

6. Start-up Program
for Formulation of Joint Research Hub by Crossing Departments

No.	Name	Project Title
6-1	Shinya Hayami	Construction of antiviral social and agricultural infrastructures based on nanomaterials
6-2	Tetsuya Kida	Valorization of “Blue Carbon” for Sustainable Well-Being
6-3	Ruda Lee	The Effect of Urban Forestry on Lung Health in Fine Dust Environment
6-4	Yoshitaka Nakanishi	The science of interactions, communications, and fusions in boundaries (FUREAI Science)

No.6-1	Construction of antiviral social and agricultural infrastructures based on nanomaterials		
Research Field(s)	<input type="checkbox"/> Science	<input type="checkbox"/> Engineering	<input type="checkbox"/> Medical Pharmacy Others()
Coordinator			
Name	Shinya Hayami		
Affiliation	Faculty of Advanced Science and Technology Email: hayami@kumamoto-u.ac.jp	Title	Professor
Members			
Name	Title	Affiliation	
Terumasa Ikeda	Associate Prof	The Joint Research Center for Human Retroviru	
Yukie Takahashi	Researcher	IRCMS	
Taiki Amagasaki	Prof	FAST	
Shintaro Ida	Prof	IINa	
Shinichiro Sawa	Prof	FAST	

1. Overview and achievements

Nanomaterials have attracted attention as a source of innovation in various fields, and by combining nanotechnology and biotechnology, nanomaterials with unique physicochemical properties have shown remarkable advantages in the field of medicine. Recently, graphene oxide (GO) has attracted much attention due to its excellent biocompatibility and physicochemical properties. The GO nanosheets have tremendous potential as an innovative material because of their ability to skillfully combine the functions of the host layer, the nanosheet, with those of the interlayer guest species. With the thirst for innovation as a truly useful material, the use of nanosheets is becoming extremely valuable. The impact of various viruses on health has become a major social issue, and the development of antiviral materials that can meet social needs has been proposed, but the direction of practical application has yet to be determined. In addition, environmental problems are becoming more serious, and it is necessary to develop antiviral and environmental purification materials with a view to their true practical use. In this study, we focus on nanomaterials such as graphene oxide (GO) nanosheets and aim to develop true antiviral materials and establish an agricultural infrastructure by integrating materials chemistry, medicine, information science, and agriculture.

2. Prospects for the future and anticipated results

- (1) Development of antiviral materials in GO and other nanomaterials
- (2) Development of farm improvement materials in GO and other nanomaterials
- (3) Confirmation and mechanism elucidation of antiviral activity of GO and its derivatives
- (4) Feedback to the development of antiviral materials by materials informatics
- (5) Establishment of society through antiviral and farm monitoring and management by AI

3. Application plan of KAKENHI and other external grants

We have not received any for this research project, but we plan to apply for large-scale projects from NEDO and JST in near future.

4. Possibility about an international collaboration with institutions and universities in abroad

Currently, preliminary experiments are in progress and the research is limited to intra-group collaborations, but other research topics, such as biomass research, are being conducted in collaboration with Australia and the Philippines. In addition, this research needs to be developed globally, and global research development and collaboration will be conducted as the research progresses.



GOなし土壤

GOあり土壤



トマトを海水程度の塩水 (0.5M) で生育



No.6-2	Valorization of “Blue Carbon” for Sustainable Well-Being		
Research Field(s)	Science <input type="checkbox"/> Engineering <input type="checkbox"/> Medical <input type="checkbox"/> Pharmacy <input type="checkbox"/> Others (Interdisciplinary)		
Coordinator			
Name	Tetsuya Kida		
Affiliation	Faculty of Advanced Science and Technology Email: tetsuya@kumamoto-u.ac.jp	Title	Professor
Members			
Name	Title	Affiliation	
QUITAIN Armando	Professor	Headquarters for Admission and Education/Division for Promotion of Global Education	
INOMATA Yusuke	Assistant Professor	Faculty of Advanced Science and Technology	
AGUTAYA Jonas Karl	Postdoctoral Researcher	Faculty of Advanced Science and Technology	
AHMAD Muhammad Sohail	Specially Appointed Assistant Professor	Faculty of Advanced Science and Technology	
ASSABUMRUNGRAT Suttichai	Professor	Chulalongkorn University (Thailand)/Faculty of Engineering	
AVISO Kathleen	Professor	De La Salle University (Philippines)/Faculty of Engineering	
GOODFELLOW Ian	Professor	Cambridge University (UK)/Department of Pathology	
HOSMILLO Myra	Research Associate	Cambridge University (UK)/Department of Pathology	
LOTA Maria Margarita M.	Assistant Professor	University of the Philippines-Manila(Philippines)/Department of Medical Microbiology	
DAYRIT Geraldine	Assistant Professor	University of the Philippines-Manila(Philippines)/Department of Medical Microbiology	
PABLO Carol Geraldine	Assistant Professor	University of Santo Tomas (Philippines)/Department of Pharmacy	
KOIKE Ursula	Professor	Headquarters for Admission and Education/Division for Promotion of Global Education	
SIMS Lander	Lecturer	Headquarters for Admission and Education/Division for Promotion of Global Education	
DEVKOTA Hari Prasad	Assistant Professor	Headquarters for Admission and Education	
RICKARD Joshua	Associate Professor	Center for International Education	

WANG Jincao	Lecturer	Center for International Education
AXT Alexander Florian	Assistant Professor	Center for International Education
CHOI Sangjin	Assistant Professor	Center for International Education

1. Overview and achievements

The existing general framework for scientific research normally begins with experimental work carried out in the laboratory, followed by long and tedious assessment stages for commercialization that also consider societal acceptance. In this way, most research output can take many years to be socially implemented, or in some cases, not fully utilized. This research will attempt to radically change this existing framework by carrying out interdisciplinary research covering technology and various societal aspects such as:

- social, cultural, political, history, science and technology, and education right from the initial stage of research, as we investigate the possibility of utilizing
- green technologies for sustainable coastal communities using “blue carbon” (carbon stored in coastal and marine ecosystems)

In AY2021, we have initially explored the possibility of applying green technologies for producing platform chemicals from sugars obtained from seaweed polysaccharides, e.g., fucose, galactose and glucose. These will then be converted to biochemicals and biofuels to support sustainability of the coastal community and neighboring areas.

2. Prospects for the future and anticipated results

The scientific group will further work on the scientific and technological aspects of converting seaweeds into useful chemicals in the laboratory including analysis of the products, life cycle analysis and process integration. The medicine/pharmacy group will analyze the efficacy of the obtained chemicals on certain diseases or viruses. Simultaneously, the sociology/history/ politics group will assess the applicability of the technology by reaching out to the local community, and study the historical and socio-cultural aspects. Concerns and issues to the implementation of the technology such as political and environmental will also be considered. We will also propose ways to educate the stakeholders including students in the community.

The team will collaborate with various institutions overseas to broaden the assessment of the applicability of the approach. To keep the community informed, we will host forums to which we invite experts to share visions of how we might resolve the challenges in the local community.

3. Application plan of KAKENHI and other external grants

The following external grant applications were prepared and submitted in AY2021:

- a. KAKENHI Grant-in-Aid for Challenging Research (Exploratory) AY2022~AY2023
- b. JST e-ASIA Project (SICORP) AY2023~AY2025

4. Possibility about an international collaboration with institutions and universities in abroad

A memorandum of understanding for collaborative research has been initiated between Kumamoto University and the University of the Philippines-Manila. This connection with the University of the Philippines will further extend the network to other institutions such as Cambridge University

(UK) and University of Santo Tomas (Philippines).

Collaboration with a more extended network of top ASEAN universities can be further strengthened if the applied JST e-ASIA Project could be approved.

No.6-3	The Effect of Urban Forestry on Lung Health in Fine Dust Environment		
Research Field(s)	Science	Engineering	Medical Pharmacy Others ()
Coordinator			
Name	Ruda Lee		
Affiliation	Institute of Industrial Nanomaterials Email: aeju-lee@kumamoto-u.ac.jp	Title	Associate Professor
Members			
Name	Title	Affiliation	
Woojin LEE	Research Associate	Kongju National University	
Jung Hoon CHOI	Professor	Kangwon National University	
Myeung Hee NAM	Principle Investigator	Korea Basic Science Institute	

1. Overview and achievements

One of our era's greatest scourges is air pollution, on account not only of its impact on climate change but also its impact on public and individual health due to increased morbidity and mortality. There are many pollutants that are major factors in disease in humans. Among them, Particulate Matter (PM 2.5), particles of variable but very small diameter, penetrate the respiratory system via inhalation, causing respiratory and cardiovascular diseases, reproductive and central nervous system dysfunctions, and cancer. From an environmental perspective, urban forests tend to enhance regional biodiversity, mitigate stormwater management demands, and improve air quality. The only way to tackle this problem is through public awareness coupled with a multidisciplinary approach by scientific experts. This research unit performs interdisciplinary research among engineers, scientists, and veterinarians for suggesting ways how to protect lung health under air pollution circumstances and prevent the production of fine dust. We demonstrated that phytoncide reduced lung inflammation after or before treatment.

2. Prospects for the future and anticipated results

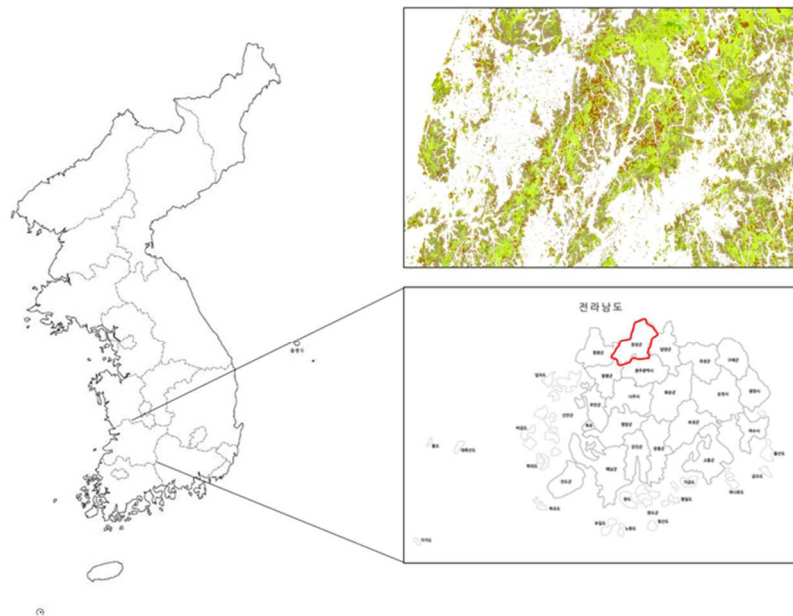
This research was the first discussion between inflammation and phytoncide in animal lung inflammation models. We will search how to act the phytoncide under the fine dust air pollution based on the result. Phytoncide will be purified from Cypress and confirmed as the ingredient by LC/MS and NMR. We will set up an acceptable dust-related lung disease model and test the protective effect of phytoncide. The treatment effect will be confirmed in lung tissues and blood and bronchoalveolar lavage fluid (BALF) by LC/MS. Currently, we start to prepare manuscripts for publication with previous results of phytoncide in the environmental science engineering field.

3. Application plan of KAKENHI and other external grants

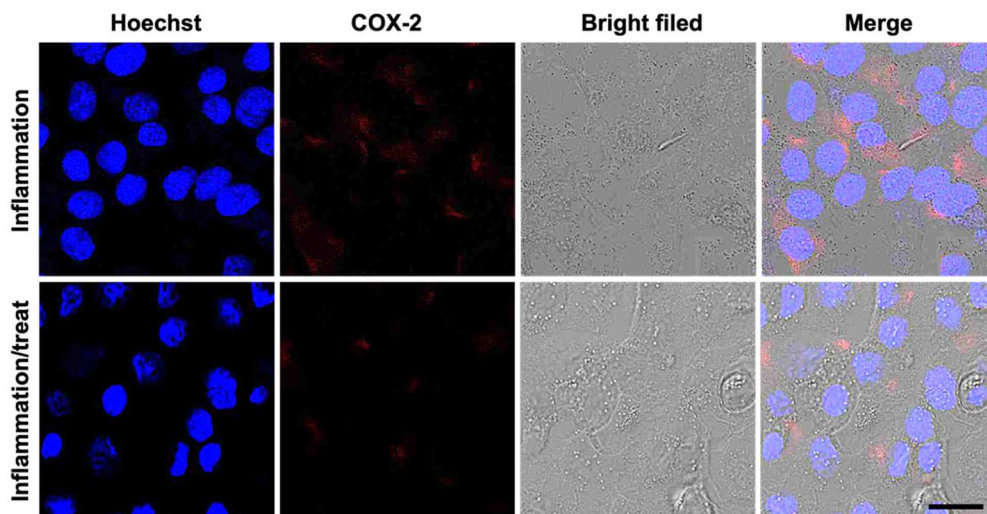
We have a plan to apply Bilateral grant between Japan and Korea in FY2022. Also, Dr. Woojin Lee will apply for the Sejong fellowship in FY2022 based on this research outcome.

4. Possibility about an international collaboration with institutions and universities in abroad

\ Seoul National University has special devices for fine dust research, so we have plan to expand collaboration in FY2022. Furthermore, the relation between air pollution and child welfare will be researched with Department of Civil engineering, BAUHOUS, Germany in the future.



The largest Chamaecyparis obtusa (hinoki) area in Korea

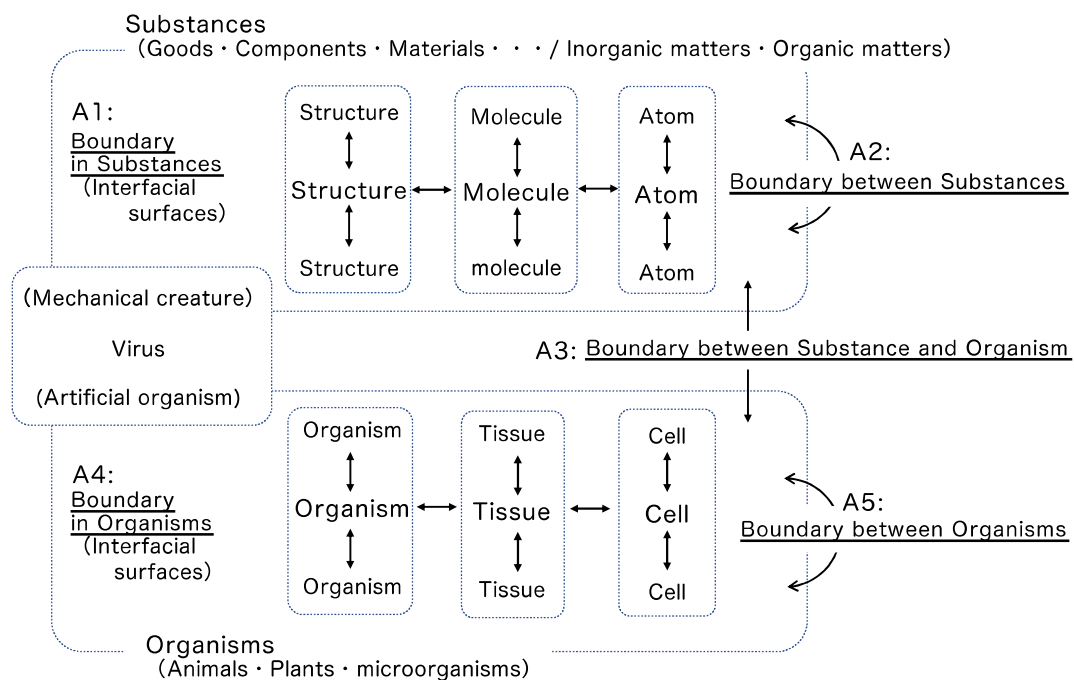


Representative images of anti-inflammation effects of Phytoncide in human pulmonary endothelial cell.

No.6-4	The science of interactions, communications, and fusions in boundaries (FUREAI Science)		
Research Field(s)	Science	Engineering	Medical Pharmacy Others()
Coordinator			
Name	Yoshitaka Nakanishi		
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Members			
Name	Title	Affiliation	
Kei Toda	Professor	Faculty of Advanced Science and Technology	
Yoshihiro Komohara	Professor	Faculty of Life Sciences	
Yuta Nakashima	Associate Professor	Faculty of Advanced Science and Technology	
Yukio Fujiwara	Lecturer	Faculty of Life Sciences	

1. Overview and achievements

“FUREAI Science,” which is the science of interactions, communications, and fusions in boundaries, was launched by the joint research hub. “FUREAI” in Japanese includes various meanings, including physical/sensory/emotional interactions, communications, and fusions observed in multiscale of substance–substance/organism–organism/substance–organism.

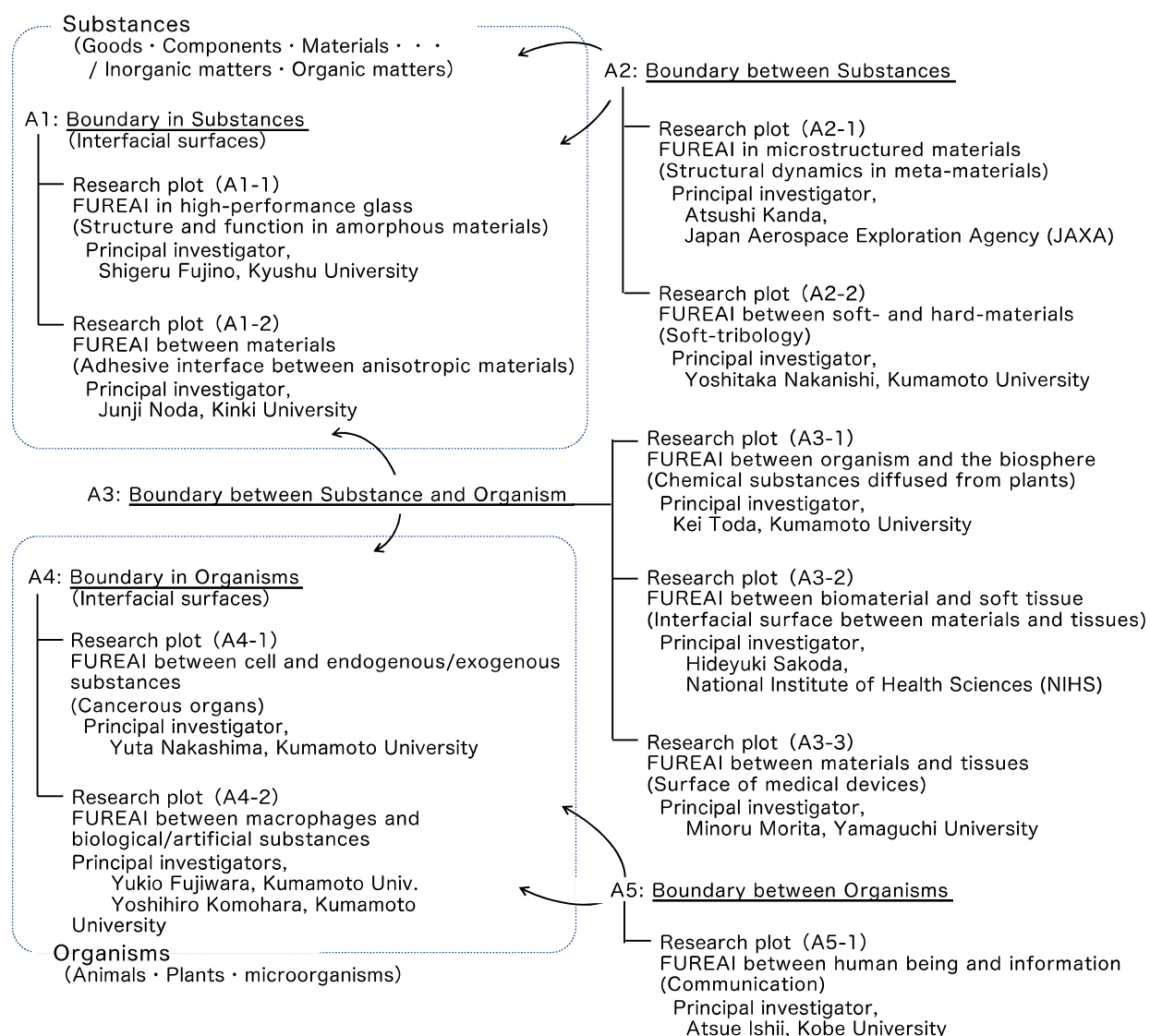


The sciences for interactions, communications and fusions in boundaries (FUREAI Science)

Researchers with different areas of expertise explain various phenomena through “the FUREAI Scientific method.” The wide range of topics proposed by the researchers stimulate scientific discussions. New ideas and approaches are revealed in these discussions, thus creating transformative research areas.

2. Prospects for the future and anticipated results

Currently, the joint research hub comprises 10 principal investigators. The headquarters is located in Kumamoto University. Although a huge organization has been established, the FUREAI Science method enables smoother communication between the principal investigators. The joint research hub has already produced several new frontier research plots.



3. Application plan of KAKENHI and other external grants

The joint research hub is currently preparing applications to Grant-in-Aid for Transformative Research Areas (A).

4. Possibility about an international collaboration with institutions and universities in abroad

Each principal investigator in the joint research hub has already launched or prepared academic research activities. The list below presents the collaboration with international institutions and universities.

Institution or University	Agreement
Chinese Academy of Sciences, China	Memorandum of understanding
Dalian University of Technology China	Academic exchange agreement Student exchange agreement
Uniersitas Brawijaya Indonesia	Academic exchange agreement Student exchange agreement
The University of Adelaide Australia	
The University of New South Wales Australia	
University of Pennsylvania USA	
University of Pittsburgh USA	
University of Twente The Netherlands	Academic exchange agreement
University of Groningen The Netherlands	
University of Bretagne-Sud France	
Gazi University Turkey	Academic exchange agreement Student exchange agreement
Kankiri Karatekin University Turkey	Academic exchange agreement Student exchange agreement