FACULTAD DE MEDICINA
UNIVERSIDAD DE CHILE

ICBM
INSTITUTO DE CIENCIAS BIOMÉDICAS

CIMT
CENTRO DE INFORMATICA MEDICA Y TELEMEDICINA

MAURICIO CERDA

LAB "BIO-RELATED": IMAGE PROCESSING METHODS FOR MICROSCOPY IMAGING

- La Serena, 8/25/2018 -

Laboratory for SCIAN
Scientific Image Analysis

- Segmentation (clustering)
- Cell segmentation (PCA)

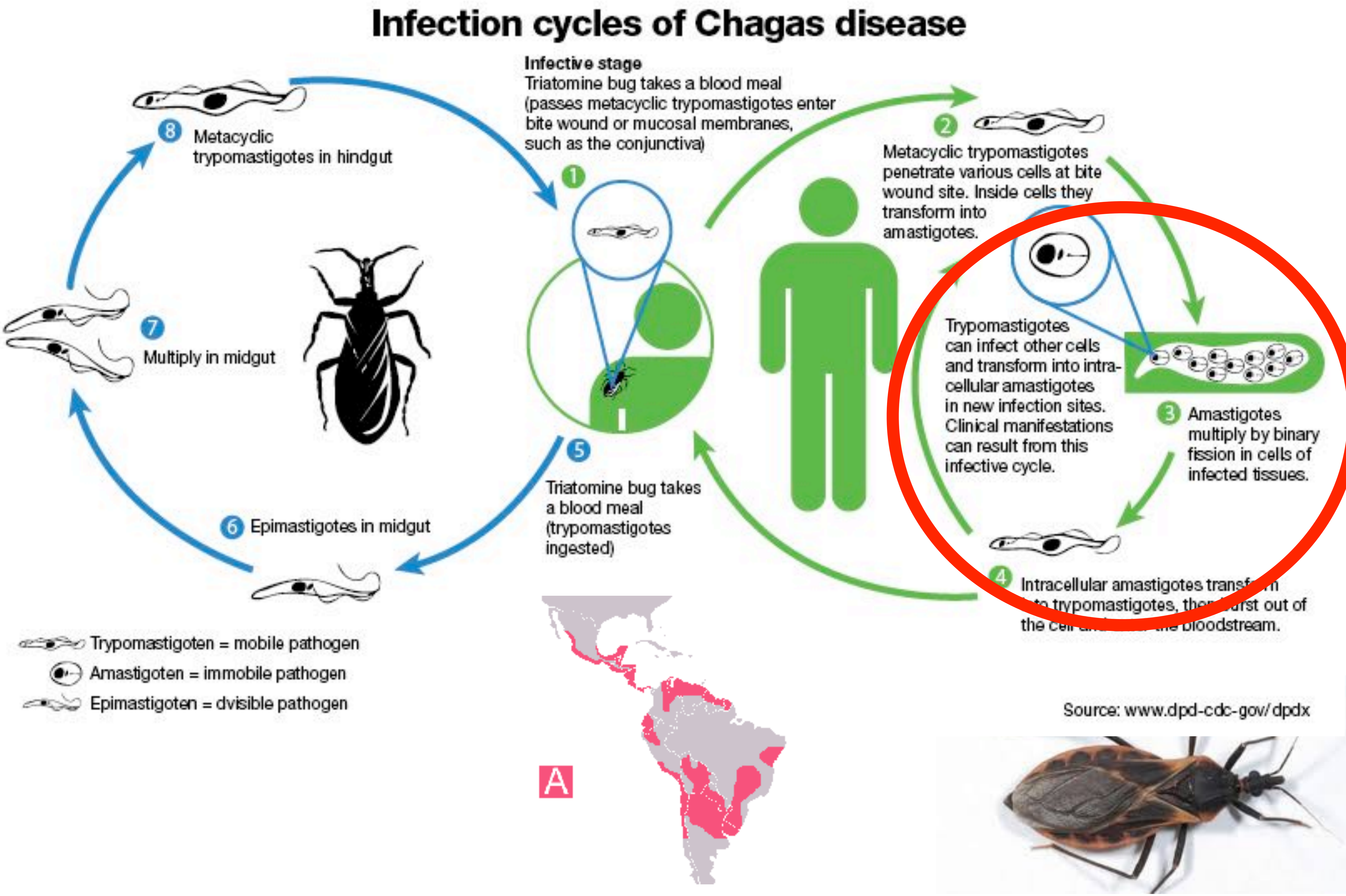
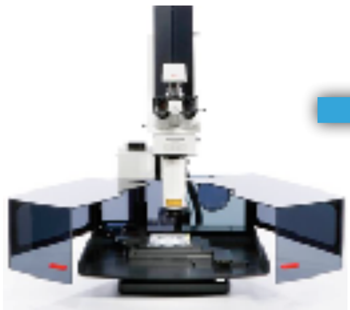

Infection cycles of Chagas disease
Infective stage
Triatomine bug takes a blood meal
(passes metacyclic trypomastigotes enter bite wound or mucosal membranes, such as the conjunctiva)
1
2
Metacyclic trypomastigotes penetrate various cells at bite wound site. Inside cells they transform into amastigotes.
3
Amastigotes multiply by binary fission in cells of infected tissues.
Trypomastigotes can infect other cells and transform into intracellular amastigotes in new infection sites. Clinical manifestations can result from this infective cycle.
4
Intracellular amastigotes transf
trypomastigotes, the rst out of
the cell the bloodstream.
5
Triatomine bug takes a blood meal (trypomastigotes ingested)
6
Epimastigotes in midgut
7
Multiply in midgut
8
Metacyclic trypomastigotes in hindgut
Trypomastigoten = mobile pathogen
Amastigoten = immobile pathogen
Epimastigoten = dvisible pathogen
Source: www.dpd-cdc-gov/dpdx
A

IMAGE PROCESSING: PARASITES



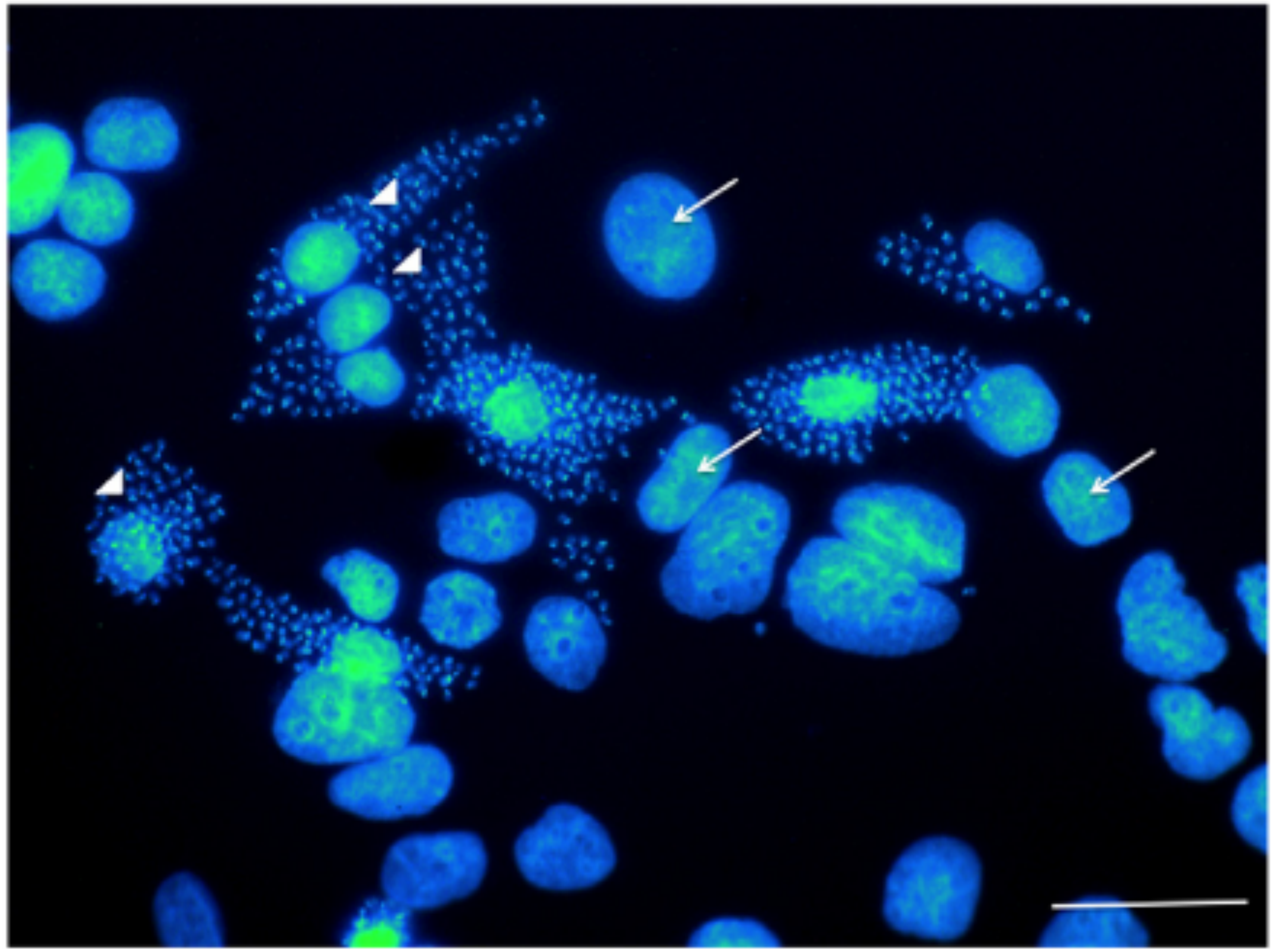
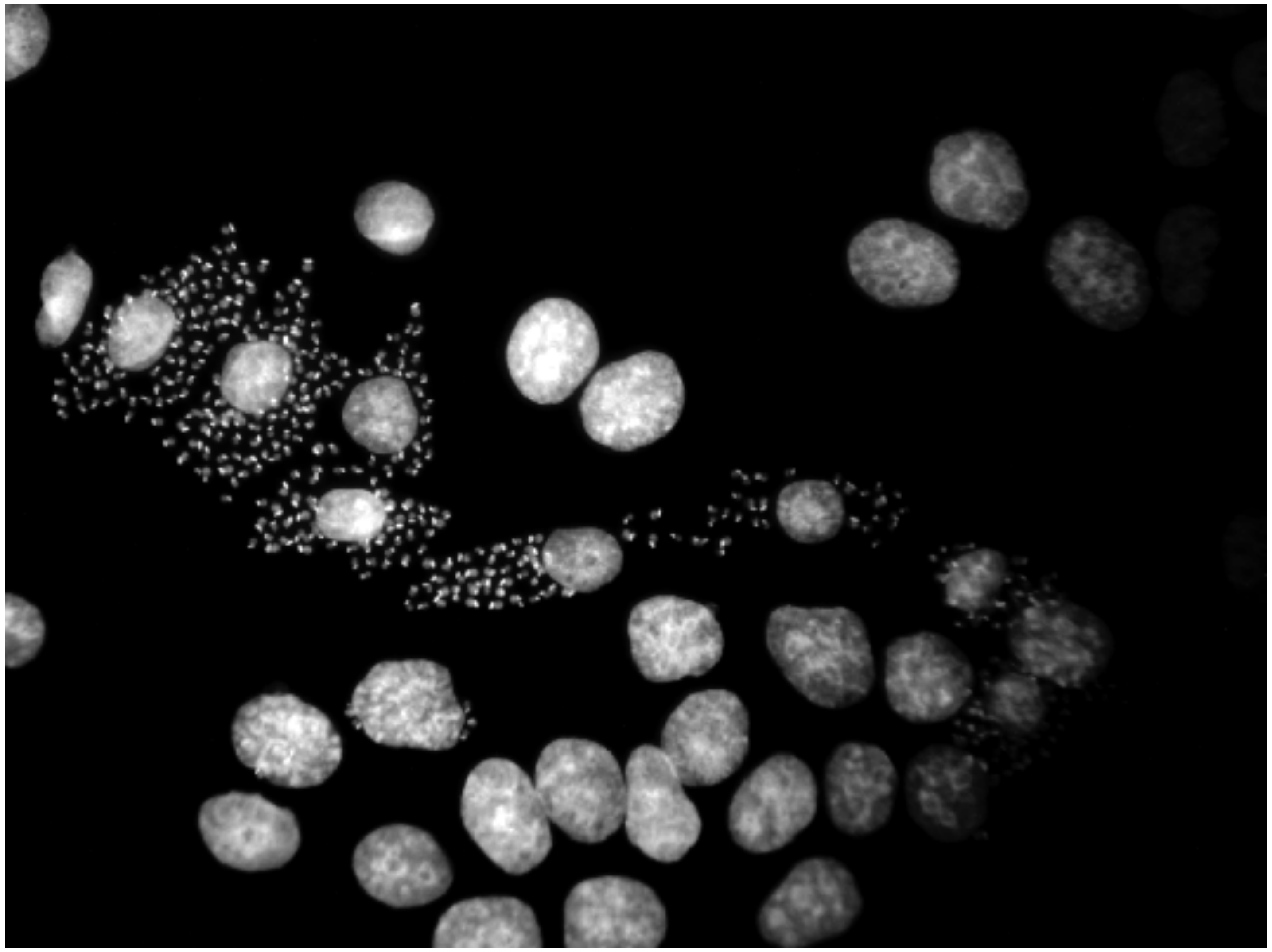


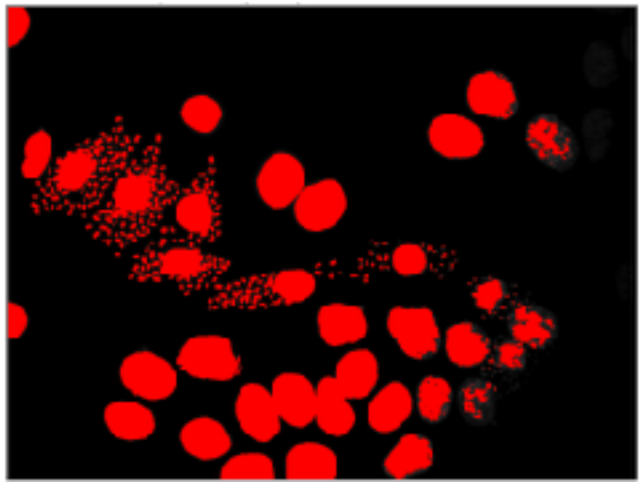
Fig. 1. Infection of BeWo cells with *T. cruzi* amastigotes. BeWo cells were challenged with *T. cruzi* Ypsilon strain trypomastigotes at a parasite:cell ratio of 1:1 for 24 h and were processed for DAPI staining after 48 h. The arrows show BeWo cell nuclei, and the arrowheads show intracellular amastigotes. Scale bar: 10 µm.

- Pregnancy?

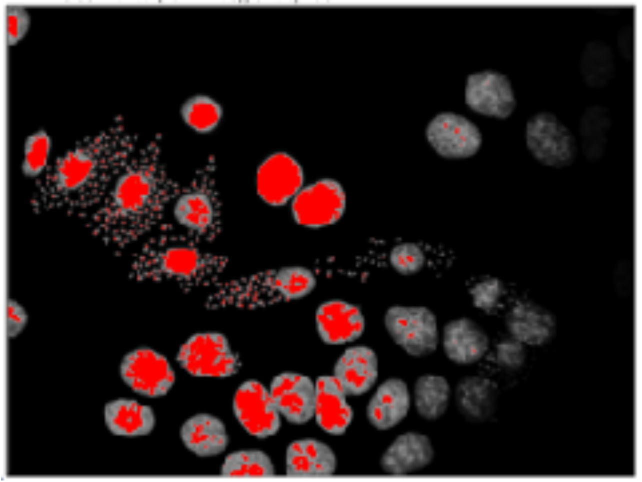
- The simplest segmentation… a manual global threshold



raw image

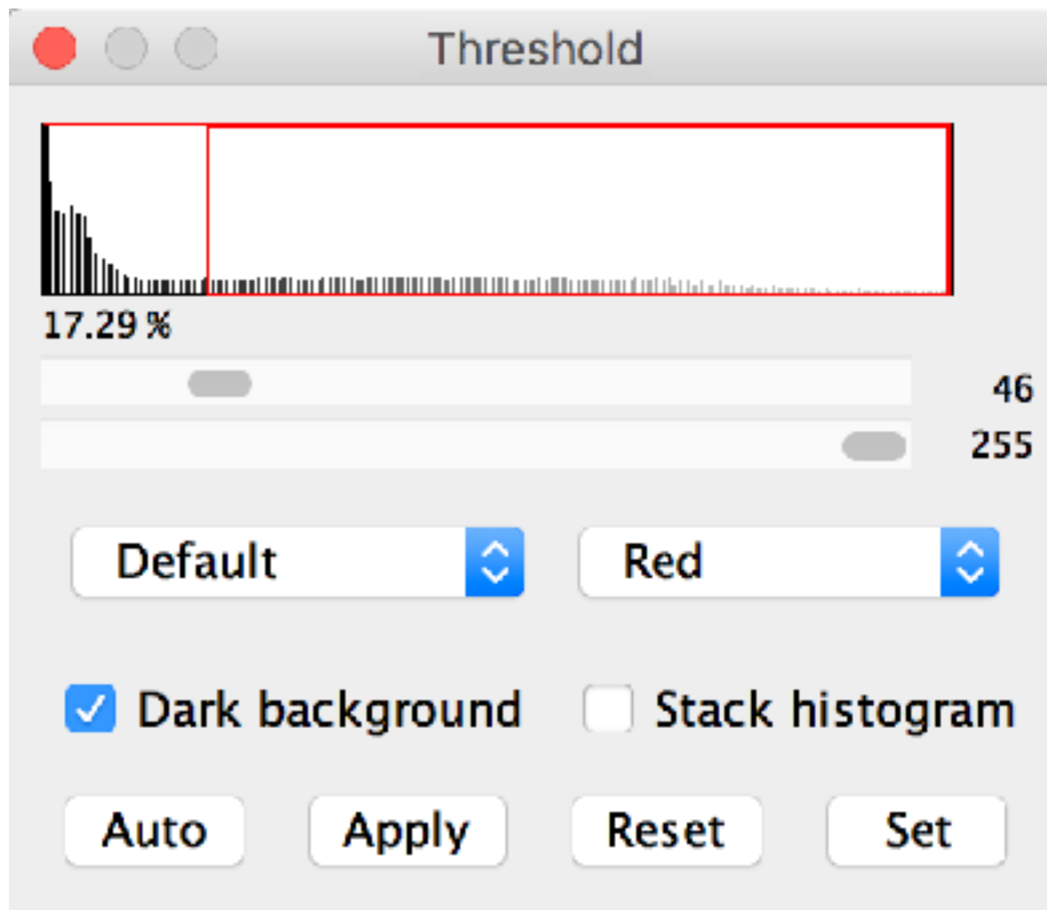


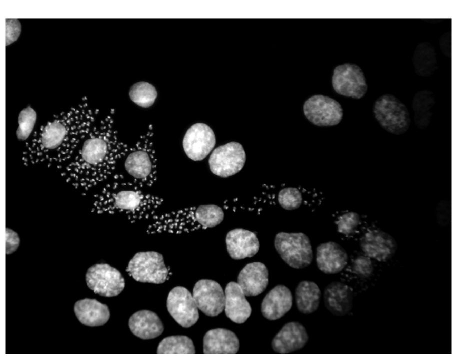
segmentation (>46)

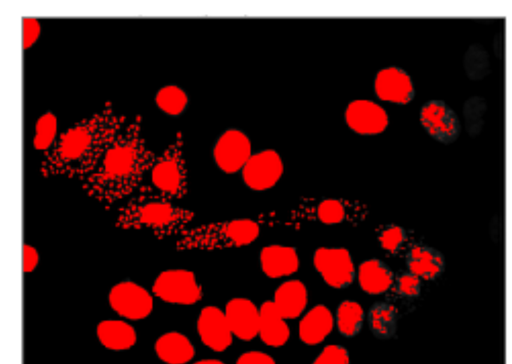


segmentation (>158)

- How to define the threshold ? …







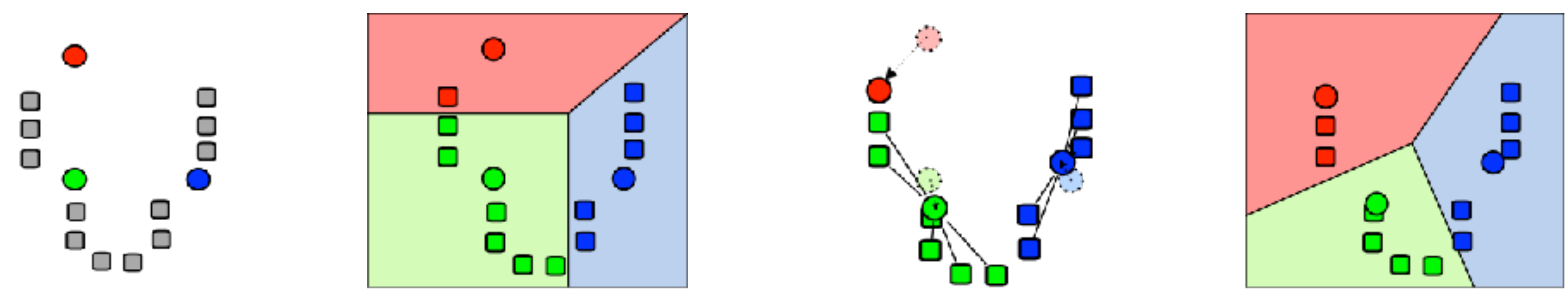
- We don’t have examples (!)
- We know there are two groups: cells, and background.

- This is another kind of learning problem:
  - Supervised: regression, classification
  - Unsupervised: **clustering**

IMAGE SEGMENTATION: UNSUPERVISED APPROACH

- We can model it as how to discover the best k groups or clusters at a pixel level.

- K-means clustering (k=3):



Random centroids

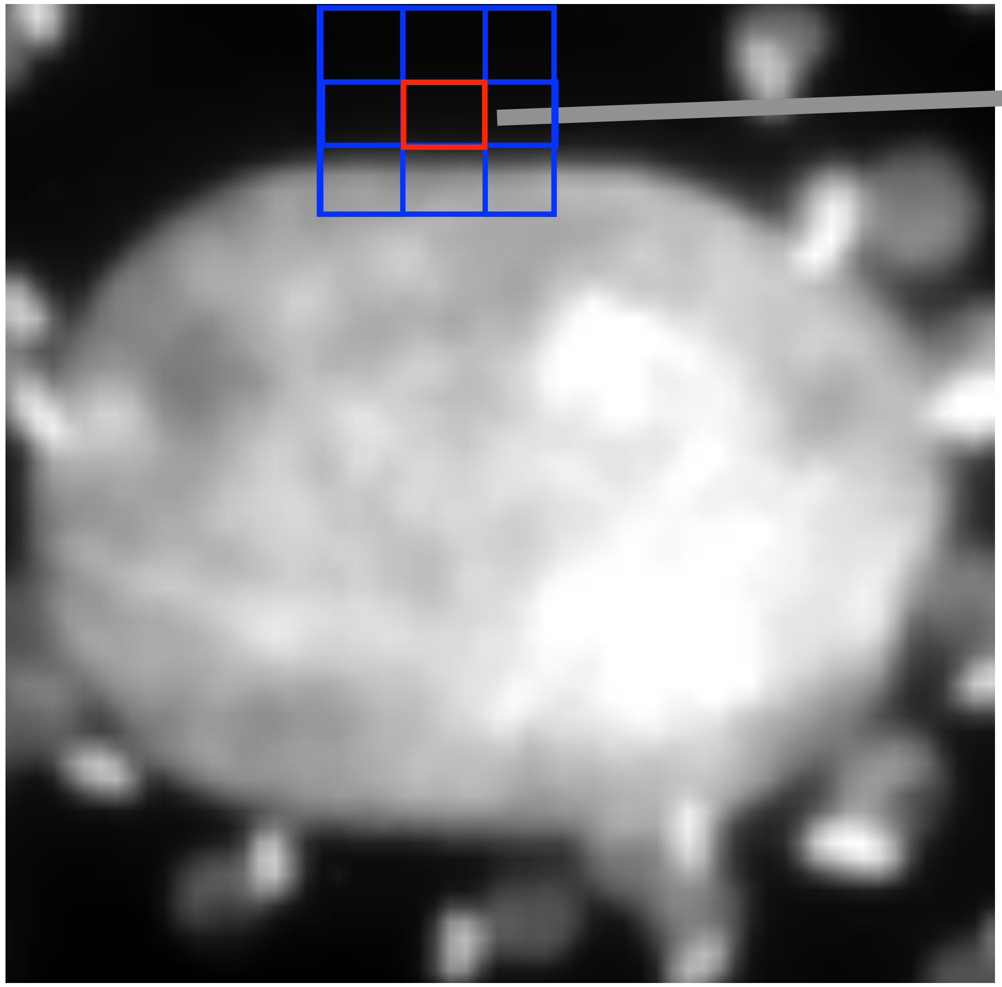
clusters assignation + voronoi diagram

centroids re-computation

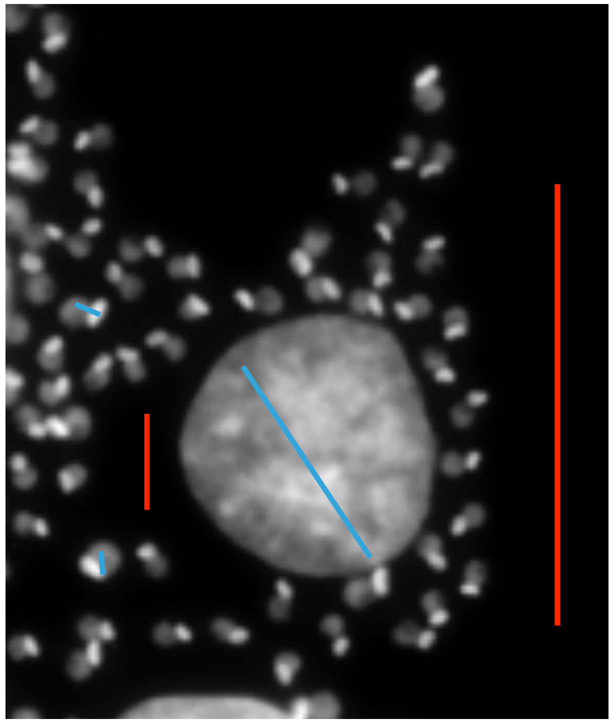
cluster assignation + voronoi diagram

- **EXERCISE A: Correct K-Mean code [python notebook]**

- We can understand pixels in higher dimensions.



- Intensity (0)
- Variance 3x3
- Mean 3x3
- Sobel 3x3
- …



- Class A (background)
- Class B (objects)

- **EXERCISE B: Use weka to train a random forest to segment nuclei + parasites [FIJI plugin]**

- We may not have examples (segmentation), but we can quickly build examples.
- With examples we can switch from unsupervised to supervised problem.