

FY 2012 WPI Project Progress Report

World Premier International Research Center Initiative (WPI)

Host Institution	Nagoya University	Host Institution Head	Michinari Hamaguchi
Research Center	Institute of Transformative Bio-Molecules (ITbM)	Center Director	Kenichiro Itami

Summary of center project progress

1. Background

“Connecting molecules, creating value, and changing the world.” Center Director Kenichiro Itami’s vision to attract top-level young scientists in the field of synthetic chemistry and systems biology all over the world has finally led to the launch of the Institute of Transformative Bio-Molecules (ITbM). The objective of ITbM is to create innovative functional molecules that make marked changes in life science and technology so-called “transformative bio-molecules”, based on the full-scale collaboration between chemists and biologists. Assembling the tools and people for ITbM started in December 2012 and the Institute began officially in April 2013.

2. Lineup

In accord with Itami’s plan, Vice Director Tetsuya Higashiyama, Nagoya PIs Shigehiro Yamaguchi, Takashi Ooi, Stephan Irle, Takashi Yoshimura, and Toshinori Kinoshita and overseas PIs Cathleen Crudden, Keiko Torii, and Jeffrey Bode have all signed on as the core researchers of ITbM. Although they are all working under considerable pressure to manage their own laboratories including giving lectures around the world, they have all enthusiastically agreed to partner with Itami to meet the goals of ITbM.

The inauguration of ITbM was announced via the web, along with detailed descriptions of its philosophy, policy, and plans for the development of truly transformative bio-molecules. As of April 1st 2013, ITbM had already employed or decided to employ Co-PIs for all overseas PIs and faculties for NU-PIs. Eight postdoctoral researchers were selected from among over 100 international applicants.

ITbM has organized a high-powered administrative office to facilitate the goals of the ITbM and enable researchers to focus on developing their world-leading research. Half of the officers will be doctoral scientists, and all research and administrative business will be carried out in both English and Japanese. Administrative officers will be responsible for organizing many important ventures, including international symposia, to effectively communicate the research of ITbM to the world.

3. Infrastructure and Bylaw

ITbM has been working to build a platform for conducting interdisciplinary research by bringing together research managers, research promotion staff, and individual researchers to work in a shared space, and in a cooperative manner. The goal is to promote interdisciplinary, mutually-supportive, and highly flexible interactions between researchers and managers from various backgrounds in chemistry and biology. The “Mix-Lab” concept is expected to accelerate cross-disciplinary research. In conjunction with this Mix-Lab-initiative, mentoring of young and female researchers is also one of the core concepts of ITbM, which is reflected in the design of the new building, began in March 2013.

As an independent Institute, the “Nagoya University Institute of Transformative Bio-Molecules Steering Committee Rules” were established. The Center Director will manage the operations of the Institute in consultation with the Steering Committee.

4. Achievement FY2012 and Future prospects

In FY2012, ITbM has announced two exciting press releases regarding the discovery of transformative bio-molecules related to controlled cross-fertilization and biological clocks. In addition, the International Symposium on Transformative Bio-Molecules, ISTbM-1 is scheduled to be held on the 18th and 19th of April to celebrate the opening of ITbM. Top researchers from around the world are invited to participate along with all PIs of ITbM. This meeting will be run by the ITbM Administrative Department. An international workshop, called the “Hirata Memorial Lecture” is also being scheduled. ITbM aims to carry out unique cross-disciplinary research in an unprecedented and dynamic manner. In the near future, we will have “Transformative Bio-Molecules” in our hands.

1. Summary of center project

<Plan at start of project>

Our goal is to develop innovative functional molecules that make a marked change in the form and nature of biological science and technology by taking full advantage of the cutting-edge molecular synthesis expertise of our chemistry PIs and intense interactions with our leading plant/animal biology PIs. Through this interaction, which is fundamental to the Center, transformative bio-molecules will be synthesized that can (1) **enhance biotic productivity and quality** and (2) **realize innovative bio-imaging**. To ensure the advancement of these projects, we will (3) **develop catalysts that enable incredibly efficient synthesis and molecule activation on demand**. The ultimate goal is to have a positive impact on global issues such as food production. Our team of PIs is an innovative mix of chemists and biologists from Japan and abroad. A Co-PI system, and an efficient administration with an English focus will ensure that international members will have significant involvement in the project.

The Center will start with 10 PIs, including 3 foreign researchers, and one Administrative Director. These founding members will then hire post-doctoral researchers, research assistants, administrative staff, and secretaries.

The seven world-class PIs selected from Nagoya University all have proven abilities to make major contributions to the objectives of this Center and the flexibility to integrate the accumulated wisdom of diverse disciplines. The large proportion of talented young PIs will help ensure the long-term vitality of the WPI Center and mentoring of the next-generation of researchers in this field.

PIs from overseas cooperating institutes include eminent chemists and biologists from around the world. These PIs will have double affiliation with Nagoya University and their home institutions, and they will actively transmit information and provide significant opportunities for other foreign researchers to participate in the Center. Their present host institutions will be designated as Cooperating Institutes, which are regarded as major gateways to our Center.

We consider this double affiliation strategy to be a considerable strength of our proposal, even if double-affiliated PIs will not be physically present full time at the Center. To ensure close contact and continuity in research, we will support the hiring of Co-PIs. Co-PIs will be based at the Center in

<Results/progress/alternations from plan at start of project >

There is no change in the outline of the center project. All the ITbM members including researchers and Administrative Department staff form a cohesive team and have helped make a superb start toward our goal to develop "transformative bio-molecules". Major achievements in FY2012 are listed below:

1. Special research laboratory "Mix-Lab" for interdisciplinary research, a server room for theoretical calculations, and measurement instruments for the product analysis were all set up.
2. 3 Co-PIs were appointed to ensure close contact and continuity in overseas PIs research. 3 designated associate professors and lecturers, and 8 overseas postdoctoral researchers were also appointed.
3. Several key people were assigned to the Administration Department based on research experience and English strength. The department is composed of two teams.
(1) Management team in charge of general affairs and accounting.
(2) Research Promotion team in charge of issues directly related to research such as public relations, research administration, and international promotion.
4. Plans for the new ITbM building are underway. The footprint of the building is about 7,000 m² and the "Mix" concept to promote the cross-disciplinary research is a priority. The building is being designed to promote interactions between researchers not just in a lab setting, but also with common areas for social interactions between researchers of various levels of experience. Consideration has been given for faculty with children with the creation of child-friendly areas, and an open-concept design will be welcoming to guests of all kinds.

Nagoya, but chosen and guided by double-affiliated PIs. Co-PIs will be considered for promotion to full PI status when their research potential is realized.

An International Advisory & Review Board has already been assembled, which will support our research.

The Center will establish an effective and efficient administration staffed by talented individuals with a good command of English, as well as a global outlook and vision. In addition, resources will be allocated to hire a substantial number of technical staff in order to minimize the extra demands on the time of researchers, freeing them to concentrate on their core research activities.

2. Research fields

<Plan at start of project >

Target research field: **Molecule-Activation Chemistry* for Advanced Systems Biology**** (This is an area in which Nagoya University has significant international competitive advantages: synthetic chemistry, molecular catalysis, systems biology, plant science, peptide science, live-cell imaging.)

The interface of chemistry and molecular biology has already resulted in important new research fields of significant scientific impact, such as chemical biology and medicinal chemistry. We plan to bring this to a new level by exploiting newly developed molecule-activation chemistry partnered with fundamental biological systems of plants and animals. This research endeavor will have significant impacts in the closely related fields of chemical biology and medicinal chemistry, but most importantly, on areas that are of urgent global importance including world food production, medical care, and bioenergy.

***Molecule-Activation Chemistry:** The synthetic chemistry that enables the activation and direct transformation of stable molecules into target structures. This methodology can rapidly convert biologically active "lead" molecules into more selective and active derivatives.

****Systems Biology:** The biology to unveil the pivotal mechanism of how organisms function as a system. The discovery of key molecules operating biological systems at an individual organism level is crucial.

<Results/progress/alternations from plan at start of project >

Target research field of ITbM has not changed.

To execute ITbM's mission, chemistry, biology, and computational science should be truly mixed. To realize this cross-disciplinary research,

1. Two Mix-Labs (area of each lab is approx. 400 m²) have been set up to enable cross-disciplinary research to take place before the new building is constructed. Each Mix-Lab space is shared by a group from chemistry, biology, and computational science. One group conducts research to develop molecules that precisely control biotic function and production, and another group focuses on the development of innovative bio-imaging molecules and related photoelectronic molecular technologies. This framework should be flexible and the composition will vary according to the progress research.
2. ITbM decided to establish a Live-Imaging Center by expanding the related center launched at the Graduate School of Science, NU.
3. ITbM decided to launch two additional new centers, the Molecular Structure Center and the Chemical Library Center to promote cross disciplinary research at ITbM.
4. ITbM decided to allocate a specialist for each of the three centers.

3. Research objectives

<Plan at start of project>

Based on our vision of employing Molecule-Activation Chemistry for Advanced Systems Biology, we propose the following research consisting of three major objectives.

I) Control of Biological Systems

- (a) Molecules that dramatically enhance plant growth
- (b) Molecules that improve animal reproduction innovatively
- (c) Molecules that overcome the genome barrier to produce novel crops

II) Visualization of Biological Systems

- (a) Targeting plant fertilization, embryogenesis, and animal season sensing
- (b) Highly efficient, full-color fluorescent molecules
- (c) Specific conjugation technologies for peptide labeling

III) Synthesis of New Bio-Functional Molecules

- (a) Catalysts activating C-H bonds for direct transformations of bio-molecules
- (b) Catalysts acting without heavy metals
- (c) Catalysts for protein ligation

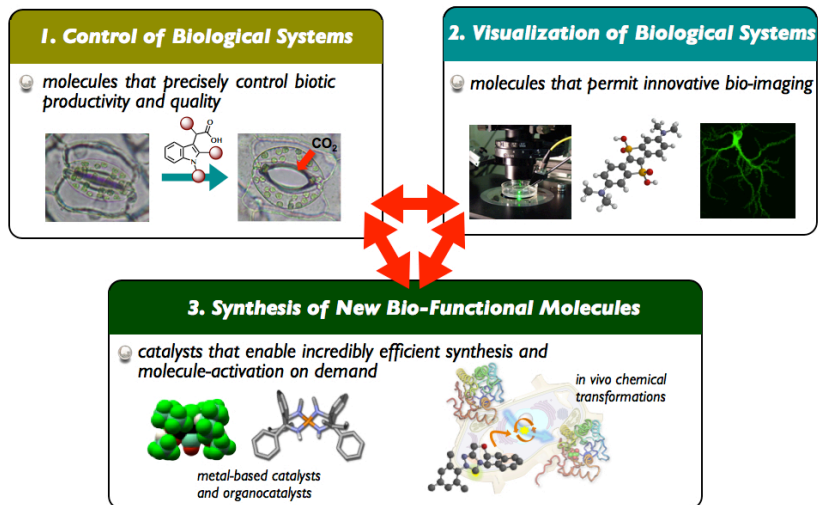
Research objective (I) aims to precisely control biological systems. We will utilize all the outcomes obtained in this Center to accomplish this objective. Research objective (II) aims to visualize biological systems at will. The outcome of this research objective (II) has significant impact on a wide range of life science-related fields. At the same time, it accelerates research objective (I). In research objective (III), we will develop small-molecule catalysts for achieving ideal chemical synthesis. This is the core of this Center and provides viable methods for realizing both objectives (I) and (II). In addition to these, feedback from objectives (I) and (II) further promote the development of catalysts in objective (III). Thus, the three major research targets are closely integrated. Importantly, progress in these three major fields will together result in the development of transformative bio-molecules.

<Results/progress/alternations from plan at start of project >

Research objectives of ITbM have not been changed. Notable achievements are listed below.

1. Higashiyama discovered a key molecule to control cross-fertilization (See Appendix 5). This result will lead to transformative bio-molecules which enable control of plant breeding at will by manipulating cross-fertilization.
2. Yoshimura ascertained how the timing of rooster crowing is controlled by circadian clock. This result was given media exposure in Japan and overseas (See also Appendix 5). This result will lead to transformative bio-molecules which enable control over biological clocks.
3. ITbM employed a Co-PI (Crudden group) and appointed 2 Co-PIs (one for Torii group and the other for Bode group).
4. ITbM put out an international call for postdoctoral researchers from all over the world. ITbM has already decided to employ 8 postdoctoral researchers from overseas.
5. Mix-Lab has already been set-up to promote ITbM's cross-disciplinary research. Chemists have already begun synthetic studies on one of the transformative bio-molecules proposed by ITbM biologists. This will be a good example to prove how cross-disciplinary interaction functions.
6. The international symposium (The 1st International Symposium on Transformative Bio-Molecules, ISTbM-1) is scheduled to be held on the 18th and 19th of April to celebrate the opening of the ITbM. 8 world's-experts in the areas of computational science, systems biology, biochemistry and synthetic chemistry, and PIs at ITbM will participate in this symposium. This meeting is being organized primarily by the ITbM Administrative Department.
7. ITbM will invite Professor Osamu Shimomura, a Nobel laureate 2008 in Chemistry and Professor Emeritus of Boston University and Nagoya University, to ITbM in October 2013. The Administrative Department has started preparing the public symposium in partnership with the Graduate School of Science.

Our Three Core Projects are closely related and integrated



8. In FY2013, ITbM is going to collaborate with two key institutes, the Center for Selective C-H Functionalization, National Science of Foundation, USA and Center for Sustainable Resource Science, RIKEN.

4. Management

<Plan at start of project >

1) Composition of administrative staff

i) The Administrative Director manages six units of administration: 1) general affairs unit, 2) accounting unit, 3) international promotion unit, 4) research

<Results/progress/alternations from plan at start of project >

On December 1, 2012, "Institute of Transformative Bio-Molecules (ITbM) Establishment Preparation Office" was launched. The office belongs directly to the Executive Board of NU, and has conducted the work necessary to launch the Institute on April 1, 2013, such as determining the rules of the Institute.

A Trustee of Nagoya University, who is appointed to the Administrative Director of the Institute, was assigned as the director of the office. This assignment enables ITbM to communicate with NU and receive full assistance from NU as the host institution.

1) Composition of administrative staff

In FY2012, the director of the office, the Head of Management (the Director of International Student Exchange Division as a concurrent post) and the

administration unit, 5) public relations unit, and 6) environmental affairs unit, with the support of Associate Administrative Directors.

ii) Two Associate Administrative Directors will be appointed. One is for internal affairs (to manage the general affairs unit and the accounting unit) and the other is for external relations (to manage the international promotion unit, the research administration unit, the public relations unit, and the environmental affairs unit).

iii) Beneath the Administrative Director and the Associate Administrative Directors, a total of 18 experts will be involved in 6 units: 4 in the general affairs unit, 3 in the accounting unit, 3 in the public relations unit, 3 in the research administration unit (including 2 Ph.Ds. to support foreign PIs in their applications for Japanese domestic research grants), 3 in the international promotion unit (including 2 Ph.Ds.), and 2 in the environmental affairs unit. Each unit will have 1 unit chief.

iv) A total of 15 bilingual laboratory secretaries will be assigned to assist the PIs. These secretaries will assist with paper work and matters regarding foreign researchers and students.

2) Decision-making system

The Center Director will have the authority to make final decisions over the appointment of personnel, the Center budget and research priorities in addition to other matters as they arise.

The Center Director needs to maintain good communications with the Administrative Directors and the PIs in the Center. To this end, we envisage establishing the following councils and committees. In order to ensure sufficient time for the scientific goals of the Center, **the number of meetings will be kept to a minimum.**

i) **Joint Management Council**

Mission: To discuss and to propose issues of fundamental importance to the Center

Members: The Center Director, the Vice Center Director, the Administrative Director, the Associate Administrative Directors, the President of Nagoya

Head of Research Promotion (full-time) were assigned. (Note: the position titles in English were changed from “Associate Administrative Director for Management” to “Head of Management”, and “Associate Administrative Director for External Relations” to “Head of Research Promotion”.)

Beneath the Head of Management, 2 full-time staff and 2 concurrent-post staff from the University, and 4 temporary staff were assigned as administrative staff.

Beneath the Head of Research Promotion, a designated lecturer was employed and a URA (University Research Administrator, as a concurrent post, Ph.D.) was appointed from the University.

In preparation for FY2013, “Nagoya University Institute of Transformative Bio-Molecules Rules” and “Nagoya University Institute of Transformative Bio-Molecules Administrative Department Internal Regulations” were developed. In addition, the Head of Management will be assigned as a full-time position, and full-time administrative staff will be increased to 4 staff in FY2013. With the addition of 4 contract employees (2 competent English speakers included) and a part-time employee, the structure of the Management team will be reinforced by having 4 staff in the general affairs unit, and 5 staff in the accounting unit. 5 PI secretaries will also be employed.

The Research Promotion team plans to recruit personnel in addition to the current members already in place by FY2012.

2) Decision-making system

In FY2012, all NU-PIs held regular meetings once a week by using break time out of their busy schedule, in order to further cooperation in their research fields and hold deliberations and discussions of major matters.

Toward the establishment of the Institute in FY2013, the “Nagoya University Institute of Transformative Bio-Molecules Steering Committee Rules” were established. The Center Director shall conduct operation and management of the Institute in consultation with the Steering Committee.

From FY2013, the number of meetings will be kept to a minimum in order to hold sufficient time for the research.

Councils and Committees ii) - iv) in the left column will be integrated into the Steering Committee, and deliberations and discussions concerning major matters including research plans, operation and management, personnel

University, the Director-General of Nagoya University, any member of the International Advisory and Review Board, and/or the representatives of Cooperating Institutes may also be invited to join the Council Meeting.

ii) Research Council

Mission: To discuss important issues regarding research projects and other matters

Members: The Center Director, the Vice Center Director, the Administrative Director, the Associate Administrative Directors, and PIs at Nagoya University.

iii) Personnel Committee

Mission: To make the final short list of candidates for new positions

Members: The Center Director, the Vice Center Director, the Administrative Director, the Associate Administrative Directors, and 2 members appointed by the Center Director and selected from the PIs

iv) Budget Committee

Mission: To design a budgetary plan

Members: The Center Director, the Vice Center Director, the Administrative Director, the Associate Administrative Directors, and 2 members appointed by the Center Director selected from the PIs

v) Internal Evaluation Committee

Mission: To evaluate research activity within the Center and the Cooperating Institutes, and to prepare reports to the External Evaluation Committee

Members: The Center Director, the Vice Center Director, the Administrative Director, the Associate Administrative Directors, and 2 members appointed by the Center Director selected from the PIs

3) Allocation of authority between center director and host institution

The Center Director

The Center Director will have the authority to make the final decisions over the appointments of personnel, the Center budget, and research priorities in addition to other matters as they arise. To enable this, Nagoya University has taken the significant step of revising its rules in order to give executive authority to the director to make top-down decisions. Nagoya University will also reform its regulations to allow the Center the prerogative to establish its own system for pay structures, employment periods, and other preferential treatment such as the conferment of appropriate titles for its

affairs, budgets will take place. Concerning Joint Management Council in the column i), the Executive Board of the University will take over the role of the Council for the time being, depending on the subject to be discussed. Organization of Internal Evaluation Committee in the column v) is under consideration. ITbM will set up this committee soon.

The Steering Committee authorizes the Center Director to make final decisions, thus it is only the place for discussion and it acts as an advisor to the Center Director.

3) Allocation of authority between center director and host institution

Institute Rules limits the role of the President of the University only to appointment of the Center Director. All matters concerning operations and management of the Institute fall under the purview of the Center Director.

According to "Implementation Guidelines for the Special Bonus System for Persons in the Service of Nagoya University Institute of Transformative Bio-Molecules" which is the system to provide special bonus to the Center Director, the Vice Center Director, PIs, and the Administrative Director based on their performance and evaluations, the determination of eligible persons

members including project managers and guest researchers.

Host Institution (Nagoya University)

The host institution has the authority and responsibility to allocate some part of the University budget for appropriate financial support of the Center. The host institution has the authority to inspect the management of the Center, and to audit the Center accounts.

and amount of bonus is left to the discretion of the Center Director. The Executive Board of NU shall determine the incentive of the Center Director. The budget of the Center is allocated by the Administration Bureau of the University, and the Center has the independent authority from other Schools of the University in the execution of its budget. However, the budget of the Center is subject to internal and external audits as is the case with other budgets in the University.

5. Researchers and center staffs

i) "Core" to be established within host institution

Principal investigators

	At beginning	Final goal (Date: March, 2017)	Results at end of FY 2012	Results at end of April 2013
Researchers from within host institution	7	7	7	7
Foreign researchers invited from abroad	3	5	3	3
Researchers invited from other Japanese institutions	0	3	0	0
Total principal investigators	10	15	10	10

All members

	At beginning	Final goal (Date: March, 2017)	Results at end of FY 2012	Results at end of April 2013
Researchers	20	70	11	22
<Number of foreign researchers among them and their percentage>	<5, 25%>	<35, 50%>	<3, 27%>	<5, 23 %>
[Number of female researchers among them and their percentage]	[4, 20%]	[14, 20%]	[2, 18%]	[5, 22%]
Principal investigators	10	15	10	10
<Number of foreign researchers among them and their percentage>	<3, 30%>	<5, 33%>	<3, 30%>	<3, 30%>
[Number of female researchers among them and their percentage]	[2, 20%]	[3, 20%]	[2, 20%]	[2, 20%]
Other researchers	10	55	1	12
<Number of foreign researchers among them and their percentage>	<2, 20%>	<30, 55%>	<0, 0%>	<2, 17 %>
[Number of female researchers among them and their percentage]	[2, 20%]	[11, 20%]	[0, 0 %]	[3, 25%]
Research support staff	10	40	3	8
Administrative staff	10	20	9	12
(Number of bilingual staff among them and their percentage)			(5, 56 %)	(8, 67%)
Total	40	130	23	42

<p>ii) Satellites <Plan at start of project > Satellite institutes are NOT applicable.</p>	<p><Results/progress/alternations from plan at start of project> Satellite institutes are NOT applicable as planned.</p>
<p>iii) Partner institutions < Plan at start of project ></p> <p><u>Institution (1):</u> Queen's University, Canada <u>Institution (2):</u> University of Washington, USA <u>Institution (3):</u> ETH Zürich, Switzerland</p>	<p><Results/progress/alternations from plan at start of project></p> <p><u>Institution (1):</u> Queen's University, Canada -Role Queen's Univ collaborates with ITbM as a host institution affiliated with Prof Cathleen Crudden, an overseas PI, who is carrying out research to develop transformative bio-molecules through her elegant and unmatched molecular transformation catalysis.</p> <p>-Personnel composition and structure Prof. Cathleen Crudden (Double affiliation of ITbM and Queen's Univ)</p> <p>-Collaborative framework ITbM employs a Co-PI and three postdoctoral researchers at Nagoya University, who carry out the research in close contact with Crudden. The Co-PI has already been employed, while the 3 postdoctoral researchers have been appointed for FY2013.</p> <p><u>Institution (2):</u> University of Washington, USA -Role Univ of Washington collaborates with ITbM as a host institution of Prof Keiko Torii, an overseas PI, and we carry out the research in our effort to advance the mission of ITbM to unite crossdisciplinary synthetic chemistry and plant developmental biology.</p> <p>-Personnel composition and structure Prof. Keiko Torii (Double affiliation of ITbM and Univ of Washington)</p> <p>-Collaborative framework ITbM employs a Co-PI and 3 postdoctoral researchers at Nagoya Univ. They carry out the research in close contact with Torii. The Co-PI has already been officially appointed, while the 3 postdoctoral researchers are under recruitment.</p>

	<p><u>Institution (3):</u> ETH Zürich, Switzerland</p> <p>-Role ETH Zürich collaborates with ITbM as a host institution of Prof Jeffrey Bode, an overseas PI, and we carry out the research to develop transformative bio-molecules through his unprecedented peptide and protein synthesis.</p> <p>-Personnel composition and structure Prof. Jeffrey Bode (Double affiliation of ITbM and ETH Zürich)</p> <p>-Collaborative framework ITbM employs a Co-PI and 3 postdoctoral researchers at Nagoya Univ. They carry out the research in close contact with Bode. The Co-PI has already been appointed (from April 1, 2013), while the 3 postdoctoral researchers are also appointed for FY2013. We will set-up “clone-lab” having the same equipment and instruments, as his lab in ETH. Co-PI and postdoctoral researchers are going to visit ETH for several months to be trained to run this “clone-lab”.</p>
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6. Summary of center's research environment

< Plan at start of project >

- 1) Environment in which researchers can devote themselves to their research

Mix-Lab System

To realize truly cross-disciplinary research projects and to nurture the next generation researchers of this field, we will create special laboratories we refer to as “**Mix-Labs**”. Rather than doing research in a small laboratory consisting of one research group, we will ask young researchers of different fields to work together in a large laboratory (**Mix-Lab**). We strongly believe that this working style will not only accelerate the mixing/merging of people, ideas, equipment, and research, but also help nurture a new generation unrestricted by the bounds of traditional disciplines.

An efficient administration run by talented staff will be introduced to free PIs from administrative duties.

Co-supervising system

To reinforce the value of the Mix-Lab concept, all postdoctoral researchers will be supervised by two PIs from different fields for accelerating collaboration and nurturing the next generation of cutting-edge research, unrestricted by the bounds of traditional disciplines.

In order to recruit excellent PIs and Co-PIs, we will provide the following: (a) a team that is responsible for supporting their applications for competitive domestic (Japanese) research funds; (b) opportunities for partners/spouses to hold positions in the University on the basis of proper evaluation (Dual Career Support); and (c) adequate information on education opportunities for the children of foreign PIs who may join them during their time at Nagoya. Through these mechanisms, we expect foreign PIs to spend significant amounts of time at Nagoya.

We will locate the world's most advanced equipment and facilities in a single space at Nagoya University, staffed with expert equipment managers such that it is fully accessible for promoting research, international collaboration,

<Results/progress/alternations from plan at start of project>

- 1) Environment in which researchers can devote themselves to their Research

Mix-Lab System

Two special laboratories named “**Mix-Lab**” (400 m² each) were established in the existing buildings to achieve the mixing/merging of people, ideas, equipment, and research prior to the construction of a dedicated ITbM building. One Mix-Lab includes members from Itami and Ooi groups (chemistry), Yoshimura and Kinoshita groups (biology), and Irle group (theoretical chemistry), in which they carry out the research to develop molecules that precisely control biotic function and production. Another Mix-Lab members consist of Yamaguchi, Bode, and Crudden groups (chemistry), Higashiyama and Torii groups (biology), and Irle group (theoretical chemistry). Here, research is directed toward the development of innovative bio-imaging molecules and related photoelectronic molecular technologies that enable the visualization of biological phenomena at will. In the process to establish the Mix-Labs, we obtained significant useful information for the design of the new ITbM building. To promote mixing, the researchers gather regularly and hold informal seminars by themselves. The efficient administration is created through an excellent cooperation of the Management team and the Research Promotion team.

Co-supervising system

The Co-supervisor will be assigned after each postdoctoral researcher has started at ITbM.

To recruit excellent PIs and Co-PIs from abroad, ITbM has decided to invite these individuals as Visiting Professors in NU to enable them to apply for competitive domestic (Japanese) research funds. Preparation of such applications is supported by the research administrator in ITbM, who has a strong connection with URA of NU. To establish the support system for the education or day-care of children of foreign PIs during their time at NU, ITbM is negotiating with a nursery on campus and with an international school nearby.

ITbM has established a Molecular Structure Center. A technician has been appointed, who is skilled in mass spectrometry. In the projected new building, more facilities such as NMR and X-ray spectroscopy will be attached to the center, and thus the Molecular Structure Center will be established as a hub

and discovery. A substantial body of postdoctoral researchers and technical assistants will be hired to ensure smooth operation of analytical instruments etc.

In order to reduce the educational and administrative burden of PIs, the University will furnish the original faculty of PIs with additional staff (a total of 7 associate professors).

A total of 15 bilingual secretaries will be assigned to the PIs in 2013 to help the Investigators cope with their paper work and any matters regarding foreign researchers and students in the groups.

2) Startup research funding

We will provide each of the new researchers with research space and start-up funds with an average value of \$125,000 USD. If necessary, the start-up money will be increased for top-caliber researchers by using a discretionary budget allocated to the Center Director.

We will furnish the new researchers with full access to instruments in the Center. Except for the start-up funds, all of the following costs are covered by our Center: lab spaces fee, utility costs including electricity and water fees, employment costs of two postdoctoral researches, one secretary, and one technical staff.

3) Postdoctoral positions through open international solicitations

We will engage in high-profile recruitment campaigns to attract highly qualified postdoctoral researchers using web sites with global appeal describing the current efforts of the Center, University, and Nagoya City for internationalization.

We will keep channels open to world premier chemists and biologists, and solicit their recommendations for suitable candidates as postdoctoral researchers.

4) Administrative personnel who can facilitate the use of English in the work place

The research groups of the PIs are international in outlook, and have excellent track records in inviting foreign researchers as visiting professors, postdoctoral researchers, and exchange students. English is routinely used in their research groups.

Not only our WPI Center but also all of Nagoya University is

of molecular structural analysis.

In order to allow PIs to concentrate on their research, NU furnishes the original faculty of PIs with additional staff who mainly take charge of education and administrative work. 3 such staff have been appointed as designated associate professor or lecturer. The other 4 staff are under selection. 5 secretaries for PIs with competent English skills will be hired from April 1, 2013.

2) Startup research funding

In addition to the two Mix-Labs, ITbM prepared a server room used for theoretical calculations. We also assigned our space for plant growth and measurement instruments, which will be set-up in FY2013.

We have also completed the expected formalities for ITbM researchers to use various measurement instruments and databases available in NU. We will provide startup research funding for the researchers who are new to NU, and accordingly facilities needed for a Co-PI employed from February 2013 have already been prepared.

3) Postdoctoral positions through open international solicitations

The ITbM web site was launched and the recruitment of postdoctoral researchers world-wide began, as advertised in English. The postdoctoral researcher position is one-year term and renewable for up to three years. The application is required to be prepared in English. In addition to the ITbM web site, it was announced at the online Job sites of Science, Nature, and JREC-IN. It was also announced in the presentation by MEXT at AAAS Annual Meeting 2013 in Boston by handing out a flyer. Accordingly, we collected 103 applications (including 25 females) over 23 countries, and 8 postdoctoral researchers have been appointed.

4) Administrative personnel who can facilitate the use of English in the workplace

All the staff of the Research Promotion team have a good command of the English language, and new staff should have a similar skill in addition to their individual expertise. In the Management team, full-time staff are functional English speakers (see section 4), and 2 competent English speakers have been appointed. Thus, from April 2013, 2/3 of the Administrative Department

internationalized as Nagoya University has started the Global 30 International program to accept foreign undergraduate and graduate students (all of classes and experimental courses are taught in English). The G30 students are also in the laboratory of the PIs. The Administrative Director is fluent in English, and the projected administrative staff will also have high English skills.

5) Rigorous system for evaluating research and system of merit-based compensation

A rigorous evaluation of researchers will be made by an external evaluation committee, with the assistance of the International Advisory and Review Board.

The annual salary of researchers hired from outside the host institute will be adjusted based on the evaluation. There will also be a merit-based fringe benefit system for internal hires.

6) Equipment and facilities, including laboratory space, appropriate to a top world-level research center

Nagoya University will provide 6,000 m² of research space for the Center.

The Science and Agricultural Building and Science South Building are regarded as the premier global facilities, and 3,000 m² of the building space will be allocated to the WPI Research Center. These two buildings, which are directly connected, were built in 2011 to accelerate the collaboration of science and agriculture research within Nagoya University. A brand-new live-cell imaging center space of 300 m², which was originally part of our G-COE program and will be further developed by our WPI program, is also in the Science South building. A teatime room of 70 m² will also be placed in the Science and Agricultural Building to facilitate communication among members of our WPI Center.

Nagoya University will provide additional laboratory space of 1,500 m² by the end of FY2012, and the other 1,500 m² as soon as possible

As also noted in the host institution's commitment, Nagoya University will draw up a plan of further allocation of space and a new building for gathering not only activities of the WPI Center but also other organizations relating to the field of our WPI Center.

Nagoya University will provide financial support for maintaining the research environment at a world-class level including the enforcement of appropriate safety measures.

staff are able to respond in English, which enabled us to organize the 1st ITbM international symposium projected in April 2013 independently.

5) Rigorous system for evaluating research and system of merit-based compensation

Special bonuses are provided to the Center Director, the Vice Center Director, PIs and the Administrative Director based on their performance and evaluations. They receive the full bonuses at the beginning (from January 2013), and the amount will vary according to the evaluation in FY2013.

6) Equipment and facilities, including laboratory space, appropriate to a top world-level research center

NU has provided 5,165 m² of research space for the Center, which contains 3,000 m² from the original faculty of PIs and additional 2,165 m² according to the commitment of NU (Ref: Appendix 7 "Campus Map"). Mix-Labs, server room, and equipment room have been set up. Other areas will be used as animal room, plant growth room, and additional equipment rooms. Renovation of these rooms is in progress.

The Administrative Department was founded in the Science and Agricultural Building. By placing the Management team and the Research Promotion team in one room, smoother communications between administrative staff and researchers on a daily basis was enabled, and an excellent cooperation system to support research activities has been established.

Nagoya University is very well equipped with top-level major instruments necessary for our WPI research. The quality and number of these instruments rivals the best institutions in the world. The following lists representative instruments that can be used by our WPI research team.

7) International research conferences or symposiums held regularly to bring world's leading researchers together

A large-scale international research conference will be organized each year, primarily at Nagoya University.

A limited number of international workshops of a small-to-medium size will be organized each year.

For the first year of the Center, the 1st international research conference is scheduled at the end of FY2012 in March 2013.

In Japanese universities, such international meetings are usually managed mainly by researchers, including administrative matters. However in our WPI Center, the Administrative Office directed by the Administrative Director and Associate Administrative Directors will manage meetings according to the decision of the subject, candidates of invited speakers, and schedule of each meeting by PIs, in order to avoid further encroachment on researcher's time.

8) Other measures, if any

As our foreign PIs are truly world-leading scientists, we are confident that they can maintain their excellent funding profiles in the future. However, there are special challenges to carrying out research in Japan for foreign PIs, in particular access to information only in Japanese, when they seek competitive funding in Japan. We wish to strongly encourage PIs and Co-PIs to become actively involved in the procurement of external funding from Japanese sources, therefore, the Center will provide **a support team**, which will collect Japanese information and translate application documents (Japanese to English and English to Japanese). The team in the research administration unit includes two Ph.D. administrators from chemistry and biology fields.

7) International research conferences or symposiums held regularly to bring world's leading researchers together

An international symposium (The International Symposium on Transformative Bio-Molecules, ISTbM-1) is held on the 18th and 19th of April 2013, at the Noyori Conference Hall as the opening ceremonies for the ITbM (ITbM). Eight established leading scientists are invited, covering disciplines including computational science, systems biology, biochemistry, and synthetic chemistry. Integration of these world premier invited speakers and PIs at ITbM is expected to advance the research of transformative bio-molecules. Guests from MEXT and JSPS are projected to give us welcome addresses. Prof Michinari Hamaguchi, the President of NU, and Prof Ryoji Noyori are going to join us. The number of participants will be amount to 400, which are exceeded expectation and required the preparation of a satellite venue near Noyori Conference Hall. ISTbM-1 is organized primarily by the Administrative Department. The department is responsible for most matters of the symposium, such as management of the guests' scheduling, making public announcements, and set-up of the conference venue. Notably, two administrative staff who have a good English skill preside over the symposium.

ITbM will host the Hirata Memorial Lecture, which was launched by Emeritus Prof. Daisuke Uemura 10 years ago. This is scheduled to take place in early 2014.

8) Other measures, if any

To facilitate the preparation of MOUs with the institutes of overseas PIs including their Visiting Professorship and intellectual properties, the Research Promotion team visited Queen's University, University of Washington, and ETH Zürich to have a discussion on these issues with Deans, Administrative Directors, and IP Managers.

To enable overseas researchers to apply for competitive domestic (Japanese) research funds, the Research Promotion team is preparing a list of funds and collecting information through a strong connection with a URA of NU.

NU gave priority to the overseas PIs in assigning university accommodations, which is achieved by a title of Visiting Professor of NU.

To facilitate both domestic and international research collaboration by our foreign PIs, the Center and Nagoya University will establish a more efficient and flexible administrative structure to process travel expenses and acceptance of outside researchers.

The Center and Nagoya University will provide opportunities for partners/spouses to hold positions in the University on the basis of proper evaluation (Dual Career Support).

Nagoya University will give priority to the principal and collaborative researchers in assigning university accommodations. In addition, the WPI Center will collect and provide information on international education opportunities, which are increasingly developed in Nagoya City, for the children of overseas researchers.

Nagoya University established a nursery in its campus (as a part of the program to support female employees and researchers), and it will accept the children of foreign researchers at the Center.

Nagoya University is very well equipped with top-level major instruments necessary for our WPI research. The quality and number of these instruments rivals the best institutions in the world. We will hire some expert operators and computer programmers for these facilities, which includes 5 postdoctoral researchers. They will strongly support the leading-edge research by the foreign PIs and other researchers.

Nagoya University has grasped the opportunity offered by being selected to host numerous Global-Centers of Excellence and the Global-30 program both to accelerate globalization of its campus and to promote high-level international research. In addition, we have implemented the mid- and long-term mutual exchange of doctoral students and young faculty members, as exemplified by the very successful "International Research Training Group (IRTG)" Program with the University of Münster (FY2005-2011). This program was followed by another Strategic Young Researcher Overseas Visits Program for Accelerating Brain Circulation, "Innovative Molecular Catalysis and Novel Functional Materials" (FY2011-2014). The Center will take full advantage of these international programs to ensure active international research activities.

For the education or day-care of children of overseas researchers during their time at Nagoya, ITbM is negotiating with a nursery on campus and with an international school nearby to establish a support system.

ITbM has established a Molecular Structure Center. A technician has been appointed, who is skilled in mass spectrometry. In the projected new building, more facilities such as NMR and X-ray spectroscopy will be attached to the center, and thus the Molecular Structure Center will be established as a hub of molecular structural analysis. ITbM is projecting to establish a Live Imaging Center by extending the function of the imaging center in the Faculty of Science in NU. A Chemical Library Center is also being planned in order to preserve all the compounds synthesized in ITbM in addition to the commercial chemical library sources, which is essential to evaluate the biological activities and functional properties of the transformative bio-molecules being developed at ITbM.

To promote the international research activities of ITbM, a series of international programs available NU will be fully employed.

7. Criteria and methods used to evaluate center's global standing

< Plan at start of project >

The global standing of the Center depends firstly on the performance of the individual researchers, and we will use a set of quantitative metrics combined with more qualitative methods to assess the performance of individual researchers and their contributions to the Center. We consider there are three aspects important to the global standing of the WPI: 1) **research quality and impact**, 2) **breakthrough from the interdisciplinary research activities**, and 3) **human resources development**.

1) Publishing our work in top journals is absolutely required. The number of papers published in top journals will be counted for evaluation. A selection of such data for our PIs clearly indicates we have a group of outstanding individuals that together will give our Center a very high global profile. Highly cited work is clearly an indication of high quality research and a significant impact. Citations can be quantified by bibliometrics such as total citations, citations per paper, and h-index.

Total number of papers cited more than 80 times (10 PIs): 86

These types of bibliometrics will be gathered for the researchers and used in evaluation throughout the life of the Center. Two more important indicators of research quality and impact are success in obtaining external funding and the number of invited lectures at international conferences and these will also be monitored.

Total number of keynote/plenary/invited lectures by 10 PIs in the last 4 years: >500

With the concentration of research talent and resources at the Center, on the longer term we envisage some of our members being rewarded with significant international prizes in the fields related to the mission of this Center. The number of such prizes will be a good indication of the Center's impact on the wider scientific community. Honors and prestigious positions will also be monitored for the same reason.

2) Breakthroughs from the interdisciplinary research activities will be monitored and evaluated by number of joint papers by PIs from chemistry and biology fields. Grants and patents resulting from collaboration of PIs from chemistry and biology fields will be also monitored.

We have already begun some interdisciplinary collaborations, which are expected to be published in the initial phase of our WPI program.

<Current assessment>

1) Research quality and impact

In FY2012, Administrative Department at ITbM is preparing to assess researchers in a quantitative, reproducible, and stable manner by utilizing Researcher ID introduced by Thomson Reuters. As of April 1st,

Number of papers: 28 (15 papers are published in top journals*).

(Note: including whose authors are not noted in the institutional affiliations as "WPI-ITbM")

Plenary and invited lectures in international symposium: 26

Awards: Shigehiro Yamaguchi, 9th Japan Society for the Promotion of Science Award. / Kenichiro Itami, German Innovation Award "Gottfried Wagner Prize 2012".

Laurel: Kenichiro Itami was elected the 108 most talented people by mainstream media and intellectuals. / Kenichiro Itami was elected the Fellow of the Royal Society of Chemistry, UK. (the youngest Japanese chemist) / Kenichiro Itami was elected the Novartis-MIT Lecturer in Organic Chemistry. / Keiko Torii was elected the Fellow of American Association for the Advancement of Science.

Patent applications: 4 (2 in domestic and 2 in overseas)

Special Instructions: A postdoctoral researcher from Higashiyama group was selected to be winner of JSPS Ikushi Prize./ Four Graduate course students of Itami and Yamaguchi groups collected CSJ Student Presentation Award 2013.

*Top journal: Nature, Science, Nature sister journals, Proceedings of the National Academy of Sciences of the USA, Journal of the American Chemical Society, Angewandte Chemie-International Edition, Nano Letters, Advanced Materials, ACS Nanom, Chemical Science, Accounts of Chemical Research, Chemical Reviews, Coordination Chemistry Reviews, Genes & Development, Developmental Cell, EMBO Journal, Current Biology, Plant Cell, Annual Review of Plant Biology, Current Opinion in Plant Biology, International Review of Cytology

2) Breakthrough from the interdisciplinary research activities.

Two special laboratories named "**Mix-Lab**" were established in our existing

<p>3) The development of human resources is key to the future development and global standing of the Center. To evaluate our progress, we will use indicators such as the career paths and academic success of former researchers of the Center and the flow of visitors to and from other international institutions. Six Japanese PIs from Nagoya University have been involved in many international exchange programs and already have good track records of exchanging researchers. In the last three years alone, they have welcomed 75 foreign visitors and arranged for 85 students and researchers to be sent abroad.</p> <p>The number of student awards garnered will be also monitored as an important evidence of nurturing the next-generation. For example, the prospective Center Director Itami has produced a number of talented young chemists who have been recognized in the community.</p> <p>Our focus on quantitative measurements of achievements reflects a worldwide trend in the evaluation of research. However, we are also aware that some aspects of research cannot be easily quantified. The importance of truly original contributions may not be recognized immediately and citation numbers may not directly reflect the quality of research. In using research metrics to assess the performance of individual researchers, it is important to take into account their age and career stage. In addition, because our Center will consist of researchers from diverse fields, we will also be conscious of the ways in which these metrics may be influenced by different research styles and conventions in different fields.</p> <p>We will, therefore, establish an Internal Evaluation Committee consisting of directors, PIs and administrative directors to evaluate research activity within the Center. These results will be used together with the recommendations of the International Advisory and Review Board to carry out a rigorous evaluation of the Center and PIs by an external evaluation committee.</p>	<p>buildings to achieve the mixing/merging of people, ideas, equipment, and research.</p> <p>Synthetic chemists have already started the synthetic studies on two of the transformative bio-molecules that biologists proposed.</p> <p>3) Human resources development</p> <p>Number of seminars: 1</p> <p>Internal Evaluation Committee is still under consideration. ITbM will set up this committee soon. Evaluation by International Advisory and Review Board will be held from FY2013.</p>
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8. Securing competitive research funding

<p><Plan at start of project ></p> <p>Prospects for securing resources for each fiscal year (full-year basis)</p> <ul style="list-style-type: none"> - Salaries of PIs who hold posts at Nagoya University, Administrative staff and new hired additional researchers 1.4 million USD / year - Partial support to the costs of utility, maintenance and renovation of laboratory and office space, provided by Nagoya University 	<p><Results/progress/alternations from plan at start of project></p> <p>Salaries of Nagoya University PIs, administrative staff and newly employed researchers have been paid by the University, and partial support to utilities, maintenance and renovation costs has been provided by the University, thus development of the Research Center is in progress as planned.</p> <ul style="list-style-type: none"> - Competitive funding acquired by Nagoya University PIs in FY2012 5.3 million USD (At start of project : @ 80JPY per USD / In FY2012 : @100JPY per USD)
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<p>0.8 million USD / year</p> <p>- Competitive funding based on the past record by PIs 7.7 million USD / year (the average of FY 2007-2011)</p> <p>Sum: 9.9 million USD / year</p> <p>* At least the following amount of Japanese grants has been already acquired by PIs: the total amount of 5.5 million USD / year for the first (FY 2012) and the second (FY 2013) years, and the total amount of 4.0 million USD / year for the third (FY 2014) and the fourth (FY 2015) years.</p>	<p>* Seeking to acquire new competitive funding in and after FY2013.</p>
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<p>9. Other important measures taken to create a world premier international research center</p>	
<p><Plan at start of project ></p> <p>Nagoya University has recently launched the Graduate School of Pharmaceutical Science in cooperation with Graduate Schools of Science, Bioagricultural Sciences, Engineering, and Medicine. The central area of Japan, represented by Nagoya City, is very famous as the industrial center of Japan. The establishment of the Graduate School of Pharmaceutical Science in Nagoya University was based on strong demand from industrial community. The achievements of our WPI Center will be directly applied through the activities of Nagoya University and Nagoya City. Thus profound ripple effects are expected not only in Nagoya University but also in other research institutions in central Japan.</p> <p>To establish a truly top world-level research center, the commitment of the host institution is essential. In particular, setting up an efficient and effective administration is crucial. The benefits to the research goals of the Center through assisting the researchers to concentrate on their core research activities cannot be overestimated. In addition, appointing talented individuals, who are capable of handling administration with a global view, is also an essential ingredient to establishing a truly world premier research center.</p> <p>The word “transformative” implies that our molecules will also make a marked change in human society. Thus another important measure is how novel products based on our molecules and resultant new plant species developed by overcoming reproductive barriers are spread and recognized by the general public.</p>	<p><Results/progress/alternations from plan at start of project></p> <p>The Graduate School of Pharmaceutical Science recently launched in Nagoya University is a good collaborator of ITbM. ITbM plans to collaborate with the School in FY2013.</p> <p>The Administrative Department is composed of personnel with excellent ability, experience in a variety of areas, and a good command of the English language. Two more competent English speakers will also be appointed. By placing the Management team and the Research Promotion team in one room, an excellent cooperation system to provide full-support of the research activities is going to be established.</p> <p>“Transformative Bio-Molecules” generated through ITbM research will be announced through publications and press-releases to be recognized widely, and will be provided to researchers from world-wide research institutes or firms who are interested in the functions of the molecules.</p>

10. Host institution's commitment

<Plan at start of project >

-Provision in host institution's mid-to-long-term plan

Nagoya University promotes its research activities based on our *Midterm Objectives*, which include establishing world-leading research centers. In addition, the manifesto of the incumbent President—also known as the “*Hamaguchi Plan*”—identifies the strong promotion of world-class research and the globalization of NU as top priorities.

This proposal for *the ITbM* (hereinafter referred to as “*the Center*”) coincides wholly with the current conception of NU. If this proposal is adopted, NU will amend its *Midterm Plans and Research Promotion and Strategy Plans* to specify the WPI and the Center, and fully commit to providing support for the Center based on clear objectives.

-Concrete Measures

(1) Competitive grants obtained by researchers participating in the project and in-kind contributions, etc.

i) NU endorses the fully committed financial support for the Center that is larger than the support from WPI.

ii) NU will continue to cover the equivalent amount of the salaries of those researchers at the Center who already hold posts at NU, and will provide 6,000 m² of the research space for the Center. Additional space will be given according to the progress of the research.

iii) The total sum of competitive funding for those researchers at the Center who already hold posts at NU is \$5.9 million (in FY2012), and receipt of competitive funding at an equal or greater level is promised from FY2013 onwards.

iv) To help with the establishment and smooth operation of the Center, NU will assign 4 staff to the center and cover their salaries as well as employing new bilingual staff.

(2) System under which the center's director is able to make substantive personnel and budget allocation decisions

i) NU will reorganize the Institute of Advanced Research, which is

<Results/progress/alternations from plan at start of project>

-Provision in host institution's mid-to-long-term plan

NU amended its Midterm Plans by adding the statement saying “Establishment of core research centers by promoting “the World Premier International Research Initiative” and “International Science Innovation Center Development Project (COI)” etc. ”, and FY2013 Plan of the University also clearly states the promotion of the research activity of the Center.

In addition, the Hamaguchi Plan of NU specifies “Establishment of the World Premier International Research Initiative (WPI) - Institute of Transformative Bio-Molecules” as a promotion of world class research.

-Concrete Measures

(1) Competitive grants obtained by researchers participating in the project and in-kind contributions, etc.

NU has covered the salaries of NU PIs (7), the Administrative Director and administrative staff (5) in FY2012, and plans to cover that of designated associate professors and designated lecturers (7 total) to be employed in FY2013. NU has also provided 5,165m² of research space for the Center (Ref: Appendix 7 “Campus Map”).

The total sum of competitive funding for NU PIs is \$5.3 million in FY2012, and seeking to acquire new competitive funding in and after FY2013.

NU has appointed 5 administrative staff (3 concurrent-post staff included) to the Administrative Department of the Center in FY2012, and all the 5 administrative staff will be assigned as full-time post in FY2013. Also, English-proficient staff were recruited (2 staff to be employed in April, FY2013).

(2) System under which the Center's Director is able to make substantive personnel and budget allocation decisions

NU has established the Research Center based on the basic philosophy of

established as an institute independent from the other departments and research centers, and will place the Center as part of the Institute.

ii) NU will support the Center Director in his leadership and give full mandate for his decisions on important matters such as personnel and the execution of the Center's budget.

iii) In addition, the Vice Director and Administrative Director will make decisions depending on the matter, to avoid placing an excess burden on the Center Director and enable the progress of daily work at the Center.

(3) Support for the center director in coordinating with other departments at host institution when recruiting researchers, while giving reasonable regard to the educational and research activities of those departments

i) NU will assign 7 associate professors, who will mainly take charge of education in each department to relieve the PIs of this responsibility, and to maintain high-level education.

ii) NU will give priority to female researchers at the Center to enable their children to enter the nursery school operated by NU.

iii) NU will support foreign researchers at the Center in their daily life and the education of their children, making full use of facilities and knowledge base which has been obtained through the operation of international projects such as the "Global 30 Internationalization Program (G30)" and "CAMPUS Asia Support for the Formation of a Core Center", and so on.

iv) NU will provide opportunities for partners/spouses of foreign PIs to hold positions in NU on the basis of proper evaluation (Dual Career Support).

(4) Revamping the host institution's internal systems to allow the introduction of new management methods (e.g., English-language environment, merit-based pay, top-down decision making) unfettered by conventional modes of operation

i) NU will give full mandate to the Center Director for a flexible management system by implementing the Center as a "Special Research Zone", and by introducing ground breaking working rules and salary system which give the researchers and staff extra allowance to encourage their activities.

ii) NU will gradually implement the Center's trial across the entire university

the Institute for Advanced Research of Nagoya University, which is "promotion of the world's most advanced project research". NU has authorized the Center Director to conduct the management and make decisions on important matters of the Center.

In addition, NU has established rules for the Center such as the Steering Committee Rules, organizing the system which enables the Center Director to exercise strong leadership in the Center concerning important matters such as personnel and the execution of the budget (detail in Article 4), while authorizing the Administrative Director to make decisions depending on the matter in order to avoid an excessive burden on the Center Director.

(3) Support for the Center Director in coordinating with other departments at the host institution when recruiting researchers, while giving reasonable regard to the educational and research activities of those departments

NU has recruited designated associate professors and lecturers to take charge of educational activities in place of NU PIs (3 to be employed in April, 2013: to be increased to 7).

Other items are the matters to be considered and discussed.

(4) Revamping host institution's internal systems to allow introducing of new management methods (e.g., English-language environment, merit-based pay, top-down decision making) unfettered by conventional modes of operation

NU established "Implementation Guidelines for the Special Bonus for Persons in the Service of Nagoya University Institute of Transformative Bio-Molecules" which is the system to provide special bonus to the Center Director, the Vice Center Director, PIs and the Administrative Director based on their performance and evaluations.

in order to give other researchers and staff incentives to apply.

(5) Accommodation of center's requirements for infrastructural support (facilities, e.g., laboratory space; equipment; land, etc.)

i) NU commits to accommodate the Center with research space equivalent to 6,000 m².

ii) 7 PI candidates who work for NU already occupy approximately 3,000 m². NU will provide additional 1,500 m² by the end of FY2012, and the other 1,500 m² as soon as possible.

iii) NU will rearrange and relocate the facilities of the existing departments and centers, and will establish the Center's core facility, making it possible to collaborate intensively with the researchers of other departments and research centers.

iv) NU will reauthorize the University's Facility Management Plan and will make the Center's core facility a top priority.

(6) Support for other types of assistance

i) NU has decided to assign a member of the Board of Trustees/Vice-President as the Administrative Director to bridge the gap between the Center and the University's headquarters.

ii) The Administrative Director will organize a team with his two associates and keep the administrative office active enough to enable the Center's research activities at a maximum performance. Two associates are: Associate Administrative Director for Management who is a high-level expert of administration affairs, and Associate Administrative Director for External Relations who has strong expertise in chemistry related science, with a good command of English.

iii) We recognize one of the important aspects of WPI is to accelerate system reform of Japanese universities such as deregulation, internationalization, and so on. Intensive commitment of NU's leadership to the Center is critically important to accelerate the system reform in not only the Center but also the entire university.

In order to reinforce the research in the University, systemic reform is now under discussion by implementing the Center's examples across the entire University as a model case. (Increase of foreign researchers, International recruitment, Reward system, Young researcher cultivation, etc.)

(5) Accommodation of center's requirements for infrastructural support (facilities, e.g., laboratory space; equipment; land, etc.)

NU has provided 5,165 m² of research space for the Center (Ref: Appendix 7 "Campus Map"). The Center has started-up two Mix-Labs to achieve fusion of the research fields. Other areas will be used as animal room, plant growth room, server room and additional equipment rooms, and the server room has already been renovated and launched.

(6) Support for other types of assistance

By placing the Management team and the Research Promotion team in the Administrative Department, it has enabled smoother communications between administrative staff and researchers on a daily basis, and established an excellent cooperation system.

A Trustee of Nagoya University was assigned as the Administrative Director, and the Head of Management and the Head of Research Promotion were placed beneath the Administrative Director. The Head of Research Promotion was also assigned as the Deputy Administrative Director to assist the work of the Administrative Director.

Replacement of the Administrative Director is planned in January, 2014.

11. Efforts to improve points indicated as requiring improvement in application review and results of such efforts

- Major points to be improved

(1) Joining two disciplines is not enough. Need for combining them. Computational approach should be strengthened also.

(2) Animal biologists or pharmaceutical scientists are not well represented in the project.

(3) The proposal does not present concrete milestones toward the mission of the center.

- Efforts to improve them and results

(1) In the process of truly combining the disciplines of chemistry and molecular biology, the Mix-Lab plays a key role. We have set-up two Mix-Labs. Both Mix-Labs were composed of groups from chemistry, biology, and theoretical chemistry as described above. One group conducts research to develop molecules that precisely control biotic function and production, and another group focuses on the development of innovative bio-imaging molecules and related photoelectronic molecular technologies. In the Mix-Labs, researchers exchange their ideas through daily interactions. Prompt evaluations of the synthetic molecules are made by the biologists, and the results are fed back immediately to the chemists. The results are analyzed by computational studies, and the studies contribute to the rational design of the molecules. The members of two Mix-Labs gather regularly to hold seminars in order to further promote our cross-disciplinary researches. This "Mix" concept has actually been producing remarkable outcomes to be the key factors for creating "transformative bio-molecules".

(2) ITbM has started a selection to hire additional animal biologists / pharmaceutical scientists to achieve the optimal ratio of plant biologists and animal biologists / pharmaceutical scientists to be 1 : 1.

(3) Our ten-year WPI project will be consisting of two phases with the following emphases and goals.

Phase 1 (FY2012-2016, 4.5 years)

- Development of key synthetic bio-molecules and molecular functions.
- Establishing truly effective and productive ways to conduct interdisciplinary research.
- Establishing a new building to further promote the WPI-catalyzed interdisciplinary research.
- Creating strong ties with overseas/domestic cooperating institutes, centers, and companies.
- Increasing internationalization at Nagoya University by the establishment of an English-based research environment and administrative offices, and by putting in place measures to attract and retain talented foreign researchers.
- Establishing a system to support young, talented researchers to focus on research.
- Introducing a performance-based salary system.

<p>(4) It will be important to establish the center as a world leader in the “safe” development of new functional molecules. Safety, ethical, and environmental issues are an area of high public awareness, and it is essential to the center’s success that it takes this aspect of the research as a focal area and not merely comply with existing safety regulations</p>	<p>Phase 2 (FY2017-2021, 5 years)</p> <ul style="list-style-type: none"> - Development of truly innovative synthetic bio-molecules (transformative bio-molecules). - Providing researchers worldwide with access to the transformative bio-molecules developed at Nagoya (International Promotion Unit). - Accelerating WPI-catalyzed system reform of Nagoya University. - Establishing mechanisms to ensure the continuous growth and perpetuation of the Institute of Transformative Bio-Molecules. - Establishing the reputation as a world-leading molecular research institute, which can design and synthesize brand new molecules for the discovery, visualization, and manipulation of biological systems. <p>(4) We have noticed that significant ethical and safety concerns related to human health, biodiversity and the environment have been raised around genetically modified organisms. Under the umbrella of NU, ITbM Research Promotion team will built strong tie with the person in charge of judicials and compliance in the Office of Research Administration of NU, and advance practical approach to the safety issues of our products.</p>
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12. FY 2012 funding

(the exchange rate used:JPY/USD=100)

i) Overall project funding

Ten thousand dollars

Cost Items	Details	Costs (10,000 dollars)
Personnel	Center director and Administrative director	8
	Principal investigators (no. of persons): 6	27
	Other researchers (no. of persons): 1	1
	Research support staffs (no. of persons): 4	7
	Administrative staffs (no. of persons): 5	10
	Total	53
Project activities	Gratuities and honoraria paid to invited principal investigators (no. of persons): 0	0
	Cost of dispatching scientists (no. of persons): 4	4
	Research startup cost (no. of persons): 8	55
	Cost of satellite organizations (no. of satellite organizations): 0	0
	Cost of international symposiums (no. of symposiums): 0	0
	Rental fees for facilities	0
	Cost of consumables	2
	Cost of utilities	0
	Other costs	4
	Total	65
Travel	Domestic travel costs	0
	Overseas travel costs	2
	Travel and accommodations cost for invited scientists (no. of domestic scientists): 0 (no. of overseas scientists): 1	1
	Travel cost for scientists on secondment (no. of domestic scientists): 2 (no. of overseas scientists): 0	1
	Total	4
	Equipment	Depreciation of buildings
	Depreciation of equipment	22
	Total	22
Other research projects	Projects supported by other government subsidies, etc.	109
	Commissioned research projects, etc.	174
	Grants-in-Aid for Scientific Research, etc.	138
	Total	421
Total		565

WPI grant for FY 2012	302
Costs of establishing and maintaining facilities in FY 2012	0
Establishing new facilities: Institute of Transformative Bio-Molecules (Number of facilities: 6,400m ²)	0
Costs paid:	0
Repairing facilities (Number of facilities: , m ²)	0
Costs paid:	0
Others	0
Cost of equipment procured in FY 2012	230
Name of equipment:Fourier Transform Mass Spectrometer System	40
Number of units: 1Set	Costs paid:
Name of equipment: Analysis Equipment(Server)	5
Number of units: 1Set	Costs paid:
Name of equipment: Single Crystal X-ray Diffractometer	40
Number of units: 1Set	Costs paid:
Name of equipment: Microcalorimeter	22
Number of units: 1Set	Costs paid:
Name of equipment: ESI-QqTOF Mass Spectrometer	49
Number of units: 1Set	Costs paid:
Name of equipment: Incubator Spinning-disk Confocal Laser Microscope	30
Number of units: 1Set	Costs paid:
Others	44

ii) Costs of Satellites and Partner institutions

Cost Items	Details	Costs (10,000 dollars)
Personnel	Principal investigators (no. of persons):	/
	Other researchers (no. of persons):	
	Research support staffs (no. of persons):	
	Administrative staffs (no. of persons):	
	Total	
Project activities		0
Travel		0
Equipment		0
Other research projects		0
Total		0