

invitrogen



Empowering development of biofuels and energy crops

Comprehensive workflow solutions for
synthetic biology to meet a growing demand

ThermoFisher
SCIENTIFIC

Engineering clean, sustainable energy alternatives

Thermo Fisher Scientific offers a comprehensive portfolio of tools and services designed for metabolic engineering, enabling a more effective approach for optimizing organisms and bioproduction pathways, empowering the development of biofuels, energy crops, biobased chemicals, and CO₂ sequestration methods.

Genes and genetic tools for **improved energy crops**

- Tailored bioenergy crops
- Crop productivity and protection
- Stacked traits

Pathway engineering tools, techniques, and biodesign software for **optimized microbial conversions**

- More efficient pathways
- More robust and productive microbial hosts
- Increased tolerance for products and resistance to inhibitors

Optimized hosts for **drop-in end-products**

- Tailored end-products
- Enabled pathways for the production of drop-in fuels
- Biofuels (i.e., diesel and jet fuel)
- Biobased chemicals (i.e., alcohols, acids, and olefins)



Comprehensive, everyday workflow solutions

You'll find the best means to complete these everyday workflow steps, regardless of which generation of biofuels you're developing.

Analyze

Utilize sequencing platforms to characterize organisms and the effects of different production environments

Design

Apply rational *in silico* design software to optimize gene expression for predictable and productive outcomes

Construct

Rapidly and easily create improved strains using powerful and flexible molecular construction products and services

Produce

Implement your solution, from small-scale research to industrial production

Supporting biofuel research and production across all platforms



Seeds or grains of edible food crops such as corn, rapeseed, palm, and soybean



Specialized nonfood crops and plants such as *Jatropha* and switchgrass



Waste biomass including stalks and wood chips



Algae

Case study: optimizing the workflow to produce engineered algal strains

We see the potential in creating new energy sources with algae. Our active partnerships attest to this dedication, as does our expanding product portfolio, which includes Invitrogen™ GeneArt™ algae engineering and protein expression kits. Contact us today to explore the potential for the best solutions for your production environment.

GeneArt algae kits

GeneArt algae engineering and protein expression kits for *Chlamydomonas reinhardtii* and *Synechococcus elongatus* are the first commercially available genetic modification and expression systems for photosynthetic microalgae. These kits are designed for rapid scale-up and production, as well as consistent, defined quality.

- Algal cells arrive ready to resuscitate, grow, transform, or store at -80°C until ready to use
- Every cell lot is manufactured using a standardized manufacturing protocol, so every experiment begins with quality control
- Optimized media, vectors, cells, and protocols permit robust selection and expression

To find out more, go to [thermofisher.com/algaekit](https://www.thermofisher.com/algaekit)



Development strategy for GeneArt algae engineering kits

Characterization	Sequencing, annotation, and transcriptome analysis	Design and development	Process scalability improvements
			
<p>Goal: Determine suitability for scale-up under local growing conditions</p>	<p>Goal: Develop protocols for high-quality genomic/total DNA isolation; sequence the genomic DNA; develop genetic optimization tool kits specific for each algal strain</p>	<p>Goal: Metabolic engineering to generate prototypes for lipid production, screening, and testing</p>	<p>Goal: Propagate optimized algal strains in sun tubes or raceways to validate production capabilities</p>
<p>Benefit: Selecting wild algae strains that exhibit the best lipid production and scalability potential mitigates the risk of late-stage failure</p>	<p>Benefit: Sequencing data provides key insights in developing metabolic models and protocols for optimizing algal growth and/or lipid production</p>	<p>Benefit: Engineered algal strains optimized for lipid production and/or rapid growth demonstrate readiness for production and scale-up</p>	<p>Benefit: Selecting wild algae strains that exhibit the best lipid production, robustness in real environments, and scalability potential mitigates the risk of late-stage failure</p>

GeneArt *Chlamydomonas* Engineering Kits. All kits come with algal cells and either a pChlamy_1/D-TOPO™ or pChlamy_1 expression vector.

We also offer kits that include Invitrogen™ One Shot™ TOP10 Chemically Competent *E. coli* and Gibco™ TAP Growth Media. Go to thermofisher.com/algaekit for more details.





Biofuels: an emerging global solution

The undeniable fact that the world has only a finite supply of fossil fuels underscores the rapidly evolving role that biofuels must play in meeting the energy needs of 7.3 billion people.

The answers are growing

With a limited fossil fuel supply and a growing global demand, synthetic biology provides emerging, alternative energy solutions. We're partnering with the industry's most forward-thinking organizations and using the most innovative, rigorous, and robust tools on the market to provide comprehensive solutions to the biofuel industry as it develops, optimizes, and produces new, renewable energy sources on a mass scale.



Find out more at thermofisher.com/syntheticbiology

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