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**Life Sciences and
Facility Management**

TRANSFER

**English edition
2022**

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

Computational Life Sciences

Chemistry and Biotechnology

Facility Management

Food and Beverage Innovation

Natural Resource Sciences

Interdisciplinary Research in Health

The strategic initiative Health Research Hub is driven by researchers of the ZHAW School of Life Sciences and Facility Management to support interdisciplinary research in the field of health and increase its visibility. Health Research Hub connects different research groups with the ZHAW, supports their collaboration and develops an institutional network around health-related research. The initiative focuses on identifying synergies between the various research groups to unveil yet untapped potential within the school. For this purpose, new interdisciplinary teams have been formed which have proposed novel directions in health-related research based on the combined strengths of the contributing researchers. The initiative continues to be active in promoting these projects and anchoring them in overarching research platforms at ZHAW level and beyond.

Seven synergistic projects have received support, addressing current topics in health-related research.



Lars Fieseler,
Institute of Food and Beverage Innovation

Engineered bacteriophages for the control of *E. coli* O157

Bacteriophages are bacterial viruses that are attracting increasing attention worldwide as a promising alternative to conventional antibiotics. This

project aims to genetically engineer bacteriophages for better control of the pathogenic bacterium *Escherichia coli* O157 and its toxins. Large-scale phage production technologies will be further developed, compatible with the requirements of the pharmaceutical industry.



Manuel Gil,
Institute of Computational Life Sciences

Computational literature-based natural product drug discovery

Literature Based Discovery (LBD) has become widespread, but little has been done to automate it in the field of Natural Product Drug Discovery. The goal of this project is to devise an automated LBD system for natural product drugs. This system can be used not only for new discoveries, but also to query and explore existing knowledge.



Andreas Lardos,
Institute of Chemistry and Biotechnology

Fighting bites with bytes – Promoting public health with crowdsourced tick prevention

Ticks are currently on the rise and transmit several infectious diseases. This project team is developing a spatio-temporal tick risk model, based on data collected from the Swiss tick app, to help reduce the risk of tick-borne diseases. The newly-developed model and methods will stimulate the interest of the general public due to its Citizen Science aspect and address an emotionally charged health topic that has become everyone's concern.



Theo Smits,
Institute of Natural Resource Sciences



Georg Spinner,
Institute of Computational Life Sciences

Bayes network analysis for data-driven decision support in healthcare and hospital catering

Constantly rising costs in the healthcare sector require economic action without compromising the quality of care. This project examines Bayesian Networks when applied to data in the health context. The resulting models will allow conclusions to be drawn about how various factors influence one another directly or indirectly, and contribute towards patient-centred and resource-optimised services in health institutions.



Nadina Müller,
Institute of Food and Beverage Innovation

Strategies to reduce mycotoxins in grain side-stream products enabling their reintroduction into the food value chain

Food safety has become a major challenge with respect to crops in recent years. This project aims at developing solutions to reduce mycotoxins in grain through the application of functional microorganisms and/or tailored enzymes. Through sophisticated analysis, the effectiveness of the newly developed processing approaches will be determined. As a result, the safe use of whole grain and wheat will be enabled, contributing to a more sustainable food value chain.



Sabina Gerber,
Institute of Chemistry and Biotechnology

Molecular mechanism of bacteriophage tail spike proteins in bacterial infection

Bacteriophages selectively kill bacteria. Their high specificity for the host bacteria is an important attribute for their application in medicine. Infection of hosts by phages is known to be mediated by tailspike proteins, among others. This project's goal is to understand the molecular basis of the first steps in infection through development of novel, quantitative bioanalytical methods using tailspike proteins produced in a phage-free context.



Martin Sievers,
Institute of Chemistry and Biotechnology

Silent pathway awakening to discover novel antibacterial compounds from actinomycetes

Many disease-causing bacteria are currently developing antibiotic resistance and thus new antibiotics are urgently needed. This project team is studying the production of novel compounds from actinomycetes. A structure-activity relationship of the new antibiotics is being established to optimise their medicinal chemistry profiles toward clinical use, which is the next critical step towards the development of antibiotic drugs.

Imprint

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News

New Master's degree in Sustainability – Entrepreneurship – Food

The specialists trained in the new master's programme 'Preneurship for Regenerative Food Systems' come up with solutions to effectively counteract the growing climate problem and the scarcity of resources, taking socio-economic aspects into account. The main competency of the graduates lies in the regenerative design of agro-food systems – by initiating, developing and implementing interdisciplinary and innovative business models.

➔ zhaw.ch/lsfm/master



New MOOC on Cell Cultivation Techniques

The third massive open online course (MOOC) of the ZHAW will start on May 2 on edX.org, called 'Cell cultivation techniques – An Introduction'. The course is aimed at students and continuing education participants around the world with a biological or technical background. In addition to the basics of biochemical engineering, the fundamentals of cell cultivation will be presented. The focus will be on mammalian suspension cells, human mesenchymal stem cells and plant cells. The course has been developed by the ZHAW Institute of Chemistry and Biotechnology, Center for Biochemical Engineering and Cell Cultivation Techniques in collaboration with the Center for Innovative Teaching and Learning.

Contact: Rüdiger Maschke (masc@zhaw.ch), Minna Koponen (kopo@zhaw.ch)



New bachelor's degree 'Applied Digital Life Sciences'

In autumn 2022, the course, which is unique in Switzerland and combines life sciences, data science and digitisation, will start for the first time. Scientific skills are combined with various digital tools and data-based methods. Students conduct research in the laboratory and in the environment, and at the same time, acquire skills in programming, artificial intelligence, data

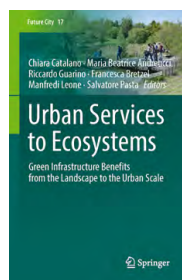
engineering, modelling and simulation. The bachelor's programme is characterised by its roots in the life sciences, encompassing the fields of biology, environment, biotechnology, chemistry, food technology and health.

➔ zhaw.ch/lsfm/bachelor



New book: Urban Services to Ecosystems

In order to highlight the multifaceted aspects of the Green Infrastructure concept, the book contains contributions written by vegetation and urban ecologists, agronomists, urban foresters, architects and landscape architects.



The book's 26 chapters were blind peer-reviewed by the editors as well as by independent parties. Chiara Catalano from the Institute of Natural Resource Sciences is one of the editors. The book involves 75 authors and presents the experience from 14 countries, grouped in the following three thematic sections: Green Infrastructure, Urban Ecology and Vegetation Science; Planning and Implementation of Green Infrastructure; Nature-based Solutions and Innovative Design Approaches.

Contact: Chiara.Catalano@zhaw.ch
➔ link.springer.com/book/10.1007/978-3-030-75929-2



Master's programme «Real Estate & Facility Management»

The innovative Master's degree in 'Real Estate & Facility Management' is a collaboration between the ZHAW Institute for Facility Management in the School of Life Sciences and Facility Management, and the Department of Banking, Finance, Insurance of the School of Management and Law. It is the first master's course in Switzerland to combine the areas of real estate and facility management, economics, finance, operational technology/IT and services with the megatrends of sustainability and digitisation.

➔ zhaw.ch/ifm/master

How the planets could drive the sun into quiescence. Good news for our climate?

Research group Biomedical Simulation



Dr. Simone Ulzega,
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Research project
**BISTOM – Bayesian
Inference for Stochastic
Models**

Lead:
Dr. Carlo Albert, Eawag
(ETHZ)

Duration:
April 2018 – April 2021

Partner:
SDSC, Eawag, USI, Instituto
de Astrofísica de Andalucía,
University of Vigo, Leibniz
Institute for Solar Physics

Funding:
SDSC (Swiss Data Science
Center, ETHZ)

A new theory is breathing new life into the controversial hypothesis that the planets affect solar magnetic activity. It sets out a complex mechanism by which a large system as the Sun can nevertheless be affected by the extremely tiny gravitational forces of its planets. If confirmed, the theory could lead to more accurate predictions of solar activity.

In 2012, ETH Professor Jürg Beer published new evidence supporting the old and fiercely debated hypothesis that the planets could influence the activity of the Sun (Astronomy & Astrophysics 548, 2012). Prof. Beer and his collaborators were able to reconstruct the cycles of solar magnetic activity over the last 10,000 years by analyzing cosmogenic radionuclides (beryllium-10) concentrations in ice cores and comparing them with the tremendously small tidal forces exerted by the planets on the sun. The correlation was astonishing. Solar activity and planetary motions therefore present very similar periodicities, which clearly suggests a relationship between them. This raised hopes of being able to predict the long-term cyclical fluctuations of the solar activity based on the well-known planetary motions.

New theory for a controversial hypothesis

However, the so called “planetary hypothesis” is highly controversial in the scientific community. Many researchers argued that the influence of

the planets is far too small to have an observable effect on solar activity. But now, in a large international collaboration we have found an explanation of how the tiny effects of the planets could nevertheless influence the activity of the much larger Sun: *Stochastic Resonance*. Under certain conditions, the phenomenon can greatly amplify weak external periodic signals to a level where they have significant consequences.

So how does this work for the Sun and the planets? Solar activity follows a well-known 11-year cycle. However, there are other cycles. Using complex mathematical models, we showed that the Sun basically has two stable states of activity in the 11-year cycle, that is, an active state with high solar activity, and a quiescent state with lower solar activity. This is known in physics as a *bistable* system. The Sun jumps back and forth between these two states due to turbulences in its interior. Since turbulences are random, these jumps should be completely irregular and unpredictable.

Planets set the pace

However, Beer’s beryllium-10 data suggest that the change of states does not happen purely at random, but with a rhythm of about 200 years. This would be a longer 200-year cycle superimposed on the 11-year cycle. Jürg Beer and his colleagues have proposed the idea that the planetary tidal forces are responsible for this additional rhythm. Now our theory provides a possible explanation. Indeed, under suitable conditions, noise in a bistable system can massively amplify

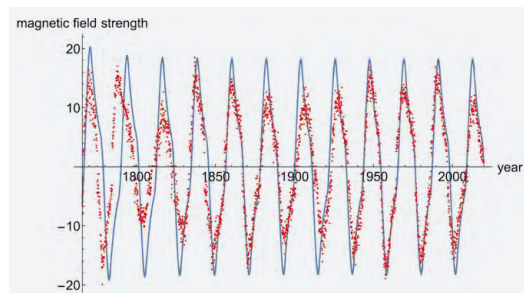
the influence of a periodic driver. This is called *stochastic resonance*. The turbulences inside the Sun (the noise) would thus amplify the weak influence of the planets (the periodic driver). In this way, the plan-

ets would enforce their beat on the Sun’s random switches between the two states of activity and regulate the pace of solar activity.

Our new theory was recently published in the prestigious *Astrophysical Journal Letters* (Albert et al., ApJL 916, 2021) and appeared in the Spanish edition of *National Geographic*. In a next step, we will investigate to what extent our stochastic model can be used to reproduce observations of solar activity over the past centuries. This data-driven calibration of a stochastic model is a computationally challenging task that will require sophisticated algorithms and the resources of the ZHAW HPC (high performance computing) facility. It would back up the theory and naturally lead to a further step, namely the prediction of solar activity for the coming decades and centuries.

Are we observing a transition to a phase of weak solar activity?

Such a forecast would be of great interest. According to Beer’s hypothesis, which is now supported by our theory, we are at the end of an active phase with a large amplitude of the 11-year cycle, and we should slowly be heading for a phase of weak activity. Such quiescent phases are called *Grand Minima*. Current sunspots observations seem to confirm that the 11-year cycle is weakening. The near-future evolution of solar activity is particularly interesting because the last occurrence of a grand minimum about 400 years ago is associated with the Little Ice Age in large parts of Europe, even if this connection has not yet been clearly proven. In a time of dramatic climate change, a slowdown in solar activity would of course be beneficial. Although it would hardly be able to compensate for anthropogenic global warming, it might be able to temporarily slow it down a little, thus buying us some precious time in the race to reduce greenhouse gas emissions. ■



Our model (blue) can accurately reproduce the solar sunspots record (red) over the past ~300 years. We aim at obtaining such a good fit using radionuclides-based data for the past 10,000 years and beyond.



Plant roots (Source: Colourbox)

Digital Tools for Codon Optimisation: Exploring Biotechnology's Potential for Negative Emission Technologies



Victor Garcia,
Research Associate, gara@zhaw.ch

This project proposes to develop, study and apply mathematical models to optimise the protein production of a gene originating from one organism in another organism. These models will take into account both the cost of nonsense errors and the ribosomal overhead costs in the cell's mRNA translation process. The focus will be specifically on genes involved in the biosynthesis of suberin. Suberin is a high-carbon, rot-resistant biopolymer found primarily in the epidermis of plant roots or in the bark of trees. Due to its chemical properties, suberin can support the long-term storage of carbon in the soil and thus serve as a soil carbon sequestration enhancer (SCS). SCS is a widely studied negative emission technology (NET). NETs are technologies that actively remove greenhouse gases from the atmosphere and play an important role in scientific models. NETs, if deployed on a large scale, can contribute to climate stabilisation in line with the Paris Climate Agreement. ■

Softscope – Automatic evaluation of microscopy images



Adrian Busin,
Research Associate, Data Management & Visualization Research Group, busi@zhaw.ch

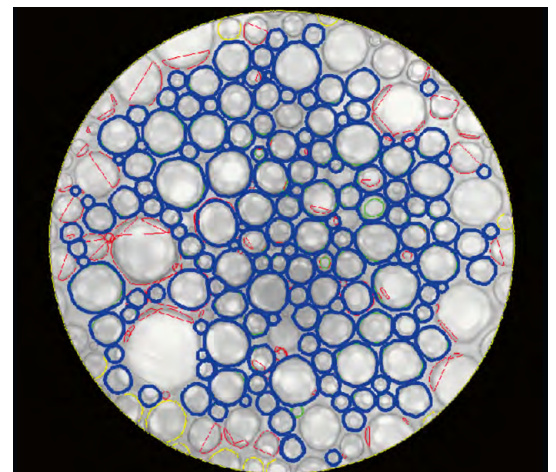


Dr. Robert Vorburger,
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Dr. Matthias Kinner,
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Digital, high-resolution microscopy images serve as an important analytical data basis in many areas of the life sciences. Most of the evaluations are still carried out manually. Shapes and structures of the objects to be examined are recorded and measured by hand. This is not only difficult to reproduce, but due to the ever-increasing number of images, it is also practically impossible to do in terms of time. In the Softscope project, the Data Management & Visualization Research Group of the Institute of Computational Life Sciences, in collaboration with the Food Technology Research Group of the Institute of Food and Beverage Innovation, has developed software for the automatic evaluation of microscopy images. An image processing pipeline provides a generic approach for the qualitative processing of the images, for the recognition of objects and the determination of shape parameters. By configuring a large number of process parameters, the evaluation can be optimised specifically for particular applications – such as the analysis of foams and emulsions in food research. ■



Food foam, magnified 4 times © ZHAW LSFM

Enzymatic Late-Stage Functionalization of an Antifungal Natural Product

Competence Center for Biocatalysis



Prof. Dr. Rebecca Buller,
Head of Competence Center
for Biocatalysis, bull@zhaw.ch



Johannes Büchler,
Research Associate,
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Research project Engineered halogenases for the late-stage functionalization of added-value chemicals

Lead:

Prof. Dr. Rebecca Buller,
Competence Center for
Biocatalysis

Duration:

Jan 18 – Dec 12

Partner:

Competence Center for Biocatalysis: Johannes Büchler, Dr. Sumire Honda Malca, David Patsch, Dr. Moritz Voss, Prof. Dr. Rebecca Buller
Syngenta Crop Protection AG: Dr. Camille Le Chapelain, Dr. Olivier Loiseleur

Funding:

Federal project contributions 2017–2020, P-14: Innovation in Biocatalysis; NCCR Catalysis (SNF Grant number 180544)

Soraphen A, a complex natural product, shows antifungal activity against several phytopathogenic fungi. Even though highly potent, the further development of this natural product as an antifungal agent has been hampered due to off-target selectivity concerns and sensitization in mammals. Modified lead structures with altered biological activity are therefore sought after.

Enzymatic modification of soraphen A

The synthesis of new soraphen A lead structures is challenging due to the chemical complexity of this natural product. Employing regio- and stereospecific enzymes for the molecules' late-stage diversification thus appears to be an appealing strategy to access a broader molecular diversity. In this context, the incorporation of halogens is of specific interest as these atoms do not only modulate the biological activity of small molecules but can also be used as synthetic handles for further modification. In our project, we therefore set out to screen a diverse halogenase enzyme library for the ability to halogenate soraphen A. We identified an engi-

neered halogenase variant, named WelO5* V81G/I161P, which was able to chlorinate the target molecule. An enzyme engineering approach based on a combination of smart library design and machine learning was employed to improve the observed initial chlorination activity of the enzyme. For this purpose, a homology model of WelO5* V81G/I161P was created and soraphen A was docked into the active site identifying amino acid 81, 88 and 161 as promising targets for diversification (Figure 1a). Based on this analysis, we created a combinatorial enzyme library in which each of the three positions was fully randomized to all 20 natural amino (20³ = 8000 possible variants).

Enzyme optimisation

The screening of the 504 unique variants showed the presence of enzyme variants capable of forming two chlorinated soraphen products (1a and 1b, Figure 1b) and two hydroxylated soraphen products (1c and 1d, Figure 1b). Using the activity data of the 504 screened variants as training set for machine learning algorithms, we investigated the remaining sequence space *in silico*. In this way, we could identify both more active and more selective variants.

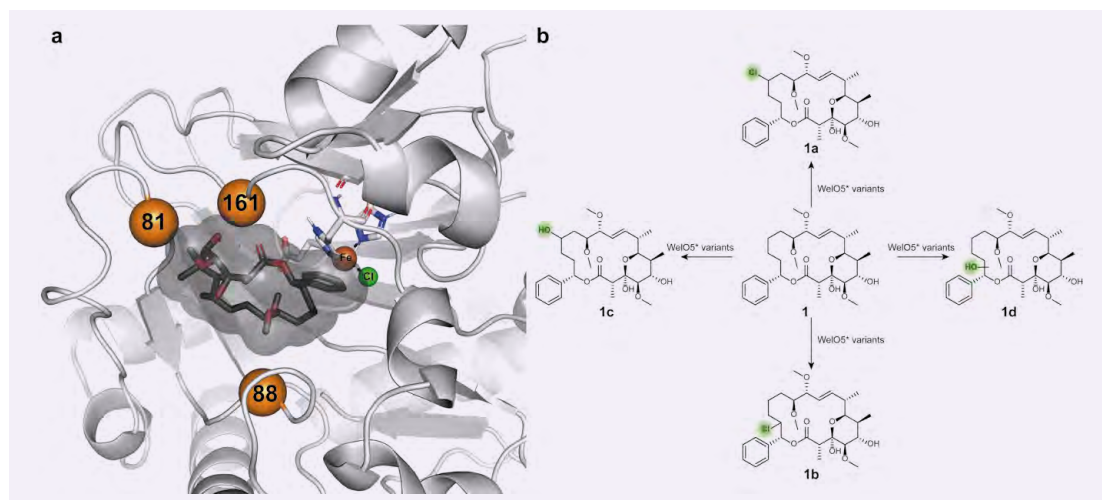
Biological activity of modified soraphens

With the improved halogenase variants in hand, biocatalytic reactions were scaled up and the products were isolated for biological testing. The functionalized soraphens were tested on six different fungi representing key pathogens in crop protection causing a large spectrum of crop diseases. Remarkably, all chlorinated analogues conserved a good level of activity on most fungal pathogens, which is unprecedented to date for derivatized soraphen analogues.

In summary, the observed modulation of the soraphens' biological activity which highlights the value of enzymatic late-stage functionalization. The targeted regions of the natural product structure by the enzyme variants would have been very difficult to obtain by chemical synthesis. In addition, our results underline the possibility to engineer enzymes for the selective functionalization of complex molecules.

Reference

Büchler, J. et al. Algorithm-aided engineering of aliphatic halogenase WelO5* for the asymmetric late-stage functionalization of soraphens. *Nat. Commun.* **13**, 371 (2022).



a Identification of target sites for enzyme engineering via docking of soraphen A in a model of WelO5* V81G/I161P; **b** Observed products upon biocatalytic derivatization of soraphen A with different WelO5* variants.



With indigo molecules, self-organized layers can be produced that show very good sliding properties. (Photo: Skier Source Colourbox, drawing of molecule in the picture D. Brühwiler)

Fast on snow with indigo



PD Dr. Dominik Brühwiler,
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The fluorinated ski waxes commonly used today are problematic in terms of occupational hygiene and ecological issues. As a result of the ban on perfluorooctanoic acid (EU, 2020), a move away from poly- and perfluorinated substances is inevitable. In fact, starting next season, fluorine-free waxes will have to be used in all competitions organised by the international ski association FIS. In collaboration with the company Isantin, the Swiss Ski Association Swiss-Ski, the Institute for Snow and Avalanche Research SLF and the Eastern Swiss University of Applied Sciences, we are developing an environmentally-friendly and toxicologically harmless high-performance lubricant based on the organic pigment indigo. Through intermolecular interactions, indigo molecules form self-organized layers that exhibit very good sliding properties. These layers are only a few micrometres thick and extremely abrasion-resistant. Contrary to the colourful idea, the skis treated with indigo do not actually leave blue traces in the snow.

doi.org/10.3390/ma15030883

Development of generic drugs



Dr. Christian Frech Nabold,
Lecturer, freh@zhaw.ch

Active Pharmaceutical Ingredients (API) are substances, or mixtures of substances, which are used as an active ingredient in the manufacture of pharmaceuticals and are intended to have a pharmacological effect or another direct effect in the diagnosis, cure, alleviation, treatment or prevention of diseases. Drugs that are manufactured with the active ingredient of an original preparation and that correspond to the original in terms of composition, quantity, dosage and galenic formulation are called generics. Drug synthesis is usually a complicated and multi-step process involving numerous chemical transformations and operations on a range of raw materials with different physical and chemical properties, but must not violate existing patents, which is often the real challenge of drug synthesis.

Christian Frech Nabold's research group, together with AZAD Pharma AG, has successfully submitted an Innosuisse project with the aim of developing a new synthesis route for a pivotal intermediate product. From this, several active pharmaceutical ingredients are to be made accessible at low cost. ■



Ultralight chitosan nanofiber sponge supported by the pistils of a steeplebush (*Spiraea*)
(Reprinted with permission from DOI: 10.1021/acsapm.1c00799 Copyright 2021 American Chemical Society.)

Filtering according to the oyster principle



Prof. Dr. Christian Adlhart, Head, Centre for Functional Materials and Nanotechnology

To feed, oysters filter several hundred litres of water per day. As part of a BIOMAT project, researchers from the Centre for Functional Materials and Nanotechnology wanted to find out whether they could construct a similar filter to rid water bodies of microplastics. For this purpose, they used the technology of highly porous, flexible nanofiber sponges. In order not to additionally pollute the water with the filter, chitosan was produced from the biodegradable biomaterial, a substance which is found in crustaceans and is a by-product of the food industry. The use of chitosan for nanofiber sponges is new; a major challenge for the manufacturing process was the consistent avoidance of halogenated solvents. In the 'oyster farm' it was possible to reduce the content of microplastics by 80 percent, with 30 litres of water per day being pumped through a sponge. The sponge worked even better as a classic depth filter with a cleaning effect of over 99 percent.

[More about BIOMAT: zhaw.ch/de/forschung/forschungsdatenbank/projektdetail/projektid/2998/](https://zhaw.ch/de/forschung/forschungsdatenbank/projektdetail/projektid/2998/)

Publication: pubs.acs.org/doi/10.1021/acsapm.1c00799

Pioneers in cleaning standards



Irina Pericin Häfliger,
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Research project Cleaning Standards COVID-19

Lead:
Irina Pericin Häfliger, Hospitality
Management Competency
Group

Duration:
Since March 2020

Partner:
Network Cleaning Standard
Covid-19: Experts from
hygiene and cleaning
management
[zhaw.ch/ifm/
covid-cleaning](https://zhaw.ch/ifm/covid-cleaning)

Hospitality Management Competency Group

In response to the Covid-19 pandemic, those responsible for cleaning and hygiene in the healthcare sector have joined forces with the Hospitality Management Competency Group to form a network and, in a co-creation process, have developed cleaning standards for cleaning patient and residential rooms during Covid-19 isolation. The standards are available free of charge as training videos for hospitals and as guidelines for long-term institutions.

Right from the very beginning of the Covid-19 pandemic, those responsible for operations and hygiene in hospitals, as well as service providers, recognised the need for assistance that individual healthcare companies had. They asked KG Hospitality Management for support and spontaneously formed a network. Within a very short time, uniform processes for cleaning isolation rooms with Covid-19 patients in hospitals were defined, and corresponding training videos for the cleaning staff were produced. Six educational films were created, which, in a clear and easy-to-understand way, show the basics of the corona virus, the processes for correctly putting on and taking off protective clothing, and the upkeep and final cleaning of a patient's room. A short test with four or five repetition questions that stimulate reflection can also be completed for each film. The films, including the matching tests, have been freely available in four languages (D, E, F and I) on YouTube since spring 2020. The positive reactions of those responsible for cleaning in the hospitals, the lively demand and the number of tests completed show that the training videos are used in practice and valued.



Film crew at the shoot

All healthcare institutions in focus

Long-term institutions such as retirement homes, nursing homes or institutions for people with disabilities as well as for children and young people are often particularly hard hit by the coronavirus. This is because there are usually fewer resources available for infection prevention than in a hospital or clinic. For this reason, as a second project in collaboration with the Curaviva association, the 'Network Cleaning Standard Covid-19' has developed guidelines for the cleaning process when residents are isolated. The aim is to make it easier for those responsible to professionally clean and disinfect residents' rooms during or after isolation has been lifted, thereby ensuring the protection of residents and staff. The guide can also be used for training purposes, thanks to clear pictograms.

Collaborative solution development as the key

The broad and great commitment of the developers in the network shows the need for orientation at the interface between cleaning and hygiene. However, the discussions and sometimes the struggle for a common solution in the network when developing the standards also show

that individual adjustments should be possible according to the situation. Precipitated by the pandemic and the pioneers in the network, for the first time in Switzerland we have uniform standards and a professional discourse on the subject that goes beyond the technical and linguistic boundaries. The potential of collaborative work from the perspective of building cleaning for infection prevention and standardisation in healthcare is great. ■

Do healthcare institutions need a real estate strategy – even though buildings have already been constructed?



Rudolf Ernst, Lecturer in Real Estate Management, errf@zhaw.ch

This question could be dismissed as a purely rhetorical question, but it certainly makes one sit up and take notice. The healthcare system in Switzerland is characterised by continually rising costs, which are passed on to all of us through health insurance and accident insurance contributions, as well as taxes. Perhaps it is due to this simple allocation model that resources are often not used so sustainably and sparingly. As recognised studies show, too many hospitals are involved in the increasingly fierce competition for the provision of medical services. The cost and performance pressure on hospitals is currently increasing, and smaller institutions in particular are being forced to act. In the context of an assignment, the question arose as to the sense of a real estate strategy. In the specific case, this was lacking for the building with the core processes and for the other operational properties.

The structures have been able to grow over the decades, but this has resulted in a patchwork of constantly changing provisional structures, conversions and new buildings, as well as maintenance work. However, a clear goal regarding current and, above all, future uses and the application of financial resources must be made in parallel with regard to the infrastructure. With a stringent real estate strategy, it can be shown how the real estate can be optimally used in the future and what additional opportunities arise from the existing properties. Without proactive action, the painful process of working through this and the diverging interests could almost lead to collateral damage for some stakeholders. Therefore, the real estate strategy based on the corporate strategy should be both available and practiced in every situation. ■

Source: Colourbox



Work space at the Institute of Facility Management (Photo: Frank Brüderli)

Impact of the Covid crisis and the lockdown on workplace management – trend study



Prof. Dr. Lukas Windlinger,
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Eunji Häne,
Research Assistant, hanu@zhaw.ch

Due to the Covid pandemic, employees who work in offices had to switch to 'home office'. A trend study was carried out in order to understand the longer-term developments in workplace management that were triggered by this. Among other things, focus group interviews were conducted with Swiss workplace managers.

The focus group interviews show that the acceptance of home office and flexible working has increased. Depending on the initial situation with regard to mobile, flexible work, the intensification of home office working has three different consequences: (1) introduction of shared workplaces in the form of activity-oriented office concepts with desk sharing, (2) reduction of floor space by increasing the sharing ratios in the activity-oriented office concepts already implemented, or (3) continuation of the activity-oriented office concepts and review of the shares of different zones, especially with regard to spaces for collaboration. It was also found that for many employees and teams, the desire for exchange and contact is an important driver for returning to the office. In this context, from the perspective of workplace management, the importance of offices as carriers of organisational culture and the workplace experience was also expressed. ■

PhageFire: Bacteriophages against fire blight

Centre for Food Safety and Quality Management



Sandrine Kammerecker,
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Fire blight is a devastating disease of pome fruit crops such as apple, pear and quince. As a treatment option, a bacteriophage-based protection agent is currently being developed. The formulation consisting of several phages includes protection against UV radiation and ensures optimal adhesion to plant surfaces.

Erwinia amylovora:

The causative agent of fire blight

Fire blight is a plant disease, caused by the bacterium *E. amylovora*. It specifically infects plants of the Rosaceae family, causing significant economic losses in pome fruit harvests. The bacteria are carried to open blossoms by insects, wind and rain. Wilting and tissue necrosis can rapidly spread from the blossom through the tree and can cause the destruction of an entire orchard in a single season.

The most effective time for preventing infection is during bloom. The antibiotic streptomycin, the most successful treatment option in the past, was banned in Switzerland in 2016. Emerging development of antibiotic-resistant bacteria, environmental concerns with copper- and aluminium-based products and changed consumer demands necessitate the development of alternative products. Biological antagonists such as yeasts, bacteria and bacteriophages (phages) are a promising alternative.

Phages as a promising tool to fight fire blight

Phages are viruses which infect and kill bacteria. Their host-specificity is advantageous over antibiotics as they cannot harm the natural microbiome. They are considered safe for both humans and the environment, and some phage-based products are already approved as food processing aids or as biopesticides.



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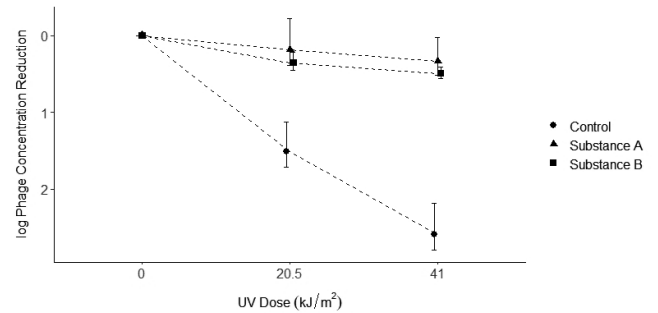


Fig. 1: Phage stability with and without UV-protectants after illumination with a UV-B dose corresponding to 4 days of sunlight in Switzerland (41 kJ/m²). Phage concentration is reduced by 2.5 log units without UV protectants. Upon addition of UV-B absorbing substances, the loss of phage concentration can be reduced down to 0.3 log units.

PhageFire: The development of a formulated phage cocktail

In the Horizon 2020 project “Phage-Fire”, the pome fruit producer association Peras de Rincón de Soto (Spain), Enviroinvest, a company experienced in phage-based pesticides (Hungary), and the biotechnology company Kimitec (Spain), have partnered with the ZHAW.

The focus at the ZHAW is the selection of an optimal phage combination and product formulation. Using qPCR to track the populations of each phage and the bacteria over time, we can evaluate the performance of different phage combinations to reveal potential synergism or competition of the phages. We can also use qPCR to study and identify the phages’ receptor specificities, facilitating optimal

combination and avoiding development of phage-resistant host bacteria. Additionally, we are evaluating substances which enhance phage adherence to the plant surface and protection from damaging UV light. Phage concentrations are strongly stabilized by the UV protectants in lab screenings (figure 1). Several commercial surfactants for optimal adherence on the plant surface have shown good phage compatibility in vitro. With this project we hope to provide growers with an effective, easy to use product for fire blight management without risk to consumers and the environment (figure 2).

zhaw.ch/de/forschung/forschungsdatenbank/projektdetail/projektid/4703/

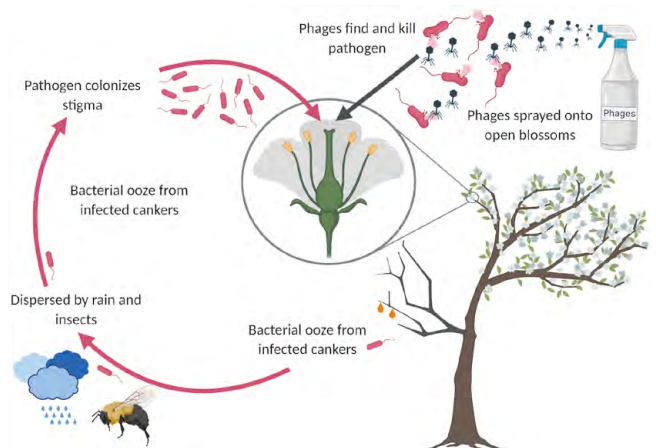


Fig. 2: Diagramme of fire blight infection caused by the pathogen *E. amylovora* and the potential biological control with the sprayed application of a phage cocktail to open blossoms. Created with BioRender.com

Vacuum cooling of baked goods – without noticeable loss of water?



Vacuum cooling



Dr. Mathias Kinner,
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Vacuum cooling of baked goods is a well-known process that uses the latent heat of water to cool these products. This results in longer lasting freshness in the form of a softer crumb and crispier crust, which, however, is not desirable for all baked goods. Durrer Spezialmaschinen AG is highly specialised in the construction of vacuum chambers and is currently developing this new type of vacuum cooling with the Institute for Food and Beverage Innovation at the ZHAW as part of an Innosuisse project (18035.1 PFLS-LS). The aim of this project is to further develop the technology and control in such a way that baked goods with a very soft crust, such as toast bread, can be removed directly from the vacuum chamber with a soft crust. For this purpose, the key factors for controlling the crust quality in vacuum cooling have already been determined, and new technological approaches have been developed and successfully implemented. Tests for the development of the optimal control process are currently underway, so far with promising results. ■

Rethinking chocolate – cell cultures make a lasting impression



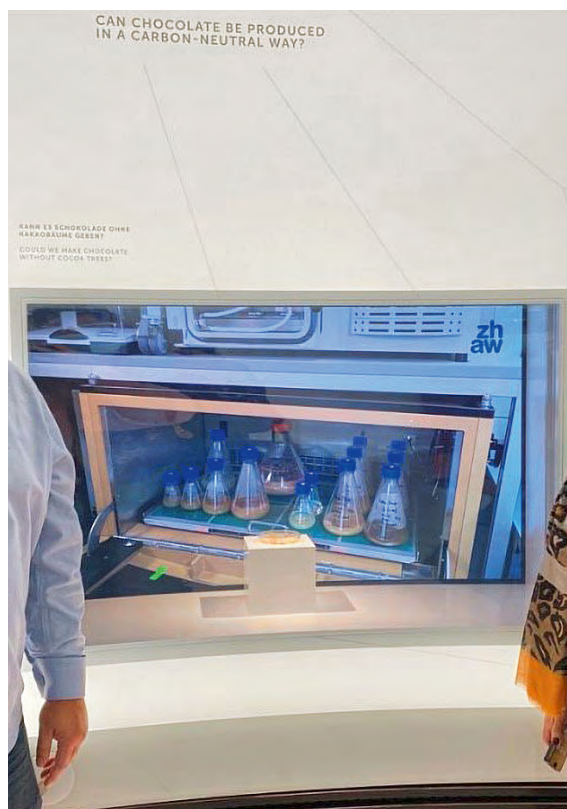
Prof. Dr. Tilo Hühn,
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The collaboration between the Institute of Chemistry and Biotechnology and the Institute of Food and Beverage Innovation at the ZHAW has made it possible to produce the first chocolate ever based on plant cell cultures. The curators of Lindt – Home of Chocolate were so enthusiastic about the project that it is presented in the form of a video contribution as part of the newly opened exhibition. The production of chocolate using cell cultures excludes the influence of pesticides and fertilisers, which also leads to a reduction in the carbon footprint. The cell culture chocolate has a fruity, floral aroma.

After the first *in vitro* wine from grape skin cells of the Müller-Thurgau grape variety was produced in 2005, the two research groups are now working on making the process industrially usable and competitive for chocolate production. The aim is to develop a process that makes it possible to economically produce large quantities of cell cultures in bioreactors. ■



Cell cultures for chocolate production

AGROMIX – Horizon 2020 project on resilience of land use systems



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Forschungsprojekt AGROMIX – AGROforestry and MIXed farming systems

Management – ZHAW:
Mareike Jäger, Horticulture
Research Group

Duration:
December 2020 – 2024

Partner:
EU project with 28 partner
institutions

Funding:
EU research programme
Horizon2020

Horticulture Research Group

In many European countries, farms are becoming more and more specialised. The aim of the EU project AGROMIX is to counteract this trend and reduce the negative ecological effects. 28 partner institutions from 14 countries are starting 12 agroforestry and mixed-culture pilot locations across Europe in order to exploit the synergies and environmental benefits of alternative cultivation systems.

AGROMIX

AGROforestry and MIXed farming systems is the name of a new EU research project that further develops mixed and agroforestry land use systems. In the course of strong specialisation, mixed types of farms within European agriculture have increasingly declined in recent decades. This has led to significant shifts in the direction of monocultural arable farming and highly specialised, animal husbandry, which is unconnected to the land. The negative consequences for the environment are known and quantifiable. While we almost only find mixed farms here in Switzerland, the farms in other European regions have a very pronounced degree of specialisation. The EU project AGROMIX is now addressing this issue and aims to exploit the synergies in mixed agriculture and agroforestry.

The participation of the IUNR in the AGROMIX project

The IUNR's Horticulture Research Group is involved in various work packages in this project. For instance, a catalogue will be created with particularly successful agroforestry examples within Europe. In national pilot projects, a new co-design approach is being applied in collaboration with companies, networks and regions. The IG Agroforst, which is managed jointly by the ZHAW, AGRIDEA and AGROSCOPE, serves as the network for the Swiss pilot project. In the pilot, the financing of ecosystem services



Agroforestry system with crops and fruit trees in the canton of Lucerne (Photo: Mareike Jäger)

and thus the profitability of our Swiss agroforestry systems is to be promoted in various ways. Among other things, new value chains and usage targets are being developed for this purpose.

Dr Sara Burbi – Agromix Project Coordinator and Assistant Professor at the Centre for Agroecology, Water and Resilience, University of Coventry – explained during the online kick-off meeting: “[...] Mixed farming and agroforestry can help build climate-resilient systems. But we do not know whether these new options are economically viable and in which environmental, socio-economic and political contexts they will prove themselves. [...] The AGROMIX project aims to fill such gaps in our knowledge of the synergies within these cropping systems and to exploit their potential in a participatory way.”

Agroecological approaches in the context of the new EU agricultural policy

The solutions developed in the AGROMIX project fit strategically into the plans for a ‘green deal’ of the EU and the proposed changes to the CAP (Common Agricultural Policy of the EU). One of the instruments, with the help of which nature, climate and environmental protection in agriculture is to gain more traction, is the in-

roduction of eco-schemes (eco-regulations). The EU agriculture ministers and the European Parliament laid the basis for the eco-schemes in October 2020. In January 2021, a list of potential farming practices that could support the eco-schemes was published. It is evident that the agro-ecological approaches focused on in AGROMIX will play a major role in the design of future agricultural programmes – both within the framework of the funding strategy and of the future EU research programme, Horizon Europe.

agromixproject.eu/
ec.europa.eu/info/sites/info/files/food-farming-fisheries/key_policies/documents/factsheet-agri-practices-under-ecoscheme_en.pdf

Cultural Mapping 4.0

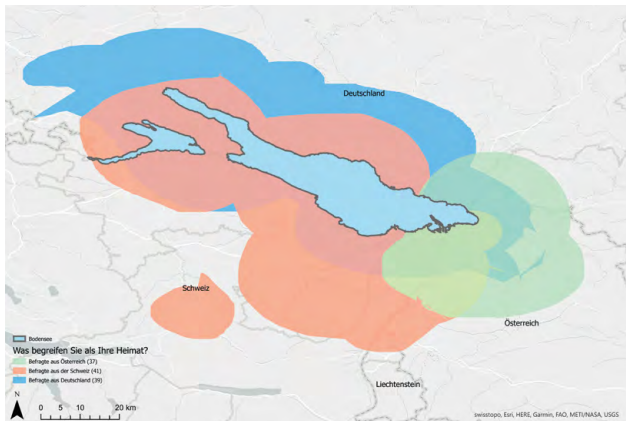


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The Cultural Mapping 4.0 project is attempting to use a participatory, spatial approach to collect personal memories, experiences and stories from residents and

visitors to the Lake Constance region. Here, tourists, residents and other stakeholders are able to identify cultural movement spaces, among other things, through participatory mapping. The aim of the project is to visualise interactions between regional identity, culture and mobility from a spatial perspective. The results of this interdisciplinary approach involving social science and geoinformatics will use storytelling, a mixture of text, map and graphic elements to improve awareness of the Lake Constance region and clarify the question: is there a common, transnational cultural identity for the Lake Constance region?

➔ htwg-konstanz.de/hochschule/magazin/kulturelle-kartierung-des-bodenseeraums/



What do you see as your homeland? – Initial results for the participatory mapping of the understanding of what 'home' means.



The Russian project partner Prof. Nikolai Dronin inspects an abandoned land area near Tula (Photo: Nataliya Kalutskova)

What to do with abandoned agricultural lands in Russia?



Prof. Dr. Raushan Bokusheva,
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The transformation process of the 1990s caused a drastic decline in land use in Russian agriculture. Even after more than 30 years since the beginning of the transformation, Russia still has vast areas of abandoned farmland. In a multidisciplinary ERA-NET project, the Agricultural and Resource Economics Research Group is investigating what should happen to this land and which policy instruments could promote sustainable management of agricultural land in Russia under changing climatic conditions. For this purpose, the climate sensitivity of Russian agriculture is being assessed, the carbon sink potential is being modeled for different land uses, and the economic viability of alternative land uses is being examined for selected regions being studied. The project goals also include the identification of political measures that are intended to contribute to solving a triple challenge – securing the increasing global demand for food, promoting rural development and climate protection, and adaptation to climate change. ■

Who uses the city forest?



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In recent years, urban recreational areas have grown in importance, a trend that has intensified with the Covid-19 pandemic. However, reliable visitor numbers as a basis for area management are often lacking. These are necessary so that maintenance resources can

be used in a targeted manner and the visitor experience can be optimised. Visitor monitoring is often carried out selectively using location-based counting devices. As part of the «Erholungsmonitoring Grün Stadt Zürich» ('Recreation Monitoring Green City Zurich') project, in collaboration with Urban Mobility Research and the Federal Office for the Environment (BAFU), investigations are being carried out into the circumstances under which area-based data sources such as mobile phone data and GPS apps could replace local counting data. The study shows that the mobile phone data can be conceptually compared with the stationary count data. The comparability is better for longer, and summarised periods for individual days better, as well as better for the aggregated area than for individual locations. The use of mobility data for visitor monitoring seems possible in principle. The significance of the data is now being examined further, also using annual hydrographs. The project will run until the end of 2021.



Mountain bikers on a trail in the city forest (Photo: M. Wytenbach)

➔ [Erholungsmonitoring – stadt-zuerich.ch](https://erholungsmonitoring-stadt-zuerich.ch)

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