

A phase contrast micrograph showing a dense population of epithelial cells. The cells are mostly rounded or polygonal in shape, with prominent nuclei and some visible cell-cell junctions. The background is a light gray, and the cells are darker, creating a high-contrast image typical of phase contrast microscopy.

Phase contrast image analysis for cell counting of epithelial monolayers

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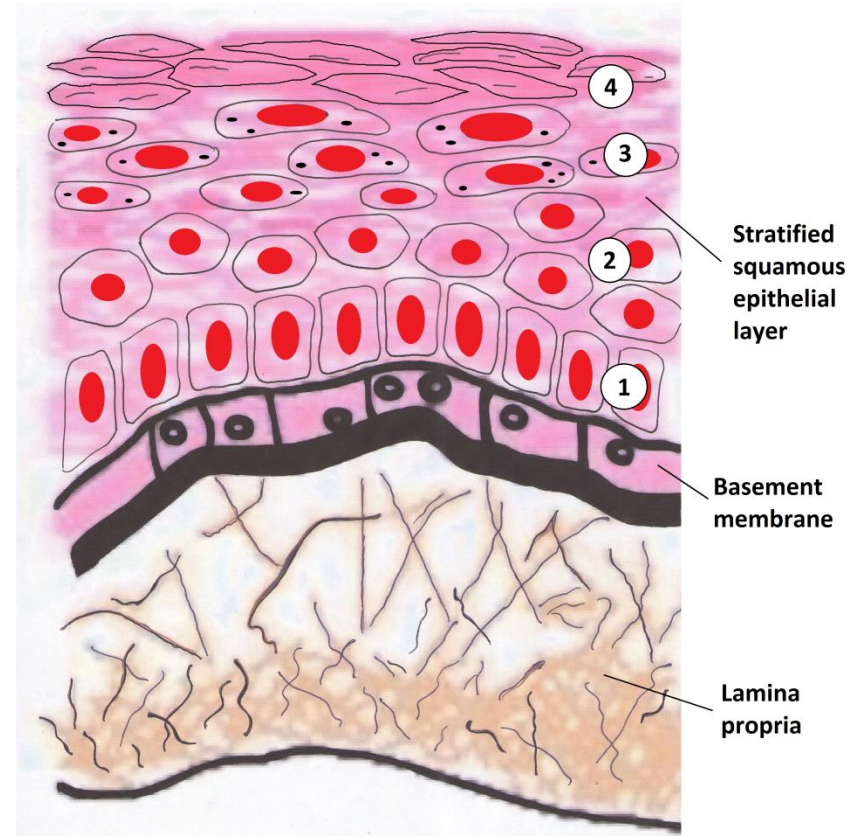
Supervisors: G. Landini, I. Styles, M. Milward, R. Shelton and P. Cooper

List of contents

1. Background and motivation
2. Segmenting cells using morphological operators
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Keratinocytes in the oral mucosa

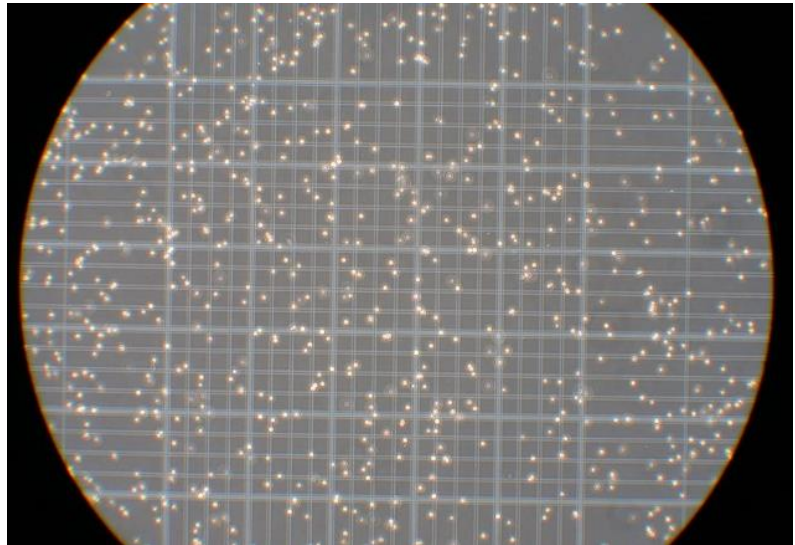
- Hard palate and gums
 - Protects underlying tissues
 - Continuity breaches lead to problems
- Want to characterise cell behaviour
 - Causes of disease
 - Response to treatments



[http://upload.wikimedia.org/wikipedia/commons/1/11/Oral_mucosa.p
ng](http://upload.wikimedia.org/wikipedia/commons/1/11/Oral_mucosa.png)

Cell counting

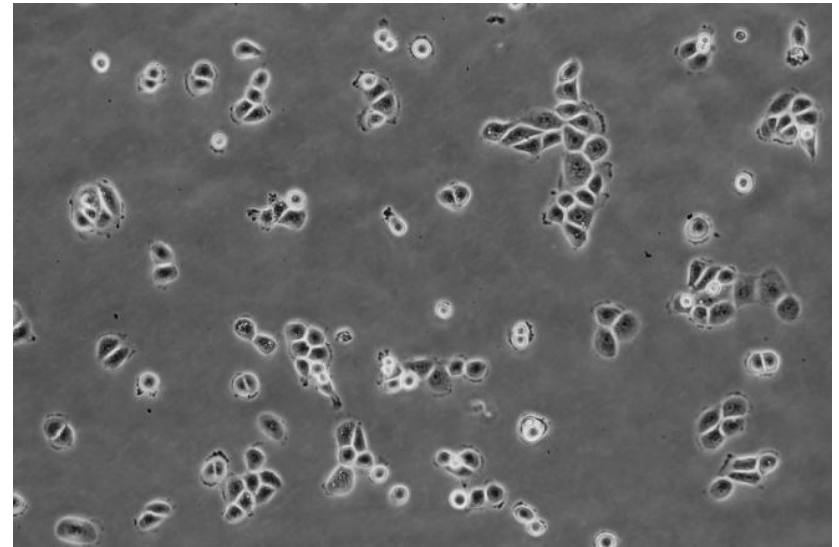
- Haemocytometer
 - Simple ✓
 - Destructive ✕
 - High operator error ✕



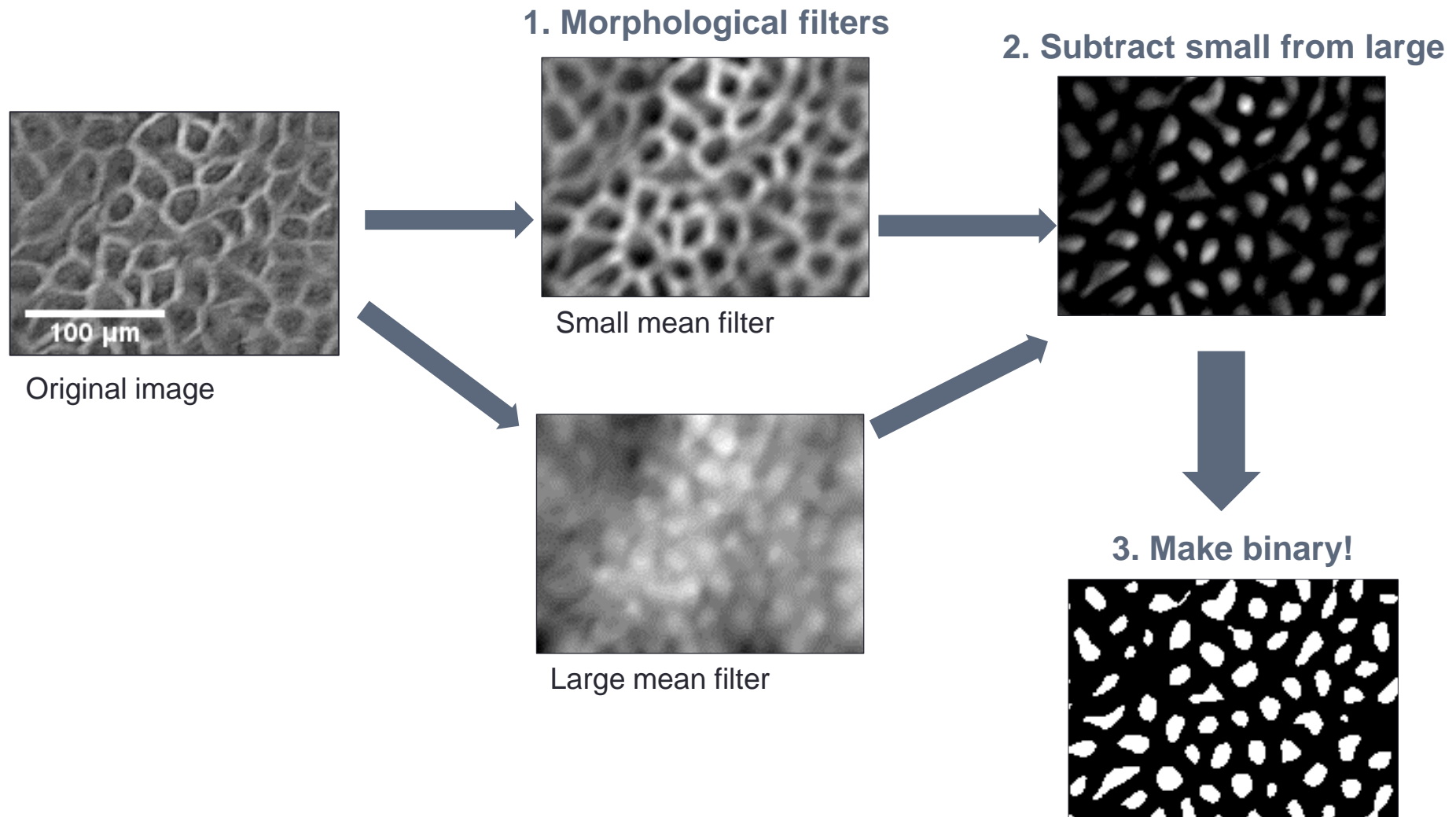
<http://www.homebrewtalk.com/f12/heady-topper-can-you-clone-390082/index46.html>

Cell counting

- Phase contrast microscope images
 - Non-destructive and stain-free ✓
 - Potential to offer more information than just cell number ✓
 - Phase contrast microscopy delivers challenges to image analysis ...



Cell segmentation



Counting cells from binary image

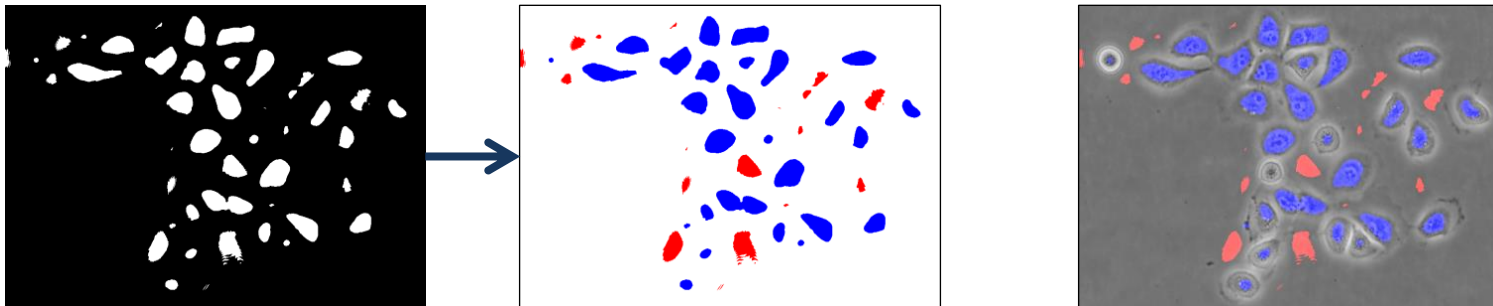
- Ideally, number of binary regions = number of cells



- Low density images suffer from incorrectly segmented “noise” regions
- These will cause erroneous cell counts

Removing erroneous segmentations

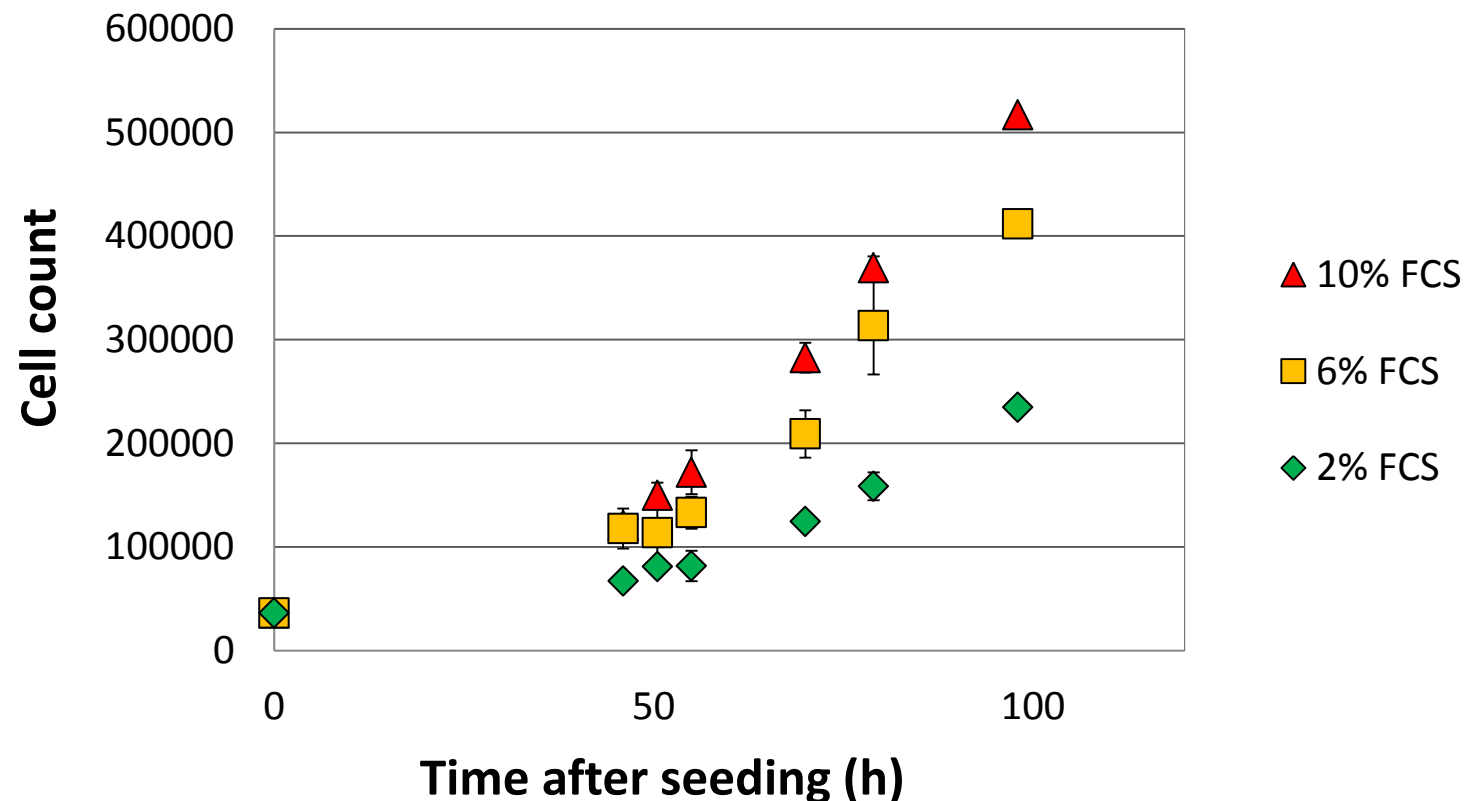
1. Calculate morphological and greyscale properties of binary regions
2. Reduce features using principal component analysis
3. Label regions using k-means clustering ($k=2$)



4. Discard errors – remaining cells = cell count!

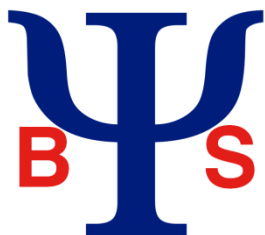
Generation of growth curves

- Image at multiple time points to generate growth curves



Thank you

Any questions?



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