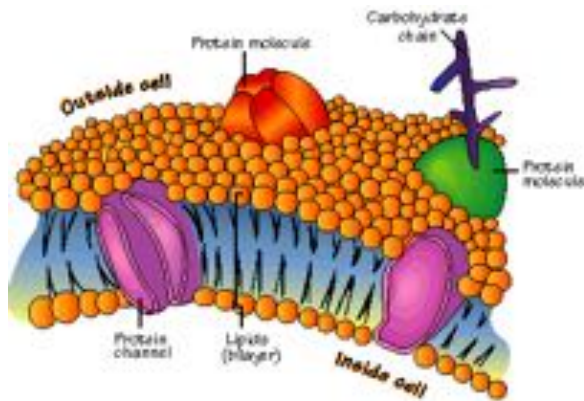


Chemical Engineering: An Overview

Given by Lamar AIChE Student Chapter
Lamar University, Beaumont, TX

In Consultation with Tracy J Benson, Ph.D



President Herbert Hoover (1954):

There is the fascination of watching a figment of the imagination emerge through the aid of science to a plan on paper. Then it moves to realization in stone or metal or energy. Then it brings jobs and homes to men. Then it elevates the standards of living and adds to the comforts of life. That is the engineer's high privilege.

Chemical Engineering

- Natural Sciences (Chemistry & Physics)
- Life Sciences (Biology, Microbiology, Biochemistry)
- Mathematics & Economics
- Transformation of one type of chemical (or energy) to a more useful type of chemical (or energy)



What Do Chemical Engineers DO?

- **Combine chemistry, math, and physics to:**
 - **Operate chemical plants**
 - **Design chemical processes**
 - **Research and Development**
 - **HAVE FUN!!!!**



What Do Chemical Engineers Make?

FOOD – cereals, meats, vegetables, frozen foods, canned foods, boxed foods

FUEL – Gasoline, diesel, motor oil, WD40, brake fluid

PLASTICS – garbage bags, Wal-Mart bags, combs, toothbrushes, hair brushes, squirt bottles, clothes baskets, car interiors, boats,

PAPER – notebook, copy, books, cardboard, toilet paper, napkins, diapers

HEALTH CARE – medicines, diagnostic instruments, joint replacements,

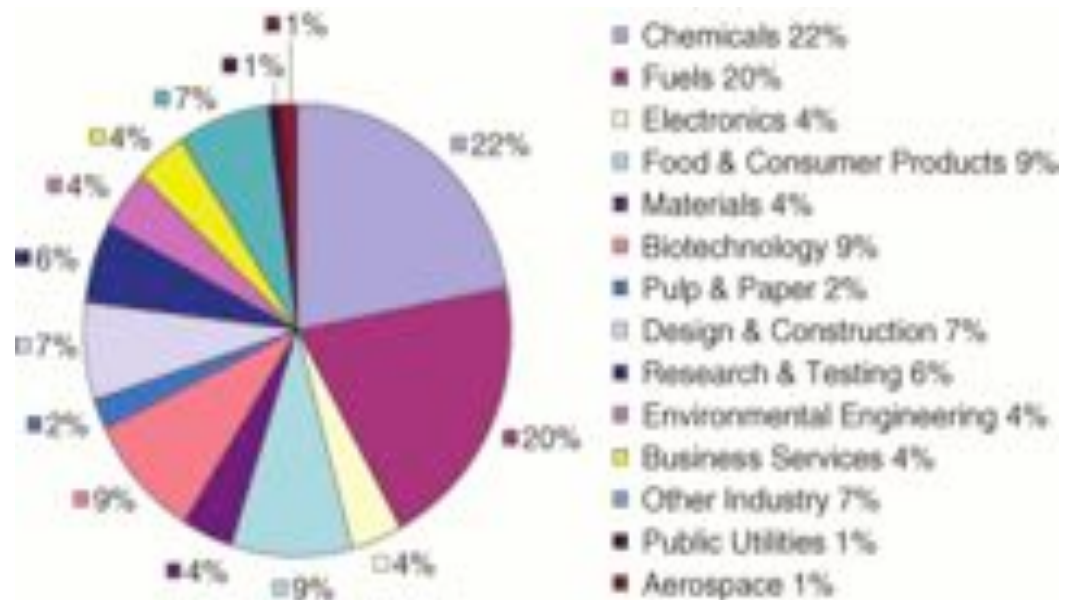
Clean water – pumps, filters, chlorine

EVERYDAY ITEMS – pens, pencils, magic markers, tv's, Ipods, cell phones, radios, sheets, pillows, carpets, household cleaners, tables, chairs, cars, trucks, paints and stains, clothes, leather, sofas, recliners,



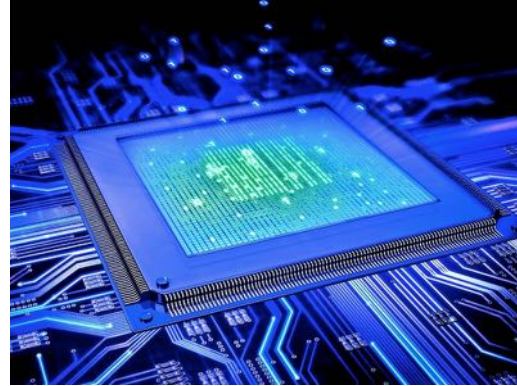
Where Do Chemical Engineers work?

- Fuels
- Pharmaceuticals
- Food
- Petrochemicals
- Biotechnology



Chem E's work in so many fields!!

- High purity solvents
- Water Treatment
- Nuclear Energy
- Food Production
- Environmental Eng.
- Advanced Materials



A deeper look into Oil and Gas

Oil and Gas can be broken down into three sectors:

1. Upstream

- Exploration and production

2. Midstream

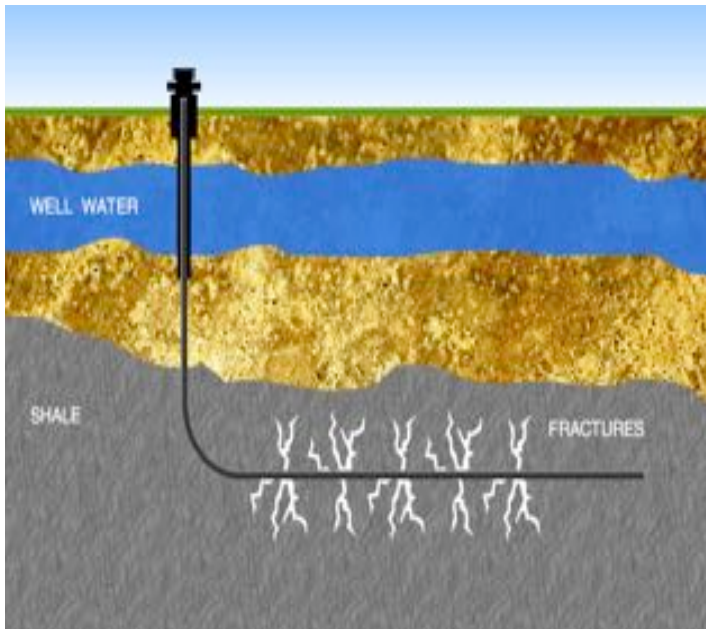
- Pipelines and transportation

3. Downstream

- Refining of crude oil into fuels
- Processing of petrochemical feeds to make marketable products

Upstream – Drilling/Pumping Crude

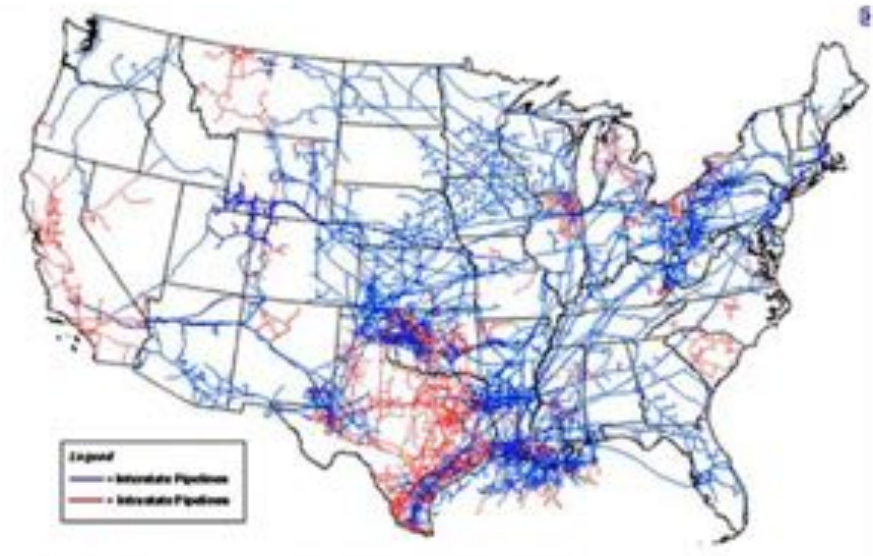
- Involved with the extraction of crude oil and natural gas from the earth to the surface.
 - The abundance of shale and directional hydraulic fracking have allowed the US to become the world's leading crude oil producer
 - Cheap North American shale gas is also a valuable petrochemical feedstock
 - Typical job after college is a drilling or reservoir engineer, sometimes working on offshore oil rigs to determine how to efficiently and safely extract the raw oils.
 - This is now the field of Petroleum Engineering, but Chemical Engineers are also trained to fill these roles



Midstream – Crude Transport

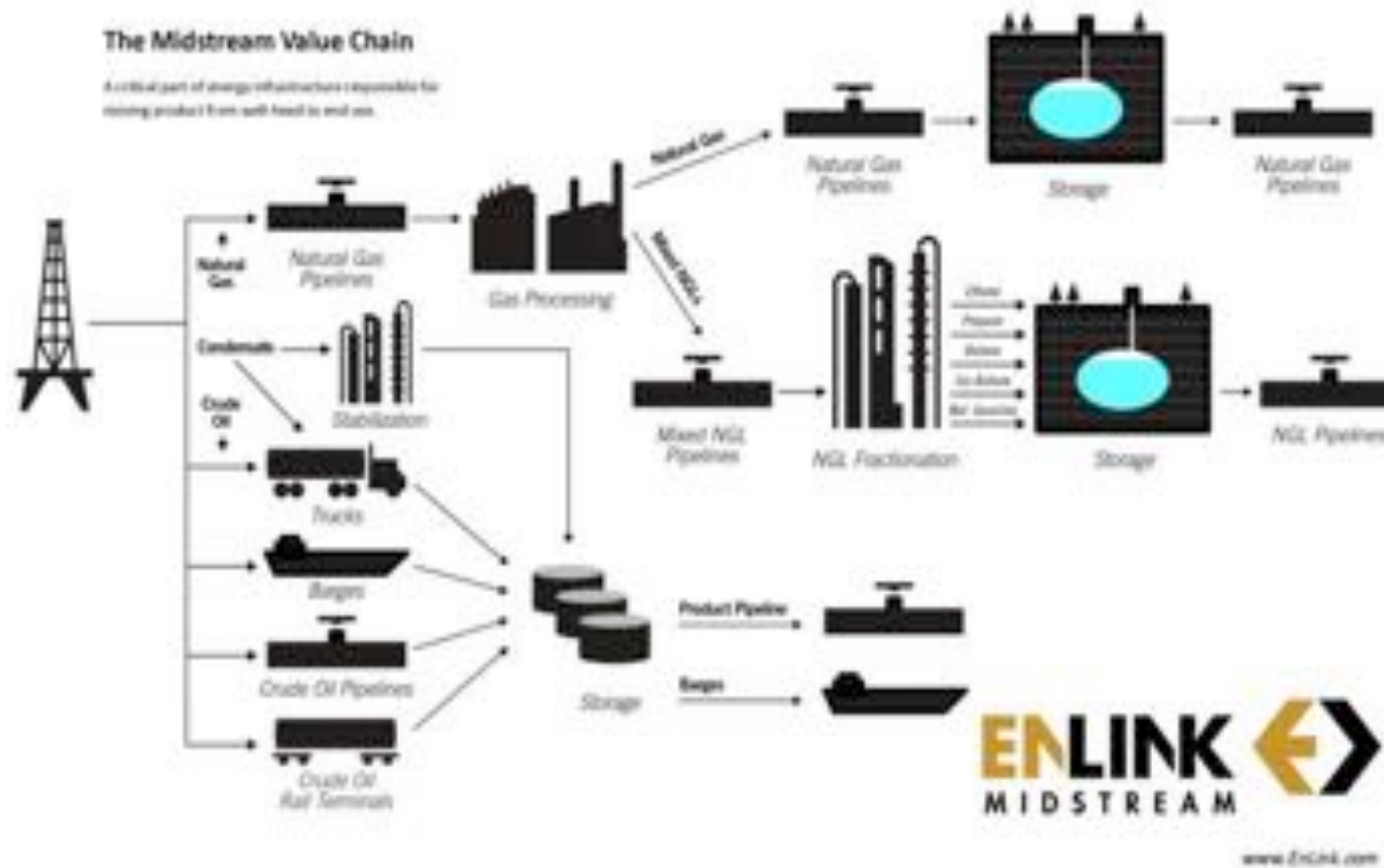
Transport of raw extracted petroleum products from drilling sites to downstream processing units

- Drilling sites can be both onshore and offshore
- Lots of work in logistics of transporting this raw material
- Purification of some feed streams is also handled at this stage
- Think of as a chemical plant which feeds other chemical plants



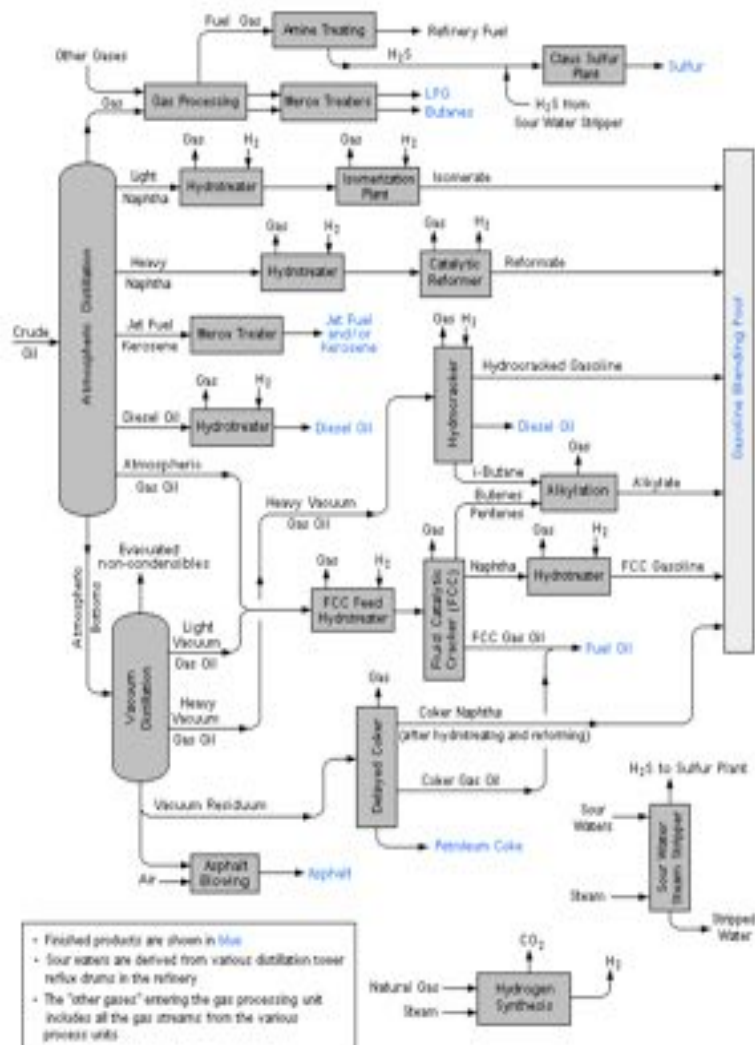
Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Division, Gas Transportation Information System

Midstream – Crude Transport



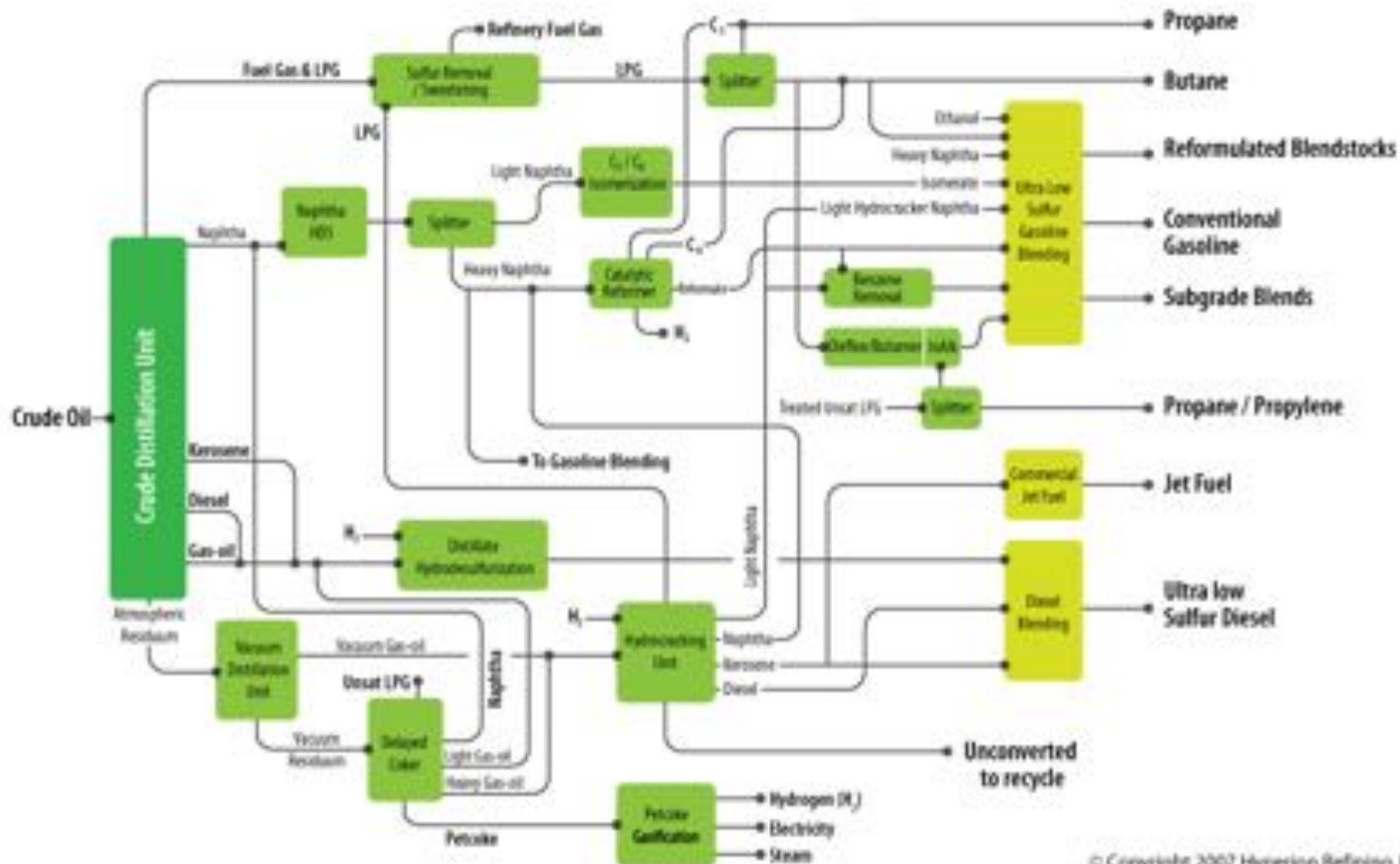
Downstream - Refining

Refining is the processing of crude oil into products such as motor gasoline, kerosene, asphalt, diesel fuel, coke fines, and other organic molecules



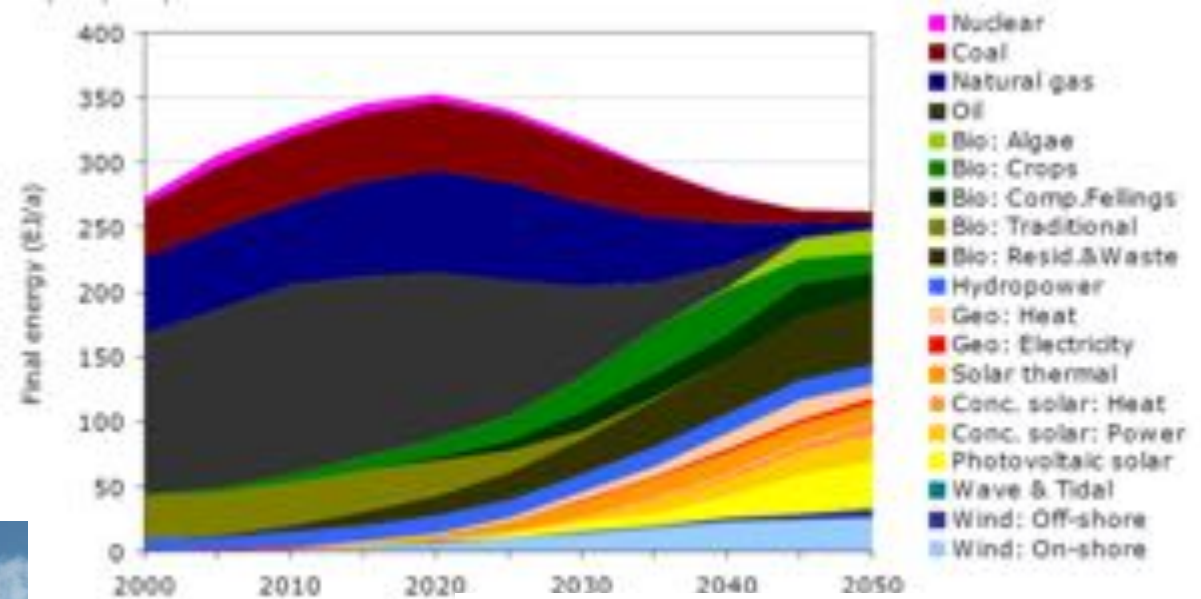
REFINERY PROCESSES

Hyperion Energy Center Refining Process



How will we meet growing energy demands?

- Global population expected to increase from **7 – 10 billion** by 2050
- A 2.2 °C temperature increase is possible by 2050 at current rates
- Renewable energy is the solution!!!



How to Become a Chemical Engineer

- Engineers are **PROBLEM SOLVERS**
- Solve simple problems and then apply those principles to more complex problems

Solving Today's Difficult Problems:



**Date rape
preventive
nail polish
(NC State)**



What about the Math?

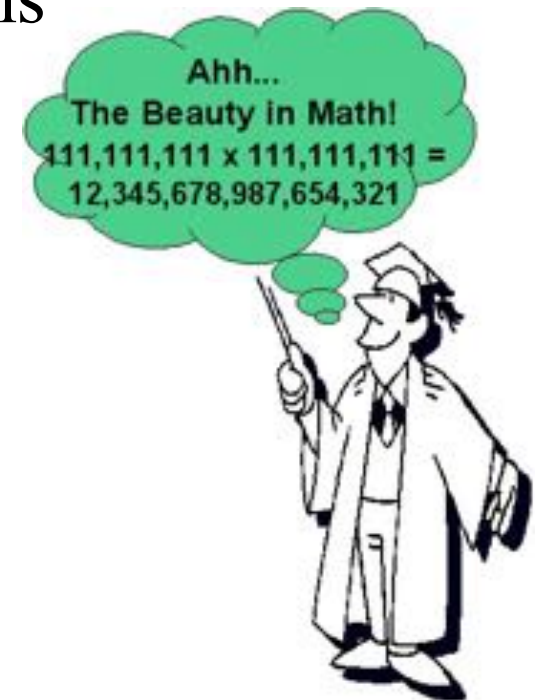


**Roman aqueduct in Northern Spain built 2000 years ago
100 ft tall, 2,500 feet long, no mortar**

Math Builds Upon Itself

- Elementary school – add, subtract, multiply, divide
- Middle school – equations, word problems
- High school – algebra, geometry
- College – Calculus, differential equations

Like learning how to crawl before you can walk, run, jump, or ride a bike.

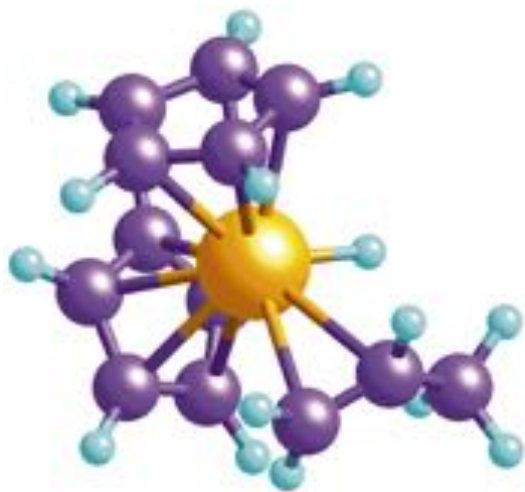


What About the Chemistry?

Chemistry is the study of how elements (carbon, hydrogen, oxygen, sulfur...) come together in tiny molecules to make the stuff we use everyday.

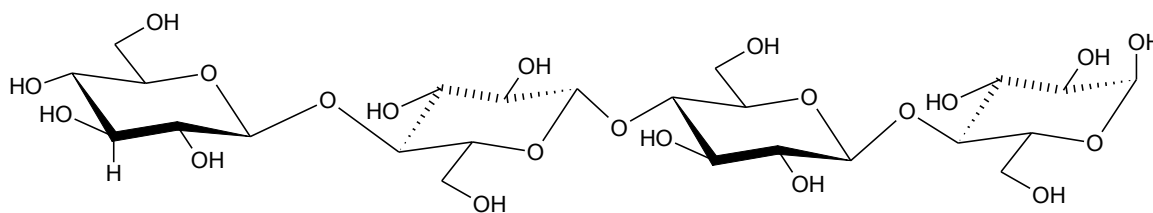
It takes energy to transform basic compounds into ones that we can use.

For example – crude oil into gasoline and diesel fuel, trees into paper, soybean oil into ink

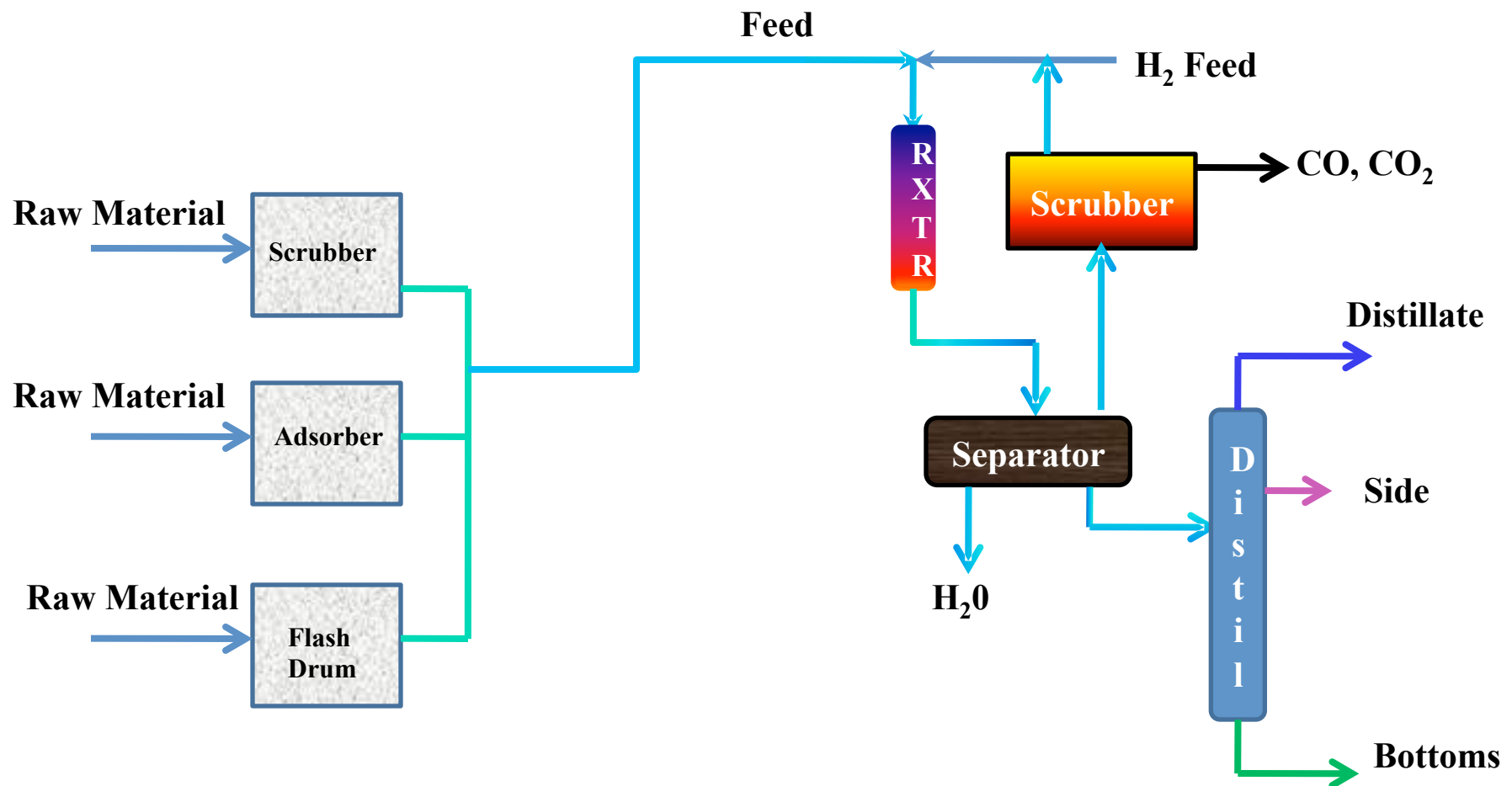


How Do We Learn About Chemistry??

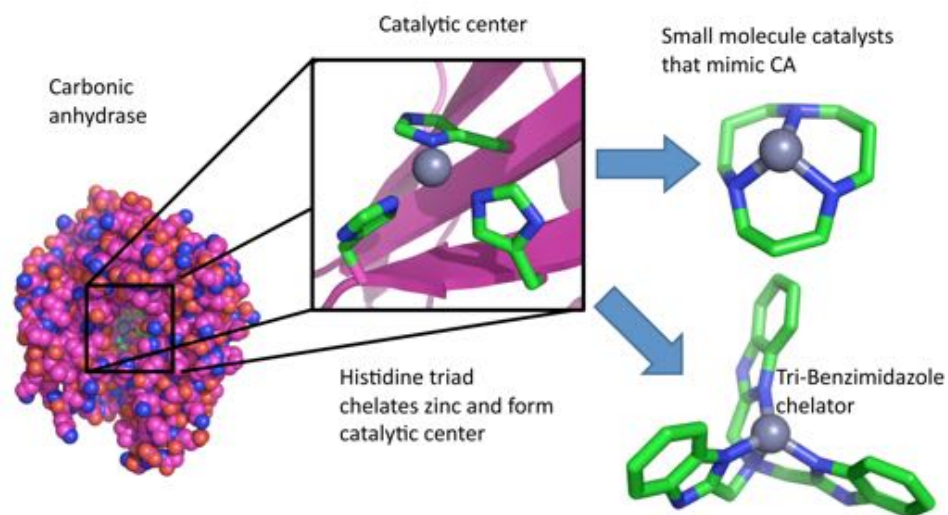
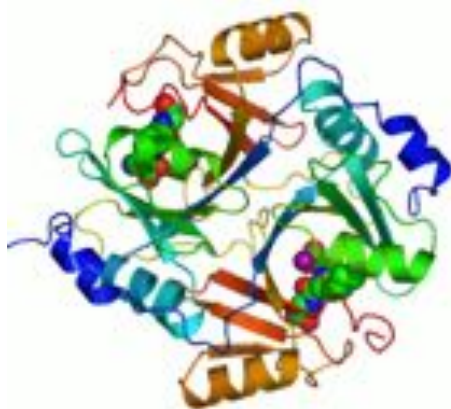
EXPERIMENTS, EXPERIMENTS, EXPERIMENTS



What Do We Mean by a Chemical Process??

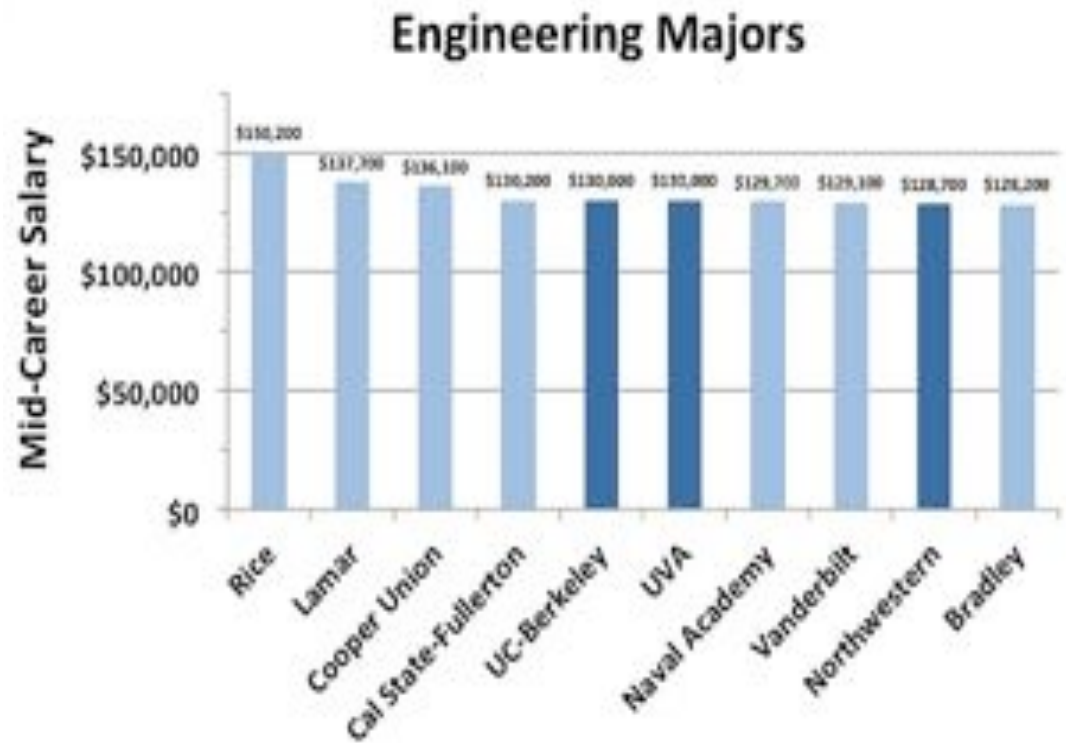


Reactions and Catalysis



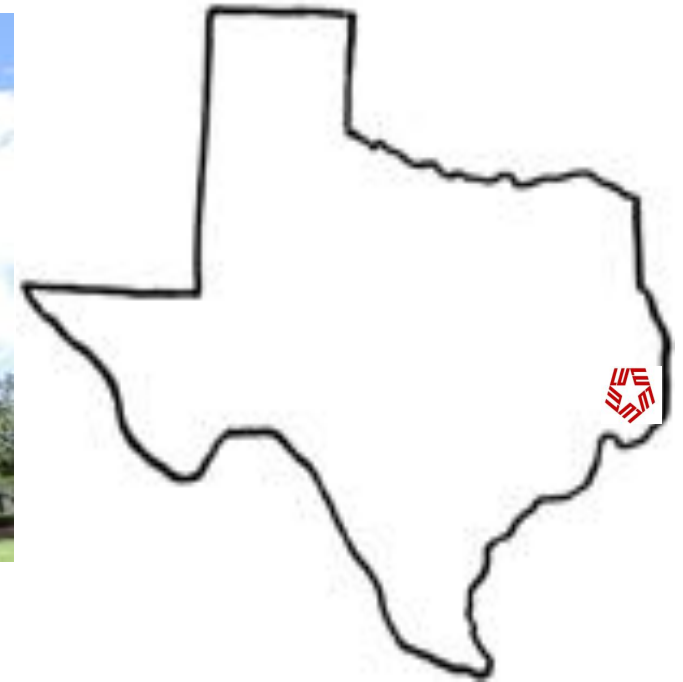
Why Choose Lamar to Study engineering?

- Graduates are competitive in receiving high paying jobs in industry out of college
- Low student to teacher ratio allowing for more interaction with professors that other universities
- Beaumont is an ideal location for Chemical Engineering Internships
- Lamar's College of Engineering is accredited by ABET



Lamar University

- Beaumont, TX
- 14,300 students (9,700 undergrads)
- Texas State University System (Sam Houston State, Sul Ross, TSU, etc)



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