

## **Synthetic enzyme assemblies at the surface of lipid droplets**

Christoph Benning, Dept of Biochemistry and Molecular Biology, East Lansing MI, 48824

Microalgae provide potentially versatile photosynthetic chassis to assemble novel pathways for the production of valuable drugs and fuels. Particularly intriguing is the possibility of targeting proteins to lipid droplets allowing the assembly of multiple enzymes that catalyze sequential reactions in biosynthetic pathways on their surface. In principle, using the lipid droplet surface as assembly platform, substrate channeling should be facilitated allowing efficient synthesis of products. Moreover, sequestration of lipophilic and cytotoxic compounds into chemically inert lipid droplets should be feasible. Enrichment of products in lipid droplets also allows them to be readily isolated following cell rupture and flotation of droplets by centrifugation. Targeting of enzymes to the lipid droplet surface is accomplished through fusing them to perilipins, which are proteins that spontaneously insert into the lipid droplets. We have isolated perilipins from different algae and used them to “paint” lipid droplets in vivo with fusions to green fluorescent protein showing proof of principle. Lipid droplet abundance can be manipulated in microalgae and should allow the generation of a large reservoir for the accumulation of lipophilic compounds. We are particularly interested in developing *Nannochloropsis* CCMP1779 as a chassis and are building the necessary toolbox.