

Cancer organoids: a precision approach to tumor treatment

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The past few decades have seen a greater understanding of the molecular and genetic underpinnings of tumor etiology. However, questions regarding indolent disease, metastatic colonization, dormancy, relapse, and the rapid evolution of drug resistance are inadequately addressed by the use of standard molecular and genetic characterization and standard monolayer cell culture models. The promise of “precision medicine” lies in the ability of researchers to devise treatment approaches that are specific to the genetic profile of individual patients and their tumors. However, predicting which drug, or drug combinations, will be the most effective based on the genetic makeup of a tumor remains a challenge. Recently a groundbreaking technology has been developed that allows tumor samples isolated from patients to be maintained and grown in a 3D environment. These in vitro growing tumors, which are called tumor organoids, provide an unprecedented opportunity to combine genetic and phenotypic heterogeneity studies in tumors from individual patients. Tumor organoids appear to recapitulate genetic and morphological properties of the original tumor and therefore allow studies of sensitivity and resistance to a large number of anticancer drugs. Furthermore, organoids allow studying real time dynamics of cancer cells and are easily amenable to live microscopy techniques, thereby overcoming a number of important limitations of current preclinical models. The knowledge acquired with these “avatars”, in terms of drug response or tumor aggressiveness, in future might be translated in therapeutic indications as well as for patient stratification.