

Steering the Formulation of Engineered Tissue by Sound Waves

With the aid of physical forces – in this case, sound – it is possible to actively steer the formation of engineered tissue. For example, sound waves can be used to create functional vascular networks with blood vessel-like structures in vitro. Scientists at the Center for Molecular Biology of Heidelberg University have demonstrated this through their methodology for acoustic manipulation. The team headed by Junior Professor Dr Daniela Duarte Campos also defines quality requirements for generating complex multi-cell-type vascularized 3D tissue that is, for example, relevant for biomedical studies.

The studies by the Heidelberg researchers show how cells “in culture” can be precisely arranged by means of sound waves in space. This acoustic structuring influences cellular development over time, as well. According to Prof. Duarte Campos, the cells in the experiments formed self-organizing networks within a week and produced their own supporting, extracellular matrix. In addition, they activated genes associated with blood vessel formation.

“In our investigations we found a clear connection between the quality of the original acoustic pattern and the maturity of the emerging tissue structures. This shows that the formation of engineered tissue can be actively steered with the help of acoustic manipulation,” says the scientist, who heads the research group “Bioprinting for tissue and organ engineering” at the Center for Molecular Biology of Heidelberg University (ZMBH).

“Earlier studies had already explored the use of acoustic manipulation of cells in vitro. However, they were not able to identify the critical quality requirements for developing complex vascular tissue in the laboratory,” explains Dr Oscar O’Dwyer Lancaster-Jones, who is a member of Prof. Duarte Campos’s team. “Our methodology now makes it possible to generate and evaluate this acoustically patterned tissue with several types of cells.”

With their findings, the researchers at the ZMBH show what preconditions are necessary for new blood vessels to successfully form and self-organize in the laboratory. They also define biological and physical parameters as design rules to help create tissue structures that are as close to reality as possible. The vascularized 3D tissue is significant not only for biomedical studies but also for regenerative medicine.

Publication:

O. O’Dwyer Lancaster-Jones, R. Quinn, N.K. Rad, K. Paul, A. Frank, and D.F. Duarte Campos: Quality Thresholds for Angiogenesis under Acoustic Manipulation in Engineered Vascular Tissues. *Advanced Science* (published online 23 June 2026) DOI: 10.1002/advs.76219

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