



Paper of the Quarter

Outstanding 3R-Research from North Rhine-Westphalia
- 1st Quarter of 2024 -

The quarterly distinction 'Paper of the Quarter' of the 3R-Competence Network NRW recognizes outstanding contributions to the 3R principles. We are delighted to announce the winner for the first quarter of 2024.

Congratulations to

Aniella Bak

RWTH Aachen University



for their publication

“Human organotypic brain slice cultures: a detailed and improved protocol for preparation and long-term maintenance”

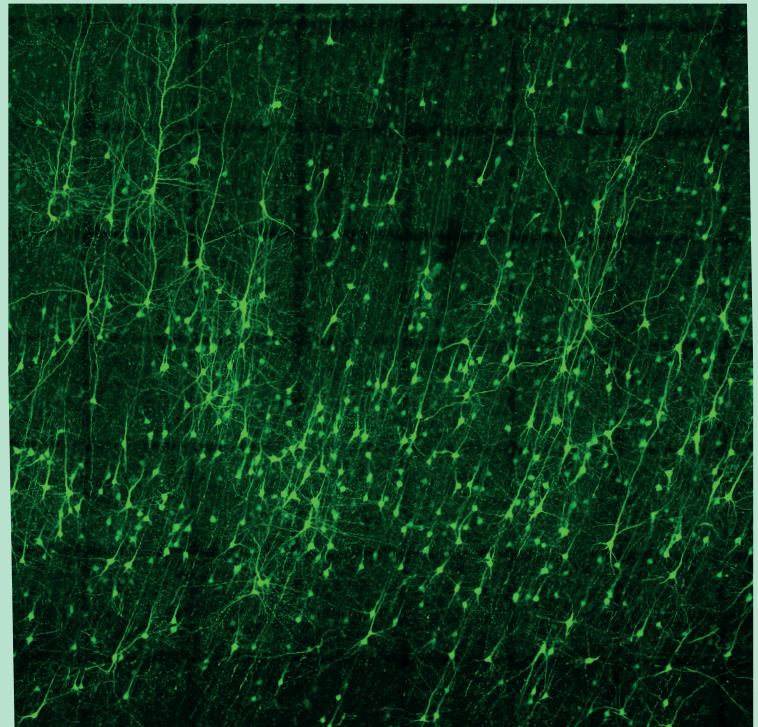
The „Paper of the Quarter“ award was given to her publication because she strives in a special way to further develop the 3R principle—“Replace, Reduce, Refine”—which has been applied in laboratory animal science for more than 60 years.

The publication was selected due to its potential **to replace many animal experiments with a human-relevant “Brain Slice Model (HBS)”**. The Scientific Advisory Board of the 3R Competence Network NRW particularly emphasizes the detailed description of the establishment of the HBS model and the culture for up to 3 weeks including the intact neuronal activity. Their model will make it possible **to study diseases such as epilepsy, neuronal degeneration or even brain tumors in vitro in the human-relevant system**.

This award underlines not only her hard work and expertise, but also the potential contribution of her research to reducing animal testing and advancing human-relevant research methods.

► You can read the original article here

[Bak A, Koch H, van Loo KMJ, et al. Human organotypic brain slice cultures: a detailed and improved protocol for preparation and long-term maintenance. J Neurosci Methods. 2024;404:110055.](#)



Microscopic image of a human cortical brain slice transduced with retrograde adenoassociated virus (AAV), encoding green fluorescent protein (GFP) under the human synapsin gene (hSyn) promoter
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Q&A with the Winner - 1st Quarter of 2024 -

How did this research come about?

Brain research has historically focused on the study of animal tissue for various reasons. While many valuable insights have been gained through this approach, the findings are only partially transferable to the functioning of the human brain. Intact, non-pathological human brain tissue is routinely removed during resections of tumors or epileptogenic brain regions as access tissue. This tissue is highly valuable for research but is often not needed for clinical diagnostics and is therefore discarded.

Dr. Henner Koch, the leader of our research group, developed a method with his colleagues in Tübingen to successfully culture this tissue for several weeks. However, this protocol is highly demanding, requiring meticulous adherence to preparation and cultivation conditions, good communication with neurosurgeons, and extensive preparation. Over the past few years, we have worked to establish this method in Aachen and can now report significant success and extensive expertise.

Despite multiple publications on this methodology, we are still frequently approached by other research groups for advice and support in implementing the method. To address this, we wanted to compile our knowledge into a publication to enable even more research groups to establish human organotypic brain slice cultures.

What is the contribution of this research to the 3Rs?

Organotypic human brain slice cultures make a substantial contribution to reducing animal experiments. Experimental studies in animals, especially in a clinically pathological context, are often not transferable to humans due to the unique characteristics of the human brain. Organotypic human brain slice cultures utilize tissue that would otherwise be discarded, while preserving the cortical structure and architecture of the human brain.

The neuronal network retains its physiological function for several weeks, providing a valuable time window to study the physiological state or to conduct genetic or pharmacological manipulations to simulate the pathogenesis of diseases such as epilepsy or brain tumors. This allows the investigation of both the healthy structure and function of the human brain and the development of diseases in a human system, reducing



The research group at the Department of Epileptology at the University Hospital RWTH Aachen ©Aniella Bak, RWTH Aachen University

or even eliminating the need for animal models in such approaches.

What is your next 3R research question that you would like to answer?

The cultivation of organotypic human brain slice cultures remains labor-intensive and dependent on factors that have not yet been fully defined. Therefore, we are continuously working to further optimize and simplify cultivation conditions to make this approach accessible to more research groups, improve cultivation success rates, and increase throughput.

In the future, this should facilitate the use of this model system as a screening platform for potential therapeutic targets or pharmacological compounds. Additionally, we are actively working on using human brain slices as a model system to investigate mutations in candidate genes for epilepsy identified in genomic patient studies. These mutations can be analyzed for their pathogenic properties in cultivated brain tissue.

We have also established a model for studying the pathogenesis and electrophysiological properties of the brain tumor glioblastoma multiforme. Such pathophysiological experiments are typically conducted in animal models. With our human model, we aim to circumvent this necessity as much as possible.

What is “Paper of the Quarter”?

The quarterly distinction „Paper of the Quarter“ serves to recognize outstanding publications in the field of 3R principle of the 3R Competence Network NRW. The aim is to recognize the diversity of research achievements and in particular those publications for which the extraordinary quality cannot be adequately reflected by quantitative evaluation criteria such as the Journal Impact Factor (JIF). A high JIF is not an exclusion criterion, but it is not a selection criterion either.

The award is presented as part of a quarterly open competition. The decision on the publication to be awarded is made by the network's Steering Committee which is formed by the representatives of the eight faculties of medicine in NRW. Each location represented on the Steering Committee has one vote, so that the winner is determined by a simple majority of votes. The selection can be made if at least 50% of the site representatives are present at the relevant meeting. The selected paper will be made visible as „Paper of the Quarter“ by the network. The award is also recognized with a certificate.

For more information and submissions for the next round **until February 28th, 2025**, please visit

► [PAPER OF THE QUARTER](#)

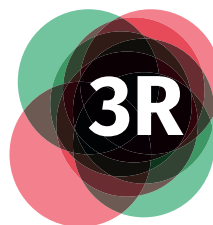
3R-Kompetenznetzwerk NRW

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