

TRANSFER

English edition
2020

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

Applied Simulation

Chemistry and Biotechnology

Facility Management

Food and Beverage Innovation

Natural Resource Sciences

Agile platforms and interdisciplinary collaboration

The Department of Life Sciences and Facility Management (LSFM) has set priorities in interdisciplinary collaboration through four strategic subject areas. In agile programmes, socially and economically relevant issues are tackled across institute and organisational boundaries.

Should you have any questions about the platforms, please write to the contact persons listed below the text concerned using the format

➔ rstname.lastname@zhaw.ch

Digitization@LSFM

Digitization has come into focus – not only at universities, but also in society at large and in the political arena. Whereas in the past only specialists dealt with digital topics, digital services now influence so many aspects of our lives that they have become an integral part of our everyday existence. As a university, we have a social responsibility and want to help shape and reflect on change. The strategic topic Digitization@LSFM is founded on the innovative strength of our employees and students. They should be motivated and empow-

ered to play an active role in shaping the digital future as researchers, teachers or future employees and managers. The aim is to make the ground-breaking potential of digitization in education and research visible, to use it and to transform it into positive, tangible changes.

Contact: Beatrice Dätwyler, Jos Hehli, Daniela Lozza, Thomas Ott

Agro-Food-Business@LSFM

The production and consumption of food are facing major challenges worldwide. Those wishing to advance system adaptation in the agro-food sector and face up to this transformation process need the appropriate skills. By offering new research-based educational opportunities, our aim is to enable young people to innovate systems and thereby change business models in the agro-food network in a sustainable way. Three projects

focusing on research into the cocoa value chain are analysing sustainability and food safety and quality criteria, business models and possibilities of digital transformation using blockchain-based traceability systems to gain insights for other product groups. The overall goal is to increase the resilience of systems in the agro-food sector.

Contact: Thomas Bratschi, Tilo Hühn

Environment@LSFM

In the strategic topic area Environment@LSFM we want to develop and implement application-oriented research projects in the sphere of sustainability. The first area of focus revolves around buildings and the second is dedicated to the social challenge of replacing plastic. The overarching aim is to combine the topics of circular economy, biodiversity, life cycle management, smart cities, and facilities and services, and to consistently align them with the well-being of the users and to improve quality of life. Sustainability requires the simultaneous optimisation of various factors, such as energy efficiency, indoor comfort and health, biodiversity and life-cycle costs. The campus area will be further developed as a Living Lab, thus making sustainability a tangible experience for students and the public. Aided by the networking of internal competencies, the second focus area of bioplastics will be fostered at the School of LSFM as an interdisciplinary priority in order to unify content.

Contact: Heinz Bernegger, Carsten Druhmman, Reto Ruff

Health@LSFM

The strategic topic area Health@LSFM aims to increase the visibility of research in the field of health. It is based on three pillars: networked research, communication and strategic positioning. The central instrument is the creation of an incubator for innovative interdisciplinary projects with which synergetic potential between researchers can be identified and fostered. Activities and projects surrounding the topic of health are actively supported, placed in a holistic context and communicated in a media-friendly way. In order to position itself, the platform promotes health research both within the school and externally to industrial partners, national initiatives and funding instruments. After an internal start-up phase, the Health platform will be opened to all schools within the ZHAW to facilitate the broad strategic anchoring of this area.

Contact: Sven Hirsch, Lukas Neutsch

Imprint

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News

Swiss Women in Chemistry



SWISS
WOMEN in
CHEMISTRY

In September 2019, the new platform Swiss Women in Chemistry (SWC) was launched. Under the umbrella of the Swiss Chemical Society (SCS), the SWC is open to all female Swiss scientists from the fields of chemistry, life sciences and biotechnology. The aim of the platform is to support female chemists through a professional network in all phases of their careers and to make their successes visible. Members of the network are provided with an open platform for the exchange of ideas and experiences, and young female scientists can be supported in their professional development via a mentoring programme. The platform is being organised by Dr. Rachel Hevey (University of Basel), Dr. Maud Reiter (Firmenich SA) and Prof. Dr. Rebecca Buller (ZHAW).



Rebecca Buller, co-founder of SWC

 @SwissWomenChem

 Swiss Women in Chemistry

 swisswomenchem

Foundation stone laid for “Future of Food Campus”

On January 14, 2020, the foundation stone for a new ZHAW laboratory building was laid at the Reidbach campus in Wädenswil. A unique and modern centre for food and beverage technology will be built here by summer 2023. The aim of the new “Future of Food Campus” is to bring all aspects of the entire value chain in the food industry together in one place. This has many advantages. In future, food and beverages from raw materials to the market can be researched here. The proximity of processing and analysis presents opportunities for the development of new foods and manufacturing processes.



Laying the foundation stone

New book on single-use technology

The second edition of “Single-Use Technology in Biopharmaceutical Manufacture” by Wiley-VCH was published at the end of August 2019. The book (ISBN 9781119477839) is aimed at anyone who wants to develop and implement modern biopharmaceutical production processes utilising single-use systems. The solutions presented range from upstream processing to Fill & Finish.



Research award for Master’s graduate in Facility Management

Virna Monero Flores, Master of Science in Facility Management graduate and Research Assistant at the Institute for Facility Management, won the so called “gif”-Real Estate Research Award for her Master’s thesis ‘Workplace utilization practices: a case study on the utilization of an activity-based flexible workplace in a Swiss company’. The prize was awarded in early October 2019 at the 15th Real Estate Symposium at the University of Regensburg.



Virna Monero Flores

Can the planets drive the sun into quiescence?

Research group Biomedical Simulation



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Research project
BISTOM – Bayesian Inference for Stochastic Models

Lead:
Dr. Carlo Albert, Eawag
Duration:
April 2018 – March 2020
Partner:
SDSC, Eawag, USI
Funding:
SDSC
(Swiss Data Science Center)

Everybody knows that planetary dynamics are driven by the gravitational forces exerted on them by the huge mass of the sun. But can a few tiny planets affect internal solar dynamics to a detectable level?

Understanding the sun’s magnetic activity is important because of its impact on the earth’s climate and environment. The longest direct record of solar magnetic activity is provided by sunspots observations, which reveal a well-known 11-year cycle modulated on longer time-scales and a puzzling 70-year-long quiescent period in the 17th century characterized by the nearly total absence of sunspots, known as the Maunder Minimum. Unfortunately, sunspot observations are limited to the past 400 years, since the invention of the telescope. This is obviously an extremely short window on astronomical time-scales, resulting in a substantial lack of information that has left solar astronomers “in the dark”: most observed phenomena, including long-term modulations and quiescent phases, have thus remained unexplained. However, recently, new exciting information has become available.

The sun: a noisy system

Sunspots are direct manifestations of strong internal magnetic fields breaking to the surface and releasing huge bursts of energy into space. The solar wind thus generated envelopes the earth (we can see it in the form of auroras, often referred to as polar lights) providing a shielding effect against galactic cosmic rays. Cosmic rays produce radioactive Carbon-14 and Berillium-10 nuclei in the earth’s atmosphere, are then stored in wood and polar ice cores, respectively. Cosmic rays are modulated by the solar wind and the production rates of radioactive isotopes are indirectly modulated by the solar magnetic activity. Time-series of cosmogenic radionuclides thus turn out to be an

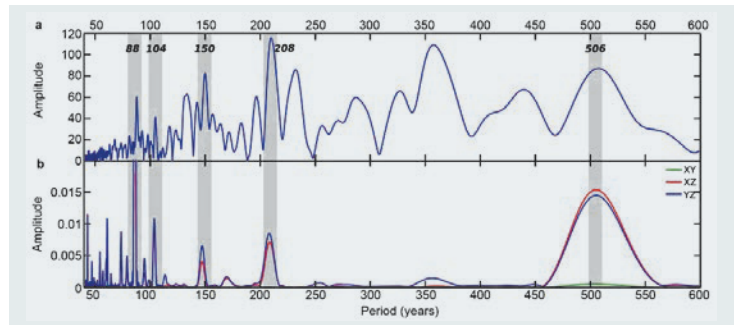


Fig. 1: The Fourier spectra of the solar magnetic activity (a) and of the planetary torque on the sun (b), calculated under three different conditions (not discussed here), reveal at least 5 matching periodicities. This correlation cannot be a mere coincidence. The solar activity calculation is based on 100k-year time-series of cosmogenic radionuclides. From: Abreu et al., Astronomy and Astrophysics 548, 2012

exceptional proxy for solar activity on unprecedented multi-millennial time-scales, up to one hundred thousand years. These time-series exhibit a variety of interesting features such as long stable cycles and many Grand Minima, that is, extended periods of very low solar activity similar to the Maunder Minimum. In a seminal and hotly debated paper by Abreu et al. (Astronomy & Astrophysics 548, 2012), the authors present new evidence (see Figure) that solar magnetic cycles and their minima might be associated with gravitational perturbations exerted by the planets on the sun. In a noisy system like the sun, it is possible that an inherently non-linear physics mechanism called *stochastic resonance* might boost an extremely tiny external periodic forcing to a level where its effects become observable. The question is still open and there is ongoing lively debate.

High performance computing is essential

The SCSC Swiss Data Science Center is funding a 2-year project for applying sophisticated Bayesian inference algorithms to the calibration of stochastic solar dynamo models on time-series of cosmogenic radionuclides. We have extended those methods with Machine Learning (ML) algorithms to compress long time-series into representative summary statistics. The coupling of Bayesian inference and ML methods make the

problem computationally extremely expensive and requires an extensive use of the newly-established ZHAW HPC (high performance computing) facility in Wädenswil. Among several project goals, we intend to test solar dynamo models including the periodic tidal torque of the planets. A better agreement with the data would substantially contribute to giving more weight to the planetary hypothesis. The solar physics community is waiting for new input. Our algorithms are running. ■

Agrolina – An Online Decision Assistance for Swiss Agriculture



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Climate change is putting pressure on agriculture. Harvest losses due to droughts, changing climatic conditions or other extreme weather conditions are constantly increasing. Swiss agriculture, for example, was affected by crop losses in the dry year of 2018. In response to the demand of the local actors facing challenges in food production, the Institute of Applied Simulation and the Institute of Natural Resource Sciences established with the industry partner Hydrolina the Innosuisse project “Agrolina”. Its purpose is to develop an information and data platform for agriculture. We are putting together an app and online information platform that assesses and visualises risks in agriculture; it is an integrated model combining reliable weather and seasonal climate forecasts, soil data and crop yield forecasts. Based on real-time and historical weather, climate, soil and crop data and machine learning algorithms, the system calculates expected weather and climate conditions and crop yields, and supports agricul-

ture with its real-time and online data in terms of production costs, irrigation management and required resources. By including users, who can manage and analyse their own data, the app provides a true information platform for agriculture. The information and data platform will thus help to plan ahead, to enable stable agricultural production, to mitigate the effects of climate change and to promote resource-saving and sustainable agriculture. ■

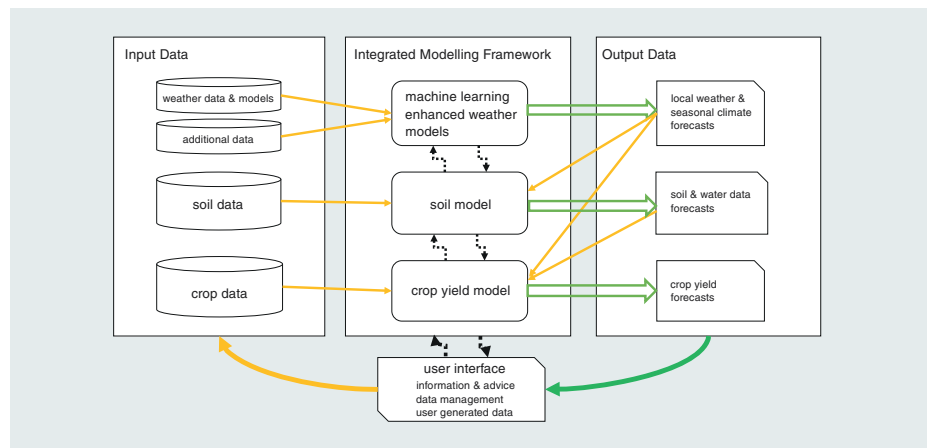


Fig. 1: Overview data and information processing platform

Repeat please!



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Protein repeats are abundant in all domains of life (Fig. 1), and are known for associations with diseases and immune functions. Tandem repeats have been successfully exploited in bioengineering due to modularity and designability. Matteo Delucchi and Maria Anisimova at the Applied Computational Genomics Team have concluded a large-scale study of protein repeats, their functional significance and mechanisms of their origin. For the first time, they systematically examined the interplay of tandem repeats with intrinsic disorder, and compared the repeat distributions of viral proteomes and their hosts. Based on state-of-the-art computational methods, the study unveils an unprecedented level of detail on the repeat universe. The results suggest that tandem repeats mostly originate by duplication and are involved in essential functions such as transcription processes, structural organisation, electron-transport, iron-binding and virulence. This work is funded by SBFI/SNF grant IZCNZO-174836, EU grant REFRACT H2020-MSCA-RISE-2018 and COST action BM1405. ■

Protein repeats are abundant in all domains of life (Fig. 1), and are known for associations with diseases and immune

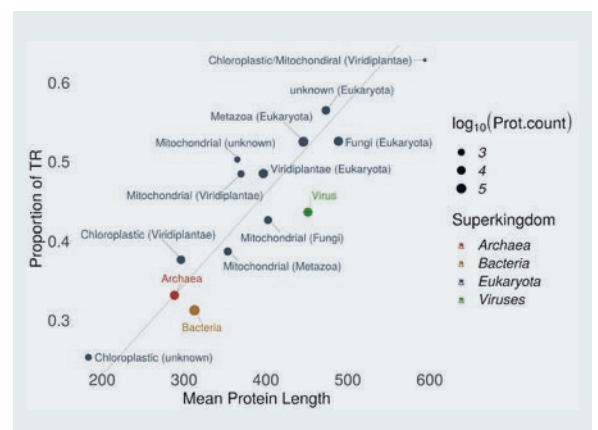


Fig. 1: Protein repeats are abundant in all domains of life. Displayed is the linear correlation of mean protein length vs. proportion of proteins containing tandem repeats (TR), from Delucchi, Schaper, Sachenkova-Lundström, Elofsson, Anisimova (submitted to Protein & Cell).

Anaerobic fungi: A bright future for bioenergy applications?

Environmental Biotechnology Unit



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Anaerobic fungi inhabit the digestive tract of various herbivore animals. They are recognized for playing a major role in the breakdown of lignocellulosic biomass by physical penetration and unique extracellular cellulolytic machinery. The unique metabolism, intensified degradation and syntrophic association with other microbes makes anaerobic fungi more beneficial for enhanced anaerobic digestion in various biofuel producing agro-industries.

Anaerobic fungi (AF) are one of the prominent members of the rumen and digestive tract of various ruminants, where they play a crucial role in initial degradation of lignocellulosic biomass (LCB). The study of anaerobic fungi has become the major interest of researchers worldwide for their ability to degrade lignocellulosic biomass by producing extracellular cellulolytic enzymes and for applications in biofuel production. AF are the initial degraders of plant biomass in rumen, by physical breakdown of lignocellulose and extracellular enzymatic secretion. AF can physically breakdown the lignin by invading the lignocellulose with the help of hyphae. AF produces extracellular carbohydrate active enzymes and a multiprotein complex called cellulosome. This unusual feature of external cellulosome has not been observed in other lignocellulose degrading fungal species.

Methanogenic archaea and anaerobic bacteria are known to have a synergistic correlation with anaerobic fungi, which prevents the product inhibition in AF. The lignocellulose degrading activity, growth and carbohydrate utilisation rate of AF was observed to increase in presence of methanogens.

The bio-augmentation of anaerobic fungi may create a new opportunity for enhanced methane production from various agricultural wastes. Sev-

eral attempts have been undertaken to improve the LCB degradation by augmenting AF in anaerobic biogas digester. However, the achievement of substantial fungal growth in a digester is still a challenging objective. Use of methanogen and AF co-culture is the promising approach for enhanced biomethanation from agricultural lignocellulosic wastes.

In a new project within ICBT's Environmental Biotechnology Lab, we aim to explore anaerobic fungi for distinct enzymatic activity and industrially valuable novel cellulolytic enzymes for enhanced bioprocessing of LCB. The interaction of the different organisms in the rumen especially between AF and methanogenic archaea are of great interest. This study could be crucial for future applications such as more efficient degradation of LCB, biofuel production as well as methane mitigation in ruminants to reduce greenhouse gas emissions. Anaerobic fungi have been growing semi-continuously for millions of years in their ancestral habitats. Mimicking this natural process to cultivate the AF semi-continuously in anaerobic digester for biofuel production shows great promise.

Cooperation with international project partners

The combined efforts of the most prominent research groups in Europe are uncovering the hidden potential of anaerobic fungi for its enhanced degradation of lignocellulose and biofuel production. The research group at Innsbruck University, Austria, headed by Prof Heribert Insam are experts in anaerobic microbiology, molecular detection methods and phylogenetics, whereas, the research group at Bavarian State Research Center for Agriculture (LfL), Germany, led by Dr. Michael Leubner is skilled with microbial culturing, anaerobic digestion and bioinformatics. The close cooperation of the different research groups brings together expertise from different scientific fields to investigate the potential and biotechnological benefits of AF. Further information about this project you find on the project-website:

www.hipoaf.com



Fig. 1: The microscopic image of *Orpinomyces joyonii* degrading the rice straw was captured by Akshay Joshi at Agharkar Research Institute, Pune, India.

Coffee without the bean

Coffee Excellence Center



Fig. 1: A fresh and aromatic cup of Atomo's molecular drip coffee



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Researchers at the Humboldt University in Berlin (Bunn *et al.* 2015) predict a global reduction in areas for coffee cultivation of about 50% mainly due to climate change. Today, production is challenged not only by climate change, but also high price volatility, low farmer's income, pests and diseases, rural depopulation and being replaced by more lucrative crops. Conversely, coffee consumption has been steadily increasing over the past decades, for example in China and countries in South East Asia, as well due to the global growth of the specialty segment. The NGO *Conservation International* extrapolates that demand for coffee will exceed the supply by a factor of three by 2050.

The Seattle-based startup *Atomo Coffee* might offer one solution to these complex problems. Atomo is the world's first molecular coffee, containing no coffee beans. The company has collaborated with the experts of the Coffee Excellence Center at the ZHAW, headed by Prof. Dr. Chahan Yeretzian, to create a naturally-derived and sustainable coffee that can be used in place of traditional coffee. The scientists of Yeretzian's group, Sara Marquart and Imre Blank, are using highly sophisticated analytical methods and strategies to reverse-engineer the coffee bean.

With the help of the Coffee Excellence Center, the goal is to build a consistently better cup of coffee that is also better for the environment, reducing the need for beans and thus minimising deforestation and destruction caused by commercial coffee farming and ensuring supply for the future of coffee. ■

Sustainable Chemical Processes through Catalysis

Competence Center for Biocatalysis (CCBIO)



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Plant fertilisers, electronic components, medicines and motor fuels – many everyday products result from chemical transformations. Establishing new strategies for sustainable chemistry is the focus of the new National Competence Center of Research "Suchcat" (Sustainable Chemical Processes through Catalysis), which is based at the ETH Zurich and at the EPF Lausanne and will be supported with 17 million Swiss Francs of federal funding (2020–2023).

The national network also involves the Competence Center for Biocatalysis at the Institute of Chemistry and Biotechnology. The CCBIO team will focus on the discovery, computer-aided optimisation and application of enzymes for the valorisation of renewable feedstocks and the manufacture of molecules with societal benefits. By tailoring the environmentally benign biocatalysts for chemical production, CCBIO will contribute to Suchcat's aim to create the scientific and technological bases to make chemical processes and products, and indeed the chemical industry more sustainable, resource-efficient and CO₂-neutral. ■

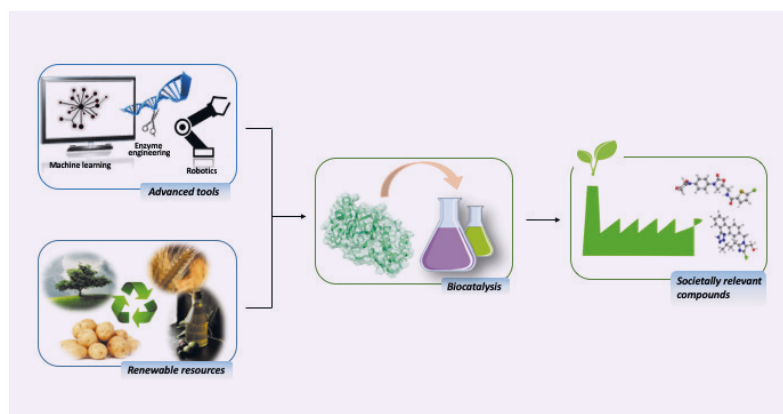


Fig. 1: Within the framework of the NCCR Suchcat, the CCBIO team will use advanced tools of bioinformatic and enzyme engineering to tailor biocatalysts for the sustainable manufacture of societally relevant compounds.

BIM trends for Smart City solutions

Real Estate Management Centre



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Smart City solutions for the whole life cycle management of real estate portfolios can be enabled by Building Information Modelling (BIM) which now has the potential to extend its applications when blended with latest complementary technologies. The related research outcomes were presented at the most important Smart Cities conference in North America.

Since the real estate industry is lagging behind when it comes to digital transformation, it has become essential to engage in conferences for the development and diffusion of new technologies as part of the process of implementation of good practices. An example is the contribution to the Ibero-American Congress of Technology and Innovation for the real estate industry framed under the umbrella term “Smart Cities” which took place in Guadalajara, Mexico. Responding to the invitation of the CITI AEC 2019 Organising Committee, the author presented her initial findings on the way BIM ecosystem could facilitate Smart City solutions.



From BIM to GeoBIM enabled Smart City solutions

Most real estate professionals focus on buildings even though real estate value is greatly influenced by the macro and micro location qualities. Consequently, the BIM processes are limited to improving the way buildings are designed, constructed and managed, through increased collaboration and so forth. However, BIM is not just about buildings; it is information modelling for the built environment. BIM platforms are starting to integrate information related to the urban context of real estate projects. On the other hand, GIS platforms are more detailed with the possibility to

integrate BIM models. Also known as the GeoBIM approach, this new integration supports sustainable development of cities which in combination with other trends, enable Smart City solutions.

BIM digital ecosystem for Smart Cities

As shown in the model below, BIM integrated with GIS can trigger Smart City developments when augmented by other digital trends, for example, extended realities, artificial intelligence, digital twins, Blockchain and so on. Based on a state-of-the-art literature review and an industry use cases review, the research identified seven digital development streams, which can extend the use of BIM in urban context to address sustainability challenges of real estate portfolios. These were identified in relation to user interaction, business models, financial and environmental modelling, whole life cycle phase, data use and stakeholder collaboration.

From the well-established BIM processes, as a step further in the real estate digital transformation, BIM has

extended its applications and impact into the whole life cycle management of real estate portfolios. This enables Smart City solutions by capitalising on blended technologies. One example is the transition from Project Information Models to Asset Information Models and ultimately Digital Twins of cities stored on decentralised data and collaboration platforms secured by Blockchain, an evolved form of a typical BIM common data environment. Furthermore, Extended Reality interfaces enable another level of interaction between the real urban context, the digital real estate and end-users.

To conclude, the technologies blend centred around BIM has unexploited possibilities in real estate. There is potential to develop new applications in urban projects such as real time life-cycle simulations, faster and more accurate valuations to maximise yields while minimising the environmental impact. The BIM digital ecosystem shows how integrating emerging technologies with BIM can make the transition from Smart to the next generation of Responsive Cities. ■

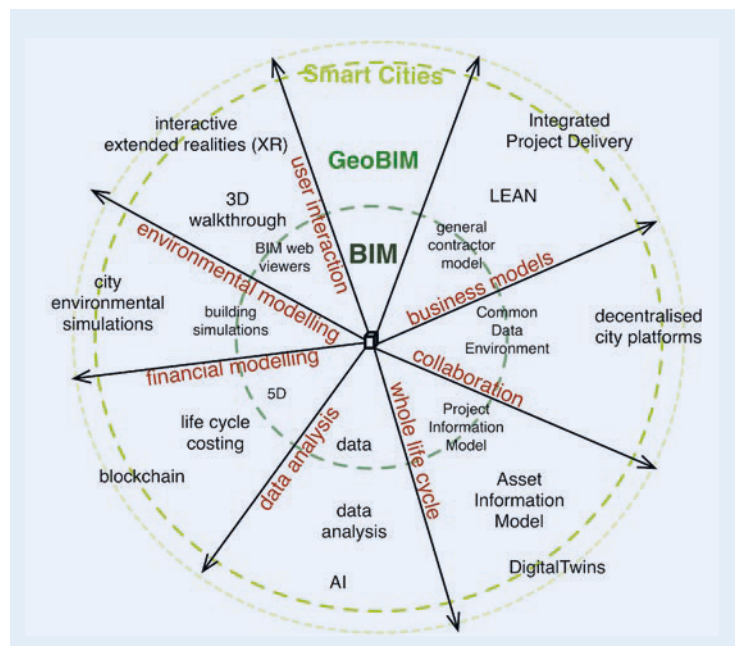


Fig. 1: BIM digital ecosystem for smart cities

Shedding light into the application thicket of hospitals

Competency Group Hospitality Management



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In a PhD thesis, a procedure reference model for the alignment of non-medical support service applications in hospitals was developed. It helps hospital ICT managers to align applications in a systematic, iterative manner and thus to improve transparency, stakeholder communication, resource management and controllability while reducing complexity, risk and cost. In so doing, the model can make a meaningful contribution to the development of a more effective healthcare provision.

Contributing in the background for a more effective healthcare provision

In hospitals, the application landscape is complex and – due to the fact that in the past ICT strategies were hardly ever holistically defined or implemented – often lacking transparency. At the same time, digitalisation currently poses various new challenges for healthcare organisations, both in the medical and non-medical context.

The goal was therefore to develop a model providing the necessary information about a standardised procedure and its significant aspects for aligning non-medical support service applications in hospitals so that relevant key performance indicators for systematic controlling and optimisation can be generated and configured as a basis for decision-making in the future. In a broader sense, the aim was to contribute to the development of a more effective healthcare provision and to bridge the gap between academia and practice.

Iterative, multi-methods approach

The model was developed based on a pragmatic philosophical grounding in a multi-methodological iterative approach including Design Science Research (DSR) principles for the modelling actions and mixed methods principles for the empirical research. In a first iteration, the relevance of the topic was researched in a survey. In a second iteration, the requirements for a possible model were determined by means of expert interviews based on which, in a third iteration, a procedure reference model was developed. In a fourth iteration, experts were asked to evaluate the model. Based on the findings, the model was then re-designed in a fifth iteration and in a sixth and final iteration, validated.

May I introduce: The model

The outcome of the thesis is the systematically developed and empirically validated “Procedure Reference Model for the Alignment of Non-medical Support Service Applications in Hospitals”, illustrated in Figure 1. The model comprises

- six component models,
- the metamodel
- two input documents and
- a documentation for application as integral parts.

All documents are available and downloadable under

zhaw.ch/ifm/fm-healthcare/procedure-reference-model

Most importantly

The key findings of the research were that

- the model implementation should be carried out in small steps, iteratively and with a long-term perspective
- the challenge of the context is not the technology, but rather the systematic stakeholder management
- the lead should be taken by someone who understands both the model and the business in addition to having the competence to influence the development together with the stakeholders involved
- the proper implementation causes an initial effort which, however, pays off mid- to long-term if done well.

Benefits for practice and scientific community

For practice, the benefit of using the model increases by the extent of the adaptation according to specific individual needs and by the degree of inclusion into the internal continual improvement processes. When applied regularly and competently, in a mid- to long-term perspective, the model can help to reduce complexity, increase transparency and security, improve stakeholder communication and controllability, optimise resources and thus to reduce cost. For the scientific community, the thesis contributes to the development of multi-methodological DSR approaches suitable particularly for complex and multi-disciplinary environments. ■

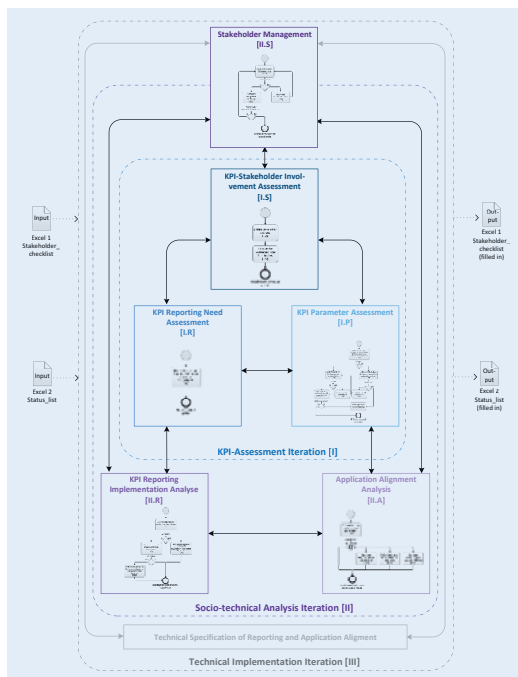


Fig. 1: Procedure Reference Model for the Alignment of Non-medical Support Service Applications in Hospitals

Fermentation to add value to plant by-product streams

Centre for Food Processing and Packaging & Centre for Food Safety and Quality Management



From left: **Ramona Rüegg, Pius Meier, Nadina Müller, Susanne Miescher, Sandra Schwenninger, Sandra Mischler**

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Research project
HiViscoFerm – highly viscous fermentations for the food industry

Head:
Dr. Nadina Müller, Susanne Miescher, Sandra Schwenninger

Project duration:
November 2018–July 2019

Water means life. At the same time, however, water is an important cost driver in the processing of food. Fermentation is a process step with great potential to facilitate the adding of plant by-product streams to the food value chain, thereby avoiding food losses. New concepts for the fermentation of grain by-products with minimal water content should make it possible to achieve an optimal product in terms of food quality and safety.

The principle “water means life” also applies to microorganisms and is a central factor in fermentation processes. Methods of fermentation have great potential in connection with the further processing of plant by-products such as wheat bran, barley flour or legume husks into food.

Use of protective cultures

The use of functional microorganisms, in particular in the form of protective cultures, is becoming increasingly important and, in addition to the positive influence on the sensory profile,

makes it possible to inhibit the growth of undesired microorganisms and to reduce the mycotoxins which (may) have already formed in the product. The latter are an important topic, especially with respect to grain by-product streams. Of the 142 million tons of wheat bran produced each year, around a quarter are contaminated with mould resulting from unfavorable weather conditions before the harvest, or improper storage conditions. These, in turn, can form mycotoxins, which are extremely difficult to remove from the product.

Cost efficiency in processing

On the other hand, water is often one of the main cost drivers in the processing of food. This is especially true if the product is then dried again to extend its shelf life. Precisely when it comes to valorising by-product streams, cost-effective processing is of the utmost importance. In spite of exciting additional functionalities, the resulting products are usually compared in terms of price with cheap, basic, raw materials such as flour, and tend to be sold in dry, powdery form.

Fermentation with minimal water content

The present collaboration between the Food Biotechnology Research Group and the Food Technology Research Group is focussed on the matter of fermentation with minimal water content. In the first project

phase, laboratory screenings were used to determine the minimum water content required to allow metabolic activity of fermentation-relevant microorganisms. The findings were transferred to a state-of-the-art solid fermenter to verify the results. This was followed by an analysis of the characteristic product properties with correspondingly low water contents. In particular, the properties relevant to processability were evaluated. Based on these findings, it was necessary to develop new fermenter concepts to enable the cost-effective production of fermented grain by-products as well as the scalability of the fermenters to the ton scale.

Goal: sustainable grain processing

In the next project phase, these concepts were tested and refined using prototypes, and microbial cultures for the fermentation of grain by-product streams were further optimised. In the future, the interplay between optimised crops and new fermentation concepts should allow the manufacture of products that are attractive in terms of their sensorial properties and of perfect quality, thus making the grain processing chain more sustainable. ■



Fig. 1: Fermentation of wheat bran in a solid fermenter to verify the minimum necessary water content which allows metabolic activity of fermentation-relevant microorganisms.

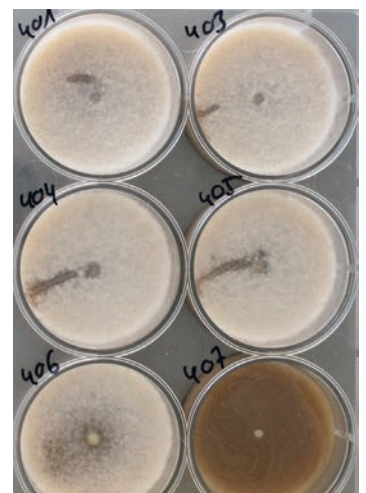


Fig. 2: Added value through antifungal lactic acid bacteria, visible in the strong inhibition of mould growth on the lower right.

Design of a cocoa aroma reference kit



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When it comes to understanding cocoa or chocolate aroma, appropriate tools are necessary. For this reason, a cocoa aroma reference kit has been developed in collaboration with the Swiss Chocolate Panel, with the purpose of being used as a tool for training and calibration of sensory panels. Although sensory reference kits for products such as wine, other alcoholic beverages and coffee are already on the market, our reference kit is the first targeting cocoa aroma and will be available via our home page soon. The reference kit has already been successfully applied in sensory trainings of cocoa producers in the countries

of origin and also for the establishment of the gas-chromatography olfactometry panel at the ZHAW Institute of Food and Beverage Innovation. Additionally, it is planned to use this tool in education formats, such as ZHAW sensory chocolate tasting courses as well as the science week, and whenever it is easier to experience cocoa aroma than to explain it. ■



Fig. 1: Picture of selected aroma reference compounds of the kit. The labels were designed in collaboration with the graphic designer Sylvie Lüscher (Sylvie.ch).

Food contact material course



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Increasing trade between the EU/Switzerland and China has led to a growing interest in understanding the differences and similarities in food contact regulations in both areas. In collaboration with the National Reference Laboratory for Food Contact Material in China and the Swiss Quality Testing Services a new training course will be organized at ZHAW Wädenswil. The course will provide insights about food and packaging technologies, and help to improve the understanding of the link between food contact regulations and packaging applications. Particular emphasis will be given to compare food contact material regulations in the EU with those in China. Additionally, the lectures will cover migration topics and sustainability approaches for food contact materials. The course is especially designed for people from food or packaging companies involved in exporting/importing goods between the EU and China, as well as those who are interested in the differences and alignments between the food contact material legislations in the EU and China.

zhaw.ch/ilgi/fcm-eu-cn

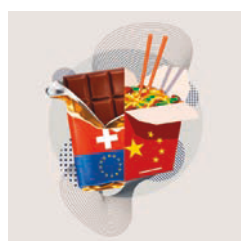


Fig. 1: Training course for "Food contact material legislation in Europe/Switzerland and China – Differences and Alignments"

Authorisation of Novel Foods in Switzerland



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Since 1 May 2017, the regulatory provisions pertaining to novel foods have been in force in Switzerland; this is due to the entry into force of the comprehensive regulatory overhaul of Swiss food legislation. Novel foods are defined in Art. 15 of the Ordinance on Foodstuffs and Utility Articles (FUAO; CC 817.02) [1]; these are foods that were not used for human consumption to a significant degree within Switzerland or a member state of the EU before 15 May 1997 and which fall under one of the categories in Art. 15 para. 1 FUAO. According to Art. 16–17 FUAO, these foods are subject to authorisation which is regulated in the Ordinance on Novel Foods (CC 817.022.2) [2]. The Federal Food Safety and Veterinary Office (FSVO) grants the authorisation if the safety of the foodstuff and protection against deception are guaranteed, which must be proven by the food business operator.

Therefore, if a food in question has not already been approved as a novel food the novel food status must be established, i. e. it must be determined whether the food falls under the regulations for novel food, or not. The Centre for Quality Management and Food Law supports companies in this step, which – depending on the type of product – can be a demanding undertaking. In addition, the Centre also assists in the

preparation of applications for approval, considering the legal and other requirements (e. g. publications of the European Food Safety Authority, EFSA).

One example concerns the bulb of the David's lily (*Lilium davidii*), which has long been part of Chinese cuisine and is now planned to be marketed in Switzerland. The Centre for Quality Management and Food Law supported the food business operator in the development of the dossier regarding determination of the novel food status as well as the actual application dossier; also in the context of a student project. The FSVO has recently classified this product as a traditional novel food according to Art. 15 para. 1 let. k FUAO; the substantive assessment of the application is still in progress. (Status: January 2020). ■

[1] Ordinance of 16 December 2016 on Foodstuffs and Utility Articles (FUAO), CC 817.02; Status on 15 October 2019.

[2] FDHA Ordinance of 16 December 2016 on Novel Foods, CC 817.022.2; Status on 1 May 2018. Abbreviations: CC Classified Compilation [of Swiss federal legislation]/FDHA Federal Department of Home Affairs



Fig. 1: Freshly harvested lily bulbs for food purpose in China.

i-Tree - ecosystem services of urban trees



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Fig. 1: The pressure arising from human activities and the reflection of thermal radiation from urban infrastructure will continue to increase in the future. Climate-adaptive planning ensures that trees are able to grow to full maturity. (Daniel Bösch, ZHAW)

Research project
Manage ecosystem services of urban trees and forests in a climate-adaptive manner

Project leader:
Andrea Gion Saluz,
Planting Design Research
Group

Project duration:
November 2018 –
December 2021

Partners:
Pan Bern AG, Arbor Aegis

Funding:
Pilot project – adaptation to
climate change, FOEN Federal
Office for the Environment

The “i-Tree” software programme, which was developed in the USA, enables a quantitative assessment of the ecosystem services of urban trees and forests to be made and these to be given a monetary value. The programme, financed by the Federal Office of the Environment, is being implemented for the first time in Switzerland using Swiss climate and population data. The data recorded pertaining to ecosystem services form the basis for the development of instruments for the sustainable planning of urban green spaces.

Urban trees and forests

Urban green spaces, and especially urban trees, are of increasing importance and usefulness to society, be it due to the aesthetics of a mature tree, the increase in well-being or the climate-adaptive ecosystem services. The latter will continue to grow in importance, due to the effects of climate change. In urban locations, trees only achieve around 25 percent of their potential lifespan, which is problematic because trees only reach their full ecological potential after 50 years. The project presented here provides analytical tools and recommendations that can lead to a more adaptable, sustainable, and therefore more durable, urban ecosystem. The development of climate-adaptive

management strategies for urban trees and forests is forward-looking. The basis for this is a comprehensive knowledge of their ecosystem services, i. e. benefits that humans can directly gain from the environment. In the case of urban trees, this includes filtering air pollutants, evaporation rates as well as providing shade and the associated temperature reduction.

The i-Tree programme

The i-Tree programme is used to document these ecosystem services and to process the necessary data. i-Tree is a peer-reviewed software programme (2006) developed in the USA, which can quantitatively calculate and illustrate the ecosystem services of trees. Basic data from qualitative and quantitative recordings of trees recordings, as well as climate and population density from the respective countries, are used for the calculations. This ensures local and individual calculations leading to sector-specific approaches. The ecosystem services of the trees can be quantified and given an equivalent monetary value using selected parameters.

Implementation in Switzerland

The “i-Tree” – climate-adaptive management of ecosystem services of urban trees and forests project will work on the basis of six pilot cities. The project quantifies and gives a monetary value to climate-relevant ecosystem services of urban trees and ur-

ban forests. Specific parameters and fundamentals of these cities are examined, the ecosystem services are recorded, modelled and processed in a target group-specific manner in order to derive a climate-adaptive management approach. The results serve to help develop implementation strategies. These strategies take into account the needs of urban trees as well as those of society and the economy in the face of today's challenges, e. g. climate change or cuts in the maintenance budget of green spaces. With i-Tree's economic basis of argumentation, political and economic developments can be influenced and sustainable planning concepts launched and consolidated. The monetary evaluation of the services and functions of urban trees using the same methodology is a novel approach and can be used in various forms.

Outlook

Initial results are expected at the end of 2020. The project, on the basis of i-Tree, provides the opportunity to develop such planning concepts in Europe for the first time. This approach can also be seen internationally as a model. In view of the need for international cooperation (action plan 2014 to 2019 to adapt to climate change in Switzerland), this project thus makes an important contribution to the international exchange of experience. ■



Fig. 1: "Cause We Care" is committed to more sustainable tourism. Photo: © Frank Brüderli

Climate Protection in a World Heritage Site



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Climate change is particularly noticeable in tourism. We perceive the changes in the landscape when traveling, while at the same time, tourism contributes to these changes. It causes CO₂ emissions, especially upon arrival and departure, transportation and engaging in

local activities. The myclimate initiative "Cause We Care" [causewecare.ch](https://www.causewecare.ch) is committed to curbing these negative effects on the climate. It makes it possible to offset CO₂ emissions caused by tourism while at the same time supporting sustainable activities undertaken by local tourism companies. The idea is that tourists and companies act jointly to reduce greenhouse gases and make tourism more environmentally sustainable. The guest makes a voluntary contribution that is matched by the tourism company, thereby doubling the overall contribution made. Both flow into a fund that supports both myclimate climate protection projects and the operational sustainability of tourism companies. Since the start of the pilot phase in 2017, 345'000 climate-neutral bookings have generated CHF 455'000 in Switzerland. The ZHAW Tourism and Sustainable Development Research Group provides scientific support for "Cause We Care" and develops recommendations for further advancement of the climate protection initiative. ■



Fig. 1: Prototype of the LaundReCycle on the Grüental campus, Photo: © Devi Bühler

LaundReCycle – Water after "Day Zero"



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"Day Zero" was the name given to the day on which the water ran out during the water crisis in 2018 in Cape Town, South Africa. Thanks to strict austerity measures, a state of absolute emergency was narrowly avoided. Since then it has become clear as never before: investments in new infrastructure and the development of new solutions are urgently needed. This is where the LaundReCycle project comes in. In cooperation with South African partners, the Ecotechnology Research Group is developing a washing machine operation which is self-sufficient in terms of water and energy. This does not need a connection to power, fresh water or a waste water disposal system. In the resource-saving cleaning process, the water is filtered after the wash cycle, skimmed off, biologically cleaned and can thus be reused directly for the next wash. Water losses are compensated for by rainwater. The solar panel provide the energy necessary to operate the washing machine and pumps. The prototype has recently been located at the ZHAW Grüental campus in Wädenswil. The project is part of the government-funded REPIC platform [repic.ch/repic-en/](https://www.replic.ch/repic-en/) and aims to develop the LaundReCycle innovation in South Africa into a marketable solution. ■

A "Green Hospital" is on its way



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From an environmental perspective, the health sector is the fourth most important consumer area in Switzerland. But which processes in a hospital are particularly environmentally-relevant and how can they be made more environmentally-friendly? The "Green Hospital" project combines environmental assessment with practical knowledge and implements concrete measures in conjunction with

partner hospitals. In autumn 2018, the data for a comprehensive environmental assessment was collected in two hospitals. The results show that infrastructure, food, heating and electricity consumption are the most polluting aspects. Wastewater, refuse and the requirement for medical consumables and medicines are also relevant. Other areas, such as paper consumption, are insignificant from an environmental perspective. In order to estimate the results across Switzerland, an online survey was sent to all Swiss acute care hospitals. The evaluation of the survey will be published next year at [greenhospital.ch](https://www.greenhospital.ch). The project is part of the National Research Program "Sustainable Economy" (NRP 73) of the Swiss National Science Foundation (SNSF). ■

Total environmental impact per area	
Building infrastructure	!!!!
Catering	!!!
Heating & electricity	!!!
Medical products	!!
Waste & waste water	!!
Pharmaceuticals	!!
Textiles & Laundry	!!
IT infrastructure	!
Housekeeping products	!
Patient transport	!
Paper use	!
Water use	!
!!!! = very high	
!!! = high	
!! = moderate	
! = low	
! = negligible	

Fig. 1: Environmental relevance of different hospital areas. Provisional results calculated using the ecological scarcity method. Graphics: Karen Muir

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- Cell biology and tissue engineering
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- Tourism and sustainable development
- Urban ecosystems

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