

Spring 2024

Lib4RI Training Series: Module 1 - Searching Scientific Information

Bobby Neuhold & Stephanie Hofmann

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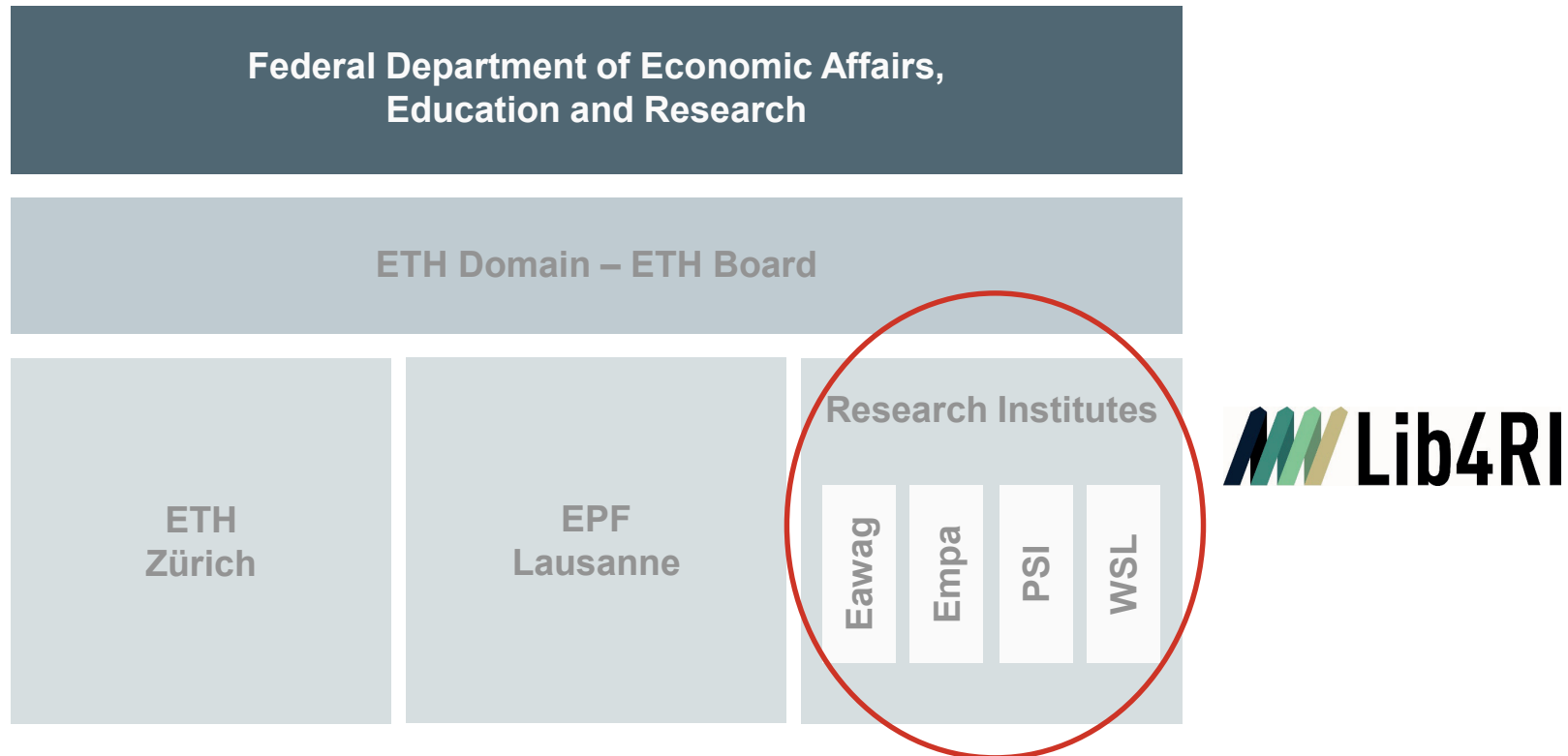
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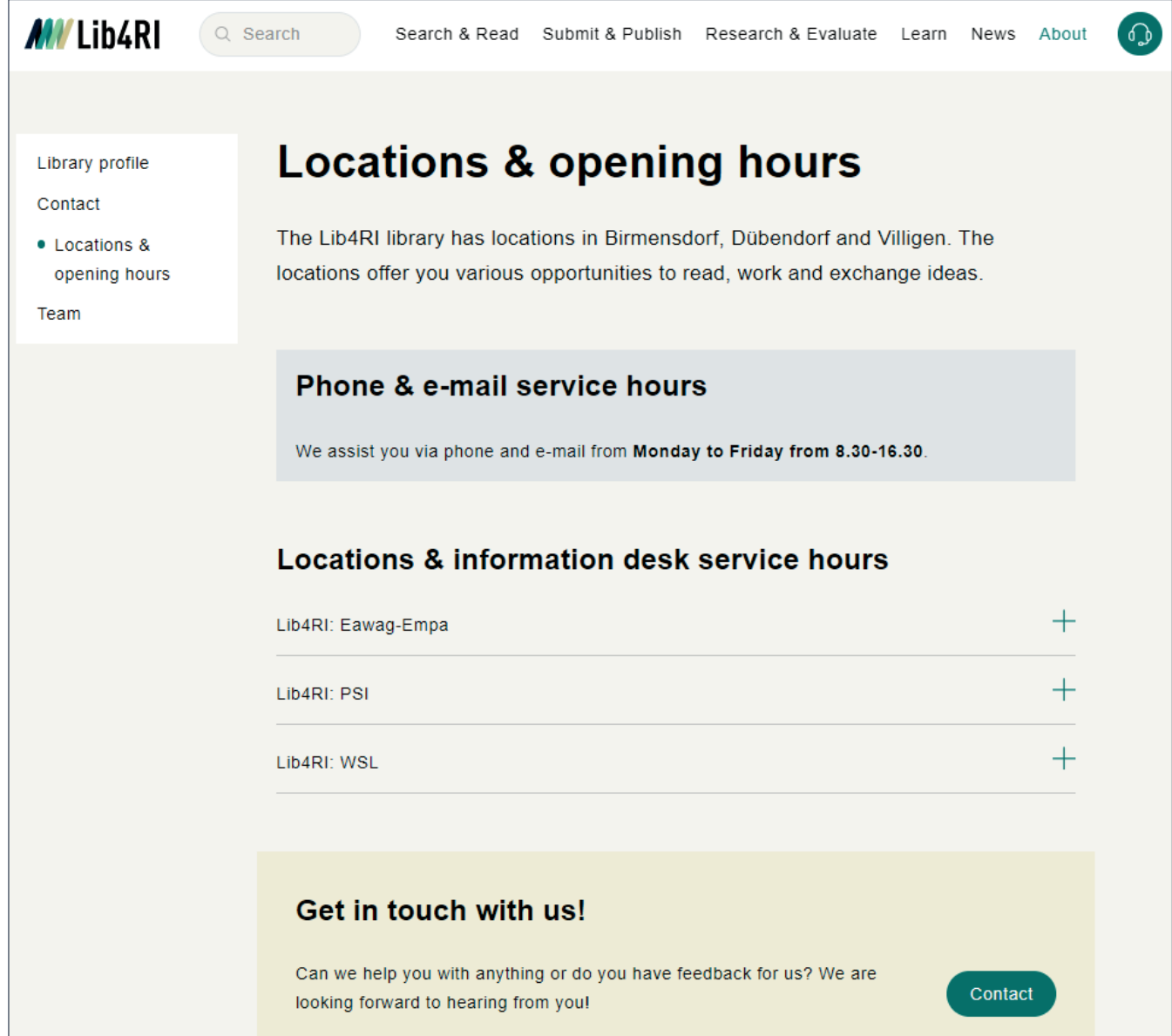


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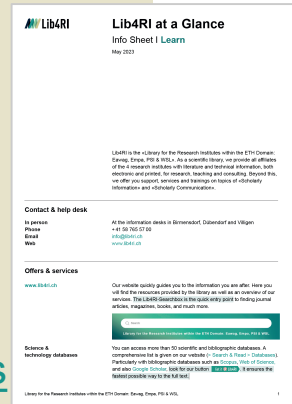
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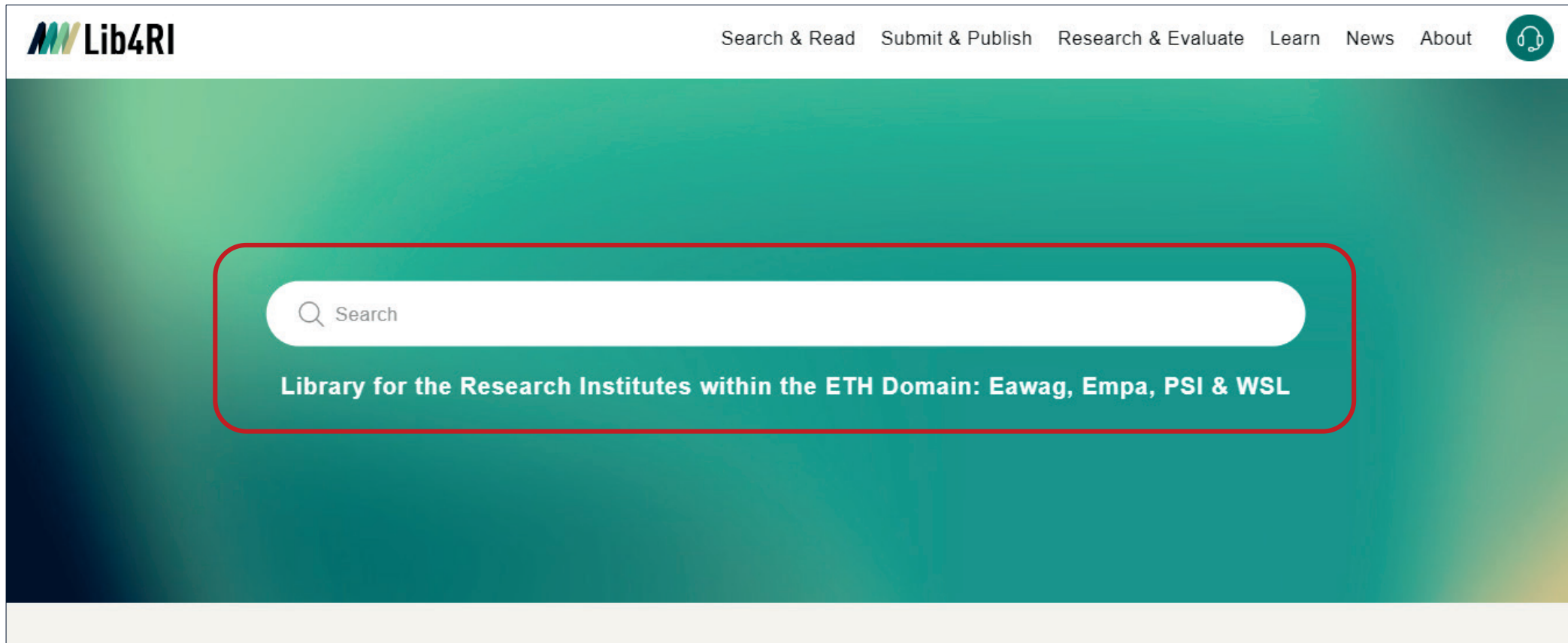
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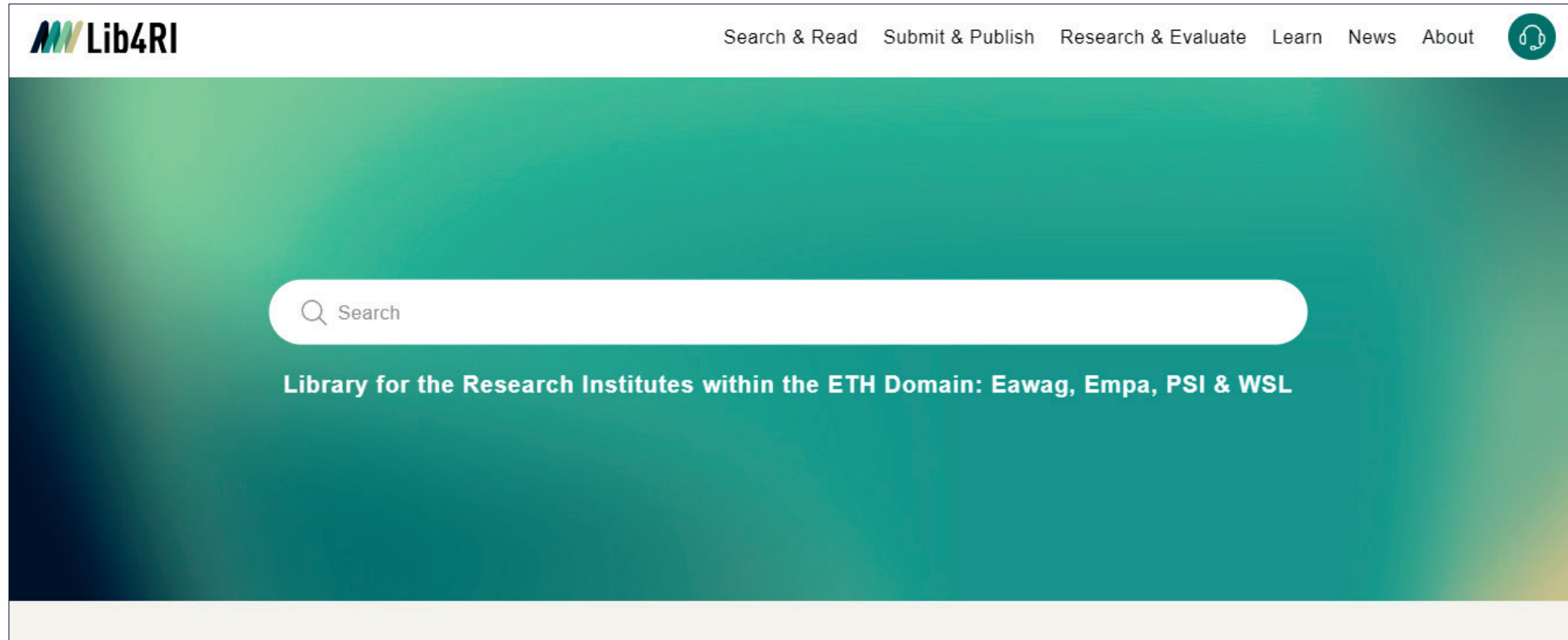
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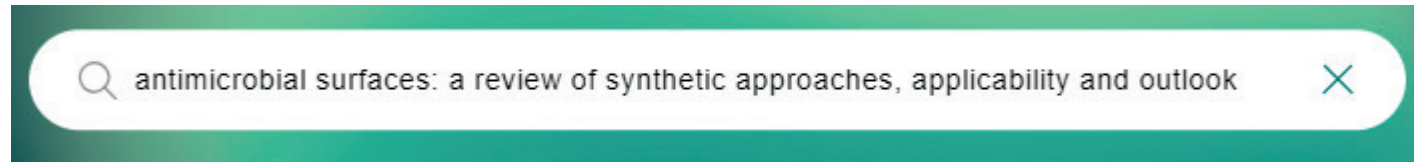
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Antimicrobial surfaces: a review of synthetic approaches, applicability and outlook

By: Mahanta, U (Mahanta, Urbashi)^[1]; Khandelwal, M (Khandelwal, Mudrika)^[1]; Deshpande, AS (Deshpande, Atul Suresh)^[1]

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JOURNAL OF MATERIALS SCIENCE

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Indexed: 2021-08-18
Document Type: Review

Abstract

The rapid spread of microorganisms such as bacteria, fungi, and viruses can be extremely detrimental and can lead to seasonal epidemics or even pandemic situations. In addition, these microorganisms may bring about fouling of food and essential materials resulting in substantial economic losses. Typically, the microorganisms get transmitted by their attachment and growth on various household and high contact surfaces such as doors, switches, currency. To prevent the rapid spread of microorganisms, it is essential to understand the interaction between various microbes and surfaces which result in their attachment and growth. Such understanding is crucial in the development of antimicrobial surfaces. Here, we have reviewed different approaches to make antimicrobial surfaces and correlated surface properties with antimicrobial activities. This review concentrates on physical and chemical modification of the surfaces to modulate wettability, surface topography, and surface charge to inhibit microbial adhesion, growth, and proliferation. Based on these aspects, antimicrobial surfaces are classified into patterned surfaces, functionalized surfaces, superwettable surfaces, and smart surfaces. We have critically discussed the important findings from systems of developing antimicrobial surfaces along with the limitations of the current research and the gap that needs to be bridged before these approaches are put into practice.

Keywords

Keywords Plus: SMART ANTIBACTERIAL SURFACES; BACTERICIDAL ACTIVITY; POLYETHYLENE-GLYCOL; MEMBRANE; RELEASE; CONTAMINATION; MECHANISM; ADHESION; ANTIFUNGAL; PARTICLES

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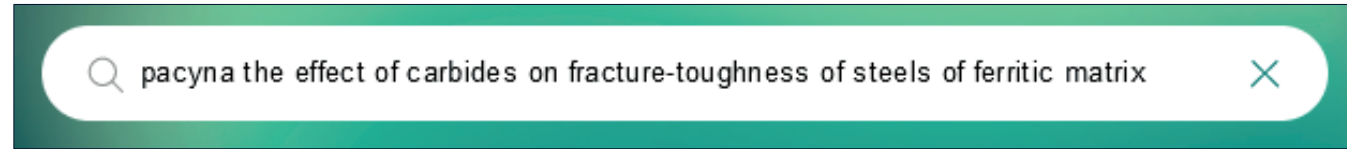
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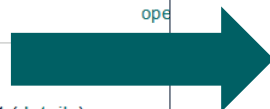
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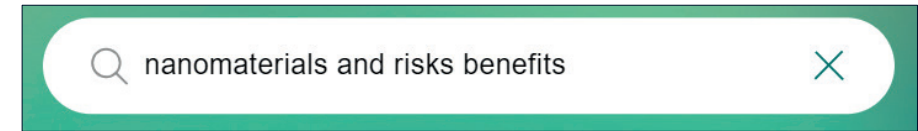
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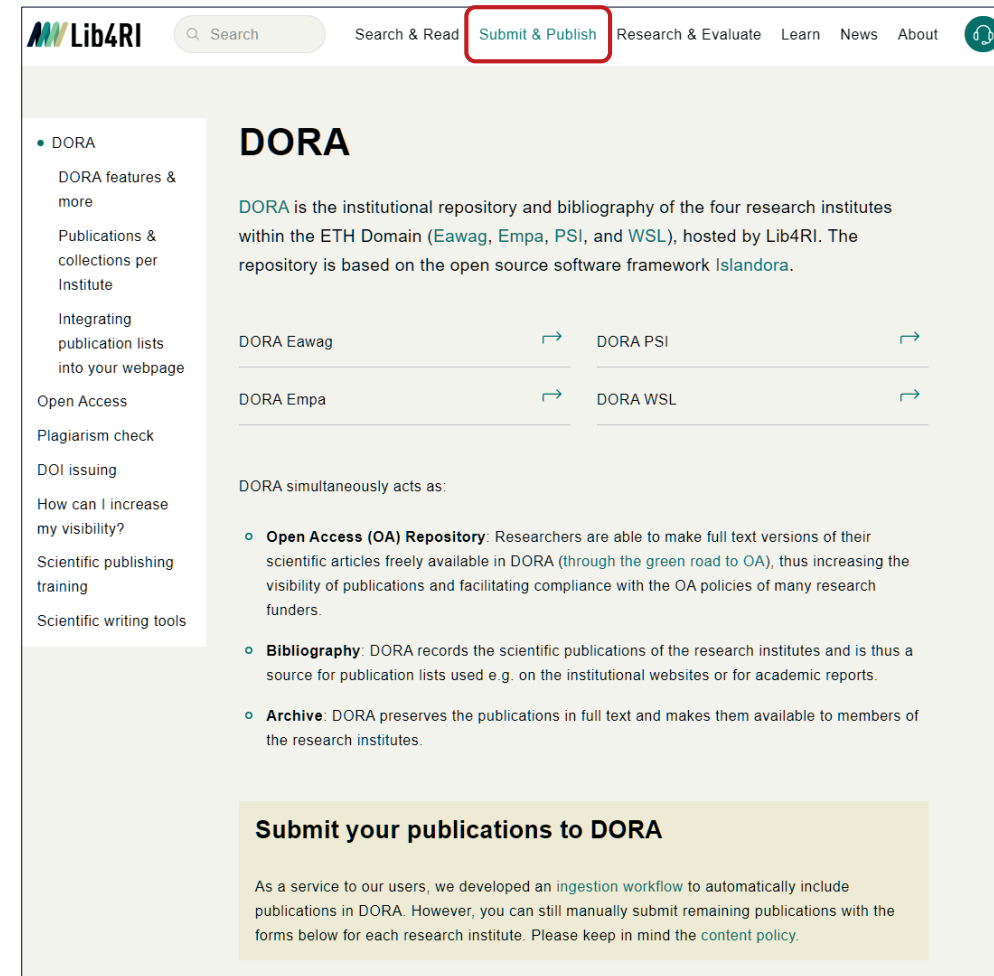
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Bath toys pose an interesting link between flexible plastic materials, potable water, external microbial and nutrient contamination, and potentially vulnerable end-users. Here, we characterized biofilm communities inside 19 bath toys used under real conditions. In addition, some determinants for biofilm formation were assessed, using six identical bath toys under controlled conditions with either clean water prior to bathing or dirty water after bathing. All examined bath toys revealed notable biofilms on their inner surface, with average total bacterial numbers of 5.5×10^6 cells/cm² (clean water controls), 9.5×10^6 cells/cm² (real bath toys), and 7.3×10^7 cells/cm² (dirty water controls). Bacterial community compositions were diverse, showing many rare taxa in real bath toys and rather distinct communities in control bath toys, with a noticeable difference between clean and dirty water control biofilms. Fungi were identified in 58% of all real bath toys and in all dirty water control toys. Based on the comparison of clean water and dirty water control bath toys, we argue that bath toy biofilms are influenced by (1) the organic carbon leaching from the flexible plastic material, (2) the chemical and biological tap water quality, (3) additional nutrients from care products and human body fluids in the bath water, as well as, (4) additional bacteria from dirt and/or the end-users' microbiome. The present study gives a detailed characterization of bath toy biofilms and a better understanding of determinants for biofilm formation and development in systems comprising plastic materials in contact with potable water.

Publication Type	Journal Article
Title	Ugly ducklings - the dark side of plastic materials in contact with potable water
Author(s)	Neu, Lisa (Environmental Microbiology UMIK) Bänziger, Carola (Environmental Microbiology UMIK) Proctor, Caitlin R. (Environmental Microbiology UMIK) Zhang, Ya Liu, Wen-Tso Hammes, Frederik (Environmental Microbiology UMIK)
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The intrinsic compliance of soft robots provides safety, a natural adaptation to its environment, allows to absorb shocks, and protects them against mechanical impacts. However, a literature study shows that the soft polymers used for their construction are susceptible to various types of damage, including fatigue, overloads, interfacial debonding, and cuts, tears and perforations by sharp objects. An economic and ecological solution is to construct future soft robotic systems out of self-healing polymers, incorporating the ability to heal damage. This review paper proposes criteria to evaluate the potential of a self-healing polymer to be used in soft robotic applications. Based on these soft robotics requirements and on defined performance parameters of the materials, linked to the mechanical and healing properties, the different types of self-healing polymers already available in literature are critically assessed and compared. In addition to a description of the state of the art on self-healing soft robotics, the paper discusses the driving forces and limitations to spur the interdisciplinary combination between self-healing polymer science and soft robotics.

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Nanomagnetic encoding of shape-morphing micromachines

Cui J, Huang T-Y, Luo Z, Testa P, Gu H, Chen X-Z, Nelson BJ & Heyderman LJ

Citation Cui, J., Huang, T. Y., Luo, Z., Testa, P., Gu, H., Chen, X. Z., ... Heyderman, L. J. (2019). Nanomagnetic encoding of shape-morphing micromachines. *Nature*, 575(7781), 164-168. <https://doi.org/10.1038/s41586-019-1713-2>

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Shape-morphing systems, which can perform complex tasks through morphological transformations, are of great interest for future applications in minimally invasive medicine, soft robotics, active metamaterials and smart surfaces. With current fabrication methods, shape-morphing configurations have been embedded into structural design by, for example, spatial distribution of heterogeneous materials, which cannot be altered once fabricated. The systems are therefore restricted to a single type of transformation that is predetermined by their geometry. Here we develop a strategy to encode multiple shape-morphing instructions into a micromachine by programming the magnetic configurations of arrays of single-domain nanomagnets on connected panels. This programming is achieved by applying a specific sequence of magnetic fields to nanomagnets with suitably tailored switching fields, and results in specific shape transformations of the customized micromachines under an applied magnetic field. Using this concept, we have built an assembly of modular units that can be programmed to morph into letters of the alphabet, and we have constructed a microscale 'bird' capable of complex behaviours, including 'flapping', 'hovering', 'turning' and 'side-slipping'. This establishes a route for the creation of future intelligent microsystems that are reconfigurable and reprogrammable in situ, and that can therefore adapt to complex situations.

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Author(s) Cui, Jizhai (3701 Mesoscopic Systems)
Huang, Tian-Yun
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Gu, Hongri
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Nelson, Bradley J.
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Glacier runoff variations since 1955 in the Maipo River basin, in the semiarid Andes of central Chile

Ayala Á, Fariás-Barahona D, Huss M, Pellicciotti F, McPhee J & Farinotti D

Citation
APA

Ayala, Á., Fariás-Barahona, D., Huss, M., Pellicciotti, F., McPhee, J., & Farinotti, D. (2020). Glacier runoff variations since 1955 in the Maipo River basin, in the semiarid Andes of central Chile. *Cryosphere*, 14(6), 2005-2027. <https://doi.org/10.5194/tc-14-2005-2020>

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As glaciers adjust their size in response to climate variations, long-term changes in meltwater production can be expected, affecting the local availability of water resources. We investigate glacier runoff in the period 1955–2016 in the Maipo River basin (4843 km², 33.0–34.3° S, 69.8–70.5° W), in the semiarid Andes of Chile. The basin contains more than 800 glaciers, which cover 378 km² in total (inventoried in 2000). We model the mass balance and runoff contribution of 26 glaciers with the physically oriented and fully distributed TOPKAPI (Topographic Kinematic Approximation and Integration)-ETH glacio-hydrological model and extrapolate the results to the entire basin. TOPKAPI-ETH is run at a daily time step using several glaciological and meteorological datasets, and its results are evaluated against streamflow records, remotely sensed snow cover, and geodetic mass balances for the periods 1955–2000 and 2000–2013. Results show that in 1955–2016 glacier mass balance had a general decreasing trend as a basin average but also had differences between the main sub-catchments. Glacier volume decreased by one-fifth (from 18.6±4.5 to 14.9±2.9 km³). Runoff from the initially glacierized areas was 177±25 mm yr⁻¹ (16±7 % of the total contributions to the basin), but it shows a decreasing sequence of maxima, which can be linked to the interplay between a decrease in precipitation since the 1980s and the reduction of ice melt. Glaciers in the Maipo River basin will continue retreating because they are not in equilibrium with the current climate. In a hypothetical constant climate scenario, glacier volume would reduce to 81±38 % of the year 2000 volume, and glacier runoff would be 78±30 % of the 1955–2016 average. This would considerably decrease the drought mitigation capacity of the basin.

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Title Glacier runoff variations since 1955 in the Maipo River basin, in the semiarid Andes of central Chile

Author(s) [Ayala, Álvaro \(Mountain Hydrology and Mass Movements\)](#)
[Fariás-Barahona, David](#)
[Huss, Matthias \(Mountain Hydrology and Mass Movements\)](#)
[Pellicciotti, Francesca \(Mountain Hydrology and Mass Movements\)](#)
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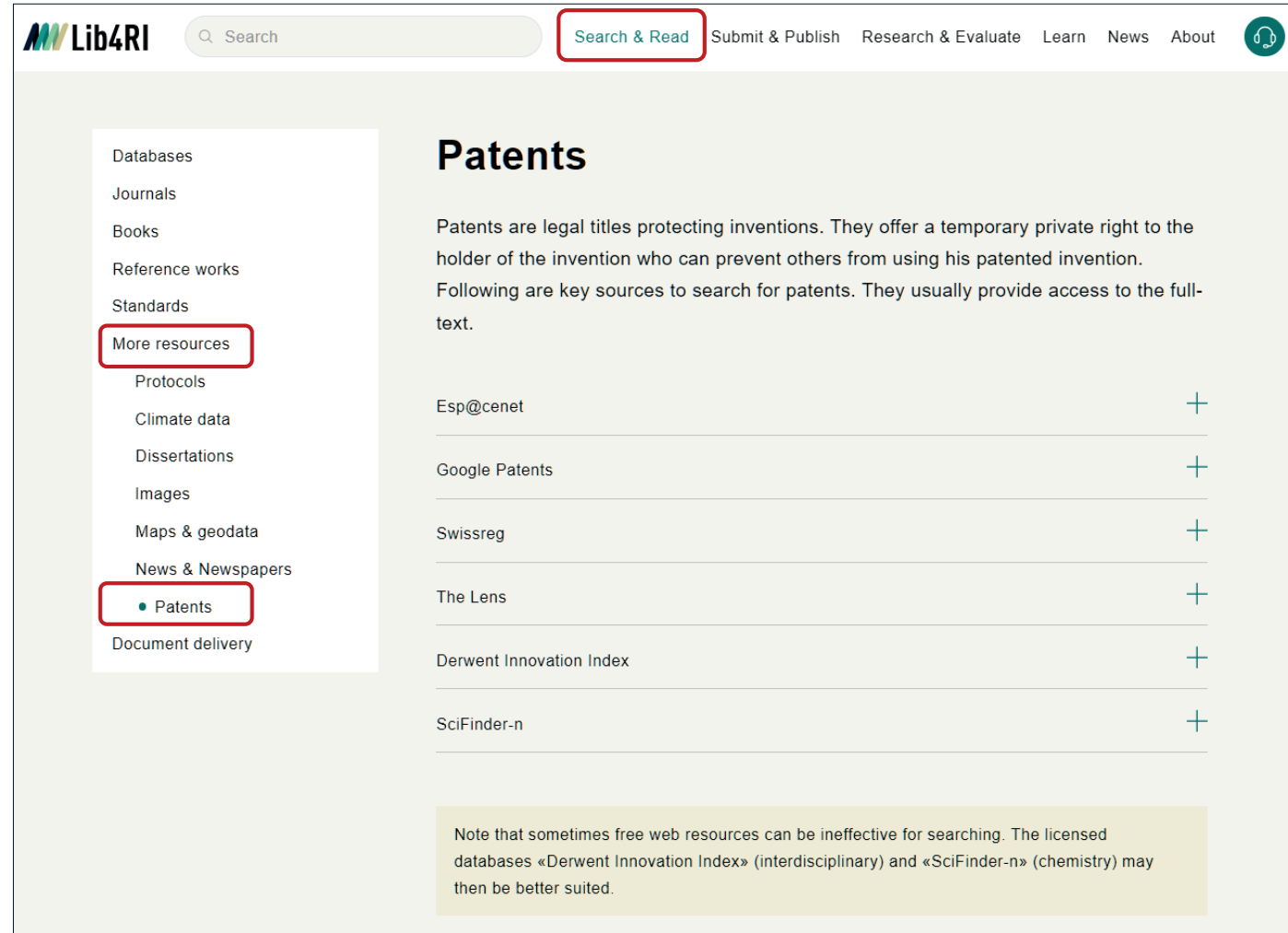
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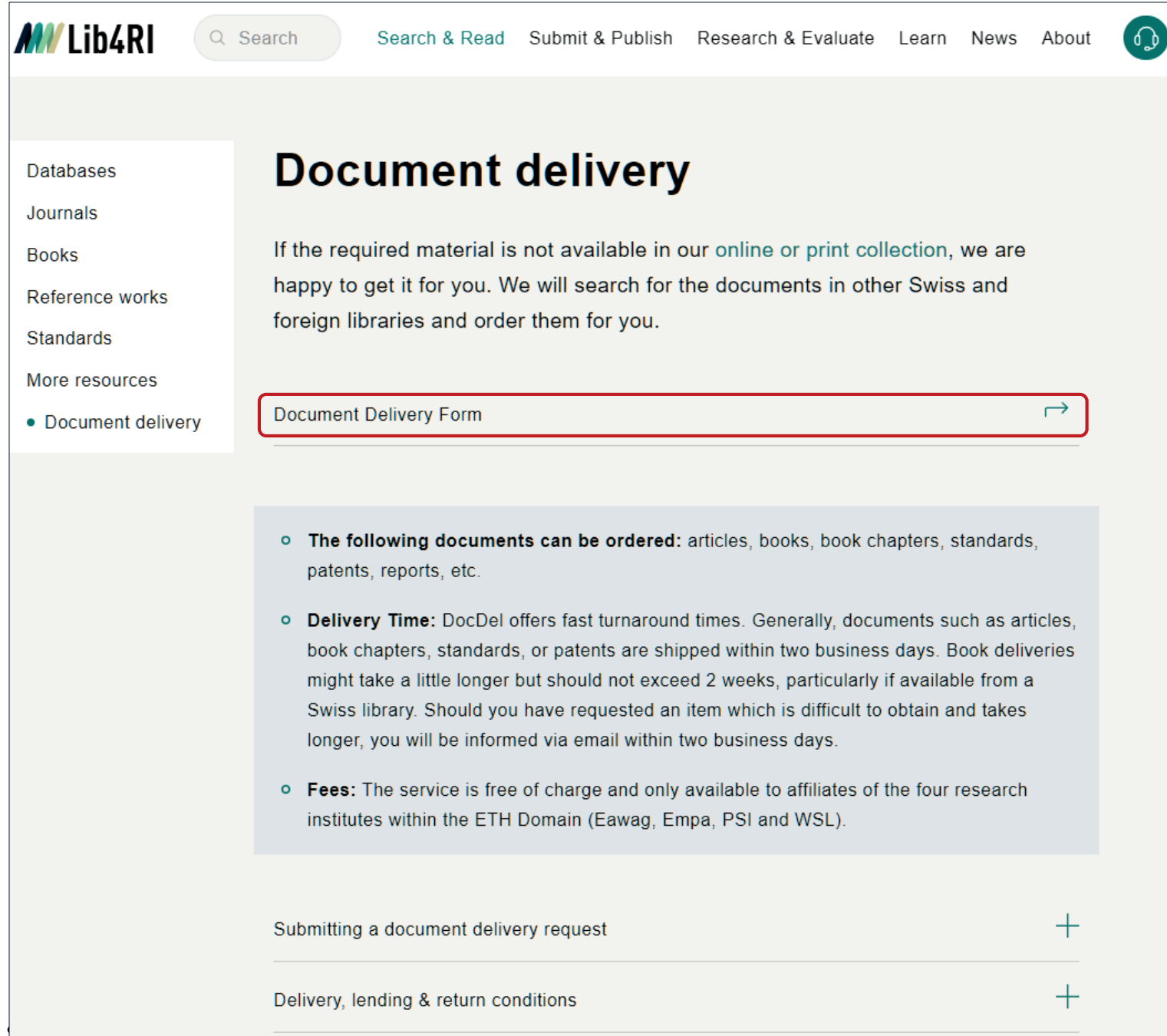
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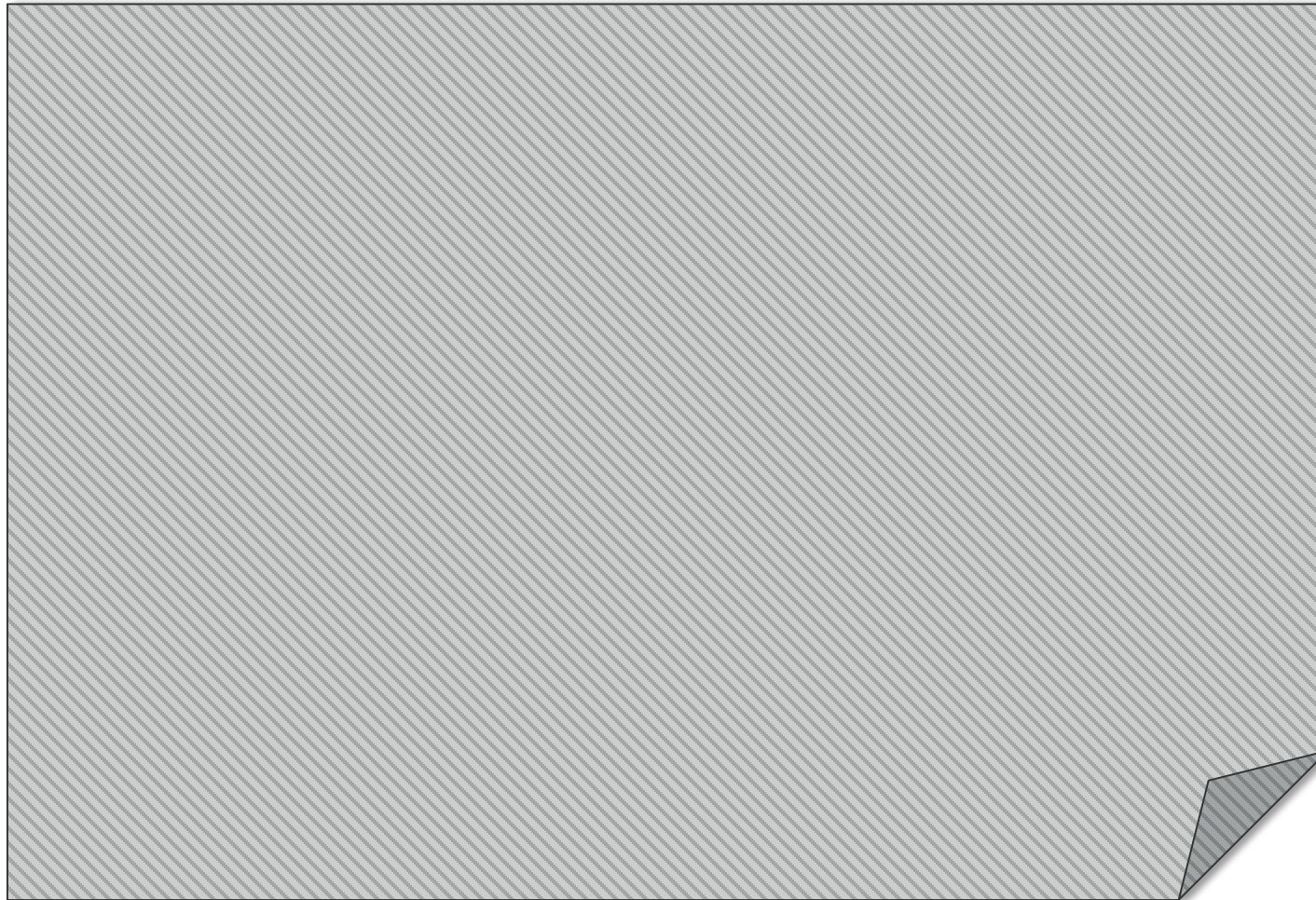
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Stephanie Hofmann & Bobby Neuhold
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