus is on supply chains for dairy products and meat from the farm to the food industry, gastronomy and consumers. In cooperation with industry partners, strategies and recommendations for a healthy and sustainable Swiss food culture and for more creativity and variety on the plate are being developed. NOVANIMAL is supported by the Swiss National Science Foundation. For further information visit: www.novanimal.ch

The Rhine experience



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The Rhine is one of the most important rivers in Europe, with 1324 km of cultural and landscape ecology. It flows through nine countries and around 50 million people live in its catchment area. The source of the Rhine is in the canton of Graubünden, where the two headstreams, Vorder- und Hinterrhein, absorb numerous streams from side valleys before they merge with the Bündner Alpenrhein near Reichenau.

The source regions of the Rhine are a unique selling point for Graubünden, which should be culturally, ecologically and touristically valued. This requires first of all a comprehensive understanding of the culture, history and landscape ecology of the region, from which natural and cultural experiences can be designed for local people and guests. In addition, an annual Rhine event with international appeal is planned, making use of joint communication and marketing as well as the definition of customised infrastructures (visitor centre, signage, etc.). The Research Group for Tourism and Sustainable Development in Wergenstein is responsible for the management of the first phase of the project. ■



Rhine Gorge, © ZHAW, Photo: Frank Brüderli

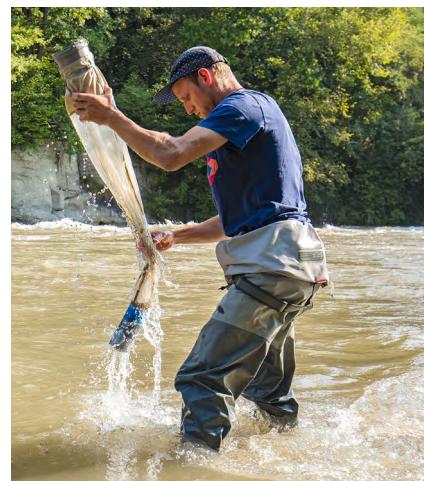
Effects of hydropeaking induced drift on aquatic invertebrates



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Hydropeaking operation of high-head storage power plants leads to discharge and water level fluctuations. These can have both short- and long-term effects on aquatic life communities. Rapid increases in discharge cause shear forces, flow velocity and water depth of the corresponding waterbody to increase, which can lead to movement of parts of the river bed. Due to the associated hydraulic forces, aquatic invertebrates that populate the body of water (macrozoobenthos) need to expend a considerable amount of energy to avoid downstream displacement. The hydraulic load can thus have a considerable influence on the drifting and flushing out of these creatures.

This project investigates the connections between hydropeaking and the reaction of macrozoobenthos, especially how they drift. The aim is to be able to forecast the effect of restoration measures. For this reason the project is of great importance for the implementation of hydropeaking remediation in Switzerland and the Alpine region. ■



Investigations at Sarine, © Ecohydrology Research Group, ZHAW



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