**Modelling the Emergence of Resistance to Chemotherapeutics with Virtual Tumour**

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**Objectives:** Drug resistance is a major cause of treatment failure in cancer [1] that arises from mutations in the genome of cancer cells and/or epigenetic changes [2]. This issue is compounded by considerable tumour genetic heterogeneity, and it is therefore becoming increasingly clear that cancer should be managed through personalized medicine [3, 4]. Recent studies have shown that the emergence of drug resistance can at least be delayed using novel dosing regimens [5,6].

**Methods:** Physiomics has developed a ‘Virtual Tumour’ (VT) technology that can predict how a tumour will respond to drug exposure. The VT technology integrates pharmacokinetic and pharmacodynamic effects, and models the way individual cells behave within a tumour population. These agent-based methods are particularly suitable for modelling multiple cell populations, and representing the tumour heterogeneity. As a first step toward developing personalized medicine solutions, we have incorporated chemotherapeutic resistance into our VT platform.

**Results:** The VT has been extended with a resistance module, which has been developed, calibrated and qualified using literature data [6]. This module captures the fundamental mechanism by which resistance arises. Through this case study, we demonstrate that the extended VT can be applied to model the emergence of resistance in patient-derived xenografts. Furthermore, we show that the VT can be used to identify and optimize therapeutic strategies for delaying the emergence of drug resistance.

**Conclusions:** Our enhanced VT capability represents the first step towards a tool for developing personalized treatment, which is set to revolutionize cancer therapy in the near future, especially for patients with resistant disease.

**References:**