**Lay abstract**

Whether therapy will succeed or fail depends on the amount of drug molecules reaching all live cancer cells at a lethal level. This is often challenging to achieve because of the larger than normal distance between blood capillaries in solid tumors. This situation is made worse by a lack of oxygen deep in the tissue. This work introduces a novel tumor model of hemi-spherical shape that replicates tumor tissue in a dish and makes in-depth mapping of oxygen levels possible to aid therapy design for patients. The Multicellular Tumor Hemi-Spheroid will also make drug development and personalized medicine more effective.