# STRONG CHILDREN'S RESEARCH CENTER

***NIH Human Biomolecular Atlas Program (HuBMAP) Summer Student***

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## ABSTRACT

**Title:** Spatial Distribution of Mast Cells in Asthma and Non-Asthma Donors

**Background:** Mast cells are intrinsically linked to the pathogenesis of asthma, a chronic inflammatory condition that affects the lower airways of the lung[1].

- Asthma is characterized by contraction of airway smooth muscle in lower airways of the lung and increased mucus secretion, resulting in difficulty breathing[2].
- Mast cells are tissue-inhabiting leukocytes that originate from bone marrow. They are one of many cell types that accumulate in the airways of asthma patients[2].

Any differences observed in spatial distribution between asthma vs. non-asthma donors will support previous observations that mast cells play a role in the asthmatic response

**Objectives:** Identify differences in spatial distribution and enumeration of mast cells between asthma and non-asthma donors, as well as between airways and vessels in the lung.

**Methods:** Identified three asthma donors and three non-asthma donors using BRINDL. Using a microtome, cut desired lung samples from formalin fixed paraffin embedded (FFPE) blocks. Stained slides of FFPE lung tissue with both Akoya™ and self-conjugated antibodies. Ran 45-marker panel on each slide using the Akoya™ Phenocycler and Phenoimager, resulting in fluorescent images. Targeted MC through expression of TPSAB1 tryptase marker. Vessels identified with smooth muscle SMA marker, airways with Pan-CK epithelial marker. Collected data from images using QuPath software. Using Stardist extension and DAPI marker, trained "pixel classifier" and "pixel thresholder" to identify and differentiate mast cells with TPSAB1, SMA, and PanCK markers according to annotations and point detections. Analyzed data in R using Shapiro-Wilkes normality test and Wilcoxon Rank-Sum test. Compared statistical significance in mast cell spatial distribution in asthma vs. non-asthma donors and airways vs. vessels.

**Results:**
Findings revealed there are consistently more mast cells around airways than vessels. Surprisingly, although there are fewer mast cells around airways of asthma donors, they are clustered more tightly around those airways. This supports previous research that the spatial distribution of mast cells plays a role in the asthmatic response.

[1]Méndez-Enríquez, E., & Hallgren, J. (2019, March 28). Mast cells and their progenitors in allergic asthma. *Frontiers*.
https://www.frontiersin.org/journals/immunology/articles/10.3389/fimmu.2019.00821/full

[2]Banafea, G. H., Bakhashab, S., Alshaibi, H. F., Natesan Pushparaj, P., & Rasool, M. (2022). The role of human mast cells in allergy and asthma. *Bioengineered*, *13*(3), 7049-7064.
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