Project Details	
Project Code	MRCIIAR24Br Weavers
Title	The impact of microplastics on immune health: are novel bio-derived polymers a safer alternative?
Research Theme	Infection, Immunity, Antimicrobial Resistance & Repair
Summary	Humans are estimated to consume millions of microplastics (MPs) each year, but their impact on our health remains unclear. In this project, we will explore how MPs interact with cells of the immune system and decipher why these interactions might suppress the immune response (e.g. to pathogens). By combining in vivo animal models with in vitro analyses of human cells and state-of-the-art imaging, we will then test whether novel bioplastics are safer alternatives.
Description	Background: Microplastics (MPs) – microscopic plastic particles smaller than 5mm – are increasingly prevalent in our environment. MPs are now recognised as a growing threat to human and marine health. Recent studies have suggested that humans consume over 10,000 MPs a year, through both ingestion and airborne routes. Strikingly, MPs have been found in a huge variety of human and animal tissues, suggesting that once consumed, they disseminate widely through the body. However, the impact of MP exposure on our cells, tissues and overall health remains immensely unexplored. Recent in vitro studies have revealed that MPs can enter many human cell types (including the cells that make up our immune system) and can even cross the blood brain barrier. Once inside cells, MPs have the potential to trigger extensive cellular damage and even cell death. However, it remains unclear exactly how cells interact with MPs and what the consequences of MP uptake are on cellular function, as well as long-term health. There is a clear need for cutting-edge research to investigate the effects of MP exposure across scales – from the biochemical effects at the cellular level, through to their effect on whole tissues and host longevity. Proposed Plan of Research: This is an inter-disciplinary project, combining in vivo animal models with in vitro studies of mammalian and human cells, along-side synthetic chemistry. It builds on exciting data from the lab showing that MPs accumulate within immune cells (e.g. macrophages), which are specialised for clearing invaders (such as pathogens). We are eager to explore how MPs interact with cells of the immune system and whether excessive MP uptake causes immune suppression (including problems fighting infection) or even exacerbates antimicrobial resistance. In this project we will investigate: 1. How cells of the immune system (e.g. macrophages or microglia) interact with MPs at the molecular level 2. The consequences of MP accumulation on cell health and function e.g. the immune response to infection 3. If newly developed sustainable (biodegradable) polymers offer a biologically safer alternative There are extensive opportunities for the student to steer the project, including aiding the design of novel bioplastics. The student will learn skills in experimental in vivo and in vitro cell biology, as well as quantitative biology and bioinformatics. They will also be trained in polymer synthesis techniques to participate in the design of innovative bioplastics. The in vivo studies will involve state-of-the-art live imaging, genetic manipulation, omics and molecular biology within Drosophila, and be complemented by cutting-edge in vitro assays using

	cultured mammalian and human cells. By synthesising our own bespoke MPs (including commercial bioderived plastics or novel sugar-based polymers developed at Bath), we will explore exactly how polymer material and particle size influences the downstream biological effects.
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