

# Biofuels Potential for Hawaii

## Algae for Biofuels in Hawaii

University of Hawaii Sakamaki Lecture  
August 5, 2009

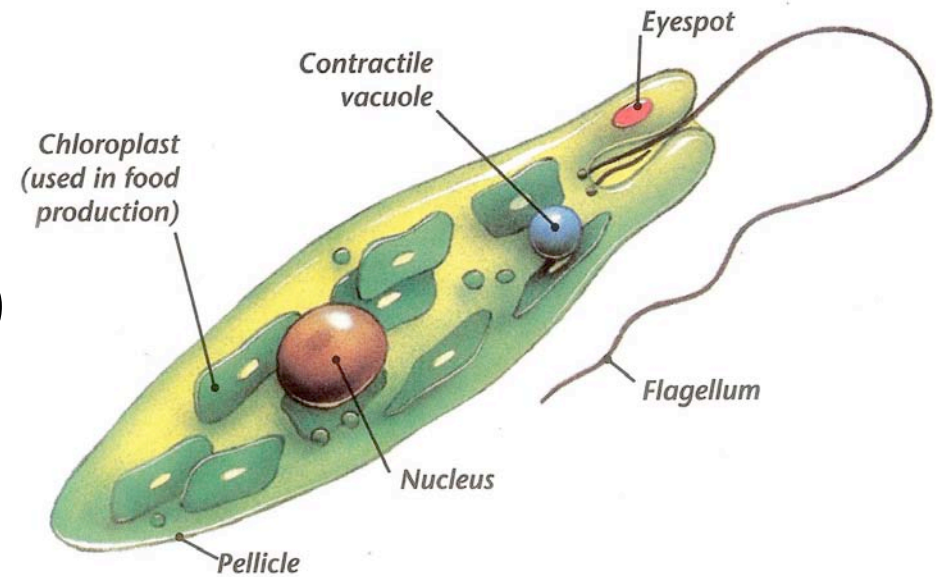
Frank Chan  
Kuehnle AgroSystems Inc.

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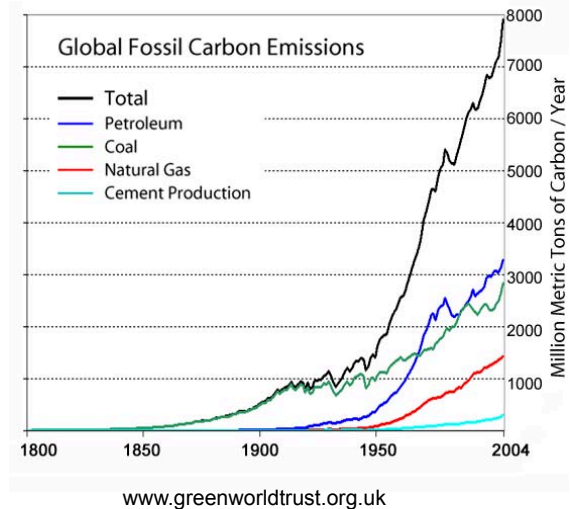
# What is algae?

- Protist Kingdom
- Eukaryotes
- Unicellular (microalgae) and multi-cellular (kelp)
- Autotrophs, heterotrophs, mixotrophs
- Source of oil, protein and carbohydrates



# Why algae for biofuels?

- CO<sub>2</sub> sequestration
- Oil yield per hectare (2.47 acres):
  - Soy: 400 gallons/ha-yr
  - Corn: 1000 gallons/ha-yr (ethanol)
  - Palm: 1500 gallons/ha-yr
  - Sugar cane: 2000 gallons/ha-yr (ethanol)
  - Microalgae: >10,000 gallons/ha-yr
- Co-products
- Non-arable land
- Fresh, Brackish, Salt or Wastewater



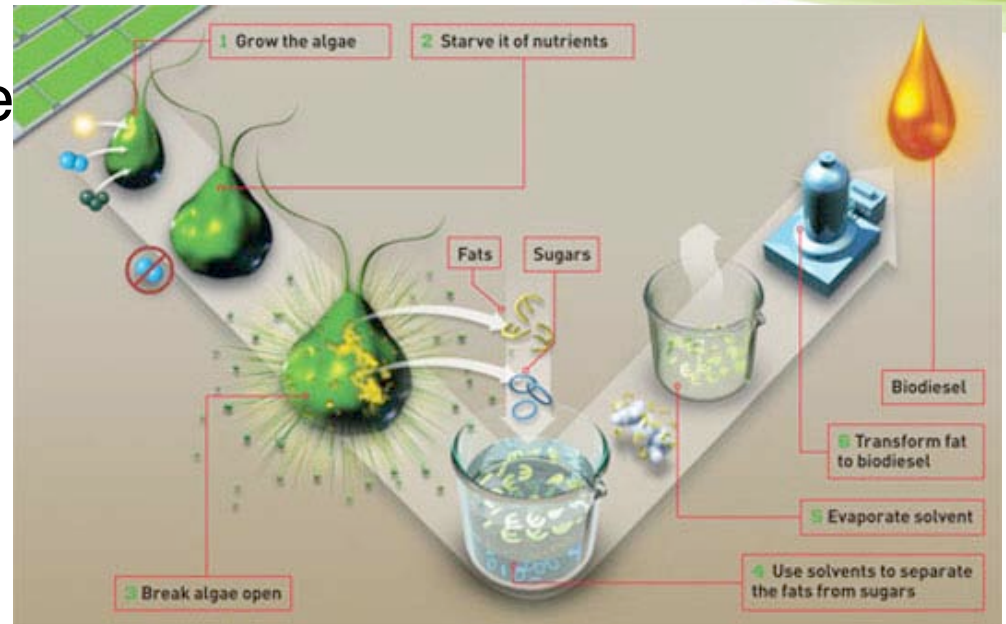
<https://www.eere-pmc.energy.gov>

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# What are the key challenges?

- Low Cost, Large Scale Algae Production

- Open Ponds vs. Bio-Reactors
- Contamination leading to system failures
- Dewatering a large volume
- Extraction methods
- Permitting, land availability



Credit: [www.neduet.edu.pk](http://www.neduet.edu.pk)



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# Industry Advancements

- **Commitment from Government and Large Companies**
  - DARPA – approx \$35M awarded for 2 projects
  - USDOE – allocating \$85M for development of algae biofuels
  - Venture Capital – more than \$150M
  - Shell - est. multi-million
  - Algenol/Sonora Fields - \$850M
  - ExxonMobil - \$300M into Synthetic Genomics
- **Game Changing New Technologies transforming the value chain**
  - Grow out systems
  - Harvesting strategies
  - Dewatering
  - Oil extraction
  - Oil refining



[www.ecofriend.org/](http://www.ecofriend.org/)

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# Kuehnle AgroSystems Inc.

## Mission Statement:

To be the world's leading provider of certified, high performance algae seed stock.



## KAS Elite Algae™ Seed Stock

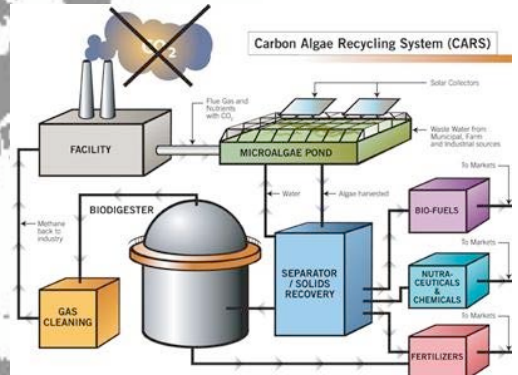
- Fast growing, adapted to production conditions
- Targeted expression/growth of high value compounds (oil, protein, chemicals, CO<sub>2</sub> capture)
- Resilient to contaminants

## Providing expertise and lab services

- Strain selection and testing of algae and conditions to optimize productivity
- Develop products & downstream processes to make value chains more competitive

# Vision of the Future

## Global Production of Algae for Biofuels using Kuehnle AgroSystems Elite Algae™ Seedstock



Credit: Alberta Research Council



Credit: U.S. Department of Energy



Credit: Cequesta Algae

