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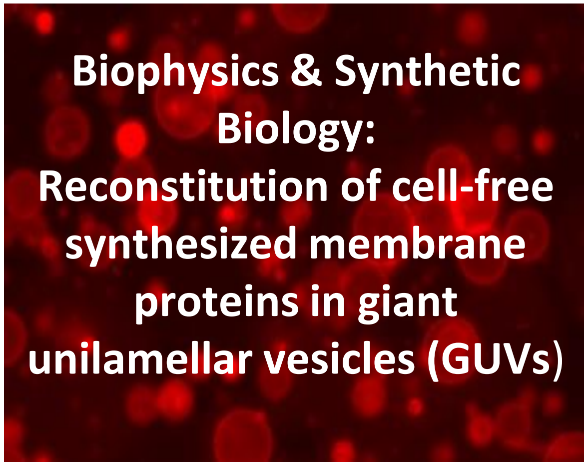
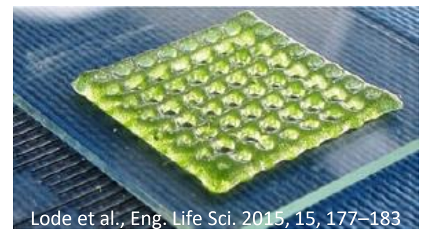
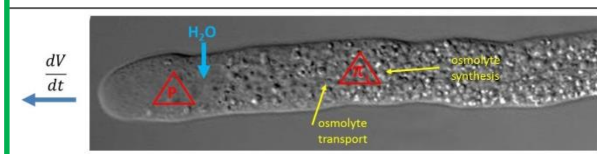


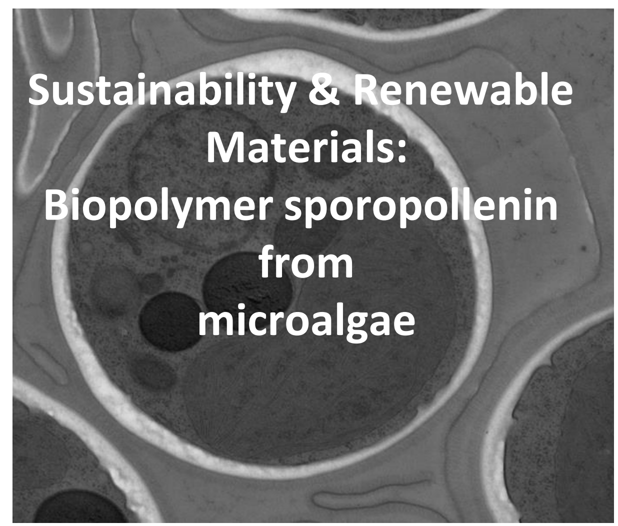

## Green Bioprinting: Growing sustainable materials for future


Lode et al., Eng. Life Sci. 2015, 15, 177–183

## Plant Systems Biology: Sensing drought stress and regulation of water transport




$$\frac{dV_{tube}}{dt} = J_V = -AL_P[\Delta P - \sigma(\pi_i - \pi_o)]$$



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## Biophysics & Synthetic Biology: Reconstitution of cell-free synthesized membrane proteins in giant unilamellar

Cell-free *in-vitro* translation allows the synthesis of native membrane proteins into proteo-liposome which can be incorporated into giant unilamellar vesicles (GUVs) to provide an excellent tool to characterize membrane proteins by means of patch-clamp analysis. Alternatively, transporters can be incorporated into bilayers separating nano-wells and transport activity is monitored via fluorescence intensities. Several membrane proteins including ion channels and pumps as well as ligand-operated receptors are the next candidates waiting for Master students.

contact: gerhard.obermeyer@plus.ac.at

- Generation of genetic bricks (promoter cassettes, ORFs, enhancer elements,…) for cell-free synthesis
- Production and characterisation of lipid vesicles (GUVs, LUVs) with specific membrane lipids and fluorescent indicators
- Cell-free synthesis of soluble and membrane proteins
- Glass surface coating with functional groups for optical ‘patch-clamp’

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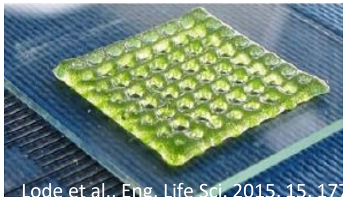
## Green Bioprinting: Growing sustainable materials for future




In cooperation with Dr. H. Pertl-Obermeyer, Dept. CPM, MorphoPhysics

We study the behaviour of plant cells or mamalian cells in synthetic matrixes or scaffolds, so-called hydrogels. Hereby, plant cells originating from different tissues are printed together with the fluid hydrogel in a specific shape using a modified 3D printer (BioPrinter). Depending on the plant cell type and the hydrogel formula various functional shapes are generated for future applications, e.g. humidity or light-dependent closing and opening vessels or drug delivery, wound dressings

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- Generation of Arabidopsis suspension cell cultures using transgenic Arabidopsis plants expressing genetic engineered biosensors, e.g. Ca2+, pH, metabolite
- Production of new hydrogel blends for printing plant cells
- Custom-made moification of 3D printers for specific bioprinting

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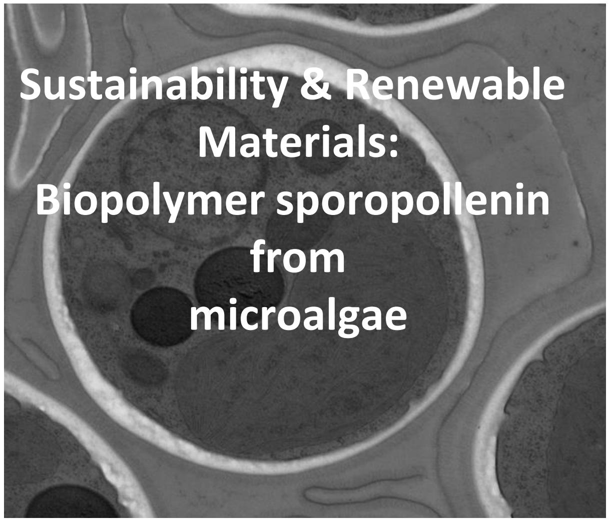


Sporopollenin is a ubiquitous biopolymer that constitutes the outer wall of higher plants' spores and pollen grains but also some algae produce sporopollenin as a cell wall component. Due to its extremely chemical and biological inertness, sporopollenin opens new technical applications for renewable biopolymers but on the other, possesses new challenges in production and fabrication processes. Although pollen amounts are limited and not suitable for mass production, clean and pure sporopollenin fractions from pollen various species can be purified as intact exine shells without any modifying steps and thus, serve as reference (standard) material for sporopollenin fractions from other plant sources. In addition to pollen grains, some microalgae species produce sporopollenin to fortify their cell walls. These organisms provide a suitable source for industrial production of sporopollenin, if reliable and robust culture conditions are established.

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- Establishment and optimisation of protocols for microalgae culture with different C/N ratios
- Isolation of RNA and identification of spropollenin synthesis-related genes

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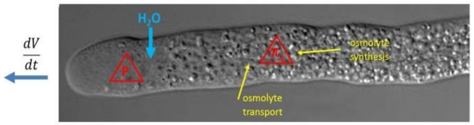
## Plant Systems Biology: Sensing drought stress and regulation of water transport




$$\frac{dV_{tube}}{dt} = J_V = -AL_P[\Delta P - \sigma(\pi_i - \pi_o)]$$

Plants need water for the generation of seeds and fruits that are the basis of human nutrition. On the other hand, water uptake has to be well balanced by not yet known osmosensing receptors and regulation pathways to prevent an increased turgor pressure. Due to their high water uptake and corresponding high cell wall synthesis rates pollen tubes provide an ideal model system to reveal these new signalling pathways.

contact: gerhard.obermeyer@plus.ac.at

- The wired plant: measuring signal transduction from root to flower in Arabidopsis plants with opto-electronic sensors attached to plants
- Synthetic soil: creating transparent soil of specific reproducible properties of water potential, particle size and nutrient content
- Biophysical measurement of water transport in pollen (turgor pressure, protoplast swelling)
- Biohysical characterisation of ion transport (patch-clamp)