Microbial Lipid-Metabolism Engineering

We design and build yeast strains that secrete or store tailored fatty acids and TAGs under process-relevant conditions, focusing on variants you can test and scale next.

BACKGROUND

Yeasts (e.g., *P. pastoris/K. phaffii, S. cerevisiae, Y. lipolytica*) combine GRAS status, high cell densities, and mature genome editing to produce lipids from inexpensive carbon sources. Tailoring chain length and unsaturation is commercially relevant (oleochemicals, cosmetics, nutraceuticals, palm/cocoa-butter alternatives), but wild-type profiles are limited – hence the need for targeted engineering.

TECHNOLOGY

We apply push–pull–block strategies to redirect flux and profile control to set chain length/unsaturation:

- **Push (precursors & redox):** Raise malonyl-CoA (e.g., ACC1 variants) and balance NADPH through PPP/malic enzyme routes; select host and pathway choices for higher theoretical yields.
- **Pull & secretion:** Activate thioesterases and disable fatty-acyl–CoA re-activation to drive FFA secretion (simplifies downstream). In P. pastoris, deleting FAA genes plus expressing leaderless *E. coli* 'TesA enabled FFA secretion; fed-batch and DWP screens quantified product profiles.
- **Block (sinks & degradation):** Down-prioritize β-oxidation and non-target lipid sinks when beneficial; adjust TAG/PL routing to match your separation strategy.
- **Profile control** (desaturation/elongation/FAS): Introduce or tune Δ9/Δ12/Δ15 desaturases, elongases, and FAS variants to shift C16/C18 ratios and saturation. In *P. pastoris*, overexpressing a C16-specific Δ9-desaturase increased palmitoleic acid fractions; additional edits modulated secretion and growth.

Our approach is low risk because it delivers concise, mechanistically reasoned shortlists with reproducible analytics, prioritizes secretion routes to ease downstream where feasible, and matches the host to product and regulatory needs. *P. pastoris* for secretion and high cell densities, *Y. lipolytica* for oleaginous storage, and *S. cerevisiae* as the chassis/tooling.

OFFER

All project IP can be fully transferred and used commercially by the financing company partner.
Share your target product profile (chain length/unsaturation), preferred host(s), and assay constraints, if preferred under protection of an NDA, and let's discuss a potential workplan for you!

EXPERTS

Prof. Dr. Harald Pichler

DEVELOPMENT STATUS:

Status of the project proposal – Technology Readiness Level 2-4 (technology concept formulated – technology validated in lab)

KEYWORDS

- Tailored Fatty Acids
- Chain-Length Control
- Degree of Unsaturation
- Secretion vs. Storage
- Host Selection
- GRAS Chassis
- Genome Editing
- Promoter Engineering
- Copy-Number Tuning
- Redox Engineering
- High-Throughput Screening
- Palm-Oil Alternatives
- Cocoa-Butter Equivalents
- Food Ingredients
- Bio-Based Lubricants
- Emulsifiers

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