

# Automated image analysis methods for the quantification of cell damage and adherent fungal cells

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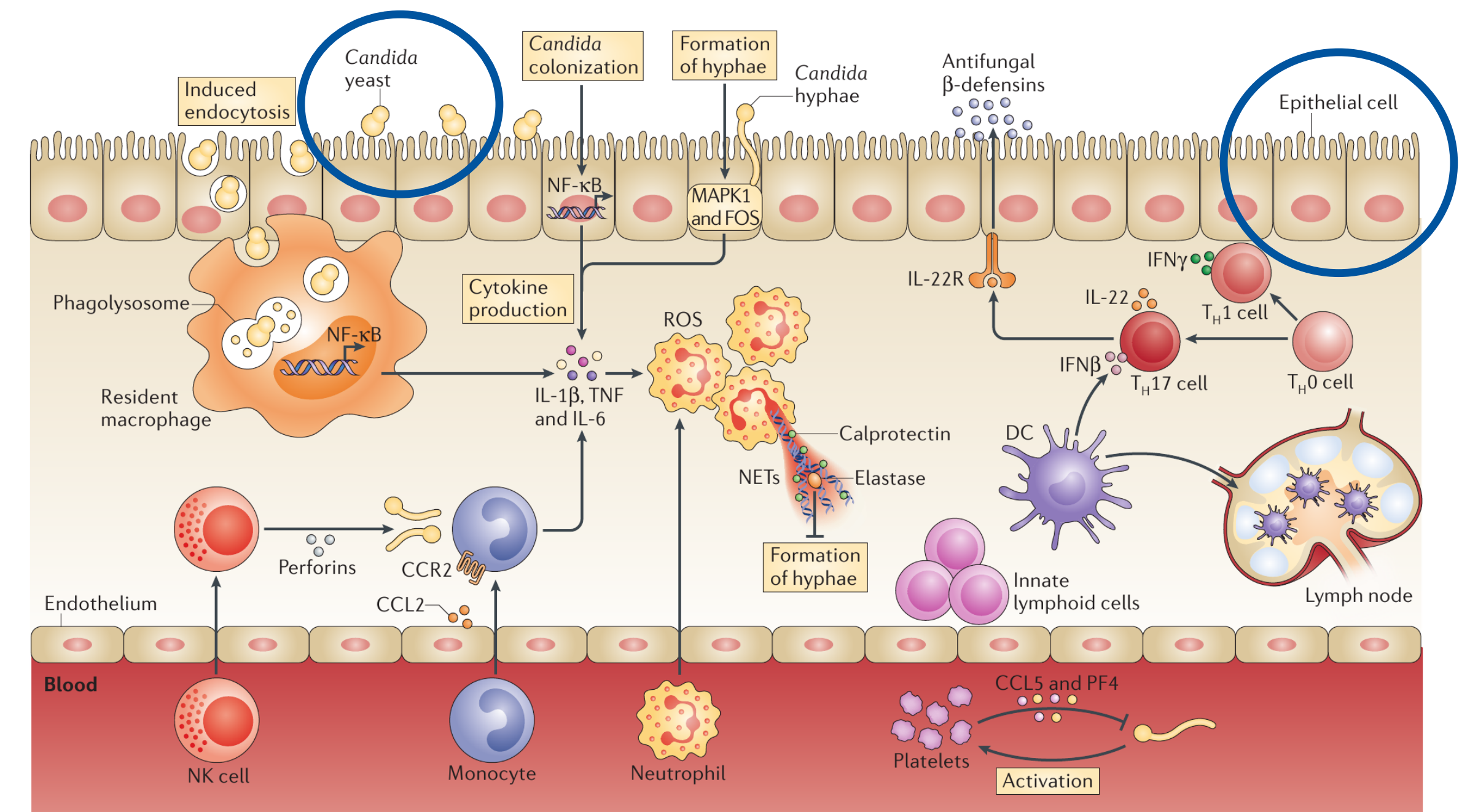
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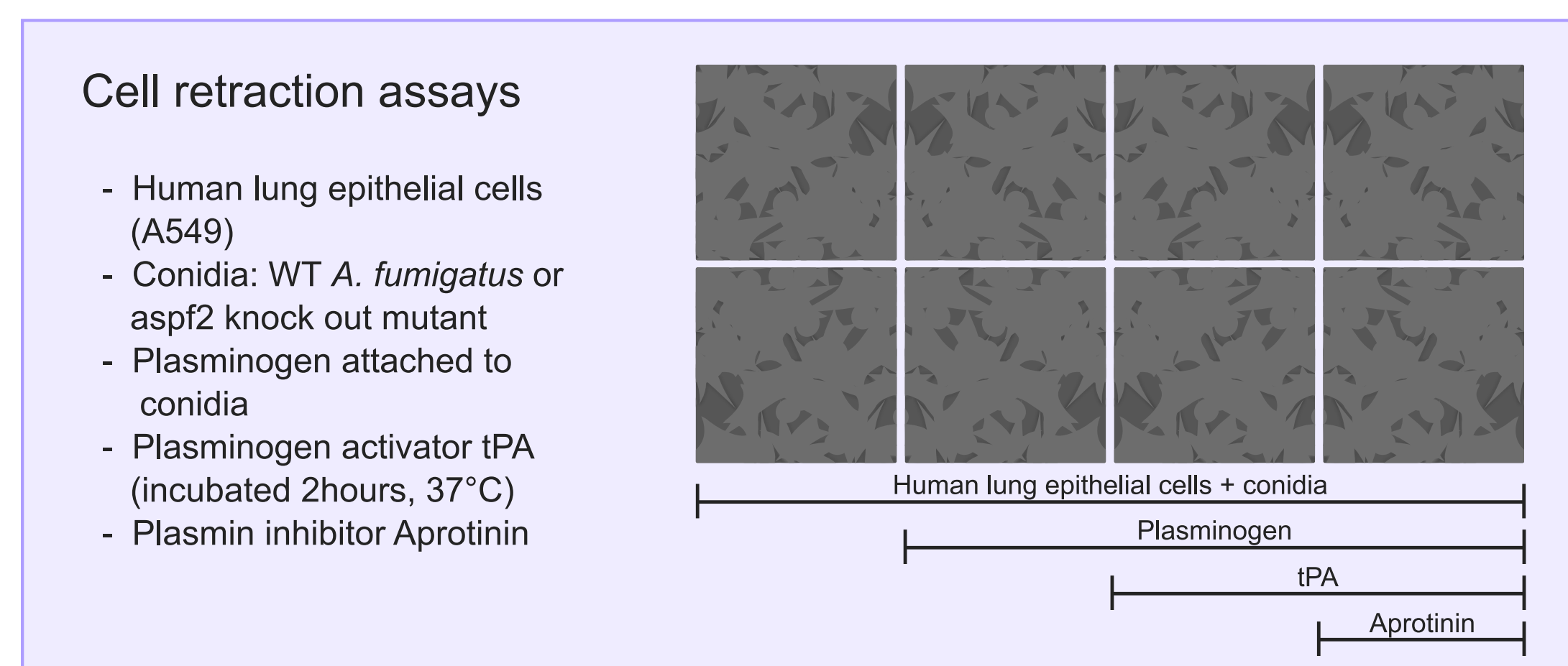
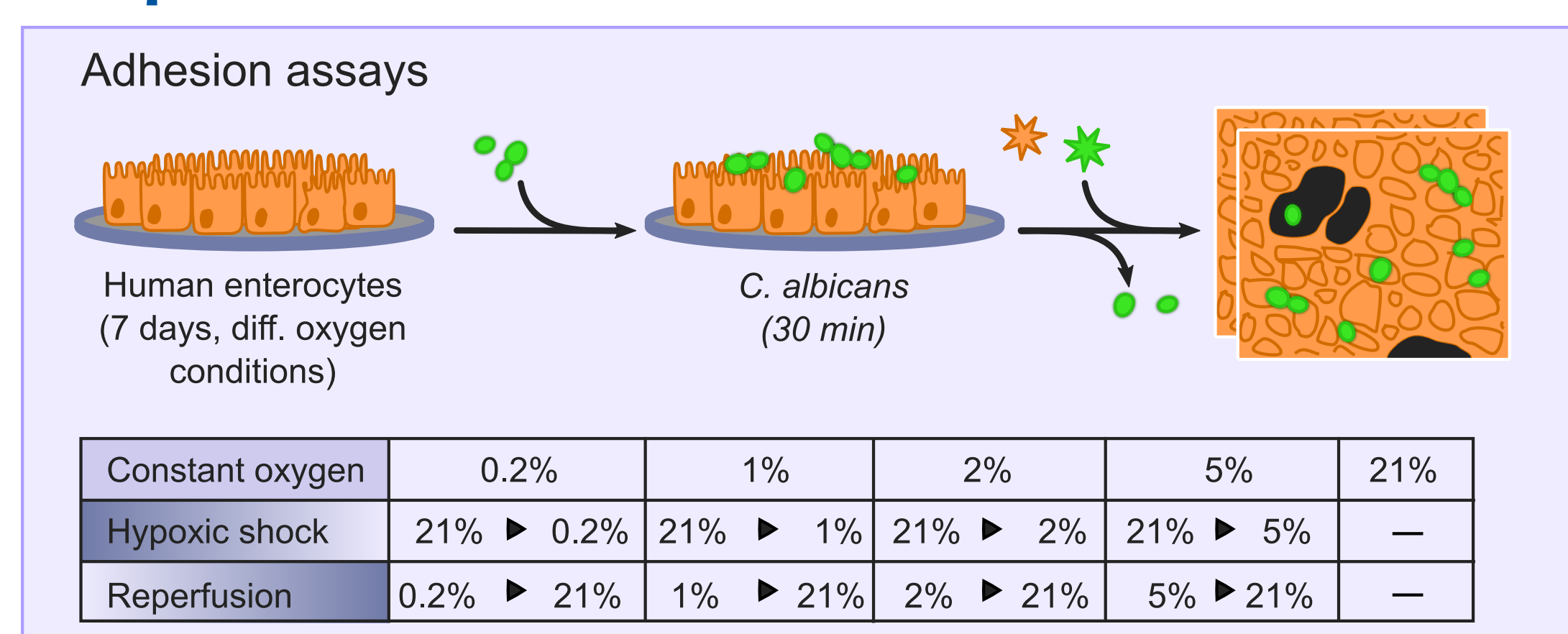
## Introduction

Epithelial tissues are the first line of defence against many microbial invaders like human pathogenic fungi. An impaired functionality of these barriers can lead to invasion and infection, but the exact mechanisms on host and pathogen side are still unknown. Therefore, experiments were conducted by the research group Infection Biology to study the interplay between *Aspergillus fumigatus* aspf2 mutants and wildtype and human lung epithelial cells. The effect of mesenteric ischemia on the barrier function of enterocytes and adhesion of *Candida albicans* was studied by the group Microbial Immunology. Microscopic images of both assays were generated in order to quantify damage of the cell layer and the number of adherent fungal cells. We developed tailored image analysis algorithms to automatically analyse the image data in a fast and objective manner. We combine standard image analysis techniques with machine learning and advanced segmentation methods.

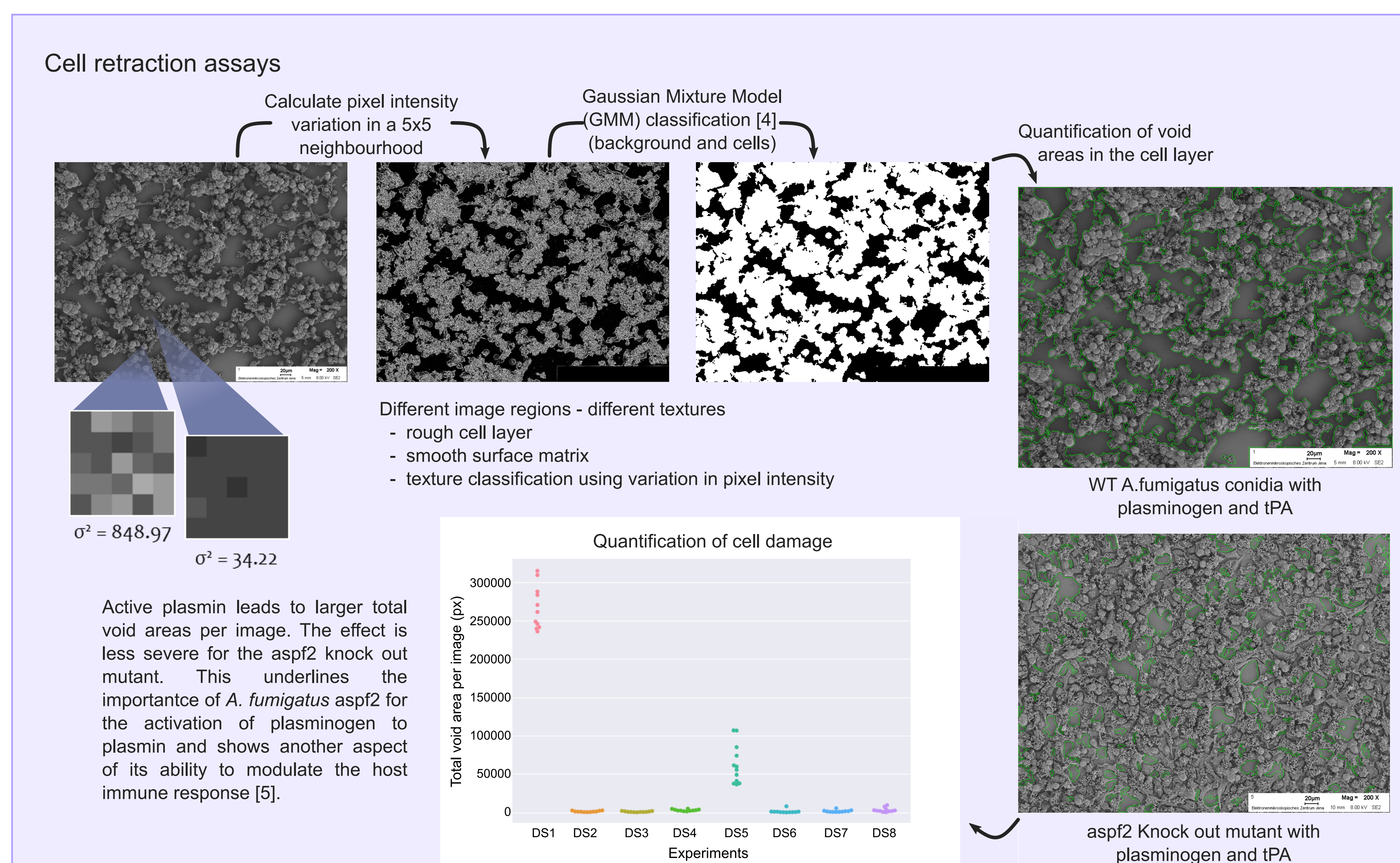
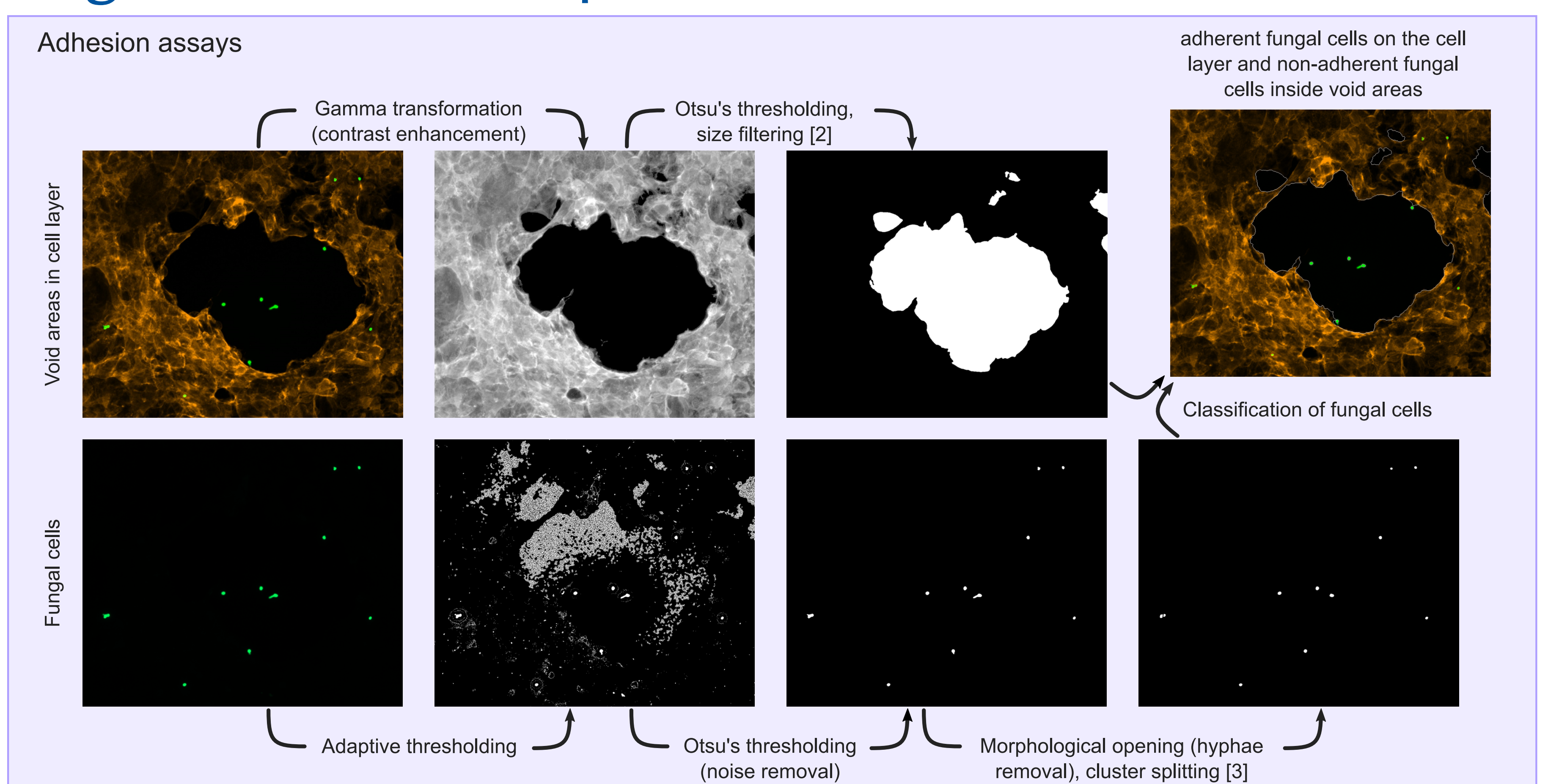


Overview of immune defence mechanisms against *Candida*. Adapted from [1]

## Experiments/Data

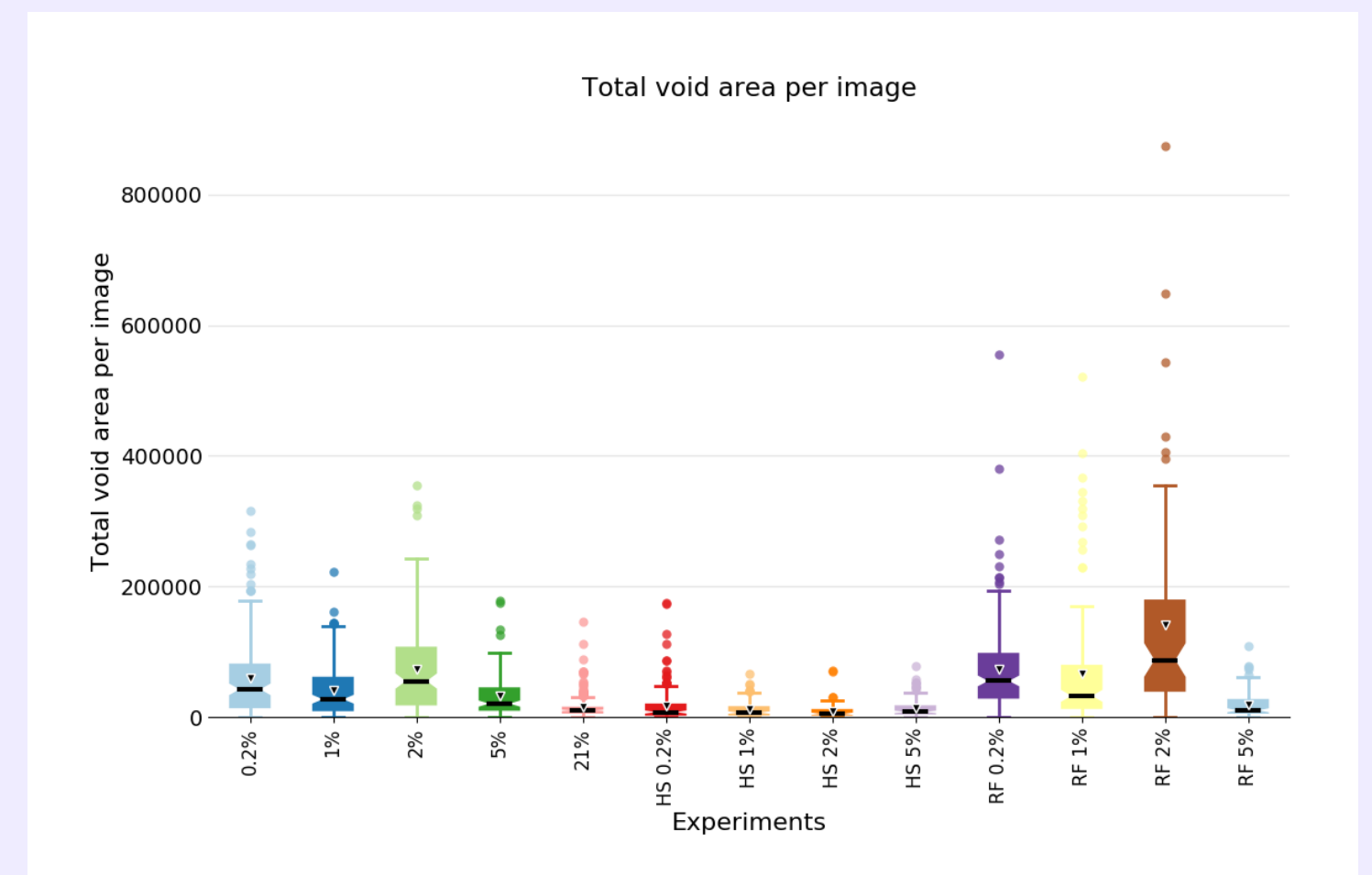


## Segmentation and quantification

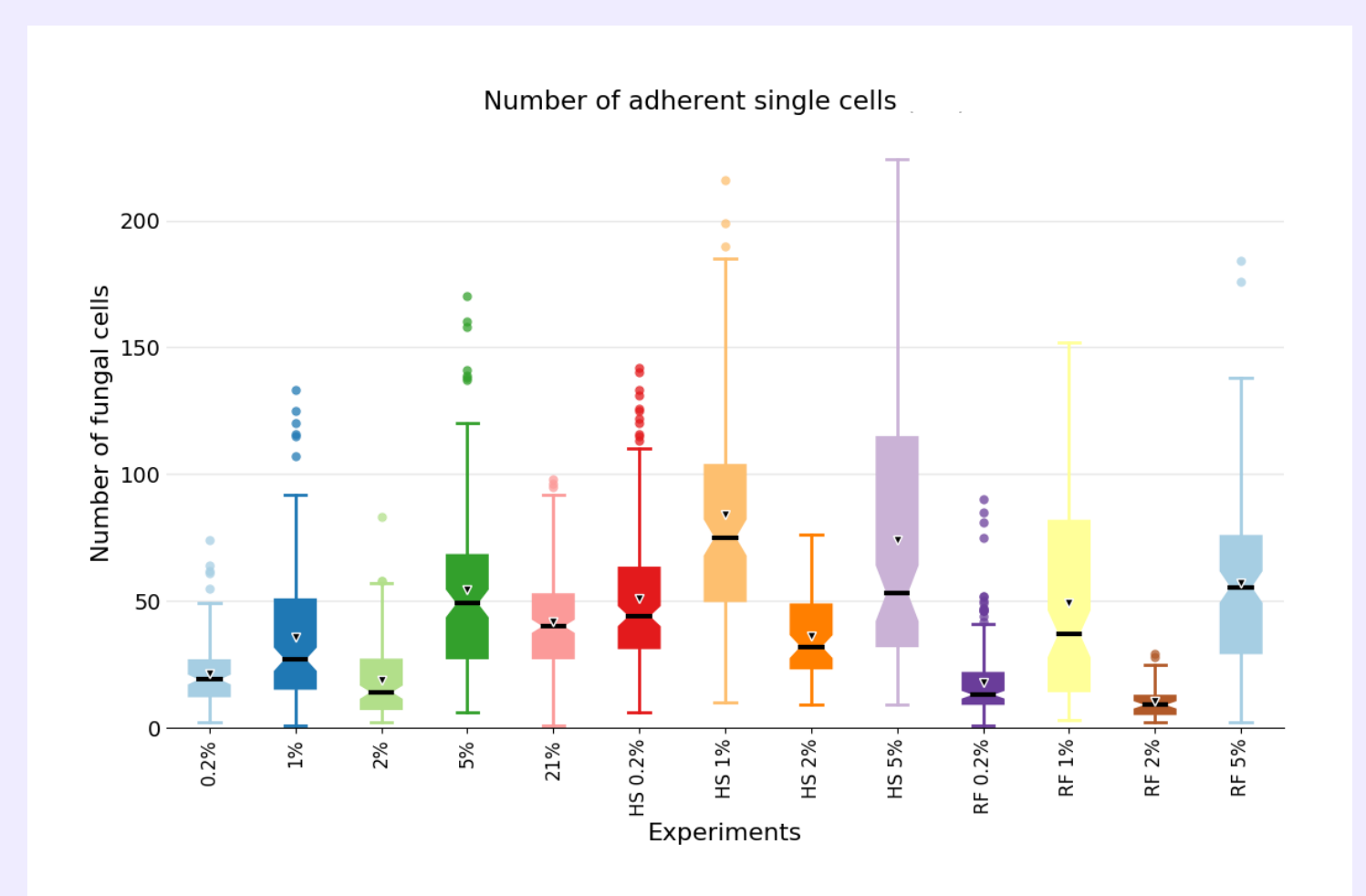


### Quantification of void area and adherent fungal cells

The void area per image is increased for reperfusion conditions with 0.2%, 1% and 2% oxygen and for constant oxygen levels of 0.2%, 1% and 2% oxygen. This indicates a weakening of the epithelial barrier.



Most distributions of the number of adherent fungal cells per image possess a high variance. Whereas the number of cells is small for reperfusion with 0.2% and 2% oxygen it is larger for 1% and 5%. Therefore the conclusion regarding the influence of oxygen concentrations on fungal adhesion is currently not entirely clear.



## References

- [1] Netea, M.G. *et al.*, *Nat. Rev. Immunol* 15, 630-642 (2015)[2]
- [2] Otsu, N., *Automatica* C (1), 62-66 (1975)
- [3] Farhan, M. *et al.*, *Pattern Recognit.* 46 (3), 741-751 (2015)
- [4] Brandes, S., Dietrich, S., Hünninger, K., Kurzai, O., Figge, M.T. *Medical Image Analysis* (2016)
- [5] Dasar, P. *et al.* [under revision]

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