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**Topic of a Master thesis**

*Optimizing the ATP synthase purification and its activity*

Experimental / theoretical

Magdeburg, 02.09.2022

**Motivation:**
The *E. coli* ATP synthase is one of the most important membrane proteins in the synthetic biology project MaxSynBio. It is used to synthesize ATP, the energy source of all living organisms, to supply energy-consuming parts and modules build in our lab [Otrin *et al.* 2017] [Marusic *et al.* 2020] or for our project partners [Schwander *et al.* 2016].
These parts can be either isolated from different living organisms or of synthetic nature. Combining these parts in a functional, well-characterized, and controllable way is the challenge of the MaxSynBio project, to bring us closer to an artificial cell [Schwille *et al.* 2018].

**Problem definition:**
The *E. coli* ATP synthase is a huge 547 kDa membrane protein complex that either hydrolyzes or synthesizes ATP. In our lab we use it in an inside-out direction, so it synthesizes ATP to the outside when it is reintegrated in an artificial membrane. Constant high activity still seems to be a problem that needs to be solved when we want to use it as a reliable energy supplier.
Major tasks in this context are:

**Task list:**
- Plasmid check regarding integrity of the genes
- Analysis of critical steps during cultivation and protein purification including literature search and comparison of methods
- Experimental verification (cultivation, protein purification, activity check)

**Start**: immediately

**Duration**: 5 months

**Prior knowledge:**
- Biological/Biotech background and lab experience
- Ability to work independently, motivation and interest for the topic

**Supervison**:
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**References:**
More information about the project:
**https://www.mpi-magdeburg.mpg.de/maxsynbio**

(1) L. Otrin *et al.* 2019. "Artificial Organelles for Energy Regeneration." *Adv. Biosyst.* **3**: 1800323.
(2) N. Marušič *et al.* 2020. "Constructing artificial respiratory chain in polymer compartments: Insights into the interplay between *bo3* oxidase and the membrane." *PNAS* **117** (26): 15006-15017.
(3) T. Schwander *et al.*, A synthetic pathway for the fixation of carbon dioxide in vitro. *Science* **354**, 900 (2016).

(4) P. Schwille *et al.*, MaxSynBio: Avenues Towards Creating Cells from the Bottom Up. *Angewandte Chemie (International ed. in English)* **57**, 13382 (2018).