Social games of tumour and virus on microfluidic device with interconnected microchambers

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Microfluidic devices with heterogeneous microhabitat can be used to recapitulate bacterial social interaction, bacterial resistance, cancer drug resistance, and virus transmission in society.[1-3] We demonstrated that the emergence of drug resistance was accelerated in brain and breast cancers using a cancer drug resistance accelerator (CDRA) chip within 10 days. The CDRA chip consists of 488 interconnected microchambers (200 μm diameter) surrounded with two microchannels, enabling cells to be cultured under gradients of drug and nutrients over two weeks. We observed both normal-sized drug-resistant cells and polyploidy giant cancer cells (PGCCs) in microchambers perfused with high concentrations of drug. On the other hand, the chip was used to monitor virus propagation rates by seeding host cells (lung fibroblasts) infected with human coronavirus in the center of a chip filled with uninfected host cells (**Figure 1**). The rate of propagation depended on the initial number of infected cells (I_0), the density of susceptible cells (S_0), and the proportion of immunized cells on the chip. Taken together, it is suggested that our microfluidic platform technology can be utilised for drug screening and disease transmission modeling.

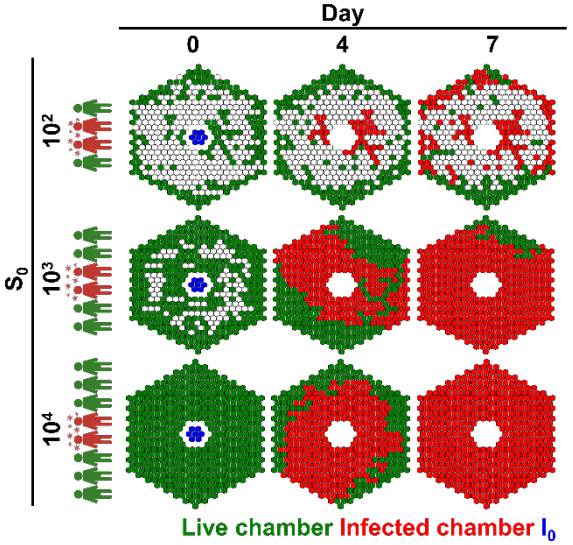

Figure 1: Effect of the density of susceptible cells on virus transmission.

[1] Park, S., *et al. Science* **2003**, *301*, 188.
2 Zhang, Q., *et al. Science* **2011**, 333, 1764-1767.
3 Han, J., *et al. PNAS* **2016**, *113,* 14283-14288.