



Cellular Connections

By Roeland Merks

The research story

“Cellular Connections” shows a computer simulation of the growth of blood vessels. Endothelial cells, the building blocks of blood vessels, collectively form networks of blood vessels, much like ants work together to form their nests. In the centre of the image, the cells are sufficiently close together such that they feel one another and manage to interconnect. The cells at the periphery are too far away and wander around aimlessly.

The image

The tiny blood vessels that we simulate are formed early in embryonic development, and they continue to grow throughout our lives. Cells can stimulate adjacent blood vessels to form side branches as a healthy response to lack of oxygen, for example during wound healing and menstruation. Unfortunately, cancer cells can hijack this process, and attract blood vessels for their own benefit. By figuring out the rules that endothelial cells use to construct a blood vessel, we hope to find new ways to control blood vessel growth. Through this computer simulation we found out that the cells form particularly realistic networks if we let them assume an elongated shape, and we let them attract one another through a signal that they emit into the environment. The simulations are performed on a square grid through stereotypic algorithmic steps. Yet they generate life-like forms. This is due to the biological model rules and a pinch of mathematically-generated unpredictability.

References

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- [2] Palm MM, Merks RMH, Vascular networks due to dynamically arrested crystalline ordering of elongated cells, *Phys. Rev. E* 87: 012725, 2013.

