CMP MASTER THESIS

**Topic:** Model based segmentation of drosophila egg chambers in 3D fluorescent microscope images

**Annotation:** Segmenting the internal structure of drosophila egg chambers in 3D fluorescent microscope images is an important subtask for the automatic analysis of gene expression patterns in the early egg development. The goal is to identify and segment the internal structures (endothelium, nurse cells, oocyte) of egg chambers, assuming that the egg chambers are weakly registered in a common frame. The task is particularly challenging because of the high variability of shape and pose during the egg development.

The thesis objectives are twofold: To develop a part based model for the egg chamber and to derive an efficient segmentation algorithm. Secondly, to develop and implement an algorithm for semi-supervised learning (estimation) of the model parameters.

**Goals:**
- Develop a hierarchical model for the egg parts and their mutual spatial positions. The model should combine a spatially distributed Markov Random Field based binary segmentation layer with a global model for the shape and positions of the egg chamber parts. Derive an efficient inference algorithm (segmentation) for the model.
- Develop and implement semi-supervised learning of the model parameters. The learning sample consists of 3D images along with partial segmentations and annotations.

Both tasks require an efficient and scalable implementation of the corresponding recognition and learning algorithms.

**Requirements/skills:** Open for students majoring in computer vision. Prerequisites: good skills in mathematics, probability theory, graph algorithms and pattern recognition. Willingness to co-operate with specialists from Max Planck Institute of Molecular Cell Biology and Genetics (Dresden) is expected.

**Supervisor:** Dr. Boris Flach
REFERENCES

