Mammalian-like inflammatory and pro-resolving oxylipins from marine algae

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Oxidized lipids function as versatile tissue hormones in mammals. Especially $C_{20/22}$ polyunsaturated fatty acid-derived eicosanoids contribute to inflammation and its resolution. Well-known classes of these immunomodulatory lipid mediators include the pro-inflammatory leukotrienes (LT), the prostaglandins (PG), and the anti-inflammatory resolvins (Rv). They are biosynthesized by oxygenating enzymes such as lipoxygenases and cyclooxygenases. Besides mammals, also certain edible marine algae possess a comprehensive repertoire of oxylipins, including LTs, PGs, and Rvs. However, their formation in algae and effects on human cells are not well investigated. Here, we present an array of mammalian-like oxylipins from marine algae such as the novel acid-labile oxylipin, (5*R*,8*S*)-diydroxy-eicosatetraenoic acid, that forms inflammatory LTB_4 enantiomers raising concerns about food safety. The analysis of PGE_2 biosynthesis in algae led to the identification of the novel 15-hydroperoxy-PGE_2 that prompted us to re-investigate the mammalian route. There as well the novel hydroperoxide was detected representing an alternative precursor of PGE_2 and 15-keto-PGE_2. Novel putative bioactive RvE_3 derivatives were also found in algae. These molecules and alternative pathways may open opportunities to intervene with inflammation-related diseases.

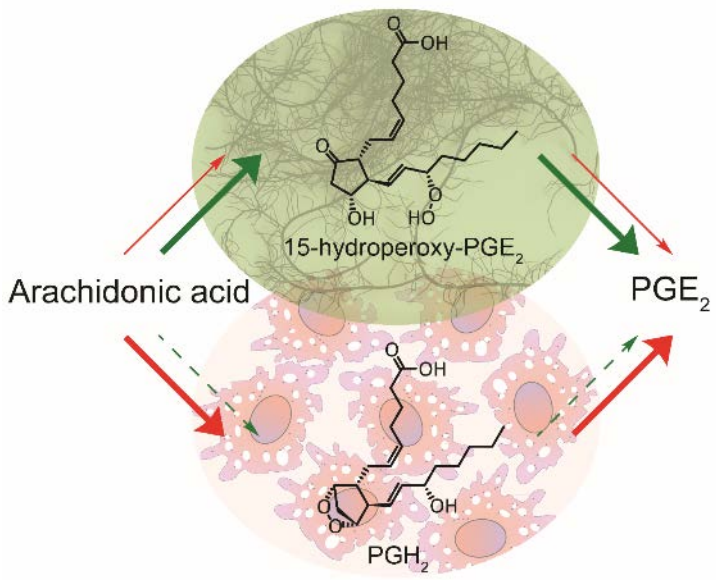

Figure 1: A new pathway to a long-known lipid mediator, PGE_2, was discovered in algae (green) and, upon re-investigation, in mammals (red).