



# MPA Career Seminar

April 14<sup>th</sup> 2015

## The roots of thinking and movements

Also between fields of research

Dr. Michele Cappetta



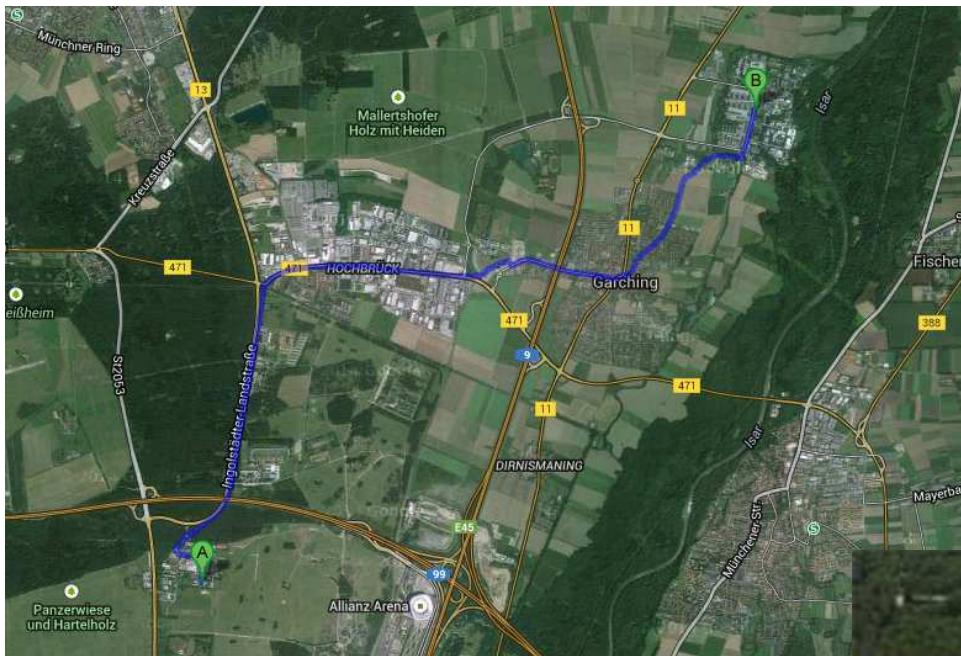
Technische Universität München



Klinikum rechts der Isar  
Technische Universität München



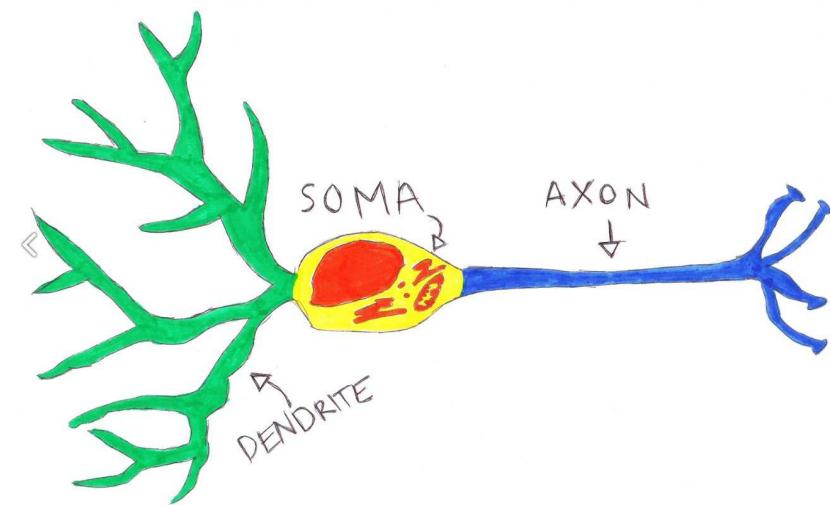
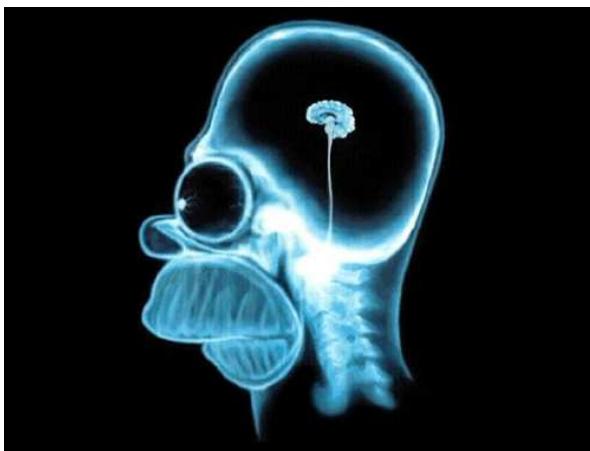
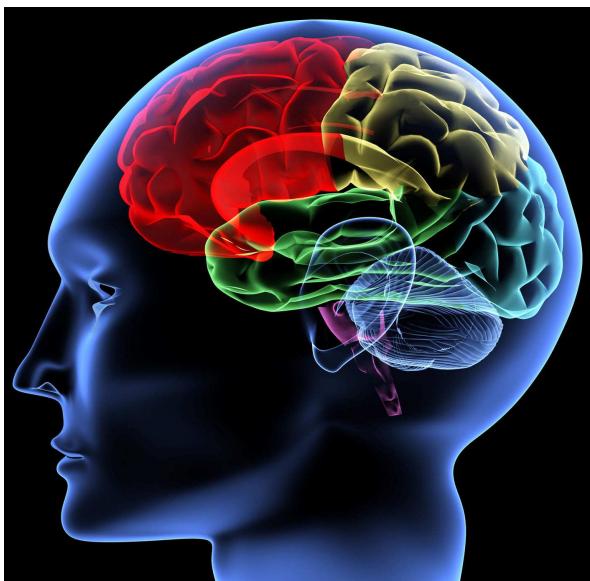
# The Helmholtz Zentrum



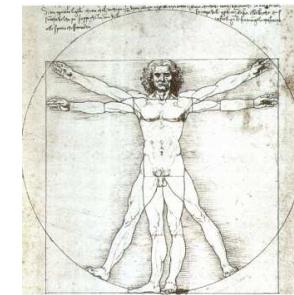
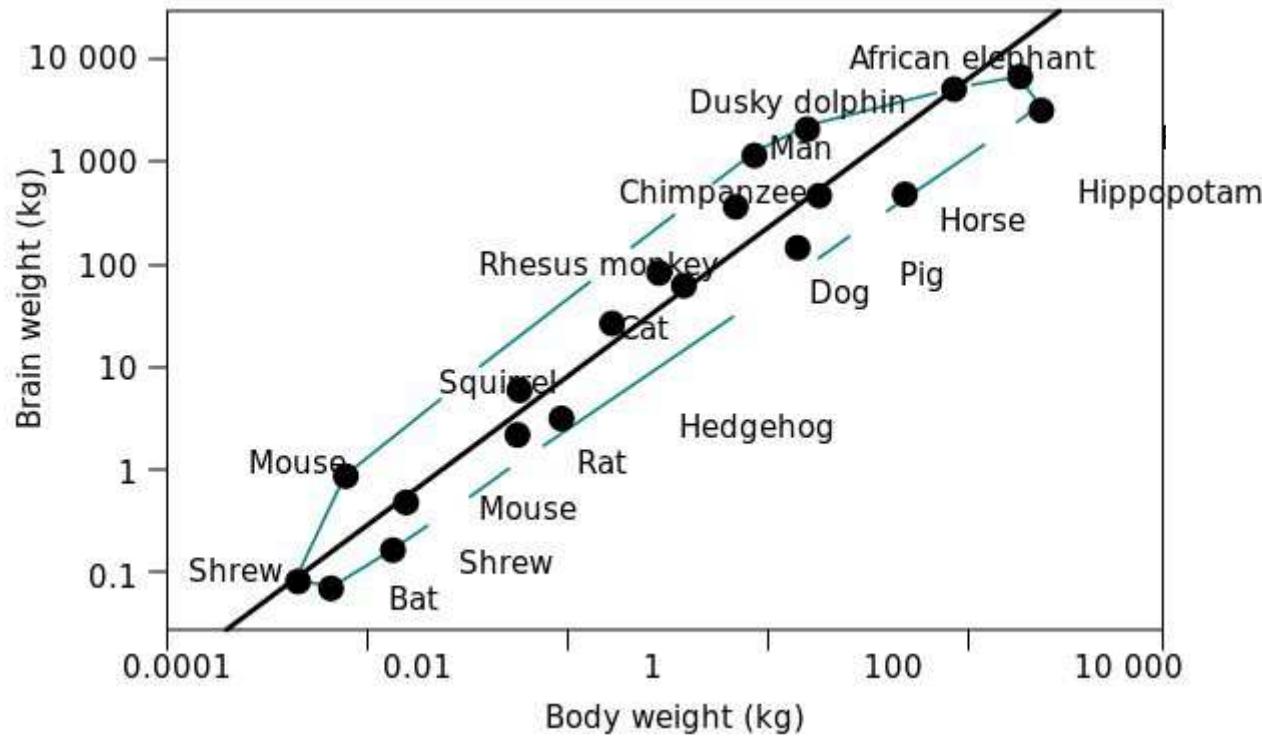
Institute of Biological  
and Medical Imaging



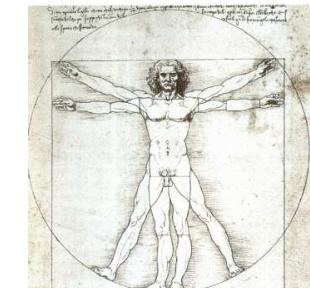
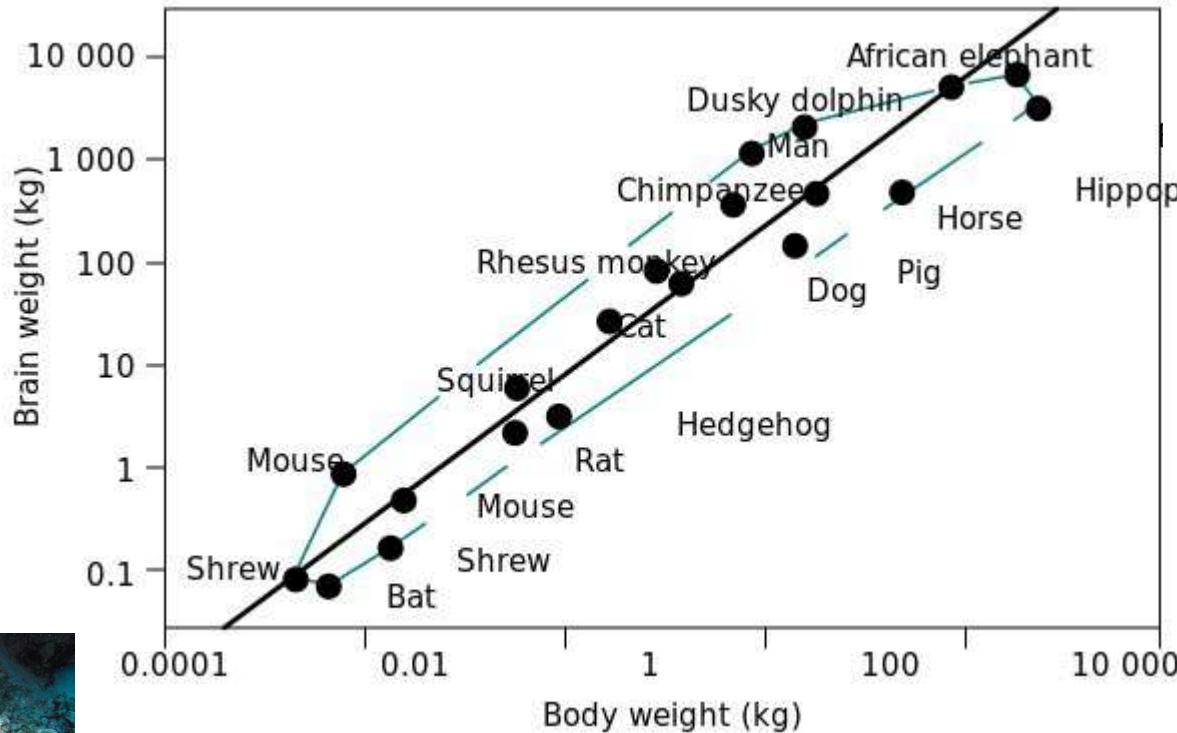
# Study of the brain



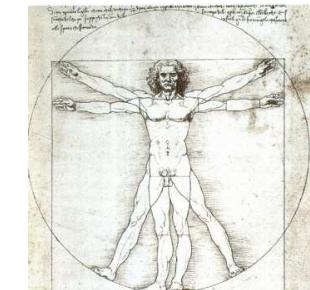
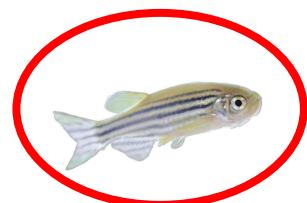
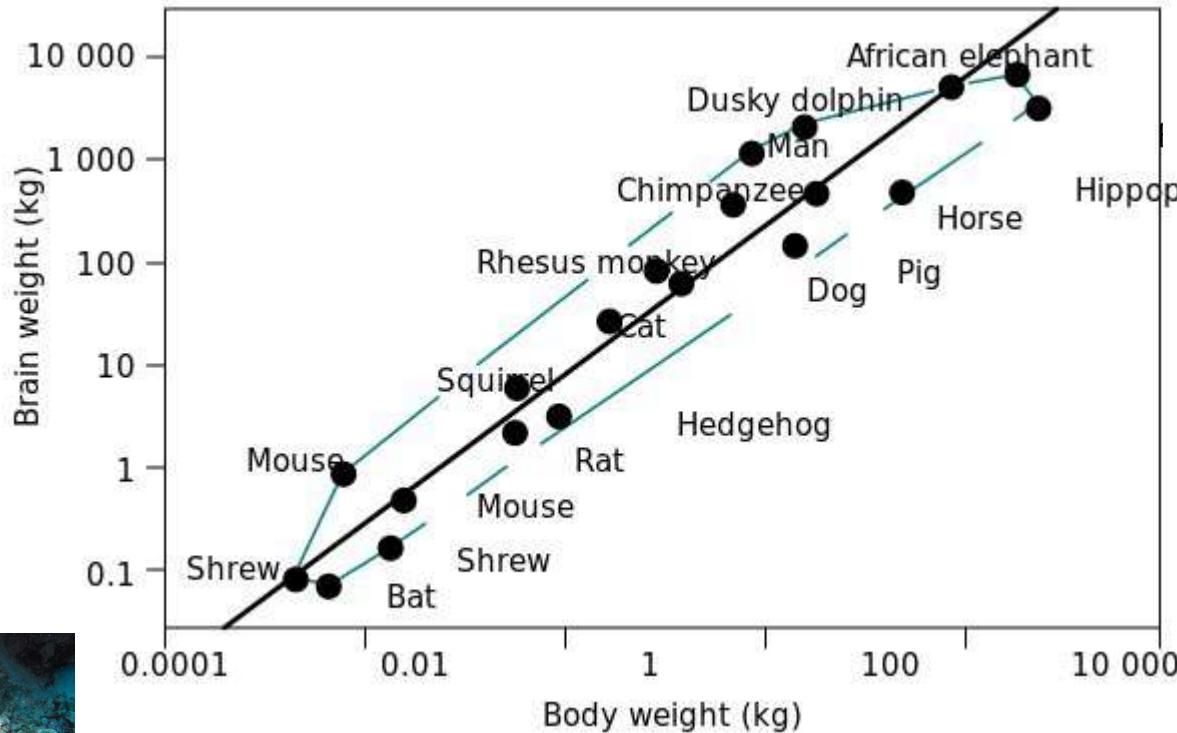
# Study of the brain



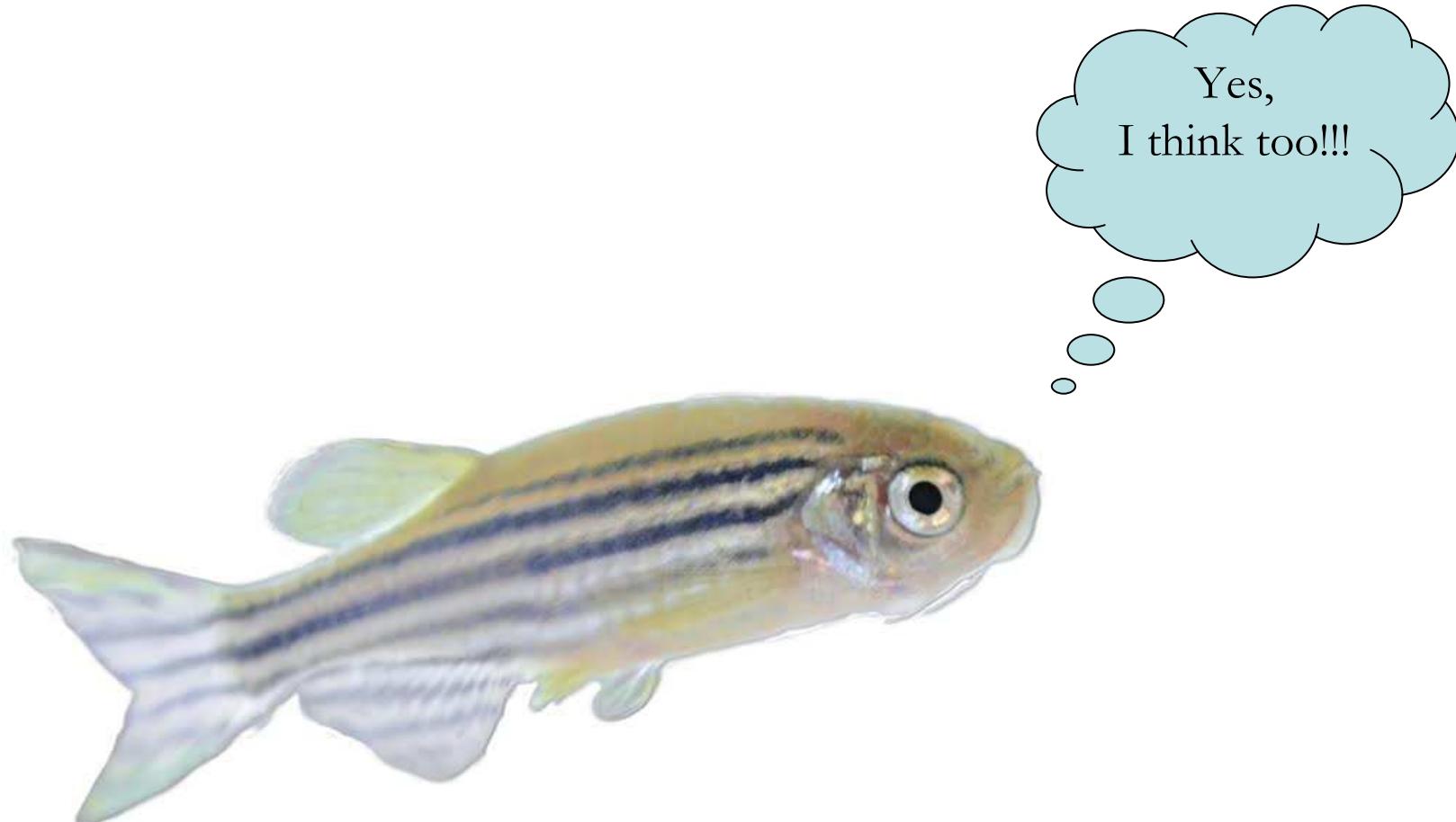
# Study of the brain



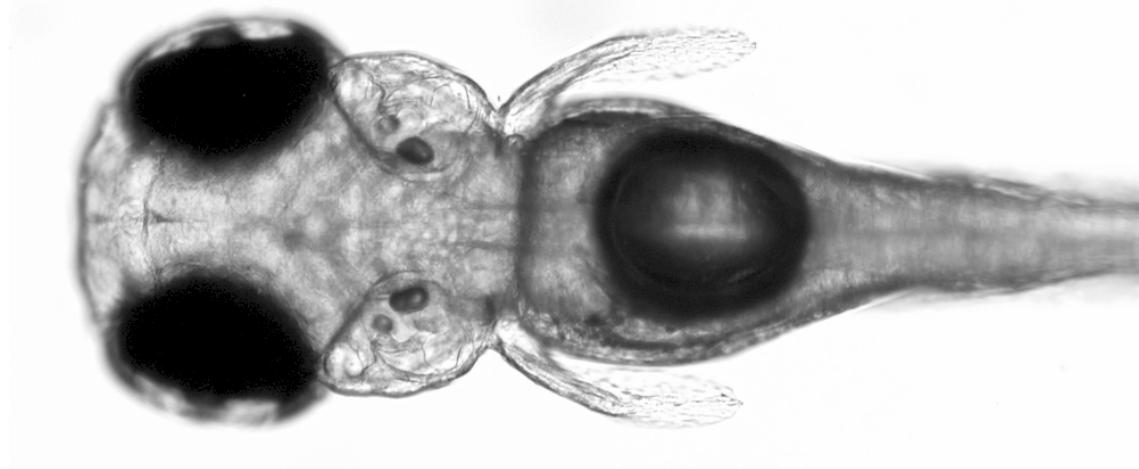
# Study of the brain



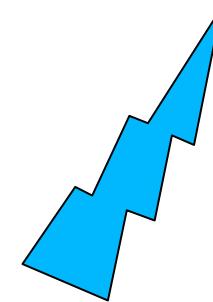
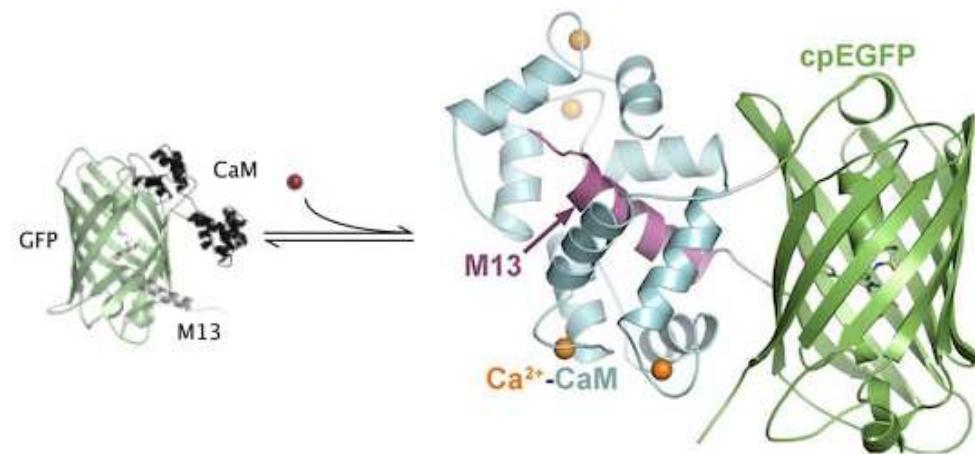
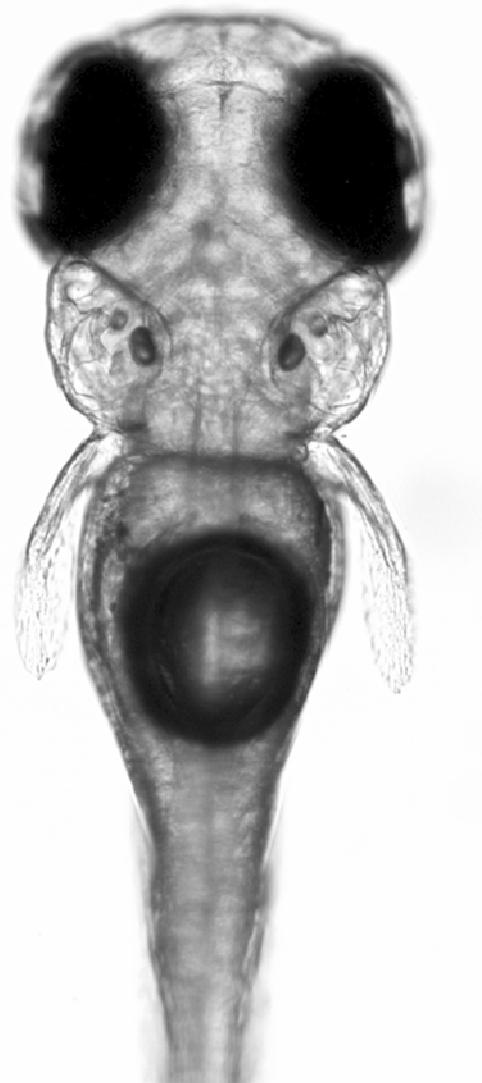
# Zebrafish



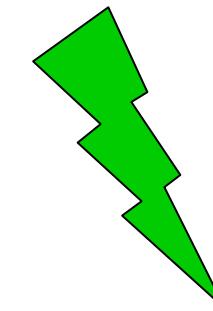
# Zebrafish larvae



# GCaMP - Zebrafish

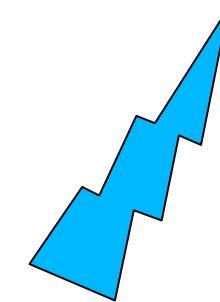
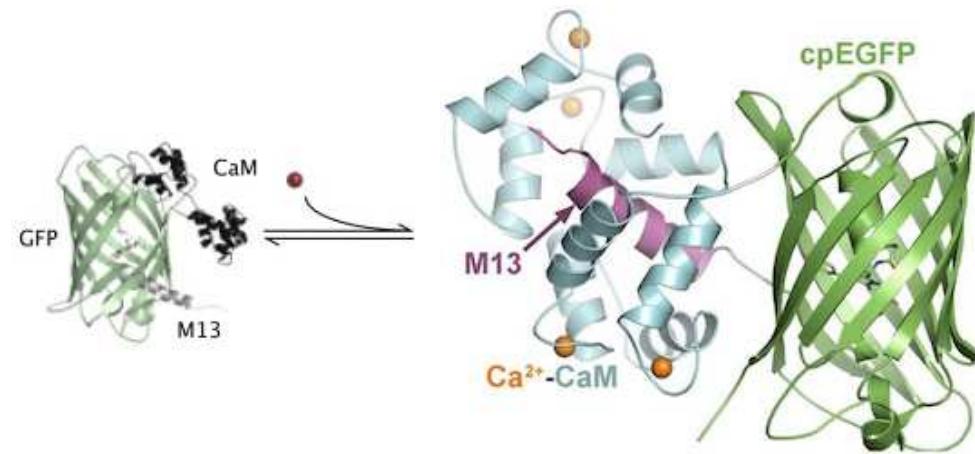
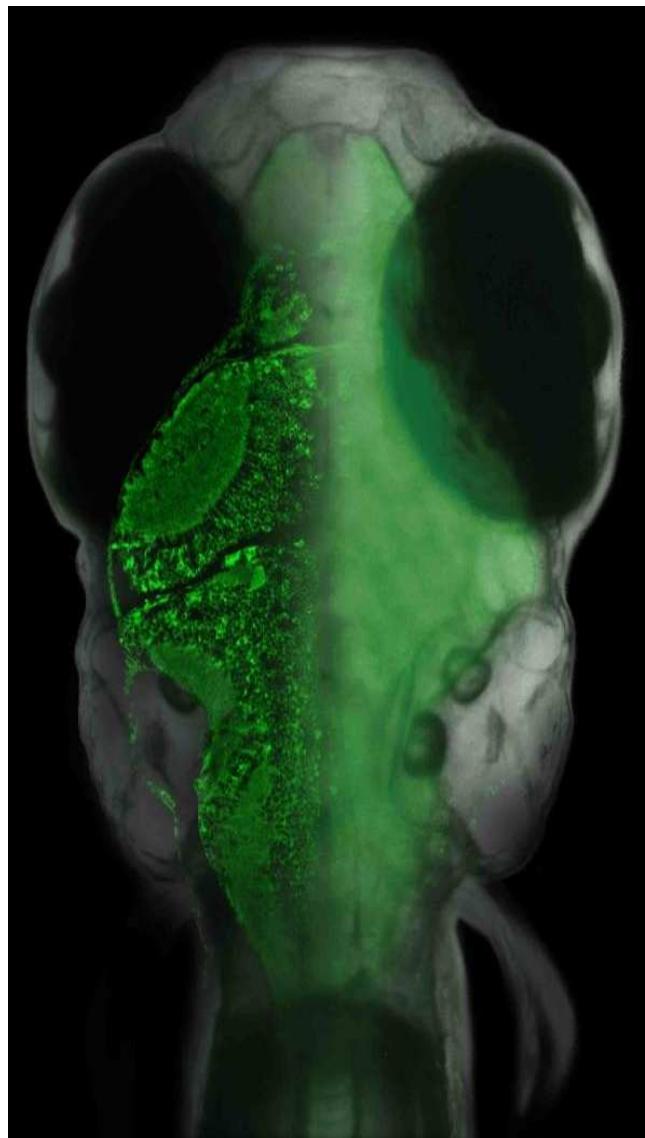


490 nm

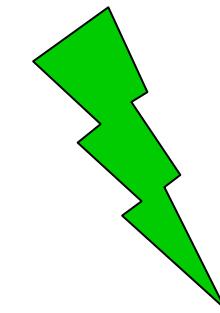


520 nm

# GCaMP - Zebrafish

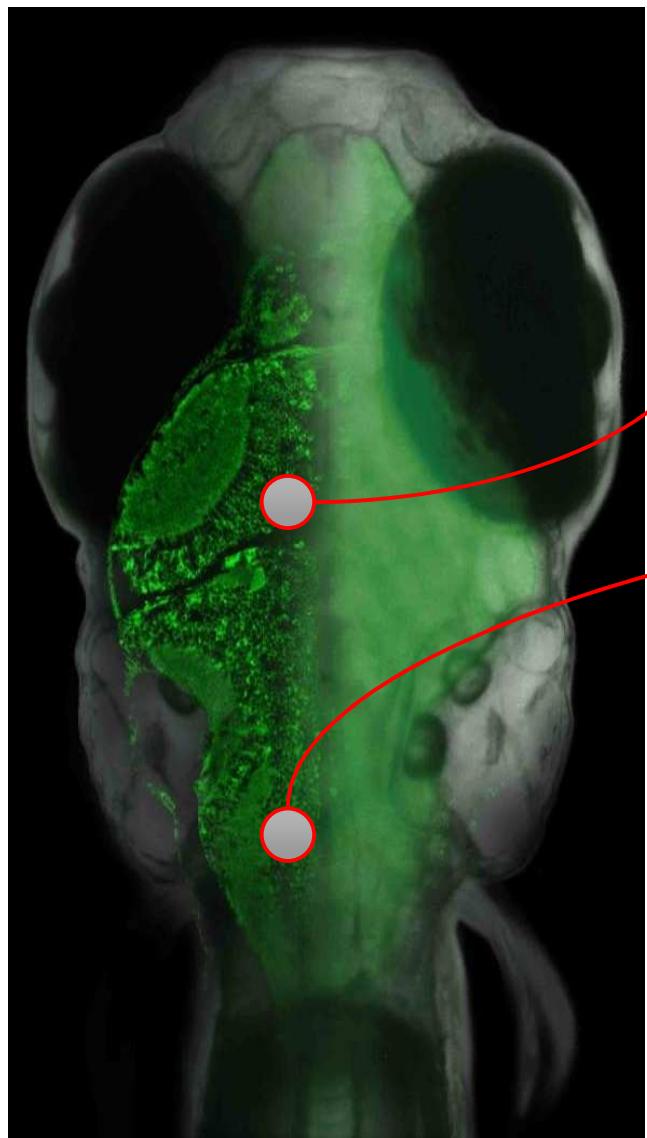


490 nm

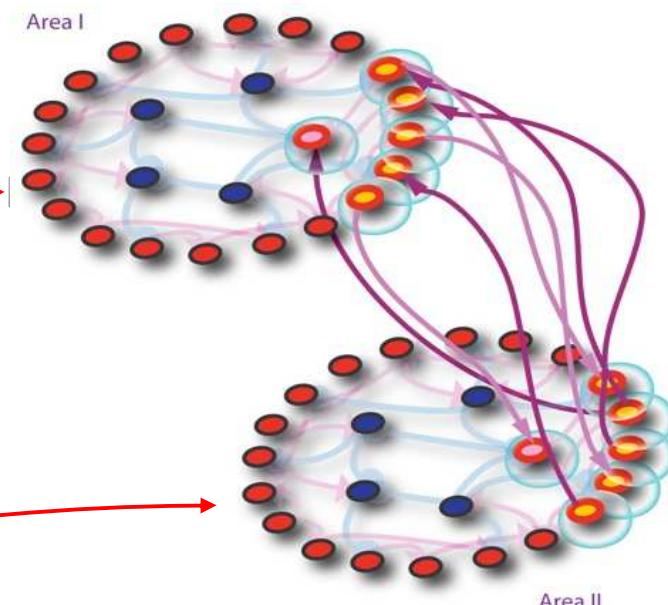


520 nm

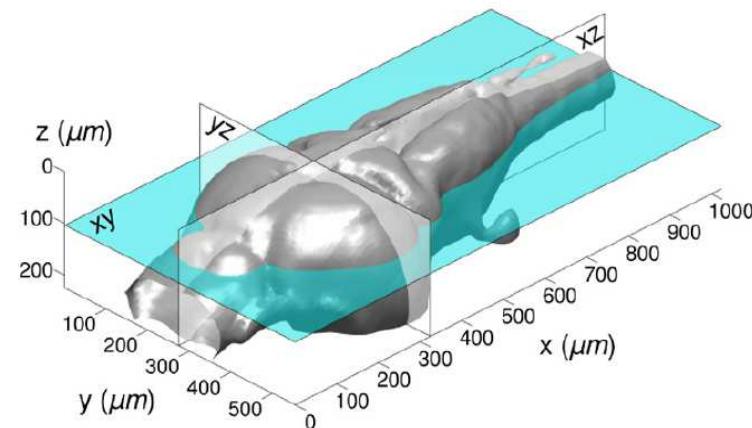
## Anatomy



## Topology



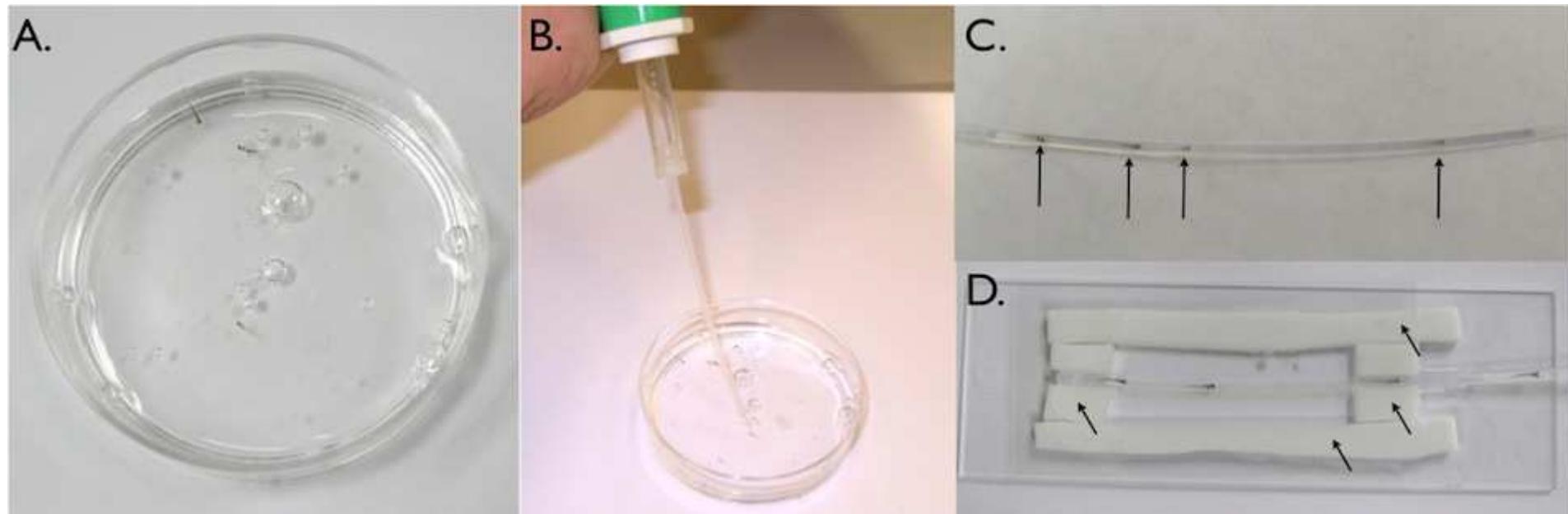
Frontiers in Neural Circuits  
2013 (Article 13):1-22.



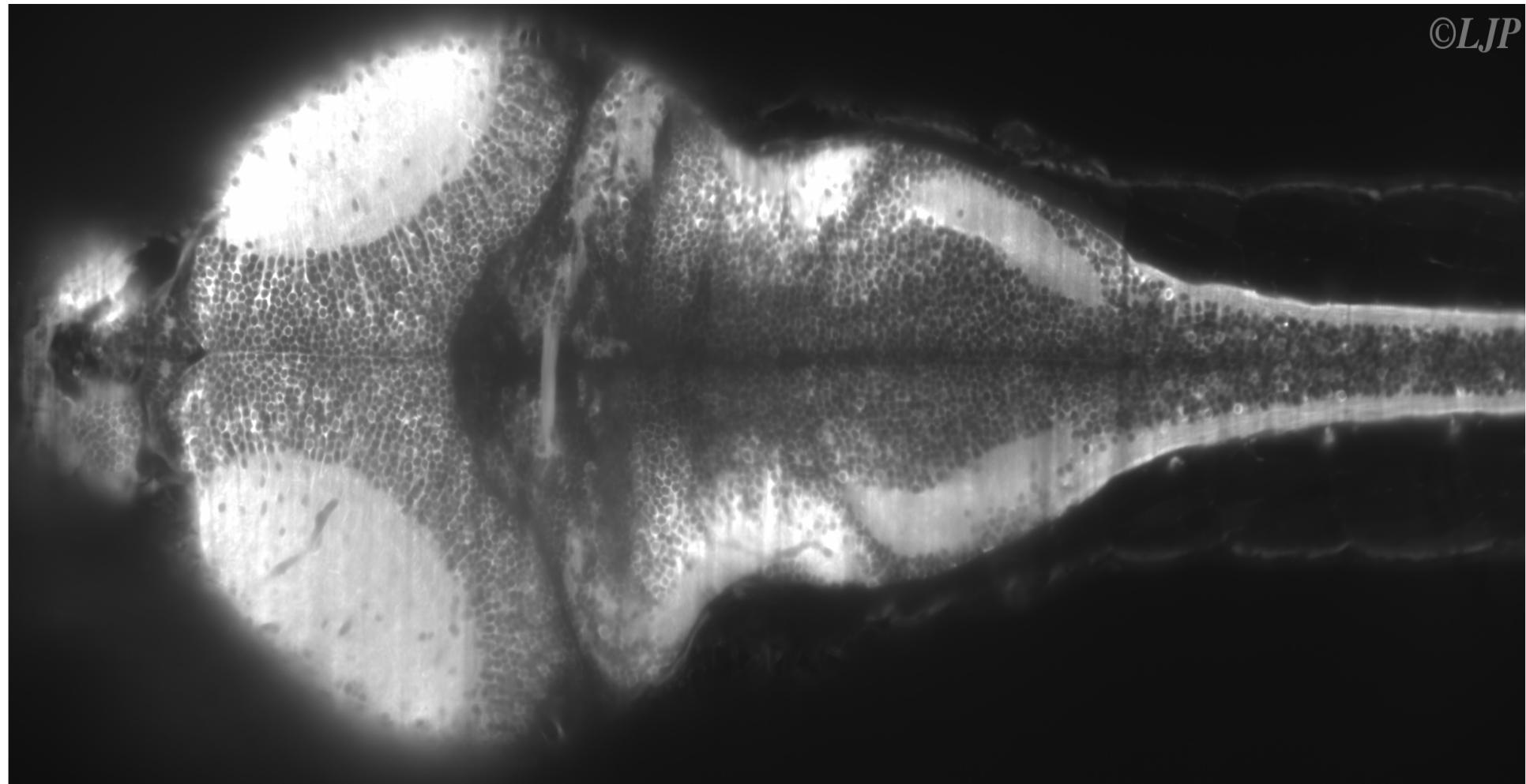
Panier et al. 2013,  
Frontiers in Neural  
Circuits 10.3389

Panier et al. 2013, Frontiers in Neural Circuits 10.3389

# Zebrafish mounting



# Whole brain, single cellular resolution



©LJP

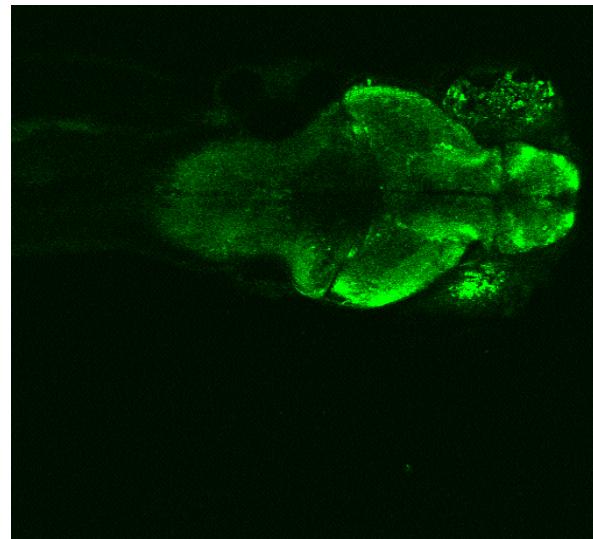
# Datasets

(courtesy of Dr.A.Lauri & A.Myklatun)

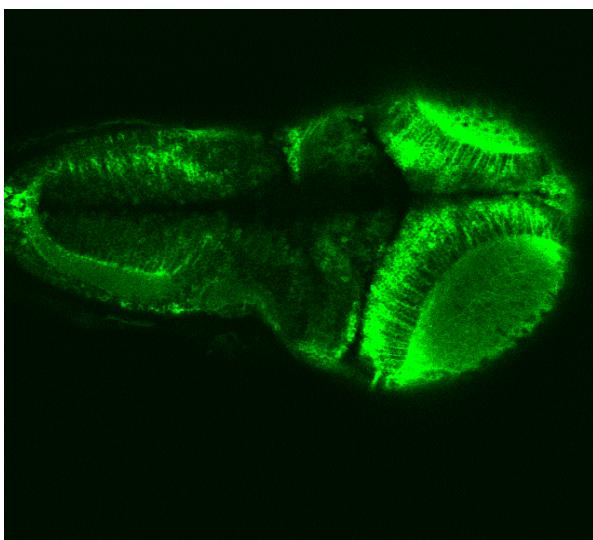
Z=1



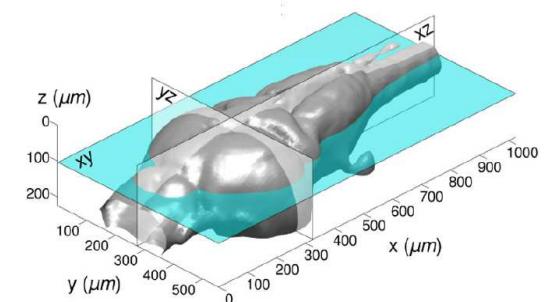
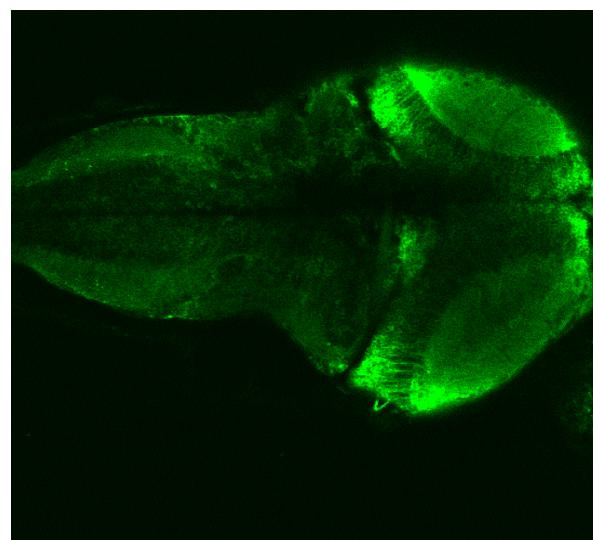
Z=16



Z=1



Z=11



XY res. 512x512;  
16 Z-planes; 180 T-frames  
2.5  $\mu\text{m}$  - 30s/volume

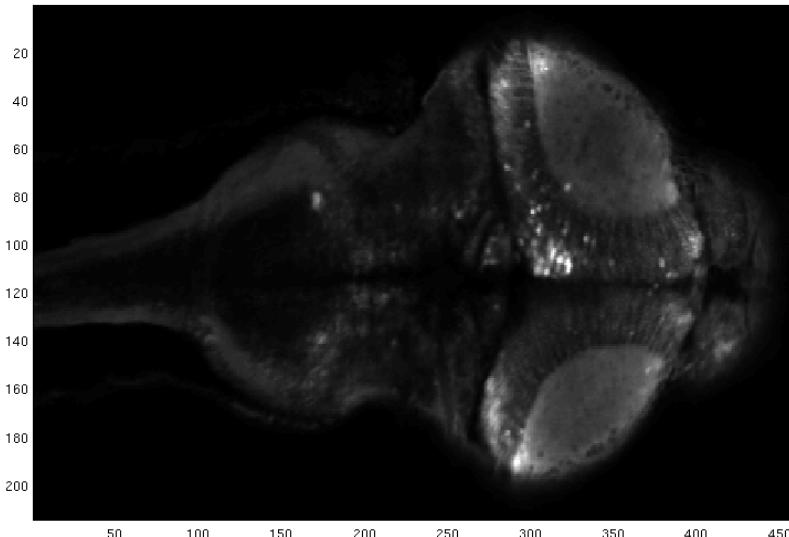
XY res. 640x640;  
11 Z-planes; 60 T-frames  
2.5  $\mu\text{m}$  - 30s/volume

show the  
movies



# Segmentation and ROIs detection

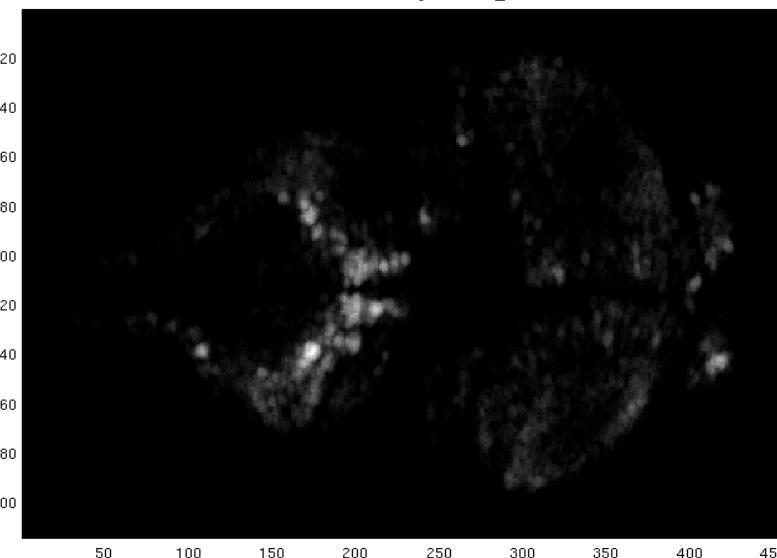
Mean over the T-frames



Detected ROIs

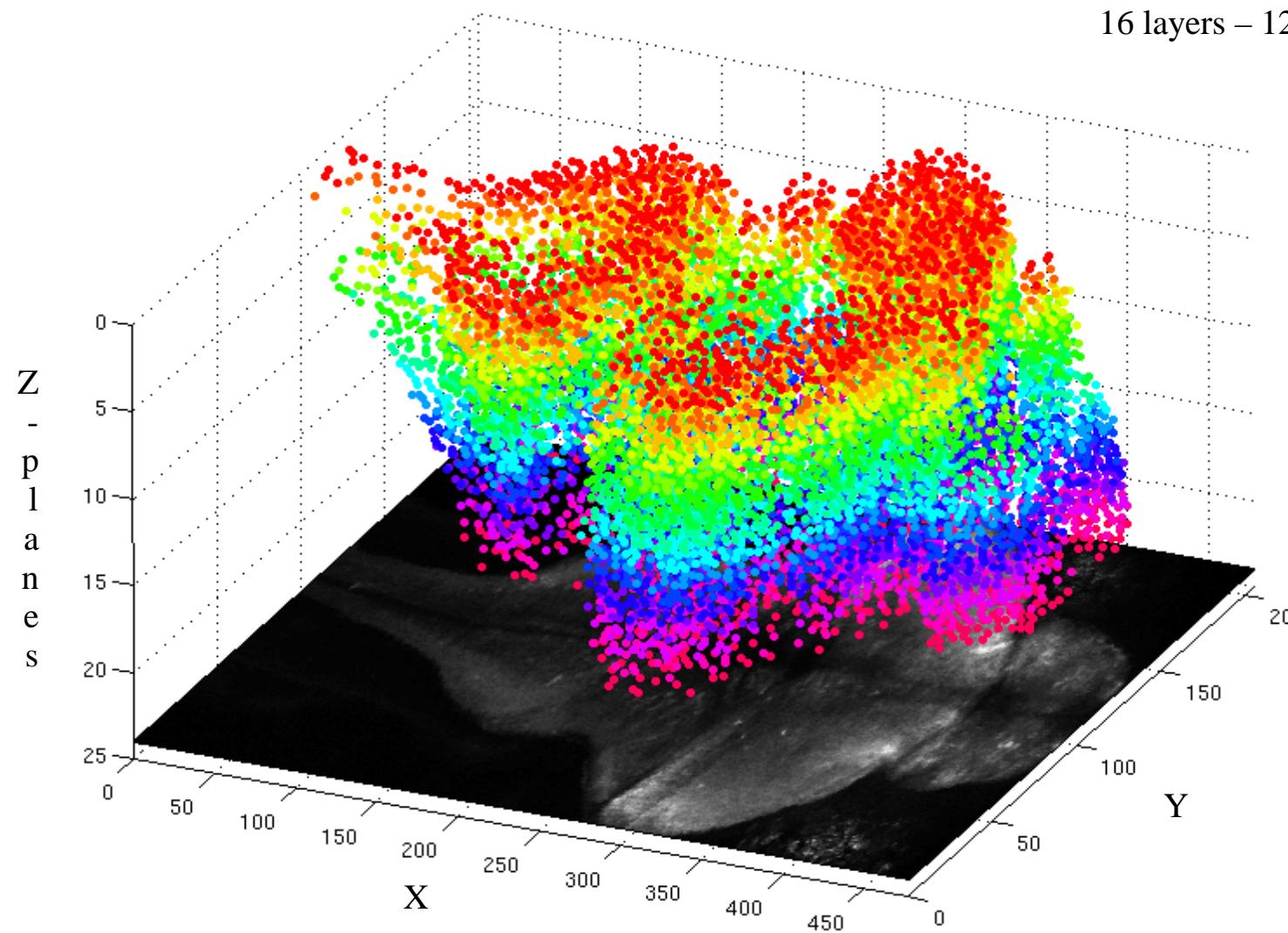


Activity map

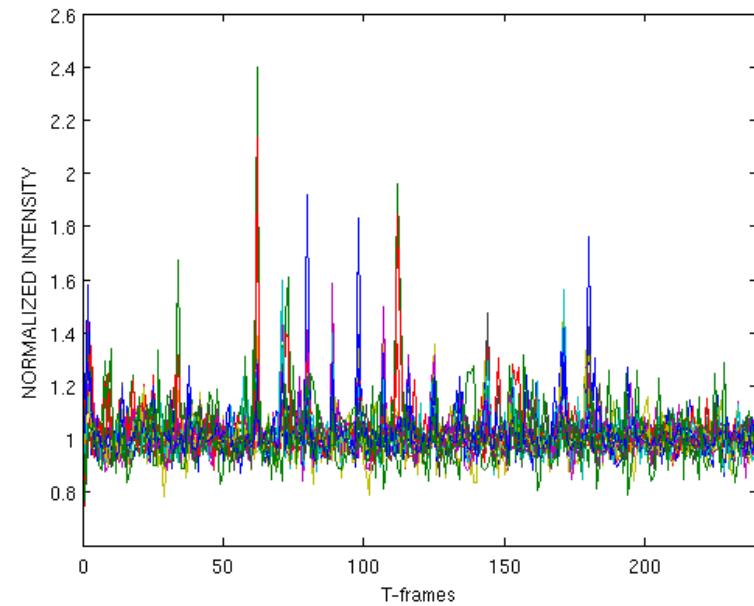
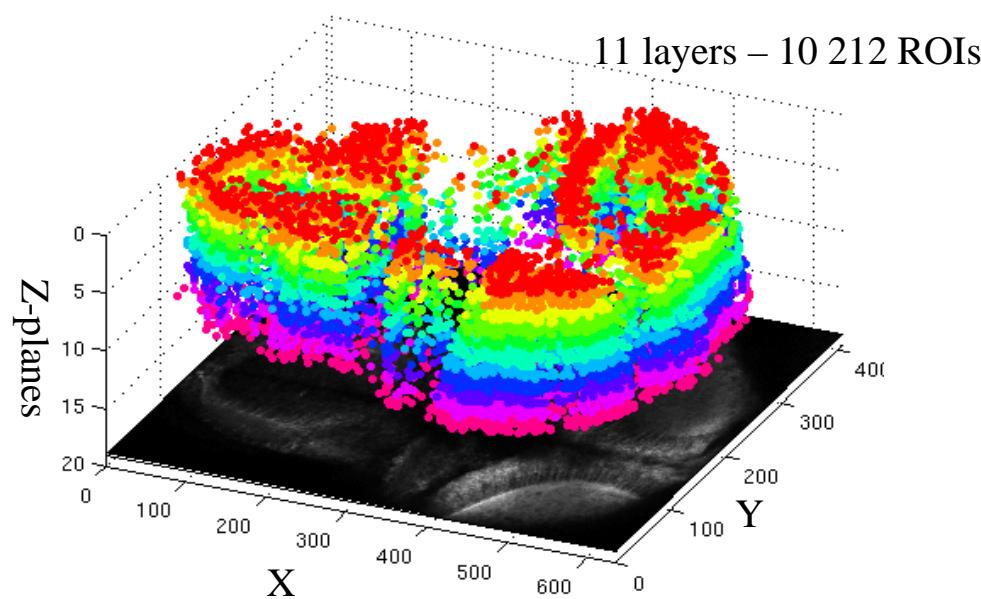
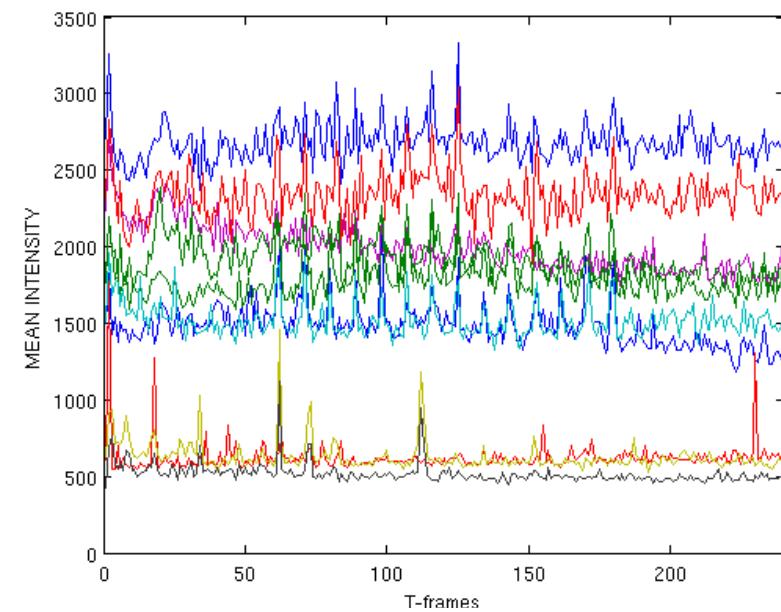
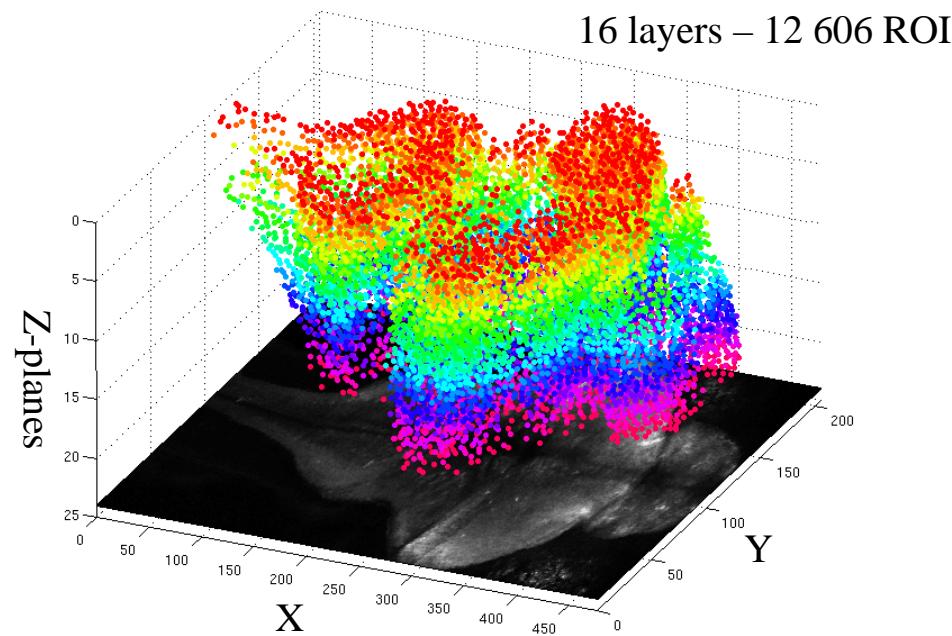


# Signal reduction

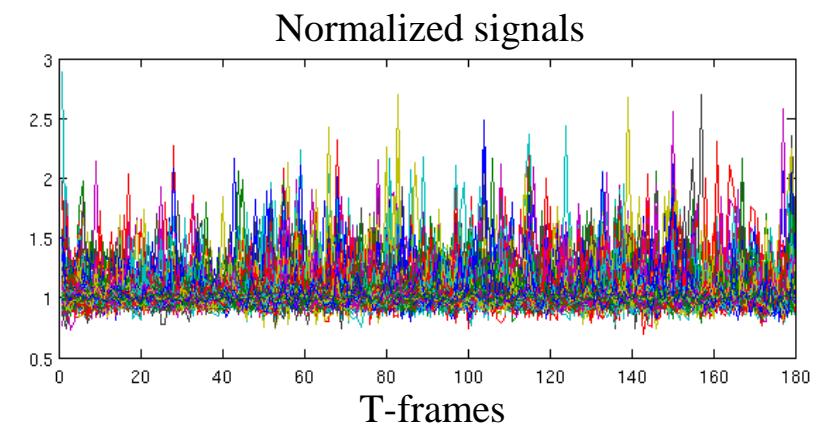
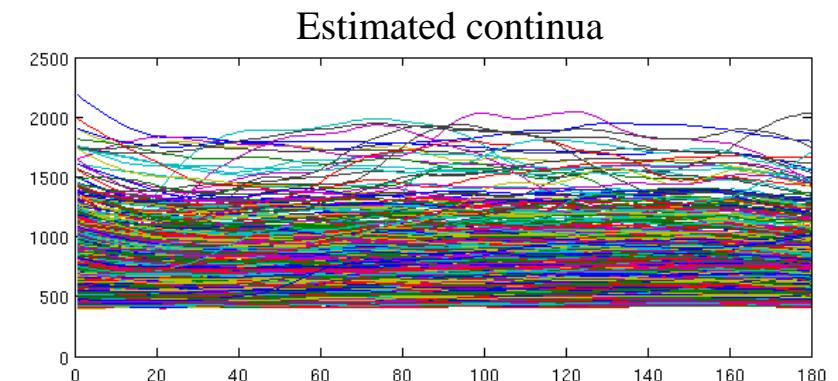
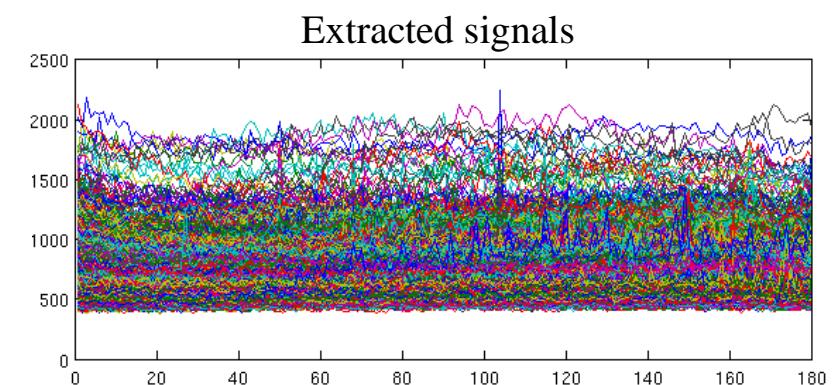
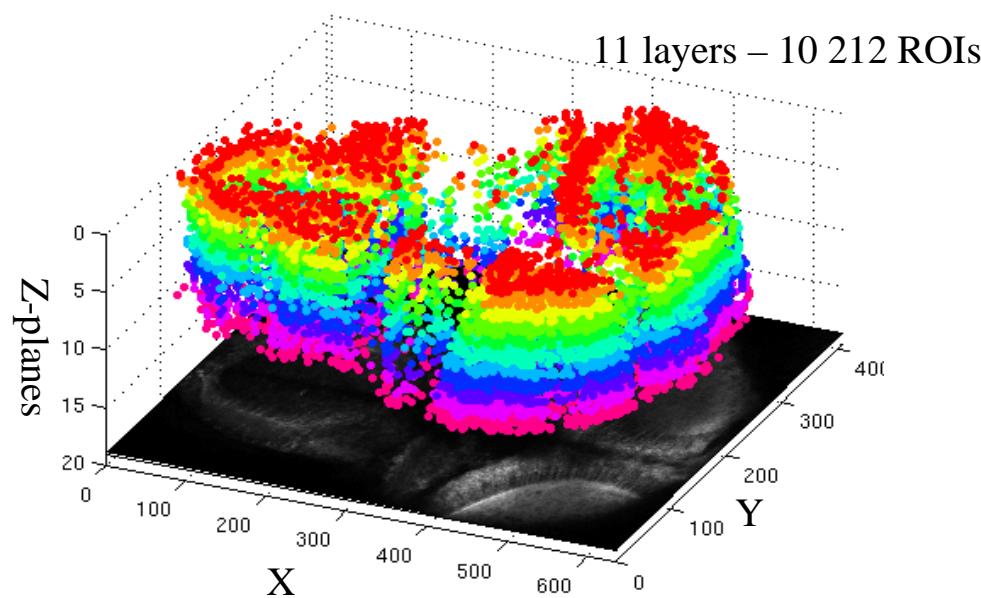
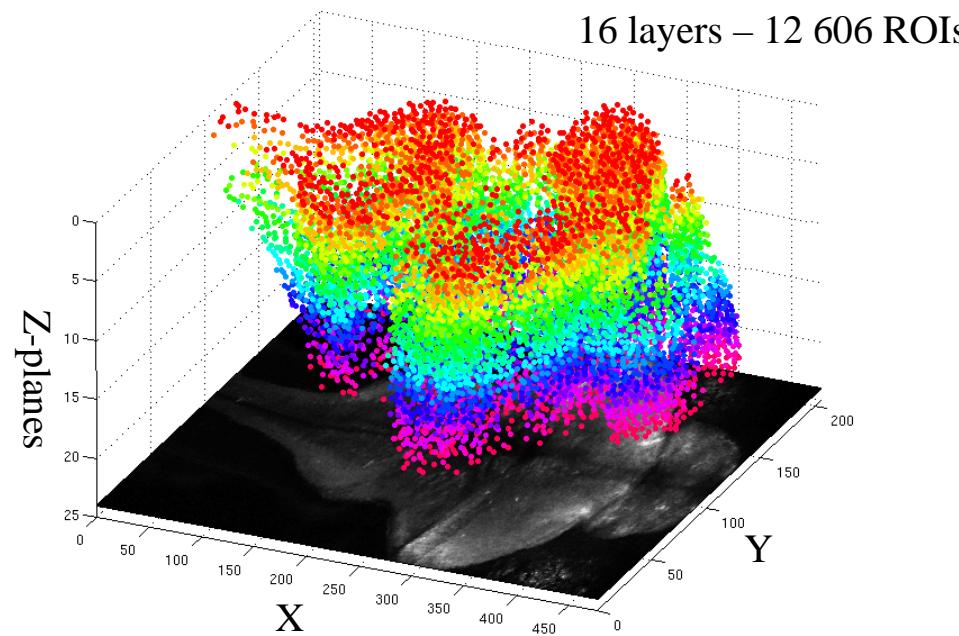
16 layers – 12 606 ROIs



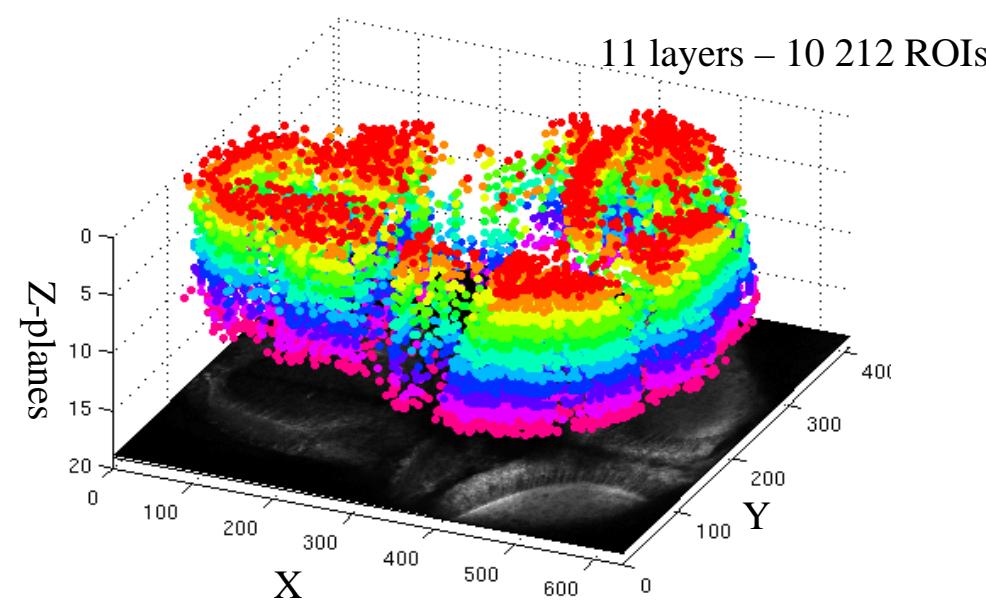
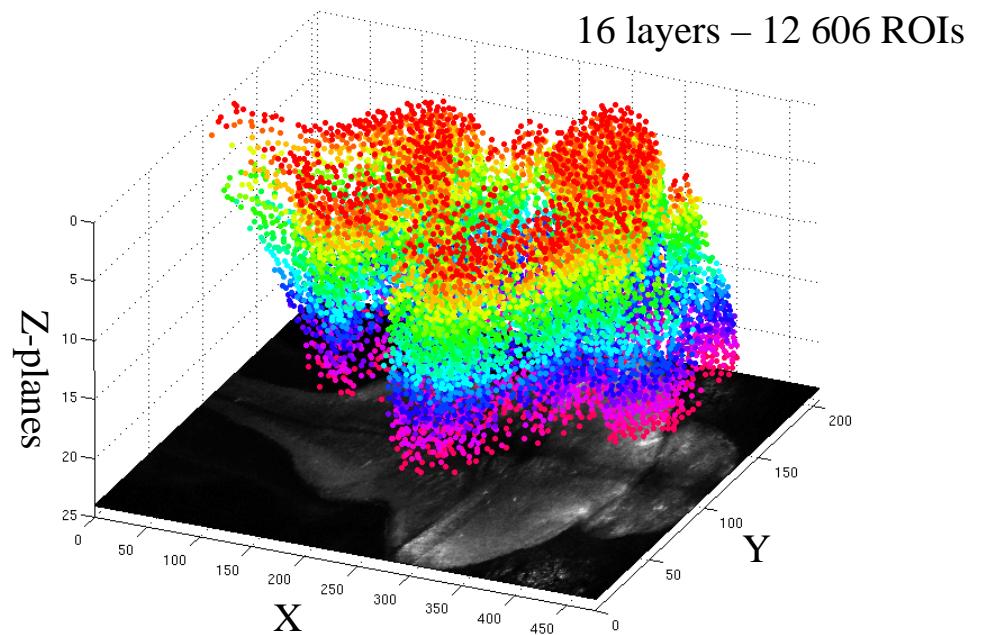
# Signal reduction



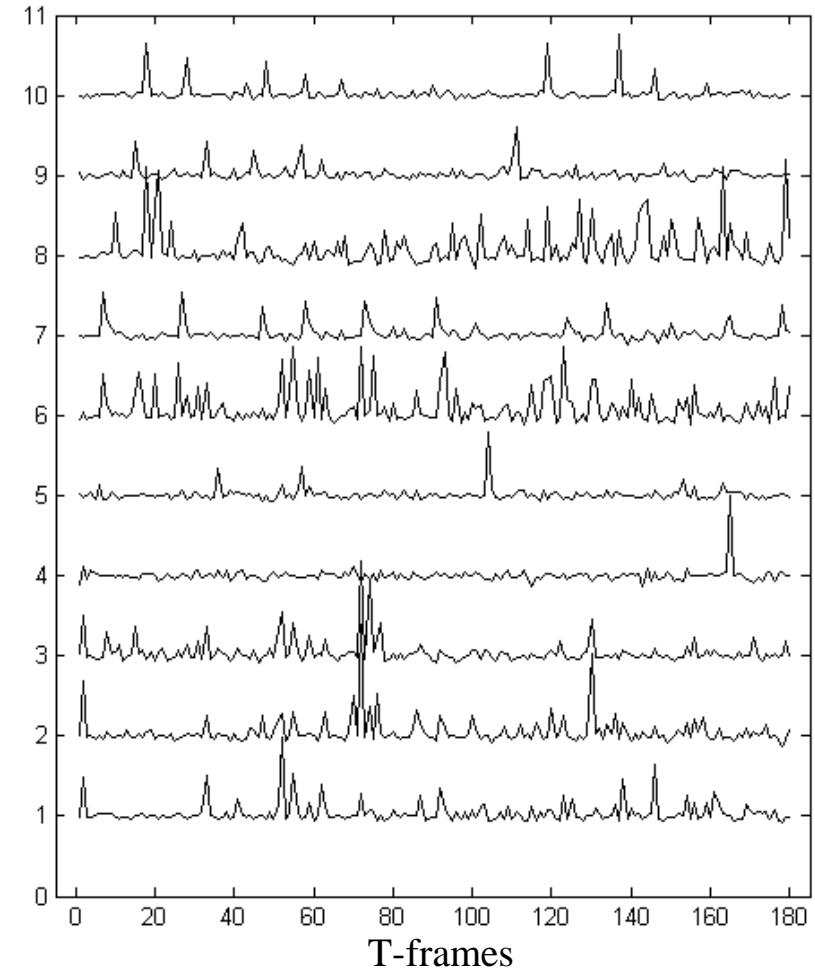
# Signal reduction



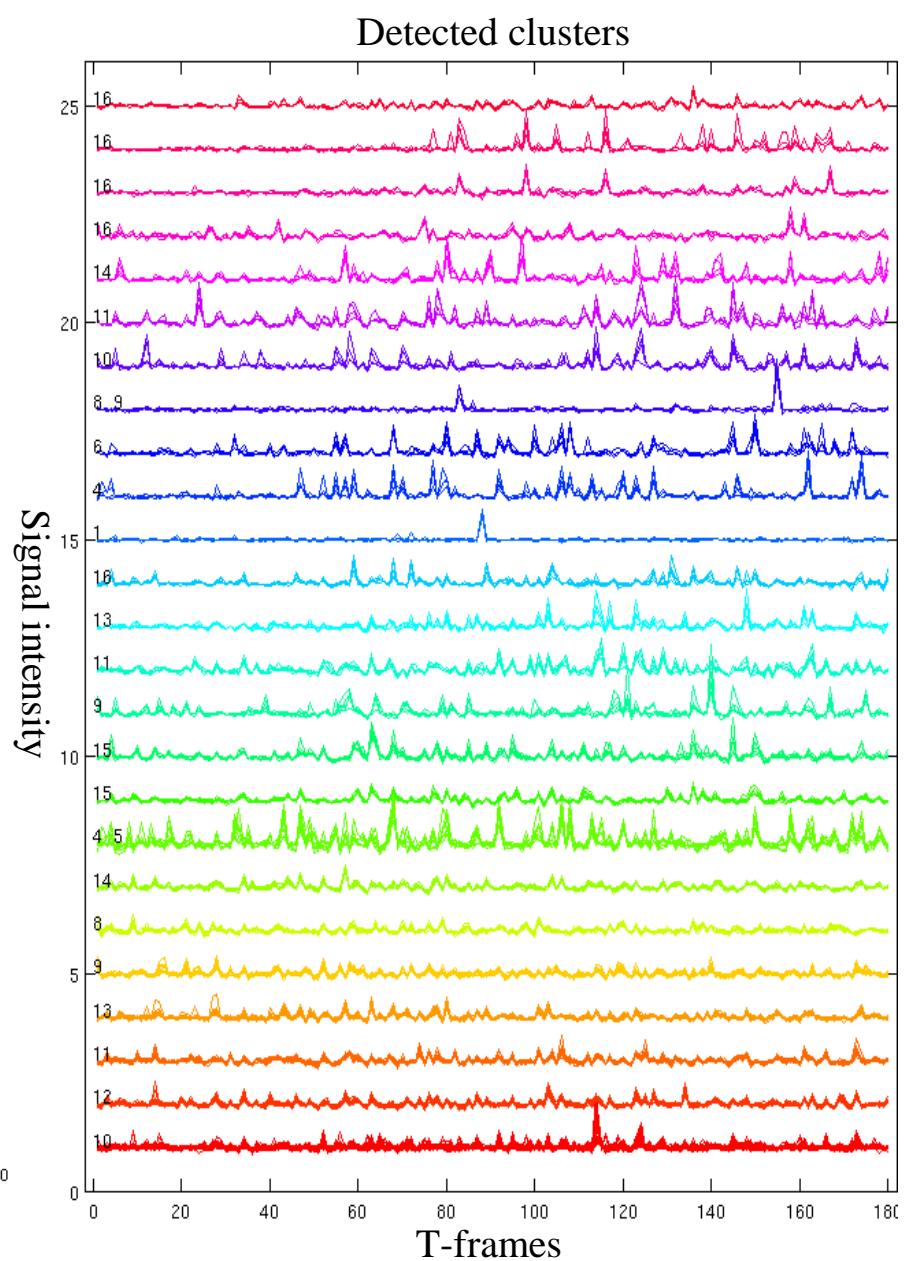
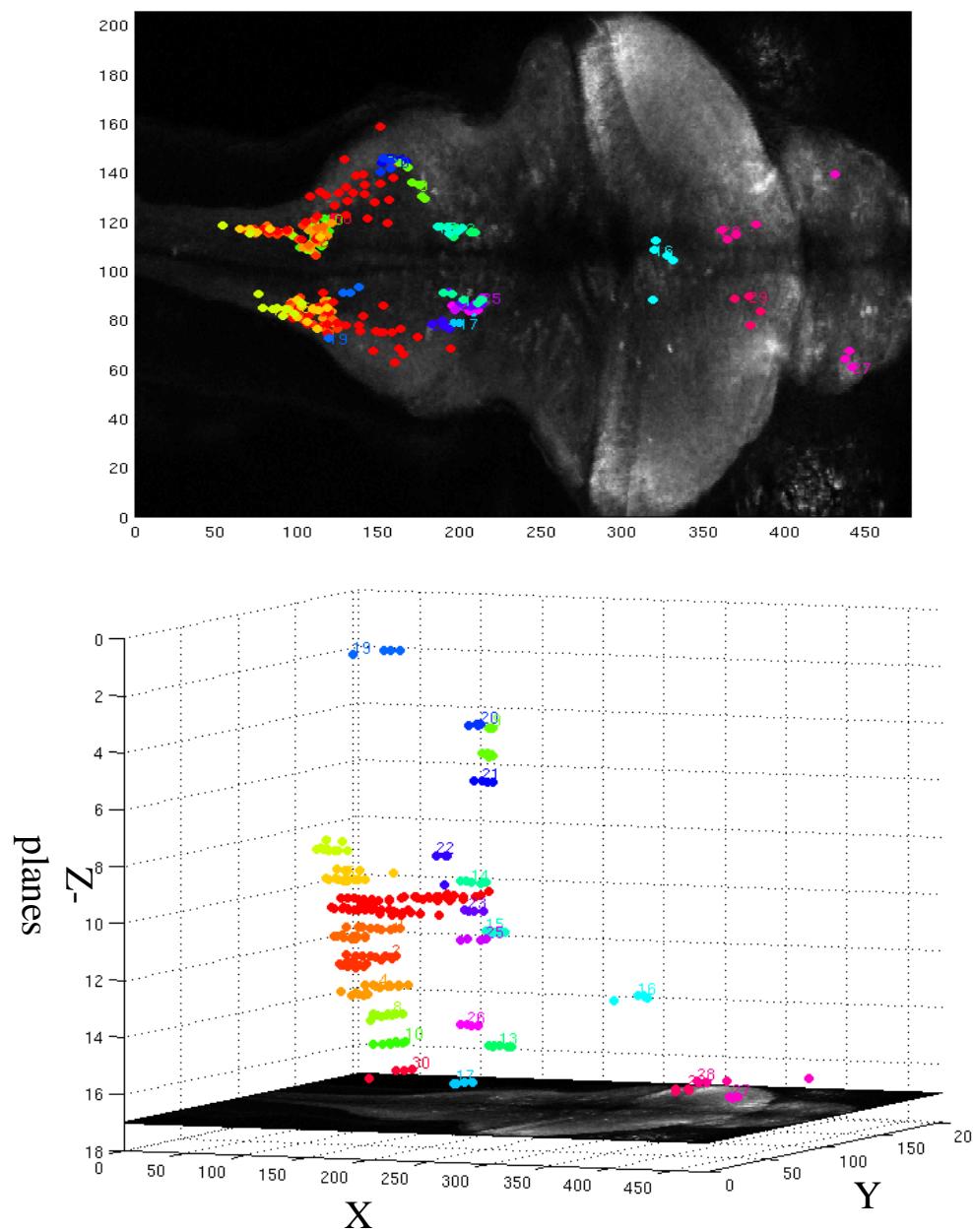
# Signal analysis



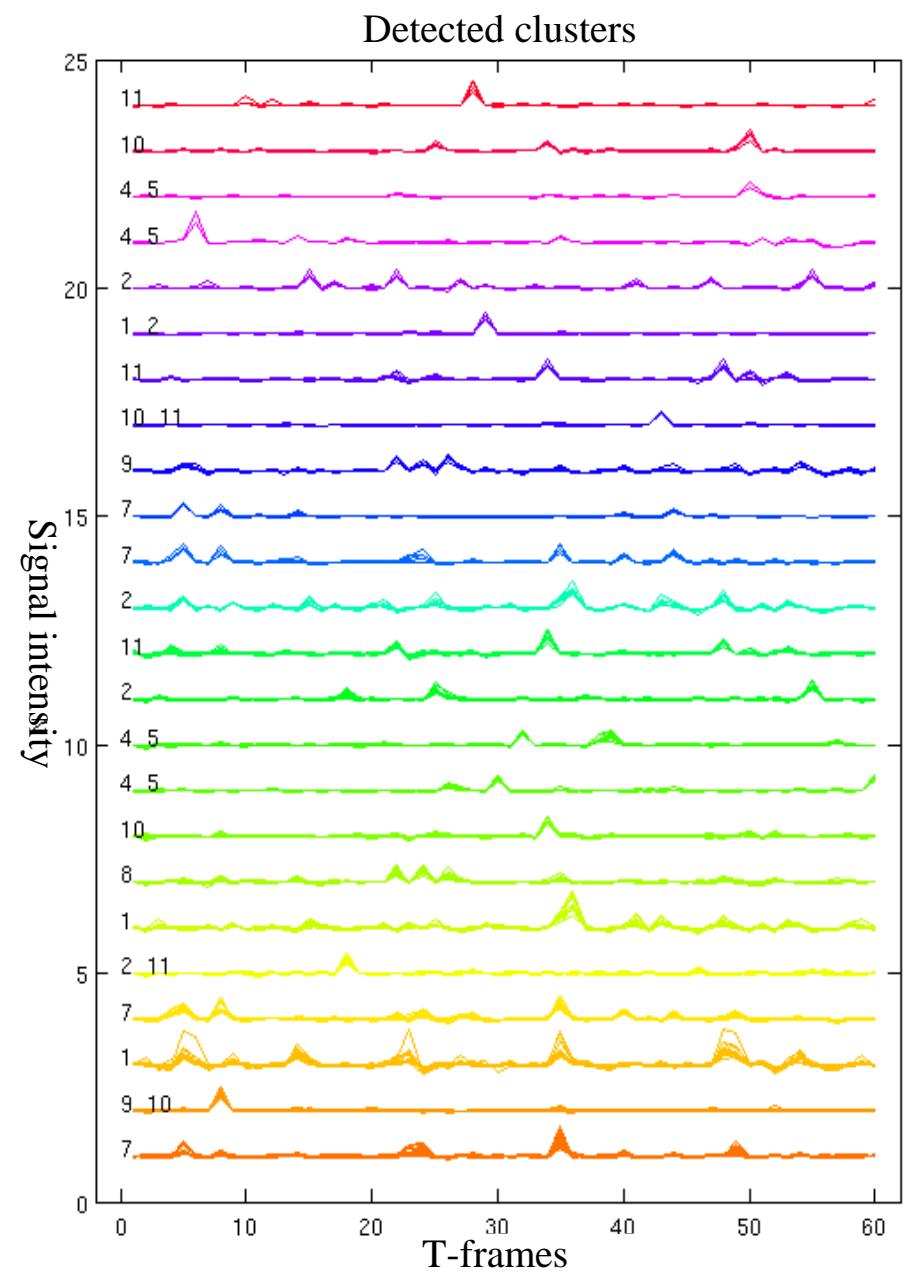
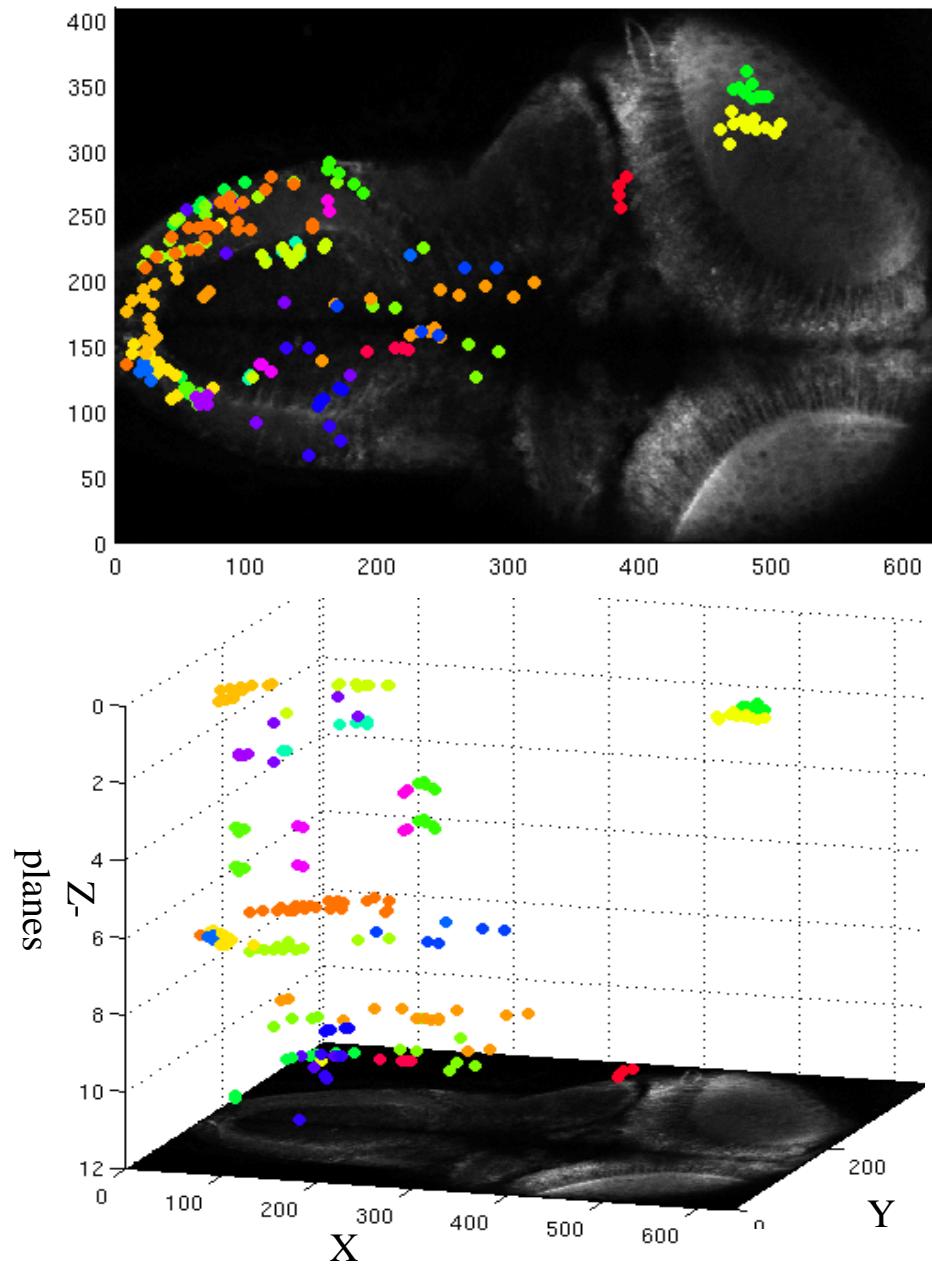
Normalized signals of 10 random ROIs



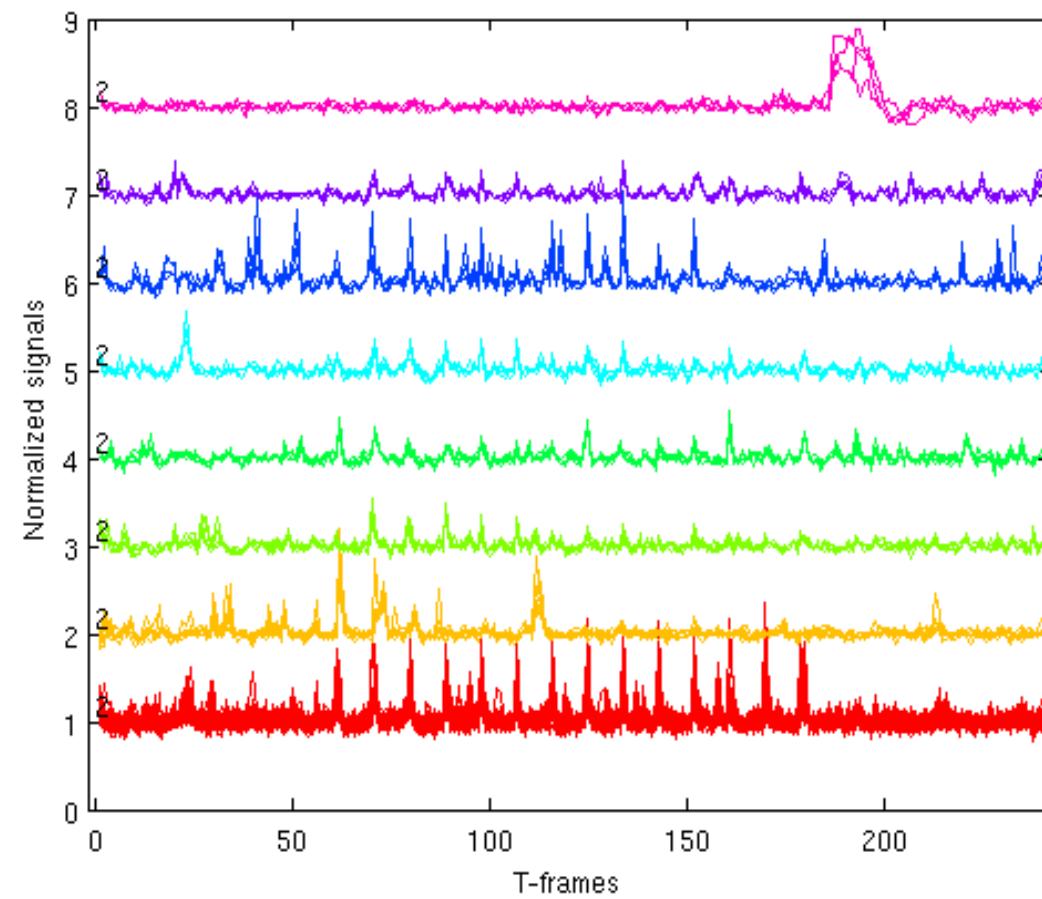
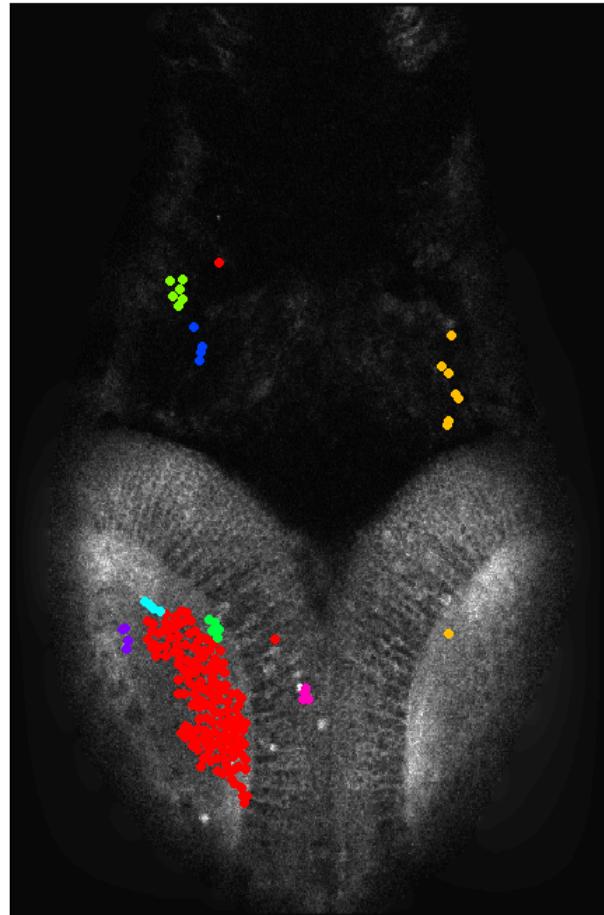
# Signal analysis – Correlation clustering



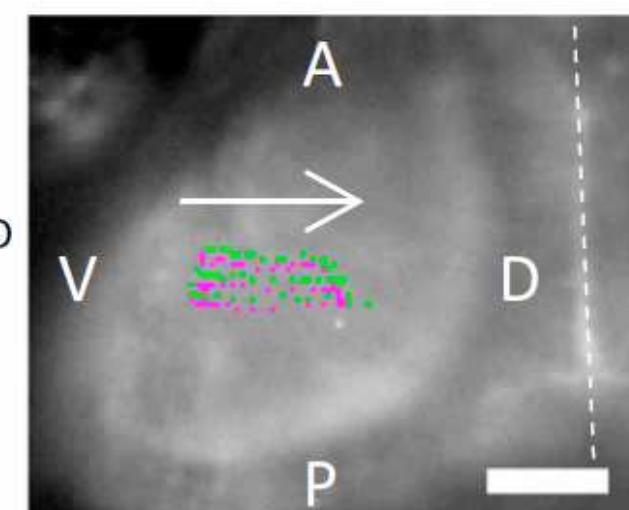
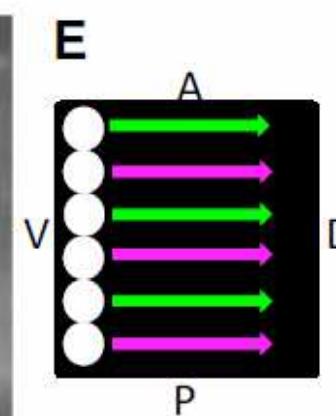
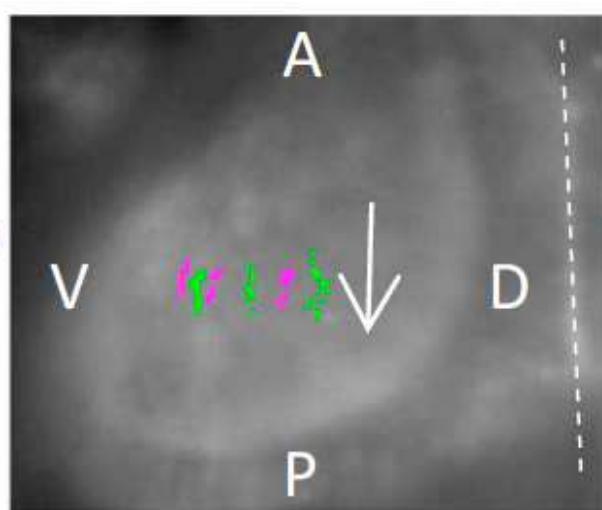
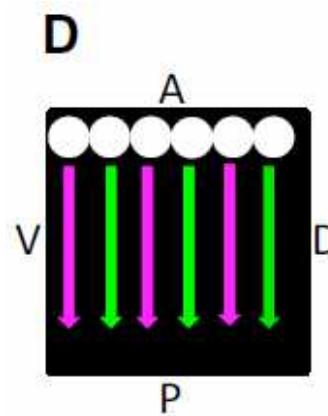
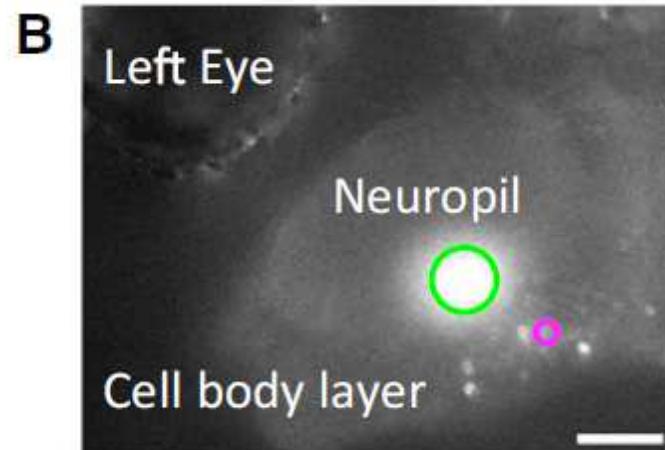
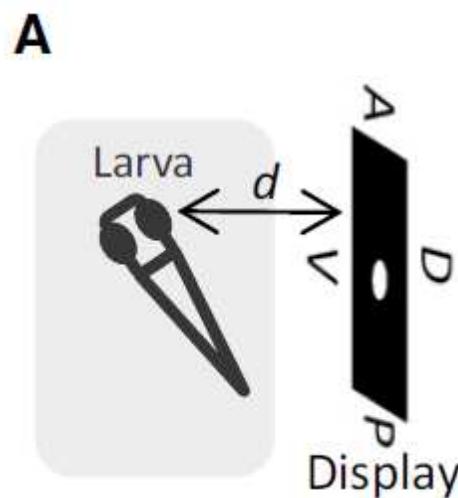
# Signal analysis – Correlation clustering



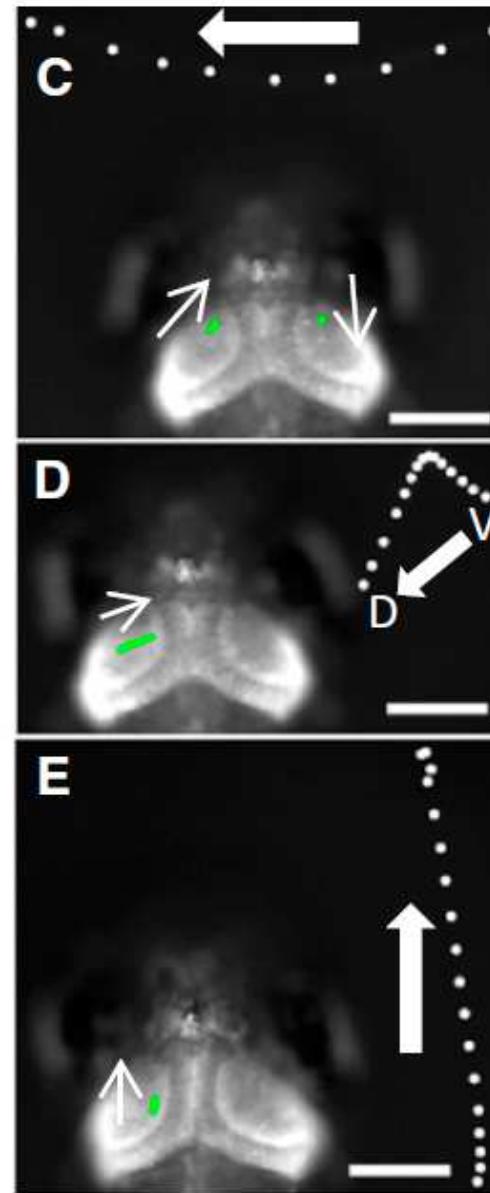
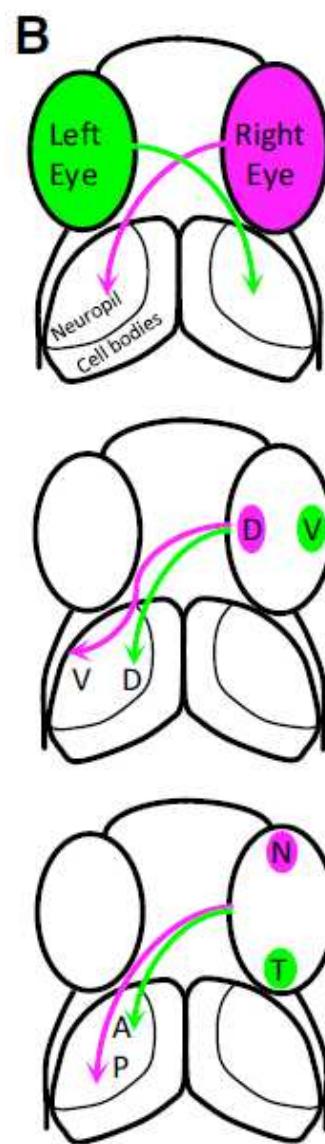
# Visual stimuli – Light pulses from left



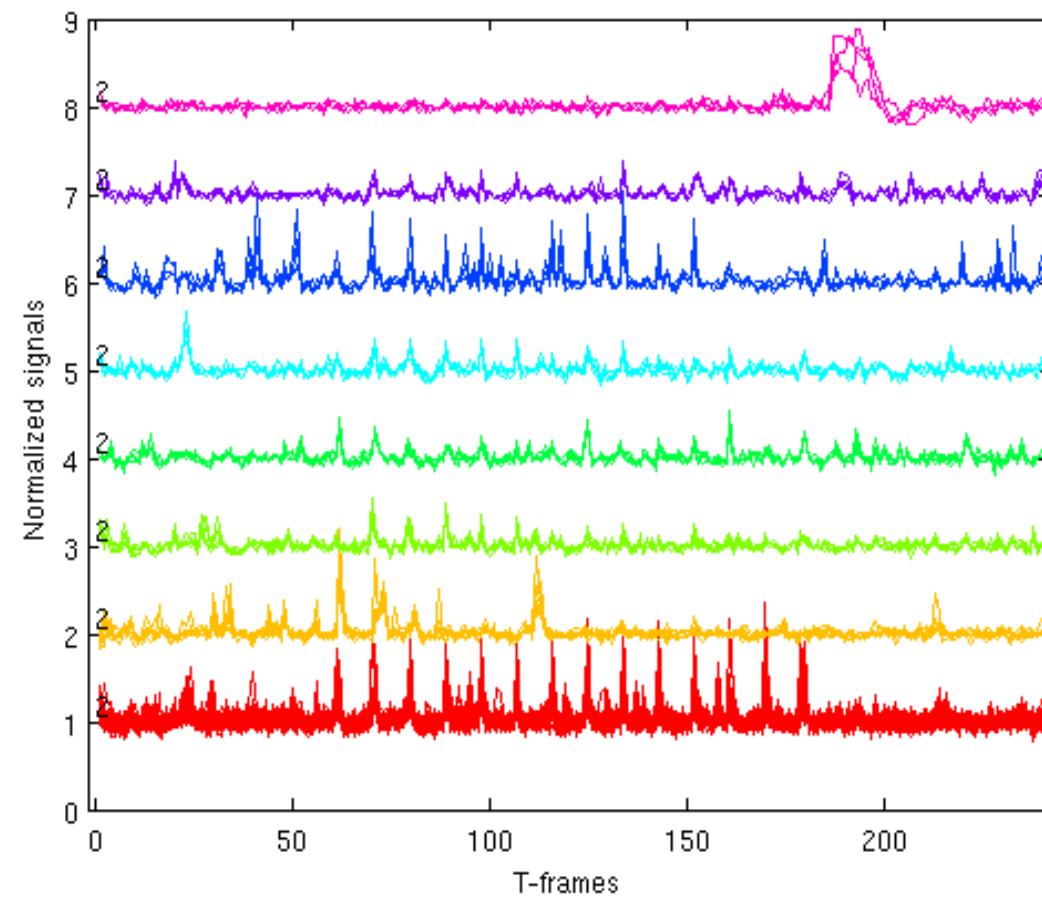
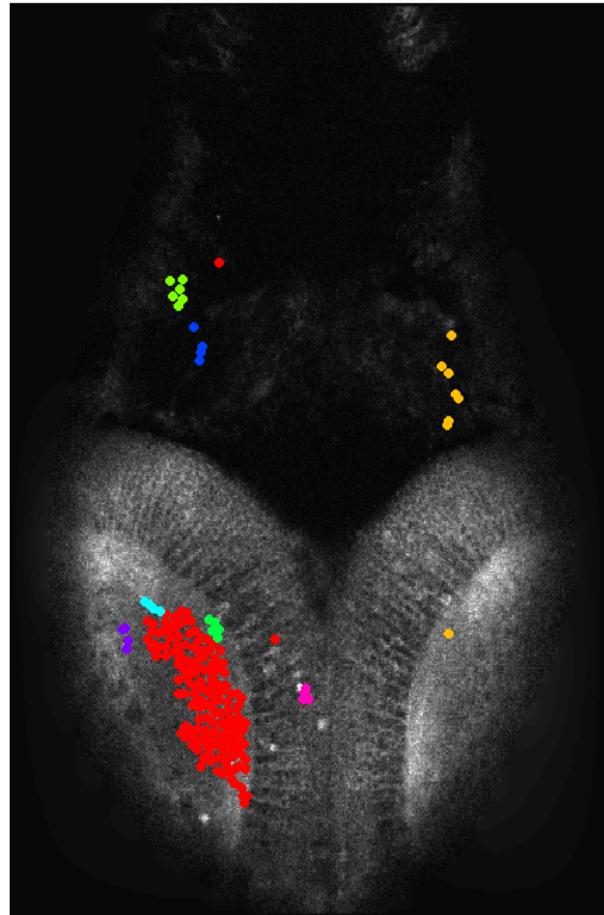
# Visual stimuli – Moving light spots



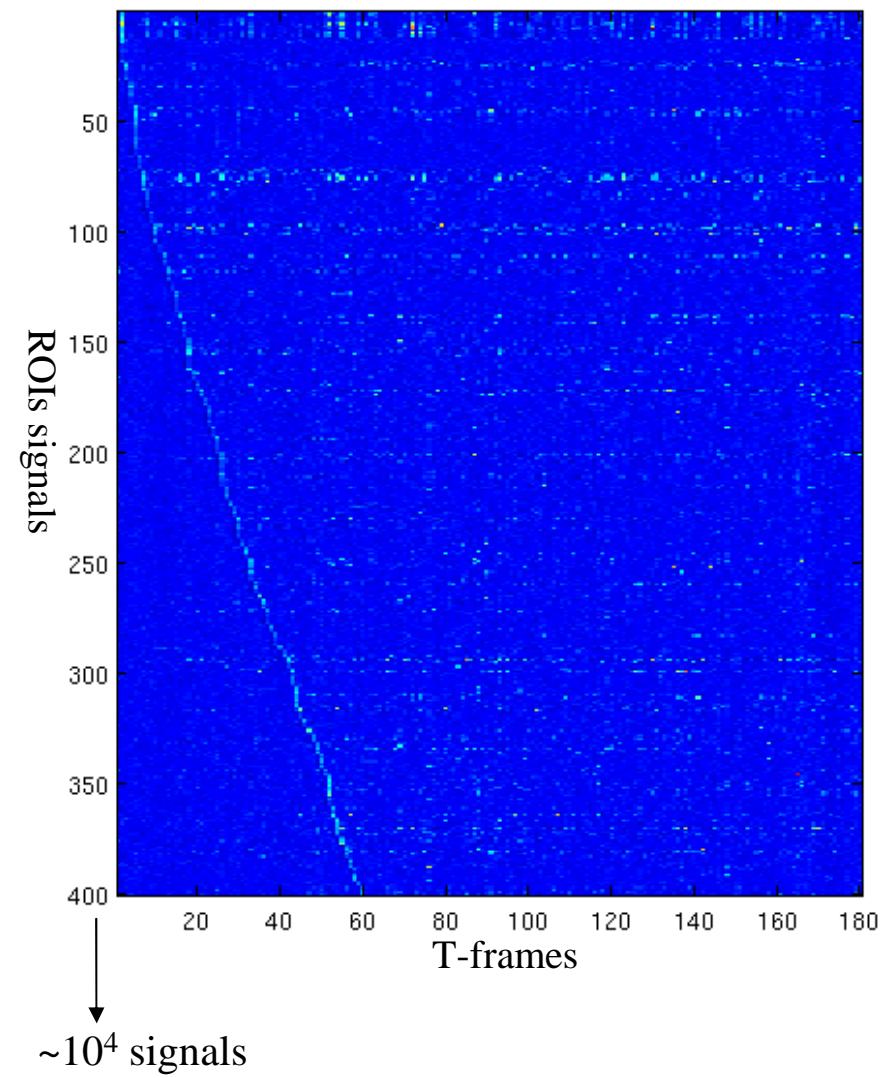
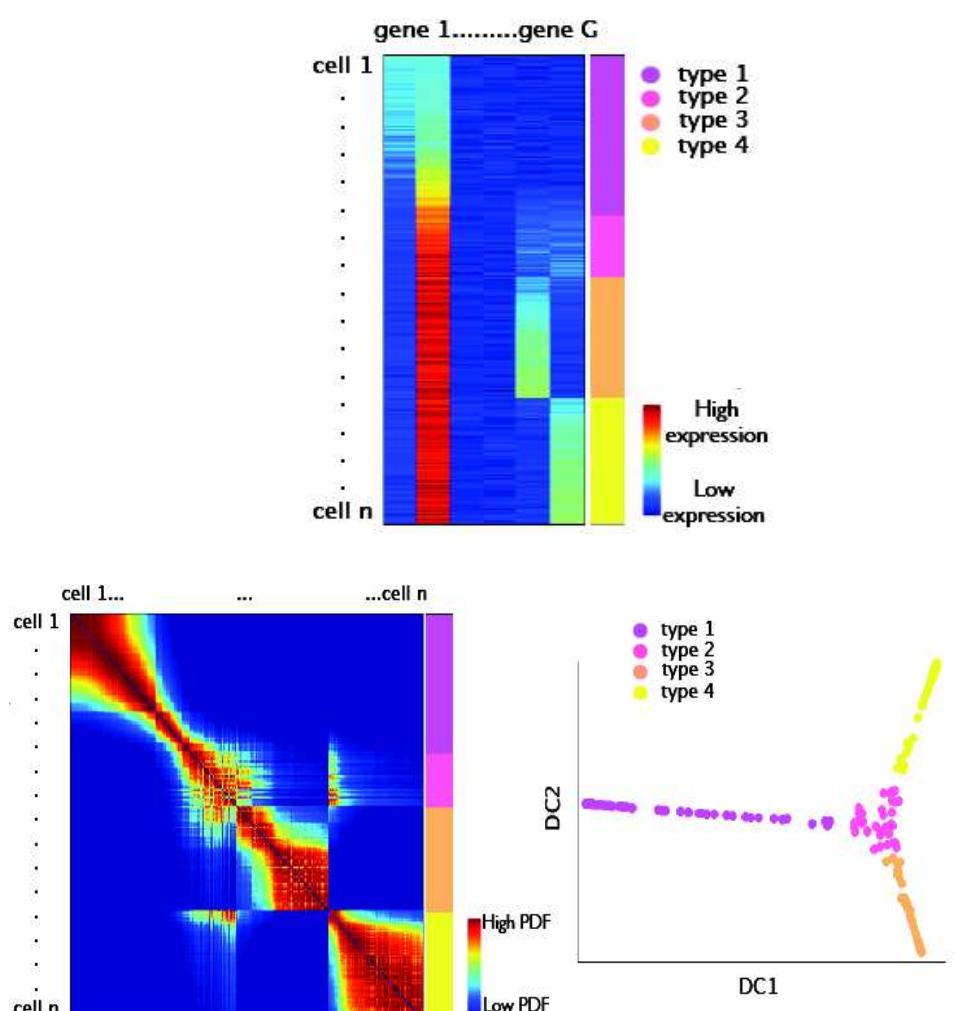
# Visual stimuli – Moving light spots



# Visual stimuli – Light pulses from left



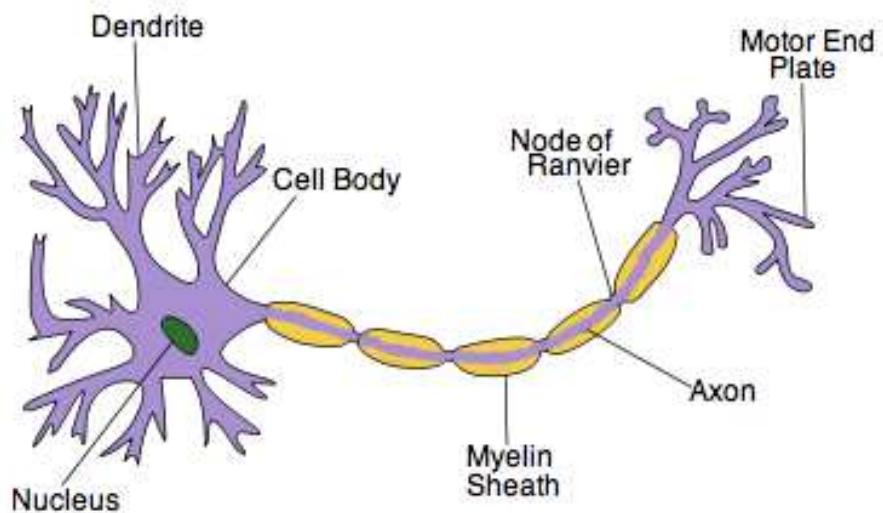
# Signal analysis – Diffusion algorithm



# Thank you for your time



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