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Uncovering cancer cell behavioral phenotype in 3-D *in vitro* metastatic landscapes LIYU LIU, Physics, Princeton University, BO SUN, Mechanical & Aerospace Engineering, GUILLAUME DUCLOS, Physics, Princeton University, YOONSEOK KAM, ROBERT GATENBY, Moffitt Cancer Institute, HOWARD STONE, Mechanical & Aerospace Engineering, ROBERT AUSTIN, Physics, Princeton University, PHYSICS-MECHANICAL & AEROSPACE ENGINEERING, PRINCETON TEAM, PHYSICS, PRINCETON-MOFFITT CANCER INSTITUTE COLLABORATION — One well-known fact is that cancer cell genetics determines cell metastatic potentials. However, from a physics point of view, genetics as cell properties cannot directly act on metastasis. An agent is needed to unscramble the genetics first before generating dynamics for metastasis. Exactly this agent is cell behavioral phenotype, which is rarely studied due to the difficulties of real-time cell tracking in *in vivo* tissue. Here we have successfully constructed a micro *in vitro* environment with collagen based Extracellular Matrix (ECM) structures for cell 3-D metastasis. With stable nutrition (glucose) gradient inside, breast cancer cell MDA-MB-231 is able to invade inside the collagen from the nutrition poor site towards the nutrition rich site. Continuous confocal microscopy captures images of the cells every 12 hours and tracks their positions in 3-D space. The micro fluorescent beads pre-mixed inside the ECM demonstrate that invasive cells have altered the structures through mechanics. With the observation and the analysis of cell collective behaviors, we argue that game theory may exist between the pioneering cells and their followers in the metastatic cell group. The cell collaboration may explain the high efficiency of metastasis.

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