

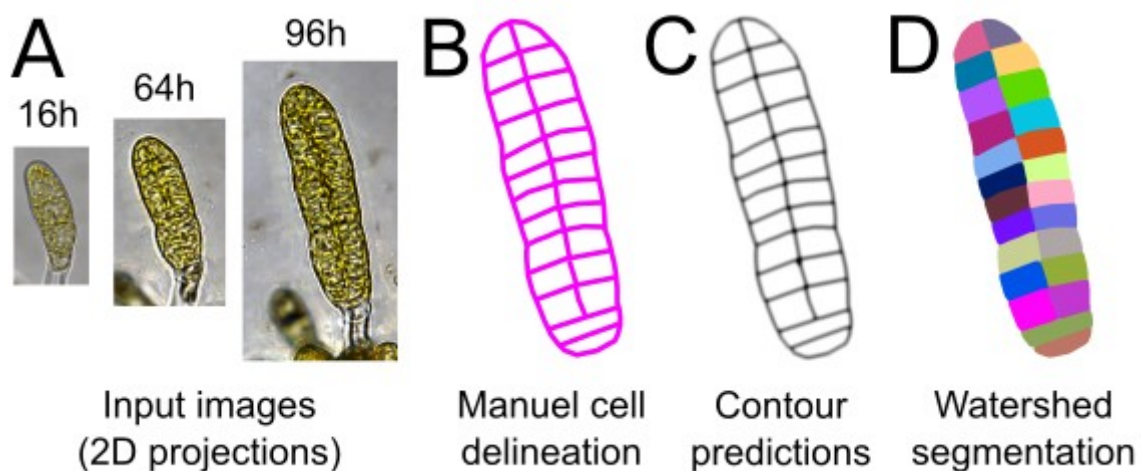
# Segmenting cells of algae embryos using deep learning

The objective of this project is to **setup and evaluate a deep learning-based approach for segmenting cells** in images of developing algae embryos.

## Objective

One of the most fundamental question in biology is to understand how organisms develop from a unique initial cell. As in terrestrial plants, the morphogenesis of algae results from the growth and divisions of their cells. To describe quantitatively these phenomena, the biologists analyse time-lapse images of developing algae embryos. Automatically segmenting cells is highly challenging in these images (Figure A). Until now, manual delineation of the cell contours has been used instead (Figure B), and a large collection of segmented images has thus been established.

The main objective of the project is to exploit this collection to train a deep neural network for the prediction of cell contours (Figure C) from input images. The predicted contours would then be used to label individual cells using a classical mathematical morphology approach (Figure D).



## Workplan

- bibliographical study of classical and deep learning-based approaches for segmenting cells in 2D and 3D images of biological tissues, focusing on plants and algae ;
- selection of images in the available collection (>200 images with manually delineated contours) and establishment of training, validation, and testing sets ;
- selection of the relevant data augmentation transformations (orientation, scale, illumination and contrast, etc.) given the characteristics of the input images and image acquisition conditions;
- training of a CNN model and evaluation of its performances.

## Supervision and contact

This project is proposed by the [Modeling and Digital Imaging](#) team at Institut Jean-Pierre Bourgin, INRAE Versailles. The team is specialized in the development of image analysis methods, software and computer models for studying plant development and morphogenesis.

This project is in collaboration with the team [Morphogenesis of Brown Algae](#) (Lyon), who is providing the primary image data.

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