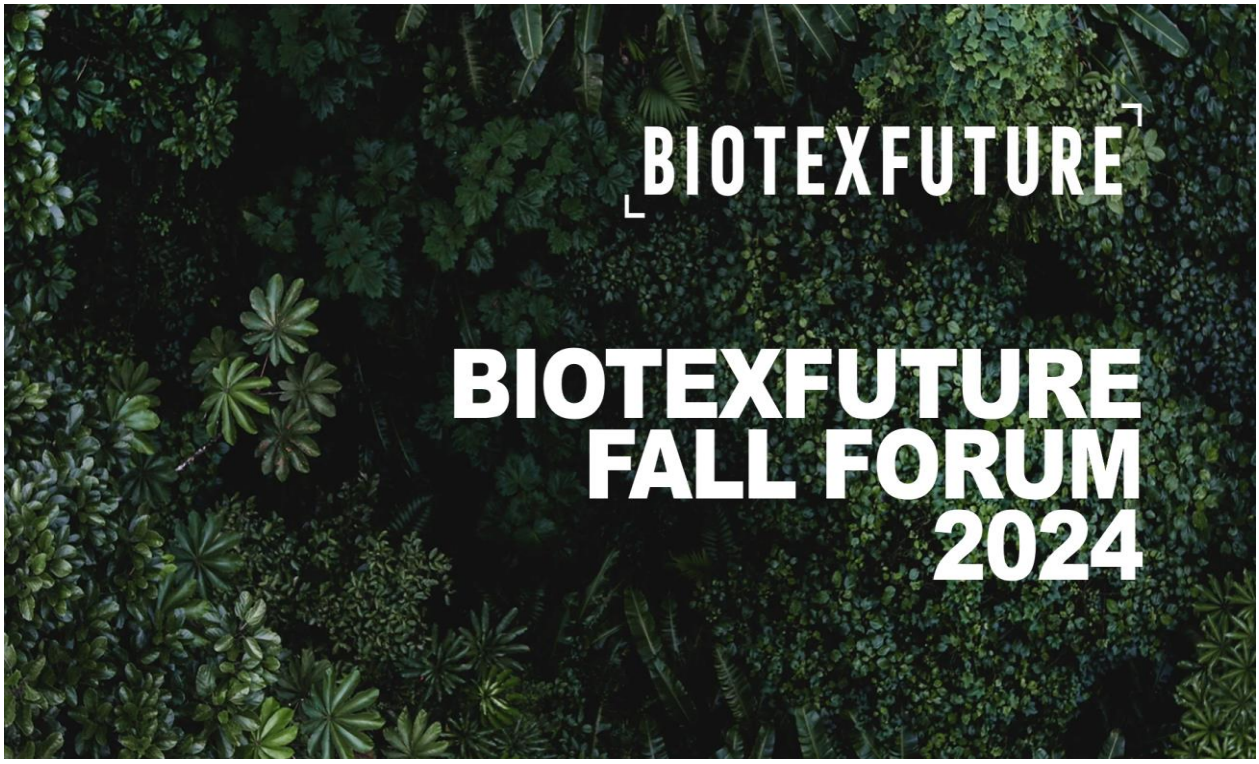


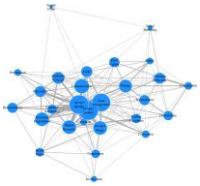
Post-Event Report

“Sports Textiles and Bio-Innovations: Shaping the Future of Performance”. The last edition of the BIOTEXFUTURE Fall Forum on 2 December 2024 in Munich in combination with the ISPO trade fair, was dedicated to sustainable sport products and new bio-based materials. Especially fungi, as ubiquitous natural feedstock, have multiple different application options and even show the potential to “revolutionize” our future lives.

“Fungi” as natural material source for future sport textile have been high on the Forum´s agenda. In her key-note speech under the headline “„How fungal-based materials may revolutionize our lives”, Prof. Vera Meyer, Technical University Berlin, Institute of Biotechnology, vividly showcased the extensive potential of this feedstock for our everyday life. There are six million species of fungi, of these, only 120.000 have been researched so far. They are therefore the least studied category of the three large kingdoms of organisms; the other two being plants and animals. Already well known from the pharmaceuticals industry and the discovery of

“penicillin”, fungal cultures have long provided the material for groundbreaking innovations. In her lecture Prof. Vera Meyer highlighted the application areas far from the medical sector in in the furniture and building industry and presented impressive examples of fungi as three-dimensional composite materials to construct even houses. In this scope she works with the species “Tinder fungus”, in Latin Fomes fomentarius, growing mainly on weakened or dead birch and beech trees. Its fruiting body is completely water-repellent, stable and ultra-light providing the potential to replace i.a. polystyrene, currently produced on crude-oil basis or any further insulation material. For the textile industry, fungi are now being explored as a natural, vegan substance for the leather, textile fibre and even dye manufacturing to substitute crude-oil based synthetics or harmful chemical currently still widely applied for colour production. The first BIOTEXFUTURE fungal-research projects, FungalFibers and FunColor, already show very promising results. They were presented by the responsible project leads in the afternoon of the same day.

Network science

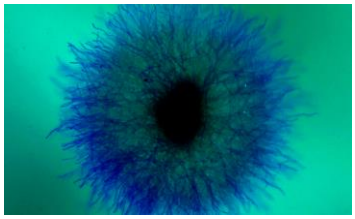


The following session highlighted the social science perspective on multiple official and unofficial collaboration channels within the BIOTEXFUTURE innovation space. In the framework of the TransitionLab, the social science accompanying research program to the technical projects of BIOTEXFUTURE, this is one of the scientific questions having been addressed by the team of Prof. Johannes Glückler, Ludwig Maximilians University, Munich, Department for Geography. Within his research he focussed on network analysis and was able to reveal informal communication and interaction mechanisms within the innovation spaces, emphasizing the underlying high value of non-organized cooperation and learning structures within such complex systems. Moreover, the research findings demonstrated the crucial value of intermediary positions facilitating and supporting cross-project interaction. In general, the results of Prof. Glückler's team specifically underline the kind of “unintended”, but very valuable side-benefits of the new “Innovation space” funding concept. At the same time, they are transferable to any other complex organizational structures.

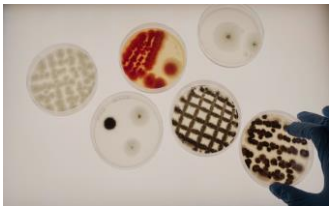
In the subsequent discussion, the participants agreed that beyond a successful internal conversion and collaboration external communication and integration of key stakeholder´s is also pivotal for the long-lasting success of the innovation space funding model. In this respect, Prof. Vera Meyer emphasized her engagement with cultural organizations, museums and citizen scientists in Berlin opening up new pe perspectives for BIOTEXFUTURE activities as of next year.

Project presentation

FunColor – Fungal-based dyes



In the afternoon sessions it was all about presenting the results of already finished BIOTEXFUTURE projects and to provide an outlook on those who started in 2024. Taking up the prevailing topic of the day, Birke Weber, Textile and Material Designer and fungi-enthusiast from Berlin, presented the new BIOTEXFUTURE project **FunColor** on the research of fungal-based melanin dyes as a biological substitute for chemically synthesized grey-brown-black textile dyes. Based on the fungal "cell factory" Aspergillus niger, in this project the research team is developing a biotechnological process for the production of pyomelanin, a biological black color pigment. To achieve this aim, the Aspergillus niger is genetically modified to increase the pyomelanin production and to develop standard procedures for fermentation, extraction and formulation protocols. Furthermore, the team intends to establishes in the upcoming month a stable, high-throughput and cost-efficient textile dyeing process that offers color fastness, color strength and wash fastness at the same time. The objective of the project is to demonstrate the applicability of bio-based pigments for a more sustainable and environmentally friendly textile-colors and thus reduce the release of environmentally harmful petrochemical dyes. The initial deliverables show that the project is on a very promising path, but still has a year and a considerable number of further trials ahead of it before further results are to be presented at the end of 2025.



The second BIOTEXFUTURE fungal-project "**Fungal Fibers**" on the research on biodegradable, antibiotic solution-spun chitosan fibres, is already nearly finished, and, therefore, project results having been displayed at the ISPO Material Lab, on the days following the Fall Forum.

LIGHT LINING: Insulation technologies

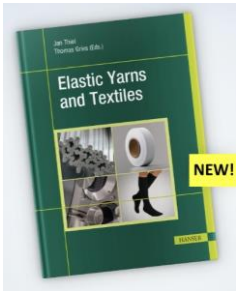
The subsequent session focussed on insulation and spacer material. Dr. Sascha Schriever (ITA, RWTH Aachen University) presented the outcomes of the project **LIGHT LINING** focussing on the creation of a new lightweight super-insulating "aerogel" nonwoven material based on cellulosic fibres. An "aerogel" is a synthetic porous ultralight material derived from a gel, in which the liquid component has been replaced with a gas, usually air. This material has only very limited space as well for convection and gas-phase conduction. Due to these characteristics, aerogels are the world´s lowest density solid and most effective thermal insulator. In the LIGHT LINING project, the project team successfully modified the production of aerogels by applying a super-critical drying process to develop aerogels suitable to be integrated into different cold-weather garments, such as sportswear, to replace common down or feather infill or polyester insulation materials by natural ones. The successful results of LIGHT LINING have been showcased in the ISPO Material Lab adjacent to those of Fungal Fibers.

BioCushion: Spacer Fabrics

The following project, **BioCushion,** presented by Caroline Gierke, TITV-Greiz ("Think Tank for high- tech textiles" in Thüringen, Germany) referred to spacer fabrics. These textile substrates are characterized by excellent air permeability (breathability), a pressure-relieving effect and the ability to regulate heat and moisture transport. They are often used as cushioning elements to substitute conventional foam components in a large variety of application areas, such as car seats, mattresses or upholstery elements, due to their three-dimensional structure. In the sport industry they are commonly applied as padding for back-packs. Although, there is an increasing range of new sustainable yarns, the vast majority of these textile components are still crude-oil based. Therefore, and due to the increasing demand of the textile industry of these specific knitted fabrics, the BioCushion research team decided to create an application-specific guideline for the development of recyclable or bio-based spacers for textile designers and product managers. Currently they are about to compile the required information to be able to present final recommendations and an applicable database for the development of "sustainable" spacer fabrics at the end of 2025.

CO2Tex – Elastic yarns

The next session was dedicated to "elastic yarns". They are currently facing challenges due to the environmental harmful production in the commonly applied spinning process. Therefore, in the **CO2-Tex**-project, the research-team focused on thermoplastic polyurethanes (TPU) as a melt spinnable alternative for conventionally dry-spun elastanes. These TPU yarns have had long been characterized by a particular "tackiness" hindering significantly their industrial application.



Thus, the objective of the project was to develop a spinnable TPU-stretch yarn, a task the project team successfully implemented in the framework of their activities. The next step in the coming months will be to test the CO2Tex-based yarn on an industrial scale as a prerequisite for the market launch of the new stretch-fibre. Additionally, the deputy project lead, Dr. Jan Thiel published the book, **"Elastic Yarn and Textiles"**, covering information on production technologies, a wide range of application areas, new developments in industry and trade as well as environmental aspects. Further information and ordering options can be found at **www.biotexfuture.info.**

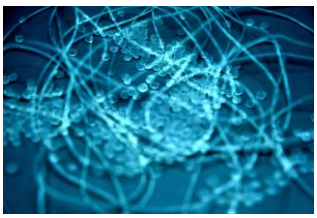
SmartBioFinish – Finishing and coating

After the areas of "dyes", "yarns", "insulation" and "spacer fabrics", the area of "finishing and coating" is of particular importance due to the widespread use of per- and polyfluorinated chemicals as repellent

technology in the textile industry. Due to the fact that the European Union recently proposed a restriction of around 10 000 of these hazardous and environmental persistent chemical substances, eco-friendly technologies, able to meet high performance criteria, such as oil-repellency, are urgently required. This is topic is addressed in the new BIOTEXFUTURE project **SmartBioFinish,** a follow up of the BIOTEXFUTURE project **BioCoat** dedicated to the research on anchor peptides. These short protein chains, able to adhere to surfaces, have already successfully been analysed for their antimicrobial effects and are now being investigated regarding their hydrophobic and oleophobic properties for a potential application in sport textiles or Personal Protective Equipment (PPE). The project started in beginning of 2024 and is now half-finished already showing first positive results.

BioBase and BioTexCirc: Bio-based Fibres and Cicularity

The final BIOTEXFUTURE projects on bio-based fibers was presented by Dr. Jonathan Meakin (adidas AG). He emphasized the fact that in the scope of **BioBase,** bio-based polyamide fibers, available on the market, have successfully been tested for the application in different application areas such as home-textiles, automotive and sport-apparel but that their potential recyclability is s till to be investigated. This is the objective of the follow-up research **BioTexCirc** dealing with the textile recycling capabilities of “bio-polyamide”, namely PA11, PA 4.10 and PA 6.9. In the scope of the project. Concretely, BioTexCirc aims to close the recycling loop by covering the entire path from "polymer to polymer", i.e. from the end product to the new raw material. In this framework, the fibres, are being broken down from their polymer into their monomer structure. This procedure is carried out under aqueous conditions at elevated temperature and pressure with the aid of a depolymerization catalyst. The monomers are further separated and purified by means of extraction, distillation and crystallization. Once these processes have been established, the recycled and purified building blocks are re-polymerized into polyamides so that their properties can then be compared with the original polyamides having been used as the starting material for the recycling process. As this process may differ for the specific polyamides, this whole research project is very challenging. Nevertheless, the research-team has already achieved some positive deliverables and can now progress into a scaling phase for the recycling of specific polymers such as PA 4.10. The project is still running for a couple of months, final results are expected to be presented at the next BIOTEXFUTURE Fall Forum in 2025.



Overall the BIOTEXFUTURE Fall Forum 2024 had been a success with many new insights into ongoing and accomplished scientific textile projects and valuable discussions and networking activities.

We would like to thank all participants and are looking forward to welcoming you to our events in 2025.

– Please stay tuned!

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