

Ph.D. topic 2016

## 3-D structural analysis of neuronal cells in live animals

Supervisor

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### Presentation of the Ph.D. topic

Brain plasticity is critical for learning and memory, as well as recovery from neuronal damages, but the mechanisms are not well understood. By manipulating the neuronal activity and simultaneously labeling neurons, we can study the dynamic changes of the neuronal morphology and gain a deeper understanding of how the brain re-wire its connections and thus achieve plasticity. We have developed a method to track and study in live animals some specific neurons and image them at different time interval. We observed a change in the 3D morphology of some neurons. However, the large amount of image data and the dynamic change of the 3-D structure of neurons make most of the current study labor-intensive, subject to manual analysis errors, and low-throughput. We aim at developing new methodologies to study neuronal morphology in live animals.

### Expected deliverables

The candidate will first have to extract the 3D neuronal morphology from the volume data and reconstruct a 3D model of the neuronal arborescence. The models then must be compared between different time points acquisition and objective measurements about the morphometric changes should be computed. The algorithm should be robust enough to deal with noisy data acquired with two-photon microscope in a live animal. Other information from the images should be extracted such as the synaptic connections. Another methodological aspect will concern an automated method for image registration, that could make use of the model to register volume data acquired at a couple of days difference.

### Keywords

Image analysis, 3-D reconstruction, 3-D registration

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### Applicant profile

- Master Degree or Engineer Student, in computer sciences or neurobiology
- Skills in programming, preferably JAVA and Matlab.
- Notions in image processing. Interest in biomedical questions.
- Open to work with both French and Singaporean scientists
- Availability for starting oct 2016.

### Gratification

Compliant to SINGA A-STAR programme.

<http://www.a-star.edu.sg/Awards-Scholarship/Scholarships-Attachments/For-Graduate-PhD-Studies/Singapore-International-Graduate-Award.aspx>

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