

## HORMONE DISRUPTING PROPERTIES OF BISPHENOLS & HERBICIDES

Breast Cancer UK is pleased to have awarded Dr Michael Antoniou from King's College London, a research grant to investigate the endocrine disrupting effects of low dose EDC mixtures of herbicides and bisphenol compounds. Previously Dr Antoniou was awarded a BCUK grant to evaluate the endocrine disrupting properties of the herbicide glyphosate, and in March 2018, he and Dr Robin Mesnage (also from King's College London) were awarded further funding to evaluate the cancer-causing potential of bisphenol combinations in primary mammary epithelial cells.

### **Brief Summary of Results**

Bisphenol A (BPA) is being phased out of plastics and is being replaced by bisphenol substitutes. Six different bisphenol substitutes were tested for their oestrogenic properties. All were found to be as oestrogenic as BPA, and in some cases more oestrogenic and potentially more harmful.

### **Project Description**

This work aims to evaluate the oestrogenic properties of herbicides and bisphenols used in the manufacture of plastics. Endocrine disrupting chemicals that will be tested include the herbicides glyphosate, 2,4-D and dicamba, and the plasticisers bisphenol A (BPA), and BPA variants (e.g. bisphenol F, bisphenol Z, bisphenol B) which are increasingly being used as BPA substitutes.

Bisphenol A is oestrogenic and may cause adverse health effects, including breast cancer. For these reasons, BPA is being phased out by plastics manufacturers and replaced with BPA variants. Identifying whether or not potential replacements for BPA are oestrogenic is important, and such data may be used to justify a ban on the use of all bisphenols as plasticisers.

Glyphosate is under consideration for reauthorization in the EU. If glyphosate is restricted, it seems likely use of dicamba and 2,4-D will increase. 2,4-D is oestrogenic and has been linked to breast cancer and dicamba is a potential EDC with possible cancer links. Hence, the oestrogenic effect of these herbicide combinations is highly relevant.

### **Summary of Results**

Six bisphenol substitutes, including bisphenol S, bisphenol F, bisphenol AP, bisphenol AF, bisphenol Z and bisphenol B were tested for their oestrogenic activity using cell culture, gene expression profiling and RNA sequencing. Each was able to promote breast cancer cell growth through oestrogen receptors. Furthermore, bisphenol AF, bisphenol B and bisphenol Z contained in "BPA-free" plastics, were more oestrogenic than BPA (which was recently classified by the EU as a substance of very high concern due to its endocrine disrupting and reprotoxic properties).

The research paper was highlighted by both the US Environment Protection Agency and the Editor-in-chief of the official journal of the Society of Toxicology. The US EPA issued a press release to highlight the need for testing of replacement chemicals to demonstrate they are safer than the chemical being replaced, prior to their introduction into commerce. Furthermore, the study was used to support the introduction of a new bill by the State of New York to prevent children from being exposed to certain harmful chemicals. The bill amends the "Bisphenol A-free Children and Babies Act" and will prohibit the sale of children's products (for those three and under) containing BPA substitutes BPS, BPF, BPAP, BPAF, PBP and BPZ. The act will take effect from December 31, 2019.