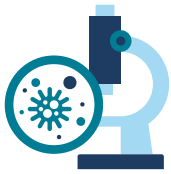


Breast Cancer



Thus far, breast cancer research has heavily relied on animal models but approaches that efficiently characterize the pathogenesis of breast cancer as well as **effective treatments are still lacking.**



Animal models only capture limited aspects of human breast cancer disease, because their biology and their tumours differ significantly from that of humans and human cancer.



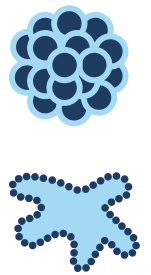
Research is increasingly moving towards the development of **human-based methods** that can recreate the physiological environment specific to human breast cancer.

Human breast cancer immortalised cells

have already extensively been used to study breast cancer initiation, treatments, metastatic process and the microenvironment-tumour interactions.



3D models, such as **organoids and spheroids**, can better reproduce the heterogeneity that characterise human breast tumours than animal models.



The use of **machine learning** in predictive (in silico) modelling is a very interesting approach, especially in drug development and for testing new therapeutic strategies.



Advanced cell-based in vitro and human ex vivo models are **powerful non-animal tools** to study the disease features as they better mimic human breast cancer pathophysiology.

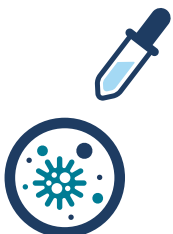
FUTURE DEVELOPMENTS



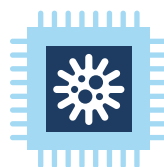
Further research should be directed towards more **efficient therapies** that match patient profiles and the clinical and molecular characteristics of the tumour.



Development of more **accurate in silico models** based on large-scale cancer datasets could provide new insights into disease mechanisms, drug development and therapeutic targets.



The replacement of 2D cell cultures with **3D models** using cells obtained from patient-derived biopsies will better reproduce the tumour microenvironment.



Researchers in bio-engineering, mathematical modelling, cell biology and oncology need to make concerted efforts in designing and optimizing **"tumour-on-a-chip"** technologies for breast cancer research, drug screening and the development of effective anticancer therapies.



Considering the high level of tumour heterogeneity observed in breast cancer as well as the poor clinical translation of preclinical data generated by animal-based research, **combining sophisticated computational tools and human relevant models** will lead breast cancer research towards efficient and effective precision medicine.