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Research in the Grisons

When cells dance

New method for generating tissue using sound

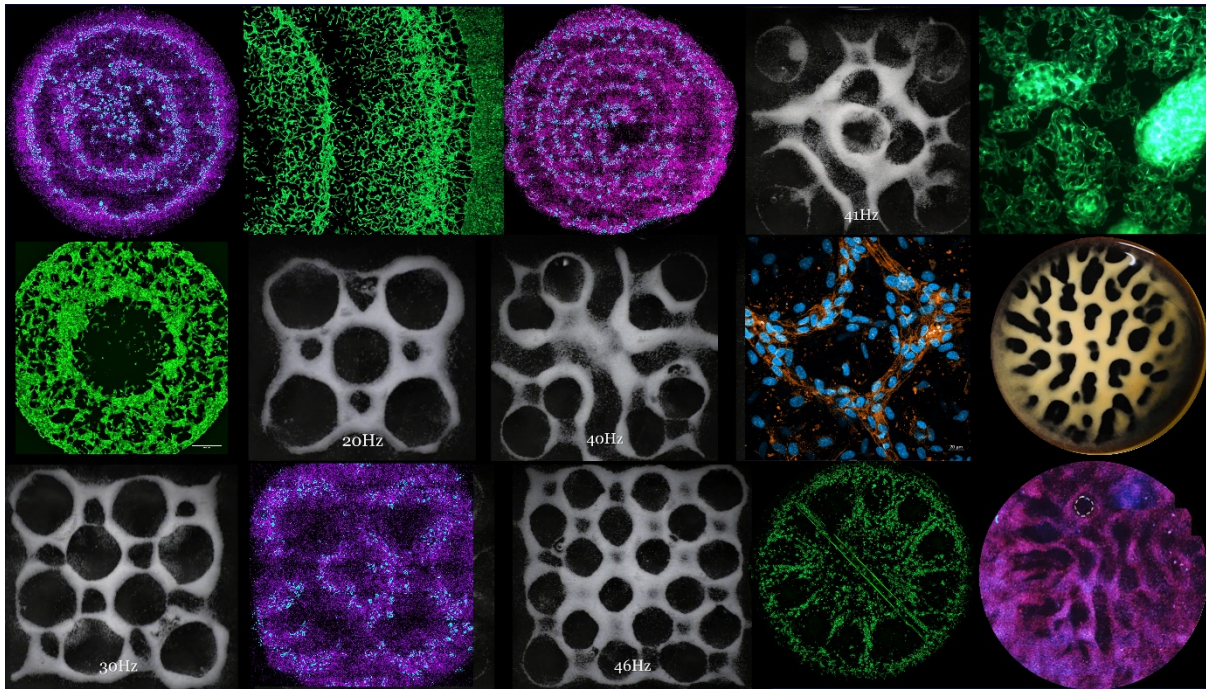


Image: The cells create fascinating shapes under the influence of sound. Image credit: Tiziano Serra

Bioengineer Tiziano Serra has developed a new process at the AO Research Institute in Davos that uses sound to stimulate cells to form new human tissue. “The idea for my research was inspired by my love of music and also of sound-based patterns in art”, explains Serra, who was born in Italy. “When I started my position in Davos in 2016, I presented the idea to my team, who supported and invested in my offbeat idea with an open mind.”

His new approach deals with morphogenesis. Serra explains, “The term morphogenesis comes from Greek and refers to the shape formation of organs, organisms and similar structures. Every kind of living system always has a shape that triggers the beginning of life. In order to create a bone, a blood vessel, or any kind of tissue, the cells, as well as all other elements around the cells, must be in a certain position. For our process, we use sound to make a liquid growth medium that contains the cells vibrate. And by sound I mean a mechanical vibration. We use a low-frequency sound between 0 and 300 hertz, which does not weaken the cells or affect them due to high temperatures.

Compared to 3D bioprinting, our method of creating tissue using sound is a fast process, especially for forming large areas of tissue. You take a pipette and spread the cells randomly in a container positioned on top of the sound device. Like a conductor, we give the first sound and then the cells

react like instruments in an orchestra. This happens in a few seconds. All the cells in an area move to a certain place. When they have formed a shape, we leave them alone and let them work as they would in a normal, natural process. We support the biological process by ‘nudging’ the cells with sound, so to speak, without touching them.”

Serra has further plans: “We have already applied for two patents on the process in 2017. To commercialize the process and a prototype, I founded the start-up Mimix Biotherapeutics together with Marc Thurner, a Swiss pioneer in the bioprinting industry, in 2019. The working prototype is a device that generates the vibrations and includes a chamber where the cells can ‘dance’. We sell the device along with biomaterials and labware to research institutions and universities so they can generate cell patterns in specific shapes, using standard instructions we have created. We are in an ongoing process to develop ‘recipes’. Blood vessel formation is one of the first applications we are exploring with this technology, but it is not the only one. The big goal is to develop the process so that clinicians can use it directly in the operating room to repair damage to tissues or organs.”

Tiziano Serra and Daniela Heinen

The AO Research Institute Davos (ARI) has a leading role worldwide in the field of preclinical research for trauma surgery and orthopedics. The research work carried out at its headquarters in Davos makes a significant contribution to Davos’ recognition as a research location.

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*Tiziano Serra. Photo credit:
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