

# Institute for Integrated Cell-Material Sciences Kyoto University



**Director**

**Susumu Kitagawa**



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**Mineko Kengaku**



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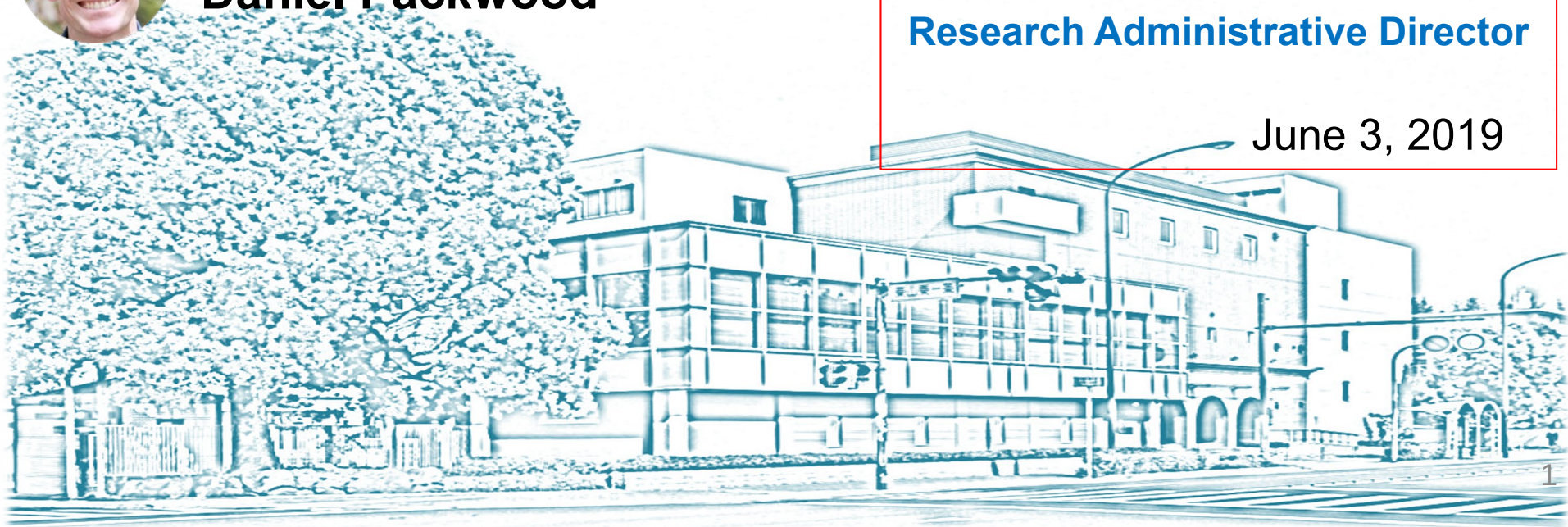


**PI Board Chair**

**Daniel Packwood**

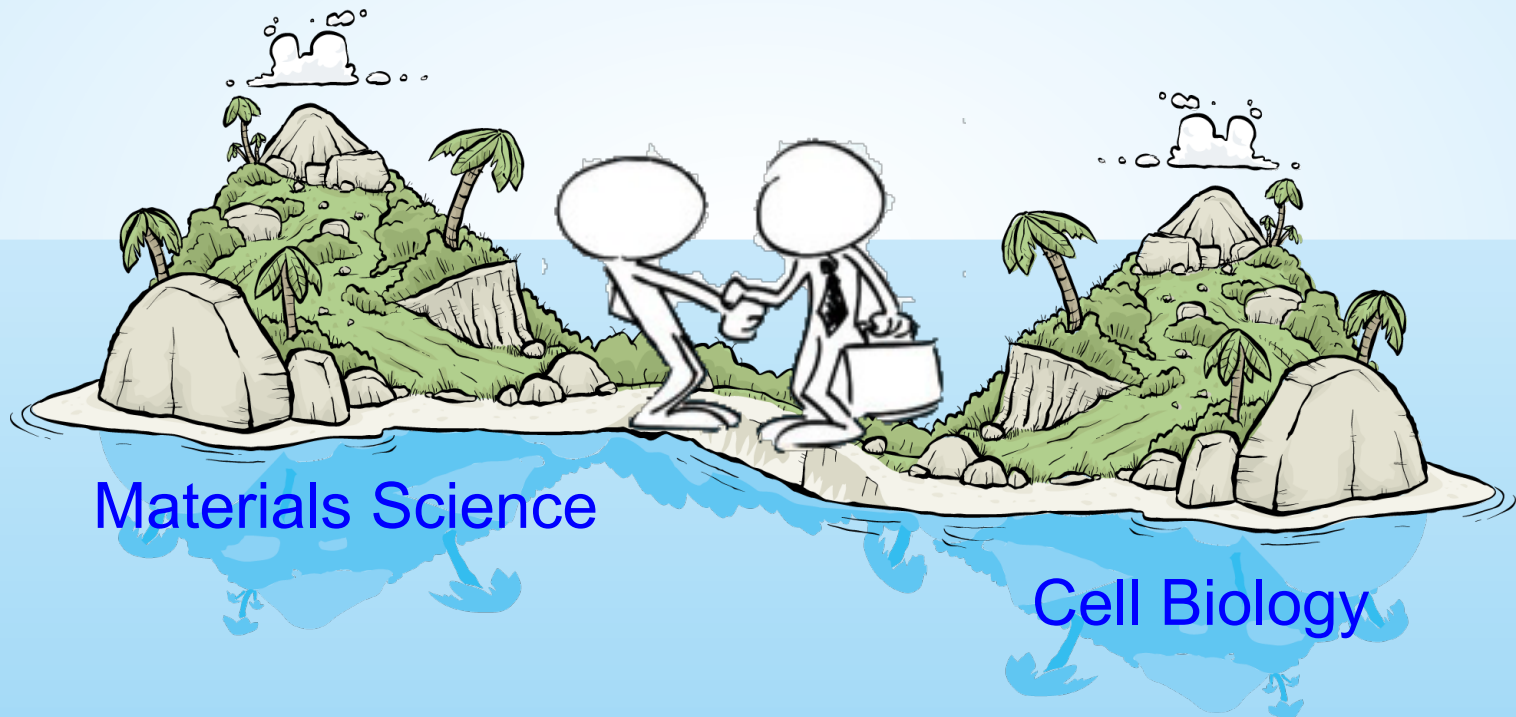
**Mitsuru Hashida**  
**Research Administrative Director**

June 3, 2019

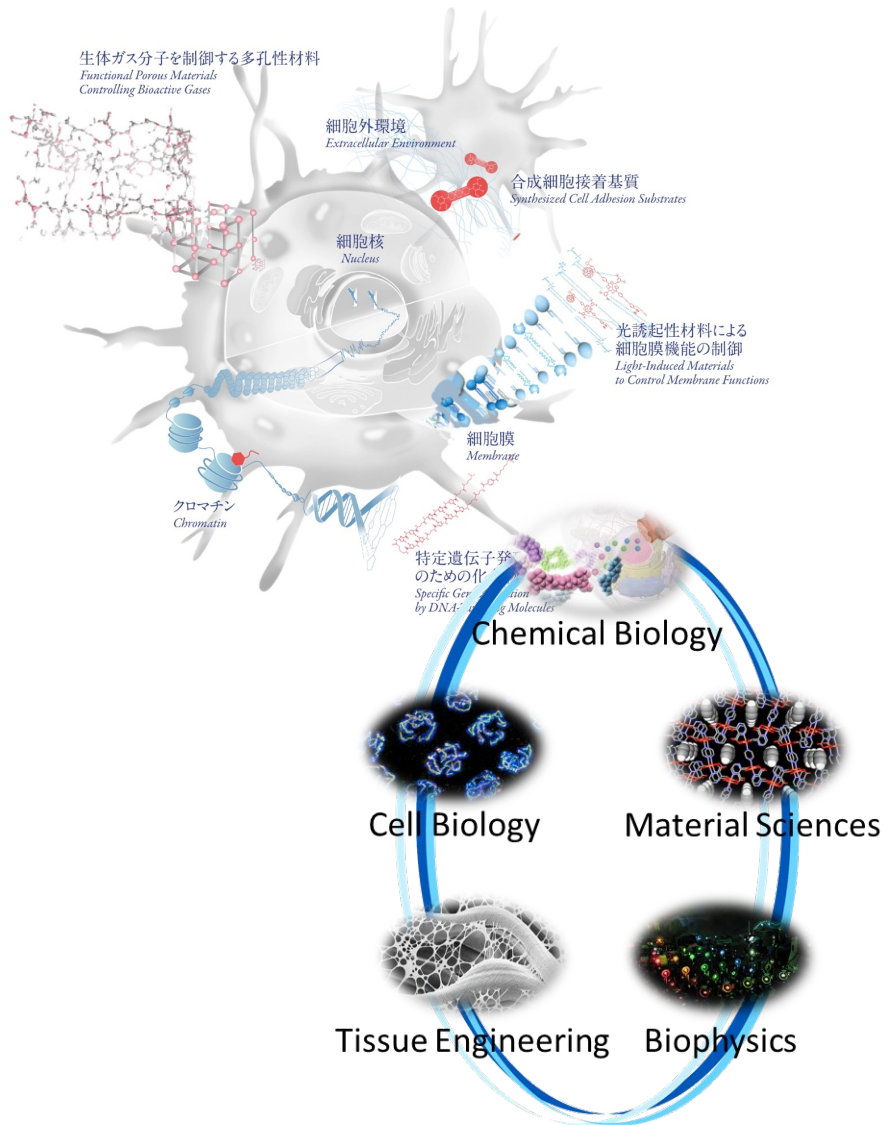


# *Integrated Cell-Material Sciences*

## *2007-2019*



# Unlocking life's secrets, transforming our lives



## Our mission is:

to explore the secrets of life by creating compounds to control cells, and further down the road to create life-inspired super materials that confront the myriad problems that afflict modern society.

## Our approach is:

multi-disciplinary, syncretic approach. At iCeMS cell biologists, biophysicists, chemists, material scientists, physicists, and bioengineers share ideas and work together to devise innovative solutions to the most pressing scientific and societal challenges of our time.

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# iCeMS Future Vision

## Cell Biology



+

**Adjunct PIs**

## Materials Science



+

**Adjunct PIs**

**Synthesis**



**Engineering**



**Simulation**



**Imaging**



**Future PI**

**Analysis Center**



**Bioanalysis Unit**



**Materials analysis unit**

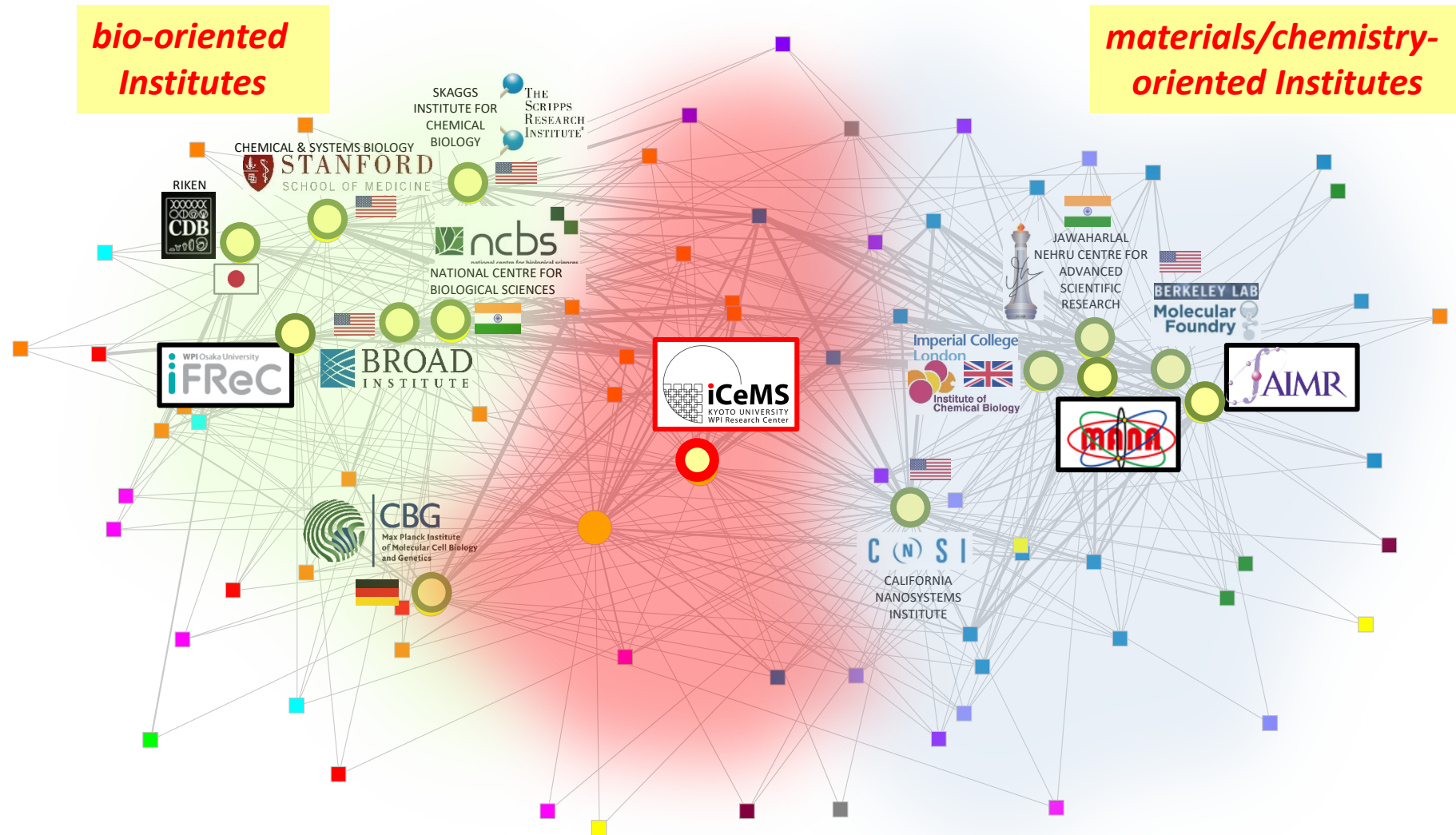




# iCeMS is at Center of Bio-Materials Galaxy 2015

*bio-oriented  
Institutes*

*materials/chemistry-  
oriented Institutes*



\* Shape of Computed Network changes from slide 6 due to additional nodes of WPI Centres and Wyss Institute



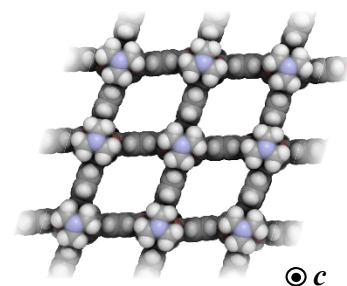
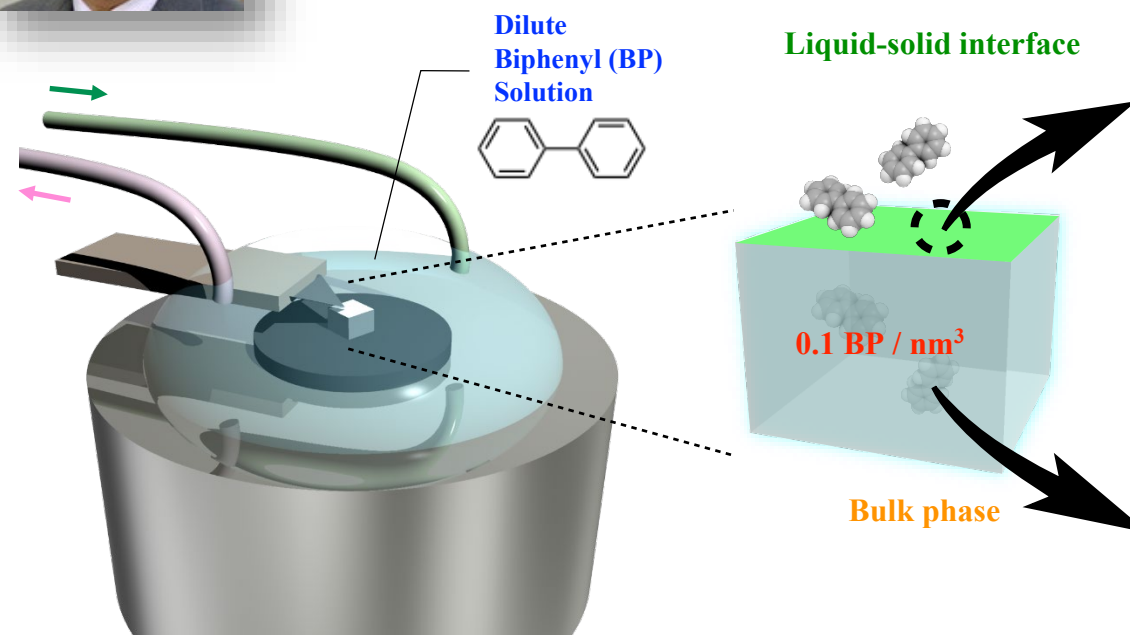
# Porous Coordination Polymer (PCP)/Metal Organic Frameworks (MOF)

## Unveiling surface dynamics (In-site AFM study for structural change)



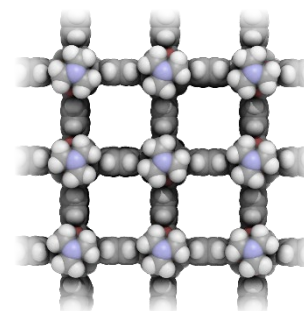
Susumu KITAGAWA

*Nature Chemistry (2018)*



Analyzed  
by AFM

$$\gamma = 86^\circ$$



Analyzed  
by PXRD

$$\gamma = 90^\circ$$



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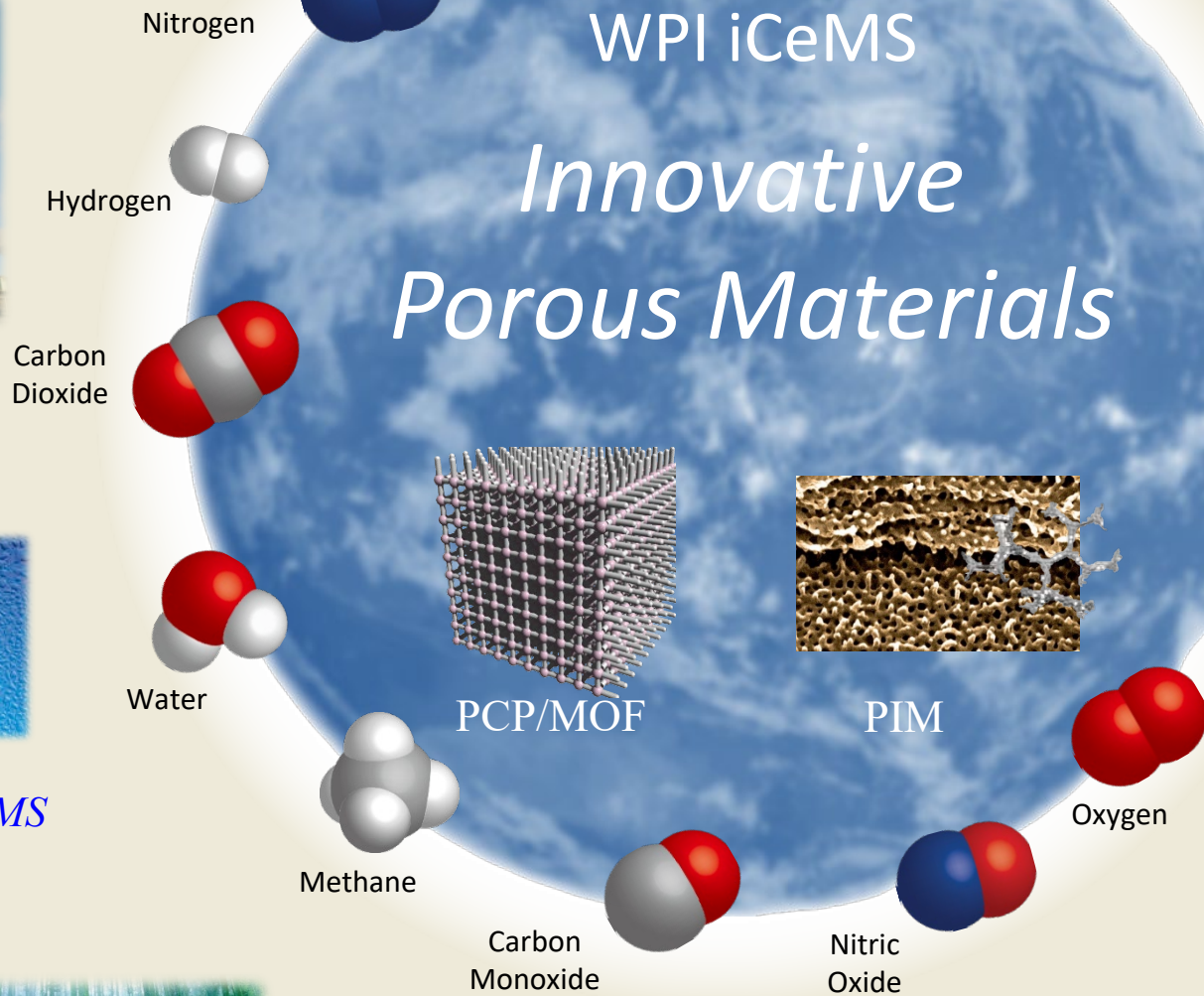
*Energy@iCeMS*



*Environment@iCeMS*



*Healthcare@iCeMS*





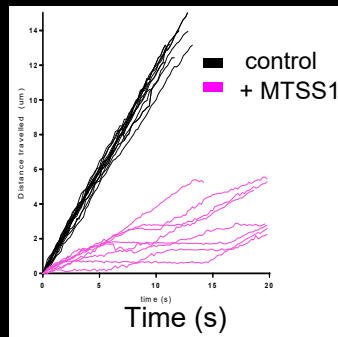
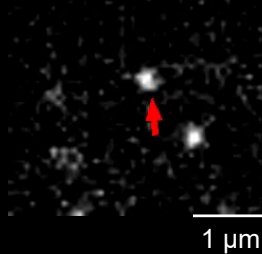


# Imaging of dynamic neuronal motility

*Mineko Kengaku*

## Molecular level

### Actin polymerization

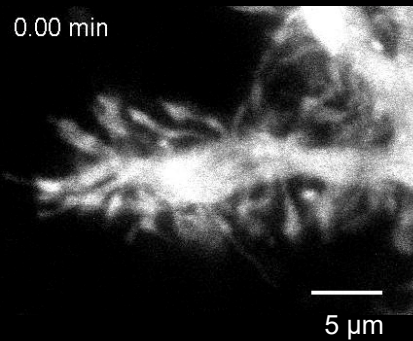


*Cell Reports 2018*  
*Neurosci Res 2018a*

## Cell level

### spines

0.00 min

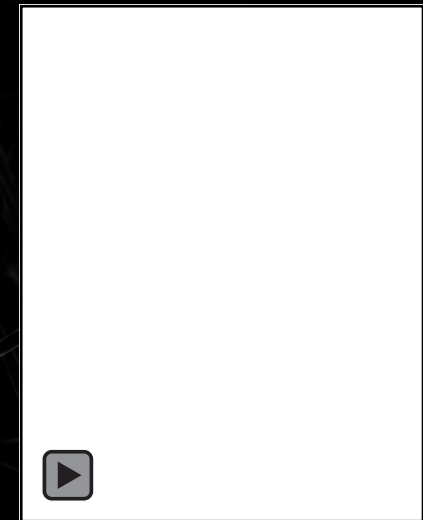


### Nucleus



*Development 2018*  
*Neurosci Res 2018b*  
*J Exp Neurosci 2018*  
*Proc Jpn Acad Ser B 2018*

## Circuit level



20 μm

*Cerebellum 2018*

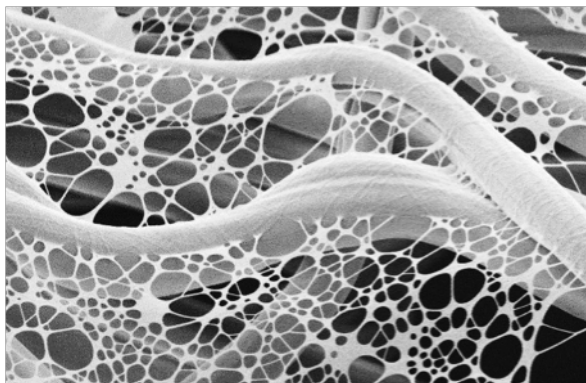


# Engineering for **ES cell growth**

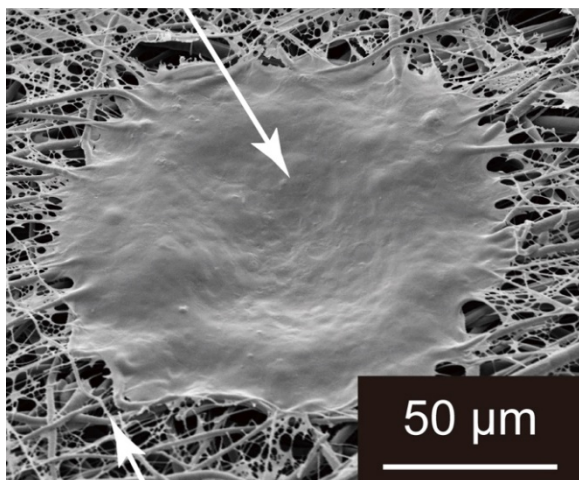
*Ken Kamei* Biomaterials (2017)

## Fiber on Fiber (FoF) matrix:

Nanofiber ECM + Microfiber supporter



ES cell colony on FoF matrix



FoF matrices in a culture bag



**40~50-fold cell number increase  
in 1 week ⇒ World record**

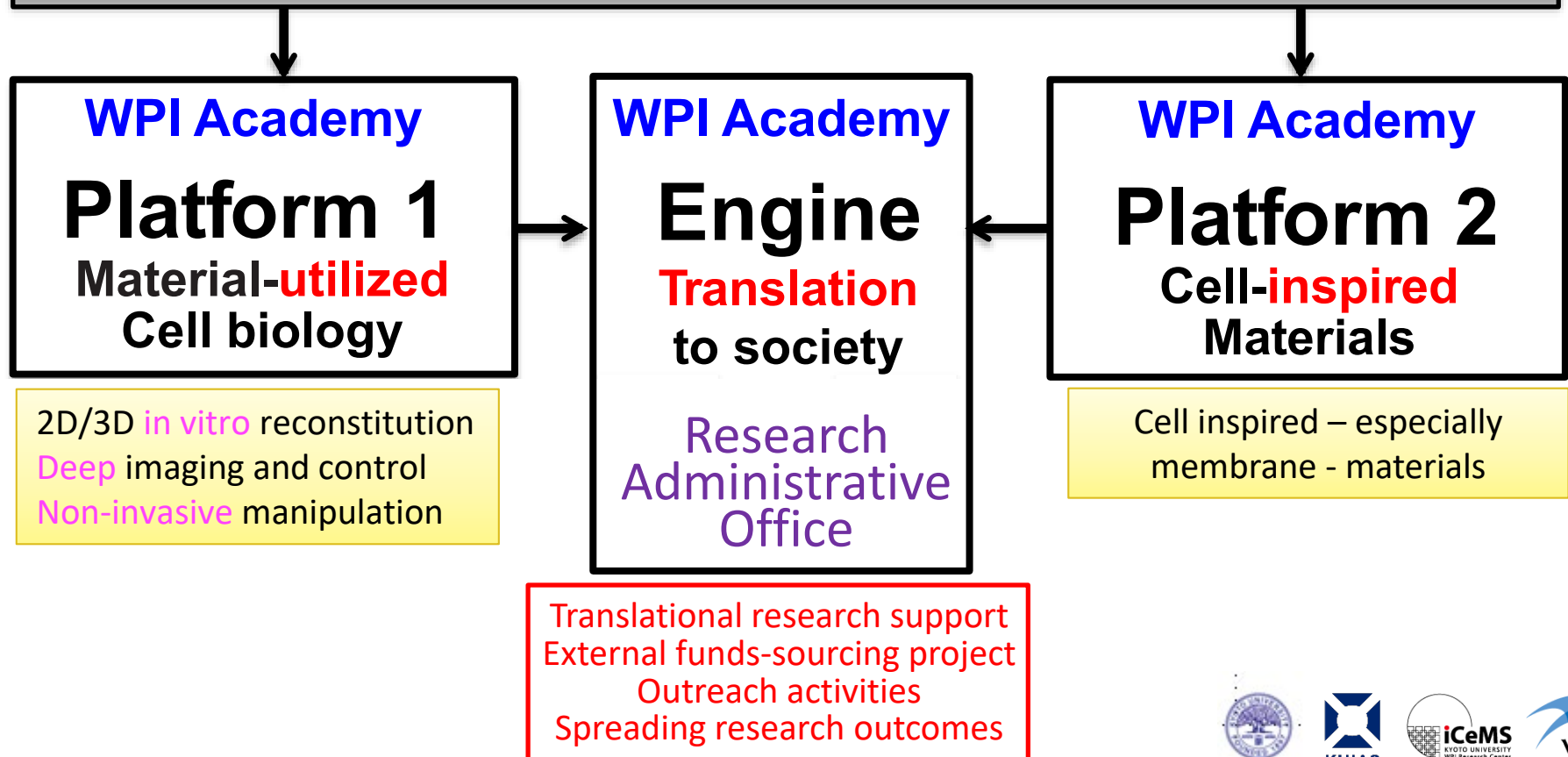


# Future Research Objectives and Strategies of iCeMS

## WPI and WPI Academy (post-WPI)

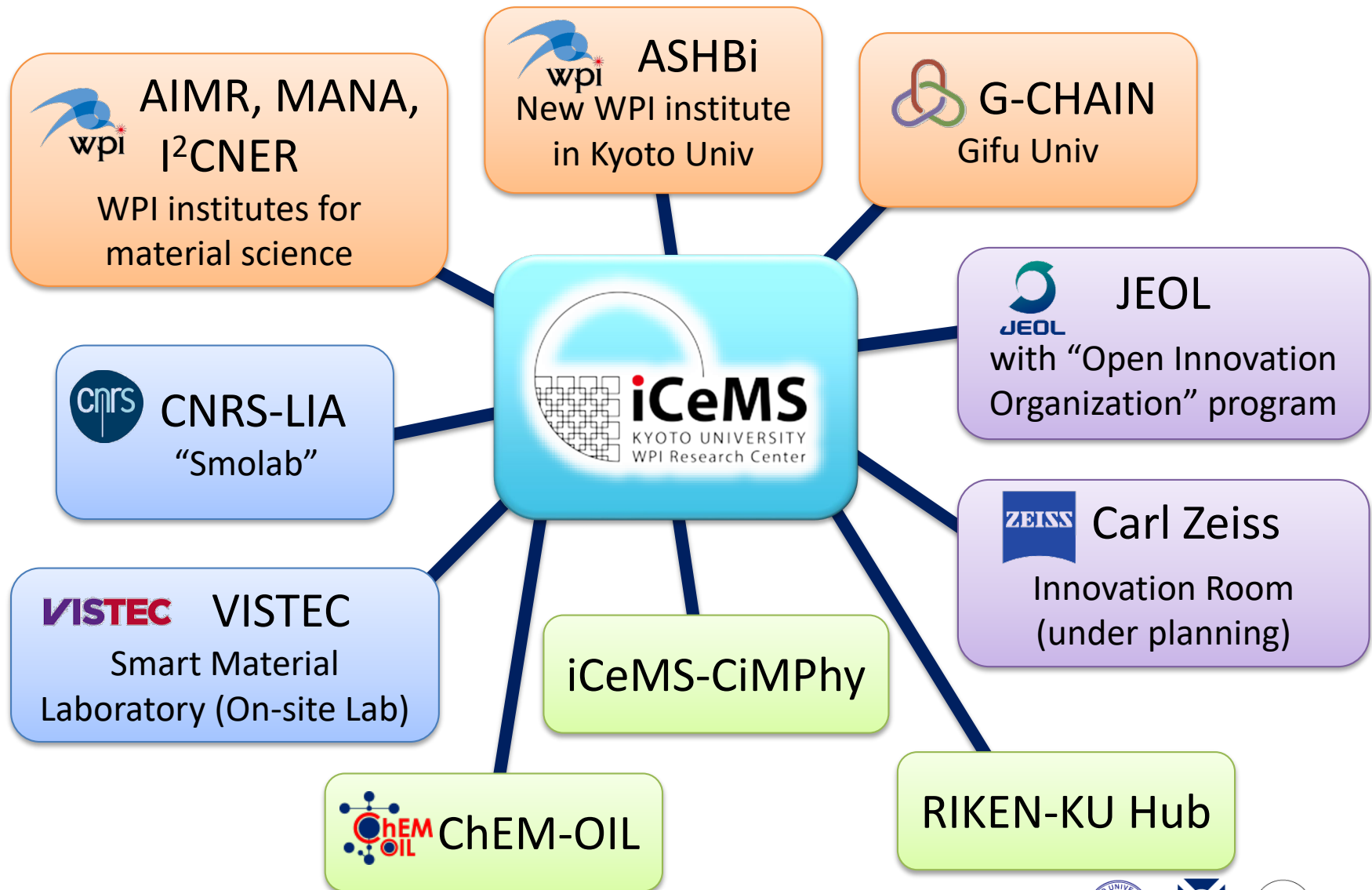
### Fundamental Cell-Materials Science

Nucleus **Information** — Membrane **Compartments** — Cell **Communication**





# Scientific Collaborators with iCeMS



# Partner Institutions

## Collaborative Laboratory

### [Smart Materials Laboratory]

Vidyasirimedhi Institute of Science and Technology (VISTEC), Kingdom of Thailand

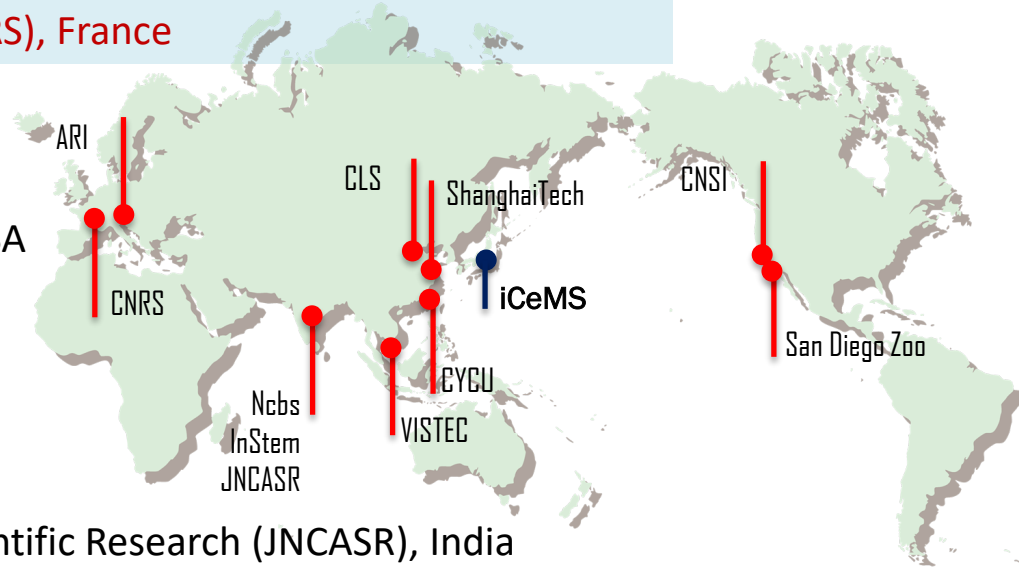
### [SMOLAB]

National Centre for Scientific Research (CNRS), France

*Founded in 2018*

## Academic Cooperation & Exchange

- University of California, Los Angeles
- California NanoSystems Institute (CNSI), USA
- The National Centre For Biological Sciences (Ncbs), The Tata Institute Of Fundamental Research, India
- The Institute For Stem Cell Biology and Regenerative Medicine (Instem), India
- Jawaharal Nehru Center for Advanced Scientific Research (JNCASR), India
- Center for Life Sciences (CLS), People's Republic of China
- Vidyasirimedhi Institute of Science and Technology (VISTEC), Kingdom of Thailand
- R&D Center for Membrane Technology, Chung Yuan Christian University, Taiwan
- School of Physical Science and Technology, ShanghaiTech University, People's Republic of China
- San Diego Zoo Global, Zoological Society of San Diego, USA
- AO Research Institute Davos, AO Foundation, Swiss Confederation



*Agreed in 2018*

