

NASAL AIR-CONDITIONING DURING BREATHING THERAPY

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Over 40% of people who undertake nasal breathing therapies, such as those using anaesthetic or nasal continuous positive air pressure (n-CPAP), report problems of rhino-sinusitis or congestion of the nose despite not having these symptoms prior to treatment. Our objective is to develop a model which can help in understanding the causes and therapies of these symptoms. This work presents a proposal for a mathematical model for nose air-conditioning during breathing therapy.

Research Hypothesis

Normally tidal breathing exerts cyclic mechanical stresses on airway epithelial cells which regulates airway liquid levels through cellular purinergic pathways. Elevated air pressure disrupts this sensing and can lead to the occurrence of negative symptoms. Additionally, air elevated pressure can also compress nasal erectile tissue leading to changes in blood flow and hence heat supply as well as increase nasal volume which has a negative effect on heat and water mass transfer.

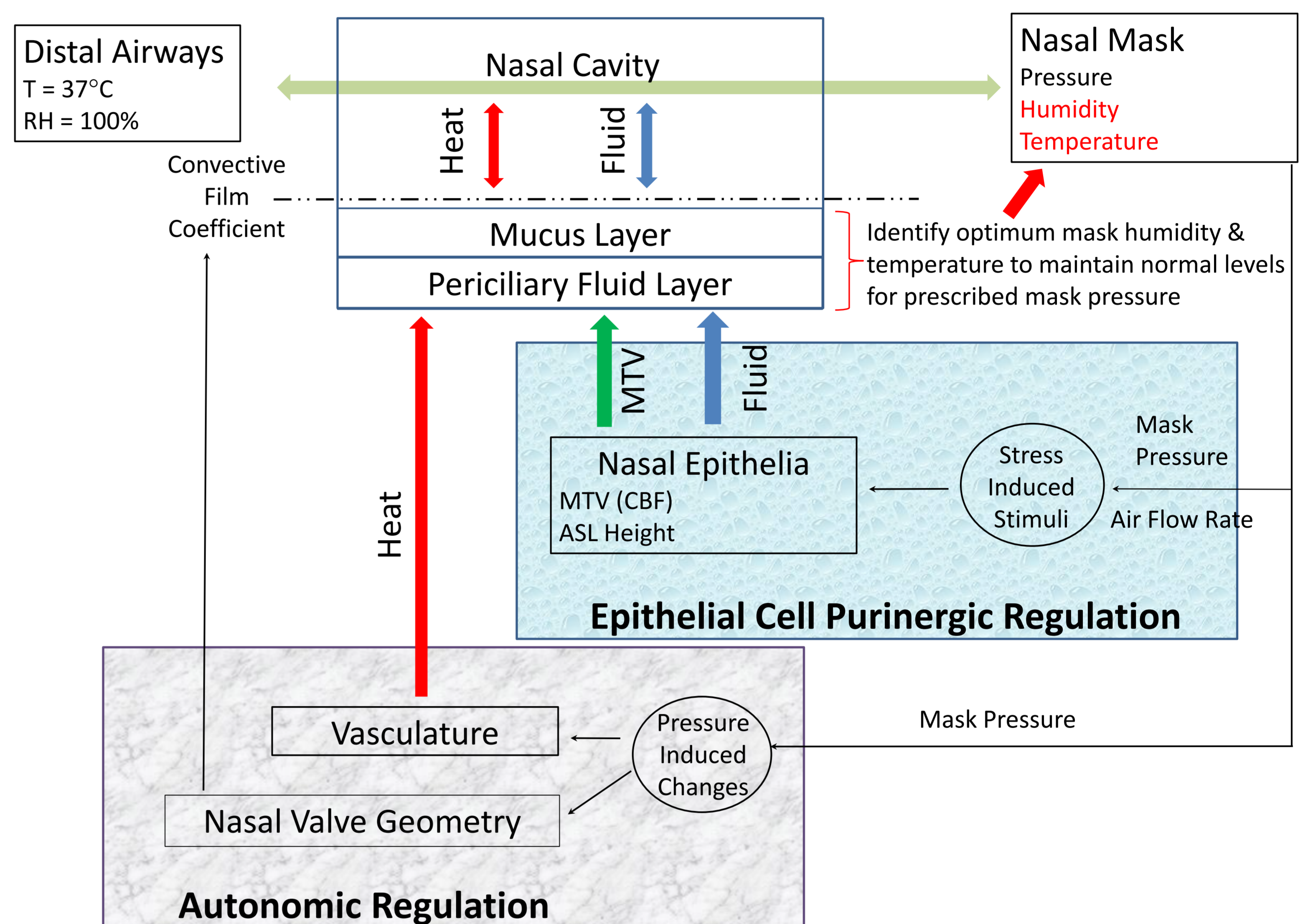


Fig 1: Nasal Air-Conditioning Model Block Diagram

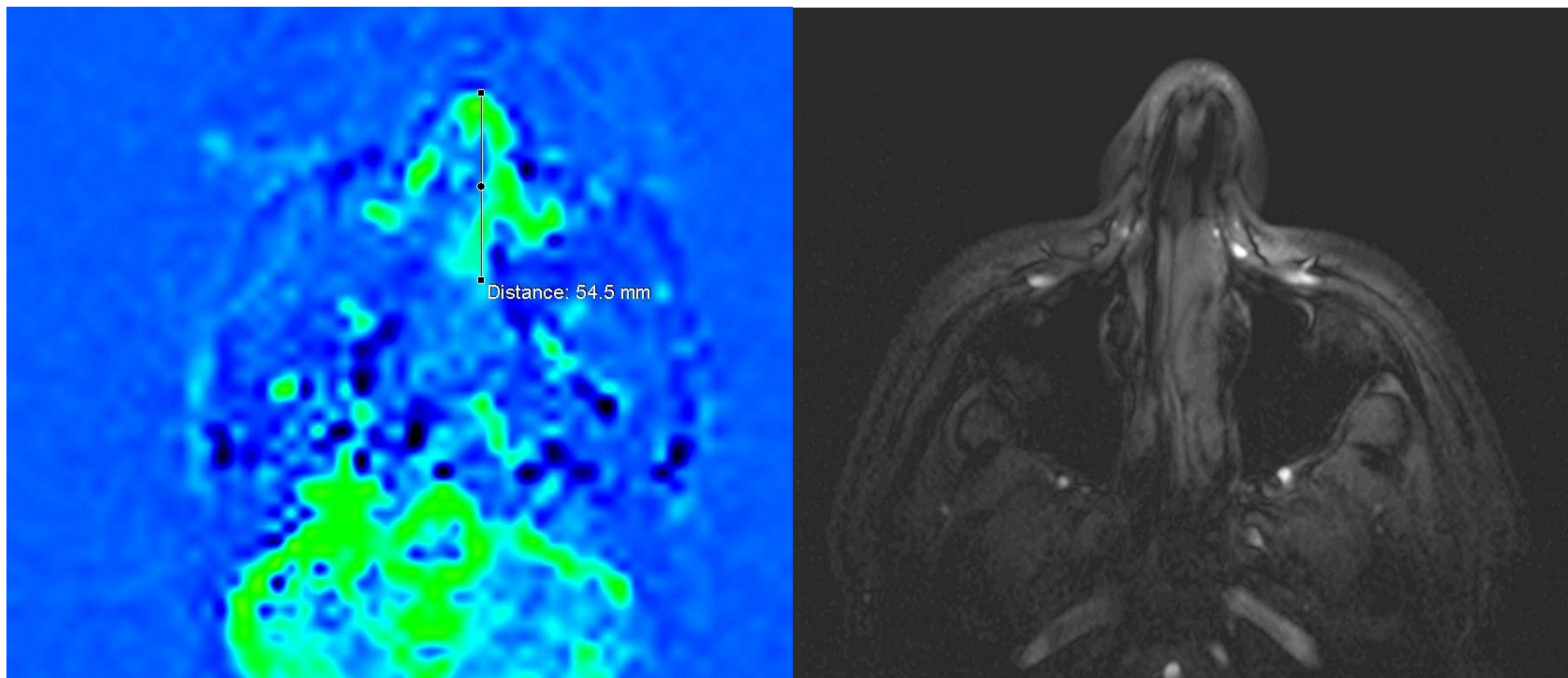


Fig 2: Axial views through nasal cavity during MRI scan comparing nasal morphology and perfusion using Arterial Spin Labelling technique.

Heated Humidification

Heated humidification is often used to condition inhaled air and minimise negative symptoms by eliminating the need for the airway mucosa to provide or recover heat or moisture. Extensive clinical research has proven the benefits of heated humidification in reducing some of these therapy's negative side effects; however, understanding of why these therapies often create negative symptoms has yet to be determined.

Proposed Tissue Test

It is proposed that trachea tissue be tested to ascertain the influence nasal mask conditions have the regulatory influence normal mechanical breathing stresses have on airway surface liquid. Also quantify the effect elevated air pressure has on the airway liquid fluid supply from epithelial cells.

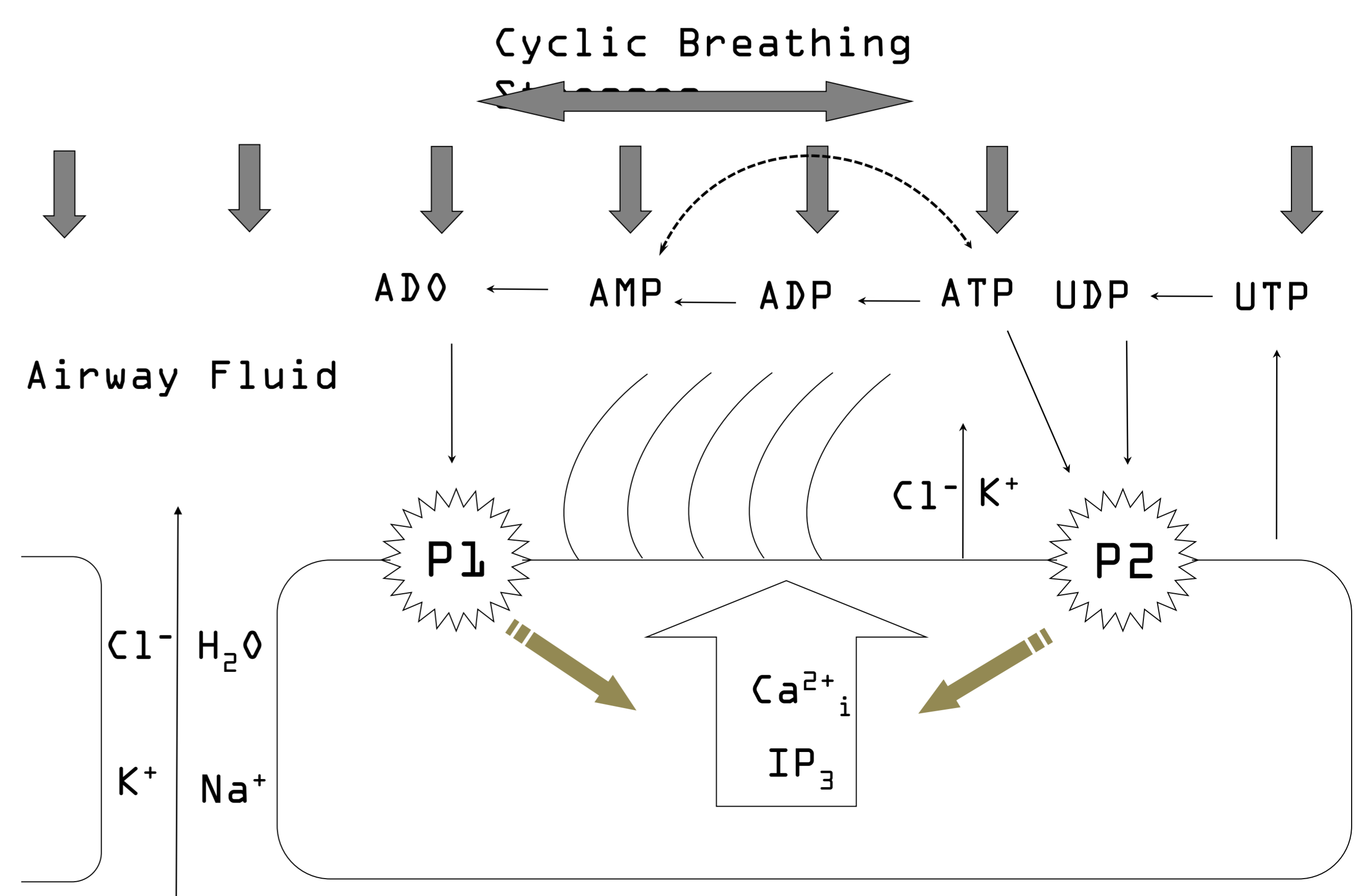


Fig 3: Schematic Representation of Epithelial Cell Purinergic Stimulation Pathways