

Bioproducts: Overview and Future Directions

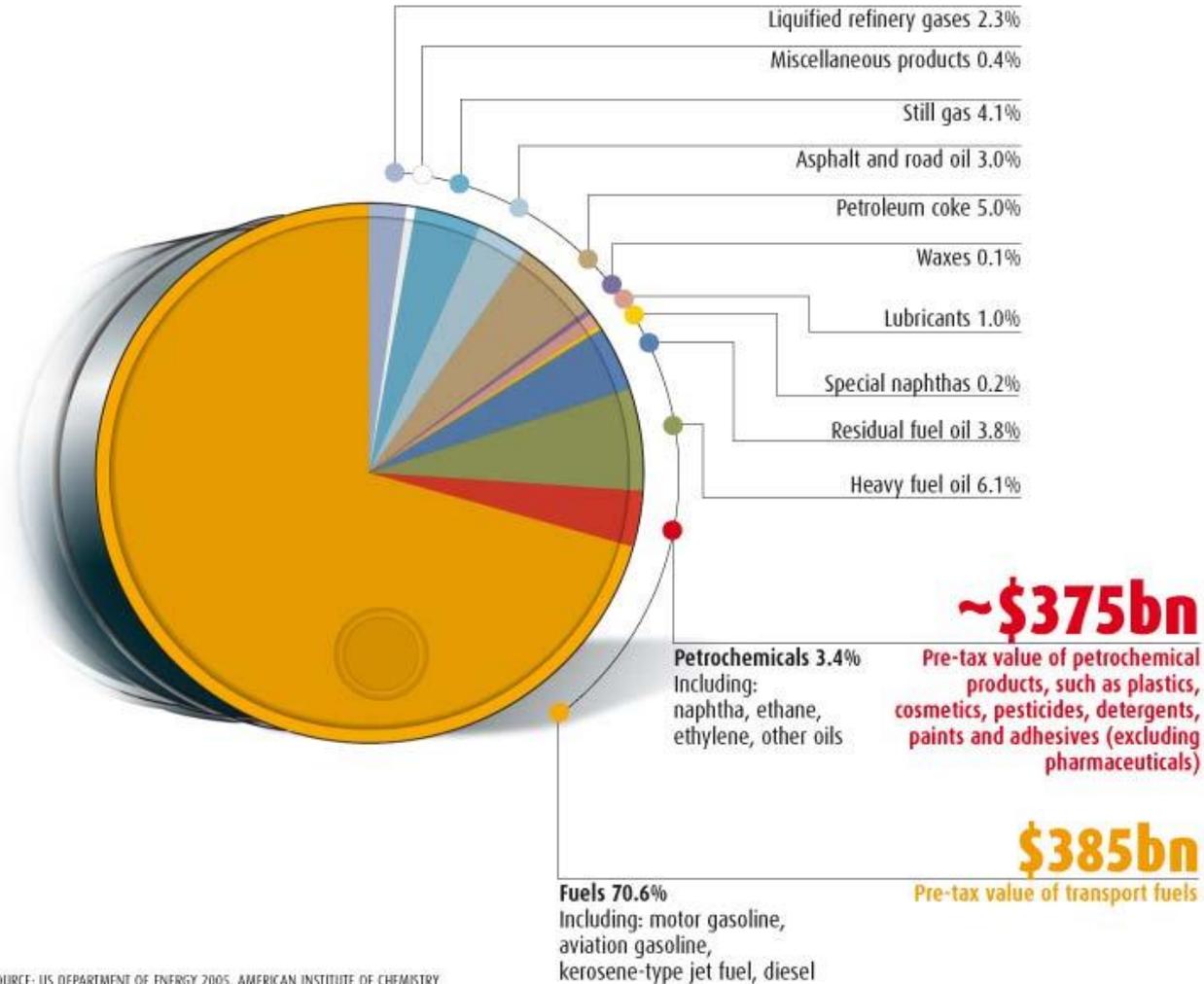
Brent Shanks
Director, CBiRC
Iowa State University
August 19, 2014



Chemicals

OIL BARREL BREAKDOWN

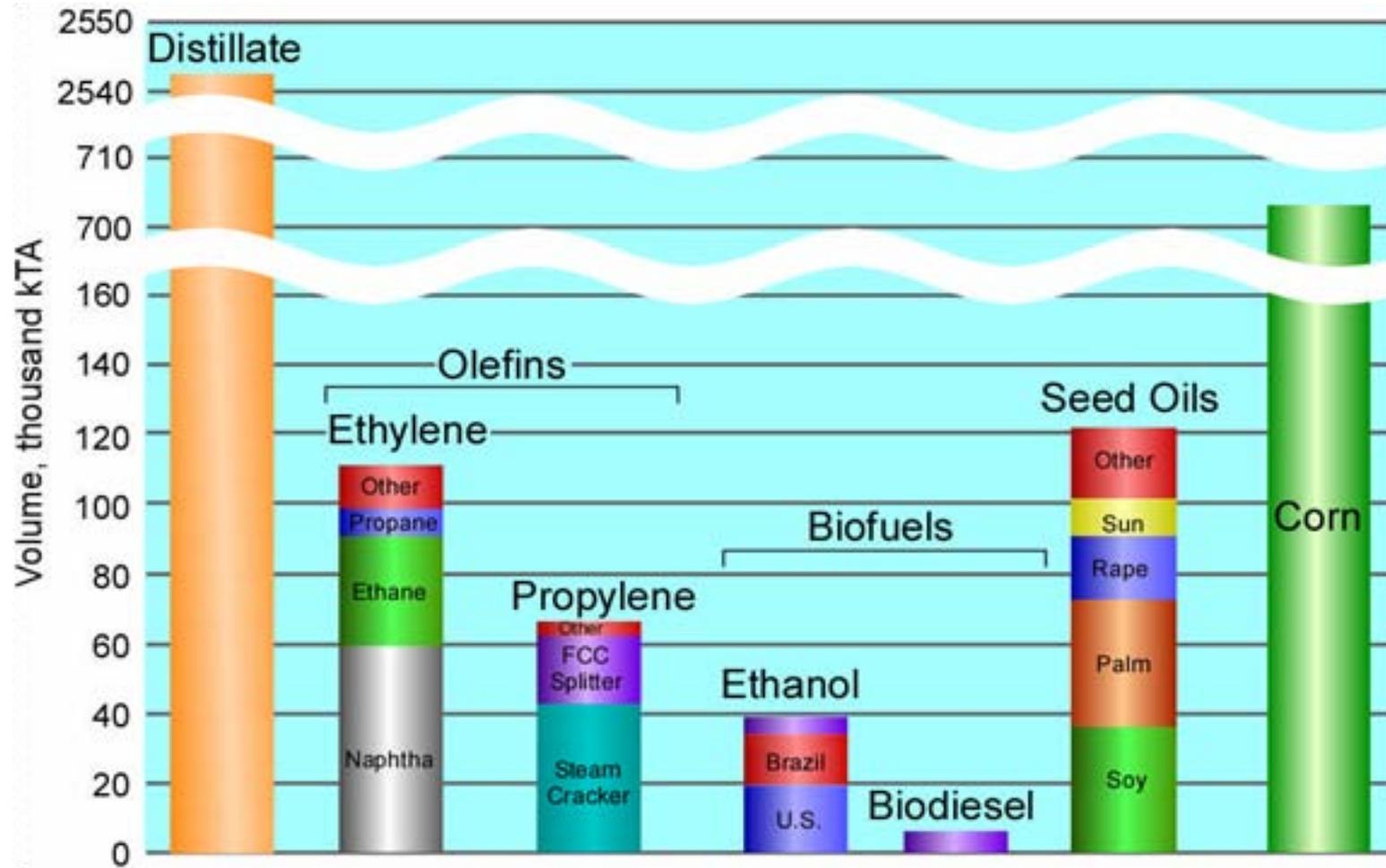
Despite consuming a small fraction of US oil compared with fuel, petrochemical products are worth more



SOURCE: US DEPARTMENT OF ENERGY 2005, AMERICAN INSTITUTE OF CHEMISTRY

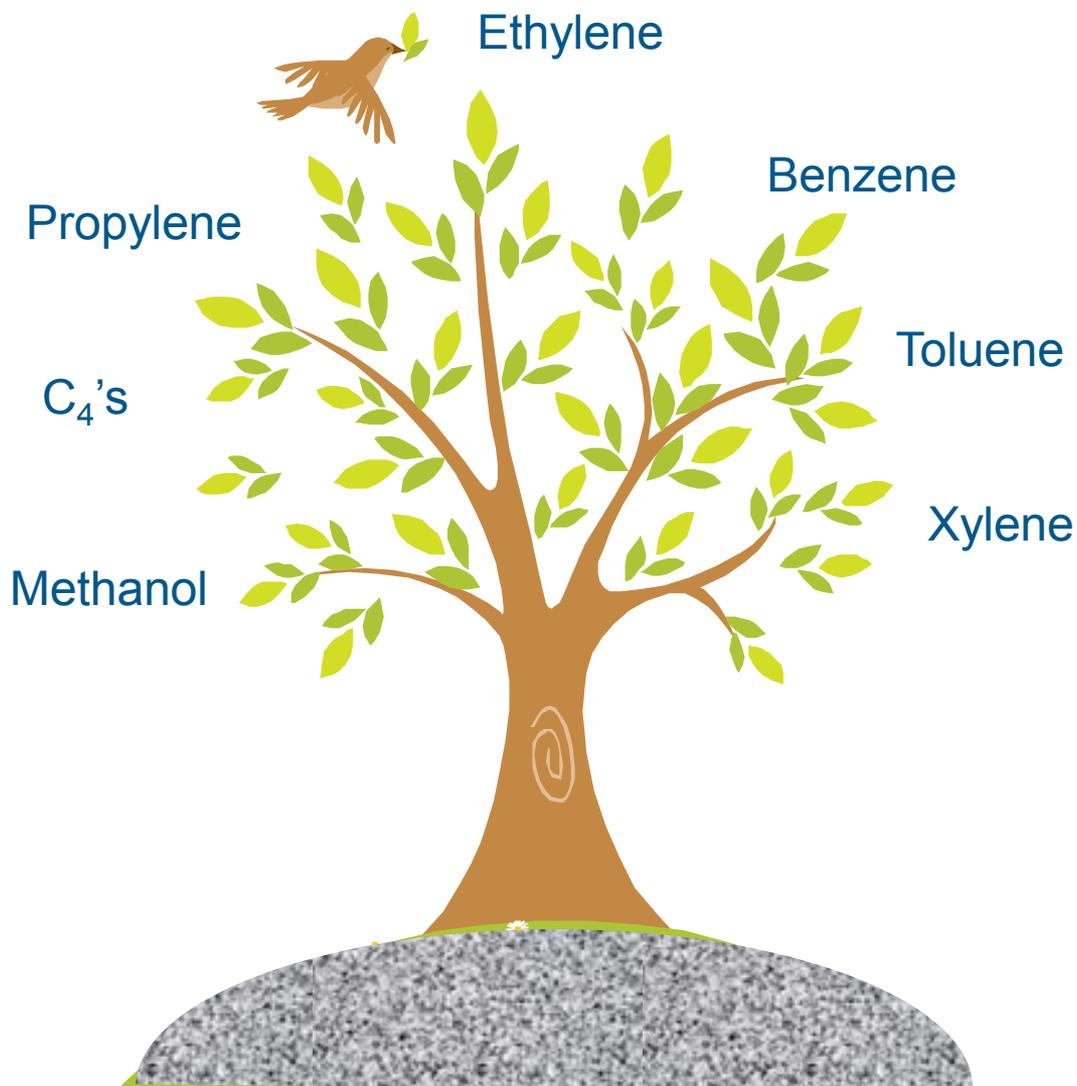


Global Volumes

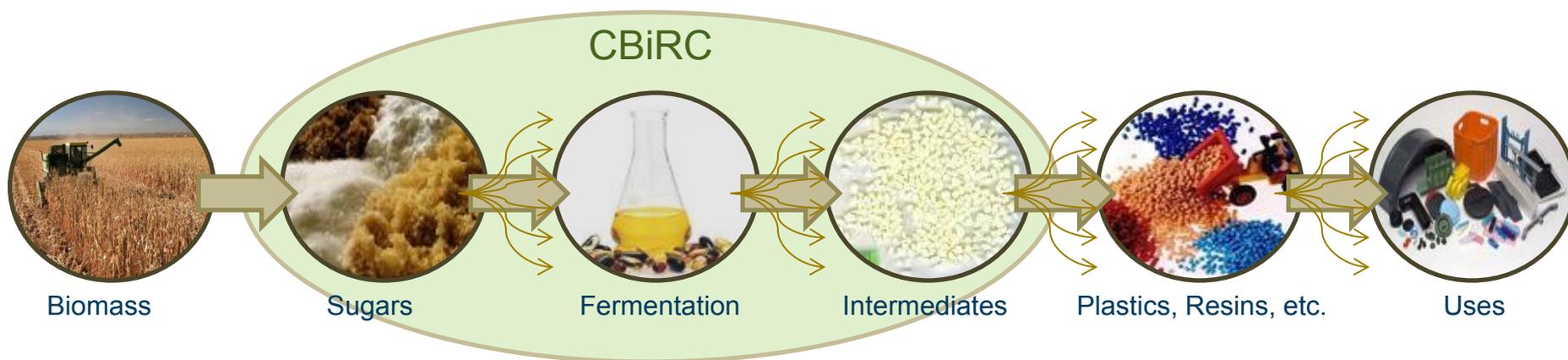


Dow, Mark Jones (2011)

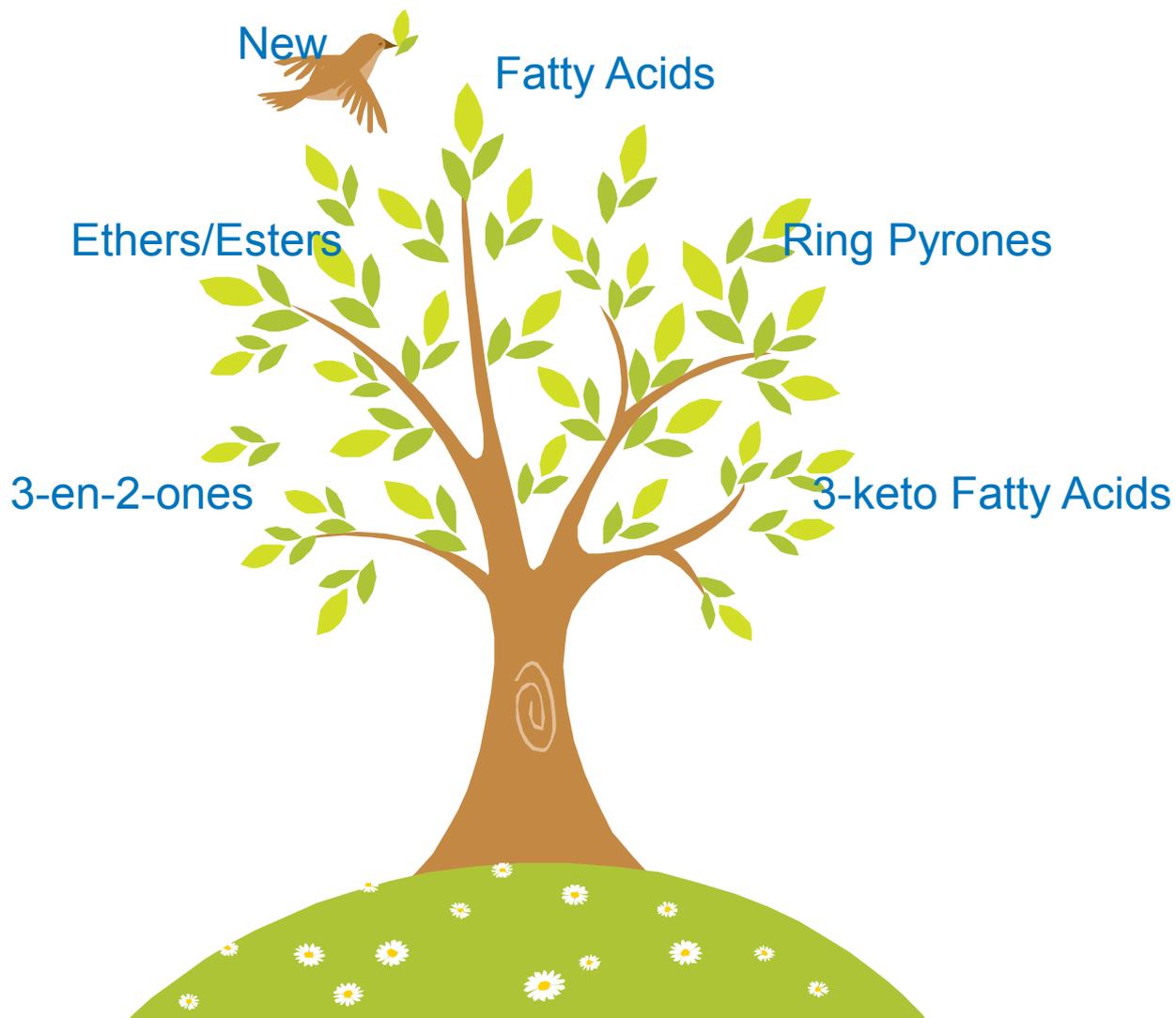
Petrochemicals



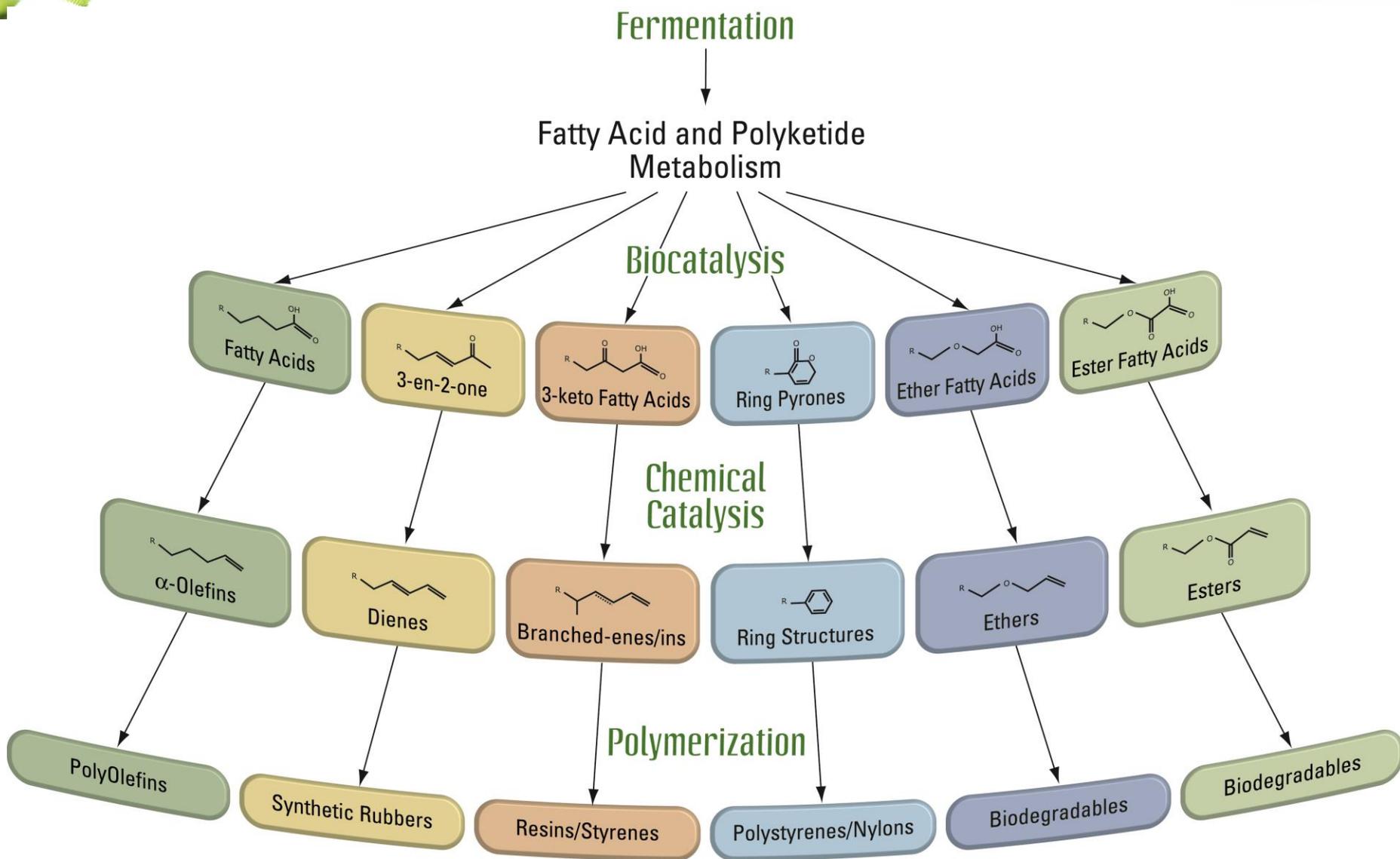
CBiRC Approach



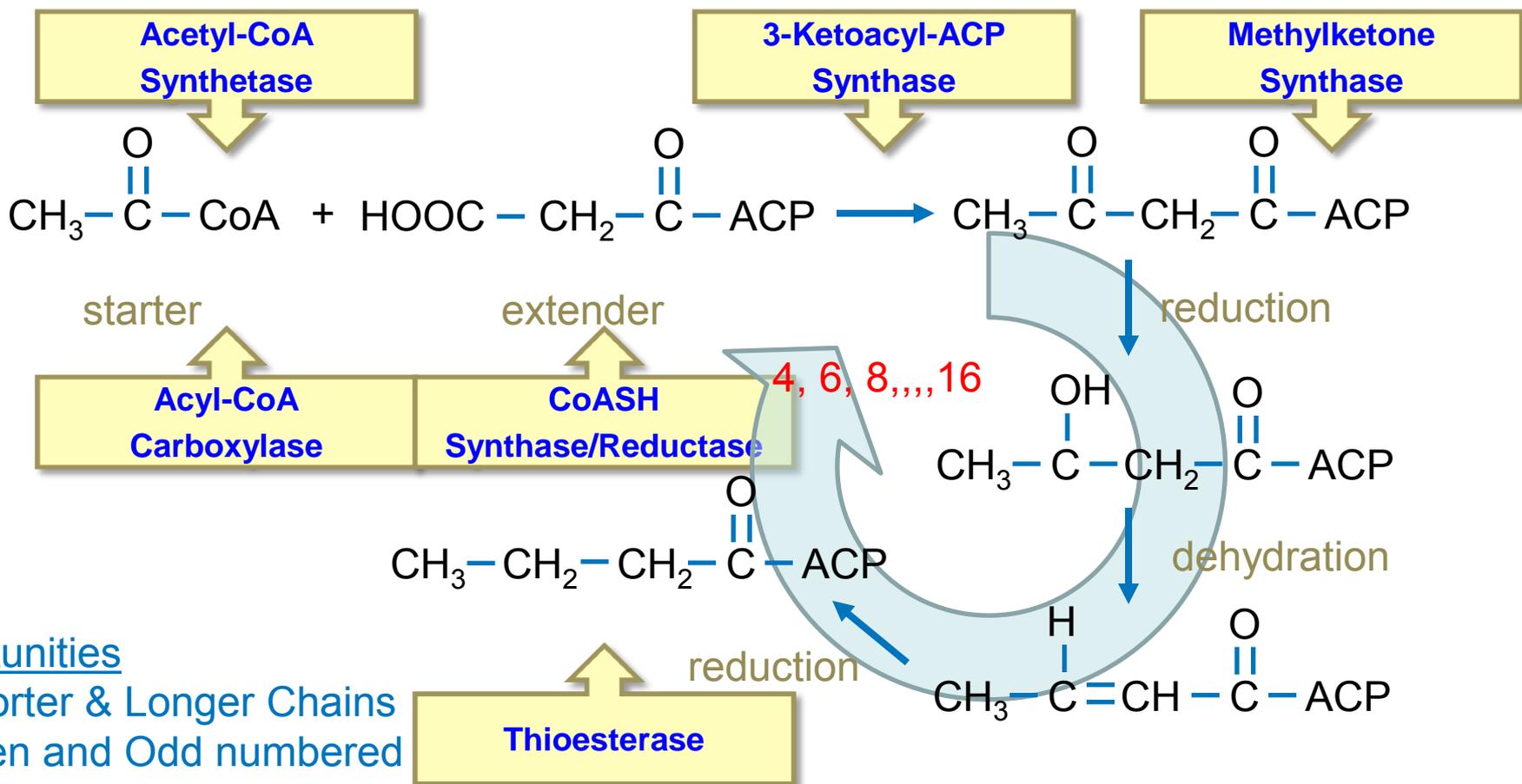
Biobased Chemicals



Array of Opportunities



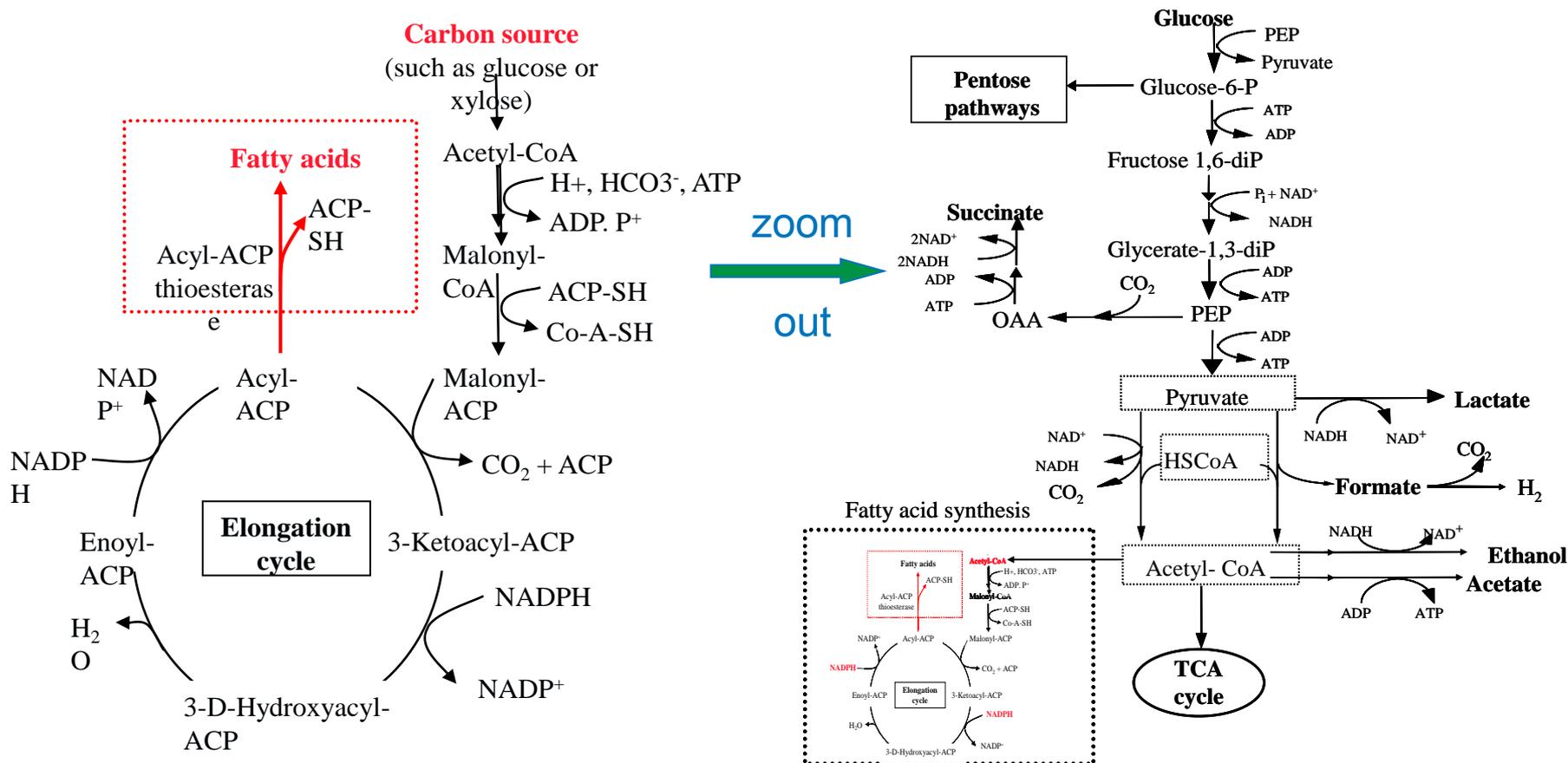
Fatty Acid Biosynthesis



Opportunities

1. Shorter & Longer Chains
2. Even and Odd numbered
3. Straight & Branched chains
4. Diversified Chemistry

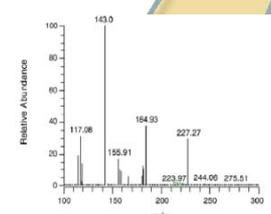
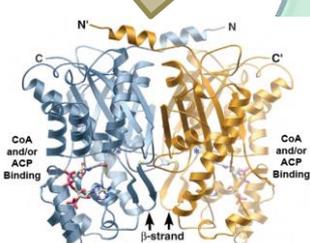
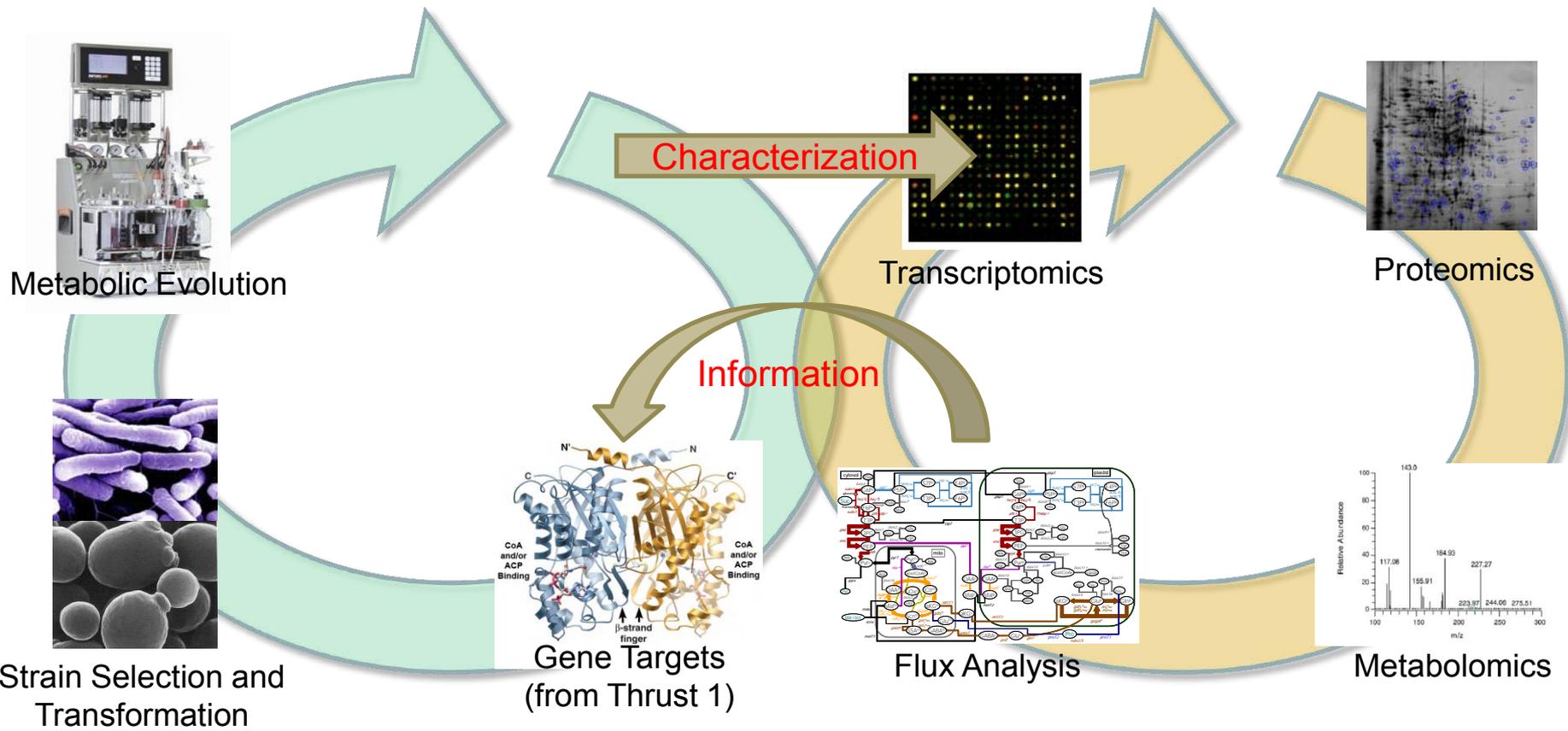
Microbial Engineering



Metabolic Engineering

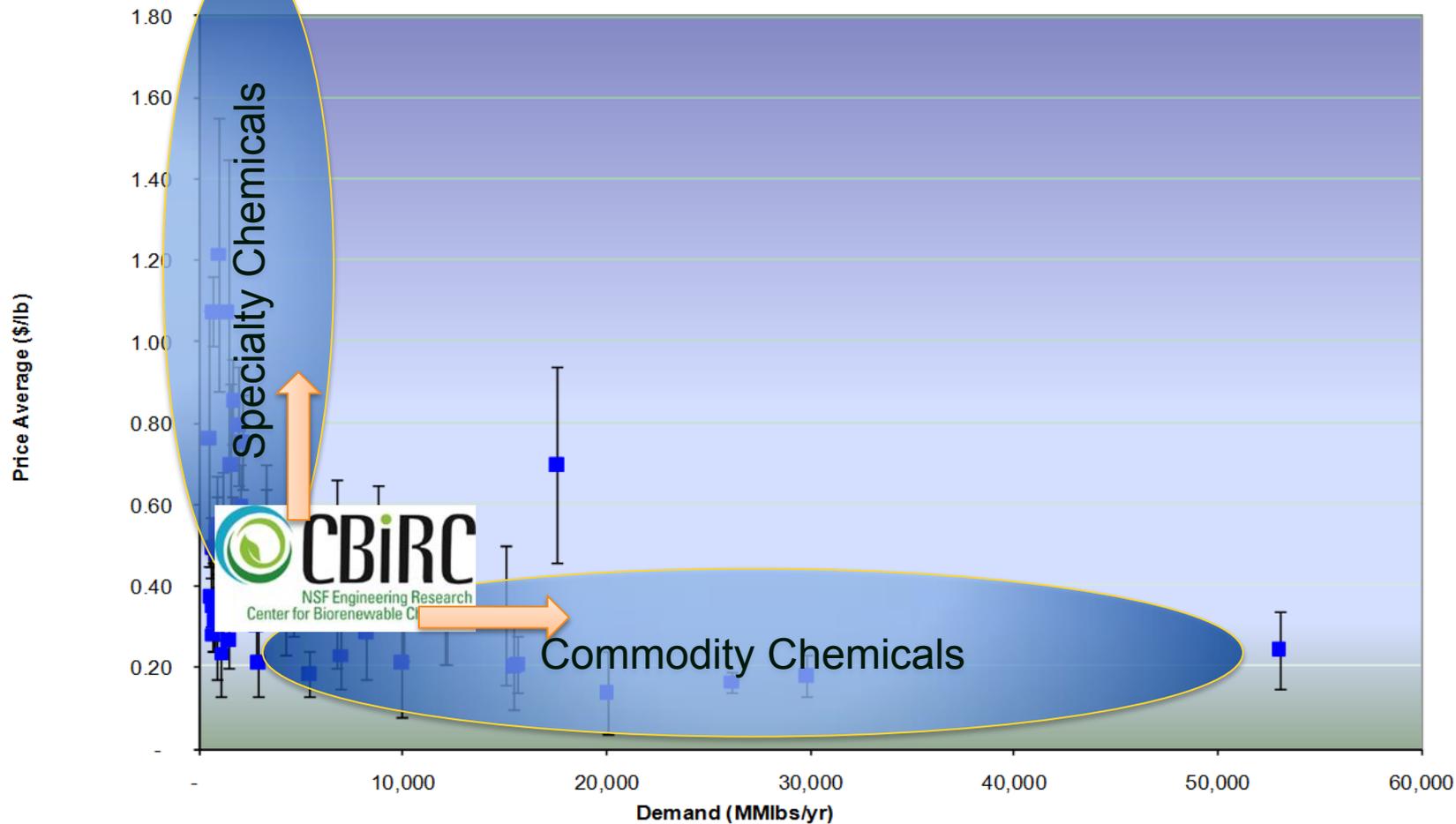
Strain Selection and Evolution

Omics and Flux Analysis

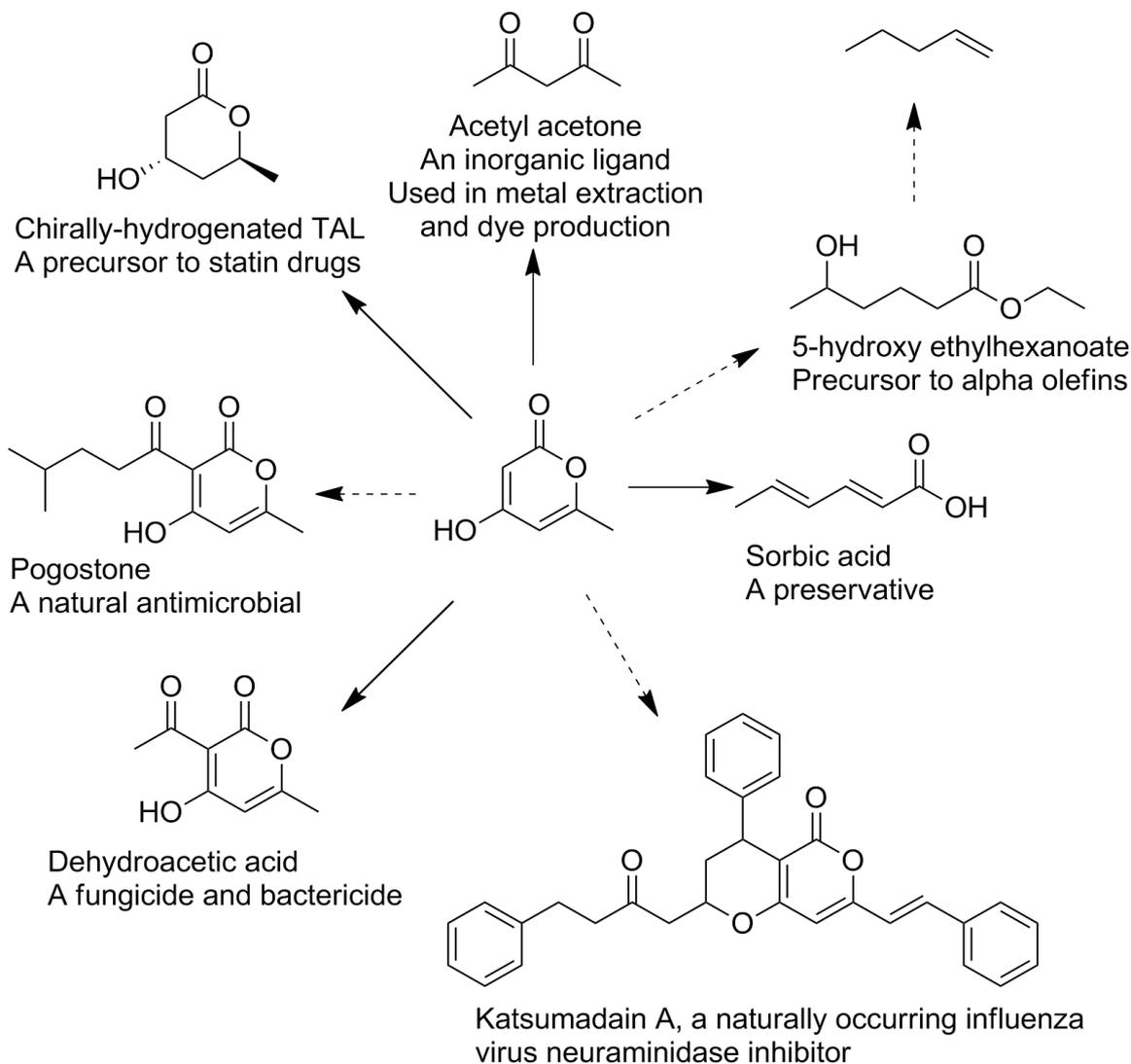


Specialty & Commodity Chemicals

Value (\$/lb) of
Largest Volume Organic Chemicals

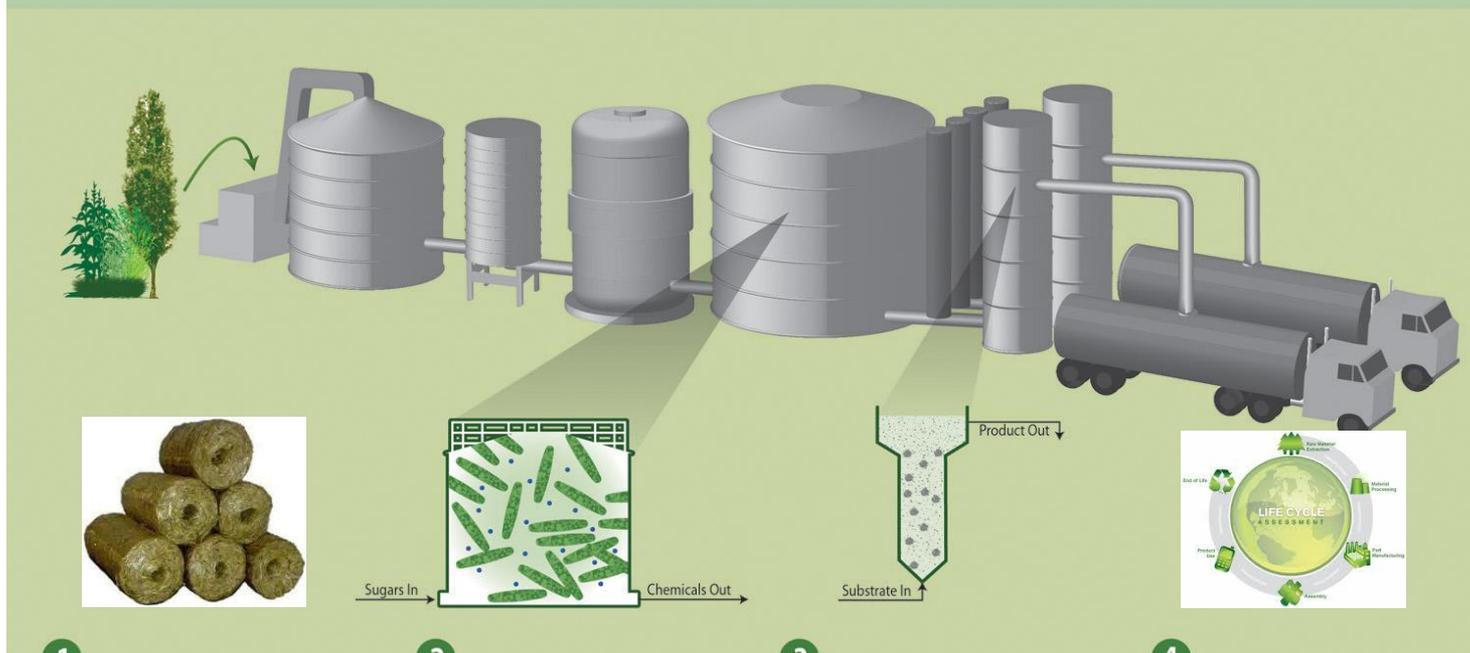


Triacetic Acid Lactone Platform



Implementation

Biorenewable Chemical Production Steps



1

Biomass Production, Delivery, and Treatment

Harvested biomass is ground and pretreated with heat, chemicals, and enzymes to release sugars.

2

Sugar Fermentation

Novel microbes ferment sugars into chemicals.

3

Catalytic Processing

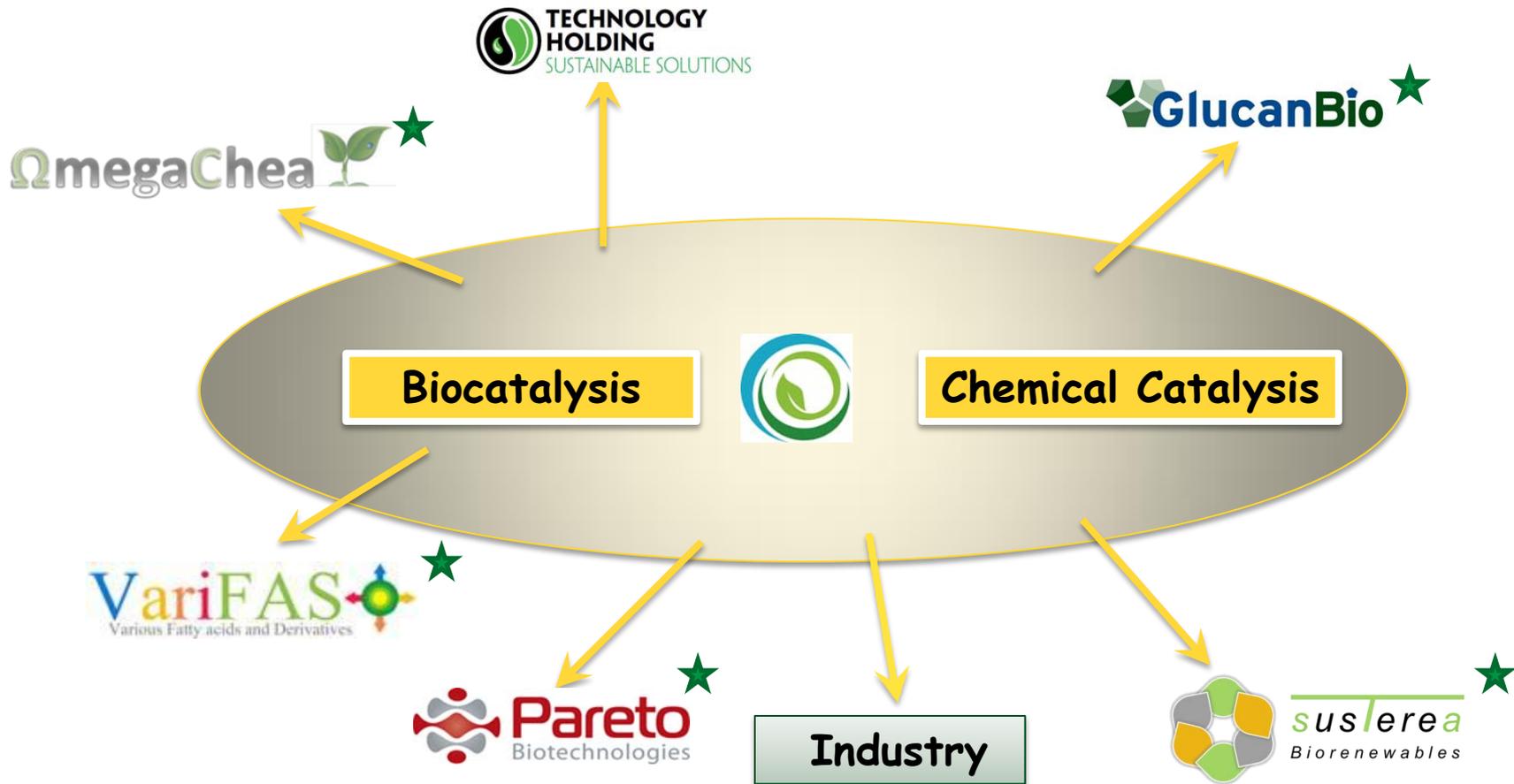
Chemicals are extracted and converted using chemical catalysis to the final product.

4

Commercialization and Sustainable Production

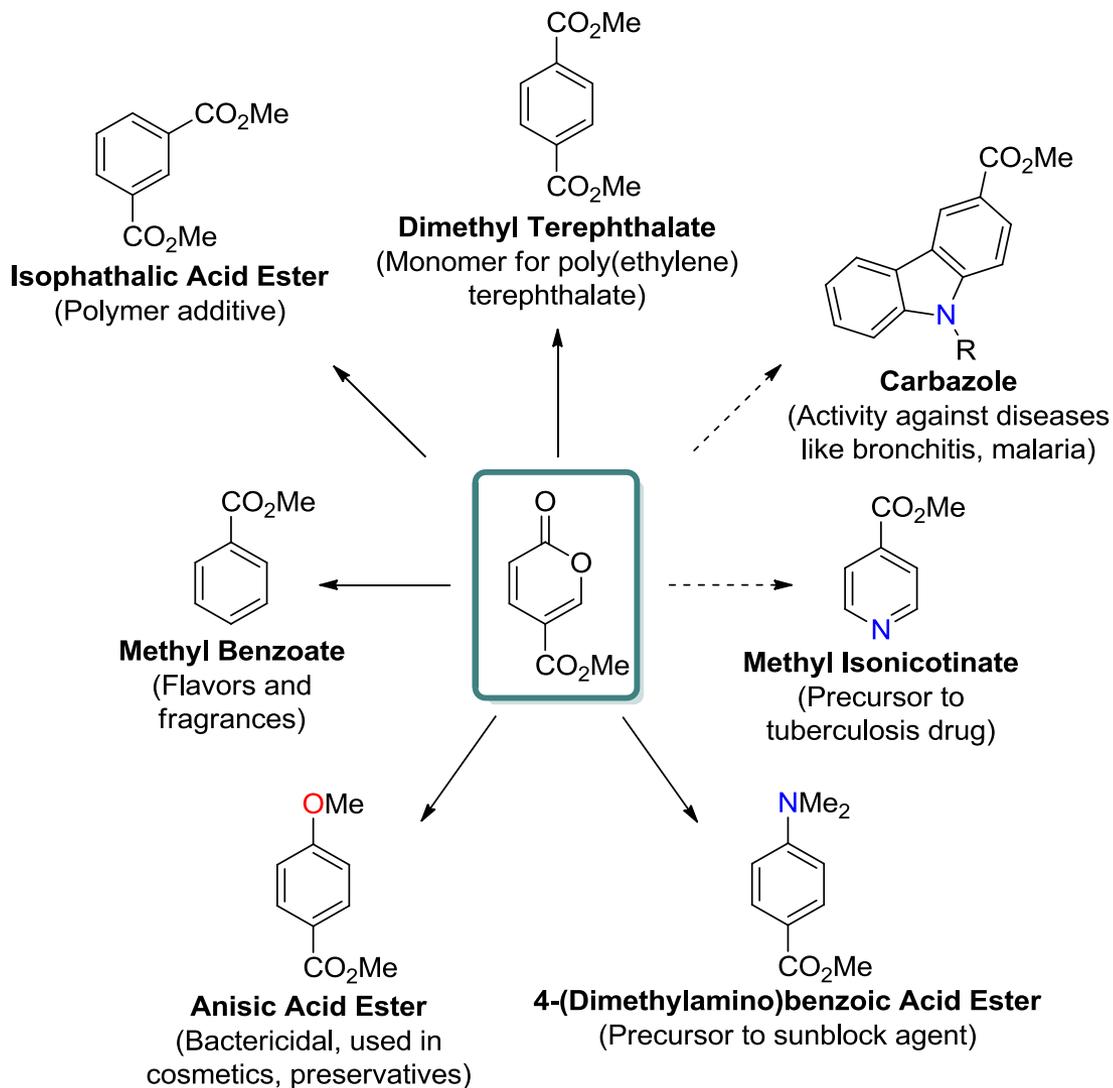
Final product is evaluated for sustainability and techno-commercial feasibility.

Technology Transfer



★ **CBiRC Startup Companies**

SusTerea Example



susTerea
Biorenewables

Acknowledgements

Allylix

ASHLAND
With good chemistry great things happen.™

BASF
The Chemical Company

Cargill

**Chevron
Phillips**
Chemical Company LLC

CONAGEN

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**SOUTH DAKOTA
INNOVATION
PARTNERS**

susterea
Biorenewables

**TECHNOLOGY
HOLDING**
SUSTAINABLE SOLUTIONS

**The BioBusiness Alliance
of Minnesota**

TORAY
Innovation by Chemistry

VariFAS
Various Fatty acids and Derivatives



Thank you