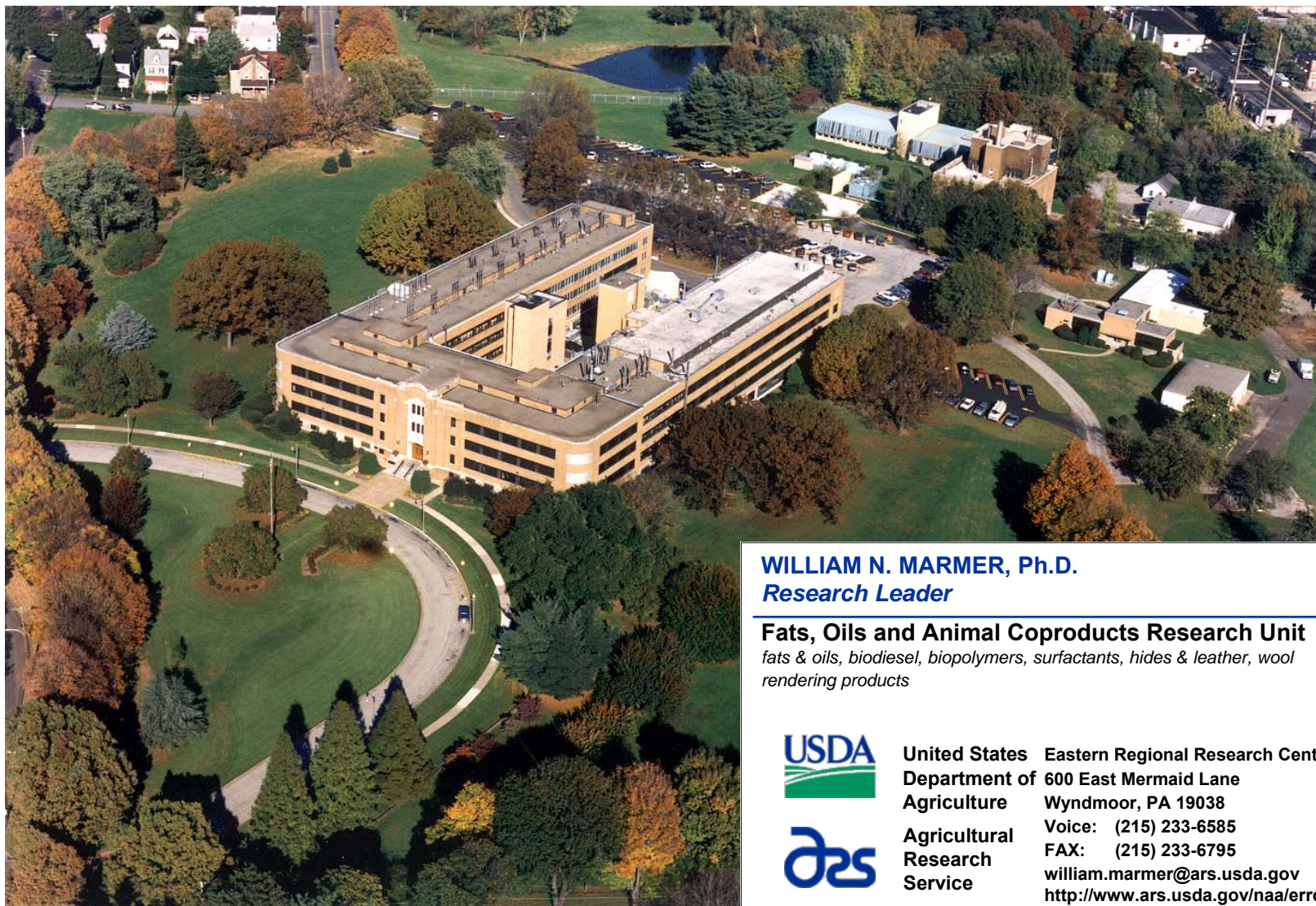


Fats, Oils and Animal Coproducts Research Unit

Fats & oils, biodiesel, biopolymers, surfactants, hides & leather, wool, rendered protein



WILLIAM N. MARMER, Ph.D.
Research Leader

Fats, Oils and Animal Coproducts Research Unit
fats & oils, biodiesel, biopolymers, surfactants, hides & leather, wool rendering products



United States Eastern Regional Research Center
Department of Agriculture 600 East Mermaid Lane
Wyndmoor, PA 19038



Agricultural Research Service
Voice: (215) 233-6585
FAX: (215) 233-6795
william.marmar@ars.usda.gov
<http://www.ars.usda.gov/naa/errc>

NP307 (213) BIOENERGY PLANNING AND COORDINATION MEETING
Beltsville, November 29th – December 1st, 2006

ERRC SY's Who Work on Biodiesel

CWU 1935-41000-066

(bioenergy in part; CWU coded NP306)



Tom Foglia



Mike Haas



Bill Marmer



Victor Wyatt

CWU 1935-41000-067

(coded NP306)



Dan Solaiman



Rick Ashby



EASTERN REGIONAL RESEARCH CENTER

WYNDMOOR, PENNSYLVANIA

John P. Cherry, Center Director





Research Project 1935-41000-066

(Tom Foglia, LS)

PRODUCTION OF VALUE-ADDED LIPIDS, BIOFUELS,
AND BIOBASED PRODUCTS FROM FATS AND OILS

Termination date: June 19, 2009

Objective 4 (of 5), Biofuels and additives:

- Develop alternative processes for producing biodiesel from intact oils and fats and/or less expensive lipid feedstocks.
- Develop methodologies for improving the quality and performance of biodiesel fuels.

Objective 5 (of 5), Glycerol utilization:

- Convert glycerol to prepolymers for prospective use in the synthesis of polyesters and polyamides or for use as polydispersants.
 - Hyperbranched and dendrimeric polymers
 - Reactive intermediates for production of adhesives, elastomers and foams
 - Linear condensation prepolymers (2-5 polyester/amide monomers)

glycerol



Research Project 1935-41000-067

(Dan Solaiman, LS)

INTEGRATIVE PROCESSES FOR THE BIOCONVERSION OF FATS, OILS
AND THEIR DERIVATIVES INTO BIOBASED MATERIALS AND PRODUCTS

Termination date: July 1, 2009

Objective 1 (of 2): Develop fermentation-based bioconversion systems
...that utilize...fats, oils and coproducts as feedstocks to produce value-added
biobased products and materials with enhanced properties and minimal
environmental footprints

Sub-objective 1.1: Broaden the application expanse of the feedstocks

- Explore their suitability for use in the fermentative or cell-based production of value-added bioproducts such as water-soluble biopolymers, biosurfactants, chemical intermediates, biolubricants, thickening agents, and bioemulsifiers

Sub-objective 1.2: Implement strain improvement...

Sub-objective 1.3: Explore the use of inexpensive feedstocks and of alternative fermentation techniques such as fed-batch culture

- produce new bio-based materials
- maximize the yields of existing technologies

glycerol



Biodiesel Research

Research capabilities/instrumentation/facilities



test engine at ERRC



Benchtop fermentors



GC-MS and HPLC-MS



ERRC Pilot Plant: "SUPER" Group support

Biodiesel Research

Production from Alternative Feedstocks



veg. oil, animal fat, restaurant grease



Soapstock



trap grease

Direct (in situ) production from



Soybean Flakes

soy flakes



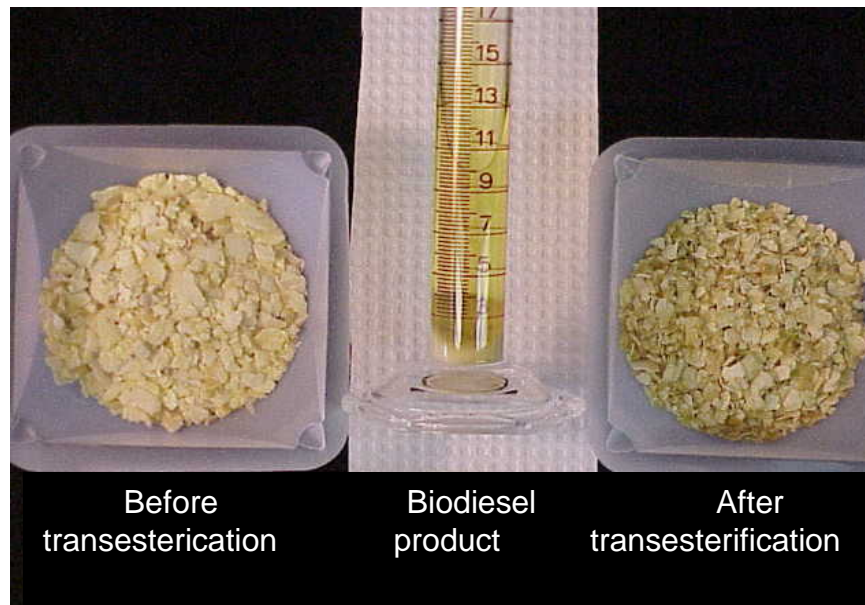
Distillers Dried Grains with Solubles

DDGS



Meat & Bone Meal

meat & bone meal



Before transesterification

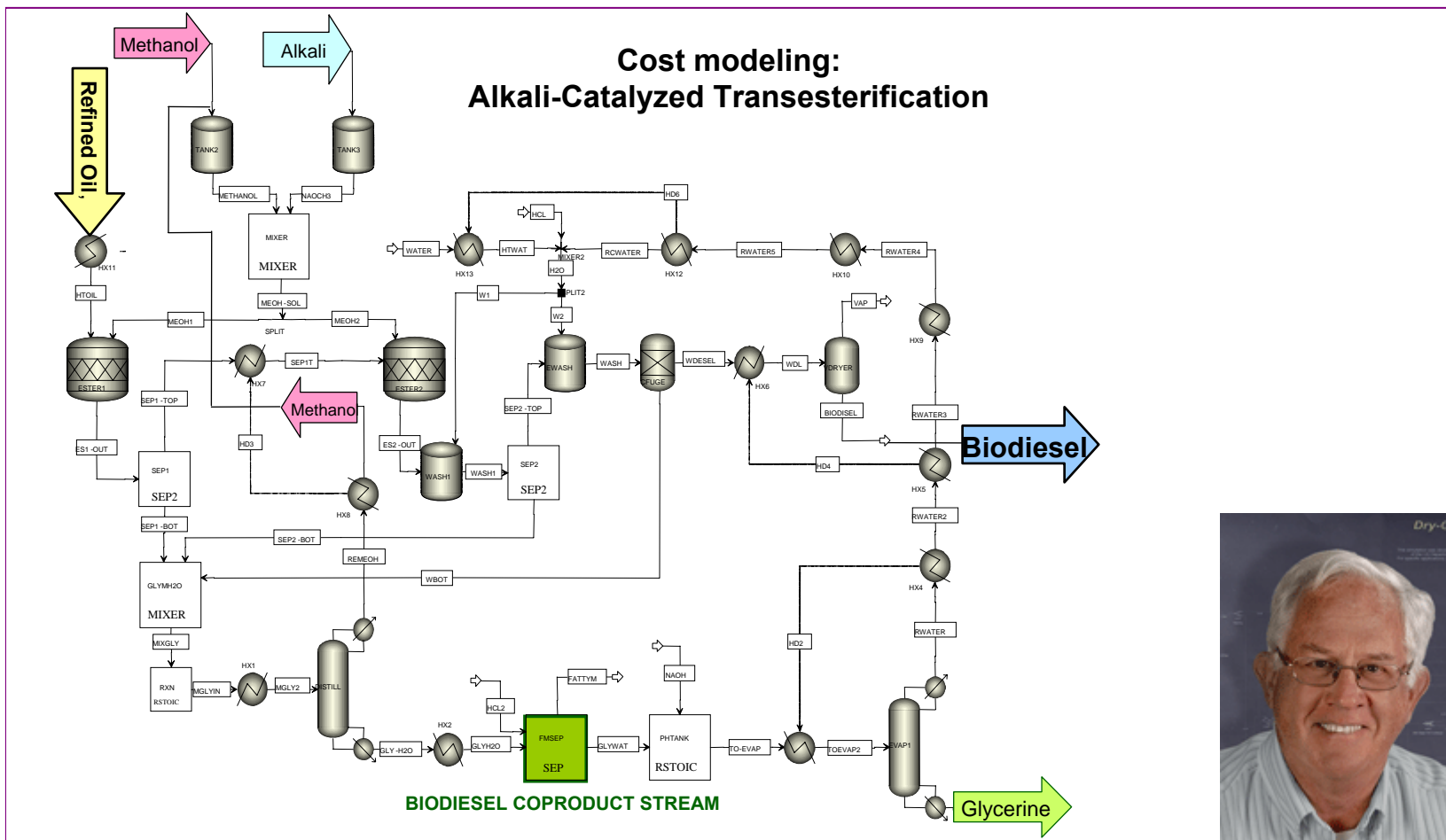
Biodiesel product

After transesterification



Biodiesel Research

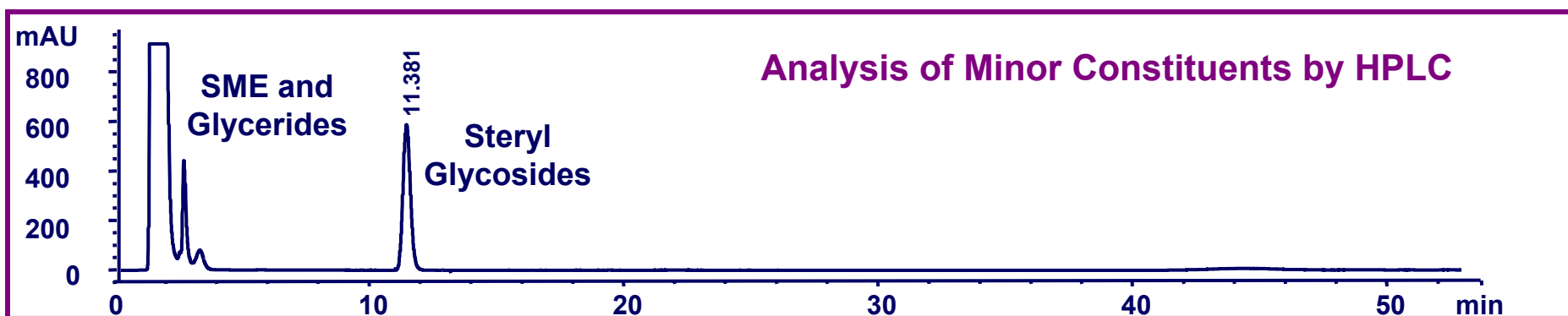
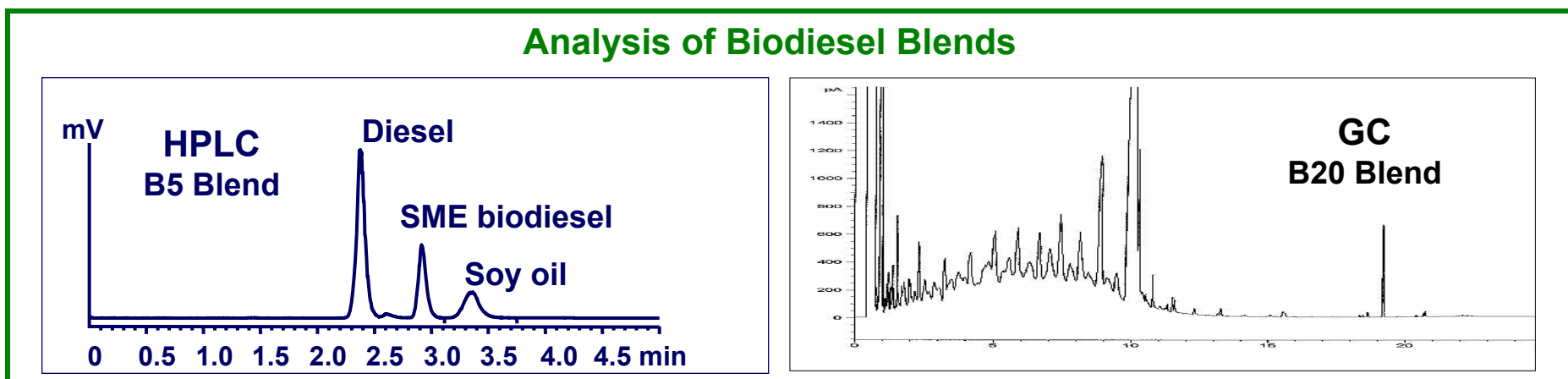
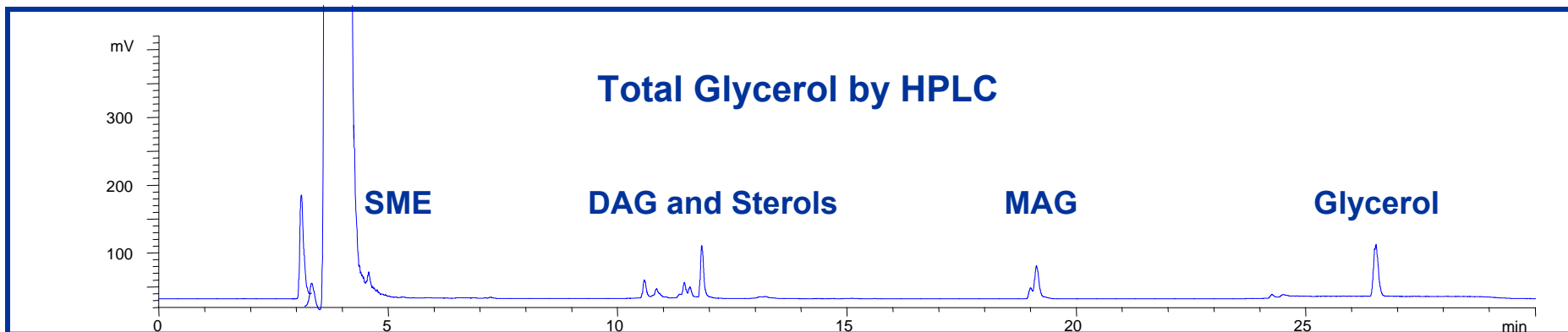
Production: Process simulation and cost engineering ASPEN+ and SuperPro Designer Software



Andy McAloon

Model for refined soy oil

Biodiesel Research: Assessment of Fuel Quality



Uses for Glycerol Coproduct Stream

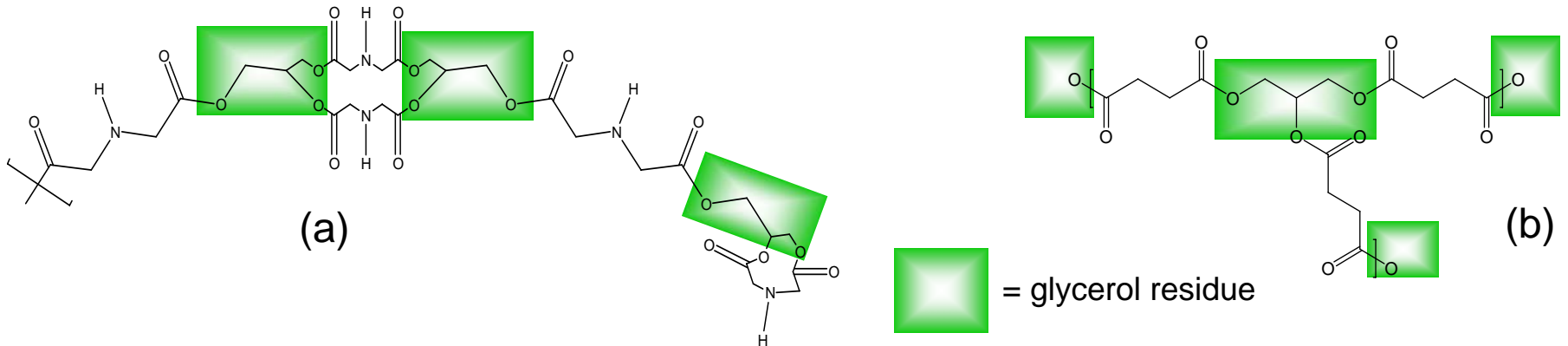
Hyperbranched Polymers from Glycerol

(Victor Wyatt, Tom Foglia)

(1) Synthesis and characterization of oligomers:

(a) with iminodiacetic acid

(b) with dicarboxylic acids
(succinic or azelaic)



(2) Conversion to hyperbranched polymers:

Anticipated: some will be water-soluble

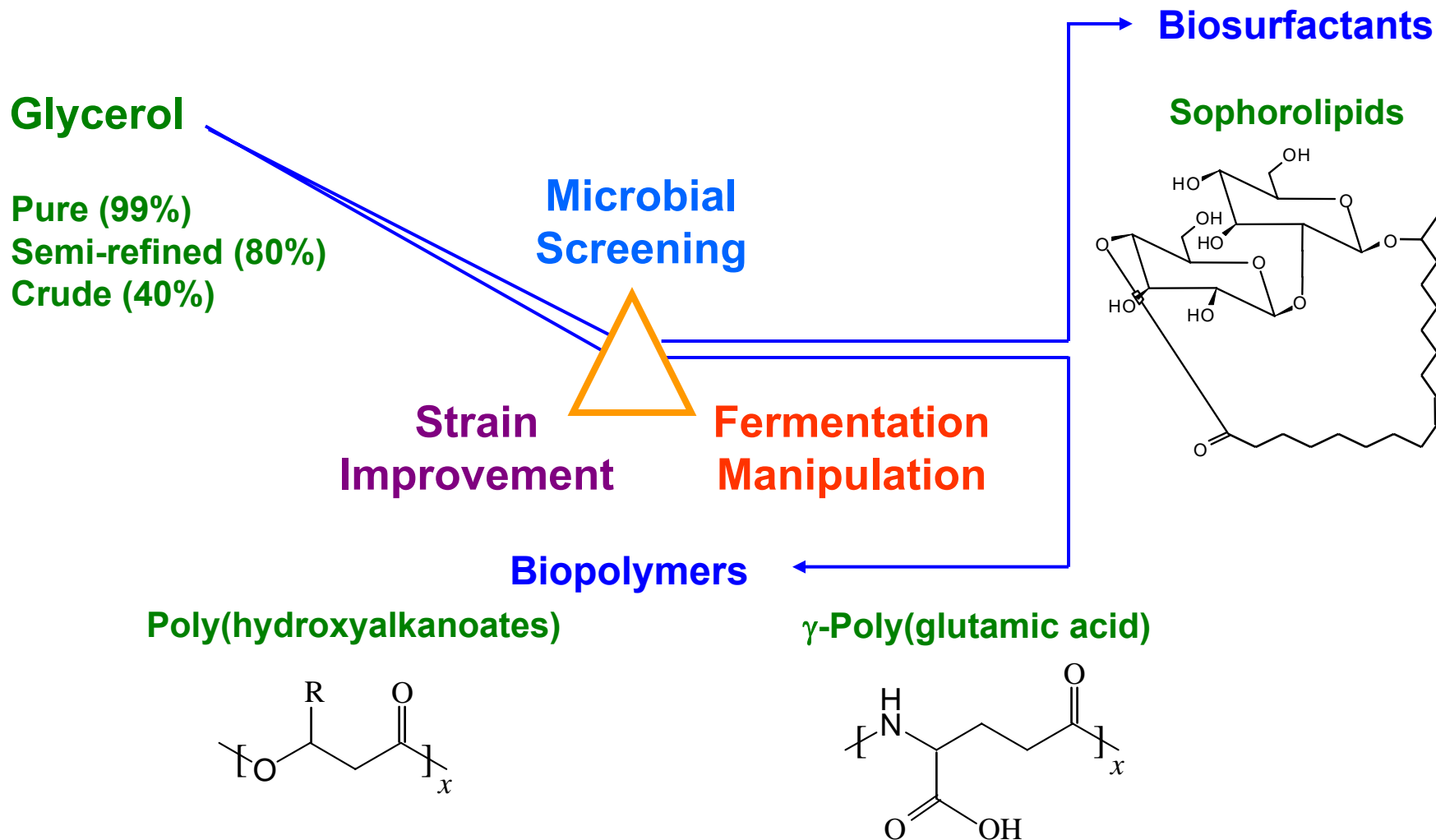
Most will be soluble in polar organic solvents

Potential uses: adhesives, films, elastomers, surgical applications

Uses for Glycerol Coproduct Stream

Glycerol as a Fermentation Feedstock

(Rick Ashby, Dan Solaiman)





Activities planned for next couple of years

- **Feedstocks:**
 - *In situ* conversions: continuous processes, assessment of defatted meal as feed
 - Grease applications: improve conversion processes
 - Enzymatic and solid acid catalysis
- **Analytical:** Adoption of new methods for trace constituents
 - Partial glycerides, steryl glycosides, residual sulfur
 - Rapid determination of blend levels
 - Applications of methods to identify and eliminate the problems
- **Glycerol:**
 - Production, characterization and application of hyperbranched polymers
 - Synthesis of new reactive monomers
 - Fermentation products: effect of feedstock on yields and properties
 - Biosurfactants and biopolymers
- **Intact fats and oils:** use as heating fuel →






EASTERN REGIONAL RESEARCH CENTER, WYNDMOOR, PENNSYLVANIA

Fats, Oils and Animal Coproducts Research Unit

William N. Marmer, Research Leader wmarmer@arserrc.gov

Biodiesel and Related Biofuels: American Collaborations (other than Pennsylvania)



Moscow, ID



Hagerman, ID



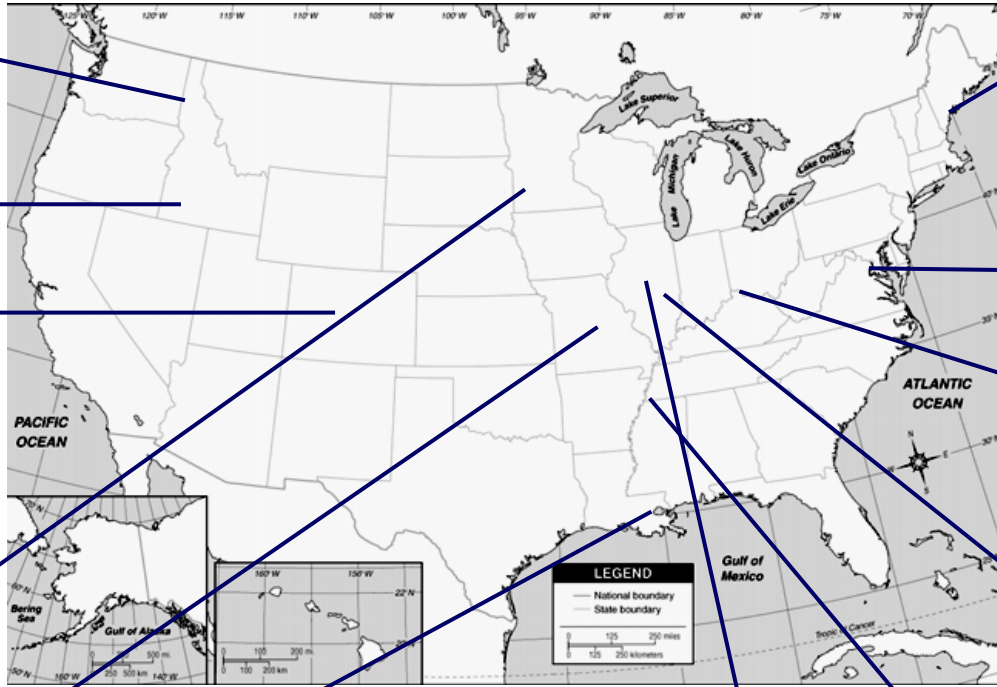

Golden, CO



Minnesota



National Biodiesel Board
Jefferson City, MO

SRRC, New Orleans



NCAUR, Peoria, IL




Laughing Stock Farm
Freeport, ME
Ralph Turner



Fats & Proteins Res. Found.
Alexandria, VA



Procter & Gamble
Cincinnati



ADM, Decatur, IL

Runyon Industries
Memphis, TN

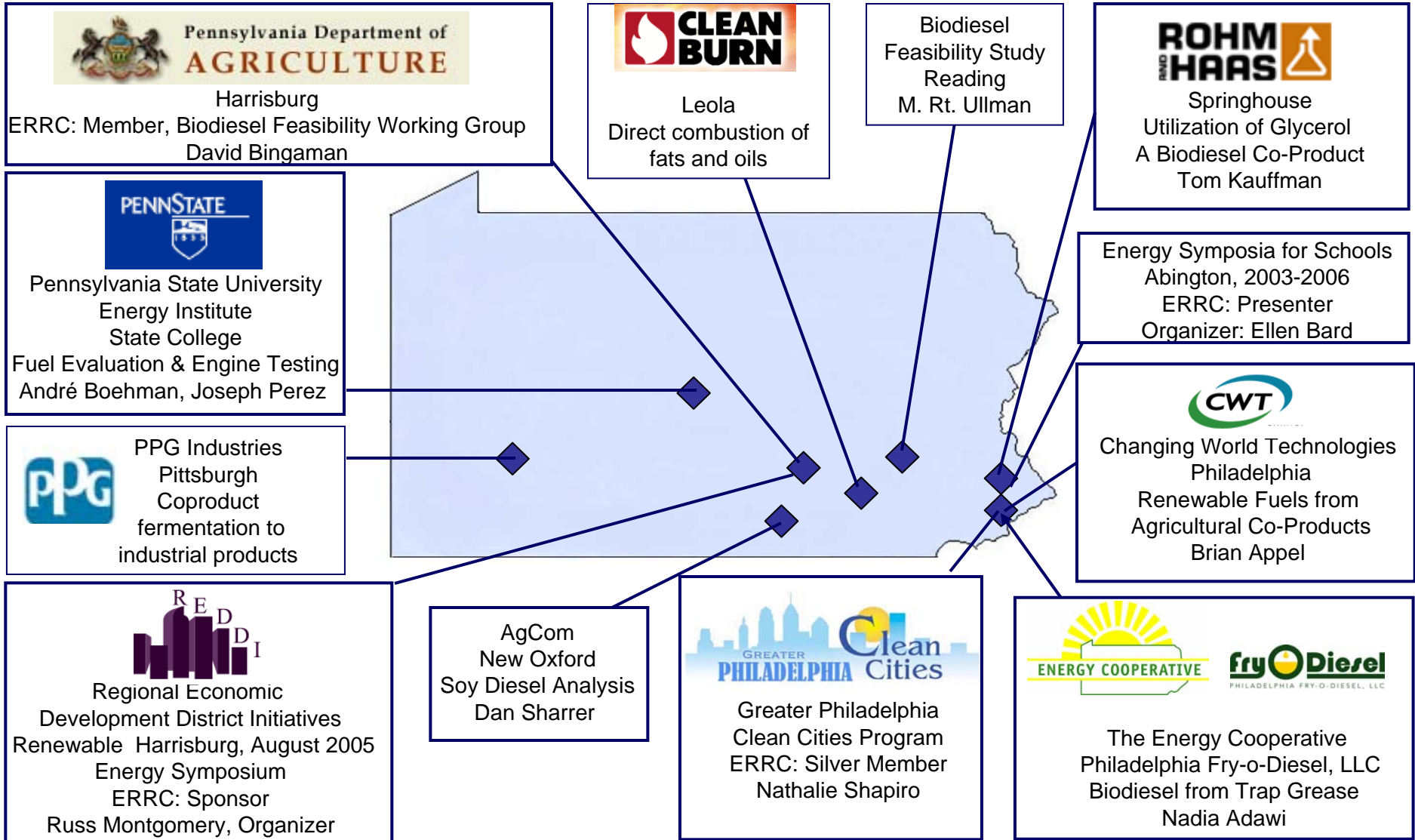


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Biodiesel and Related Biofuels: Pennsylvania Collaborations





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Fats, Oils and Animal Coproducts Research Unit

William N. Marmer, Research Leader wmarmer@arserrc.gov

Biodiesel and Related Biofuels: Worldwide Collaborations



ГосНИИОХТ

ARS-FSU Coop. Res. Prgm.
GosNIIOKhT
Moscow, Russia



Int'l Congress on Biodiesel
Vienna, Nov. 2007
Mike Haas, General Chair



Marcel Lie
Hong Kong University



Prof. Paulo A. Z. Suarez,
Univ of Brasilia
Prof. Ramos,
Univ. Federal do Paraná,
Curitiba, Brazil



CIRAD
Montpellier, France
Pierre Villeneuve



Nigerian Institute for Oil Palm
Research, Benin, Nigeria
Roland Abigor



Karl-Franzens University,
Graz, Austria
Martin Mittelbach