

Social and Technical Innovation and Societal Impact in the Context of the Engineering Sciences

- In the case of Saitama Univ., a mid-sized national university -

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President, Saitama University



Congratulations!
Nobel Physics Prize 2015
Prof. Takaaki Kajita
(graduated from SU in 1981)



Founded in 1949



2016: 67 years old



Ceremony for Foundation (Nov. 1949)



Faculty of Literature & Science



Faculty of Education



As of May 2016

Undergraduate	Student	Graduate School	Student		Exchange Student Etc.	Total No. Student	Faculty	Staff
			Master	Doctor				
Liberal Arts	847 23	Humanities & Social Science	179	73		2,572 161	102 17	
Economics	1,473 42		87	9				
Education	1,974 7	Education	144 9	–		2,118 16	108 0	
Science	902 19	Science & Engineering	843	174		3,894 271	227 14	
Engineering	1,975 56		98	98				
Others (Education Bureau, Research & Development Bureau)					126 104	126 104	34 8	
Total	7,171 147		1,166 194	247 107	126 104	8,710 552	471 39	224 0

Number (included in Number): International Student, Faculty and Staff

International Partnerships with SU

Germany: Esslingen Univ. of Applied Science
 University of Munich
 Brandenburg Univ. of Technology Cottbus
 University of Hamburg
 University of Hohenheim
 Friedrich Schiller Univ. of Jena
 Rhein-Wall Univ. of Applied Science

30 → **48**

Europe

20

North America

→ **23**

41

Asia

→ **58**

4 → **5**

Latin America and
the Caribbean

4 → **5**

Oceania

99

in total As of October 2014

139

in total As of May 2016

“Just 50 km
North of
Tokyo”



Japan

How can universities in Germany and Japan react to current societal demands while at the same time safeguarding the true mission of universities?

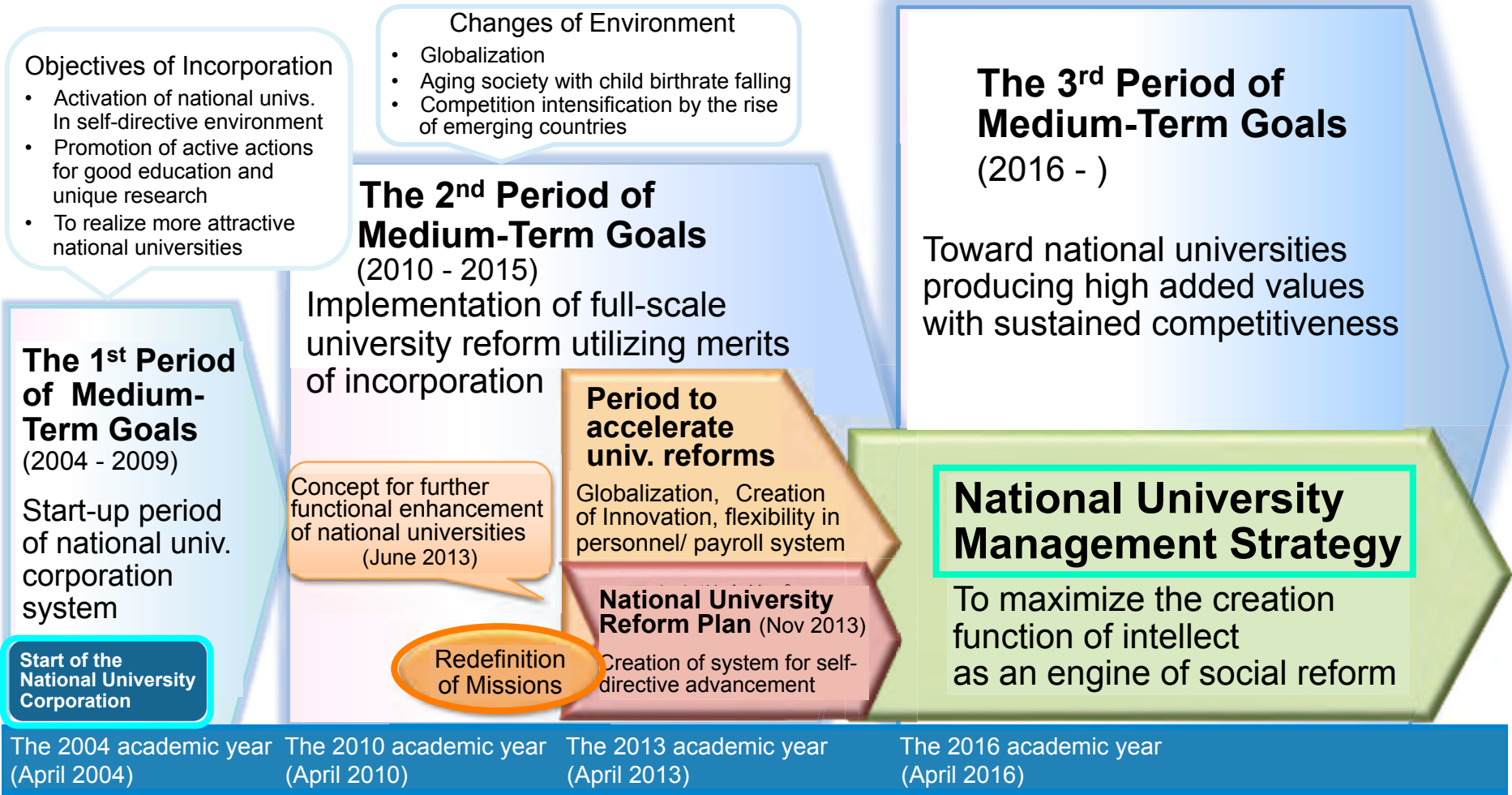
Missions of and Societal Demands to National Universities in Japan

- 86 National Universities in Japan since 2004 Incorporation
Globalization, Innovation
University reform, Functional enhancement
- National University Management Strategy (2016~)
To maximize the **creation function of intellect**
as an **engine of social reform**
International (Global), National, Regional, Specific field

Way of Achieving True Mission and Reacting Societal Demand

- In the Case of Saitama University
COE in Specific Fields of Studies: Strengthening of Research & Education Functions
Regional R/D & Education Center **Importance of Int. Cooperation**

National Universities in Japan since 2004 Incorporation



Actions of SU

● Base reinforcement as an intellectual institution

2013 National University Reform Project

Reform of Saitama Univ. by reorganization/corporation of schools - Extensive enhancement of research and education functions (2013-2018)

● Self-branding as Saitama University

Saitama University, All in One Campus at Capital Sphere, Saitama - Embodiment of Diversity, Synergy and Integration (2016-2022)

2016 Budgetary request for functional enhancement



National University Management Strategy

1. Promotion of functional enhancement based on future vision of university

A framework of 3 Priority Supports is introduced in the national budget allocation to carefully support a functional enhancement action of each national university. In this way, national universities are converted into the organizations performing the development of frontier research areas and the human resource cultivation depending on regional needs.

Priority Support 1

Promotion of HRD and research depending on **regional** needs

55 national universities

THE World University Ranking 601–800: **Saitama U**, Yokohama National U, Niigata U, Shinshu U, Gifu U, Toyohashi U of Tech, Tottori U, Tokushima U, Ehime U, Nagasaki U, Kumamoto U

Priority Support 2

Promotion of establishment of COE and network in **specific field** covered by univ.

15 national universities

THE World University Ranking 401–500: Tokyo Medical and Dental U, 601–800: Kyushu Institute of Tech

Priority Support 3

Establishment of COE in competition with **the world's** top university

16 national universities

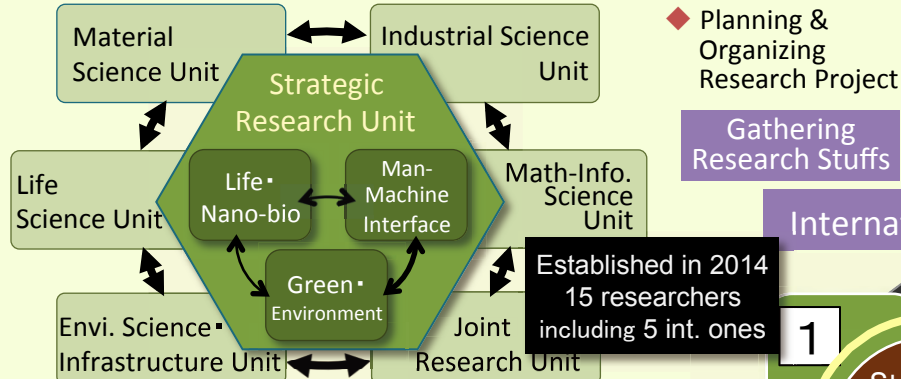
THE World University Ranking 43: U of Tokyo, 88: Kyoto U, 201–250: Tohoku U, Tokyo Institute of Tech
251–300: Osaka U, 300–350: Nagoya U, 401–500: Hokkaido U, Tsukuba U, Kyushu U,
501–600: Tokyo U of Agri and Tech, Kanazawa U, Hiroshima U, 601–800: Chiba U, Kobe U, Okayama U

Strengthening of SU's Research & Education Functions

Strengthening of Research Function

Strategic Research Unit in Graduate School of Sci. & Eng.

URA Office



- ◆ Planning & Organizing Research Project
- Gathering Research Staffs

- ◆ Strengthening of function of Global HRD

Strengthening of HRD function in Humanities & Social Science

School of Economics School of Liberal Arts

Grad. S. Economic Sci. Grad. S. Cultural Sci.

Grad. Sch. Humanities & Social Sci. (2015)

Restructuring into one graduate school

- ◆ Re-education of working people

Redesign of evening program in economics

- ◆ To ensure evening program education

International Japan-Asia Studies

Gathering Academic Staffs

International stuffs

6 int. academic stuffs are newly hired.

【No. of Students】

【No. of Academic stuffs】

Strengthening of HRD function in Science & Engineering

School of Science School of Eng.

Grad. S. of Science & Engineering

- ◆ Strengthening of function of Global HRD

Bachelor-Master Integrated Program

Increase of Master enrolment limit (308→508)

- ◆ Step-by-step increase of enrolment with integrated program

Reorganization of Schools of Science and Eng. (2018)

Strengthening of teacher training in Education

School of Education (480→380)

Graduate School of Education

- ◆ Strengthening of high-quality teacher training

Teaching Profession Grad. S. (April 2016)

- ◆ Step-by-step transition to Teaching Profession Grad. S.

Decrease of enrolment limit in Education (480→380)

- ◆ Focus on primary school teacher training
- ◆ Teacher training by the cooperation with other schools



Saitama University, All in One Campus at Capital Sphere, Saitama

- Embodiment of Diversity, Synergy and Integration -

- Liberal arts, economics, education, science and engineering in one campus
- Japanese students, overseas students and adult students in one campus

- Various regions and regional problems because of Saitama
- Many overseas and adult students gathered in SU because of the capital sphere, Saitama
- From Saitama to the world ! (Local ⇄ Global)

SU aggressively takes a role of regional R/D & Education center to activate the capital sphere around Saitama by the industry-university-government collaboration and by the regional communication.

	2016	2017	2018	2019	2020	2021
Strategy 1: RD and education in integrated sciences for innovation and regional activation		Action 1: Establishment of Graduate School of Integrated Technology & Service				
	Action 2: Doctoral expert in tech.					
	Action 3: Establishment of Frontier Industry International Laboratory					
Strategy 2: HRD and teacher training based on regional needs	Action 4: Establishment of Career Center SU					
	Action 5: Establishment of Teaching Profession Graduate School and its enhancement					
	Action 6: Advancement of teacher training					
Strategy 3: Establishment of COE in specific fields of studies	Action 7: Promotion of international joint researches in Strategic Research Units, Grad. S. of Sci. & Eng.					
	Action 8: Enhancement of Graduate School of Science & Engineering					
	Action 9: Lab-to-Lab Program in Sci. & Eng.					
	Action 10: Enhancement of global human resource development at SU					

Saitama University

Japan

601- World University Rankings
800 2016

Overall	(?)	Data withheld by THE
Teaching	(?)	18.6
International Outlook	(?)	20.6
Industry Income	(?)	29.6
Research	(?)	9.6
Citations	(?)	23.4

Area	Performance indicator	Weight (%)	
Teaching	Reputation survey	15	30
	Staff-to-student ratio	4.5	
	Doctorate-to-bachelor's ratio	2.25	
	<u>Doctorates awarded-to-academic staff ratio</u>	6.0	
	<u>Institutional income</u>	2.25	
International Outlook	International-to-domestic-student ratio	2.5	7.5
	International-to-domestic-staff ratio	2.5	
	International collaboration	2.5	
Industry Income	Knowledge transfer	2.5	2.5
Research	Reputation survey	18	30
	<u>Research income</u>	6.0	
	<u>Research productivity</u>	6.0	
Citations	Research influence	30	30

− Academic staff in Science and Engineering is about 50%.

+ Quality of research paper is relatively high.

2014- : **Lab-to-Lab Program** for Graduate Students in Science & Engineering

- A research-oriented student exchange program based on Lab-to-Lab or Prof-to-Prof relation with partner universities.

Strategy Building Ability

Global Adaptableness

Lab-Based Student Exchange

Overview of Peripheral Areas

- On-Campus Across-Labs Project

International Cooperation

- Lab-to-Lab Outbound Scheme
- Lab-to-Lab Inbound Scheme

Learn from Pioneers

Strategy Understanding

- Analysis of Research Strategy

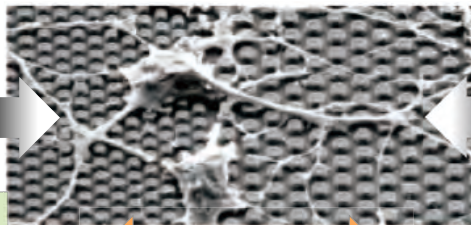
Multidirectional
Commitment
among
Government,
Industry and
University

- Joint Project to study the process from extraction to resolution of problem with counterpart professor
- Understanding of diversity

Physical Chemistry

Prof. S. Nakabayashi
and his **Lab** students

Saitama University, Japan



Biophysics

Prof. I. Ortega-Blake
and his **Lab** students

National Autonomous Univ. of Mexico

Lab-to-Lab



How do we define “innovation” and “societal impact” in the context of engineering science?

Science and Technology Policies in Japan

- The 5th Science and Technology Basic Plan
Realizing a world-leading “super smart society” (Society 5.0)
- Japan Revitalization Strategy 2016
For the 4th Industrial Revolution
➡ The most important key is innovation.

What is innovation?

Innovation is not mere technology renovation nor a spark of genius, but overall new concept to spread in human society. Paradigm Shift

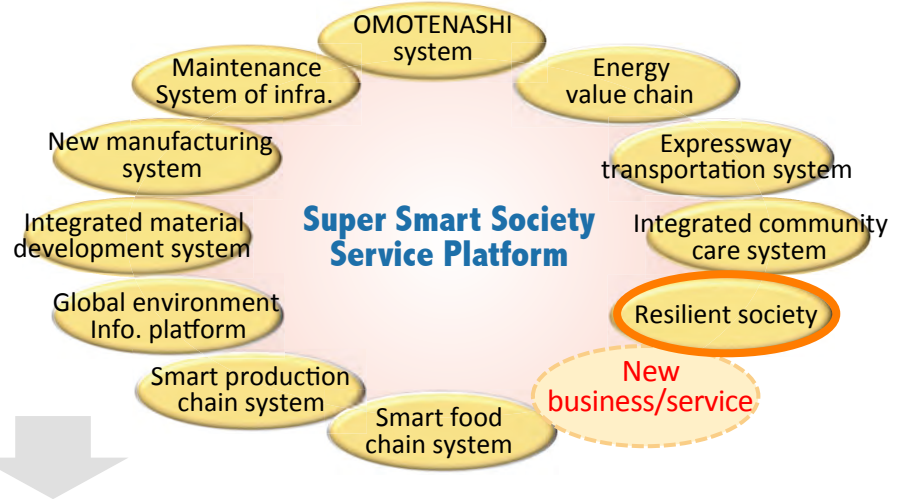
- Innovation in Earthquake Engineering
New Technology of Seismic Isolation and Control
New Concept of Resilient Society

Science and Technology Policies in Japan

● The 5th Science and Technology Basic Plan (Jan. 2016, CITI, Japan)

Realizing a world-leading “super smart society” (**Society 5.0**)

where the various needs of society are finely differentiated and met by providing the necessary products and services in the required amounts to the people who need them when they need them, and in which all the people can receive high-quality services and live a comfortable, vigorous life.



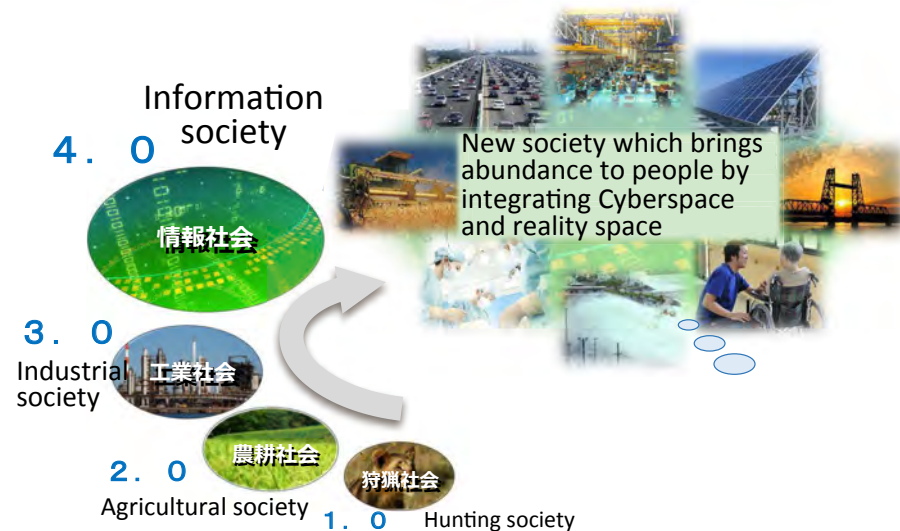
● Japan Revitalization Strategy 2016 - for the 4th Industrial Revolution – (June 2016)

The 4th industrial revolution

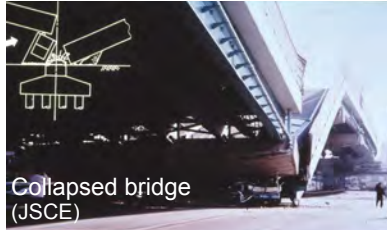
which creates new businesses that resolve social issues and arouse consumers' potential needs by using the technological breakthrough of IoT (Internet of Things), Big Data, Artificial Intelligence and robot sensor.

In promoting the 4th industrial revolution, we will coordinate with the consideration of the basic policy of the Society 5.0 strategy.

The most important key is innovation.



Innovation in Earthquake Engineering



The Great Hanshin/Awaji Earthquake (**Kobe Quake** M7.3) Jan. 17, **1995**

- World's pre-eminent antiseismic techniques → Disillusionment with Japanese seismic engineering
- The honest explanation of bridge engineers: "The earthquake far exceeded what was assumed in the design."

→ Improvement of design standard and introduction of seismic isolation & control



Science & Technology Innovation

The Great East Japan Earthquake (**Tohoku Quake** M9.0) Mar. 11, **2011**

- No severe damage of bridges by direct quake action ← Experience and lesson of Kobe Quake
- The disaster and accident due to the **tsunami** were far beyond imagination !

→ Introduction of new concept of Resilient Society

Creation of resilient society is to create a disaster-resistant and flexible community.

The hardware measures for disaster prevention which only prepare for a disaster as "**pre-risk**" based on the past way of thinking for natural disaster, are powerless when the "outside assumption" happens.

A new way of thinking is to create the society, which is **resilient to natural disaster**, by adding "**on-risk**" at the time of disaster and "**post-risk**" after disaster to "pre-risk" before disaster.

Innovation by integration of Science & Technology and Humanities & Social Science

Looking back on the history, human beings have always learned from tragic disasters and moved forward.

The 2016 **Kumamoto Earthquake** → ?

All in One
Campus at
Capital Sphere,
Saitama:
Diversity &
Synergy



International Institute for Resilient Society



which aims at research, education, and international contributions in the areas of disaster prevention, environment, and infrastructures for constructing truly resilient society.

Issue No.3

What kind of training and education do today's graduates in the engineering sciences require to act successfully as technically expert and interculturally sensitive citizens of the world?

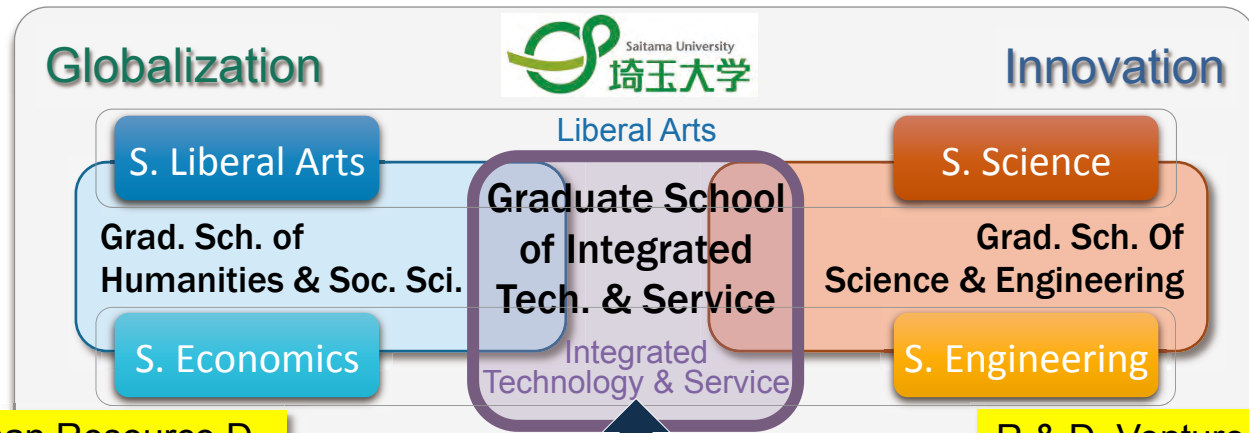
Innovation is not a spark of genius. An ability to take the initiative in solving problems with a diversity of people is a key factor for innovation.

In the Case of Saitama University

- Frontier Industry International Lab. & New Graduate School
Globalization, Innovation
Liberal Arts, Technology and Service
Integration of Arts and Sciences
- Frontier Industry Creation Project by Saitama Prefecture
Project Based Learning
Industry-University-Government Collaboration

Frontier Industry Int. Lab. (2016) & New Graduate School (2018)

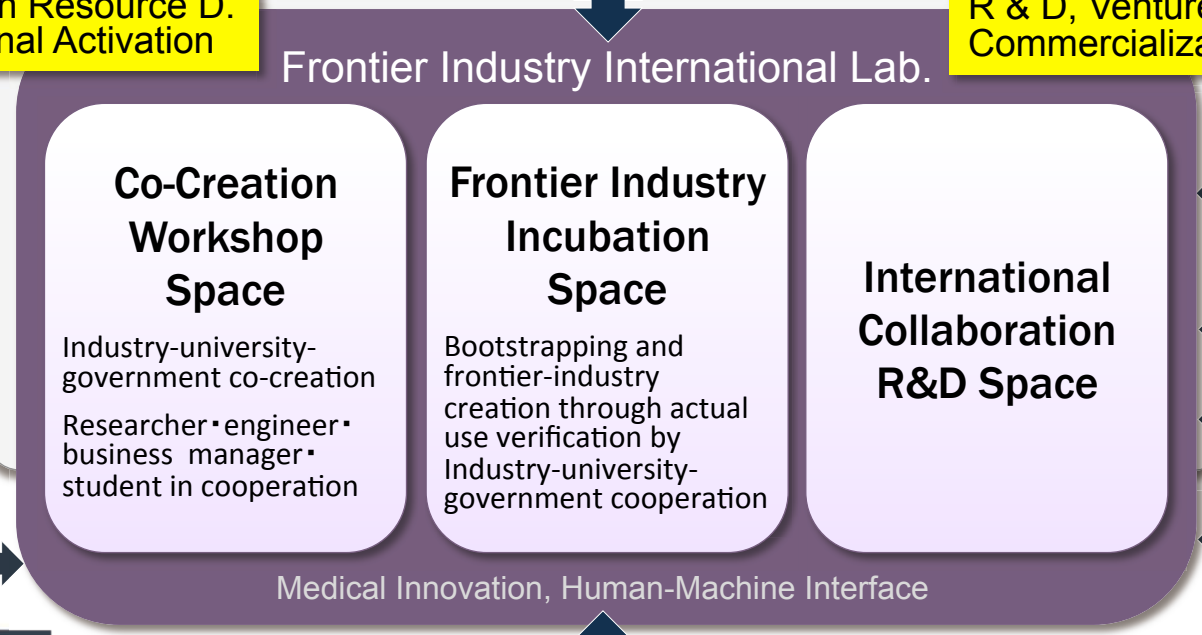
All in One Campus at Capital Sphere, Saitama: Diversity & Synergy



Human Resource D. Regional Activation

R & D, Venture, Commercialization

From Saitama To the World



Medical Univs.
Jichi Med. Univ.
Saitama Pref. U.
Saitama Cancer C.

Oversees Univ.

Domestic Univ.

Regional Industrial Firms

RIKEN

Financial Institution

AIST

NEDO

Frontier Industry Creation Project
【Health Care Industry】+【Medical Technology】etc

Saitama Prefecture

Saitama Industrial Tech. Center

Frontier Industry Support Center



Frontier Industry Creation Project by Saitama Prefecture (2014~)

Background

Task

Action

Year 2025
problem

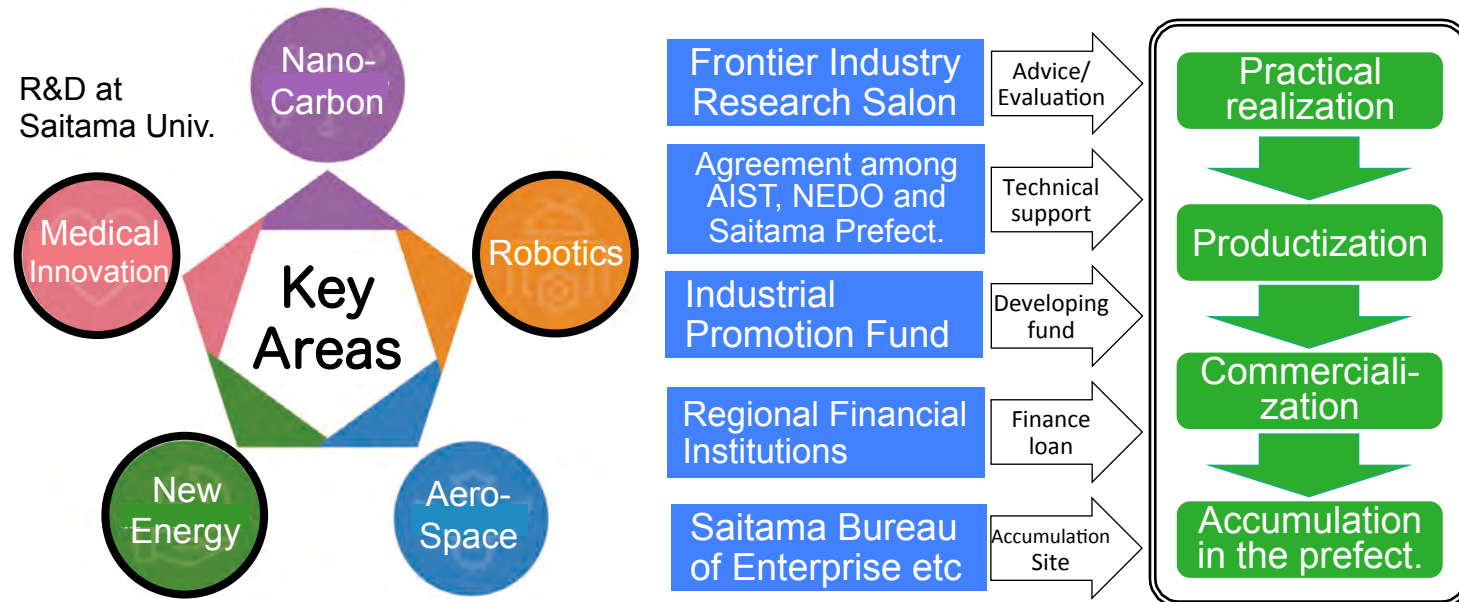
The baby-boom generation becomes elderly aged 75 or over. ⇒ Explosive increase in medical demand and drastic decrease in productive age population ⇒ Shrinkage of workforce and economic recession

To increase regional 'earning power'

Promotion of the Project to plant a seed of next-generation industry and to cultivate it

Frontier Industry Creation Project is promoted to strongly support practical realization, productization, commercialization and industrialization, by integrating advanced study seeds of university/research organization and superior technologies of industrial firm.

It aims to bring up pioneering industries in **5 key areas** and to accumulate them in Saitama prefecture by the cooperation with AIST, NEDO, and financial institutions.

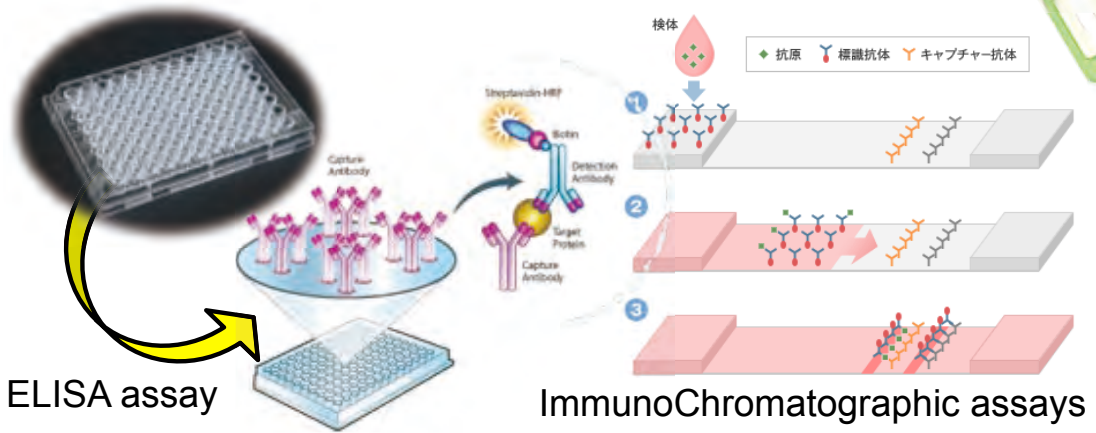


Frontier Industry Research Salon on 23 May 2015

Project 1: Quick detection for Toxins and Infectious Viruses on the basis of Next Generation Antibodies

Vero toxin,
Influenza viruses,
Noro Viruses,
Dengue Viruses,
etc.

ELISA & ImmunoChromatography, etc.



Project 2: Quick diagnostics for Cancer (Tumor) Markers on the basis of Next Generation Antibodies

Survivin,
Other known
tumor makers,
etc.

ELISA & ImmunoChromatography, etc.

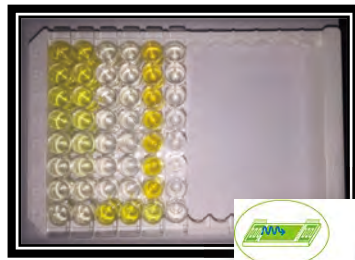
Use of cDNA display method for screening



- Merits
- High affinity
 - High selectivity

Successful Discovery
Anti-Tumor Maker!!
(Next-Generation Antibody)

New Business



ELISA assay

ImmunoChromatographic assays



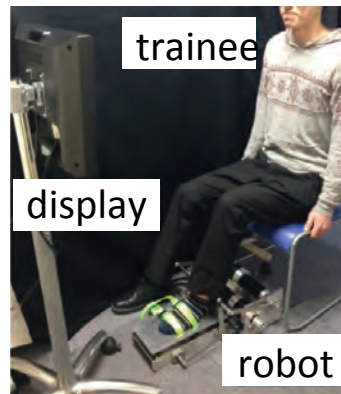
Novel Devices

What is the merit of introducing robot to rehabilitation when robots are **bulky, expensive**? Additionally, it is **less-skilled than therapists**.

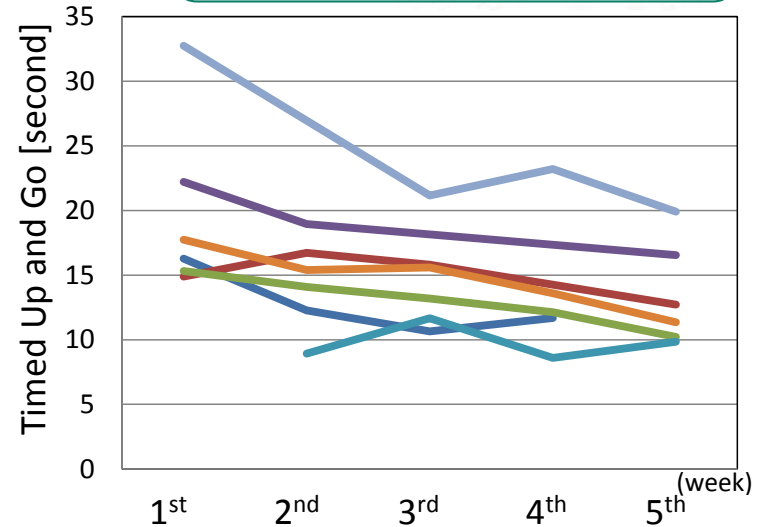
- Robot can measure **accurately** and **automatically** with the equipped sensors.
- **Augmented reality** is also good solution for enhancing rehabilitation.

Proposal in this project

Effective training based on **visualization** of force information

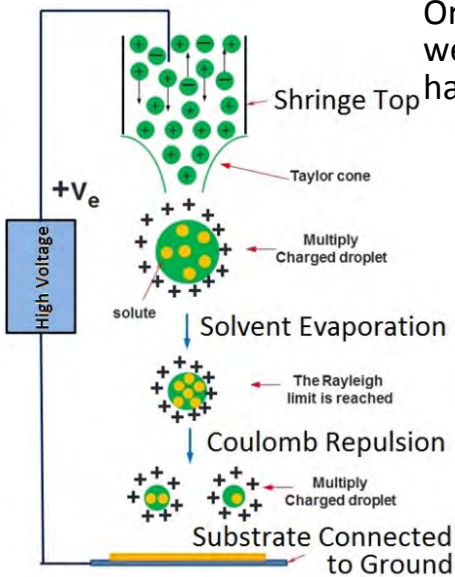


Advanced training machine with force visualization

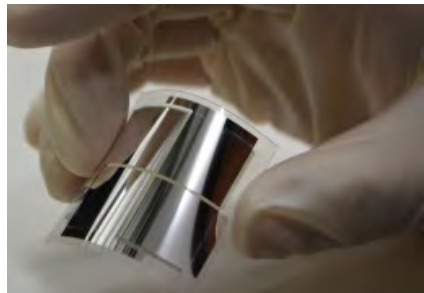


6 out of 7 participants had much **shorter time** after 1 month training. This is a possible beneficial effect of **improvement in ambulatory function**

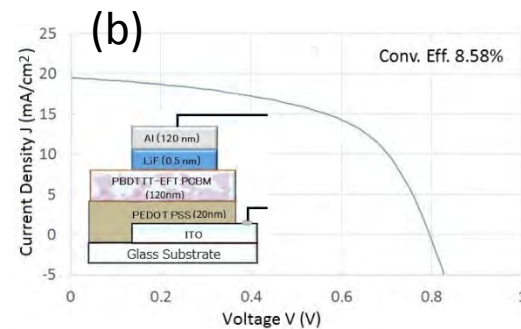
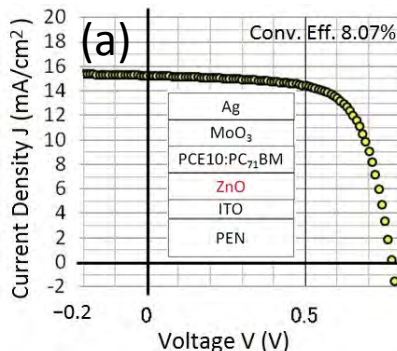
Organic Thin Film Solar Cells by Electro Spray Deposition (ESD) method provide light weight, flexible / 3D curved surface and versatile applicability for mobile and energy-harvesting fields.



Principle of ESD method.

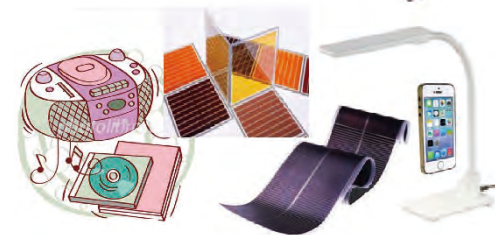


An example of flexible organic solar cell fabricated on a PEN substrate.

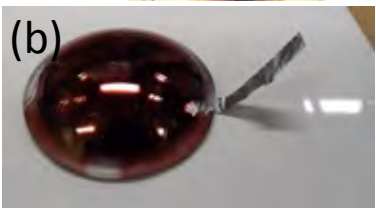
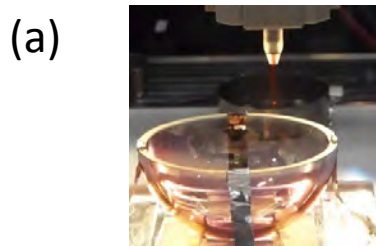


Typical C-V curves and conversion efficiencies of fabricated organic solar cells: (a) An inverse-type cell on a flexible PEN by spin-coating, 8.1%, and (b) A conventional-type cell on a glass by the ESD, 8.6%.

Light Weight, Thin and Flexible!
Combination to Energy-Harvesting Applications!
Diverse Design Capability!



We aim at cost-effective organic solar cell technology based on solution-processed approach in cooperation among industry, prefectural government and academia.



First successful Electro-Spray to 3D curved surface (a) and fabrication of Dome-Shape Solar Cells (b) in cooperation with RIKEN.



Concluding Remarks

In the case of **Saitama University**,
 For **true mission** as an intellectual institution
 ➔ **Global Center of Research & Education**
 ⇕ **Co-existence**
 For **innovation and societal impact**
 ➔ **Regional Center for Frontier Industry Creation & Human Resource Development**

Important keywords:
 International Cooperation
 Industry-University-Government Collaboration
 Technology and Service
 Integration of Arts and Sciences

➔ Diversity, Synergy and Integration



THANK YOU!
 THANK YOU!



- 教育学部 教育学科
- 経済学部 経済学科
- 教育学部 学校教育教員養成課程
 - 小学校コース
 - 中学校コース
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 - 応用化学科
 - 機能材料工学科
 - 建設工学科
 - 環境共生学科

宴
(June)

シリーズ「宴」
 世界中の宴事は、異国の文化・歴史や自然科学、地球の多様性上でのさまざまな連携だ。日本人は極めて多様な背景をもつ料理を日常的に受け入れている。そのうえ、気のおけない仲間との「あうごはん」できえり、供する飲み物、盛り付ける皿を知的に遊び、遊び心をあまじい文化を持っている。
 埼玉大学には、国籍や年齢も様々なひとが集い、多様な研究分野の連携と交流がある。それはまるで、心身を融し集う飲食空間を共にする、みり豊かな宴の場のような。

国立大学法人 埼玉大学 all in one campus

埼玉大学は、学部を超え、1キャンパスだからその周辺に知り合っている。その中身は、特色ある研究と文系・教職系・理系人材育成の機能強化。

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学務部入試課 048-858-3036 資料請求
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