

Teaching Sustainability Through Catalysis

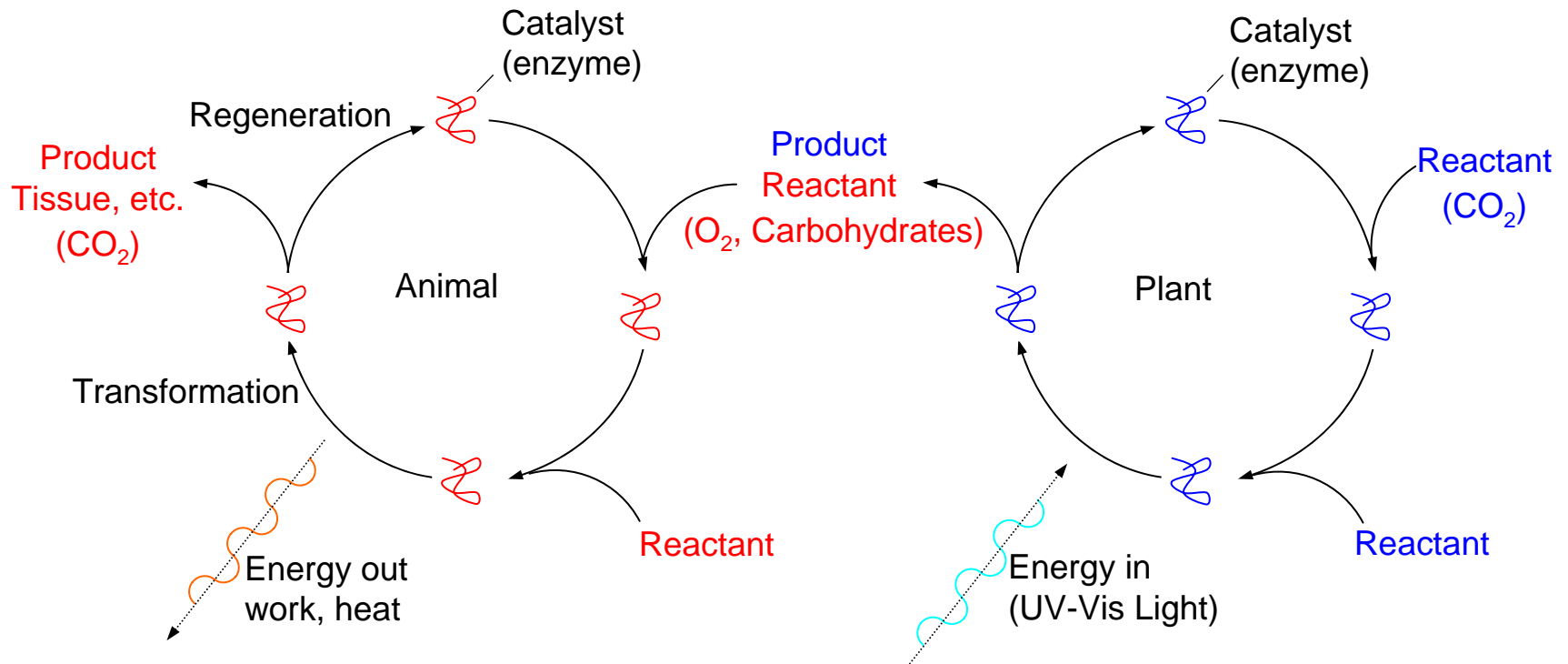
3rd International Symposium for Engineering Education
2010 University College Cork, Ireland

Gregory S. Yablonsky – Saint Louis University

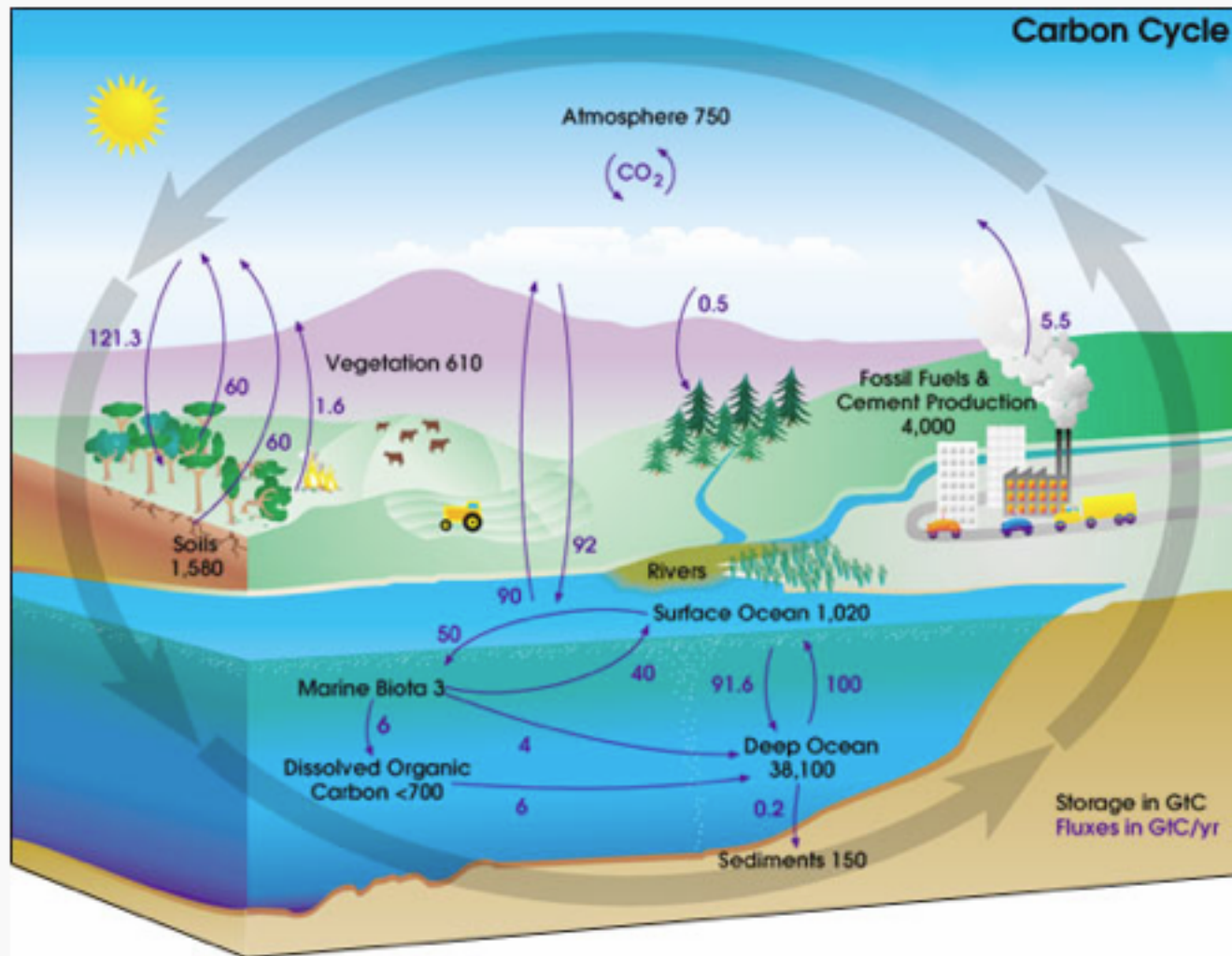
John T. Gleaves – Washington University

Rebecca Fushimi – The Langmuir Research Institute

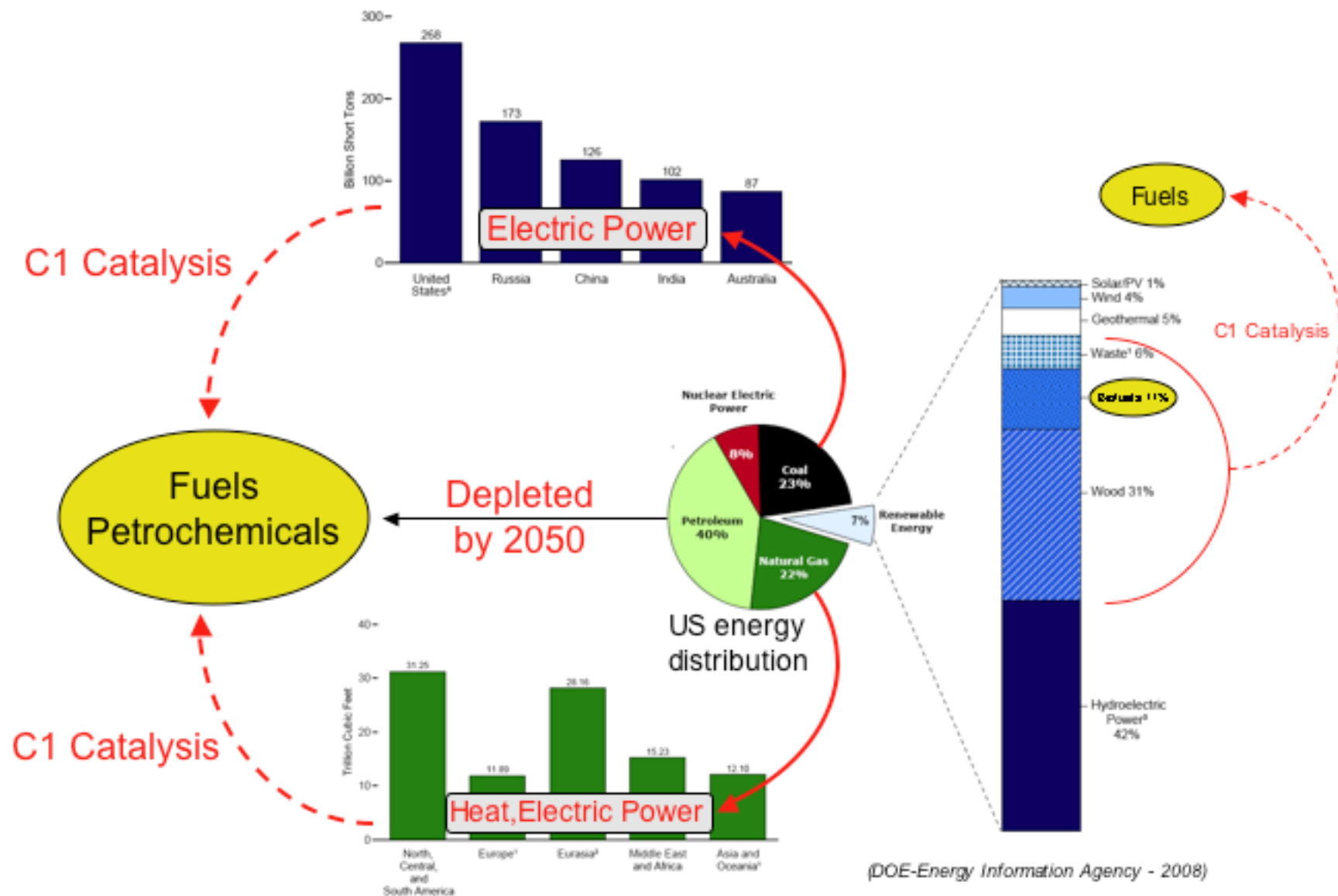
Natural Catalytic Phenomena



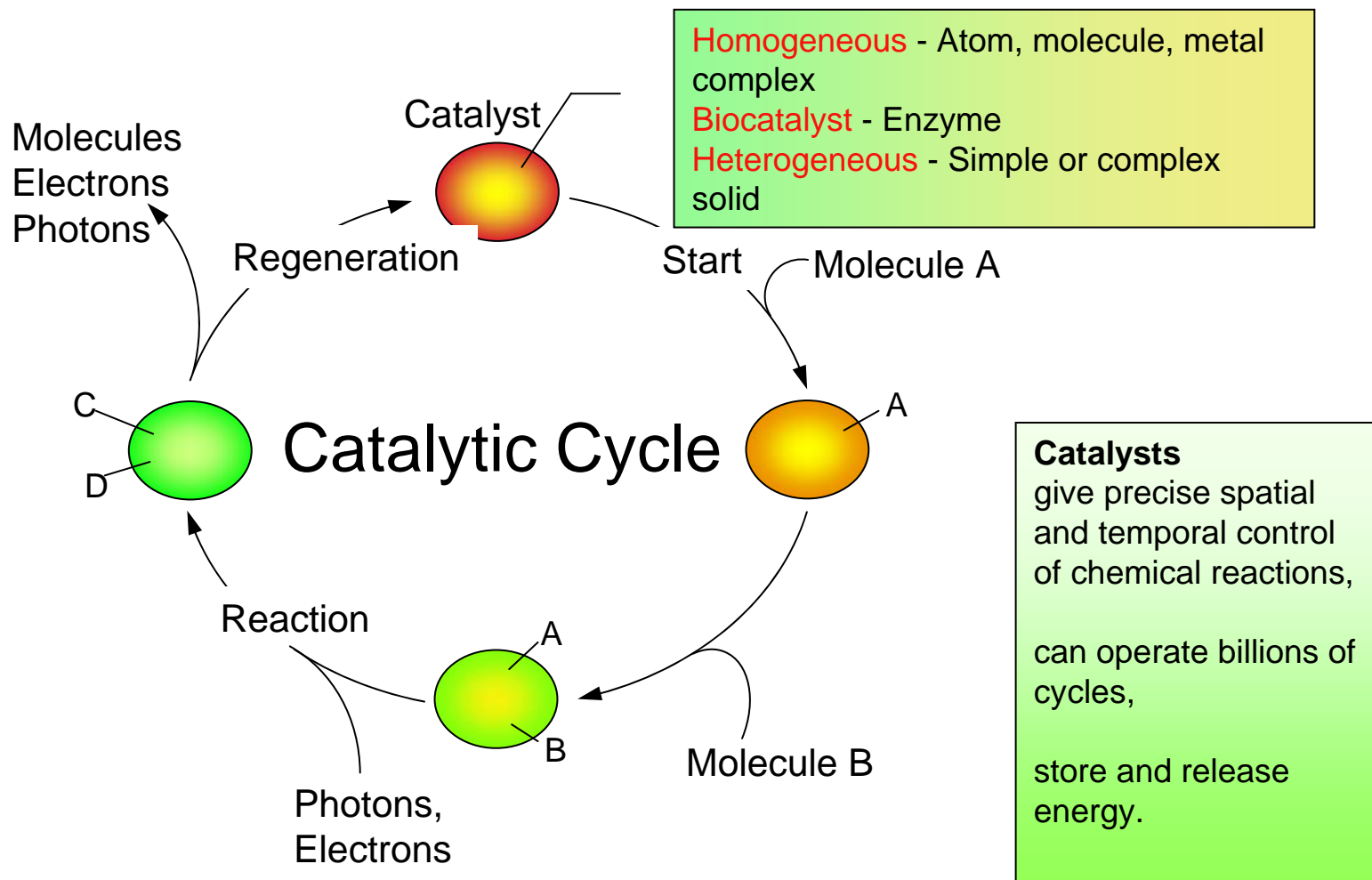
The Earth's Carbon Cycle



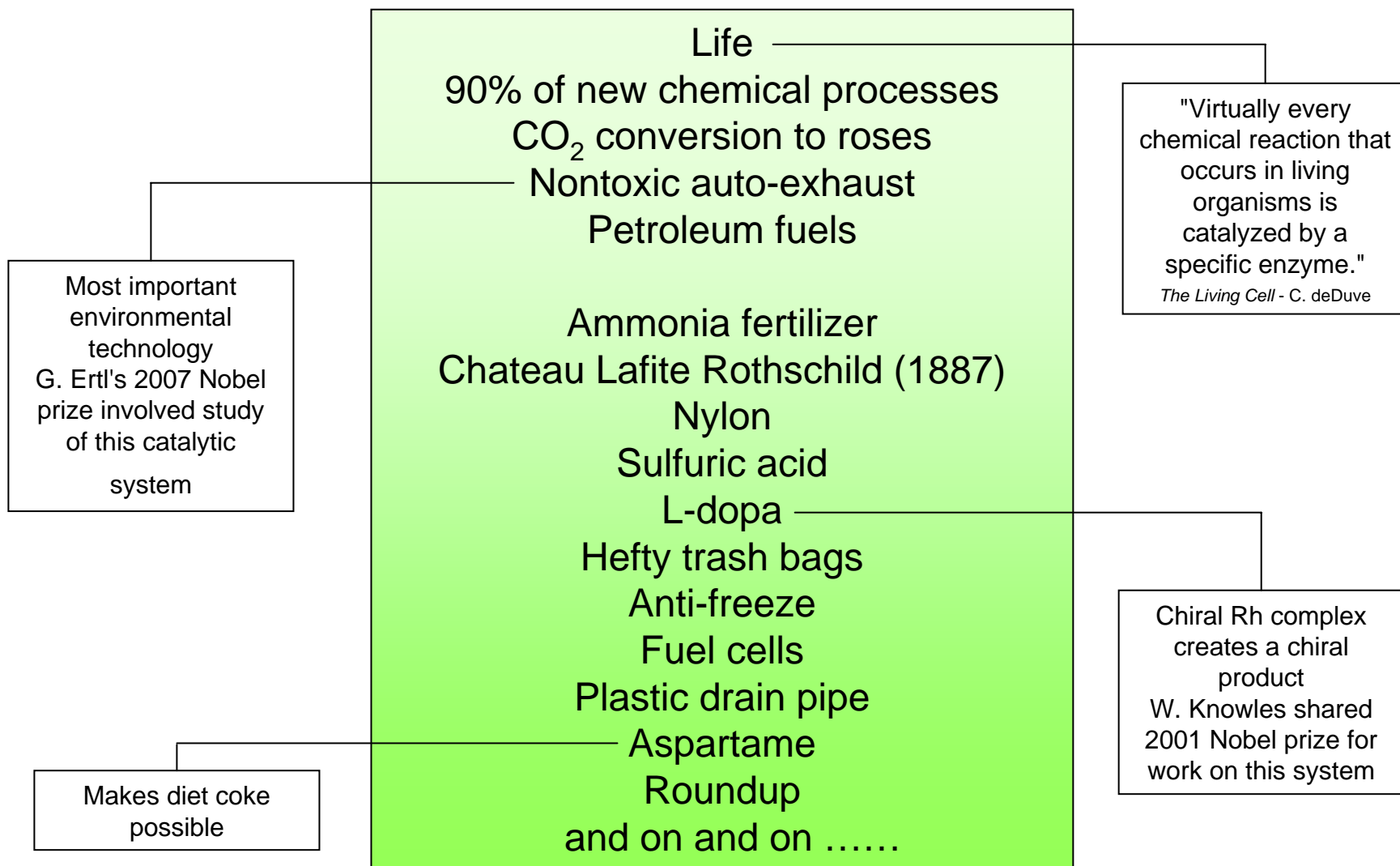
Beyond Petroleum - New Sources for Fuels and Chemicals



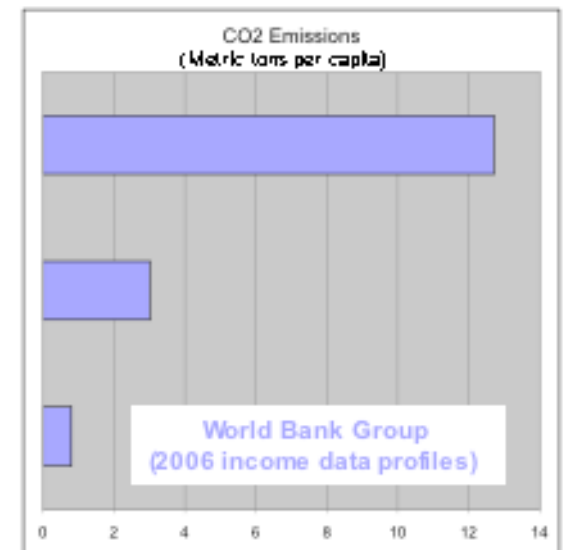
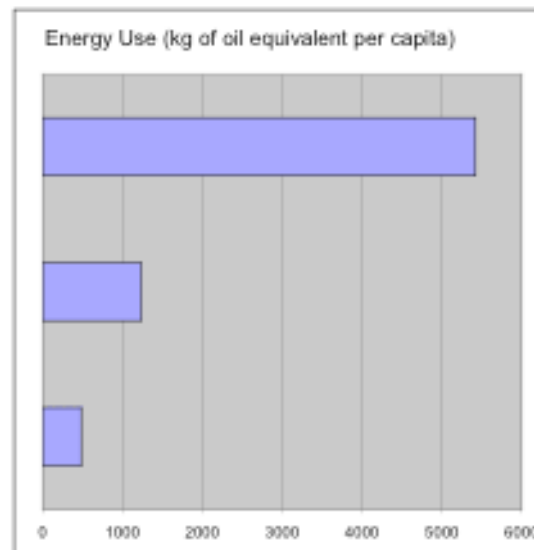
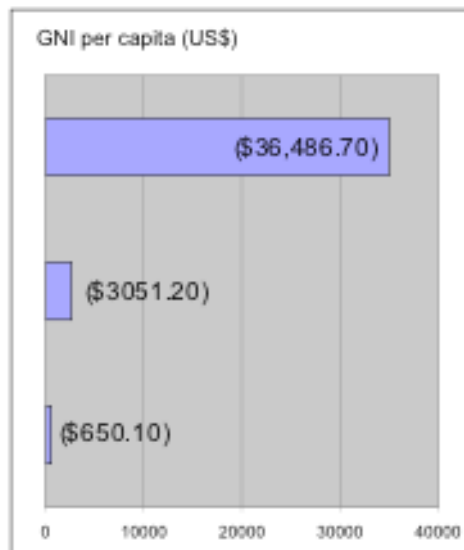
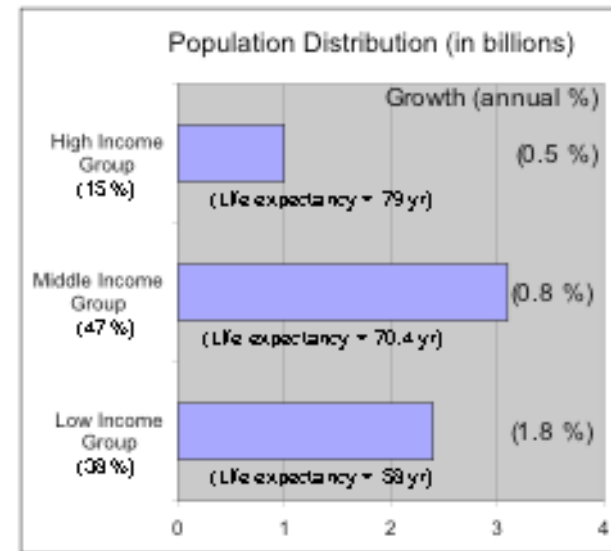
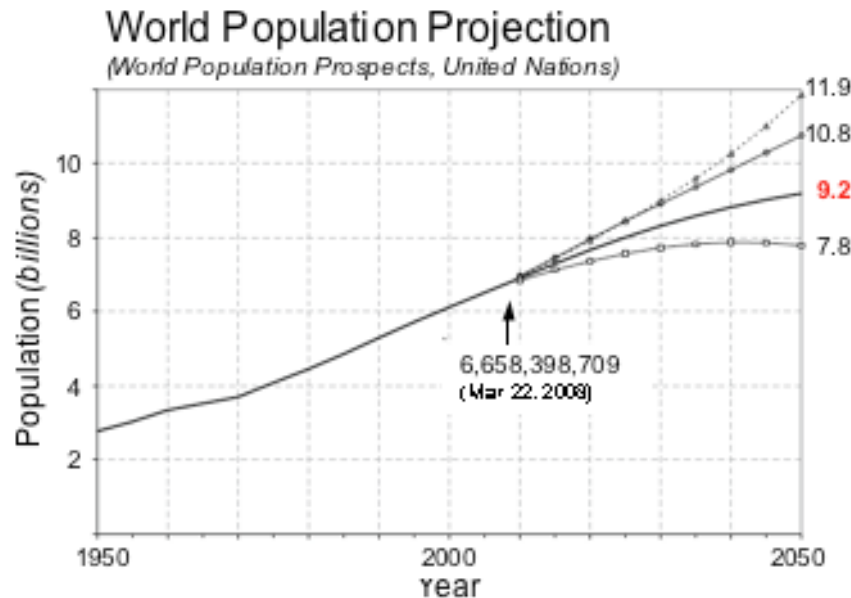
The Catalytic Cycle



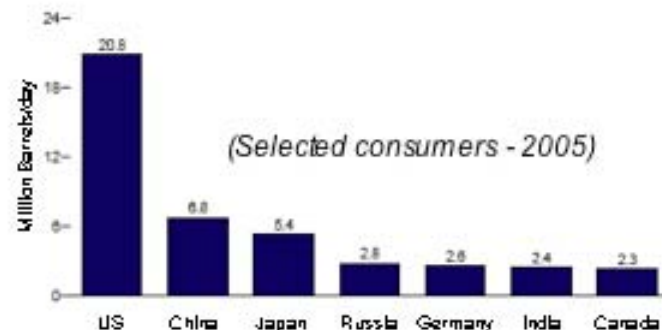
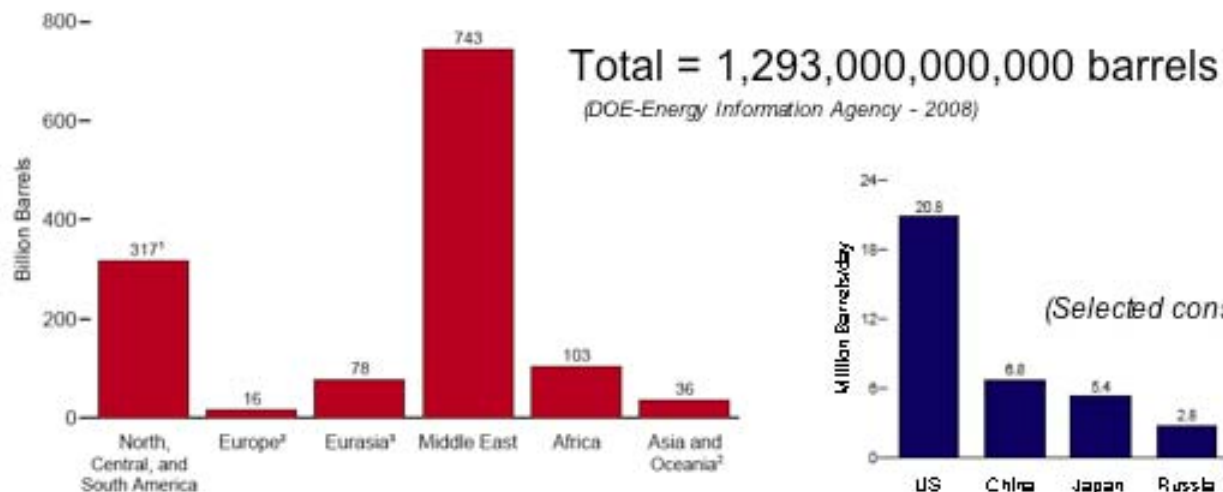
Catalysis is the fundamental chemical phenomenon that underlies



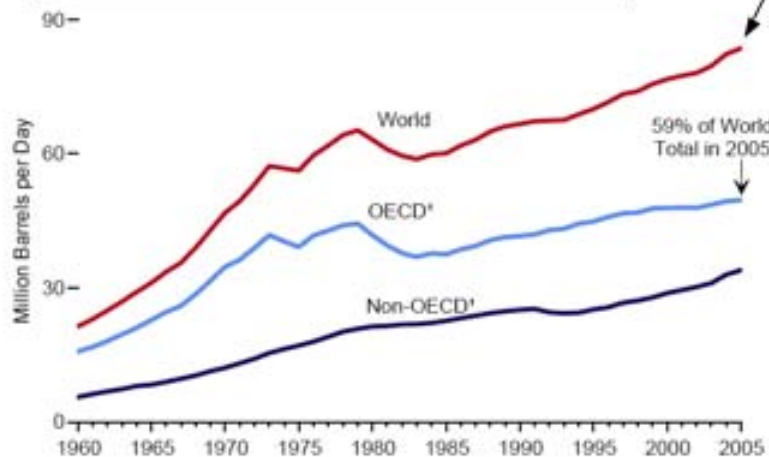
Human Population and the Distribution of Wealth



World Crude Oil Reserves (*Oil and Gas Journal*)



World Petroleum Consumption



Current Consumption

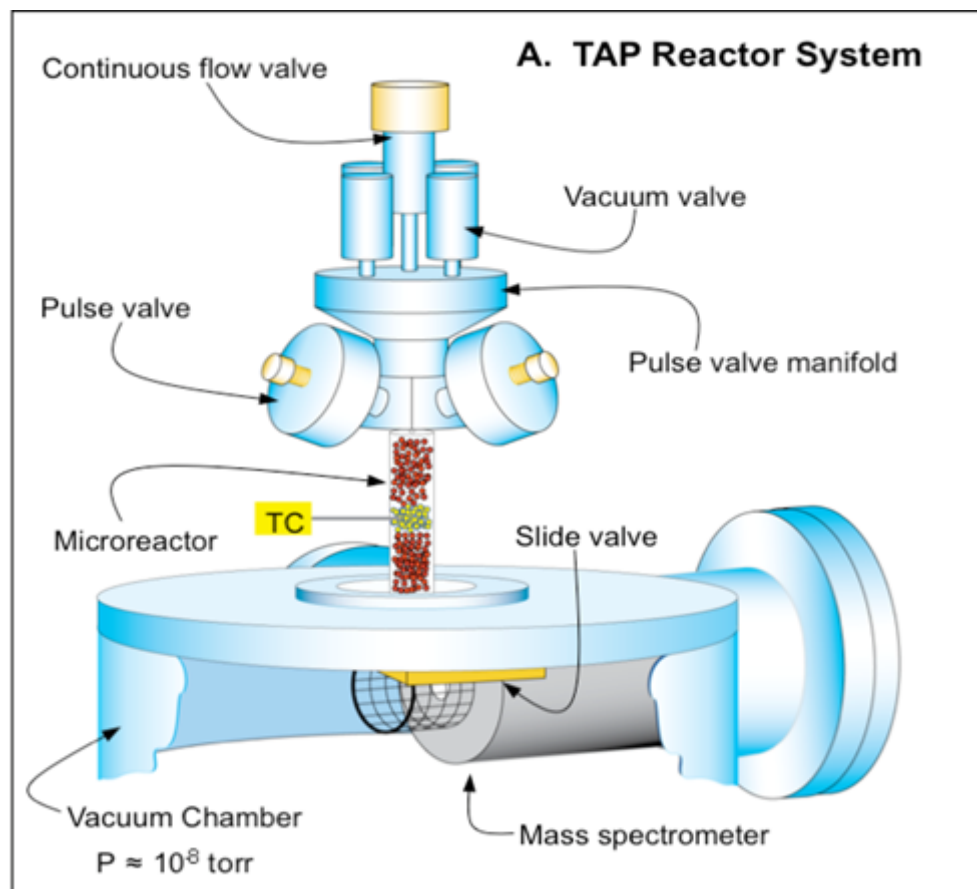
Total = 83,560,000 barrels/day
 = 30,499,400,000 barrels/year
 (1 barrel = 42 gallons)

Projected Consumption (2020)

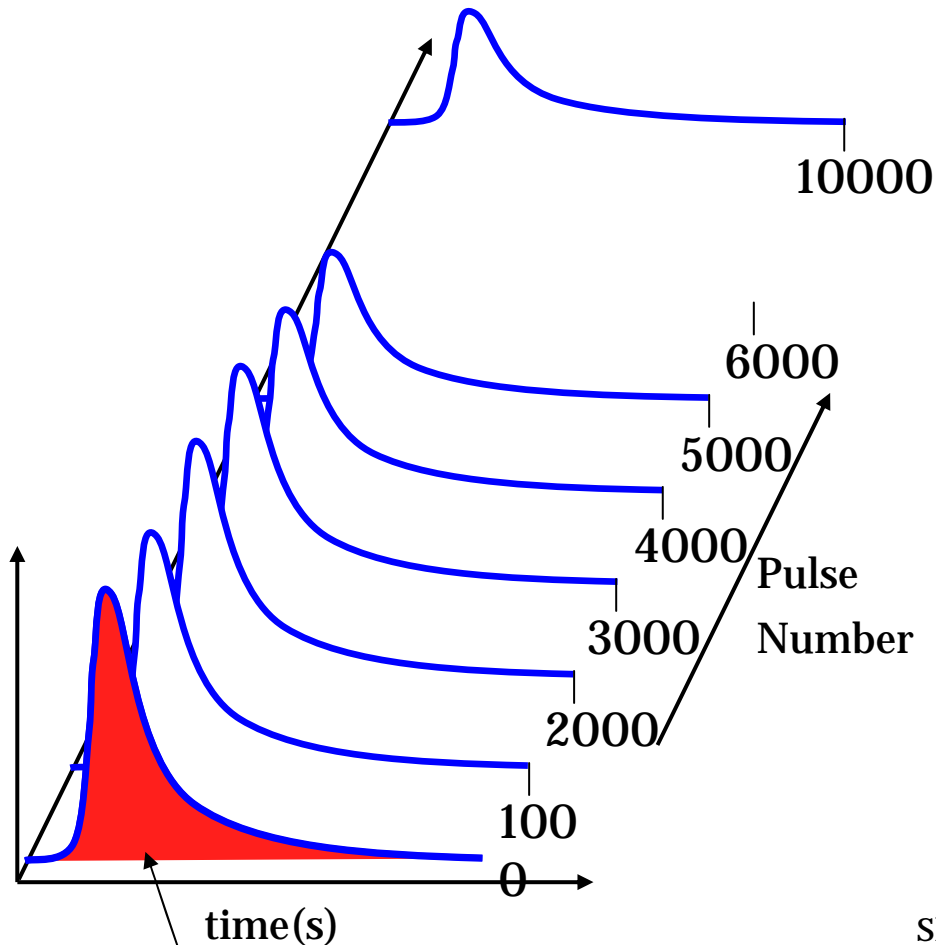
Total = 104,100,000 barrels/day
 = 37,996,500,000 barrels/year

(DOE-Energy Information Agency)

TAP Reactor Studies of Catalytic Processes



Kinetic Data from Pulse Response Curves



Zeroth Moment

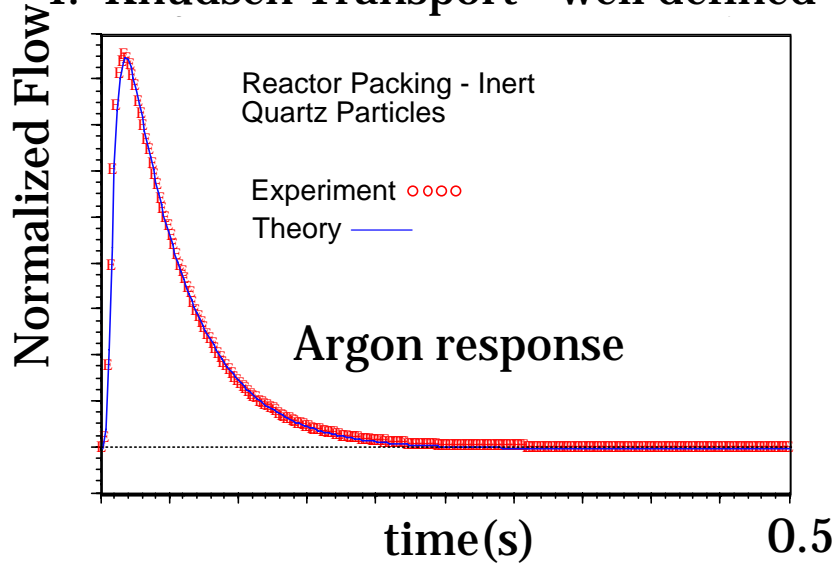
$$M_0 = \int_0^{\infty} F_{exit}(t) dt$$

Quantities calculated from 0th, 1st, and 2nd moments

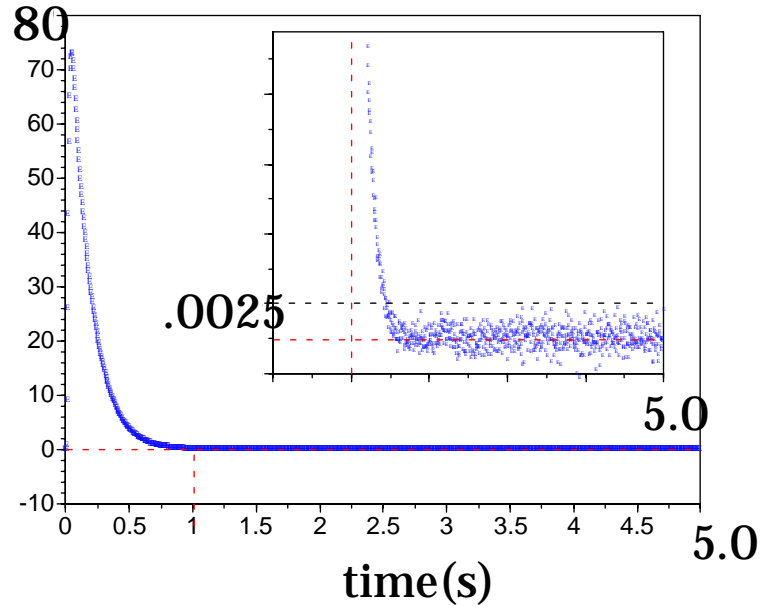
- Conversion (number of surface oxygen atoms and hydrocarbon)
- Selectivity
- Product Yield
- Residence time
- Apparent rate constants
- Apparent intermediate gas constants
- Apparent time delay

Shekhtman, S. *Interrogative Kinetics A New Methodology or Catalyst Characterization*. Doctoral Thesis, Washington University, 2003.

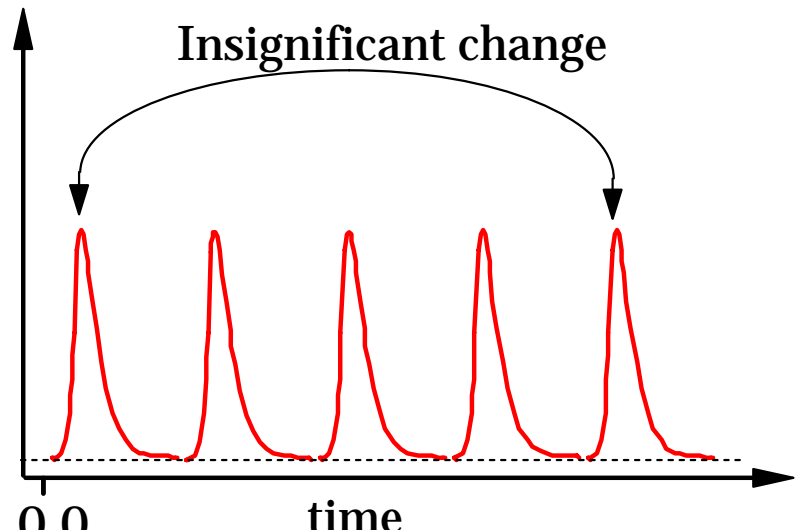
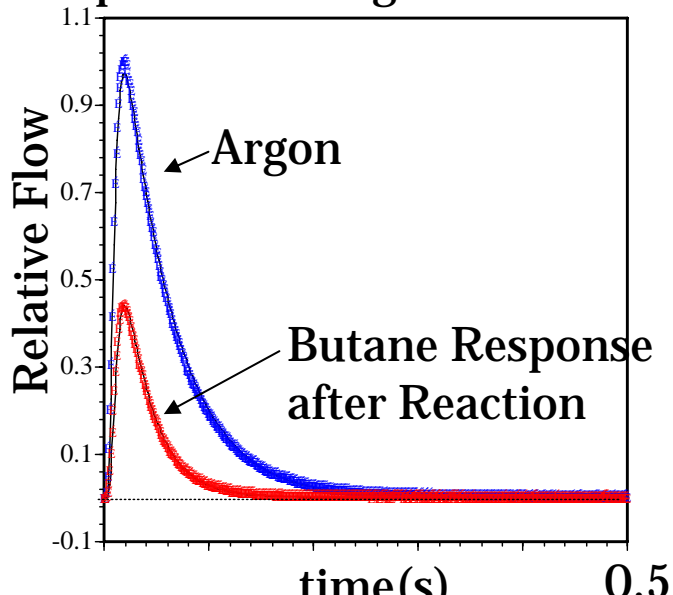
1. Knudsen Transport - well defined



2. Small pulse size - High S/N



Comparison of Argon and Butane Responses



Thank you.

A decorative graphic consisting of a solid teal horizontal bar that transitions into a series of three thin, parallel white lines on the right side of the slide.