

参考資料4
科学技術・学術審議会
基礎研究振興部会(第15回)
令和6年6月11日

資料2-2
科学技術・学術審議会
基礎研究振興部会(第12回)
令和5年8月10日

WPI-iCeMSの過去と未来

iCeMS
KYOTO UNIVERSITY
WPI Research Center

上杉志成

WPI-iCeMS 拠点長

Institute for Integrated Cell- Material Science (iCeMS)

Founded in 2007

iCeMS
KYOTO UNIVERSITY
WPI Research Center

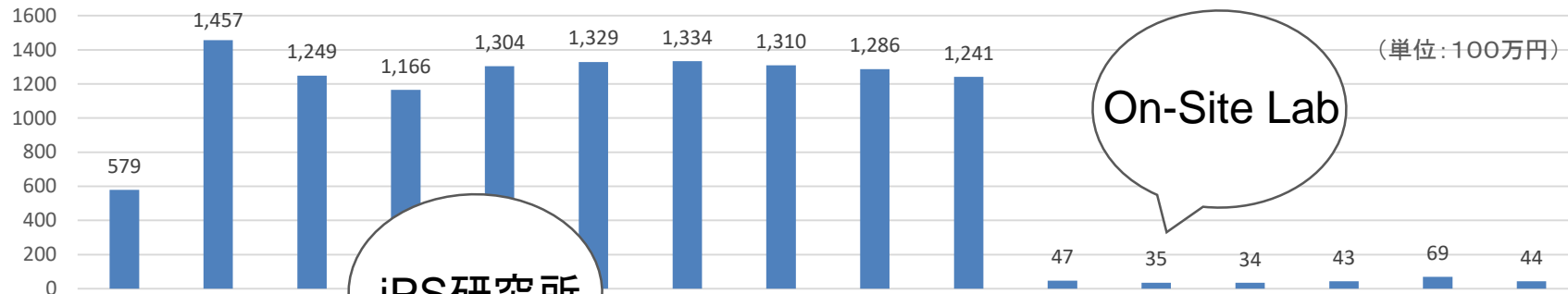


Chemistry

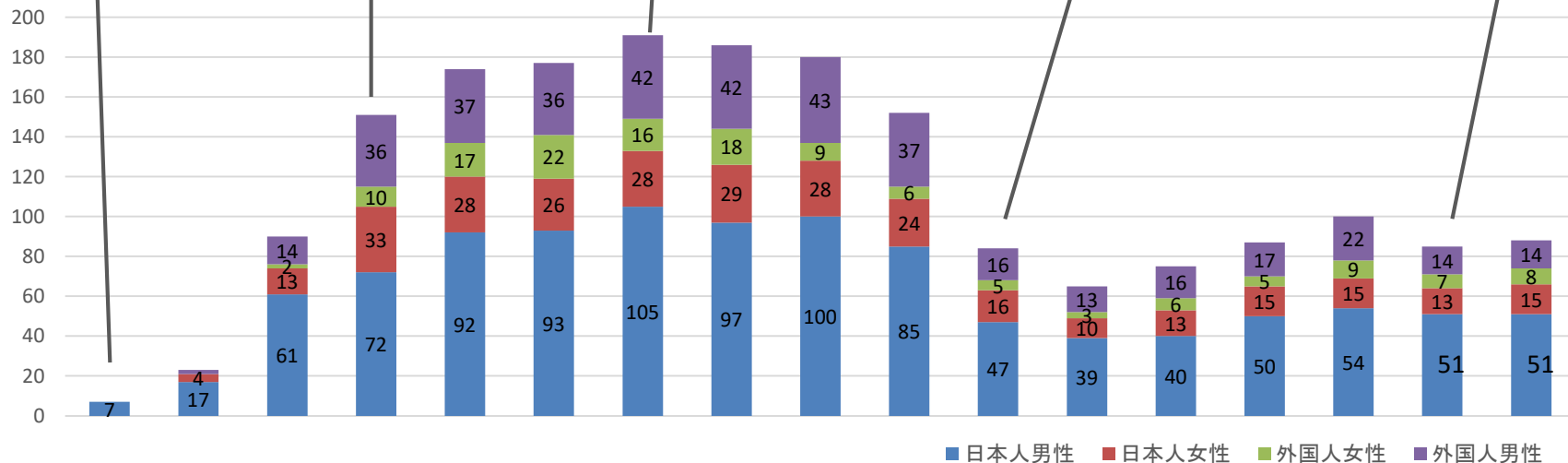
Cell Biology

WPI補助金

WPIアカデミー事業費

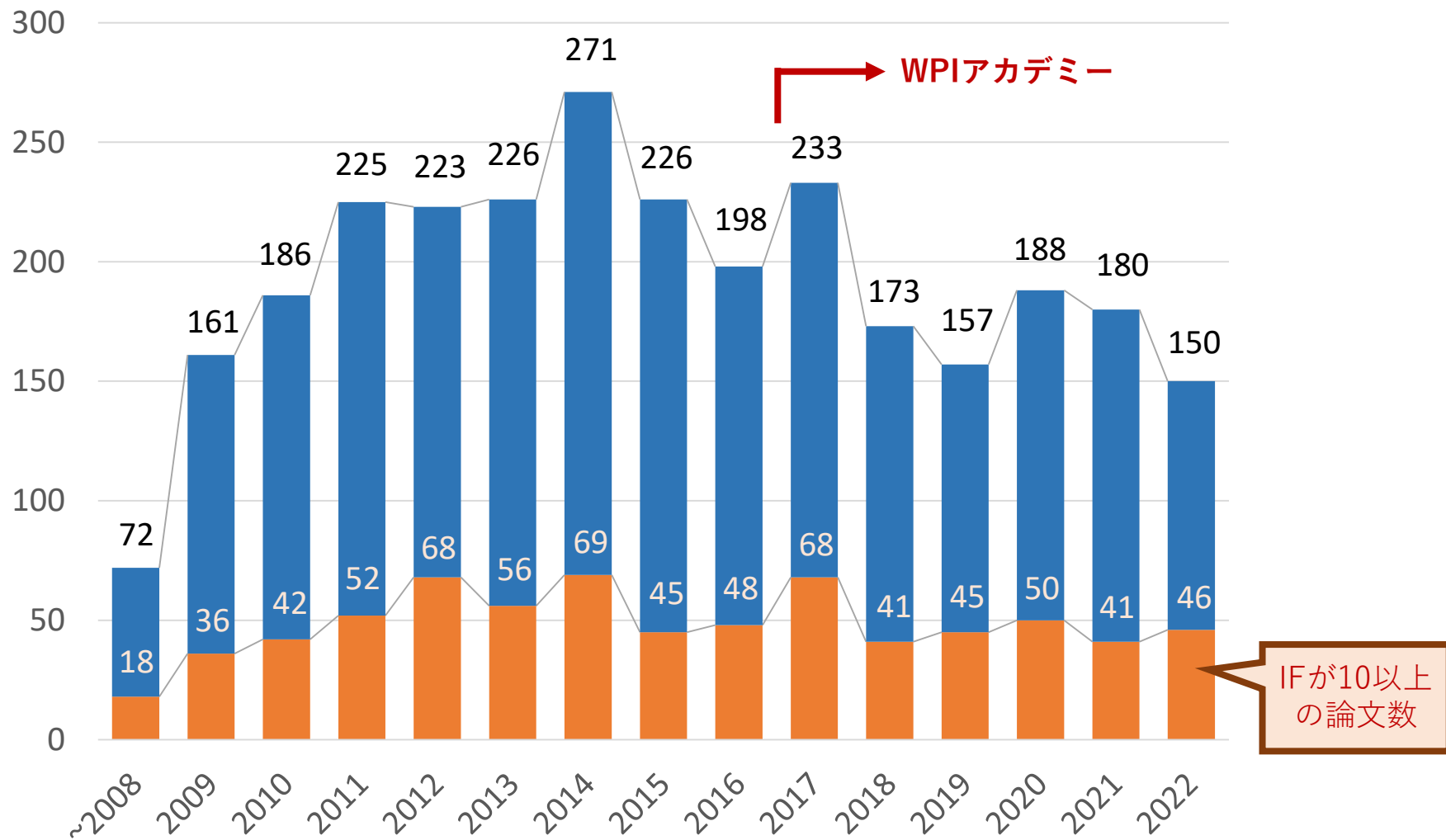


ピーク



WPI-iCeMS所属研究者数

Publication from iCeMS



Lifecycle of Organization

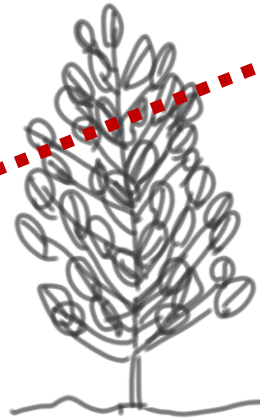
iCeMS
KYOTO UNIVERSITY
WPI Research Center



Birth Stage
-“Startup”
-New ideas



Growth Stage
-Sufficient revenue
-Increased size



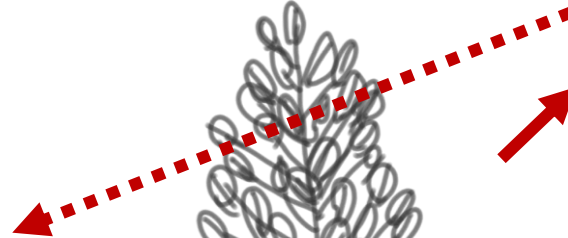
Maturity Stage
-Management tasks
-Safeguarding the survival



Death Stage
-Preoccupied with management and politics
-Loss of ideas and visions



Renewal Stage
-Redefined clear visions
-Simplified decision-making
-Optimized creativity



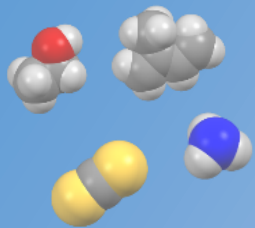
Self-Assembly as a Beginning of Life

~10 nm

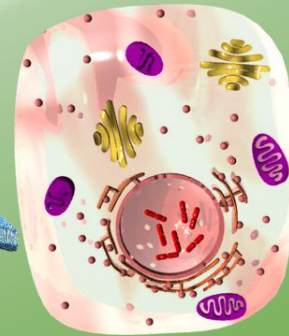
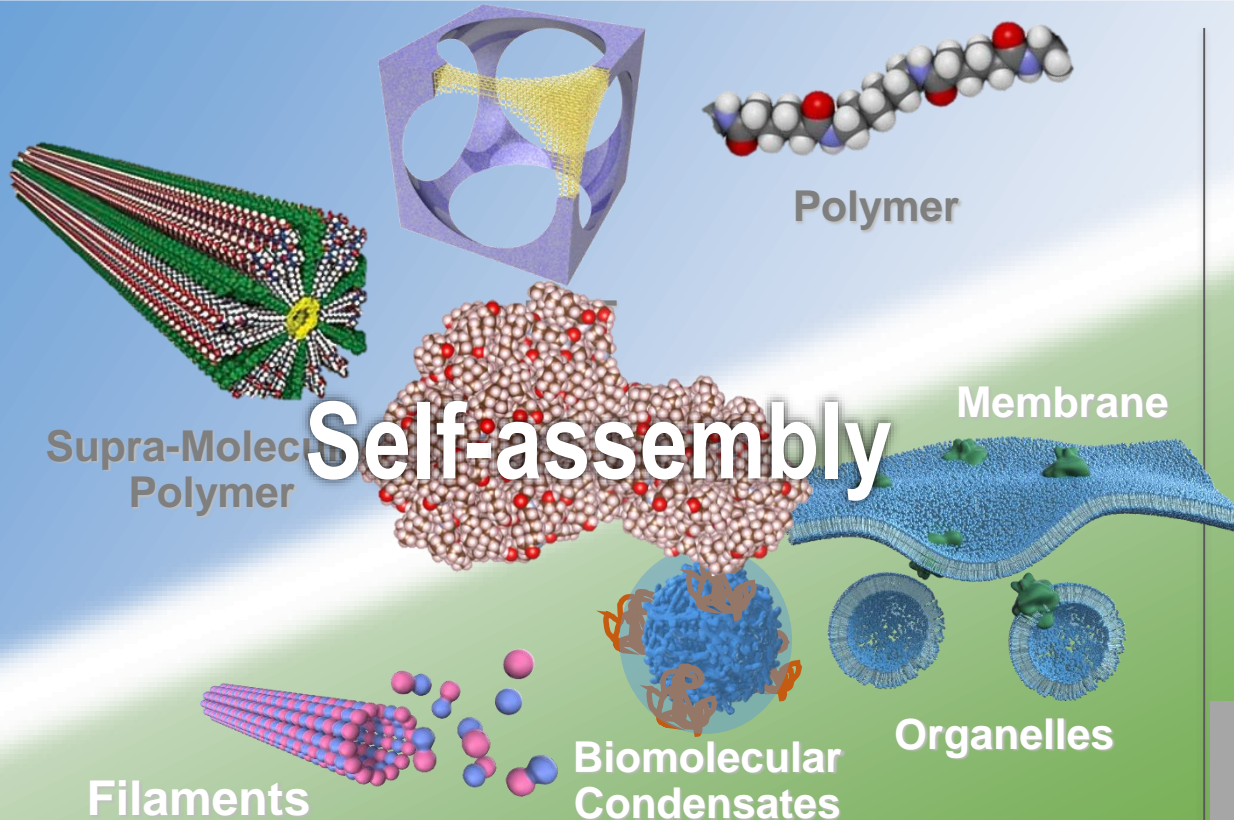
~1 μm

Chemistry

生命



Small Molecules



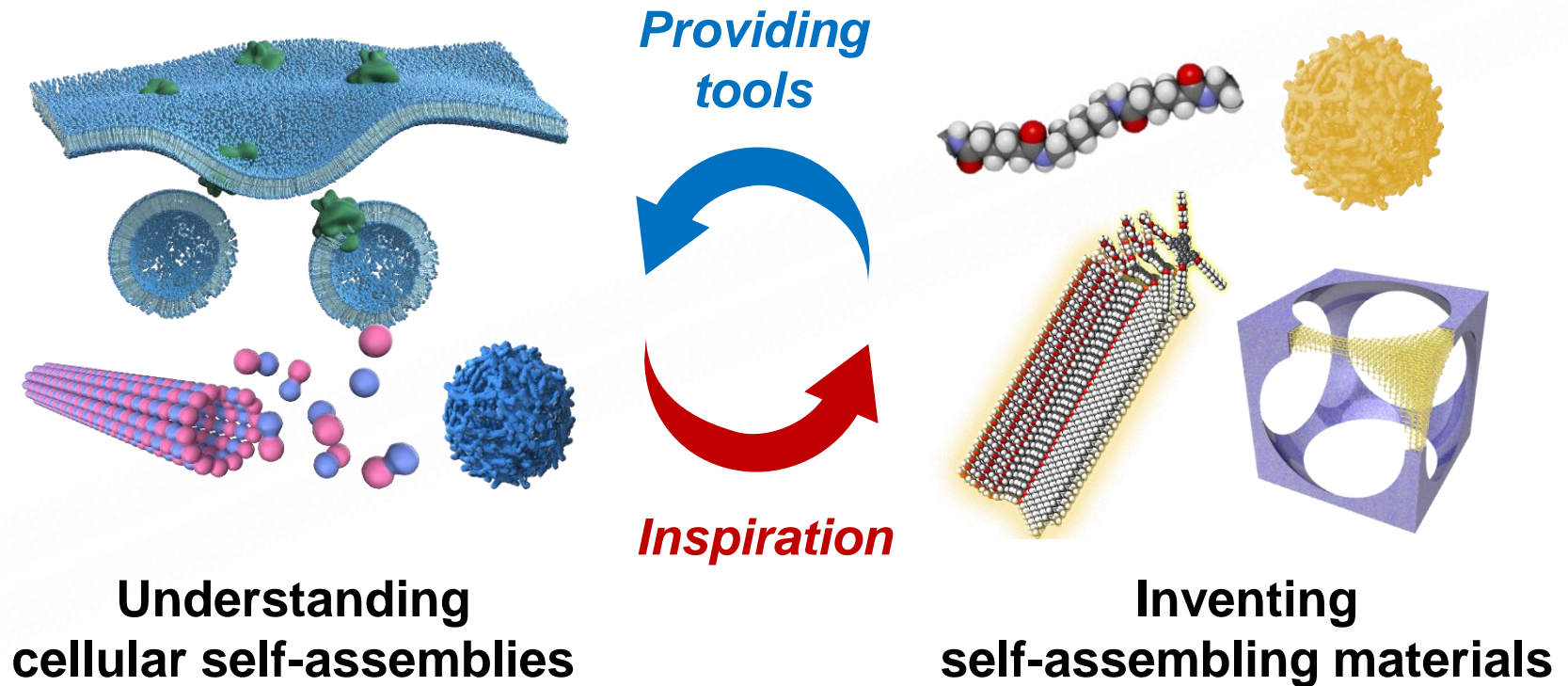
Cell

Cell Biology

Self-assembly: *Spontaneous organization of molecular units.*
It endows chemicals with functions and life-like properties.

WPI-iCeMS Target

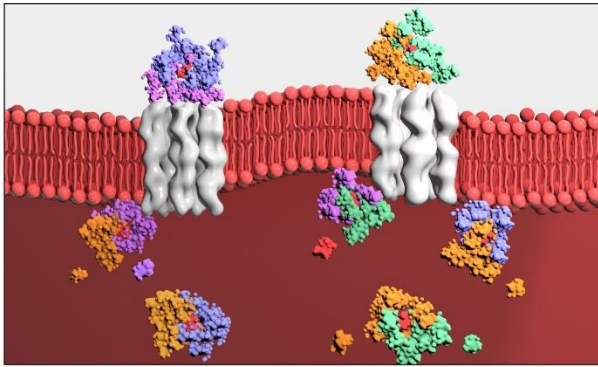
Understanding cellular self-assemblies and inventing self-assembling materials to solve global challenges



Understanding Cellular Self-Assemblies

Life is the ultimate example of self-assembly

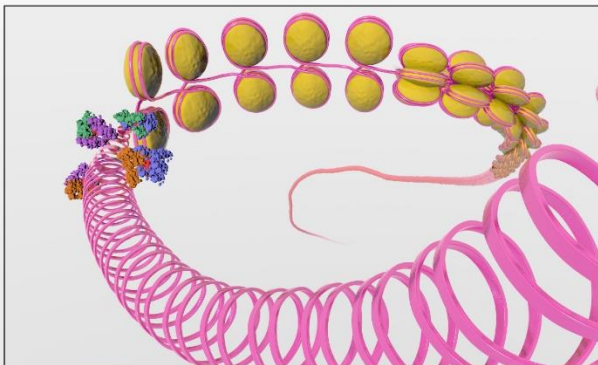
Signal transduction



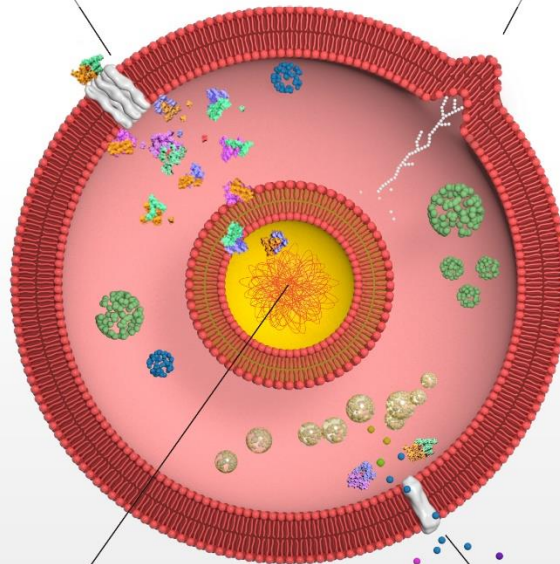
Force generation



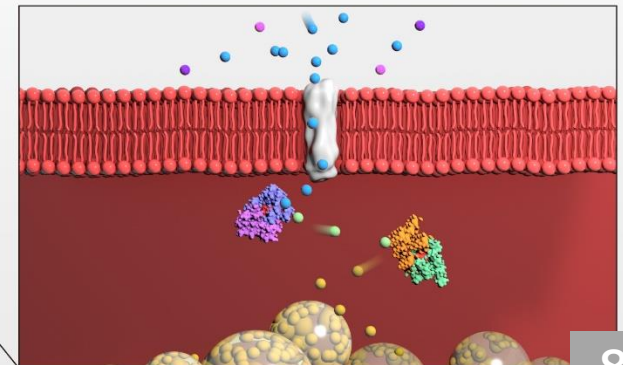
Gene expression



Compartmentalization



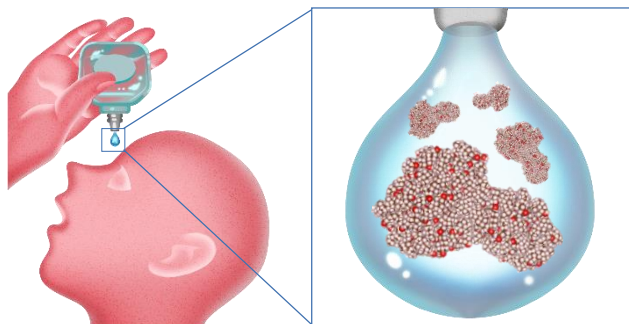
Energy metabolism



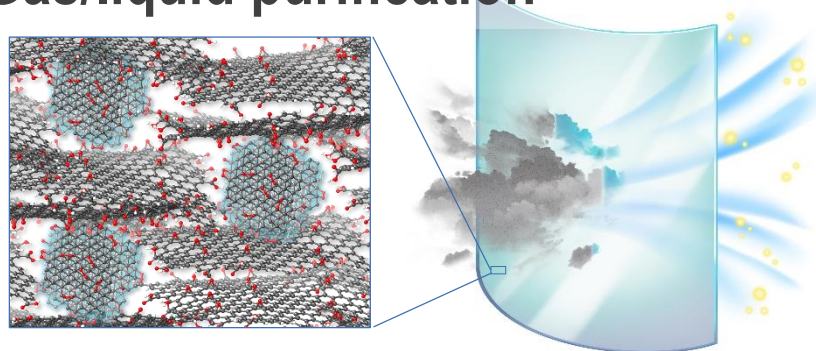
Inventing Self-Assembled Materials

to solve global challenges in health, energy, and environment

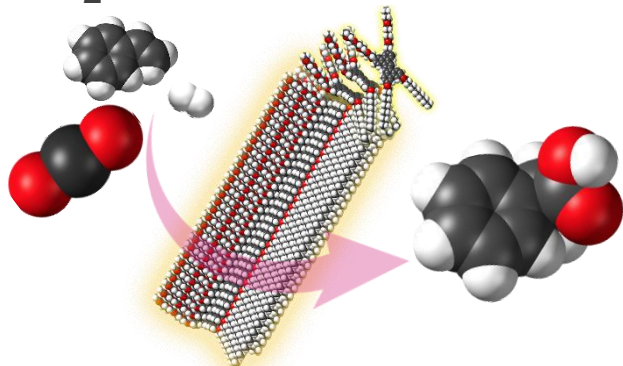
Disease treatment



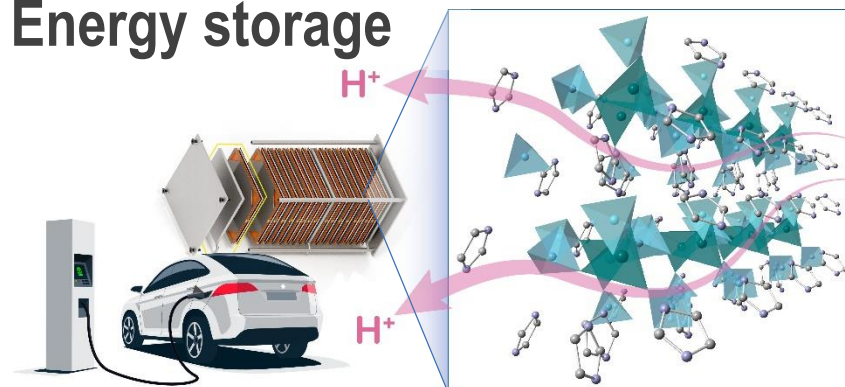
Gas/liquid purification



CO₂ conversion



Energy storage



History & Future of Materials

Inorganic

Ironware ~ BC1700

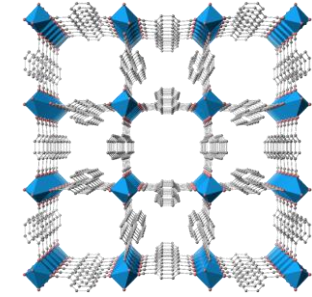
Permanent magnets



Sol-gel process
(Low temperature glass production)



Neodymium magnet



MOF
(Gas storage)

<1900 1930 1940 1950 1960 1970 1980 1990 2000 2010 >2020

Bakelite
(Plasticware)

Nylon

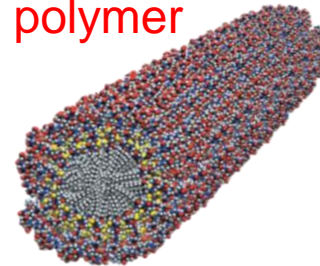


PET

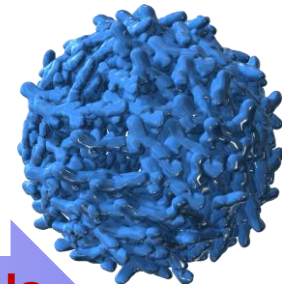
LC Display



Supramolecular polymer



Self-Assembled
Medicine?



The Age of Self-Assembling Materials

Organic

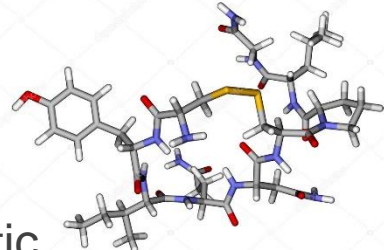
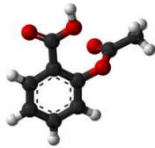
Paper ~ BC140

Self-Assembled Medicine?

Chemical

Emergence of synthetic chemical drugs (Aspirin)

<500 Da



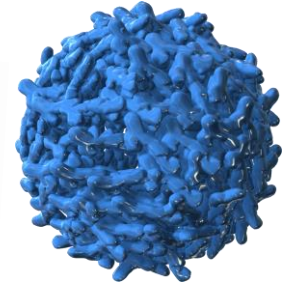
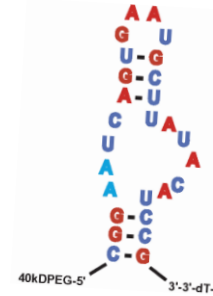
Synthetic peptide drugs (oxytocin)

~3,000 Da

Combinatorial chemistry-derived drugs

Nucleic acid drugs (Macugen)

~10,000 Da



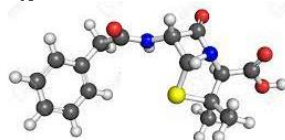
Self-Assembled Medicine?

<1900 1930 1940 1950 1960 1970 1980 1990 2000 2010 >2020

Peptide drugs (Insulin)

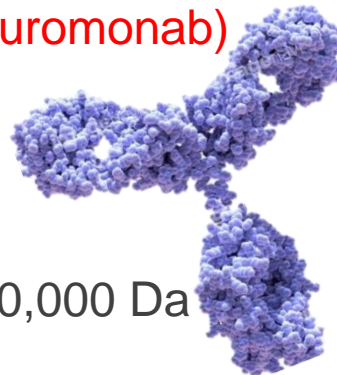


Antibiotics (penicillin)



~150,000 Da

Antibody drugs (Muromonab)



Regeneration therapy

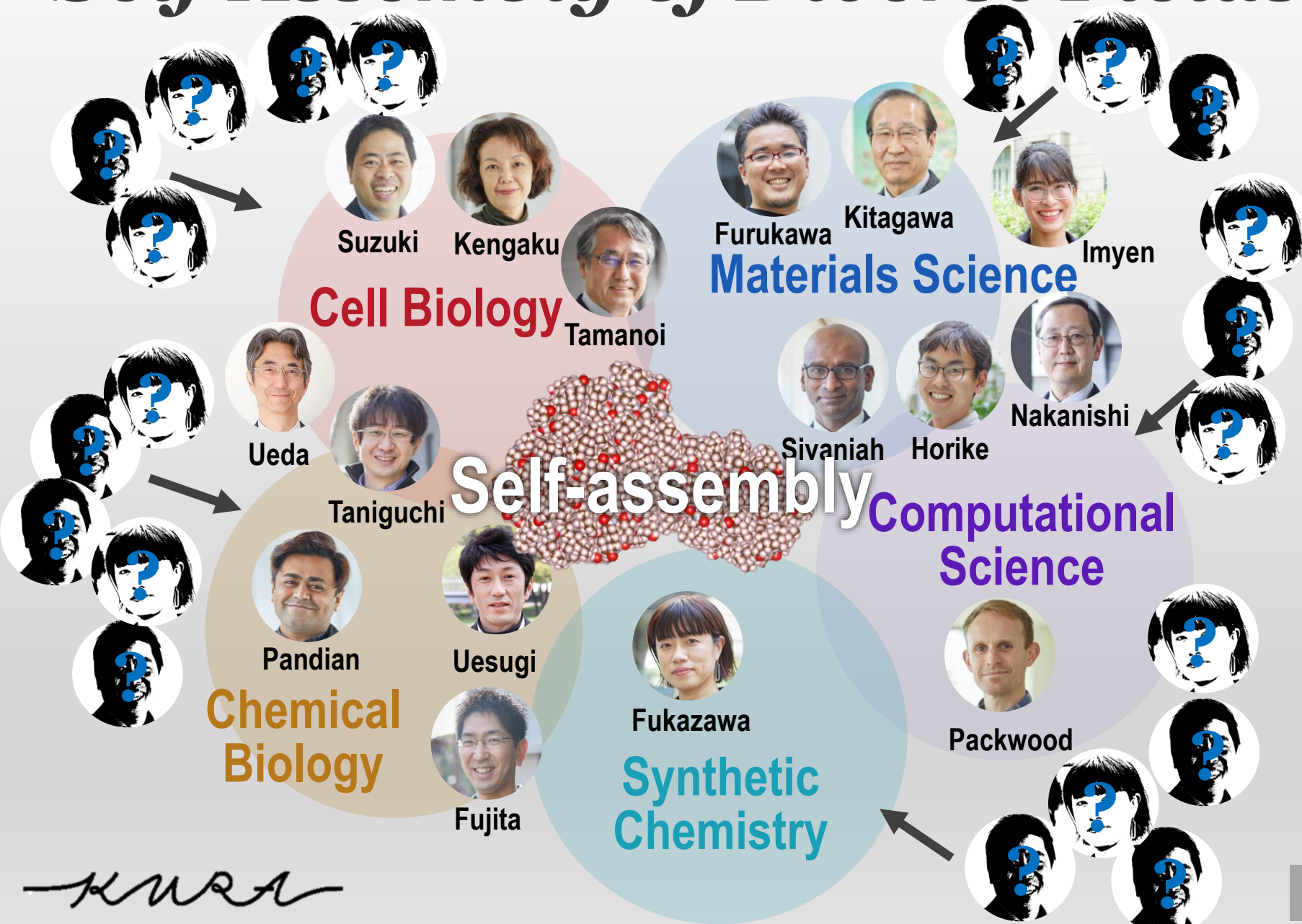
iPS cell therapy



Biologics

Molecular-weight increase

Self-Assembly of Diverse Fields



KURA

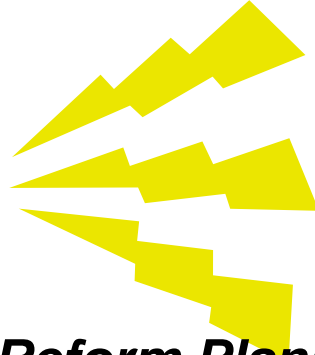
iCeMS Roles
in System Reform &
Globalization



WPI-iCeMS Target

Serving as a test bed for future Kyoto U

iCeMS
KYOTO UNIVERSITY
WPI Research Center



Kyoto U Future Reform Plans

- Research recruitment and engagement
- Multi-appointment of faculty members
- Globalization
- Core facility
- Startup
- External donation
- Interdisciplinary collaboration
- Diversity, equity & inclusion

iCeMS will lead the way as a proof-of-concept for university-wide reforms

Research Administration Division as an Engine



iCeMS Director



RAD Director
Kazumitsu Ueda



RAD Deputy Director
Hiroyuki Takigawa



*Advisors from the
financial industry*

Analysis Center

Materials Analysis Unit

Bioanalysis Unit



Kengaku
Director



Homma



Higuchi



Fujiwara



Ishidate

Communication Design Unit



Toyama



Takamiya



Monahan

Innovation Unit



Takigawa



Higuchi

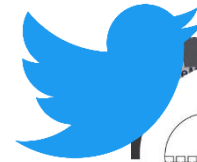


Ikeda

#1 Strategic Recruitment

- **International Student/Postdoc Recruitment**

(iCeMS Grant for Inviting Young Researchers, SNS, Talent Spot Events, Onsite Labs)



iCeMS, Kyoto Univ - International

@iCeMS_KU_INTL Follows you

iCeMS is a research institute at Kyoto University, Japan, that aims "Unl Life's Secrets, Transforming Our Lives". Scientists run the account.

Kyoto, Japan icems.kyoto-u.ac.jp/en/ Joined July 2020

1,973 Following 1,850 Followers



- **Undergrad Research Training**

(Part Time Jobs in iCeMS Analysis Center, Collaboration with KiUP, iCeMS Internship Program)



KYOTO UNIVERSITY
International
Undergraduate Program



Undergrad in Lab



Talent Spot Events

#2 Globalization through On-Site Labs

KU On-site Labs

iCeMS Project Units



Small Molecule Lab
Since 2019



India Japan Initiative for
Intelligent Biomaterials

Since 2022



Kyoto University Shanghai Lab

Since 2019 in cooperation with ICR



UCLA



Quantum Nano Medicine
Research Center

Since 2019



SUSTech-Kyoto University
Advanced Energy Materials
Joint Innovation Laboratory

Since 2022



Center for Integrated Biosystems

iCeMS Taiwan Office

Since 2019



Laboratory for
Green Porous Materials

Since 2021



Smart Materials
Research Center

Since 2018



Te Mana Tangata Whakawhanake
MacDiarmid Institute
Advanced Materials & Nanotechnology



Center for
Integrated Data-Material Sciences

Since 2021



Multiple Functions: Research, recruitment, entrance exams, and donation
With the close cooperation of the International Strategy Office and the Division of Graduate Studies.

#3 *iCeMS Analysis Center as a Core Facility Model*

iCeMS

Analysis Center



Kengaku
Director

iCeMS Deputy Director

**“Leading-edge
Equipment &
Total Support”**

Bioanalysis Unit



Fujiwara



Ishidate

Materials Analysis Unit



Higuchi

Shared Equipment Support Unit



Homma

Experiments

- Domestic & international core
- System installation (KUMaCo)
- Undergrad part-time jobs
- Training sessions



KUMaCo

Kyoto University Management System
for Core Facilities




#4 Innovation through Startups

OOYOO

Founded in 2020



 ReguGene

Founded in 2018



atomis

Founded in 2015



 tiem
factory
Inc.

Founded in 2012



FGH BioTech

Founded in 2011



Experiments



- World-wide marketing of iCeMS' inventions



Wellspring



TLO 京都

- Licensing brokerage



TLO 京都



SACI Office of Society Academia
Collaboration for Innovation
京都大学 産官学連携本部

- Discovering corporate sponsors



SACI Office of Society Academia
Collaboration for Innovation
京都大学 産官学連携本部



京都大学 Kyoto University
Open Innovation Institute
オープンイノベーション機構

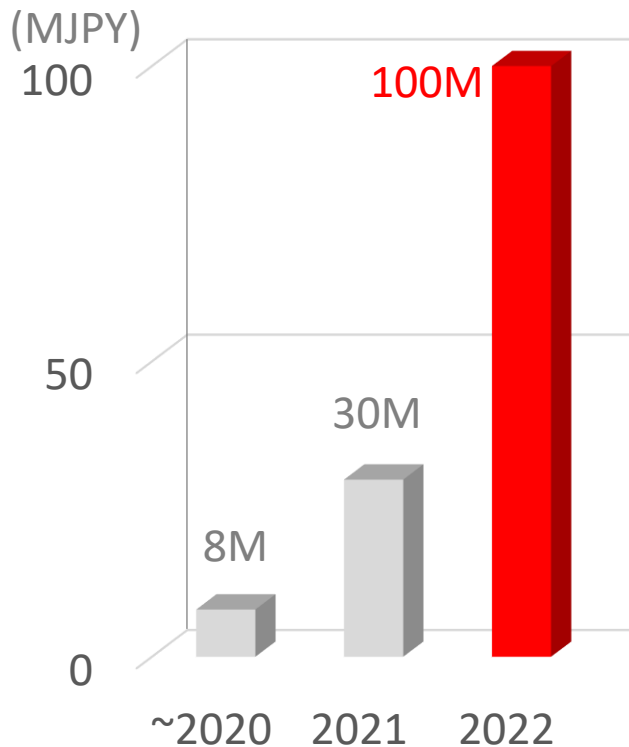
- Recruiting entrepreneurs and investors



KYOTO-iCAP
KYOTO UNIVERSITY INNOVATION CAPITAL Co., Ltd.

京大オリジナル株式会社
Kyoto University Original Co., Ltd.

#5 Efficient Fund Raising



Experiments



- Focused fundraising
- Building long-term relationships with donors
- 20th Anniversary campaign
- Obtaining group grants through project units



#6 Optimized Internal Communication

- Organizations that optimize internal communications are known to increase efficiency, compliance, and satisfaction, and decrease risk.
- Increase interdisciplinary collaboration
- Promotion of Diversity, Equity & Inclusion (DE&I)

iCeMS Retreat



Internal communication newsletter



Experiments



- Research of Collaborative Research
- Diversity, Equity & Inclusion (DE&I) Training
- PI Meeting (Working Lunch)
- Director Lunch
- Director Happy Hour
- Post-Corona Beer Bash!

KURA

WPI事業を通して見えてきた基礎研究の振興に向けた課題

- 時限付き人件費の組み合わせにより基礎研究グループを安定に維持するのは困難。
- 日本の研究プログラムにはRenewalがほぼない。
- 基礎研究から派生する実用化研究はスタートアップとして切り離すべき。スタートアップ振興は基礎研究を振興できるはず。
- スタートアップにより事業化した利益を基礎研究に還元するには時間がかかる。
- WPI事業で得た共通機器の老朽化。共通機器をいかにRenewalするか。
- Research Administrationの重要性。

iCeMS

KYOTO UNIVERSITY
WPI Research Center

**Focused vision
with diverse people**