

# Future Trends in Research

KAIST **Chemical & Biomolecular Engineering**

**Jae W. Lee**, Department Head  
2017. 10. 03



# Status of the Department

[ August, 2017 Present ]

24

Professors



17

Adjunct Professors /  
Research Professors /  
Post-doctoral Fellows



Graduate Students

375



Undergraduate Students

448

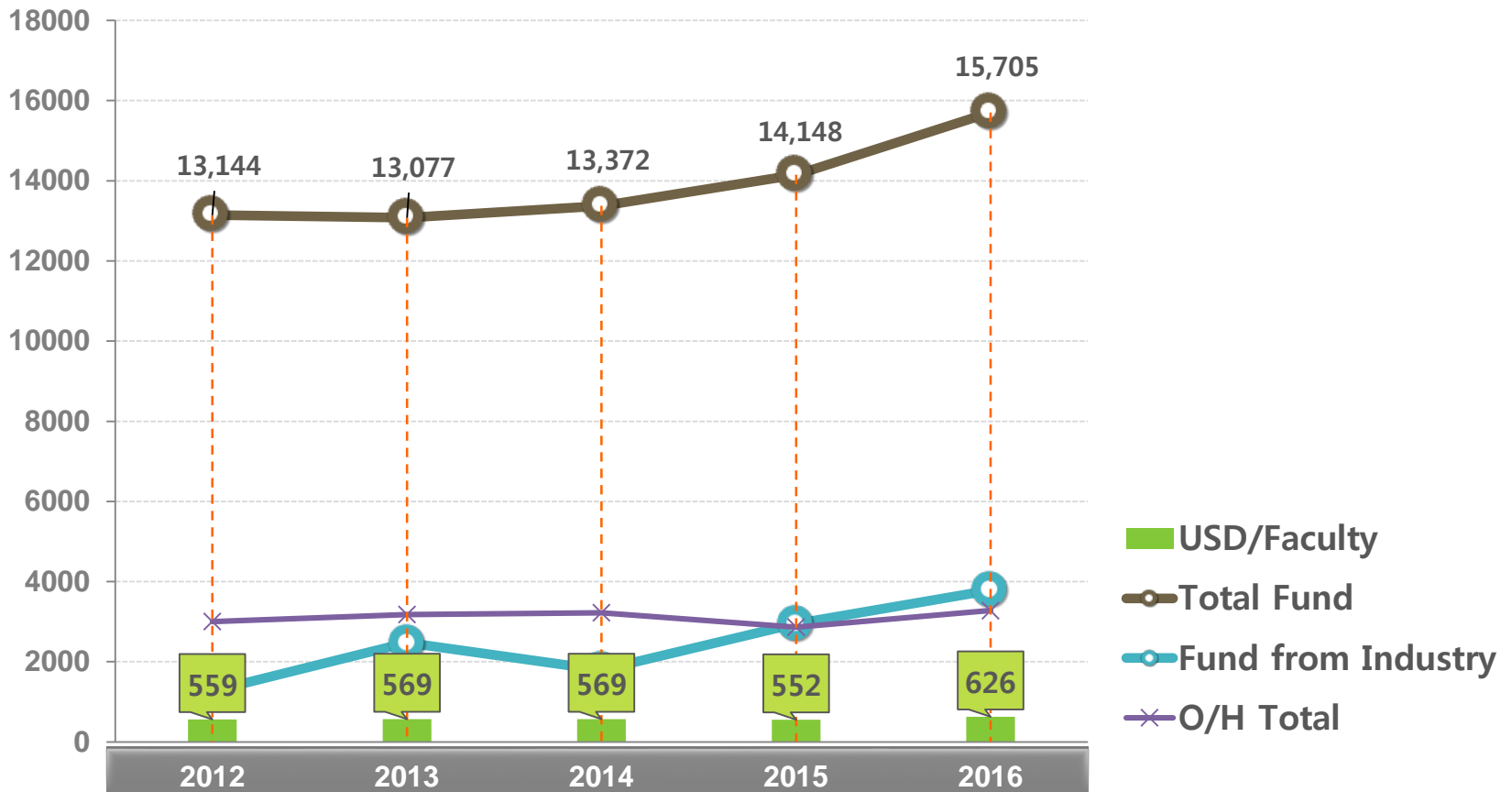
Academic Staff

5

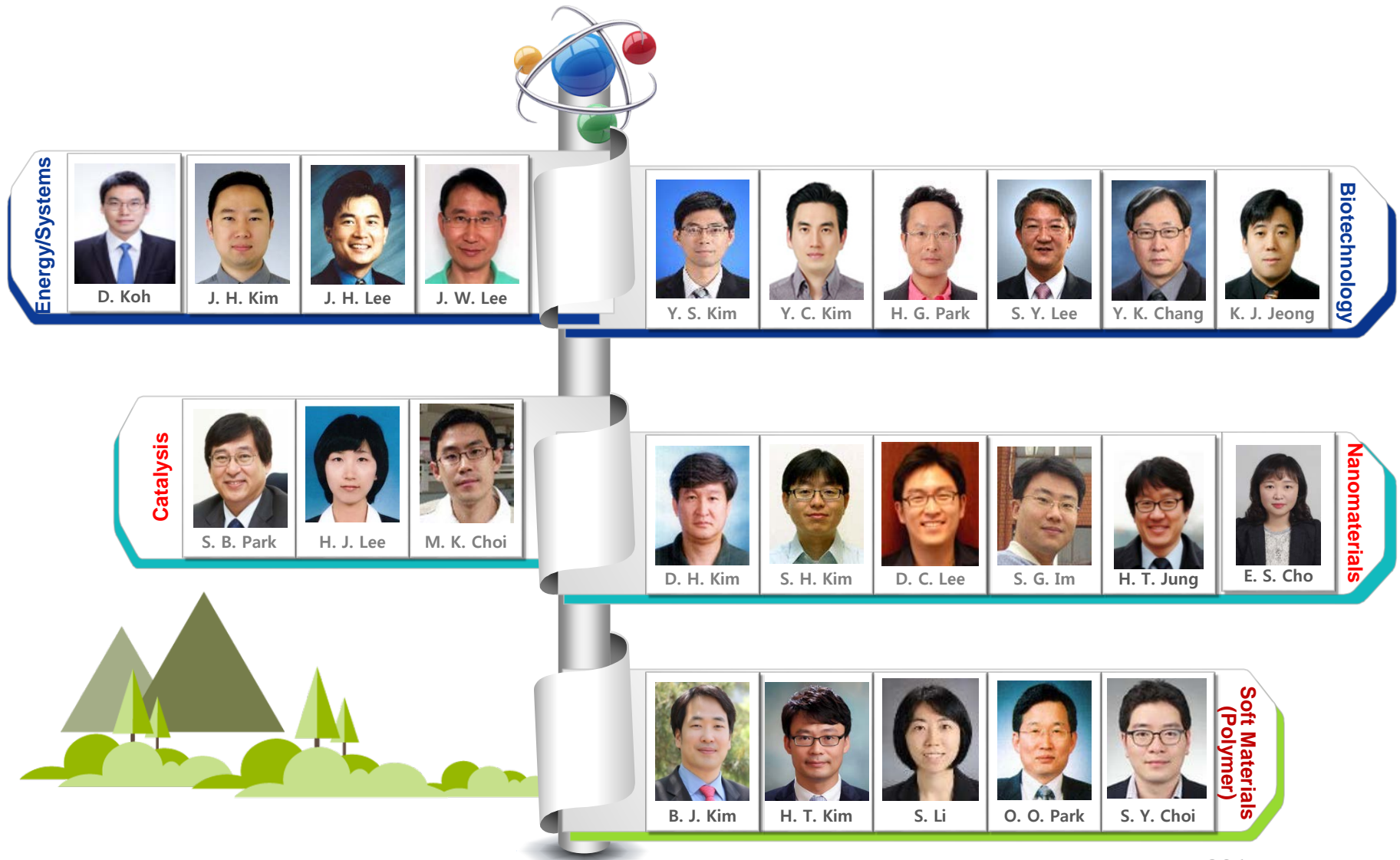
# CBE Research Funding

»» *Five years of 2012~2016*

(Unit : Thousand Dollars)



# Research Areas



# Funding Distribution in Research Areas

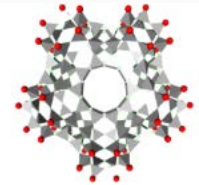
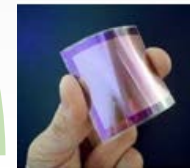
## Energy & Systems

-\$2,976,000 / 4 Profs  
-\$744,000 / Prof



## Polymer & Catalysis

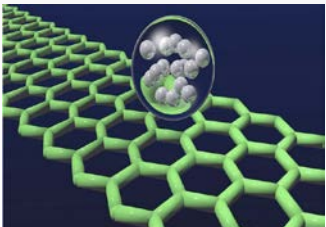
-\$4,565,000 / 8 Profs  
-\$570,625 / Prof



**KAIST**  
**Chemical & Biomolecular Engineering**

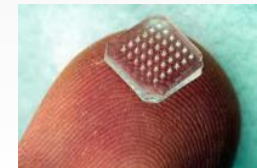
## Nanomaterials

-\$3,045,000 / 6 Profs  
-\$507,500 / Prof



## Biotechnology

-\$5,943,000 / 6 Profs  
-\$990,500 / Prof



# Overall Annual Funding Level (ROK)

**Total: \$ 6,115 MM**

**Ministry of Trade,  
Industry and Energy**  
\$ 527 MM

Industrial research, power  
resource research

**Ministry of SMEs and Startups**  
\$ 780 MM

Small and medium business  
support, startup support

**Ministry of Land,  
Infrastructure and Transport**  
\$ 388 MM

Construction, urban  
architecture, transportation  
research

**Ministry of Science and ICT**  
\$ 3594 MM

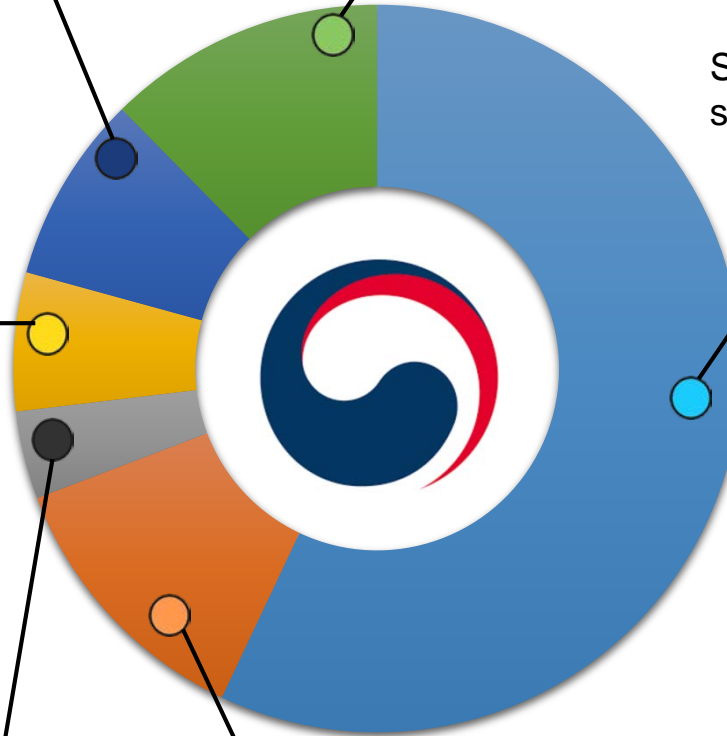
Basic science, technology  
development,  
commercialization

**Ministry of Environment**  
\$ 246 MM

Environmental research

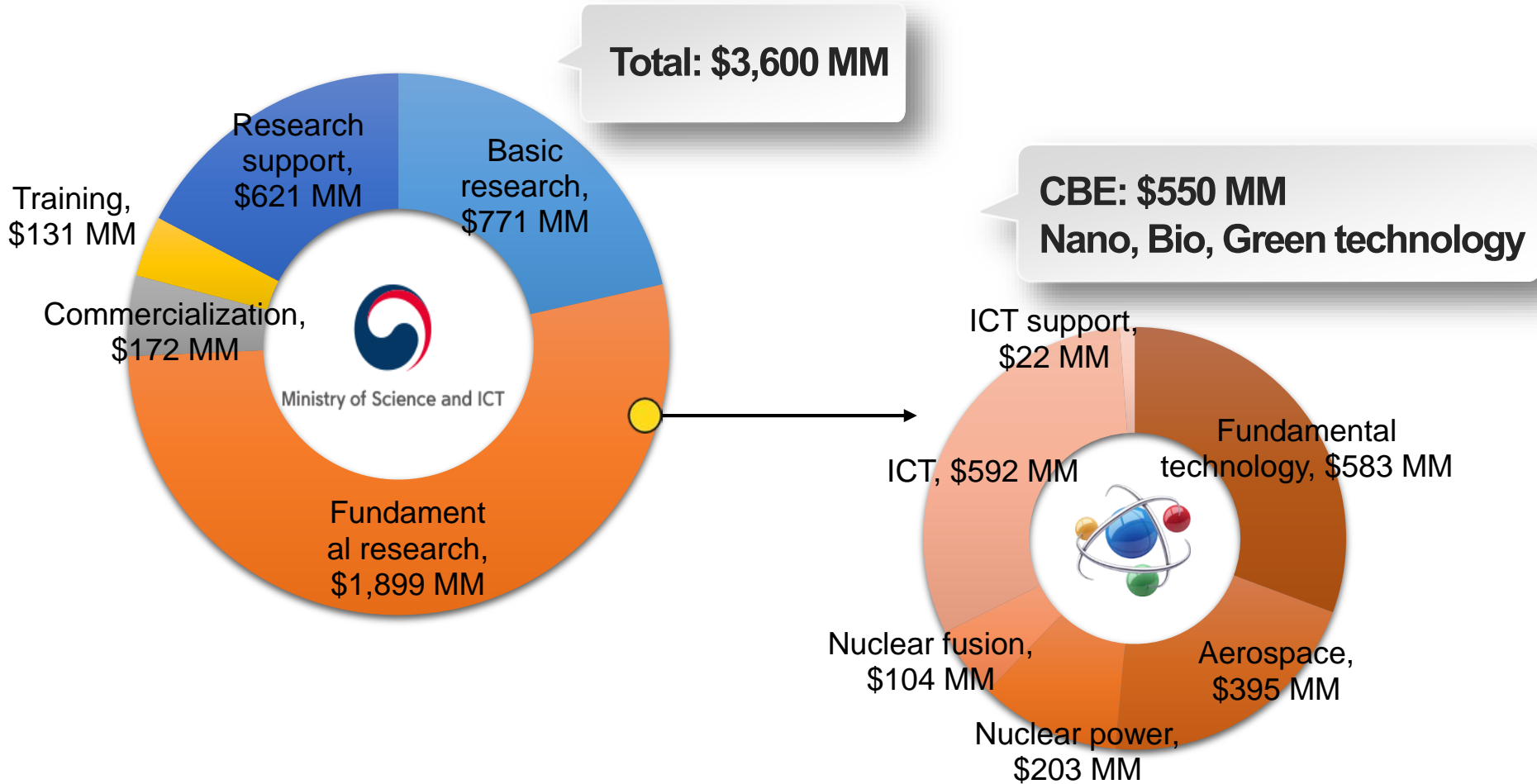
**Ministry of Education**  
\$ 768 MM

BK21, training, education  
support



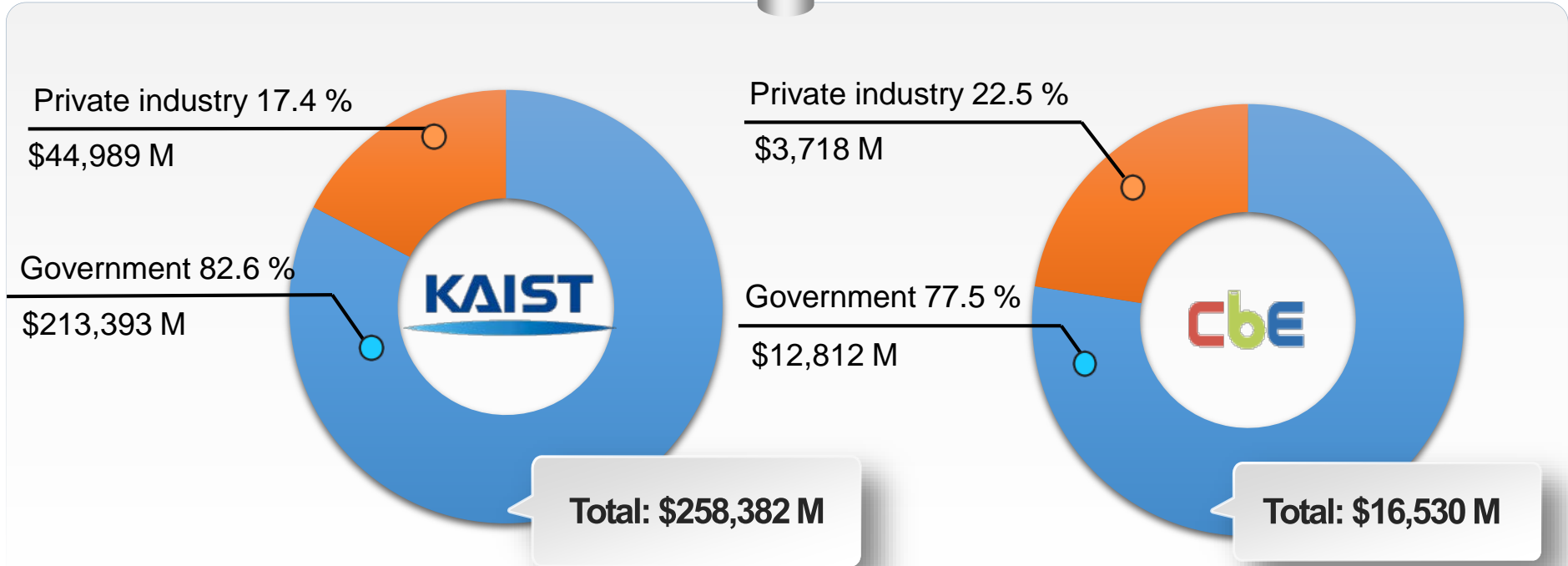
# Main Funding Agencies with Budgets

» Ministry of Science and ICT



# Research Funding

» Government Private industry

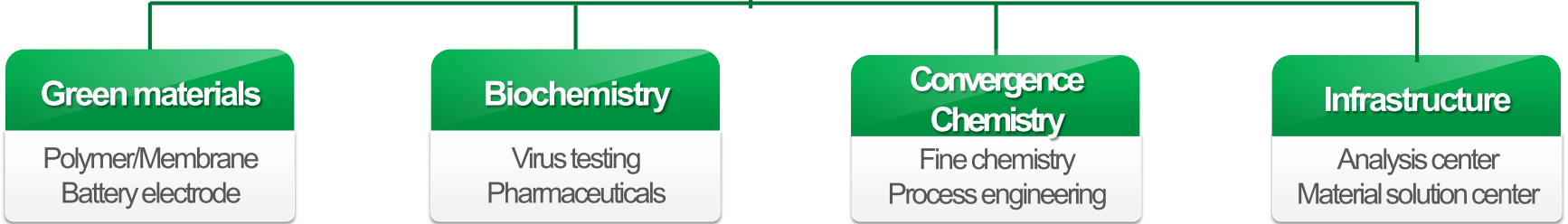




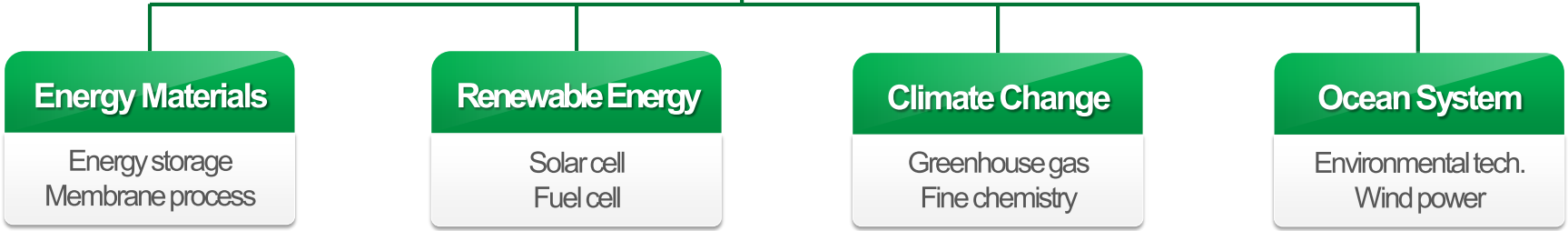
# Korean National Labs



**Korea Research Institute of Chemical Technology (KRICT)**  
 Total government fund: **\$68,175 M**



**Korea Institute of Energy Research (KIER)**  
 Total government fund: **\$66,170 M**



# KAIST vs Korean National Lab



\$ 5,942 M	Material Science	\$ 20,607 M
\$ 2,976 M	Energy system	\$ 19,481 M
\$ 5,943 M	Biotechnology	\$ 12,109 M
\$ 1,668 M	Catalyst/Fine chemistry	\$ 13,972 M
\$ 16,529 M	<b>Total</b>	\$ 66,170 M

# Korean Research Center



## Korea CCS 2020 Objectives

### Capture

- ✓ Non-solvent system
- ✓ Energy exchangeable system
- ✓ Superflux membrane technology

### Storage

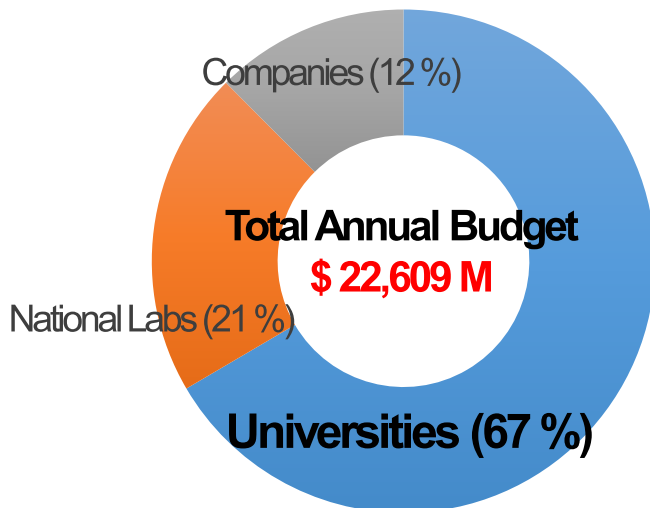
- ✓ Storage facility specification
- ✓ CO<sub>2</sub> diffusion modelling & monitoring

### Conversion

- ✓ Energy storage material
- ✓ Syngas production
- ✓ Polymer chemistry

## Achievements

- ✓ 926 International journal publications (11.11~ 17.4)
- ✓ 116 international patent registrations
- ✓ 11 technology transfers



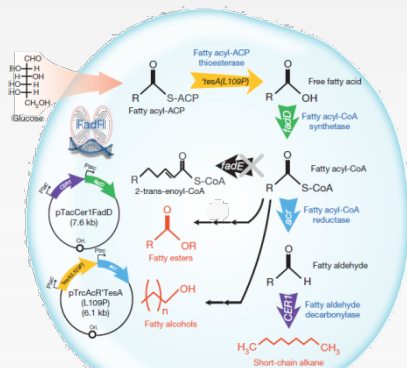
# Research Remarks

## Biomolecular Technology



**Sang Yup Lee**

- Microbial production of short-chain alkanes



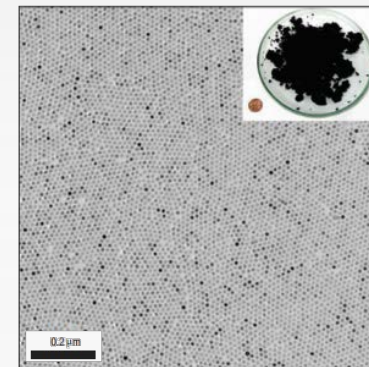
- Nature, 502, 571 (2013)

## Nano Materials



**TAEGHWAN HYEON**

- Ultra-large-scale syntheses of monodisperse nanocrystals (Citation: 2800)



- Nature Materials, 3, 891 (2004)

## Robotics



**Jun-ho Oh**

- Walking humanoid robot, head mounted on a life-size walking bipedal frame



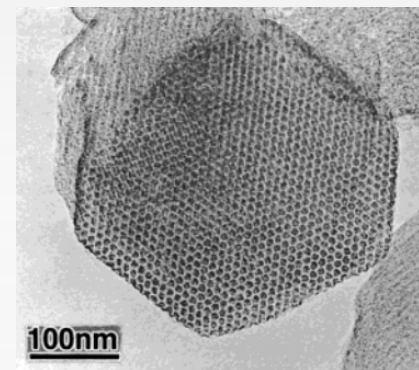
- KAIST Humanoid Hubo

## Mesoporous Materials



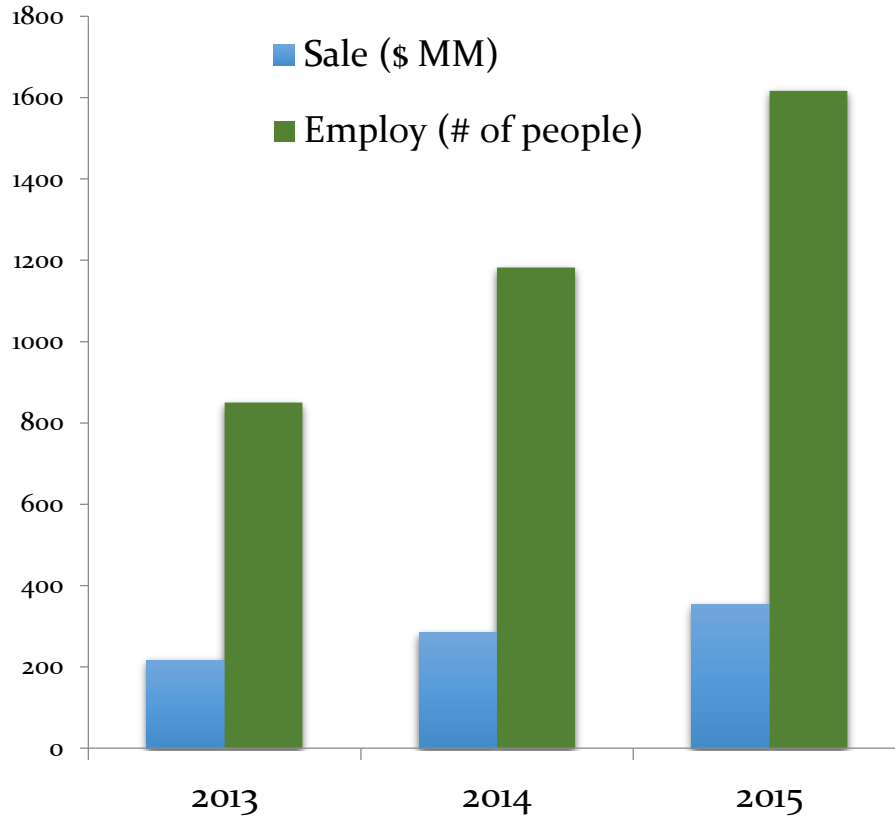
**Ryong Ryoo**

- Ordered nanoporous carbon (Citation: 2242)



- JACS, 122, 10712 (2000)

# Lab to Market

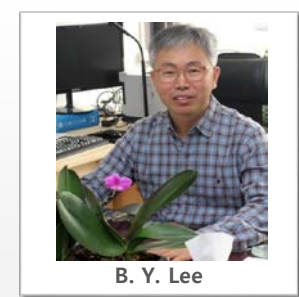
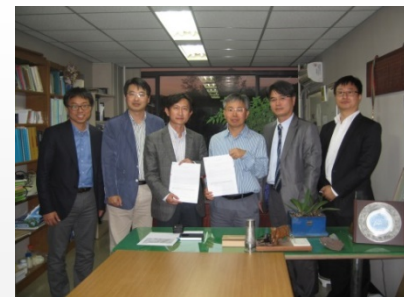


2017 Research Development Plan  
Ministry of Science, ICT and Future Planning

## CO<sub>2</sub> conversion to Porous Carbon : \$130 M

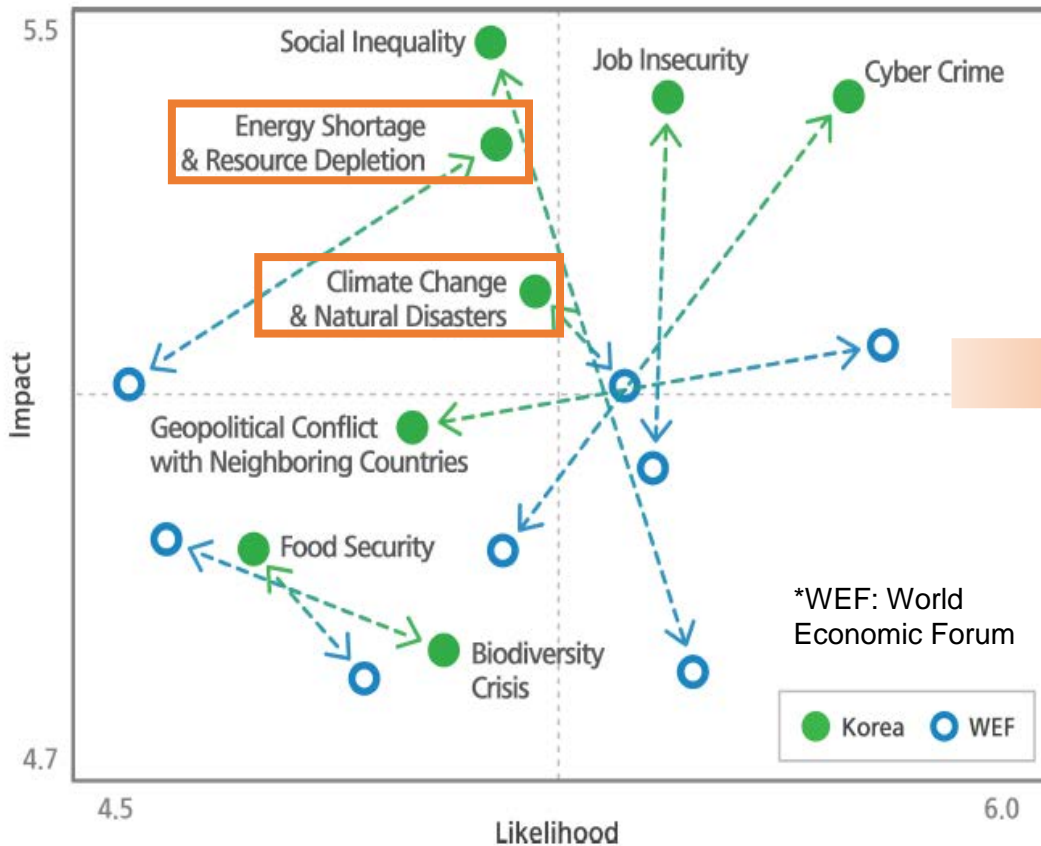


## Polymer synthesis : \$950 M



# Challenges and opportunities for the future

## World & Korea major challenges



## Chemical & Bio Engineering

- Plant design/catalysts
- Energy Harvest
- Energy Storage
- Energy Circulation

# Challenges and opportunities for the future

## »» CBE technology

### Energy/resource recycle technology

- Advanced Materials, 28, 857, 2016.
- Nature Communications, 4, 1896, 2013.

### GHG reduction technology

- Nature Communications, 7, 12640, 2016

### New renewable energy

- JACS, 136, 8883, 2014.
- Nature Materials, 14, 628, 2015.

### Nano material

- Nature Nanotechnology, 7, 29, 2012.
- Nature Materials, 11, 978, 2012.

### Genetic engineering & molecular biology

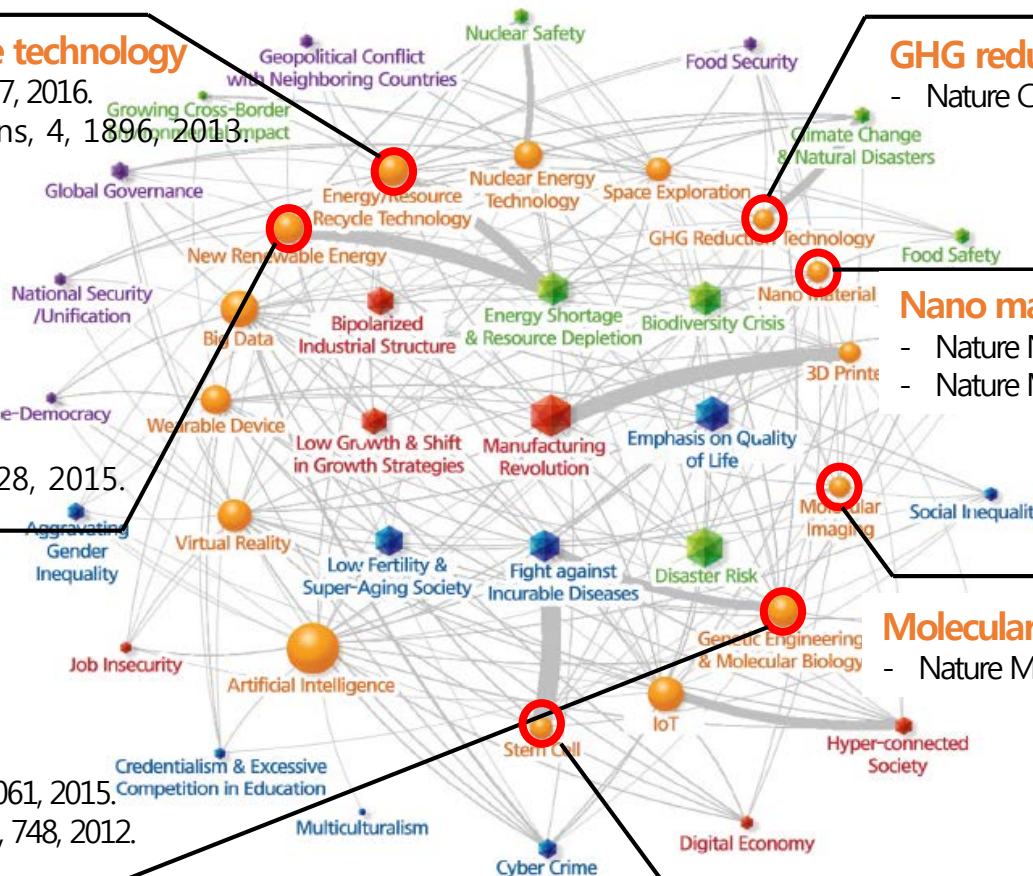
- Nature Biotechnol., 33, 1061, 2015.
- Angewandte Chemie, 51, 748, 2012.

### Molecular imaging

- Nature Materials, 11, 633, 2012.

### Steam cell

- Cell, 151, 765, 2012..



# THANK YOU

