



An Overview of Chemical Engineering at UC Berkeley

C. J. Radke
Vice Chair

Department of Chemical Engineering

Community College Day
October 29, 2009

“BEAR” FACTS

- **19 Faculty (highly recognized); 7 in NAE; 2 in NAS, 1 National Medal of Science, 2 in AAAS (1 joint with chemistry, 1 with biophysics, 1 with neuroscience, 2 with bioengineering, 1 with vision science)**
- **2 DTA winners, 3 Noyce award winners**
- **Ranked # 2 in USA (NRC) with Caltech and Minnesota, Currently ranked #2 in US News & World Report**
- **One of three chemical engineering depts. in the USA that is NOT in the College of Engineering.**
- **350- 400 undergraduate students**

What Do Chemical Engineers Do ?

Answer: Whatever they want !

This is a variant on chemical engineering is whatever chemical engineers do.

More technically:

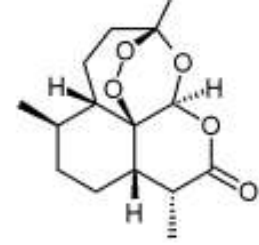
- A professional who can **design** and **operate** a wide range of chemical processes involved in the **production** of **fuels, chemicals, polymers, pharmaceutical, and many other chemically-based products**
- Basically, we engineer chemical transformations

The H₂ Economy: H₂ + 1/2O₂ → H₂O

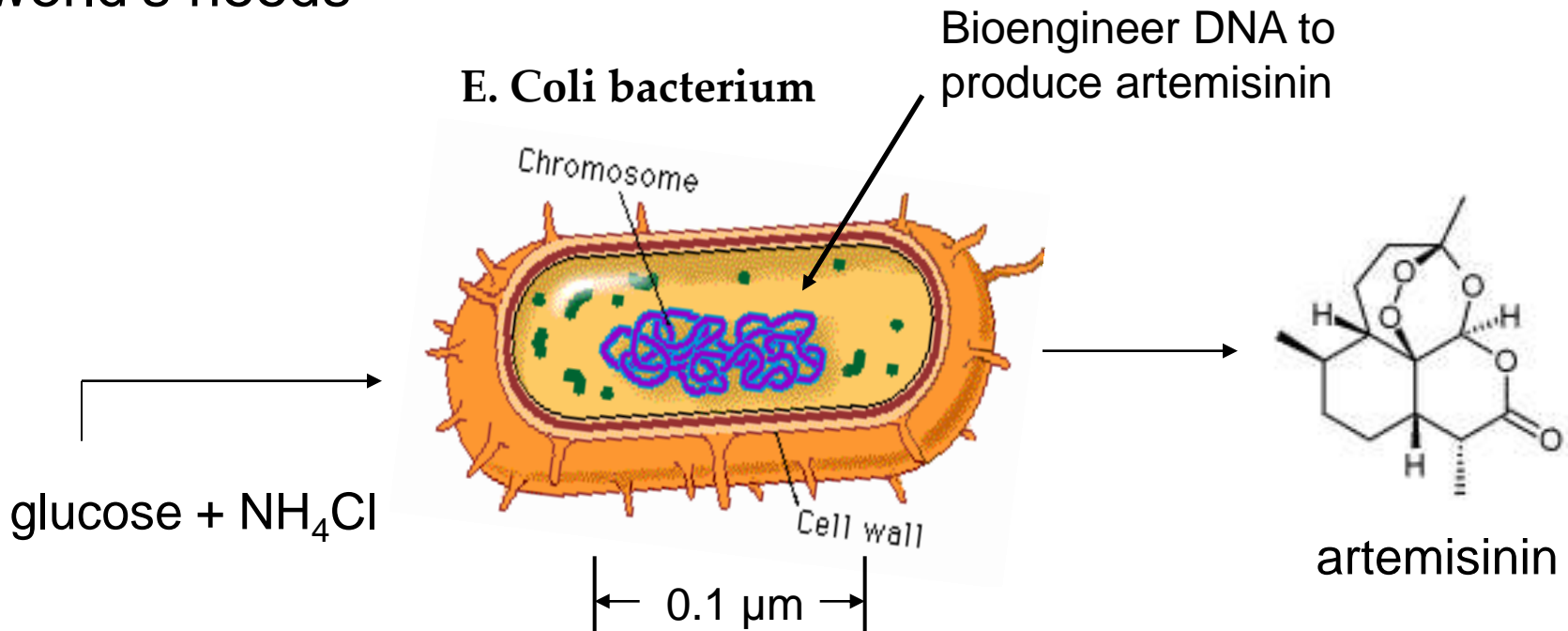
From coal to hydrogen: CH + 2H₂O → 5/2 H₂ + CO₂



Production of Artemisinin: A Bacterial Chemical Plant



- An antimalarial agent
- Normally produced from the wormwood plant
- There isn't enough to supply world's needs



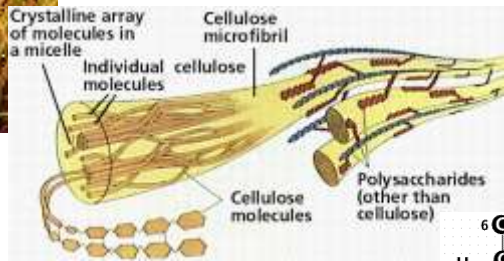
From Grass to Gasoline



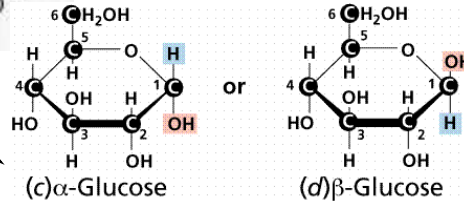
Biomass growth



Biomass preparation



Cellulose depolymerization



Glucose conversion to plastics



Glucose conversion to fuel (alkanes, alcohols)



CO₂ Neutral !

CO₂

Technology Needs

- Genetically modified crops that grow rapidly and require no fertilizer and little water
- Efficient catalysts for cellulose depolymerization
- Selective catalysts for the conversion of glucose to fuels (alkanes) and chemicals

- Biomass can provide for 33% of the US fuel needs
- Biomass can provide a wide range of platform molecules for the chemicals industry

CO₂

Research Opportunities for Undergraduates

- Biotechnology
 - Harvey Blanch, Douglas Clark, Jay Keasling, Danielle Tullman-Ercek
- Biomedicine
 - David Schaffer, Clay Radke
- Materials Processing
 - David Graves, Roya Maboudian
- Polymer Science
 - Nitash Balsara, Rachel Segalman, Susan Muller, Jean Frechet
- Molecular Simulation
 - Berend Smit, Jhieh-Wei Chu
- Catalysis
 - Alexis Bell, Enrique Iglesia, Alexander Katz
- Electrochemistry
 - John Newman, Jeffrey Reimer

What Do Chemical Engineering Students Study?

- Core Curriculum (108 semester units)
 - Math, Physics, Chemistry (5 semesters), Biology
 - Humanities and Social Science
 - Engineering Fundamentals: thermodynamics; momentum, heat, and mass transport; reaction kinetics
 - Engineering Applications: separation processes; chemical reactors; process control; process design
- Technical Options (12 semester units)
 - Chemical processing, biochemical processing; materials processing; environmental protection; applied science

After Graduation

Graduate ca 100 students: 1/3 grad school, 2/3 employed

Air Liquide

Alza Corp

Boston Scientific

California Dept of Health Services

ChevronTexaco

ChevronTexaco

DOW

Fluor Corp.

Fluor Corporation

Impax Laboratories

Intel Corp

Intel Corp

JM Hyde Consulting, Inc.

Johnson and Johnson

JSR Micro Inc

Merck and Company Inc

Merck and Company Inc

Merrill Lynch and Company Inc

NorthernStar Natural Gas LLC

Samsung Electronics

SembCorp Industries (Singapore)

Shaw Group

Shell Oil Company And Subsidiaries

Singapore Government

United States Army

United States Department of Energy

Valero

Valero Energy Corporation

Verisign Inc

Highly diversified !

Oski says “ChE is Where the Action Is!”

