Molecular sensors for reactive oxygen species detection in non-communicable diseases

Maria Weber¹,², Amanda B. Mackenzie³, Steven D. Bull¹, Tony D. James¹*

¹Department of Chemistry, University of Bath, Bath BA2 7AY, UK
²Centre for Doctoral Training, Centre for Sustainable Chemical Technologies, University of Bath, Bath BA2 7AY, UK
³Department of Pharmacy and Pharmacology, University of Bath, Bath BA2 7AY, UK
*E-mail: t.d.james@bath.ac.uk

Abstract: Non-communicable diseases (NCD) are the major cause of death worldwide, with cancer accounting for 8.2 million deaths each year. The need for early detection tools has led to significant advancements in the field of molecular fluorescent sensors. Our group is mainly interested in sensing reactive oxygen species (ROS) since increased levels of ROS have been linked to NCD. Selective and sensitive targeting of a particular ROS is highly challenging as they are very short lived species. A series of molecular sensors based on a resorufin scaffold, incorporating boronic esters as a ROS targeting unit have been synthesized. Upon reaction of the boronic esters with peroxynitrite (ONOO⁻), the molecular sensors emit a fluorescence signal. ROS selectivity fluorescence studies confirmed sensitivity and selectivity towards ONOO⁻. Preliminary J774.2 macrophages cell studies with one of the molecular sensors have confirmed detection of intracellular produced ONOO⁻. ONOO⁻ is involved in NLRP3 inflammasome activation, which is a key factor to induce inflammation in order to limit NCD progression.

Keywords: Reactive oxygen species; Molecular sensors; Fluorescence; Non-communicable diseases