University IP Commercialization and Entrepreneurship: The Experience of the Okinawa Institute of Science and Technology

TECHNOLOGY DEVELOPMENT & INNOVATION CENTER

Okinawa Institute of Science and Technology
Robert Baughman, Executive Vice President / Vice-CEO

December 14, 2017
OIST OBJECTIVES

By conducting internationally distinguished education and research in science and technology in Okinawa

Contribute to the development of science and technology worldwide

Contribute to the promotion and self-sustaining development of Okinawa

• A private research University, with a 5-year PhD program
• Funded by the Japanese Government
• Truly international:
  ➢ At least half the faculty, researchers & students must come from abroad
  ➢ All University business – teaching, research – is conducted in English
  ➢ Academic year starts in September
TIMELINE FOR ESTABLISHMENT OF OIST

- 2001: Proposal of OIST design
- 2004: Research Activity begins
- 2005: Okinawa Institute of Science and Technology Promotion Corporation begins
- 2010: Completed Main Campus and Lab 1
- 2011: OIST Graduate University received accreditation
- 2012: Inaugural PhD class began Sep 3
NEW STYLE GRADUATE UNIVERSITY  Inaugural PhD class began Sep 3, 2012

Mix of different fields of research

Five year integrated doctoral program

Education and research in English
OIST ACADEMIC & RESEARCH FIELDS
Interdisciplinary Studies

Five Major Areas:

- Neuroscience
- Molecular, Cellular, and Developmental Biology
- Mathematical and Computational Sciences
- Environmental and Ecological Sciences
- Physics and Chemistry
STUDENTS AND STAFF MEMBERS

Statistics: As of Oct 1st. 2017

1028 students and staff members from over 50 countries
PROMOTING INTERNATIONAL RESEARCH EXCHANGE

31 → Academic Exchange Agreements: arrangements with universities around the world for research collaborations and student exchange

21 → OIST academic workshops and conferences annually: 2-3 week educational and practical courses with top-level researchers from around the world

+40 Countries/Regions

![Bar chart showing the number of participants in OIST workshops and conferences from FY2013 to FY2016. The number of participants increased from 488 in FY2013 to 1746 in FY2016.}
GOAL

Foster a global innovation ecosystem in Okinawa to create new businesses and industries based on R&D.
TECHNOLOGY TRANSFER WITHIN THE INNOVATION ECOSYSTEM

Multi-level, non-linear, complicated process of inputs, outcomes, and impact

SOURCE: Adapted from K. Cullen, University of Glasgow
TECHNOLOGY DEVELOPMENT & INNOVATION CENTER

Programs and services to support the entire technology transfer process

COMMERCIALIZATION
- Startup Incubator
- Entrepreneurship

PROOF-OF-CONCEPT RESEARCH
- Innovative Technology Research
- Commercialization Research

INTELLECTUAL PROPERTY
- Invention Disclosures
- Patenting

PARTNERSHIPS
- Industry Collaborators
- Licensing

THE PROCESS
FOR BRINGING INVENTIONS TO THE MARKET
Technology Development and Innovation Center
for the self-sustaining development of Okinawa

Technology Licensing Section
- Inventions, Patents
- Licensing

R&D Cluster Programs Section
- Proof-of-Concept Research
- R&D Ecosystem Development

Business Development Section
- Industry collaborations
- Startup Support
PROOF-OF-CONCEPT RESEARCH

Bridging the gap between lab discoveries and market application
OIST Proof of Concept Program

Application Process

- Request for Proposals
  - Admin Review
  - Evaluation by External Committee
  - Selection by Internal Committee
  - Award Projects

Outcomes

- Professional Development
- Attract Industry Collaboration
- Enhance Technology Transfer
- Opportunity for Startup Formation
- Contribute to Okinawa’s Economy

Technology Development Research

- Planning & Operation
  - Internal Experts
- Mentorship
  - External Experts

Funding

Education
  - Entrepreneurship Seminars

Business & Market Intelligence
INNOVATIVE TECHNOLOGY RESEARCH (ITR)

- Highly innovative research to solve important practical problems or meet societal needs
  - Focus on developing innovative technologies
  - Enhance both knowledge and utility
  - High impact projects
  - Lead to inventions and new patents
  - Up to 3 years

COMMERCIALIZATION RESEARCH

- Research that develops a patented technology towards commercialization
  - Enhances commercial value of patents
  - Milestone-based, focused experiments
  - Phase I Feasibility (prototype)
  - Phase II Scale (better, bigger, faster, cheaper, etc.)
  - 1-2 years
PROOF-OF-CONCEPT RESEARCH

RESEARCH OUTCOMES

\[\text{Inventions} \rightarrow \text{Patents} \rightarrow \text{Licenses} \rightarrow \text{Economic Outcomes}\]

BASIC RESEARCH

PROOF-OF-CONCEPT RESEARCH

INNOVATIVE TECHNOLOGY RESEARCH

COMMERCIALIZATION RESEARCH PHASE I / PHASE II

Students
Researchers

Collaboration

Publications

Students
Researchers

Collaboration

Startup
## Innovative Technology Research

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean currents and marine ecosystems; new ocean observing instruments</td>
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<tr>
<td>Next-generation solar energy technology</td>
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<tr>
<td>Coral reef genomics; algae genes involved in bio-products</td>
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<tr>
<td>Sustainable living technologies: micro-grids, electric car battery</td>
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<tr>
<td>Advanced medical technologies, including accelerators and imaging</td>
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<tr>
<td>Novel wave energy conversion technology</td>
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## Commercialization Research

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
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<tbody>
<tr>
<td>Localized surface plasmon resonance platform for biomedical sensors</td>
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<tr>
<td>Biosensors based on nanowire grids</td>
<td></td>
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<tr>
<td>Microbial fuel cells for bioethanol production</td>
<td></td>
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<tr>
<td>Laser stimulated nanoparticle drug delivery system</td>
<td></td>
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<tr>
<td>Microfluidic pump utilizing novel magnetic coupling</td>
<td></td>
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<tr>
<td>Process, instruments for large-area perovskite solar cells</td>
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<tr>
<td>Privacy management architecture for big data</td>
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</table>
INTELLECTUAL PROPERTY

Identifying and protecting novel discoveries
OIST IP POLICIES

“... all intellectual property (IP) conceived, created, developed, or first reduced to practice in whole or in part by members of the University’s faculty (including student employees) or staff in the course of their University responsibilities ... belongs to the University....”

(PRP 14.1)

“Graduate students, postdoctoral fellows, visiting researchers and scientist, and other non-employees must disclose to the University all potentially patentable inventions conceived or first reduced to practice in whole or in part in the course of participation in research projects at the University, or with more than incidental use of University resources.”

(PRP 14.3.1.1)
OIST ROYALTY DISTRIBUTION

15% Overhead Patenting direct expenses

1/3 OIST

1/3 Research Unit

1/3 Inventor(s)

IP royalties

(PRP 14.3.7.3.1)
OIST PATENT PROCESS

INVENTION DISCLOSURE
- Internal

PRIOR-ART SEARCH & MARKETABILITY
- External Experts

INVENTION EVALUATION COMMITTEE
- Internal
  - Approved
  - Rejected

NATIONAL ENTRY

PCT PATENT APPLICATION
- 18 months

PROVISIONAL PATENT APPLICATION
- 12 months

INVENTORS
**PATENTS**

- **特許出願** (Patent Filings): 265
- **特許取得数** (Issued Patents): 52

### Yearly Breakdown

- **FY2004-FY2010**: Patent Filings = 19, Issued Patents = 6
- **FY2011**: Patent Filings = 1, Issued Patents = 2
- **FY2012**: Patent Filings = 19, Issued Patents = 2
- **FY2013**: Patent Filings = 15, Issued Patents = 2
- **FY2014**: Patent Filings = 49, Issued Patents = 1
- **FY2015**: Patent Filings = 55, Issued Patents = 6
- **FY2016**: Patent Filings = 23, Issued Patents = 21
- **FY2017***: Patent Filings = 21, Issued Patents = 10

* (1 Apr – 15 Oct)
PARTNERSHIPS

Identifying industry collaborators, sponsors, licensees, investors
COLLABORATIONS WITH INDUSTRY

Multiple Opportunities to Engage with Industry

**University:**
- Link students to jobs after graduation
- Introduce industry to university; earn income to support core facilities
- Route for technology transfer; socio-economic impact in region
- Link students to jobs after graduation; training opportunity for students
- Introduce industry to university; earn income for teaching

**Industry:**
- Gain access to top talent coming from universities
- Gain access to latest technologies and equipment (particularly in new areas)
- Gain access to latest technologies and potential acquisitions
- Gain access to top talent in core research areas; training opportunity for staff
- Train staff in the latest technologies and techniques

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**Recruit Students and Researchers**

**Access to Research and Facilities**

**Launch or Work with Startups**

**License Technologies**

**Establish R&D Center**

**Train Workforce**
COLLABORATIONS WITH INDUSTRY

Sources of Industry Partners

- University-Industry Collaboration
- Mentors/Advisors of Programs
- Local Promotional Organizations
- Co-location (incubators)
- Tours/Visits/Events
- Publications
- Faculty consulting/network
- Conferences/Exhibitions
- Market/Industry Reports

University-Industry Collaboration

Sources of Industry Partners:

- University
- Industry
- Faculty consulting/network
- Conferences/Exhibitions
- Market/Industry Reports
- Mentors/Advisors of Programs
- Local Promotional Organizations
- Co-location (incubators)
- Tours/Visits/Events
- Publications
QI Unit and Japanese chemical company collaborate to improve conversion efficiencies in solar cells.

SHEN Unit and a Japanese Co. listed on the Tokyo Stock Exchange with a market cap of ¥1.5 trillion collaborate on development of micro and nano fluidics for biomedical applications.

YOKOBAYASHI Unit and Japanese pharma company collaborate on applications of RNA-based gene switches (riboswitches) to drug discovery.
COLLABORATIONS WITH INDUSTRY

KITANO Unit and SONY collaborate on autonomous vehicles

DOYA Unit and FUJITSU collaborate on artificial intelligence applied to energy efficiency
JST START PROJECT

PROJECT:
Novel Eco-Wastewater Treatment System Utilizing Microbial Fuel Cells

GOAL:
Create Venture Company ~June 2019

PARTNERS AND ROLES:
① Catalyst, membrane, electrodes, unit design: OIST
② Test site: Mizuho Brewery (Shuri, Naha)
③ Cover, stand: Engineering firm (Yamada, Onna)
④ Internal plastic parts: Parts factory (Suzaki, Uruma)
⑤ Surrounding Equipment: Chemical company (Konbu, Uruma)
⑥ Project Coordination: TDIC BD Section
⑦ IP landscape analysis: TDIC TL Section
COLLABORATIONS WITH LOCAL INDUSTRY

OIST + OKINAWA ENVIRONMENTAL SCIENCE CENTER

PROJECT:
Engineering Microorganisms to Remove Nitrogen and Phosphorus for the Treatment of Swine Waste

PARTNERS AND ROLES:
① Bacteria community analysis: OIST
② Overall management and chemical analysis: Okinawa Environmental Science Center (Kyozuka, Urasoe)
③ Swine waste sample: Livestock Research Center (Shoshi, Nakijin)
④ Sewage tank layout, technical support: Engineering design firm (Madanbashi, Tomishiro)
⑤ Project coordination: TDIC Business Development Section
COLLABORATIONS WITH LOCAL INDUSTRY

OIST + OKINAWA ENVIRONMENTAL SCIENCE CENTER

PROJECT:
Engineering Microorganisms to Purify Contaminated Soil and Groundwater

PARTNERS AND ROLES:
1. Overall management and chemical analysis: Okinawa Environmental Science Center (Kyozuka, Urasoe)
2. Soil contamination purification research: National Institute of Technology, Okinawa Kosen (Henoko, Nago)
3. Groundwater contamination purification research: OIST
4. Soil samples: Construction company (Nishizaki, Itoman)
5. Soil samples: Construction company (Oroku, Naha)
6. Project coordination: TDIC Business Development Section
COLLABORATIONS WITH LOCAL INDUSTRY

OIST + UNIVERSITY OF THE RYUKYUS

PROJECT:
Development and analysis of fermented *Koji* rice malt beverage as a health supplement

PARTNERS AND ROLES:
1. Overall management and chemical analysis: *Ryukyu University*
2. Animal test: *Ryukyu University*
3. Mouse intestinal bacteria flora DNA analysis: *OIST*
4. Sugar chain analysis: *National Institute for Physiological Science* (Okazaki Prefecture)
5. Manufacturing method improvement and evaluation: *Mizuho Brewery* (Shuri, Naha)
## COLLABORATIONS WITH INDUSTRY

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>OIST RESEARCH UNIT</th>
<th>PARTNER(S)</th>
<th>AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synthesis of novel pharmaceutical chemicals</td>
<td>TANAKA</td>
<td>Japanese Medical Device Company</td>
<td>Health</td>
</tr>
<tr>
<td>Privacy management architecture for big medical data</td>
<td>KITANO</td>
<td>Drug discovery startup</td>
<td>Health</td>
</tr>
<tr>
<td>Modified rice with reduced carbohydrate</td>
<td>SAZE</td>
<td>NARO U. of the Ryukyus</td>
<td>Health</td>
</tr>
<tr>
<td>Micro- and nano-fluidics for biomedical applications</td>
<td>SHEN</td>
<td>Japanese Medical Device Company</td>
<td>Health</td>
</tr>
<tr>
<td>Process and instruments for large area perovskite solar cells</td>
<td>QI</td>
<td>Japanese Chemical Company</td>
<td>Energy</td>
</tr>
<tr>
<td>Microgrid sustainable electricity production &amp; management</td>
<td>KITANO</td>
<td>SONY CSL Okisoko</td>
<td>Energy</td>
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<tr>
<td>Sustainable living architecture technologies</td>
<td>KITANO</td>
<td>Misawa Homes</td>
<td>Architecture</td>
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<tr>
<td>Microbial fuel cells for wastewater treatment</td>
<td>GORYANIN</td>
<td>Mizuho Shuzo Bio-sight Capital</td>
<td>Environment</td>
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<tr>
<td>Drive and control systems for electric vehicle applications</td>
<td>KITANO</td>
<td>PUES</td>
<td>Transportation</td>
</tr>
<tr>
<td>Algorithms applied to AI for energy management</td>
<td>DOYA</td>
<td>Fujitsu</td>
<td>AI, Energy</td>
</tr>
<tr>
<td>Protein therapeutic for cancer</td>
<td>YAMAMOTO</td>
<td>Japanese Pharma Company</td>
<td>Health</td>
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<td>Alien species countermeasures</td>
<td>ECONOMO</td>
<td>Okinawa Environmental Science Center</td>
<td>Fisheries</td>
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<tr>
<td>Protein imaging for drug discovery</td>
<td>SKOGlund</td>
<td>Okinawa Protein Tomography</td>
<td>Health</td>
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<tr>
<td>Genomic analysis for the pearl oyster industry</td>
<td>SATOH</td>
<td>Agricultural and Food Research Organization</td>
<td>Environment</td>
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<tr>
<td>Genomic analysis for coral restoration</td>
<td>SATOH</td>
<td>Okinawa company</td>
<td>Environment</td>
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<tr>
<td>Genomic analysis for mozuku production</td>
<td>SATOH</td>
<td>Fisheries Association</td>
<td>Fisheries</td>
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<tr>
<td>Bioactivity analysis of natural product for cancer</td>
<td>YAMAMOTO</td>
<td>Inst Biological Resources</td>
<td>Health</td>
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<tr>
<td>DNA sequencing for the fermented beverage industry</td>
<td>SAZE</td>
<td>U. of the Ryukyus</td>
<td>Environment</td>
</tr>
<tr>
<td>New materials for energy efficiency</td>
<td>QI</td>
<td>Intl Materials Science Co.</td>
<td>Energy</td>
</tr>
<tr>
<td>Novel wave energy conversion system (<em>under negotiation</em>)</td>
<td>SHINTAKE</td>
<td>Japanese Co &amp; Intl Govt</td>
<td>Energy</td>
</tr>
<tr>
<td>New concept cart</td>
<td>KITANO</td>
<td>SONY</td>
<td>AI</td>
</tr>
<tr>
<td>RNA-based gene switches in drug discovery</td>
<td>YOKOBAYASHI</td>
<td>Japanese Pharma Co.</td>
<td>Health</td>
</tr>
<tr>
<td>Compact high-current proton ion source</td>
<td>SUGAWARA</td>
<td>Japanese Instrument Co.</td>
<td>Physics</td>
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COLLABORATIONS WITH INDUSTRY

Case Studies at OIST

EXAMPLE 1:
- Proof-of-Concept Project
- Collaborative Research Contract
- Global Industry Expert Assigned as Mentor
- International Materials Science Co.
  - 10M Upfront
  - 10M with milestones

EXAMPLE 2:
- Connected with Industry at Conference
- Meetings with Faculty
- Collaborative Research Contract
  - 30M Upfront
  - 50M with milestones
- 2nd Collaboration with Another Faculty Member
  - 20M Upfront

EXAMPLE 3:
- Faculty Consulting with Company
- Sponsored Research Contract
  - 9M over 3 years
- Collaborative Research Contract
  - 5M Upfront
  - 5M with milestones
ENTREPRENEURSHIP
Transferring technologies to startup companies
STRATEGY FOR ENTREPRENEURSHIP IN OKINAWA

1. Provide an **environment** in which entrepreneurs can **thrive**
   - Create a place that fosters connections between entrepreneurs and others around them

2. **Recruit** talented entrepreneurs from around the world
   - Allow innovative ideas & solutions to enter Okinawa from **anywhere**

3. Give entrepreneurs access to **funding** to pursue innovative ideas

4. Strengthen capabilities: **technical advice, business connections**

5. Provide **entrepreneurship education** to help entrepreneurs develop their business **strategy**
INNOVATION SEMINARS AND WORKSHOPS

Seminar Series

Gwilym Roberts, Ph.D.  
(IP Expert, UK)

Scott Brown, Ph.D.  
(CEO, UK)

Nancy Hecker-Denschlag, Ph.D.  
(Industry Leader, Germany)

Sir Richard Roberts, Ph.D.  
(Nobel Laureate, USA)

Professional Development Workshops

Project Management in University Research  
Instructor: Bill Dietrich, Stanford  
Instructor: King Chow, PMP

Business Planning  
Instructors: Hiroshi Sato  
Instructor: Kaz Ohmae
32 Participants
3 Startup Teams
2 NSF I-Corp Instructors

5th ANNUAL WORKSHOP: 20 Oct – 2 Nov 2017
ENTREPRENEURSHIP

FUTURE DIRECTION: Startup Incubation

INVESTORS
- Government
- Banks
- VCs/Angels

INNOVATION incubator facility
- ENTREPRENEURS
- STARTUP COMPANIES
- INDUSTRY COLLABORATORS

OIST

Model of Innovation Ecosystem Centered Around OIST

INNOVATION incubator facility
- fees
- equity
- IP licenses
- core facilities

COMPANIES

MENTORS

PARTNERS
- Accelerators
- Service Providers
- Contractors
- Maker, Co-working Spaces

grants
loans
investments

technology prototyping

technology transfer

advice
expertise
FUTURE DIRECTION: Startup Accelerator

Startup Accelerator Model

• **Fixed term, Cohort-based** (entrepreneurs enter/exit in groups)

• **Connections** (pool of industry mentors to tap into or matched one-on-one)

• **Educational component** (entrepreneurship seminars, courses)

• **Investment** (equity and non-equity-based funding)

• **Space** (lab space, office space)
OIST STARTUP ACCELERATOR: Leveraging OIST Resources

RESOURCES@OIST
- Incubator facility
- Funding
- High-tech equipment
- Educational courses
- Access to OIST expert network
- Support from TDIC staff
- Publicity & community outreach
- Connections to investors

Startup Accelerator Program
OIST STARTUP ACCELERATOR: Process

Startups Apply + Selection
- Open application
- Selection made by external review panel

Funding/Investment
- Each selected startup will receive on first day:
  - ¥15M seed funding
  - Space in incubator facility
  - Mentors
  - Access to share/core equipment at OIST

Mentoring + Development
- 12-month duration
- Educational courses
- Advice on all subject areas related to their venture
- Expected to conduct outreach to local community (3/year)
- On-going monitoring of progress

EXIT program
- Startups spin-off, acquire seed funding
STARTUP SUPPORT@OIST

- Patenting/Licensing
- Industry Collaborations
- Proof-of-Concept Research
- External Grants
- Entrepreneurship Education
- Networking/Mentorship
- Core Equipment
- Startup Accelerator Program

Other Incubators in Okinawa
- Okinawa Science & Technology Promotion Center
- Okinawa Health Biotechnology Research Center
- Okinawa Life Science Research Center
STARTUP SUPPORT: Case Study 1

1. OIST secures 3 patents on advanced structural imaging technologies
2. START: Program for Creating STart-ups from Advanced Research and Technology
3. Industry research partners identified
4. Commercial feasibility studies
5. CEO recruited
6. Startup business plan drafted
7. ¥10M seed investment from Bio-Sight Capital Jul 2014
8. ¥80M equity investment from Okinawa Development Finance Corporation Sep 2015

>¥140M Raised
STARTUP SUPPORT: Case Study 2

START GRANT AWARDED 2017
Prepare launch of 2nd OIST Startup

GORYANIN Unit receives START grant to commercialize wastewater treatment technologies based on microbial fuel cells
SEEDING AN INNOVATION ECOSYSTEM IN OKINAWA

*Universities, Government, Startups & Industry*

**THE CORE**: Provides the seeds of innovation: educated and trained personnel, research discoveries, and public funding for research.

**INNOVATION INITIATIVES**: Provide facilities and programs to bridge the gap between research discoveries and innovative technologies and services.

**STARTUP ECOSYSTEM**: Connects business expertise, market needs, and risk financing to support entrepreneurship and grow new ventures.

**CUSTOMERS**: Industry expands markets with new technologies; social prosperity increases through new technologies, jobs, and higher wages.