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Project title: Investigating the effects of low-dose mixtures of EDCs on breast cancer initiation

summary of the project (Dr Silva)

The alarming increase in the incidence of breast cancer worldwide cannot be explained solely by hereditary factors and evidence suggests that exposures to environmental contaminants, including those that disrupt normal hormone functions (so-called endocrine disrupting chemicals, EDCs), are involved. Scientific research linking endocrine disruptors to cancer is currently inconclusive. Experimental work has shown that chemicals such as plasticisers, pesticides and cosmetic additives cause effects in animal and cell-based models that promote breast cancer. However, many of these effects are only seen at levels of the chemicals that are much higher than those found in human tissues. Also, most studies examining links between exposure to individual EDCs and breast cancer in humans have produced unconvincing results. Taken together, these observations often lead to the assumption that the concerns associated with the role of endocrine disruptors in breast cancer are unfounded, as their levels in tissues are not high enough to increase breast cancer risk. The problem with this assumption is that humans are exposed to low levels of large numbers of chemicals that could act together to increase breast cancer risk. However, to date, this possibility has not been investigated.

Our project aimed at addressing this question by studying the way EDCs act together at low levels to potentially cause breast cancer. For this, we analysed the impacts of four EDCs and investigated how they impacted on the structure and behaviour of breast cells grown in a three dimensional (3D) system that resembles the human breast. The four compounds tested were: Bisphenol A, a chemical found in plastics, DDT, a pesticide that accumulates in our tissues, propylparaben, a preservative found in cosmetics and benzophenone-3 a UV filter found in sunscreens. All four are also ubiquitously found in human tissues.

We observed that all four compounds led to a disruption of breast structure that resembled what occurs in the early stages of breast cancer. We were also able to use the information on the chemicals to predict the effects they would cause if combined at levels found normally in human tissues. We showed that, together, these chemicals affect the function and structure of the breast more significantly than when tested alone, indicating that mixtures of EDCs, even at low levels, can potentially lead to breast cancer.

Brief summary

Low concentrations of 4 EDCs (propylparaben, BPA, DDT and benzophenone-3) added to breast cells grown in 3D cell culture caused changes resembling early stage breast cancer. When EDC mixtures were used, changes were more significant.