

# Image and data analytic pipeline for studying signalling dynamics in cancer

Maciej Dobrzański

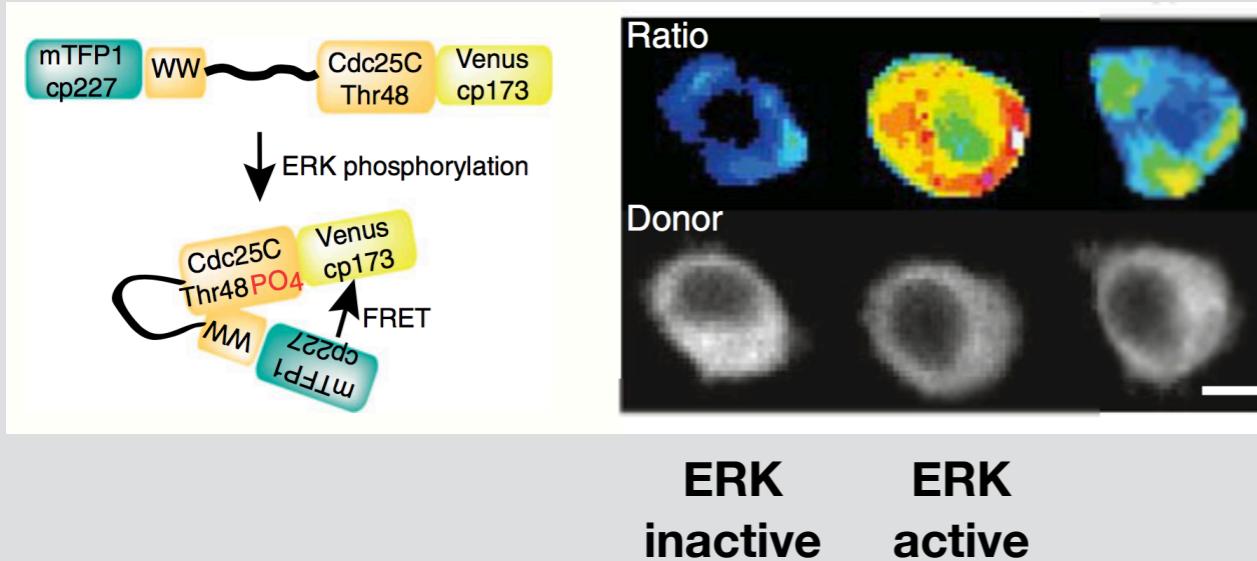
Cellular Dynamics Lab, Olivier Pertz  
Institute of Cell Biology, UniBern 

MIC Workshop, Zoom  
03.10.2020

# Key experimental technologies

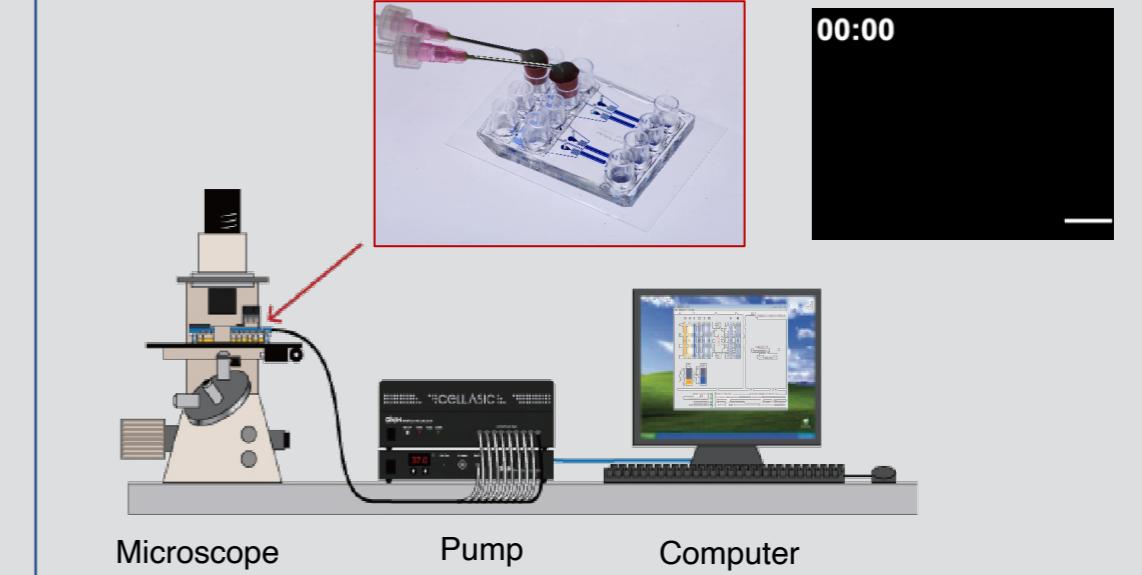
## Fluorescent Biosensors

### EKAR2G biosensor

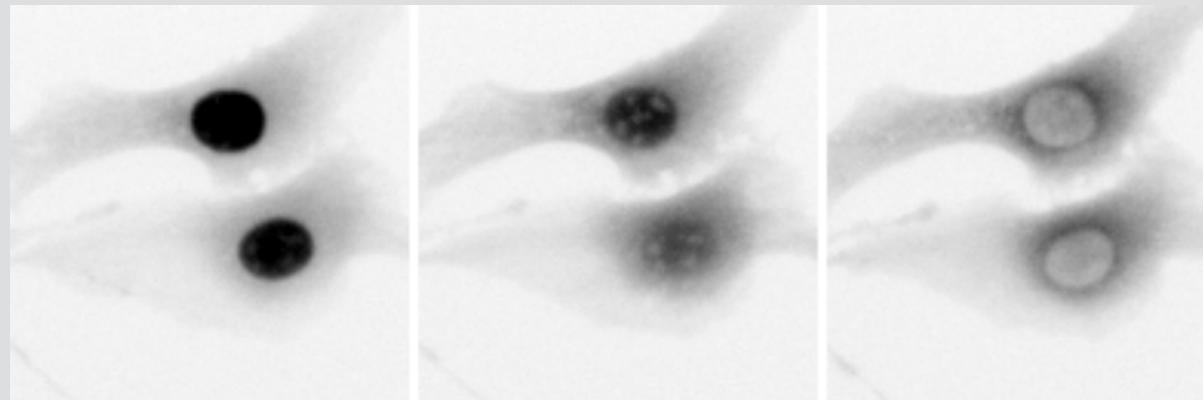


## Cell Perturbations

### Microfluidics



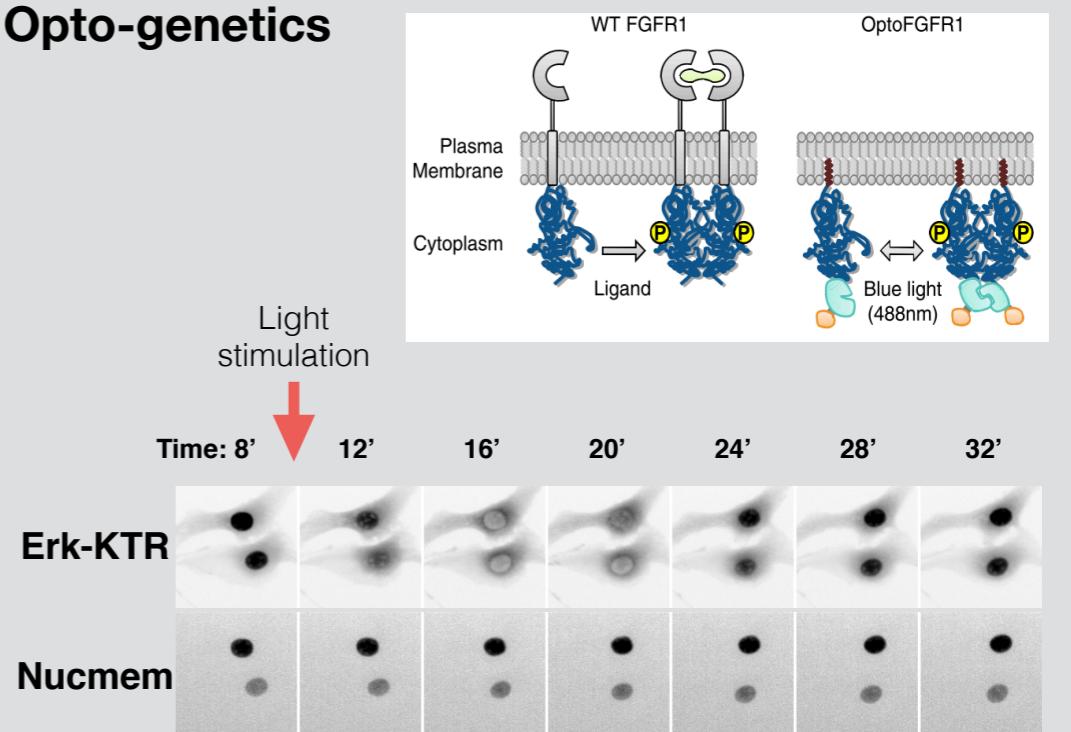
### Kinase translocation reporter



ERK inactive

ERK active

### Opto-genetics



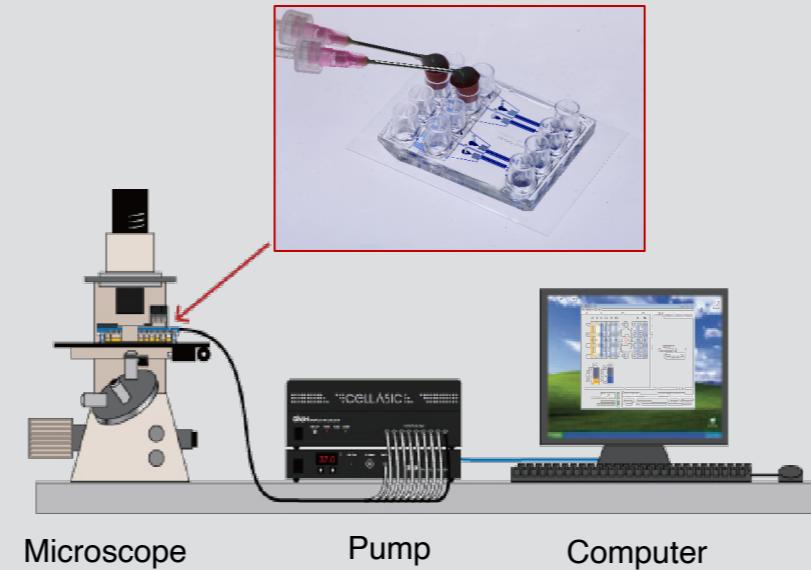


# Perturbing with microfluidics

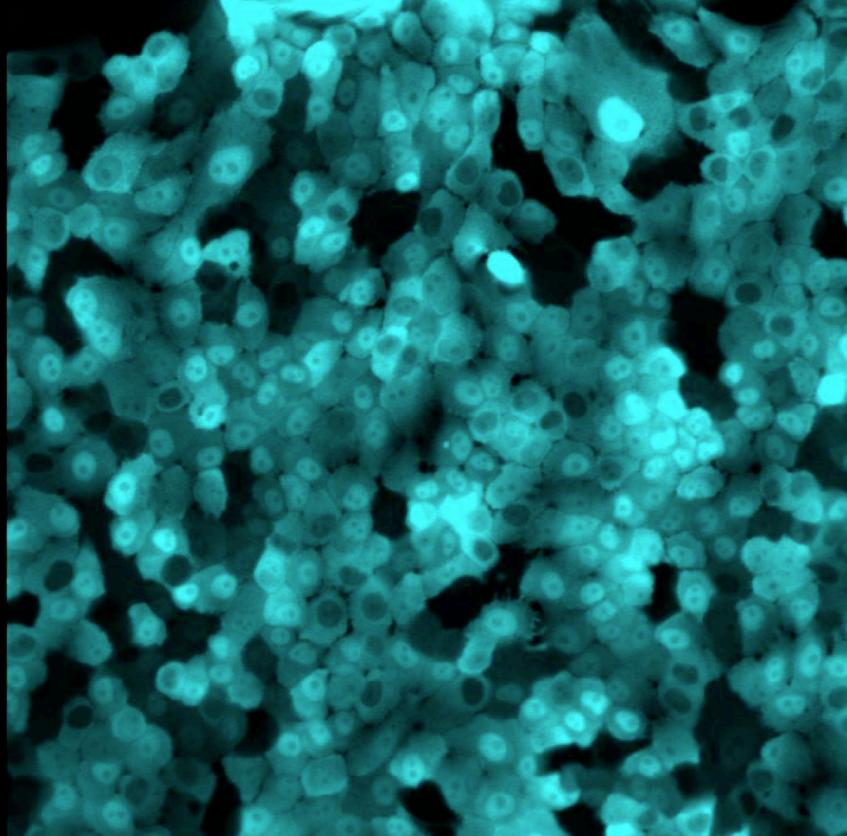
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UNIVERSITÄT  
BERN

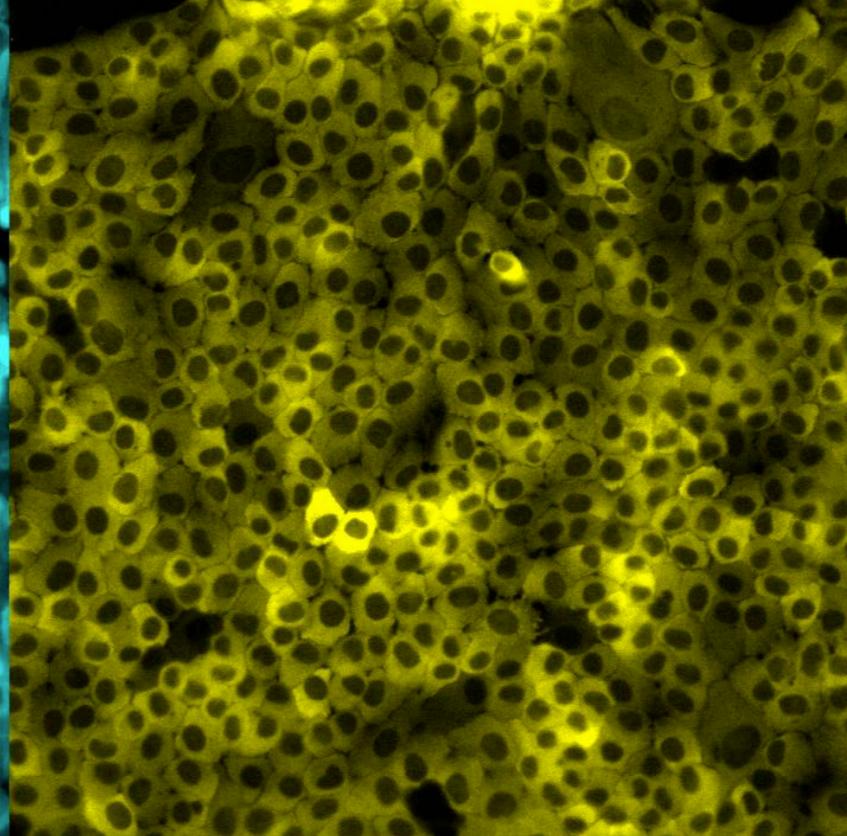
Yannick Blum  
Pertz Group



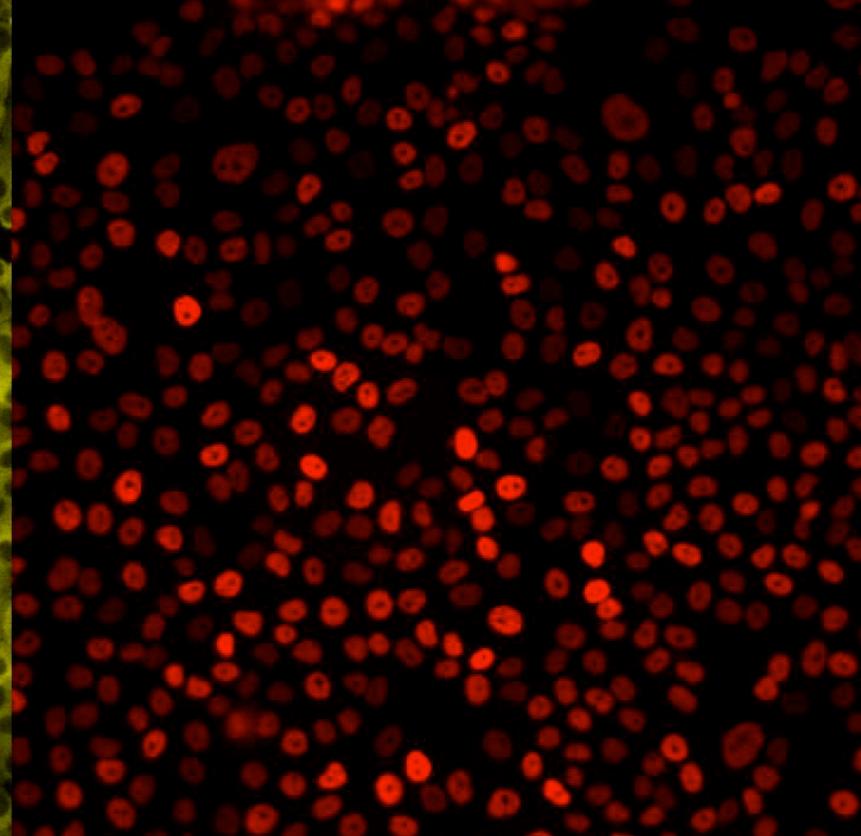
Protein 1 activity



Protein 2 activity



Cell nuclei

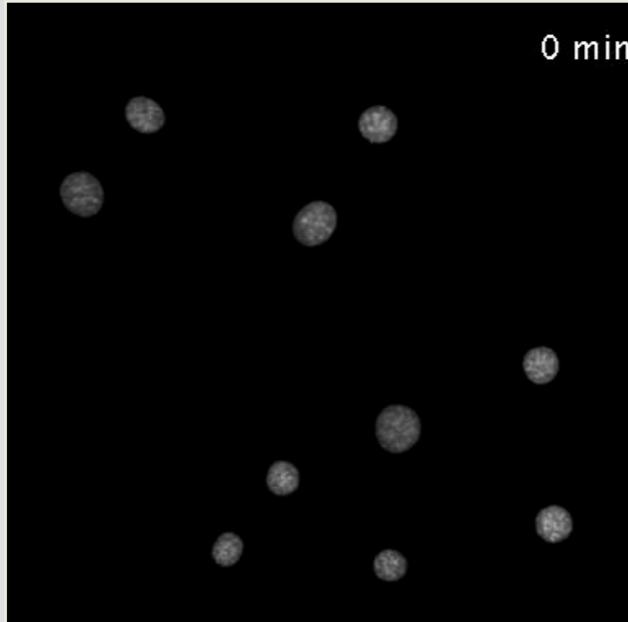




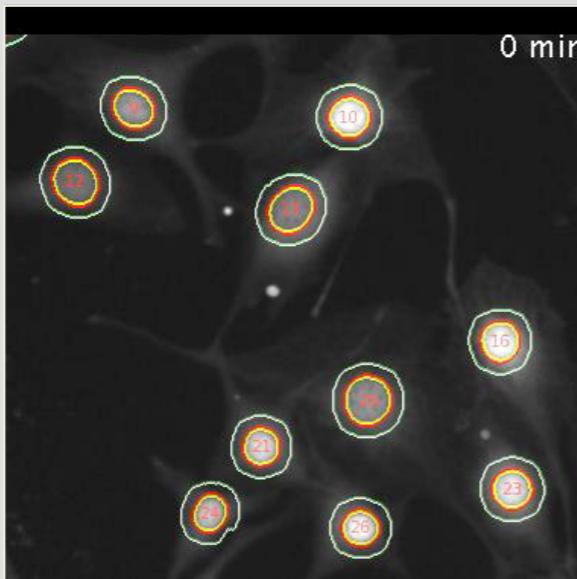
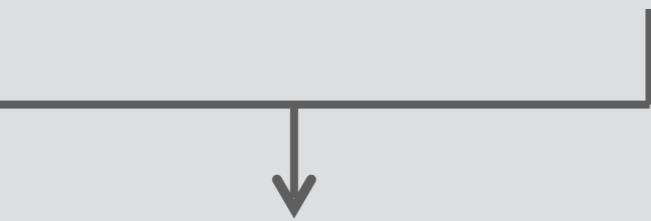
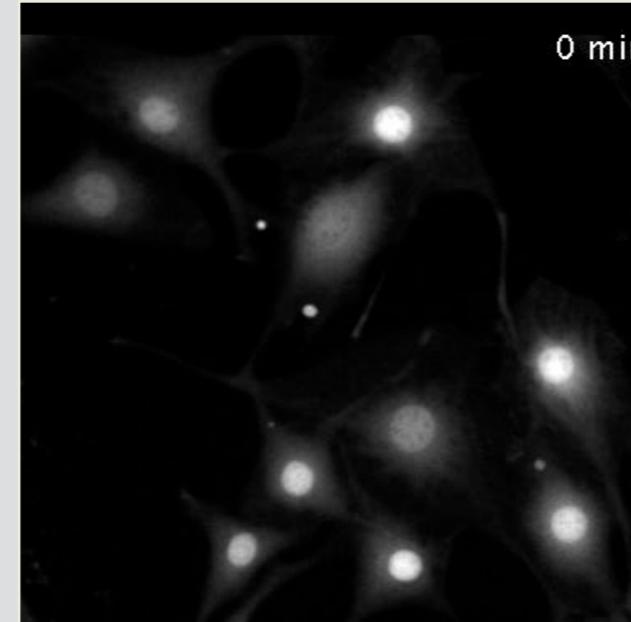
# Perturbing with optogenetics

Coralie Dessauges  
Pertz Group

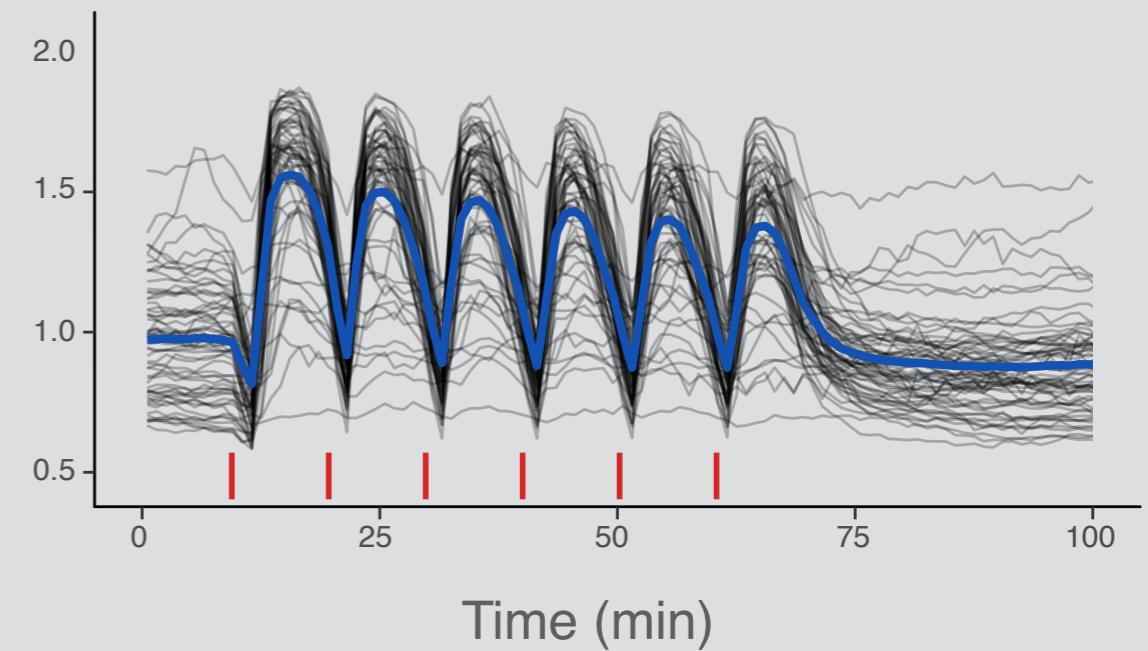
Cell nuclei



Protein activity



R Studio<sup>®</sup>  
Shiny

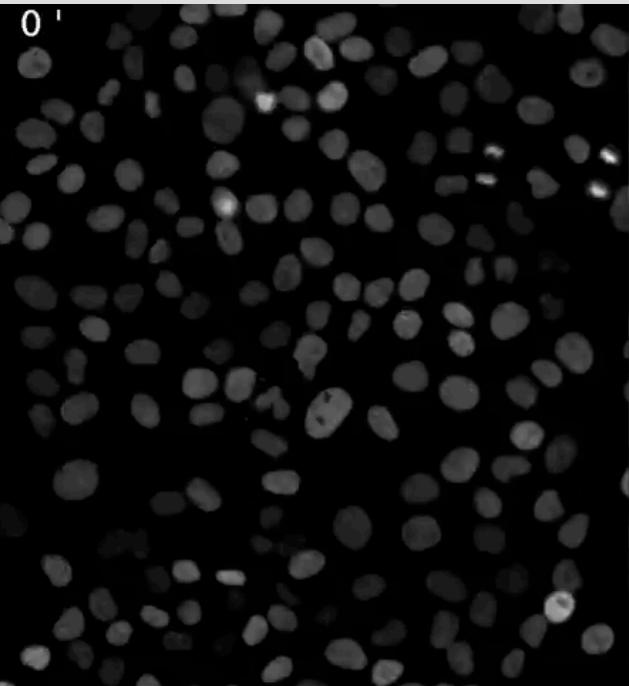


# Things we actually measure

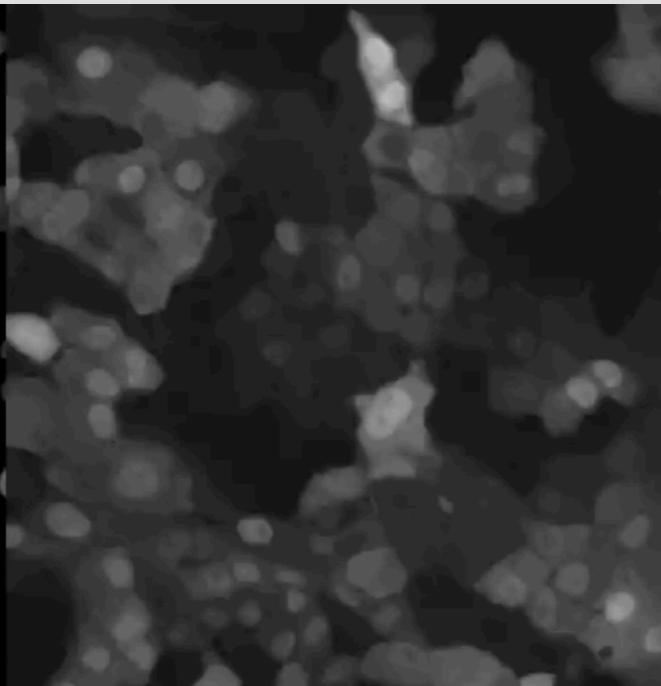
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Cell nuclei



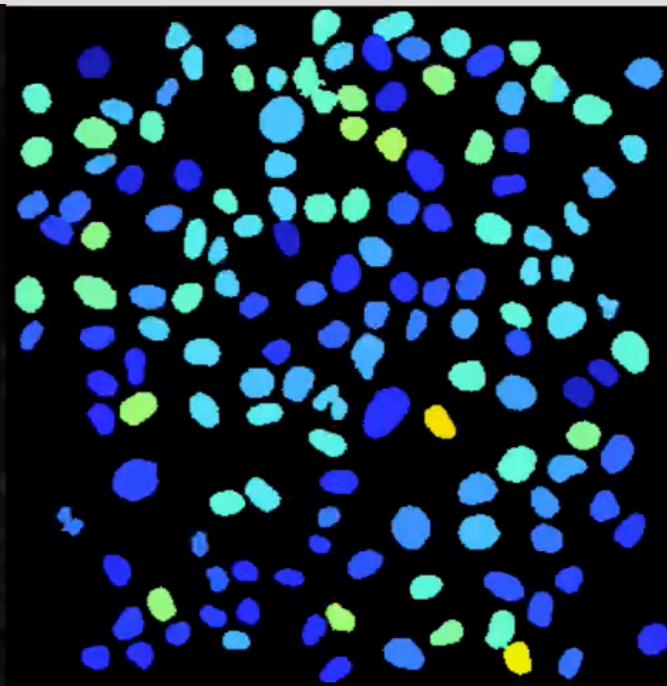
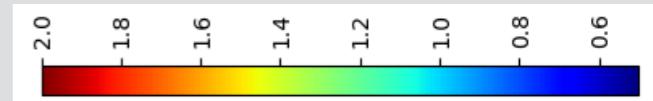
Protein activity



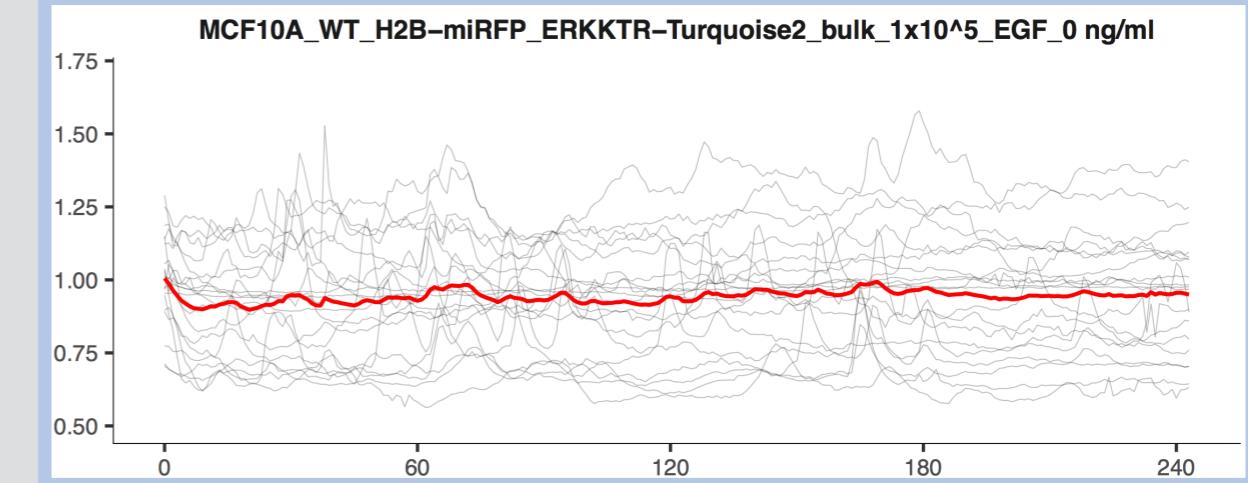
Segmentation & Tracking



Protein activity

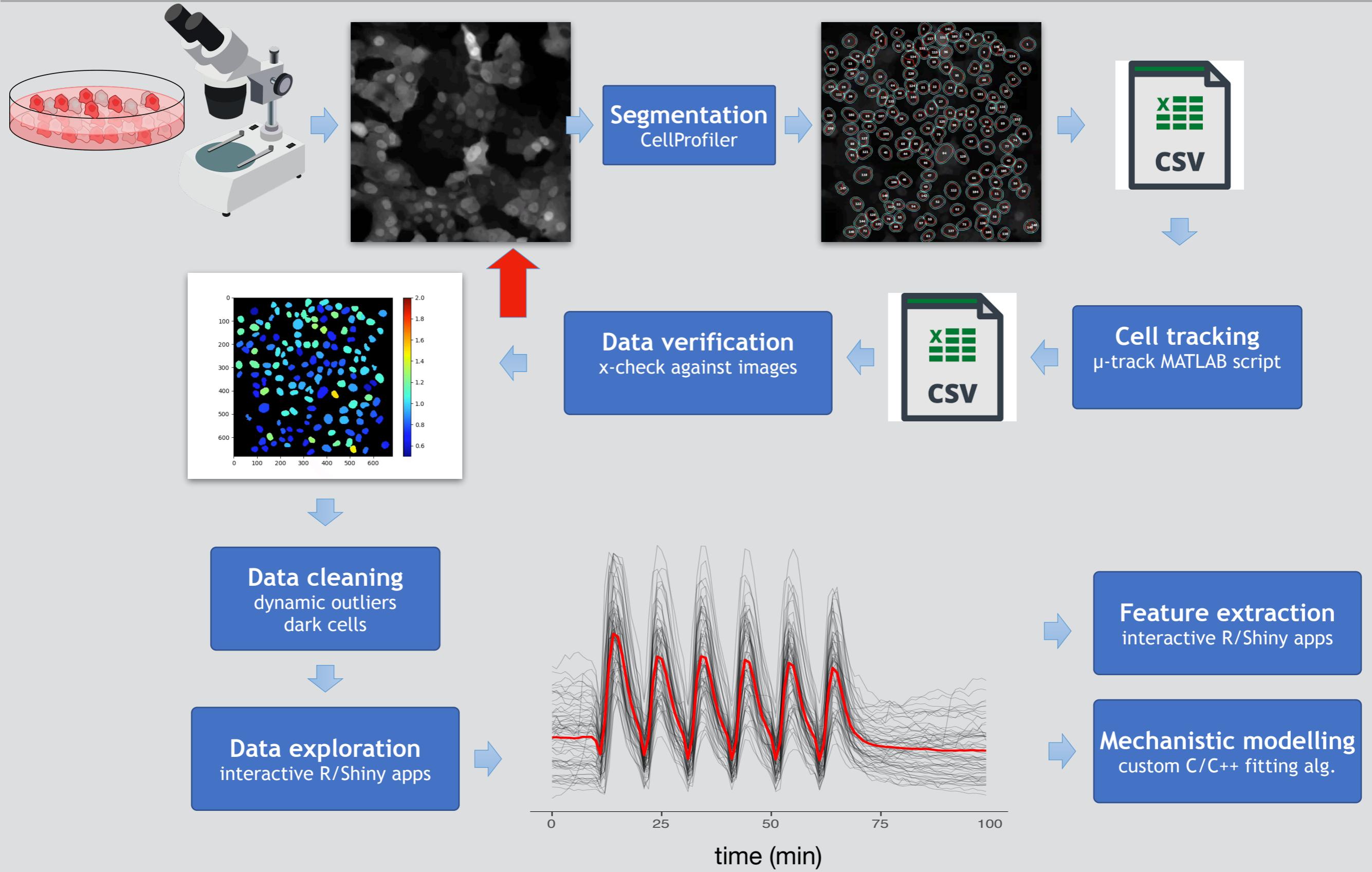


Measured

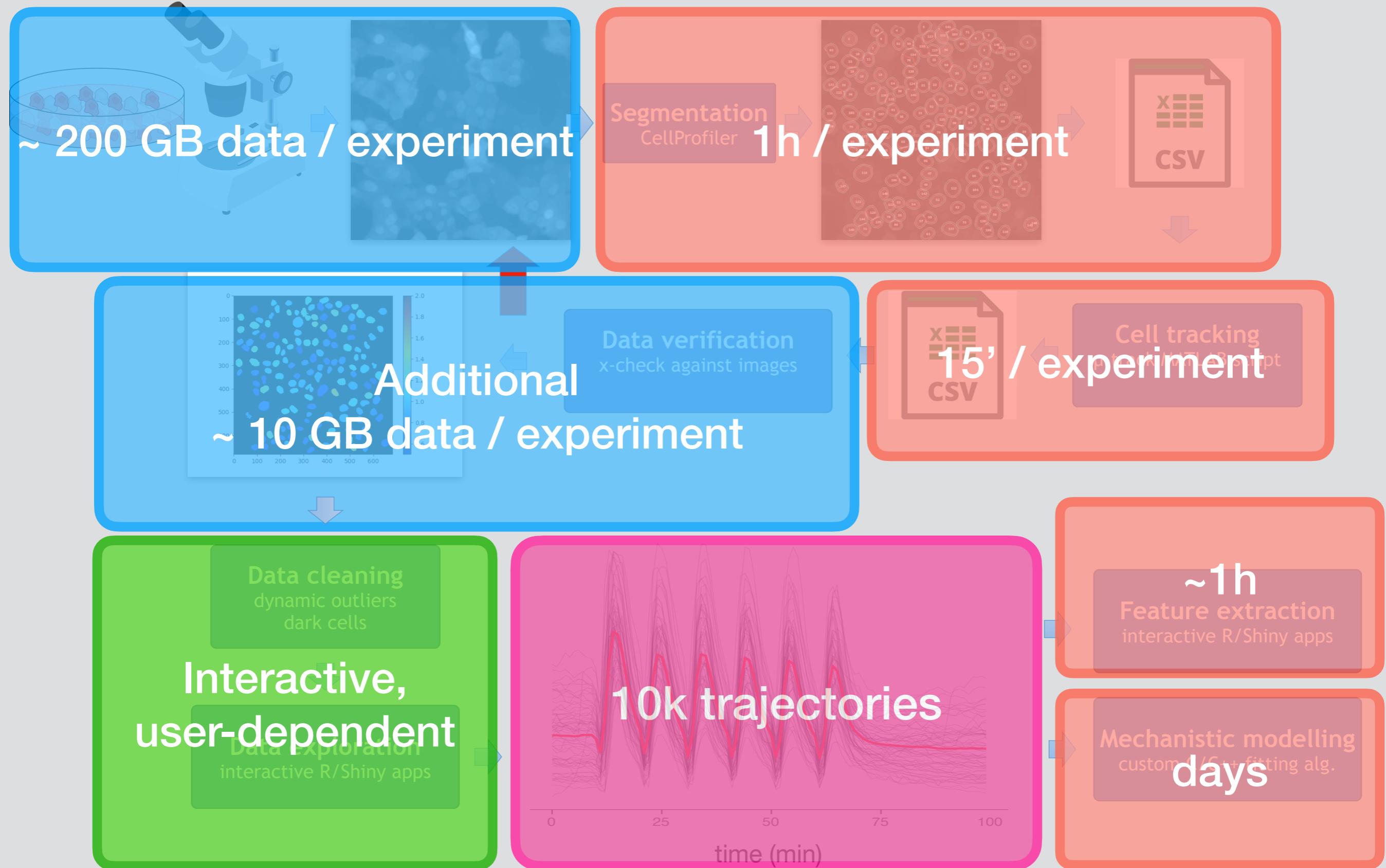


Processed

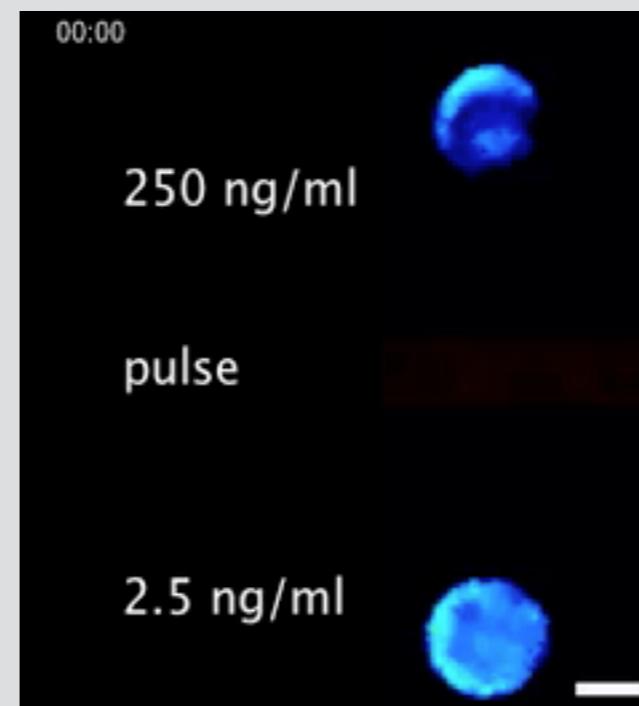
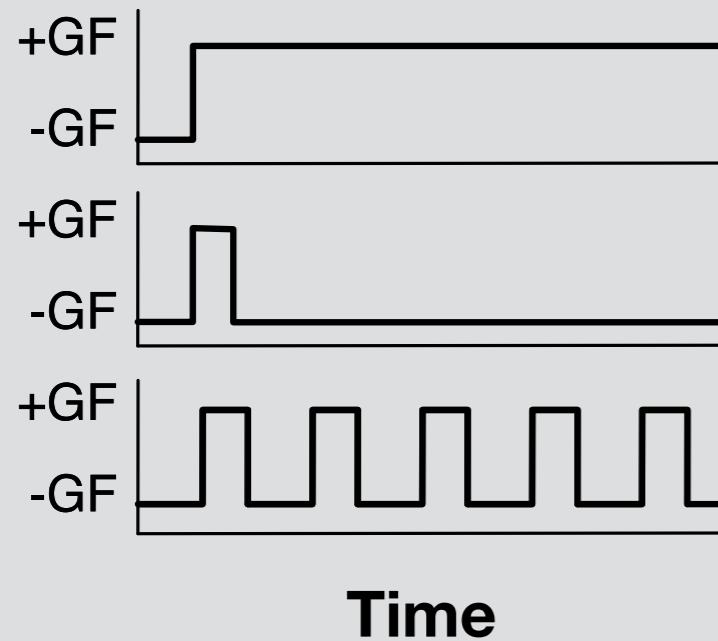
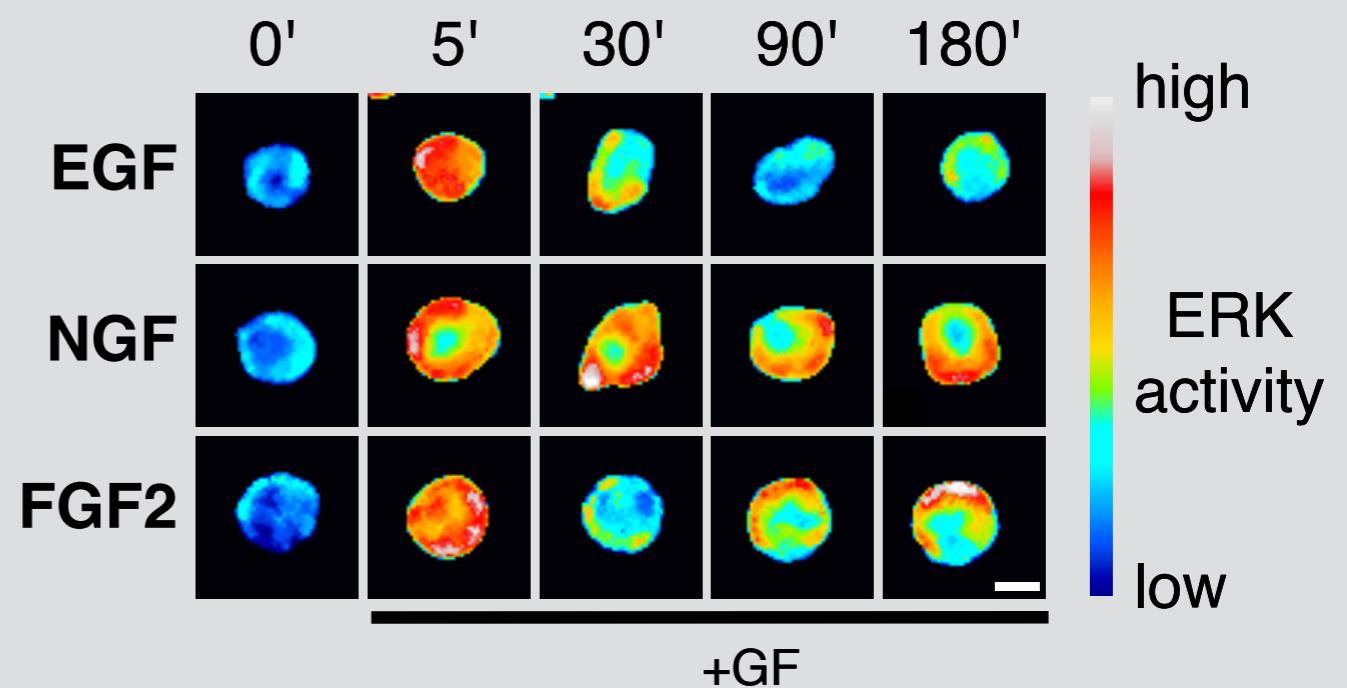
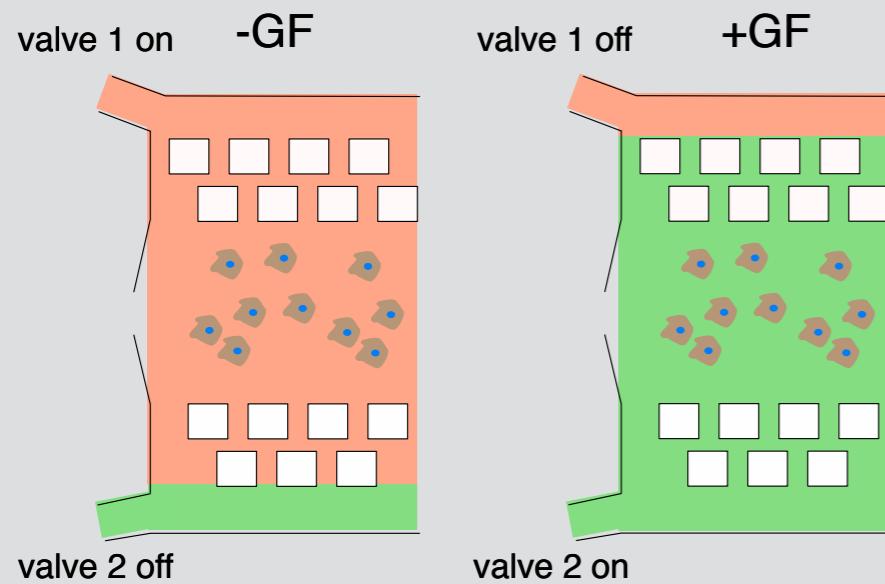
# Our pipeline in practice



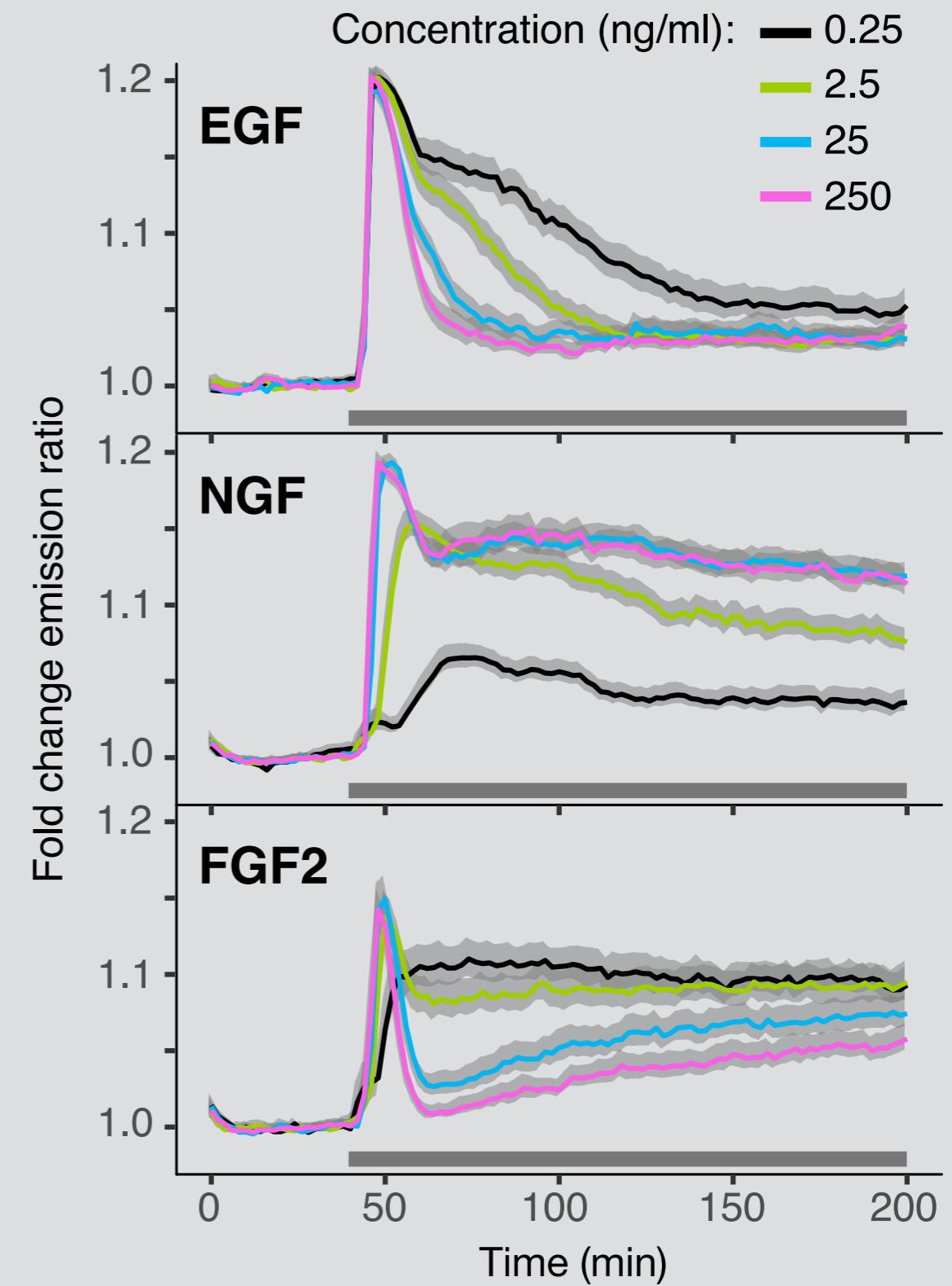
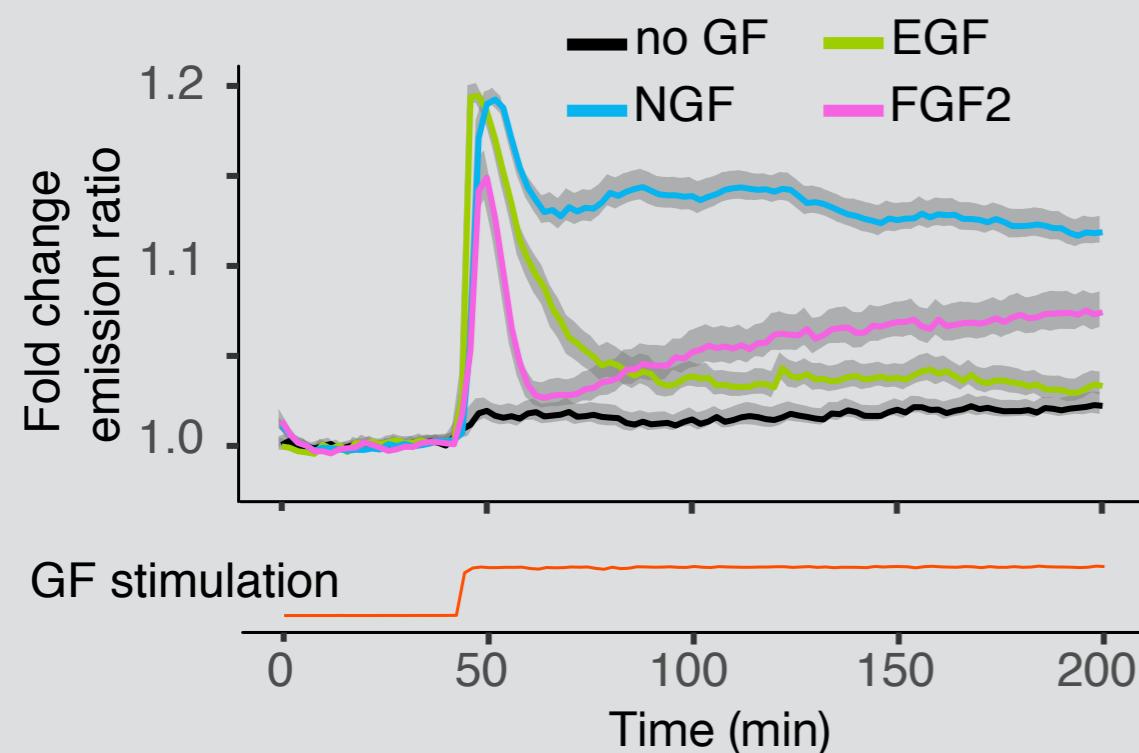
# Our pipeline in practice



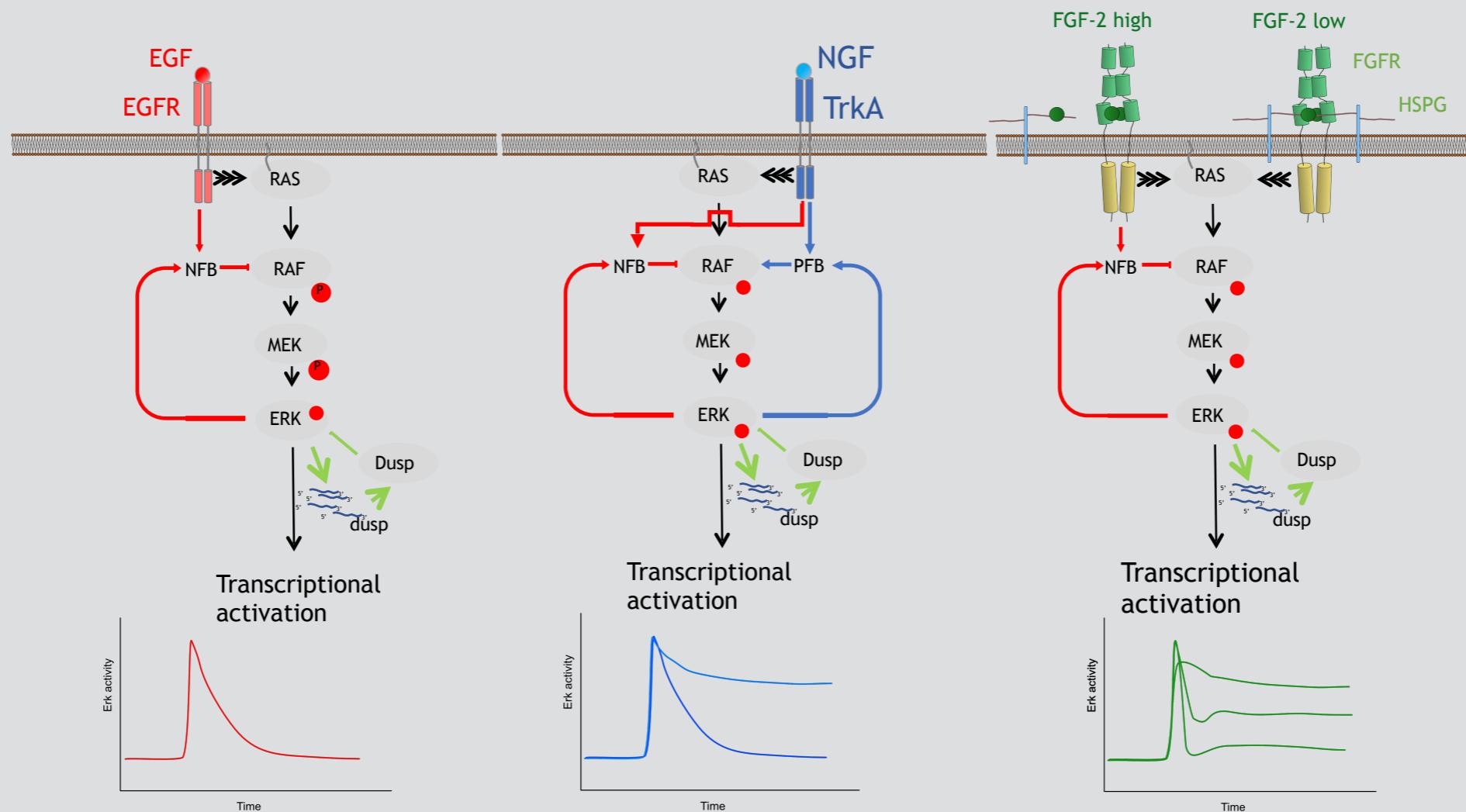
# Experiment description



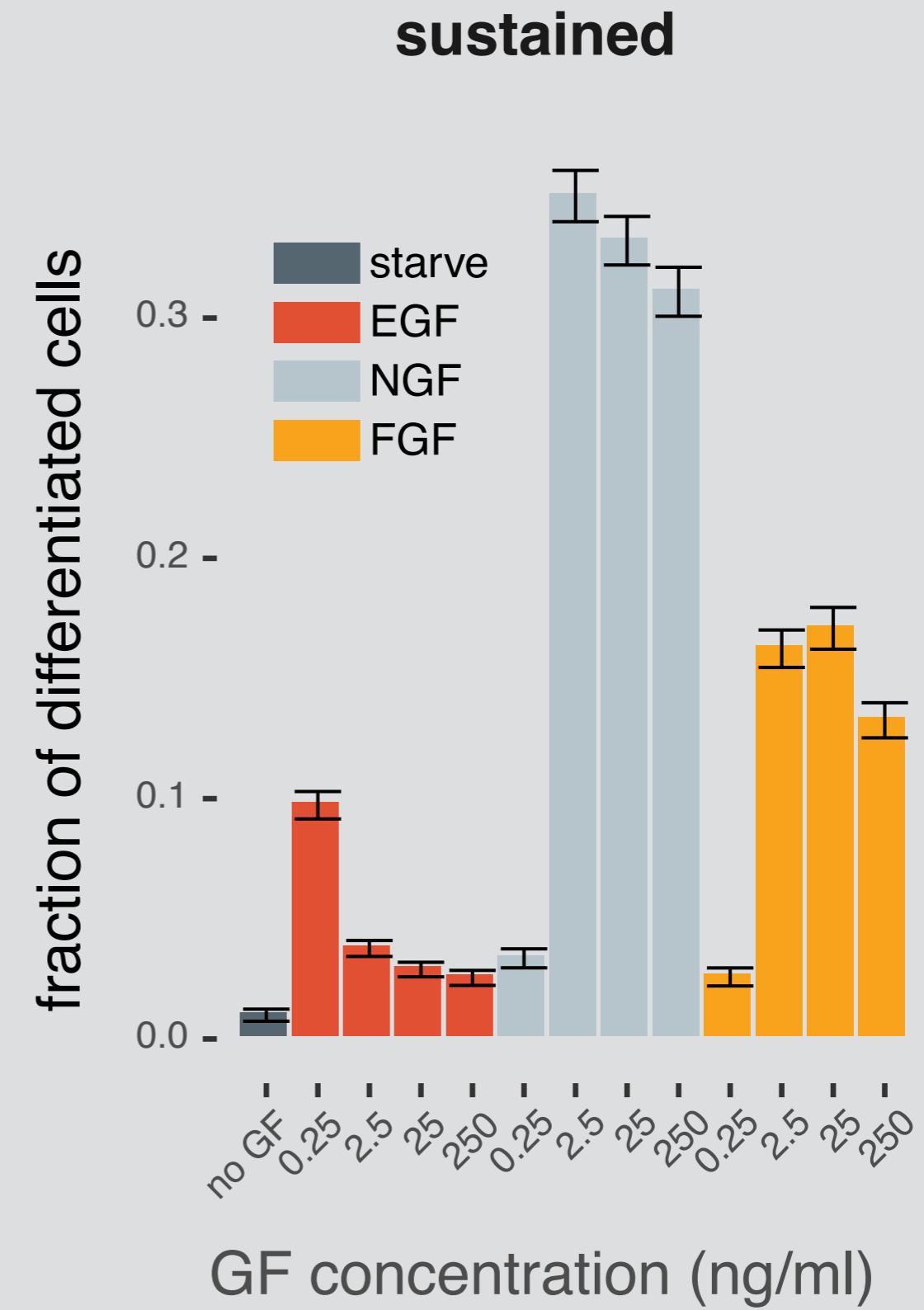
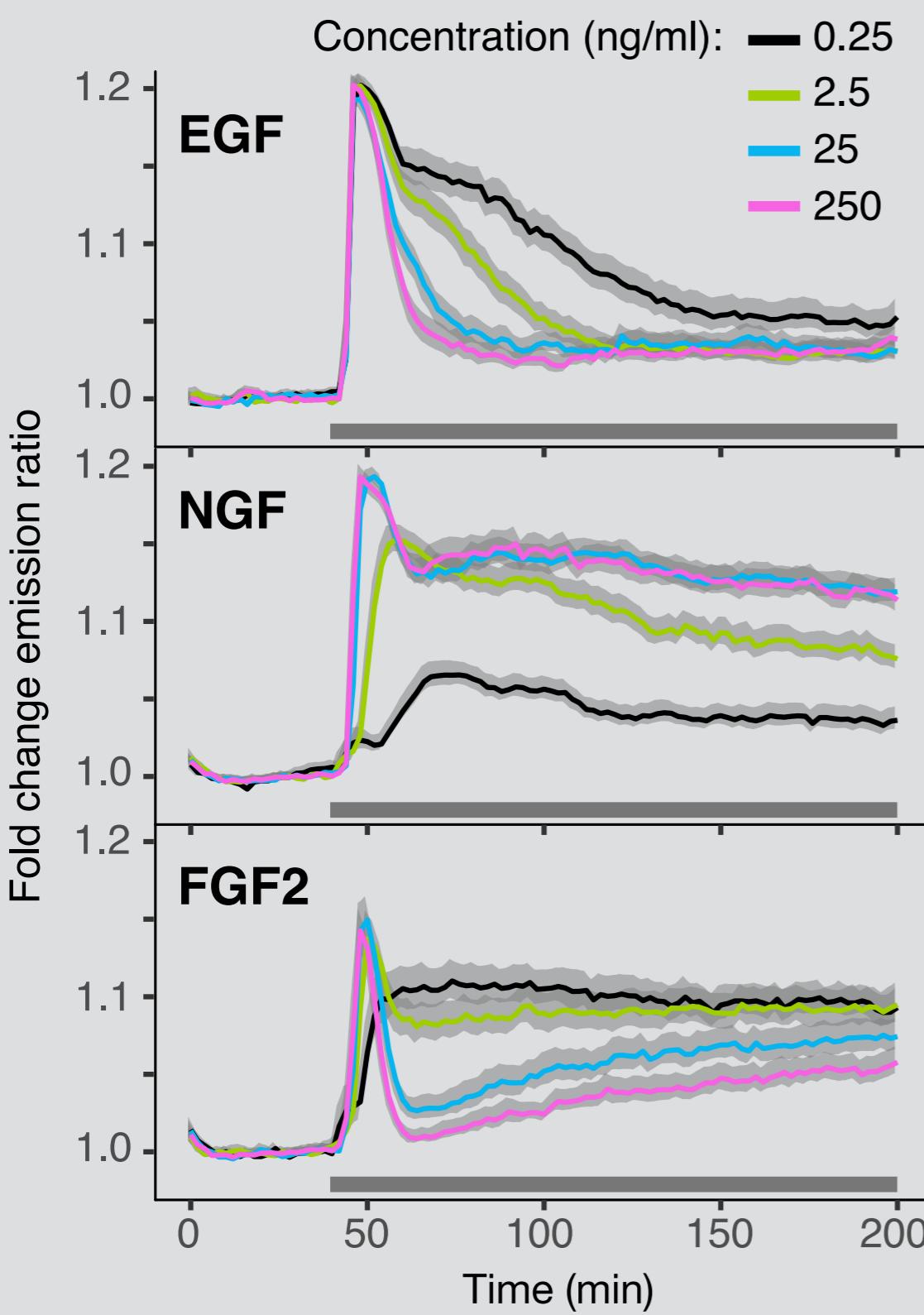
# Different GF's induce different dynamics



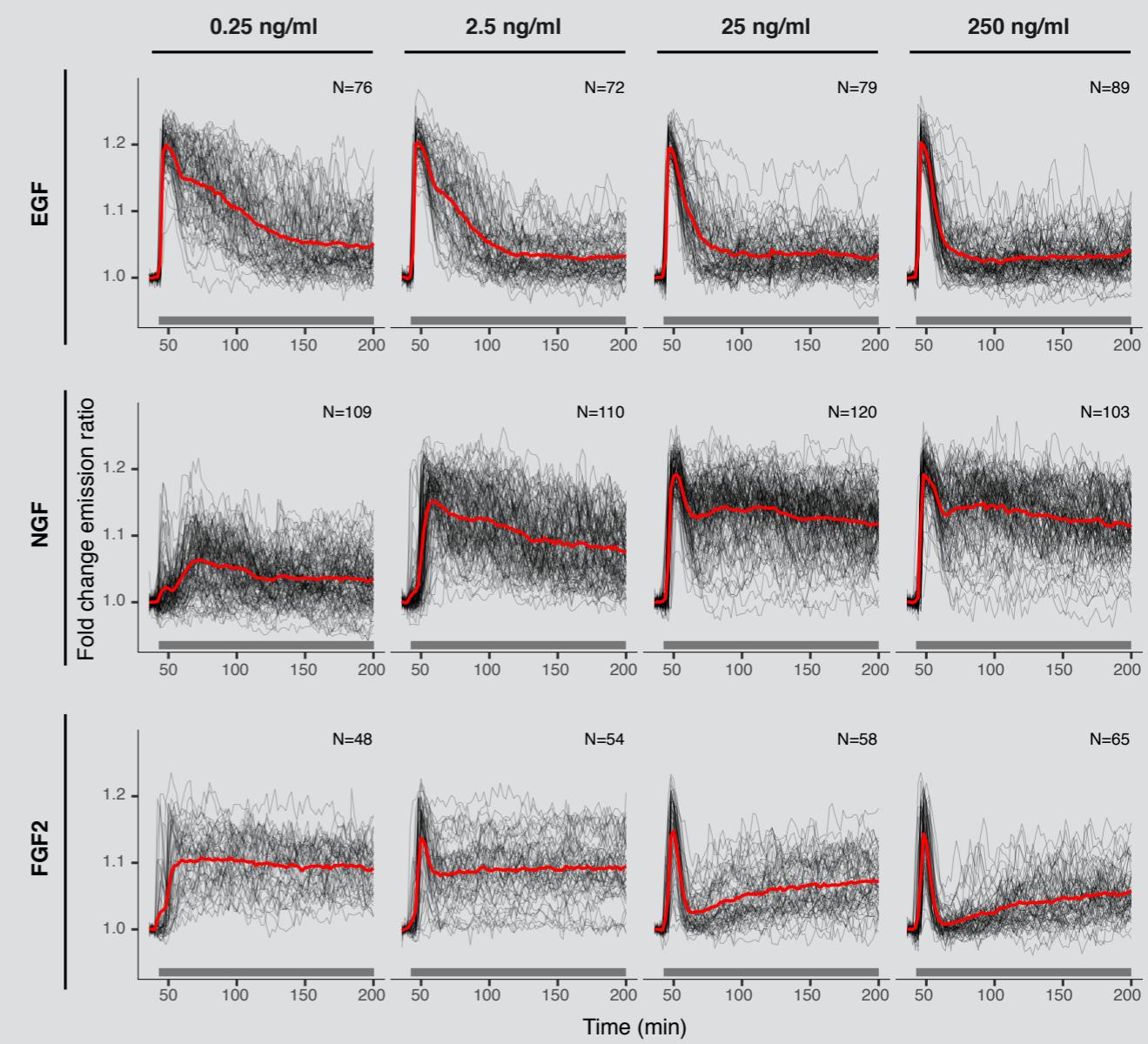
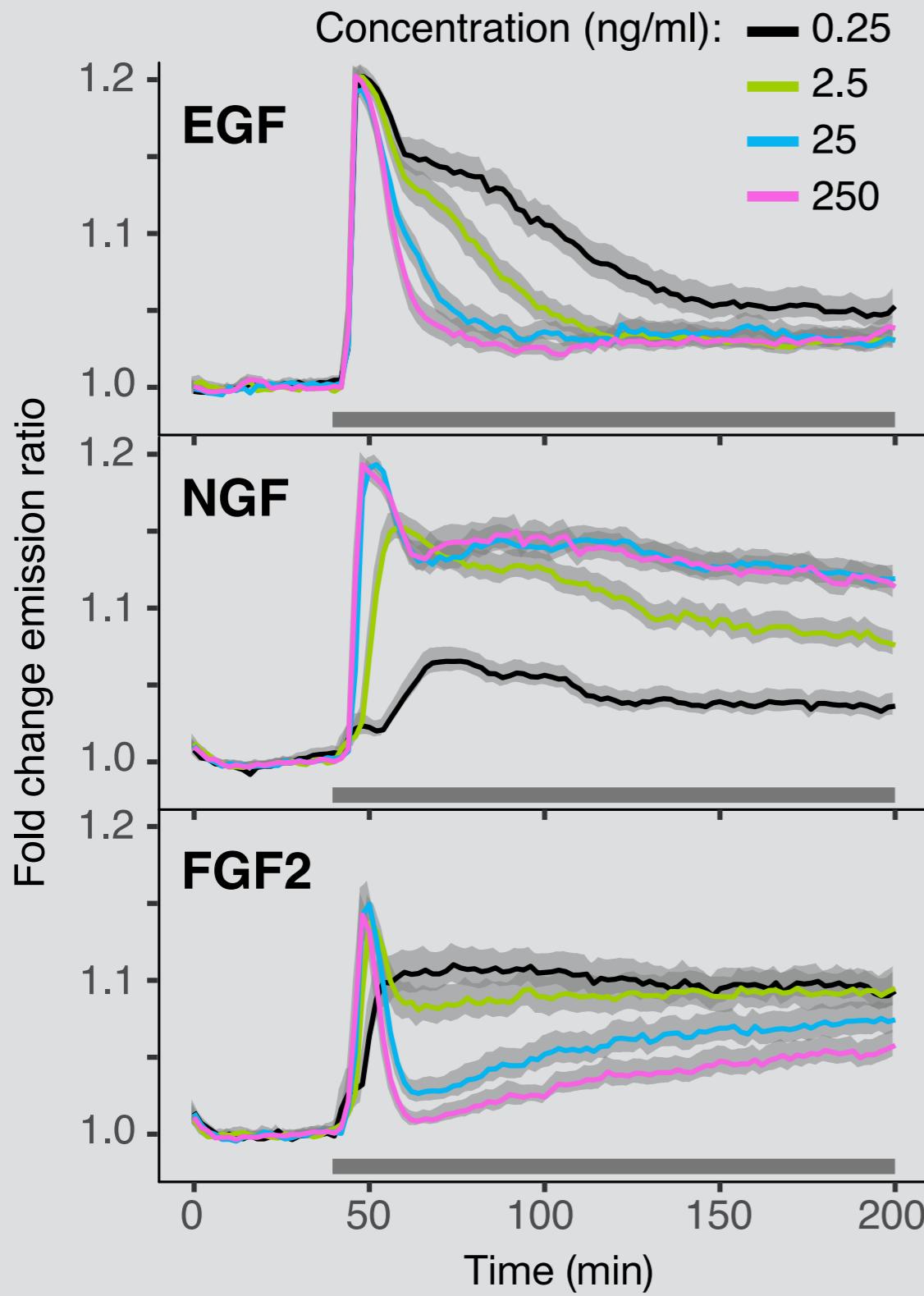
# Different GF's induce different dynamics



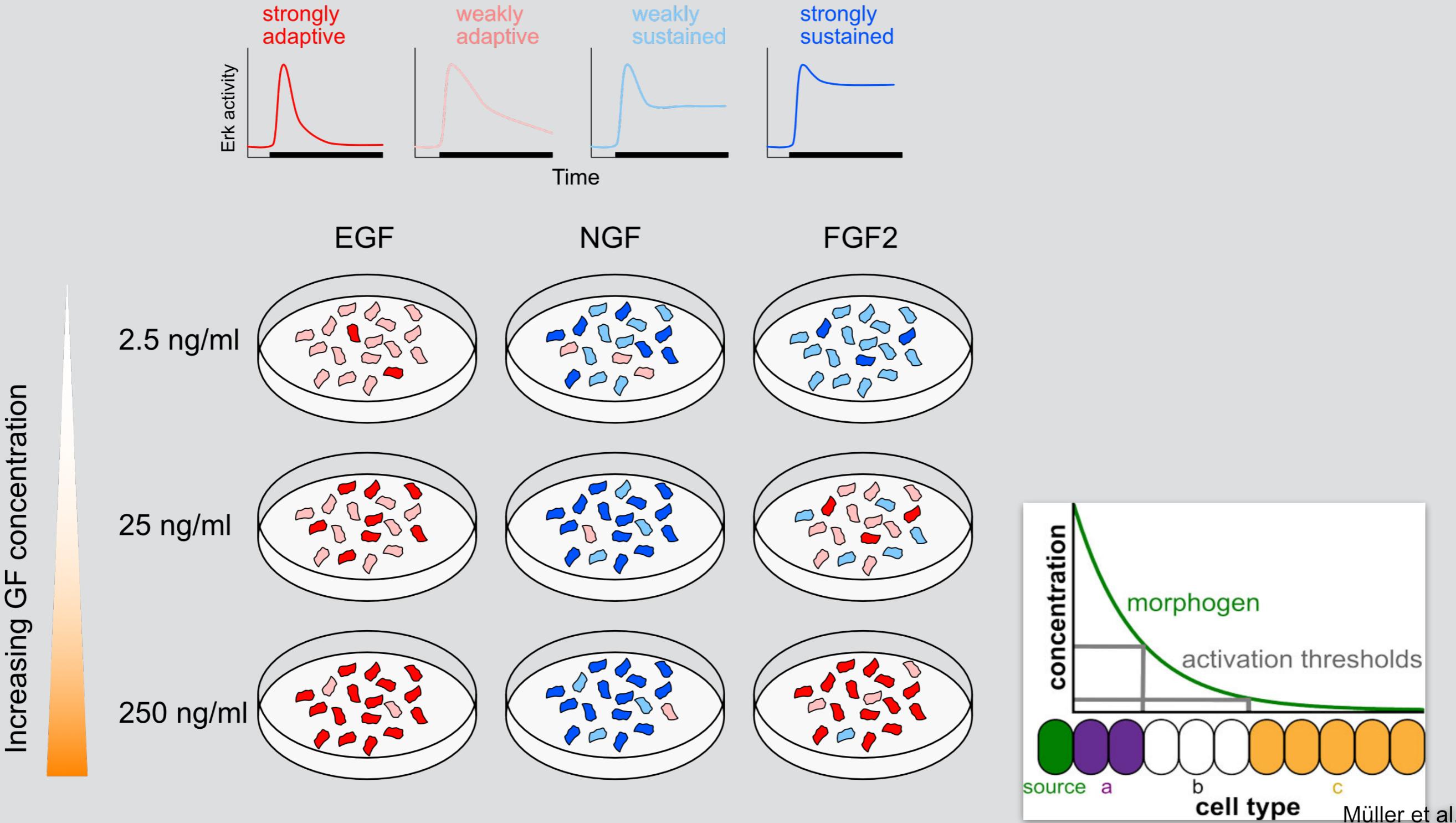
# Different dynamics result in different fates



# Population vs single-cell dynamics



# The FGF2 dose response produces a wider variety of signalling states than EGF/NGF



Important to specify different fates in a developmental morphogen gradient?

# Links and references

## **Temporal perturbation of Erk dynamics reveals network architecture of FGF2-MAPK signaling**

Yannick Blum, Jan Mikelson, Maciej Dobrzański, Hyunryul Ryu, Marc-Antoine Jacques,  
Noo Li Jeon, Mustafa Khammash, Olivier Pertz

<http://biorxiv.org/content/10.1101/629287v1>

## **Time Course Inspector interactive clustering R/Shiny**

<https://github.com/dmattek/shiny-timecourse-inspector>

## **Outlier Selector interactive R/Shiny**

[http://github.com/maurogwerder/Outlier\\_app](http://github.com/maurogwerder/Outlier_app)

## **Materials for QuantBio Workshop**

<https://github.com/dmattek/training-MIC20200319>