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 winners for the second quarter of 2025.

Congratulations to

Alina Deipenbrock & Nicole Teusch

Heinrich Heine University Düsseldorf

for their publication

"Modelling of the multicellular tumor microenvironment of pancreatic ductal adenocarcinoma (PDAC) on a fit-for-purpose biochip for preclinical drug discovery"

The "Paper of the Quarter" award was given to their publication because they strive 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 paper "Modelling of the multicellular tumor microenvironment of pancreatic ductal adenocarcinoma (PDAC) on a fit-for-purpose biochip for preclinical drug discovery" stands out thanks to its scientific excellence, high relevance to the 3R principles, and an innovative model that sets new standards in preclinical research. We were particularly impressed by the **realistic replication of the tumor microenvironment** and the **integration of immunological components**—an important step toward testing systems that are **relevant for translational research and do not require animal testing.**

▶ **You can read the original article here**

Deipenbrock A, et al. Modelling of the multicellular tumor microenvironment of pancreatic ductal adenocarcinoma (PDAC) on a fit-for-purpose biochip for preclinical drug discovery. Lab Chip. 2025 Apr 29;25(9):2168-2181.
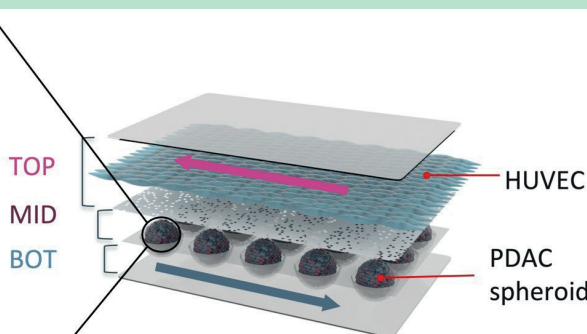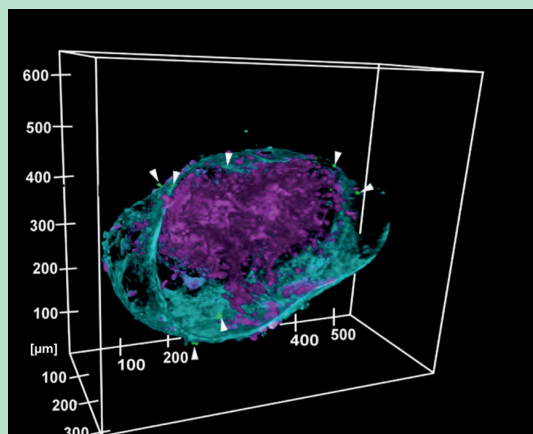
(Left) Spatial distribution of infiltrated monocytes. Fluorescent 3D image of the halved spheroid. Scale bars in 100 µm steps are provided, and the spatial orientation of the halved section is indicated. If staining for the tumor cell marker pan-cytokeratin (purple), the fibroblast marker α-SMA (blue), the and the M2 marker CD163 (green) merged in one image. White arrows indicate CD163+ signals. (Right) Schematic illustration of the PDAC model with the TOP (TOP), middle (MID) and bottom (BOT) channels. Arrows depict the flow direction in the TOP (magenta) and the BOT (blue) channel.

How did this research come about?

Today, pancreatic ductal adenocarcinoma (PDAC) is one of the deadliest cancer types worldwide with a five-year-survival rate of only 12%. A major challenge in cancer drug discovery is the lack of physiologically relevant preclinical models. Current preclinical approaches - including human 2D cell cultures, and mouse tumor models - fail to fully recapitulate the complexity of the fibrotic and immunosuppressive tumor microenvironment of human PDAC, limiting their predictive value for drug responses. To address this, we developed a microfluidic tumor-on-chip model to mimic the complex tumor microenvironment of PDAC. This cutting-edge approach could be a milestone in overcoming current preclinical limitations, allowing for dynamic drug screening, spatial immune cell infiltration and a deeper understanding of therapy resistance mechanisms.

Members of the research group led by Prof. Nicole Teusch at the Institute of Pharmaceutical Biology and Biotechnology
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What is the contribution of this research to the 3Rs?

Our model apart sets apart in its ability to provide clinically relevant data while reducing, and potentially replacing, animal experiments. Unlike 2D cultures or immune-deficient animals, our system captures the complexity of immune dynamics and fibrotic architecture, offering a more meaningful alternative for preclinical testing. From a 3R perspective, our work addresses the principles of Replacement and Reduction in a profound way. Our tumor-on-chip platform serves as a viable and scalable alternative to animal models for PDAC drug testing and cell interaction studies. Due to its high reproducibility and physiological relevance, it has the potential to significantly reduce the number of animals required for iterative therapeutic screening and optimization. The fundamental objective of our work is the establishment of a PDAC-biochip model that recapitulates despite its simplicity key components of the tumor microenvironment enabling screening of novel therapeutic approaches. By bridging the gap between preclinical research and clinical application, this project has the potential to pave the way for more effective, personalized treatments for PDAC patients.

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

Perspectively, we plan to further address the venues "Reduction" and "Replacement" by implementing patient-derived organoids into the microfluidic platform. This will enable more personalized and physiologically relevant modelling of the characteristic of the tumor microenvironment of PDAC, leading eventually to further reducing and replacing the need for animal tumor models while capturing patient-specific tumor heterogeneity as the prerequisite for precision drug discovery and development.

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 November 30th, 2025**, please visit ► **PAPER OF THE QUARTER**
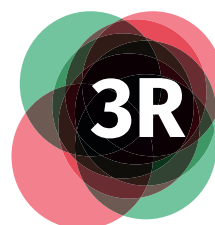
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