Endocytic vesicles on electron microscopy images can be characterized and classified quantitatively

Morphology-based classification scheme for endocytic vesicles on electron microscopy images

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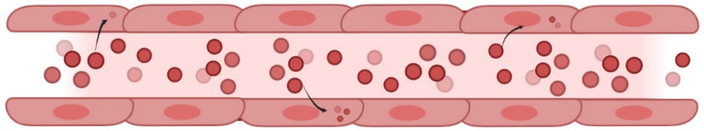
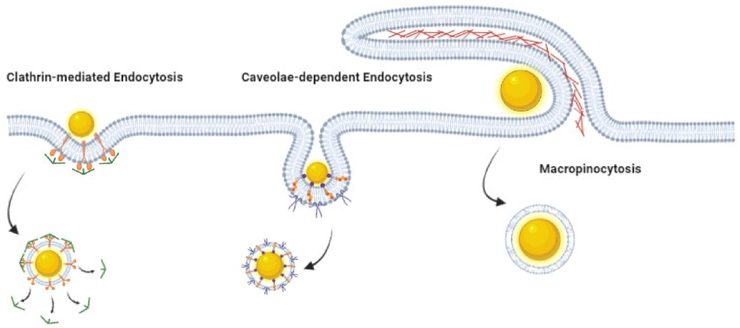
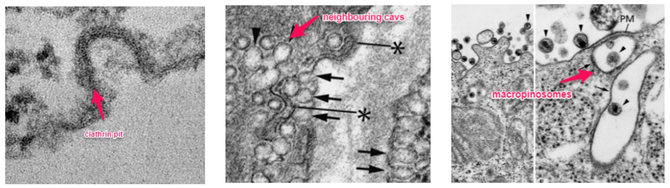
Introduction

- Nanoparticles can deliver imaging and therapeutic agents to diseased cells
- Nanoparticles can enter cells through endocytosis post-interaction with components of the plasma membrane or extracellular matrix



- Different uptake pathways have different vesicle types associated with them



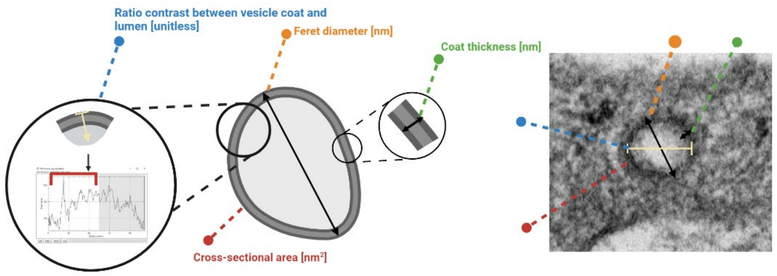


Objective

- To develop a classification algorithm for endocytic vesicles on transmission electron microscopy (TEM) images based on quantifiable features
- To automate the classification pipeline for endocytic vesicles that will maximize inter-operator reliability and minimize data-handling time for large datasets

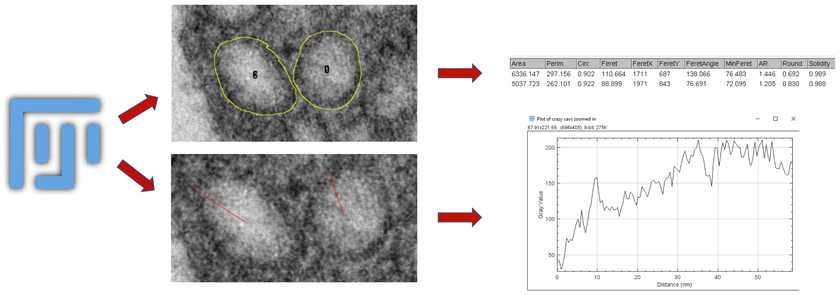
Significance

The development of this classification algorithm demonstrates an objective, impartial, and consistent methodology for identifying and characterizing endocytic vesicles in cell.



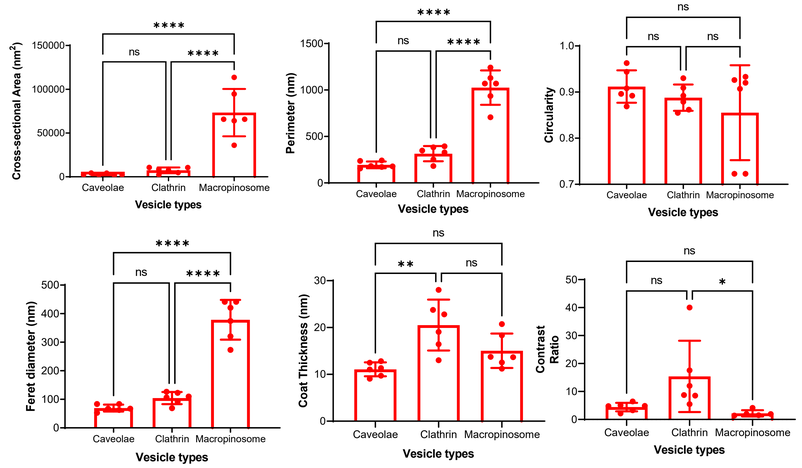
Preliminary analysis suggests certain morphological features we can use to build the classification algorithm for endocytic vesicles on TEM images

Method: Use ImageJ to manually analyze vesicle perimeters

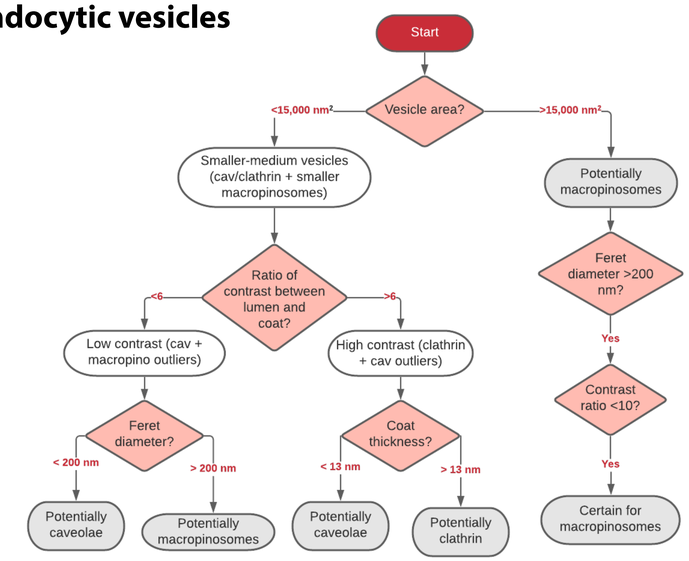


Area	Perim.	Circ.	Feret	FeretX	FeretY	FeretAngle	MinFeret	AR	Round	Solidity
6336.147	297.156	0.902	110.664	1711	687	138.066	76.483	1.446	0.692	0.989
5037.723	262.101	0.922	88.899	1971	843	76.691	72.095	1.205	0.830	0.988

Result: Different vesicle types have quantifiable characteristics



Classification algorithm coded on MATLAB® provides quantitative and automated flow for characterizing endocytic vesicles



Next steps

Validate the semi-automated classification algorithm by comparing the results and handling time with manual and subjective classification of endocytic vesicles

References

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