

Extended abstract

Brilliant Marine Research Idea 2017

1. General information

Title of the idea	Do marine aerosols improve human health? An exploratory “holistic” approach.
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2. Brilliant Marine Research Idea

Extended abstract

The idea that sea-air has health promoting effects is nearly as old as human healthcare itself. Except for the increasing amount of epidemiological studies demonstrating a coastal proximity health effect, there is no physiological or other evidence for this. The biogenics hypothesis, which is investigated in this study, states that the natural marine products that are airborne via sea spray aerosolisation are the key health promoting substances in sea-air. According to this theory, the PI3K/Akt/mTOR cell signaling pathway is the essential target. Airborne biogenic compounds can originate from a variety of marine sources. Within this project, it was postulated that marine algae are the main producers of marine bioactive compounds which aerosolise in the form of sea spray.

In the current project, the effects of biogenic compounds on human lung tissue were examined, using *in vitro* experiments. Hence, the effects of three types of (mixtures of) biogenic molecules were examined on a lung cell line and compared against a negative control treatment. In addition, a known pharmaceutical inhibitor of the mTOR pathway (mTOR inhibitor) was included to identify the molecular response associated with this inhibition. Each treatment consisted of four replicates. After 43h of exposure, cells were harvested for mRNA extraction. Afterwards, RNA concentration and quality were verified. Sequence libraries of single 75 basepair reads were then prepared from each RNA sample and subsequently sequenced on the Illumina NextSeq 500. After sequencing, the data were subjected to quality analysis and subsequently mapped to a human reference genome. For each sample, count data per gene was generated. The count data was statistically analysed with the EdgeR package in the R statistical computing environment after data filtering and data normalization. Different treatments were compared using an exact test for pairwise comparison to identify differentially expressed genes. In this way the effects on the mTOR cell signaling pathway could be determined at a molecular level and other potentially involved pathways could be identified.

Significant molecular responses were observed that distinguished each of the treatments from each other and from the negative control, clearly indicating that all treatments caused effects at the molecular level. Overall, the data from this experiment allows to state that: (1) a specific gene, which is frequently suggested as a new pharmaceutical target, is a key gene influenced in this study, (2) marine biogenic products can indeed regulate the mTOR pathway, (3) the responsible biogenic substances not only influence mTOR but a whole subset of signaling pathways and molecules involved in detoxification and (anti-)cancer.

Finally, it can be concluded that these results are in line with our previous results and that this study is an essential step towards the confirmation of the biogenics hypothesis.