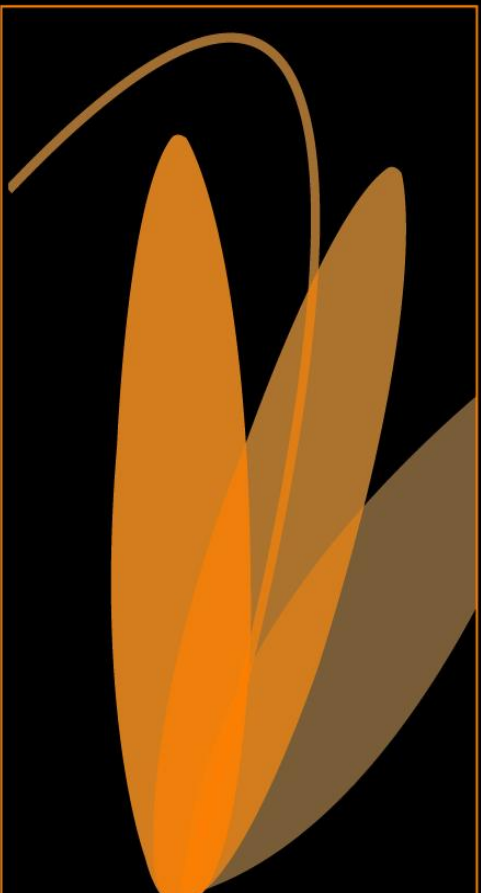


# Malaysian Life Sciences Capital Fund

## Technology and Innovation – The key to Firm Competitiveness?



*Malaysian  
Life  
Sciences  
Capital  
Fund*

**Dr. Ganesh M Kishore**  
**Kuala Lumpur**  
**September 26, 2011**

# Key Messages

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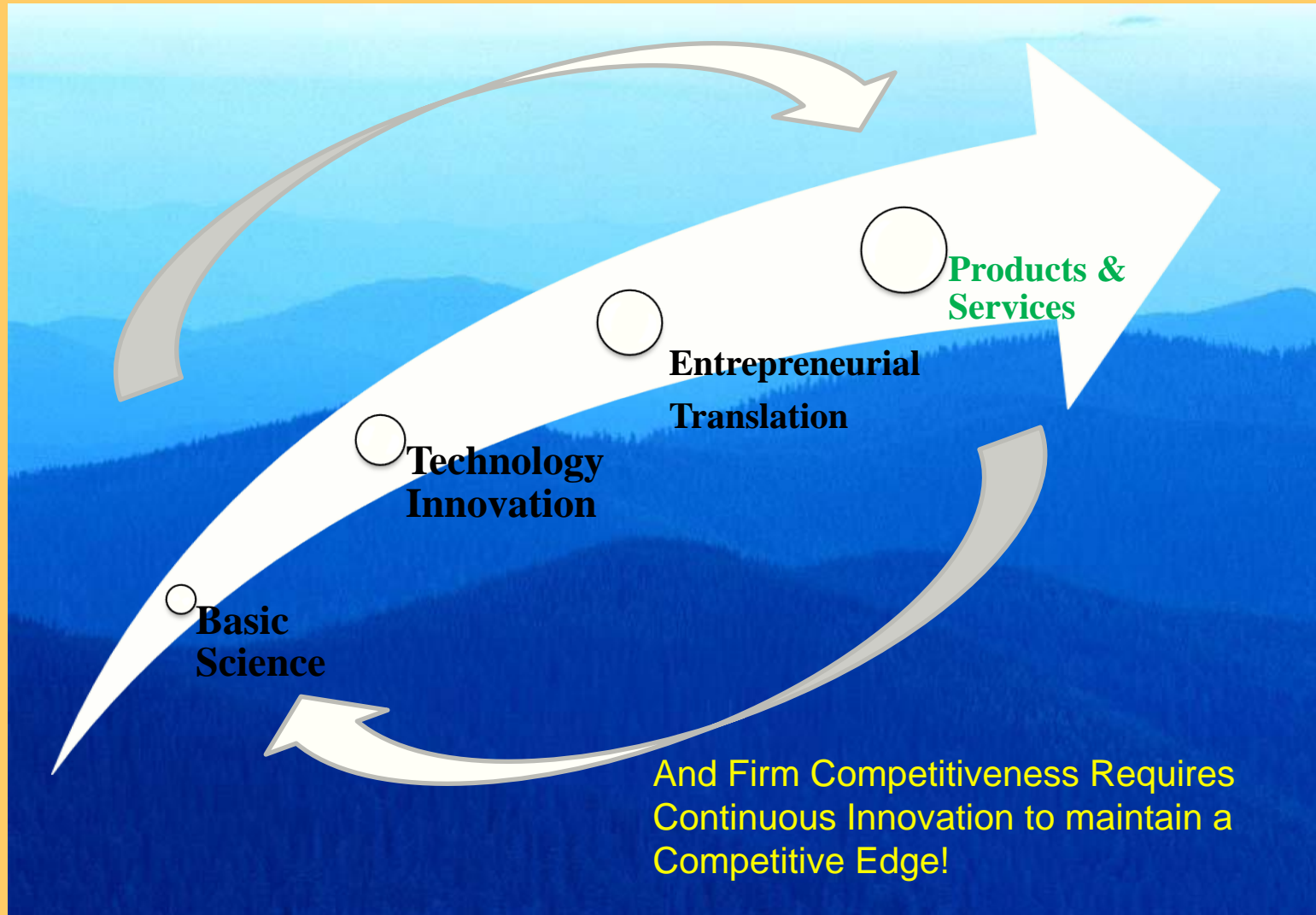
- New technologies are essential to address major unmet societal needs for diverse goods and services and will shape new businesses
- Innovation is more than R&D – innovation is essential to transform new technology to new businesses
- Interdependencies – within and outside institutions is an integral part of high quality innovation
- Focus, Leadership & Enabling Environment are essential to nourish innovation and its deployment

# The MLSCF

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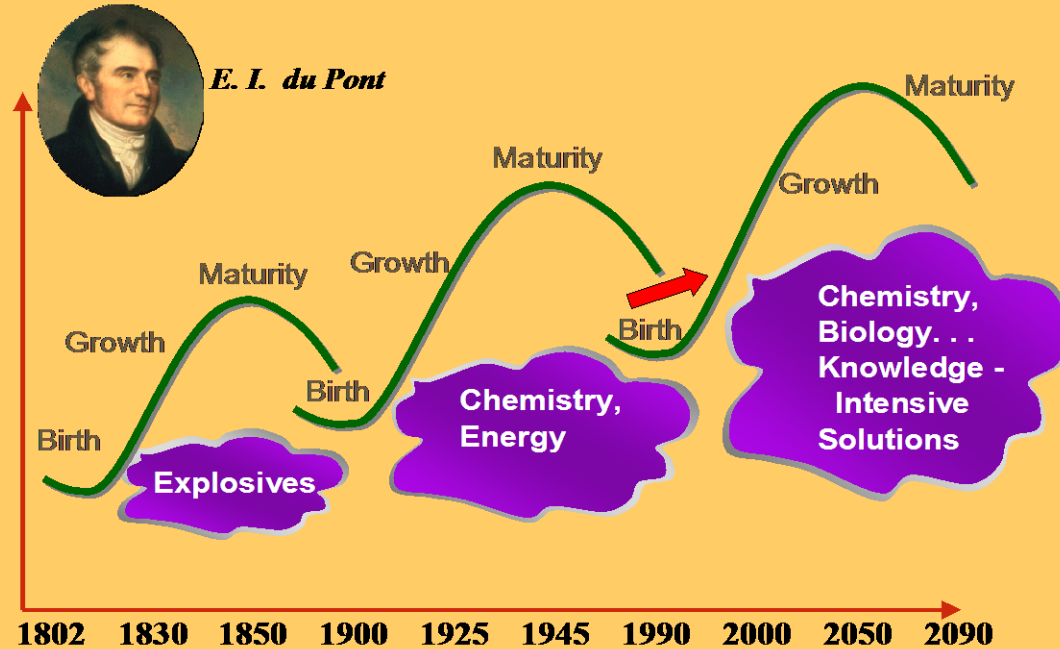
- Privately managed, US \$162 Million Fund
- Investors - Malaysian Institutions
- Implementing Malaysia's objective of building an innovation led economy; establish Malaysia as a player in the biotech industry
- In operation since November 2006
- Best practices of Venture Investment in US
- Investments across life science businesses
- Global investments with Malaysia relevance

# The Innovation Value Chain



# Innovation led change is a part of emerging and established businesses

- The case of DuPont



# Examples of Innovation Led Companies

A mix of large, mid and small cap across sectors

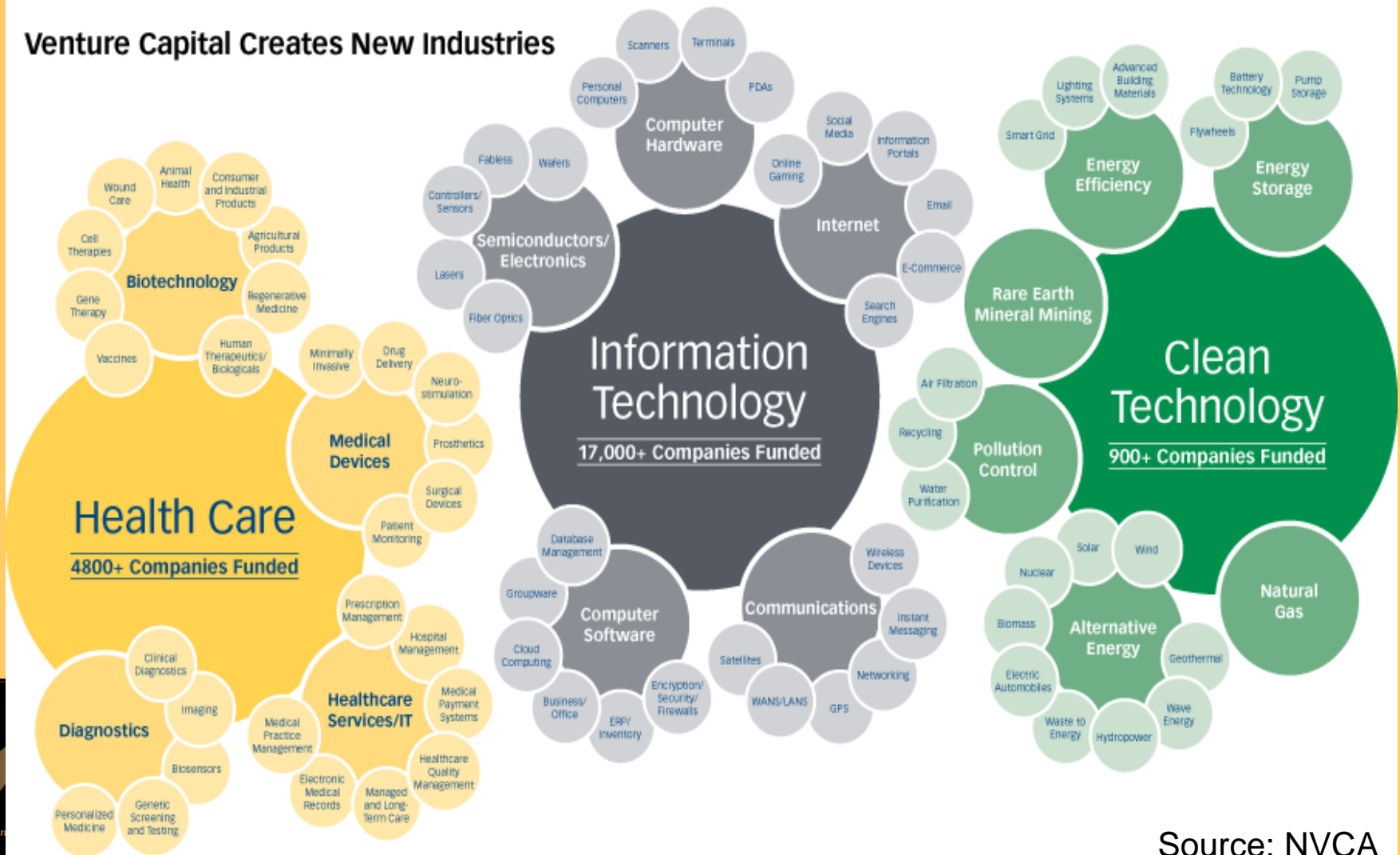


Source: NVCA



# Innovation Led Economic Sectors

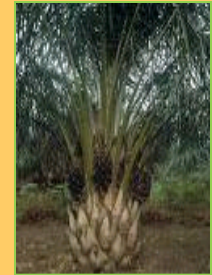
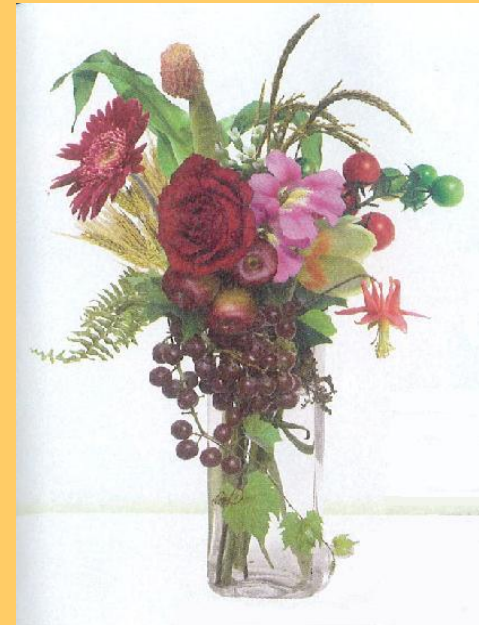
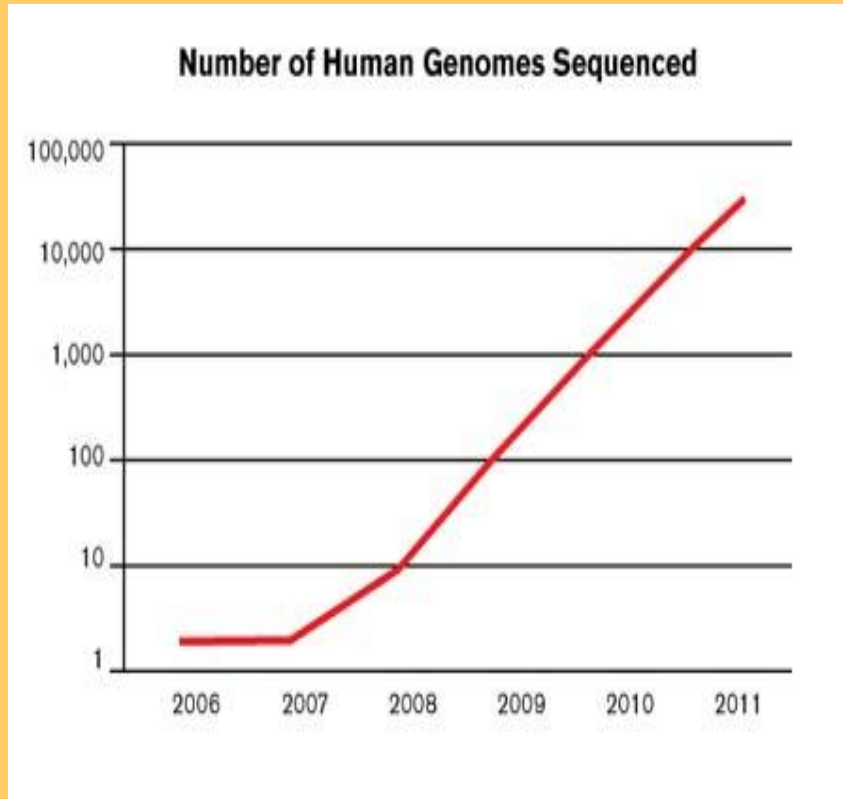
## Venture Capital Creates New Industries



Source: NVCA

# DNA synthesis and Sequencing

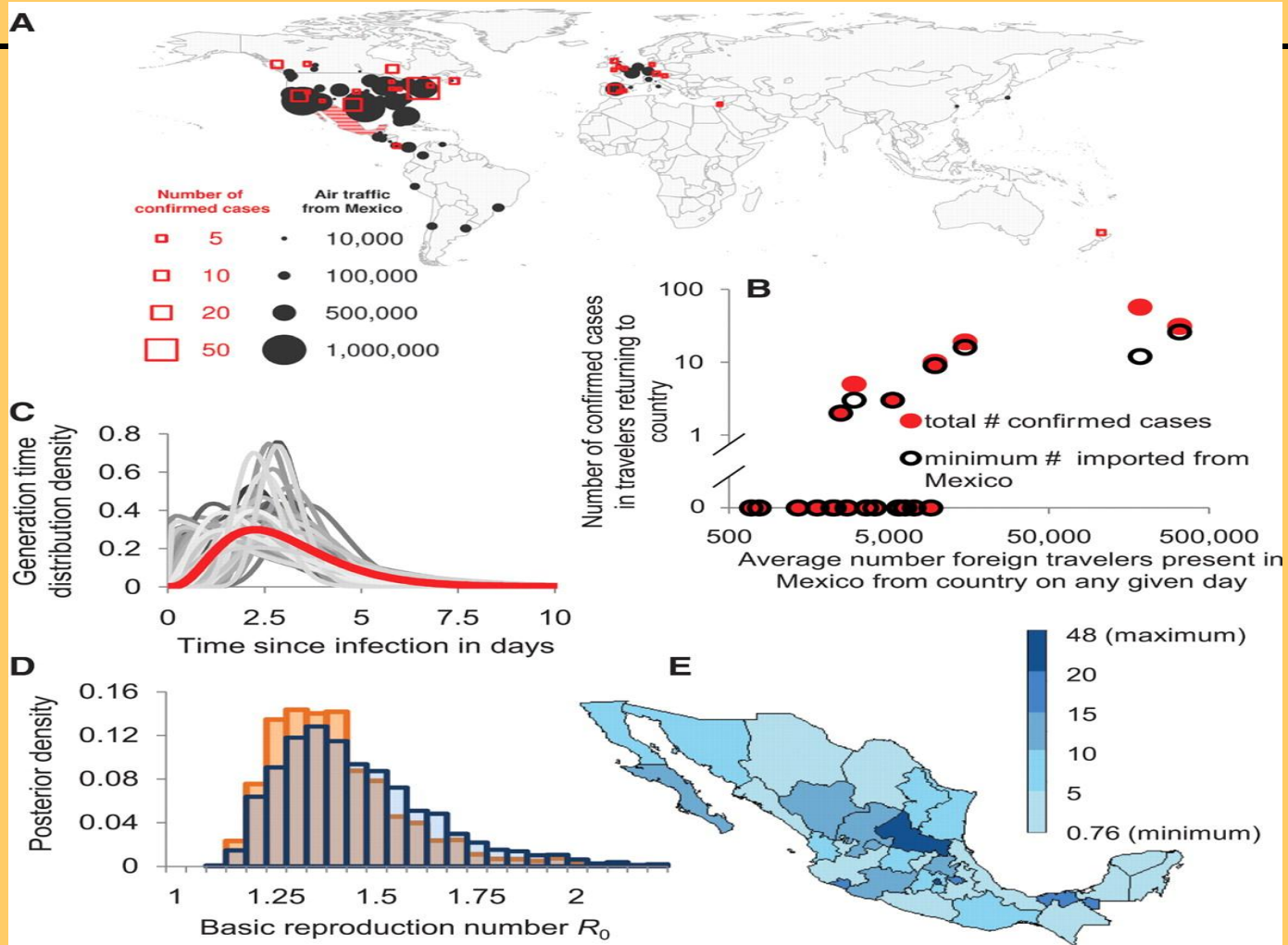
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**And gene transfer and expression are at the heart of modern biotechnology**



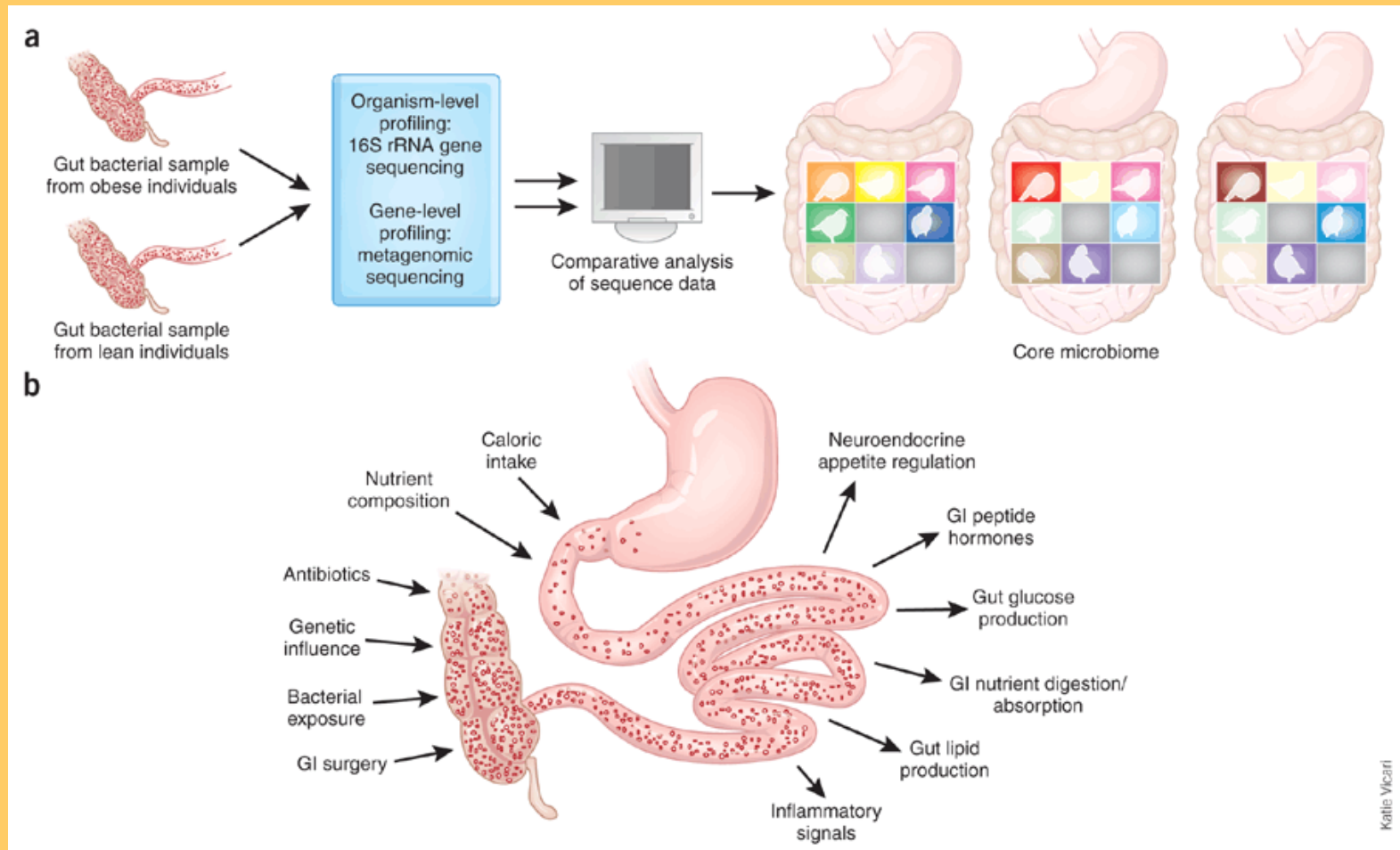
# Genomic Tools – Applications



C. Fraser et al., Science 324, 1557 -1561 (2009)

H1 N1 Pandemic

# Metagenomics – an emerging discipline



With significant applications inside and outside of human gut!

# Building Body Parts

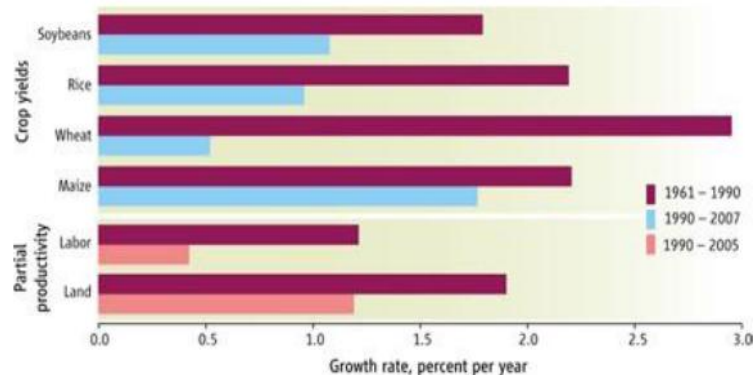
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The need for matching organs continues to escalate:

- Kidneys
- Liver
- Heart
- Lung
- Skin, Cartilage
- Neuronal tissues
- Others??



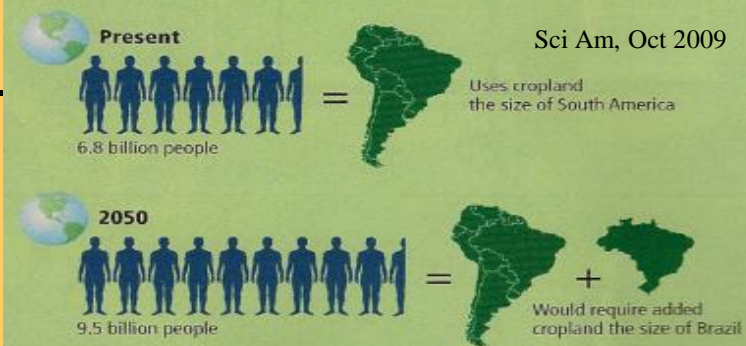
“Organs on Demand” – Stem Cell Technology



J. M. Alston et al., Science 325, 1209-1210 (2009)

## Feeding the Future: Not Enough Land

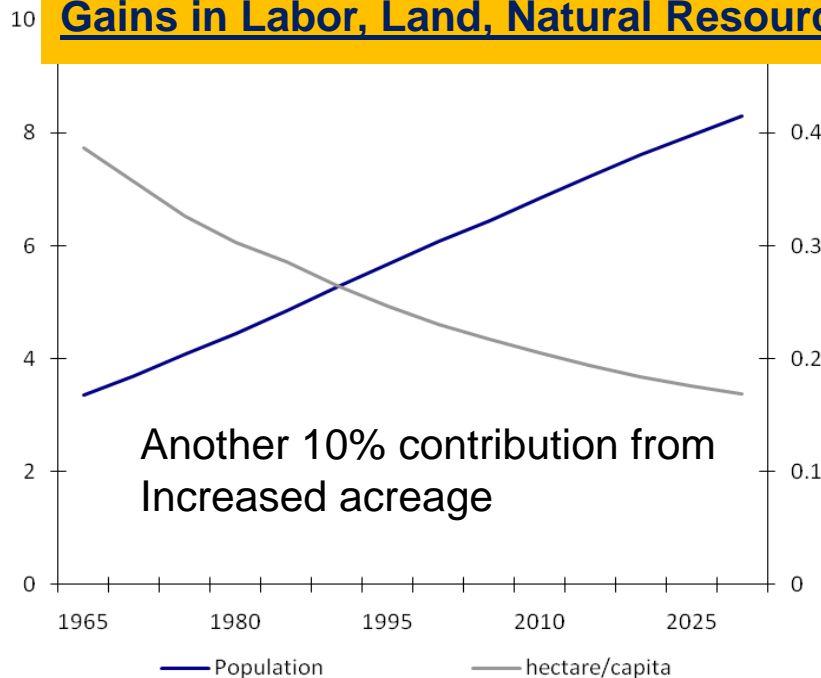
Growing food and raising livestock for 6.8 billion people require land equal in size to South America. By 2050 another Brazil's worth of area will be needed, using traditional farming; that much arable land does not exist.



## Global Population and Agricultural Land Area Available

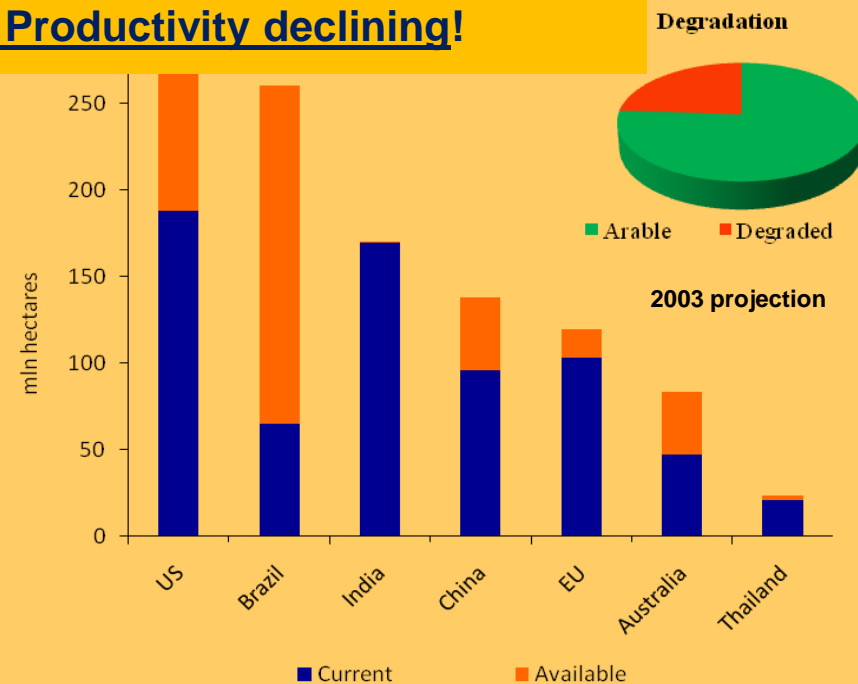
Population (billions); Land (hectare/capita)

**Doing more with less is an imperative, not a choice!**  
**Gains in Labor, Land, Natural Resource Productivity declining!**



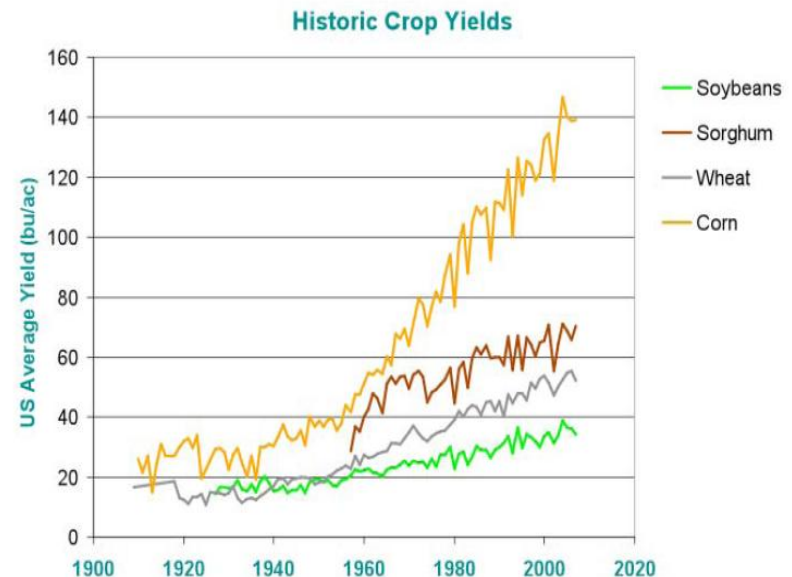
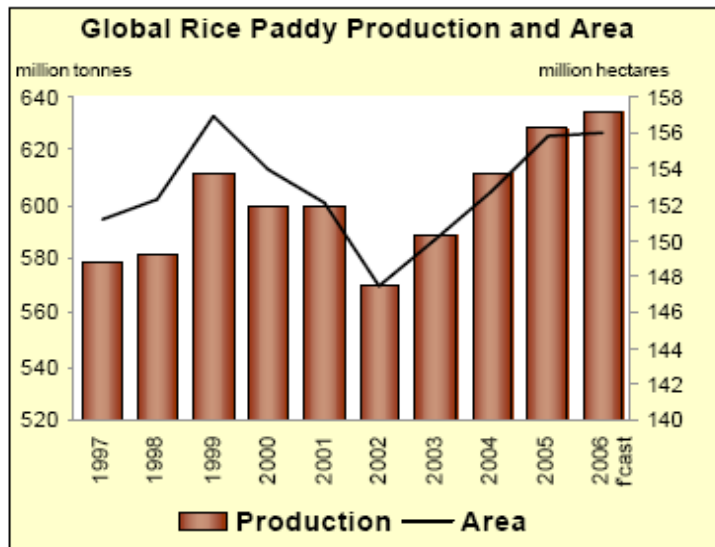
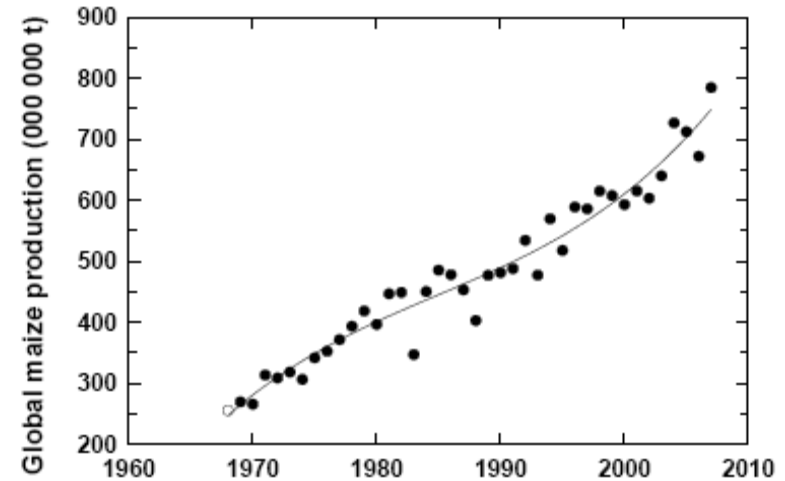
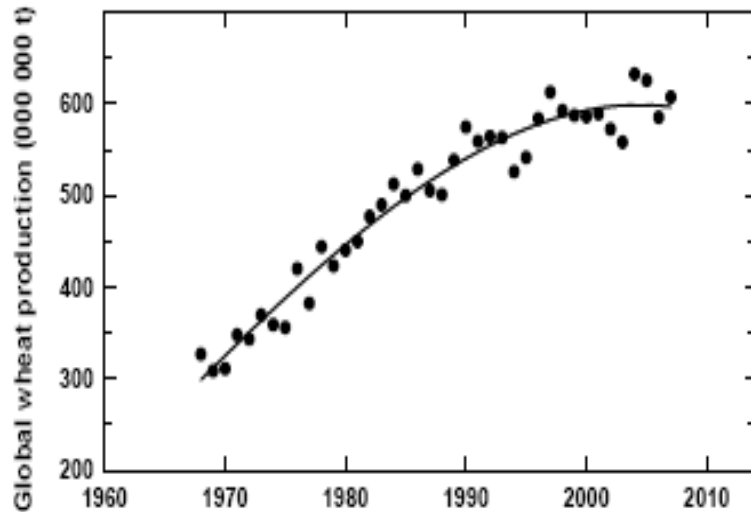
## Agricultural Land Resources, Selected Countries

Index Value: 1985 = 1000



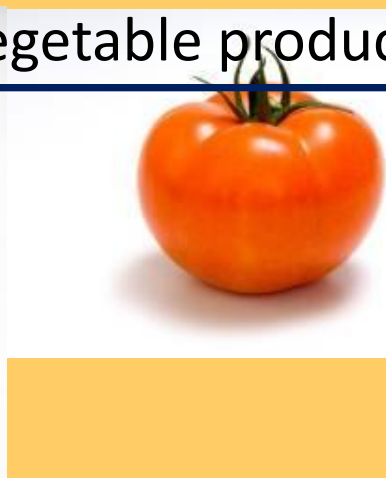
Source: Rabo bank

# Green revolution has peaked; Corn example illustrates potential of Green Bio





Exceptionally wide selection of high-quality vegetable products.



Confidential



# Microbial enhanced oil recovery – an emerging theme!



▲ Oil reservoirs are not underground lakes, but layers of oil-soaked porous rock. This five-centimeter-tall core comes from offshore fields near Sicily that are too expensive to develop with current technology. Its thick veins of oil feel solid to the touch, as if the white, carbonate rock were simply stained.

## THREE STAGES OF RECOVERY

Only 10 to 15 percent of the oil in a reservoir gushes out spontaneously after drilling (*primary recovery, below left*). Once the internal pressure peters out, pumping water or natural gas into the ground forces more oil out (*secondary recovery, center*), so that 20 to 40 percent of the original oil can be extracted. The remaining oil is either trapped in small, isolated pockets—and thus unrecoverable—or too viscous to flow toward the wells. But more advanced technologies [see box on opposite page] can thin out the viscous oil and bring total yield to as much as 60 percent or more (*tertiary recovery, right*).

### PRIMARY

Recovery: up to 15%

Reservoir's internal pressure pushes oil out

### SECONDARY

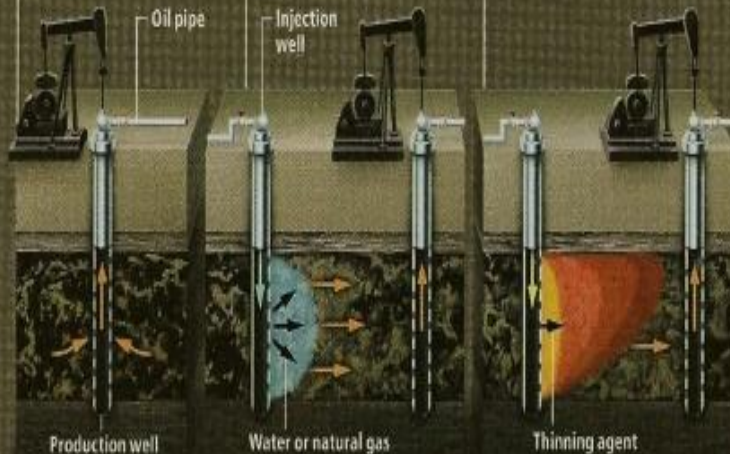
Recovery: 20% to 40%

Water or natural gas push more of the oil out

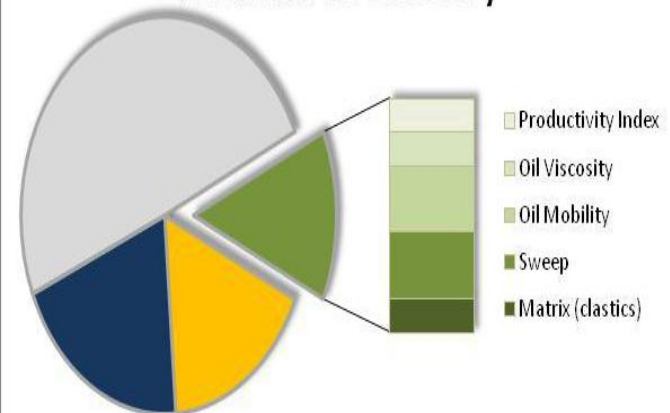
### TERTIARY

Recovery: up to 60%

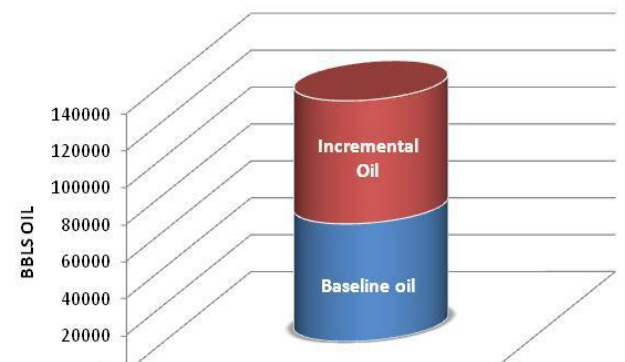
Chemicals, heat or microbes thin out the remaining oil



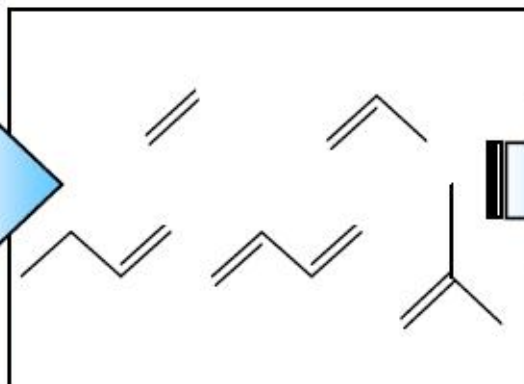
## Enhanced Oil Recovery



## 6 Months Production Data BEOR Treated Wells



# Technology migration from fossil chemistry to biological chemistry



**Organic Chemicals**

**Pharmaceuticals**

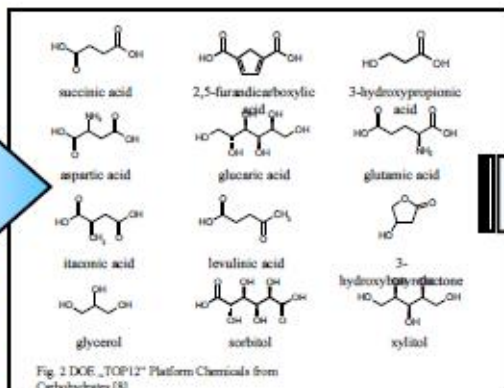
**Fine & Specialty Chemistry**

**Detergent & Hygiene Chemicals**

**Polymers**

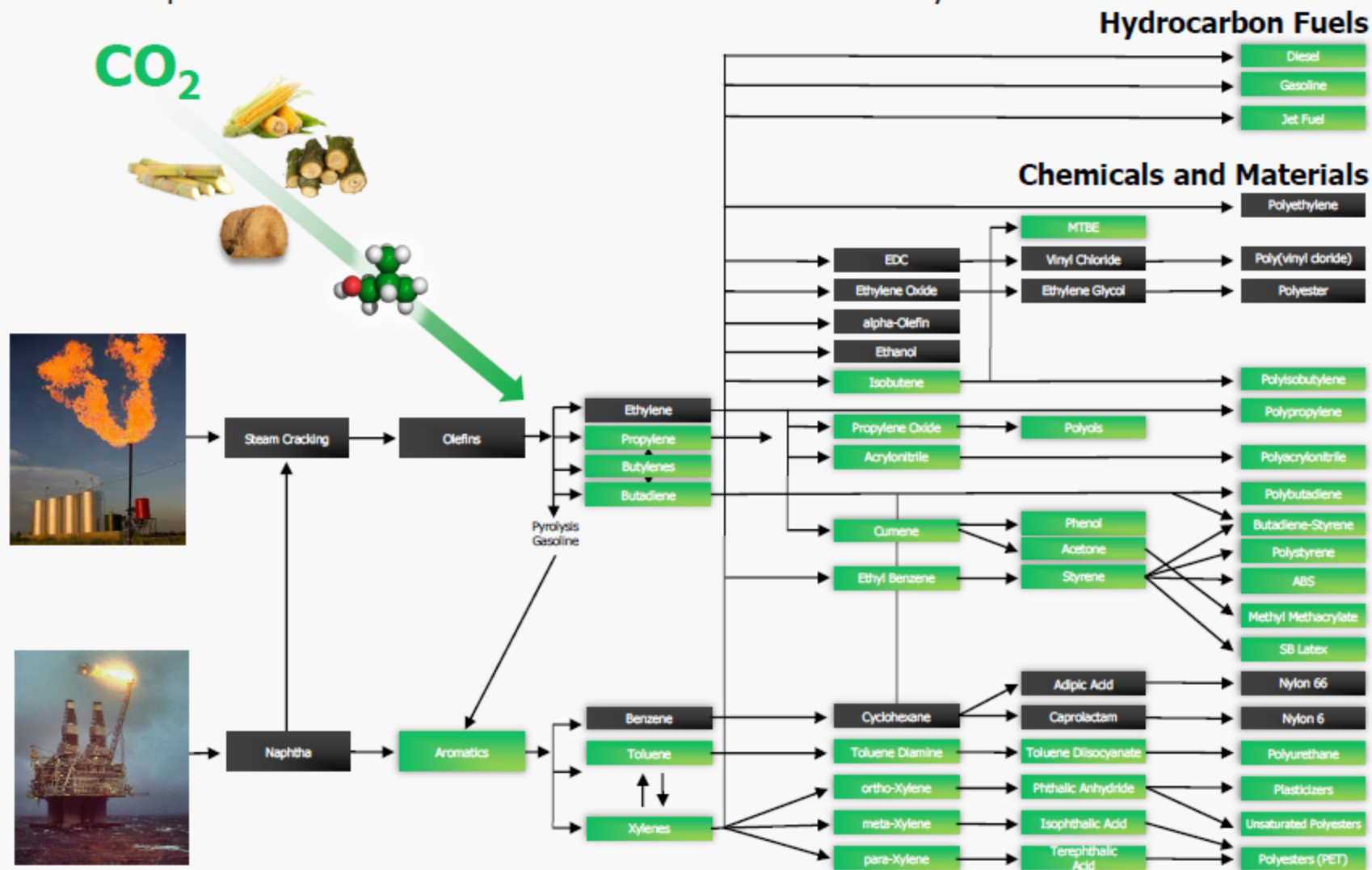
**Petrochemicals & Derivatives**

**Agrochemicals**



# Isobutanol: A Gateway to Chemicals and Fuels

40% of petrochemicals and 100% of all fuels technically enabled





# Focus: Multi-billion \$ CO<sub>2</sub> capture

Flexibility to serve large current markets with future exponential growth

## Large CO<sub>2</sub> Markets

### Economical Today

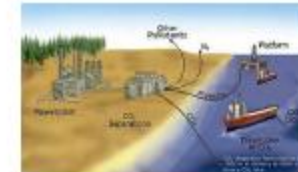
- Hydrogen purification
  - petroleum
  - ammonia
  - 290 million tons
- Natural gas processing
  - 100 million tons

### Regulatory Driven

- Cement kilns
  - 2 billion tons
- Electric utilities
  - 10 billion tons

Akermin's  
stabilized CA  
enables lowest  
cost CO<sub>2</sub> capture  
technology

## Sequestration/Use



Injection



Enhanced  
Oil  
Recovery

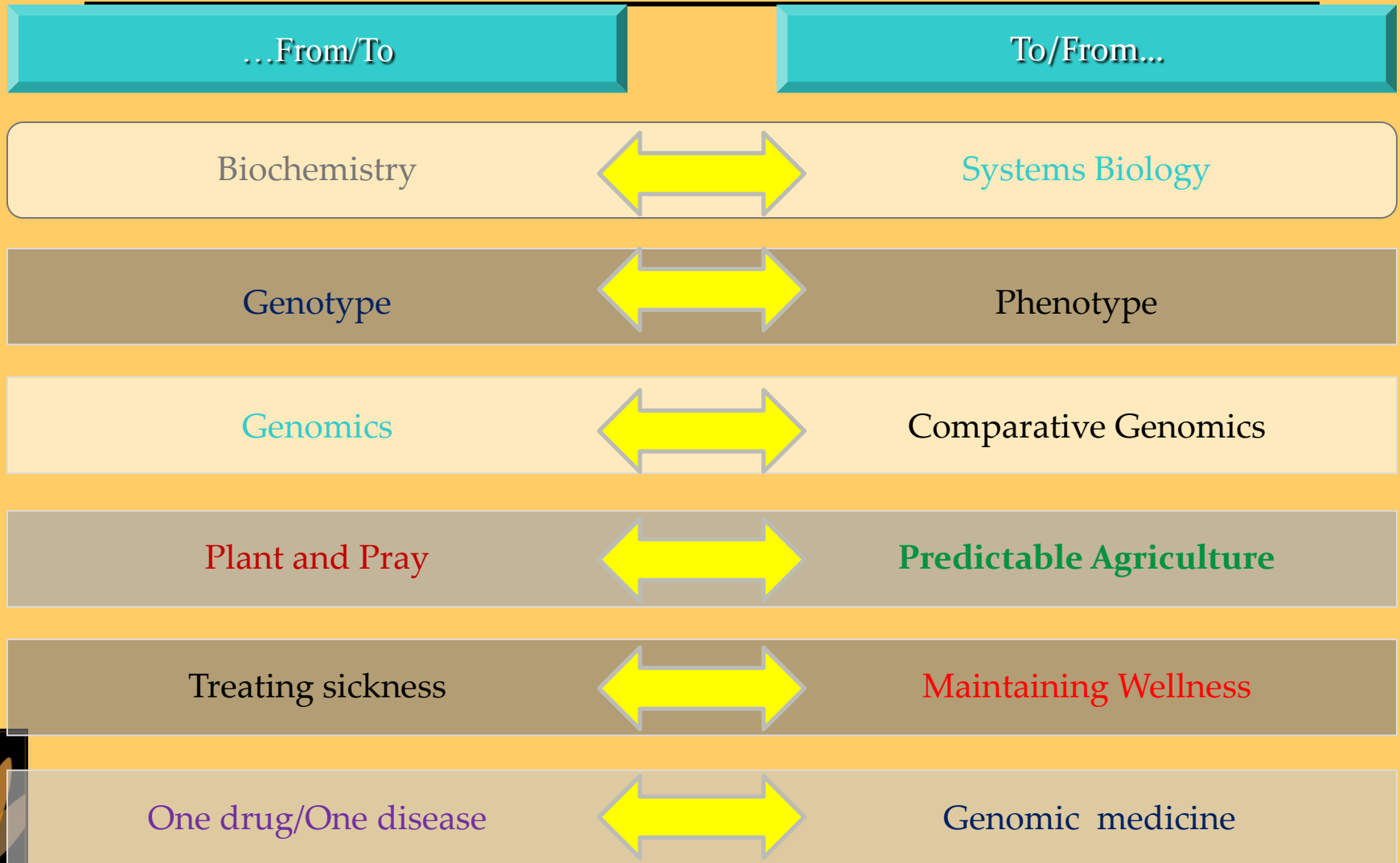


Algal Biofuels

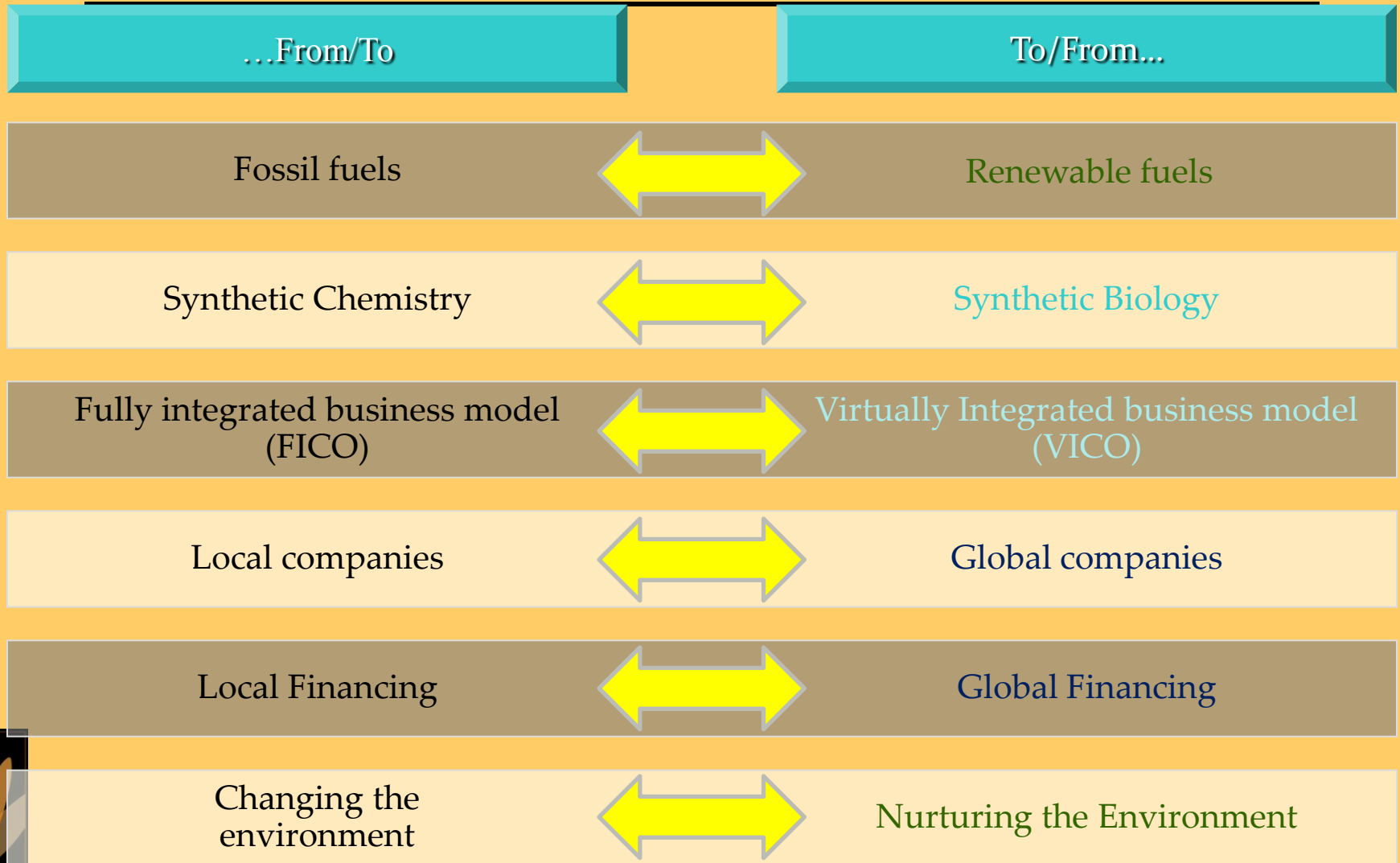


Chemicals

# A Global Transformation ...



# ... Is In Progress





# Innovation Led Companies address Unmet Societal Needs

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- Better products
- Lower cost
- Convenient to use
- Easy access
- . . . . .

## Biotechnology Sectors:

- Human Health Care
- Agriculture
- Natural Resource Management
- Industrial Biotechnology

**Governmental policies and regulations are central  
for the development of new businesses**