

Ph. D. Program in Humanics

University of Tsukuba
WISE Program
(Doctoral Program for World-leading Innovative & Smart Education)

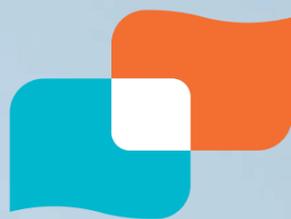
School of Integrative and Global Majors (SIGMA)
Laboratory for Advanced Research A 703, SIGMA Office
University of Tsukuba 1-1-1 Tennodai, Tsukuba, Ibaraki 305-8577 JAPAN

Tel: +81-29-853-7076
Mail: humanics@un.tsukuba.ac.jp



Ph.D. Program in Humanics





Ph.D. Program in Humanics

Be both a Biomedical Scientist and an Engineer The world is waiting for such a specialist

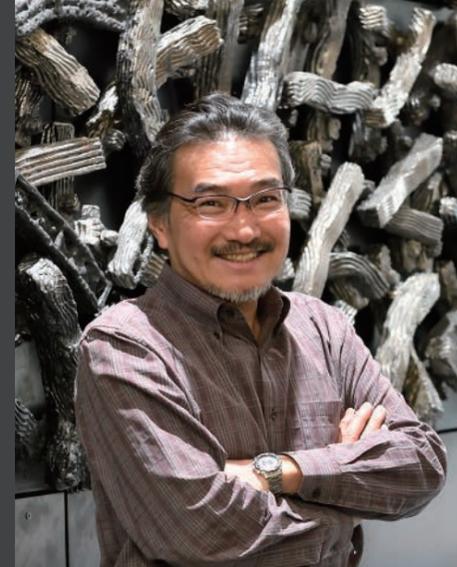
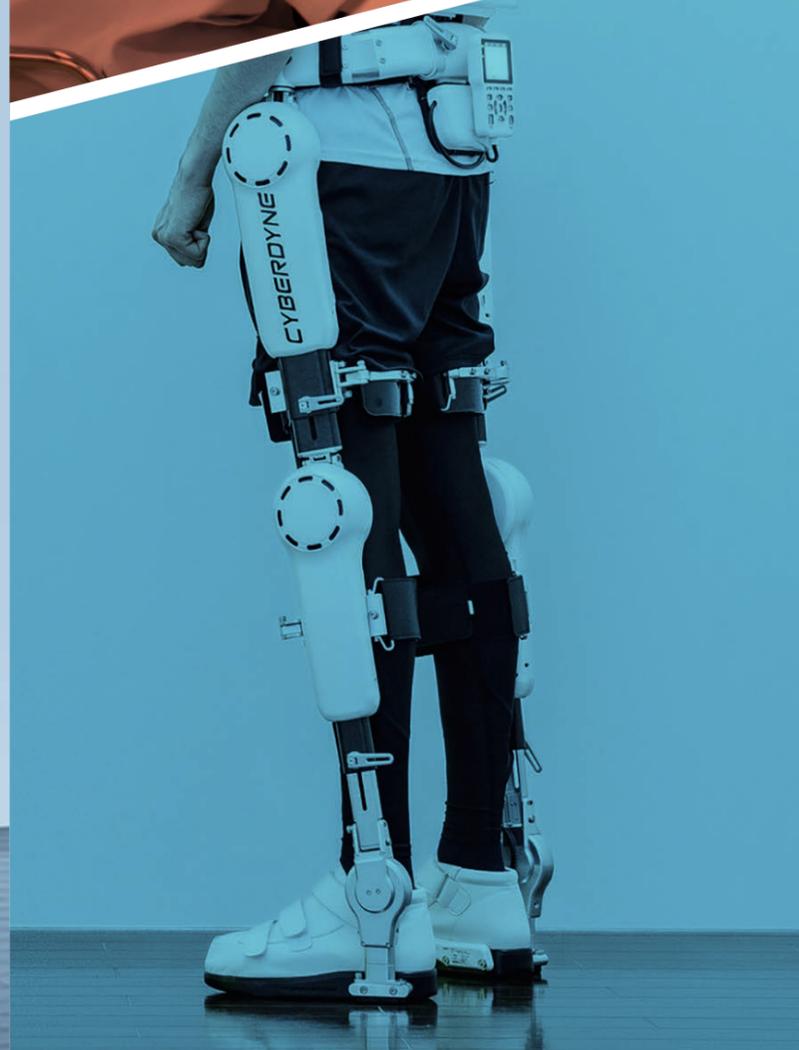
Do you want to apply your knowledge to industry
or further academic research?

Whichever path you choose, the most important thing is
to know what kind of person
you envision being at the end of that journey.

Due to the profound impact of technology on the medical field,
modern treatment cannot exist without technology.
They are becoming one and the same, creating a demand for
specialists who can seamlessly navigate between the fields
of medicine and technology.

The Ph.D. Program in Humanics at the University
of Tsukuba is an innovative interdisciplinary program
aiming to educate the leaders of this new era.
Its unique doctoral-level curriculum is designed to help
students learn the necessary skills,
develop a multi-disciplinary thought process,
and fluently communicate across the fields of biomedical
sciences and physical sciences, engineering, and informatics.
With its Double Mentor System, students will be guided by
two world-leading experts
in their respective fields,
eventually serving as a bridge between these disciplines.

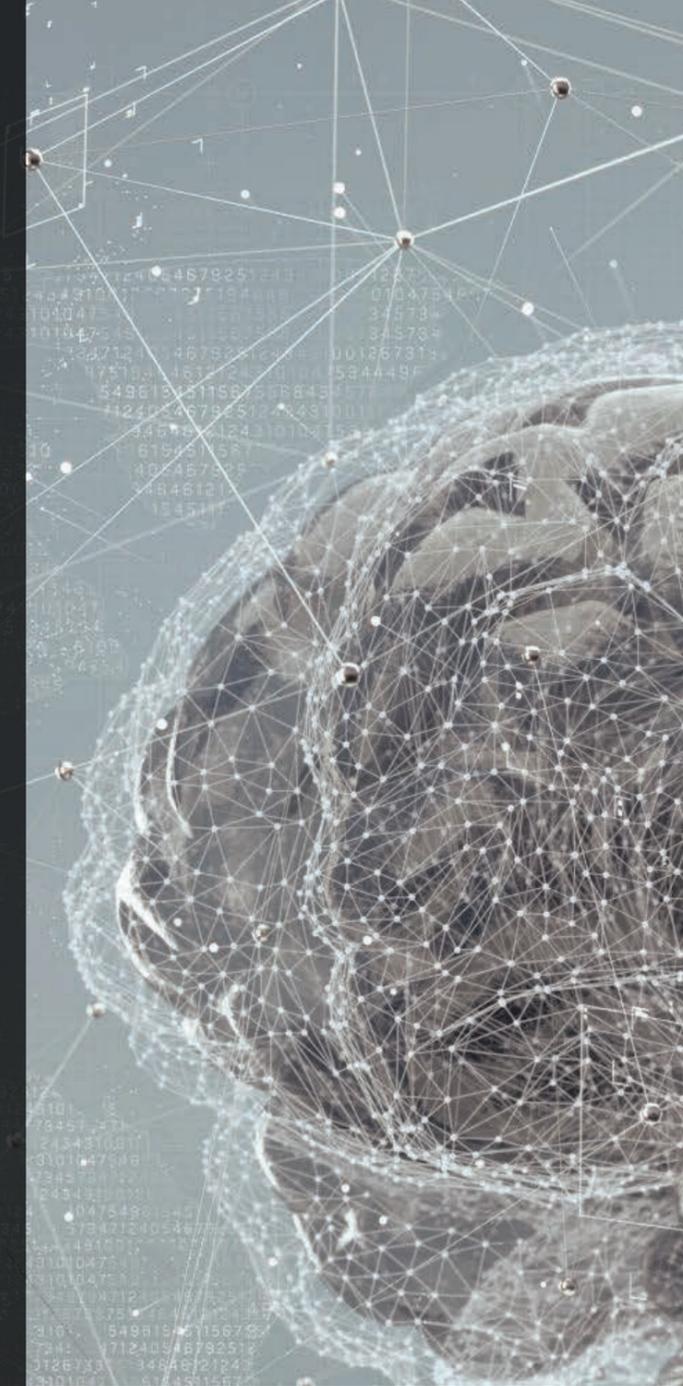
**Join the program and start your
journey to become an individual
who helps shape an unimagined and
limitless future.**



The Ph.D. Program in Humanics cultivates
leaders equipped with doctoral-level
knowledge and skills in the fields of both
biomedical sciences and physical sciences/
engineering/informatics, together with the
scientific expertise to achieve integration
of these fields and the capacity to apply
them in wider society. The program aims
thereby to address challenges to human
life and health and enables the sustainable
prosperity of all humankind. We will
welcome students who have studied either
biomedical sciences or physical sciences/
engineering/informatics, and who are
willing to study the other discipline and
fuse them together. People who have
worked as a physician or an engineer are
also very welcome.

Masashi Yanagisawa

Program Coordinator,
Ph.D. program in Humanics
Director/Professor,
International Institute for Integrative
Sleep Medicine (WPI-IIIS),
University of Tsukuba



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Biomedical science × Science · Engineering · Informatics =

Social background and installation of the Ph. D. Program in Humanics

In order to overcome the life and health challenges of the present and future and for humanity to prosper sustainably, we must constantly incorporate knowledge and technology from different fields into those of biomedical science of the moment and keep challenging ourselves to create a new paradigm. To create a new paradigm by integrating biomedical sciences and different disciplines, it is necessary to develop leaders who can talk with each other using the languages of both fields, understand both deeply, and integrate them in order to make it a reality.

For example, da Vinci, a surgical support robot, was developed from the idea of a surgeon entrepreneur with an engineering background, and the robot suit HAL was inspired and implemented in the real world by an engineer who had studied human physiology. Optogenetics, a leading candidate for the Nobel Prize, that manipulates neuronal activity with light was founded by a psychiatrist who was well versed in optical technologies and genetic engineering. However, the educational system to develop such leaders capable of integrating biomedical sciences and different disciplines, did not exist in our country. This program is a Ph.D. program that aims to overcome intractable challenges of life and health and to ensure the sustainable development of humanity, by developing outstanding talents who can create a qualitatively different paradigm that goes far beyond the common sense of biomedical sciences and physical sciences/engineering/informatics – that is, ZERO to ONE –.

The program is adopted by MEXT, the Ministry of Education, Culture, Sports, Science and Technology “WISE Program (Doctoral Program for World-leading Innovative & Smart Education)”.

The WISE Program (Doctoral Program for World-leading innovative & Smart Education)

At its core, what propels the WISE Program is each university leveraging its unique strengths and capabilities. Building upon their heretofore accomplishments in campus reform, these universities carry out systematic collaborations with other universities, research institutions and corporations in and outside Japan. By establishing integrated master’s-doctoral programs, which over a 5-year period endow their students with a melding of top world-class educational and research prowess, these universities cultivate the kind of outstanding Ph.D. professional who can pilot forward various sectors of society. Concurrently, the program propels the establishment of excellent academic hubs capable of sustainably advancing human resource development and exchange and of generating new joint research initiatives.

https://www.jsps.go.jp/j-takuetsu-pro/data/WISEbrochure_en.pdf

What is Humanics?

“Humanics” is an academic field that sheds light on the fundamental principles of physiology and pathology of the human and generates new science and technology to achieve a healthy and comfortable life of human beings in the society.

In order to nurture the Humanics talents, this program has a unique educational system to cultivate students’ “bi-disciplinary expertise” in the fields of both biomedical sciences and physical sciences/engineering/informatics. In addition, the program is designed to have them acquire “Capability of Problem Discovery”, “Capability of Breakthrough”, and “Capability of Accomplishment” that are practically necessary to establish research topics and to apply research results to society.

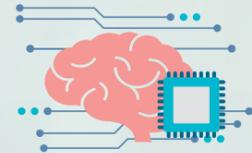
Humanics Aims for Fusion Research (CASE01, CASE02)

“Humanics” aims to promote integrated research that creates a qualitatively different paradigm that goes far beyond the common sense of biomedical sciences and physical sciences/engineering/informatics.

Future image of students

- **Researchers** creating a new interdisciplinary field
- **Entrepreneurs** who industrialize complementary technology of human function
- **Medical doctors** with knowledge of cybernics and informatics
- **Government administrators** who can create a novel plan of medical administration

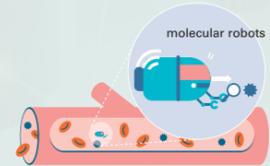
CASE 01



Improvement of cognitive function and mental health

Development of artificial neural network devices that can be linked to the brain, and understanding of sensibility, motivation, and thoughts, etc.

CASE 02



Overcoming intractable diseases by molecular robots

Development of molecular robots to intervene in cell functions based on the understanding of molecular pathogenesis and to control infectious diseases and cancer.



Masashi Yanagisawa

Yoshiyuki Sankai

Why “Humanics” research now?

What kind of talent does the Ph. D. Program in Humanics seek to develop? Why is Humanics a necessary academic discipline in the future? Professor Masashi Yanagisawa, the program coordinator of this program and a world leader in sleep research, and Professor Yoshiyuki Sankai, a leading expert in robotics and Cybernics research in Japan, talked passionately about their own experiences.

Yanagisawa : First, I'll ask Prof. Sankai: **the biggest selling point of the Ph.D. Program in Humanics is to cultivate leaders who can fluently use the “languages” of both biomedical science and physical sciences/engineering/informatics.**¹ That's exactly what Prof. Sankai is like. You are working on robots right now. What made you focus on exoskeleton-assisted robots?

Sankai : I always liked robots and the sciences, but I think that my interest in “people” played an even larger role in shaping my area of focus. When looking at human life, there are some that reach an old age before succumbing to illness, while others die too early from illnesses they were born with. I wanted to create technology that improves, expands, and remedies the natural functions of humans across this spectrum of people, and going one step further, I wanted to create robots, cyborgs, and Cybernics technologies that support the evolution of medicine, welfare, and what we con-

sider daily life, effectively evolving the human race. **When all is said and done, “people” are at the center of all of my outputs.**²

Yanagisawa : When did you decide to make such a robot?

Sankai : Probably by the time I reached junior high school. In fact, I had already been thinking about wanting to get Ph.D. in both engineering and medicine.

Yanagisawa : That's exactly Humanics. You got a Ph.D. in Tsukuba?

Sankai : At that time, the University of Tsukuba had a large number of faculty members because the medical science and engineering departments were newly established. Because of that, I luckily had two professors taking care of me. One was a professor of system control / blood purification treatment in a new engineering field, and the other was a professor of human machine / control. My research involved tactile feedback from a small robotic fingertip touching the stomach wall to find tumors using master-slave technology.

1. Educational Subjects in Humanics

In order to carry out, for example, medical-engineering collaboration, we need leaders who can have conversations in the languages of biomedical sciences and of engineering, deeply understand both fields, and create a new paradigm by fusing them together.

2. What is Humanics? (Fig.1)

A discipline that clarifies the principles of homeostasis of life, the physiology and pathology of the “human” as an individual, and creates new science and technology that can realize a healthy and comfortable life as a “human” in society.

Yanagisawa : So you got a degree in medical engineering, but both mentors were engineering professors. How did you study biology and medicine?

Sankai : That is a good point, Professor Yanagisawa (laughs). At that time, there was a rule at the University of Tsukuba that required us to take lectures from other departments. In other words, **since I was an engineering student, I had to take classes outside of engineering, so I chose medicine.**³ I enrolled in courses by Professor Hori, a Professor of Cardiac Surgery, and the Dean of Medical School, University of Tsukuba.

Yanagisawa : Professor Motokazu Hori also taught me when I was a medical student.

Sankai : I was the only engineering student enrolled in his class. When I was told to come to the hospital at 7:30 in the morning, there would be a conference taking place already. Patient slides came out one after another, and terms I had never heard before were being tossed around. When that finished, we would go to each patient. This is the so-called “Daimyo Procession”.

Yanagisawa : The Professor's round!

Sankai : When we made our way to the patients, the professor who found out that I was an engineering student would always asked me a lot of difficult questions. He would ask things like “what is the pore size of the artificial kidney membrane now?” so,

I always felt a lot of pressure (laughs). But when we were allowed to observe surgical operations, Professor Hori kept me at the front and explained everything to me one by one. In a sense, he was doing what Humanics mentors would be doing nowadays.

Yanagisawa : Great.

Sankai : It was very nice to experience these moments every week in my youth. In retrospect, it was wonderful to have a culture that accepted different worlds with different approaches simultaneously. I think the same could be said for the academic discipline of Humanics.

Yanagisawa : The improvised way you learned both fields is made commonplace in Humanics. In the case of Professor Sankai, you may have happened to take medical classes, but it is not usually possible for an engineering student to get into a surgical site and see a clinical “daimyo procession” and an operating theater. This is something that even students studying medical engineering cannot easily experience. There is a strong impact if it can be done as a matter of course. You also touched the language spoken on the spot.

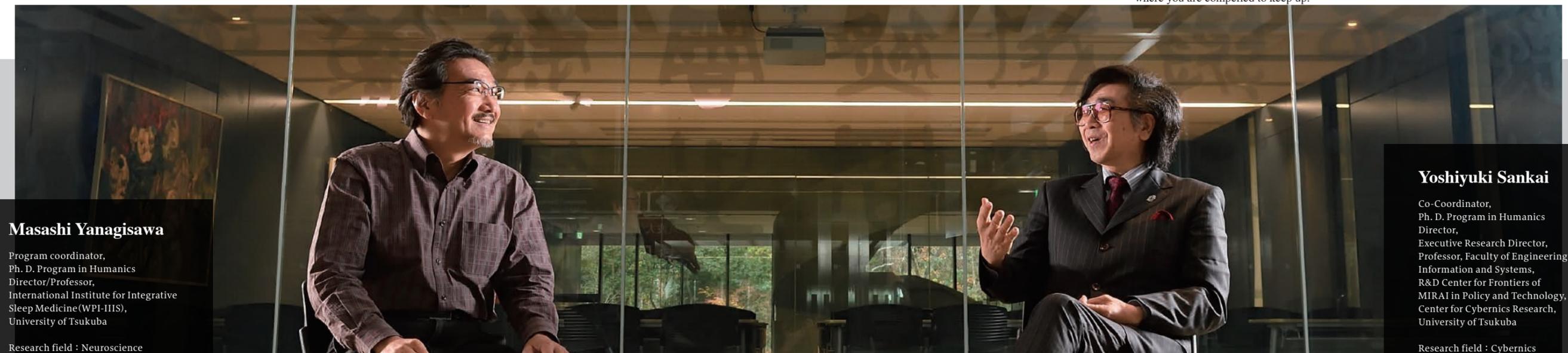
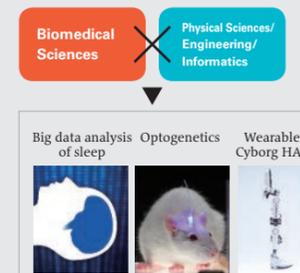
Sankai : What surprised me was that nobody would explain any of these terms. The lecture just proceeds with the assumption that everyone is following, so I had to study them on my own. The great thing about Humanics is that it grants the opportunity to jump into the frontier of the real world where you are compelled to keep up.

3. Pre-admission program in Humanics

In collaboration with bachelor's and master's programs, applicants in the medical sciences (6 years system) who wish to enroll will be given an opportunity to study physical sciences, engineering and informatics, and applicants in the physical sciences/engineering/informatics (4 years) will be provided basic knowledge in medicine, as well as practical training and exercises.

Fig.1

Big data analysis of sleep, optogenetics, Wearable Cyborg HAL, etc. are created by the fusion of biomedical science and physical sciences/engineering/informatics.



Masashi Yanagisawa

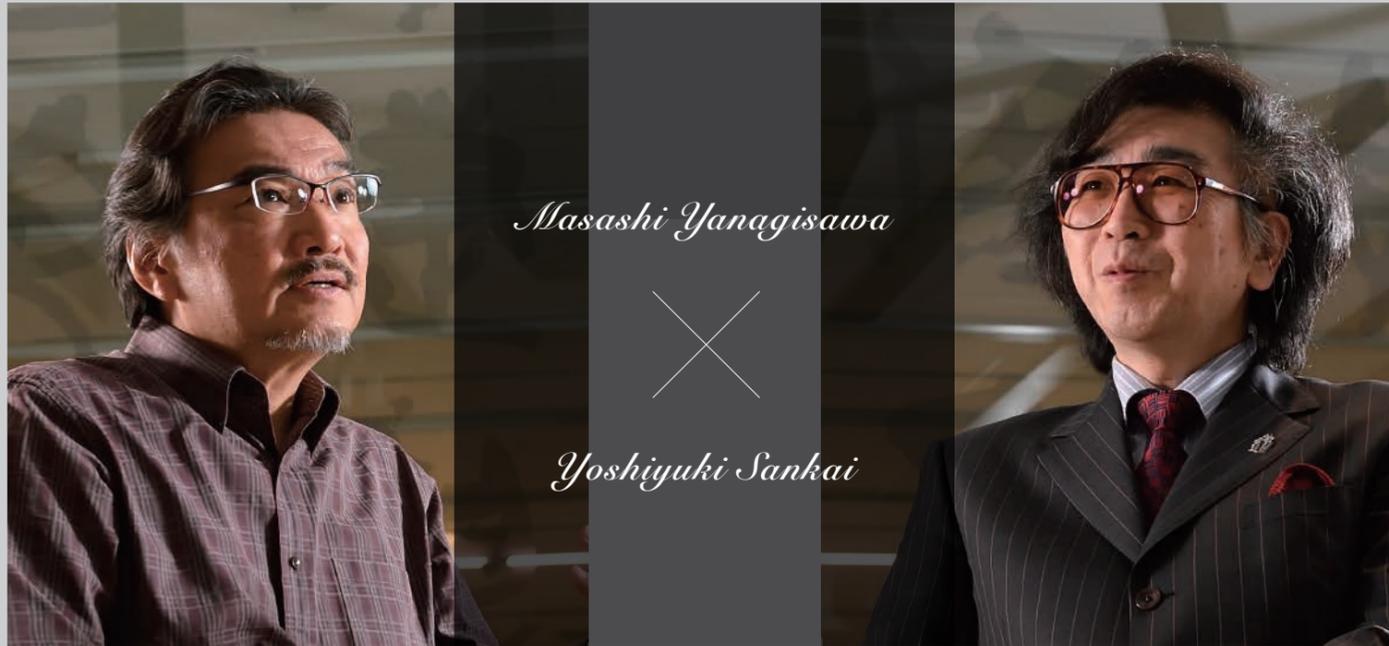
Program coordinator,
Ph. D. Program in Humanics
Director/Professor,
International Institute for Integrative
Sleep Medicine (WPI-IIS),
University of Tsukuba

Research field : Neuroscience

Yoshiyuki Sankai

Co-Coordinator,
Ph. D. Program in Humanics
Director,
Executive Research Director,
Professor, Faculty of Engineering,
Information and Systems,
R&D Center for Frontiers of
MIRAI in Policy and Technology,
Center for Cybernics Research,
University of Tsukuba

Research field : Cybernics



Becoming a talent who can handle the languages of both medical sciences and physical sciences/engineering/informatics.

Yanagisawa : Now let's talk about me. In high school, I was a typical STEM student studying only physics and chemistry. I then enrolled in the school of medicine at the University of Tsukuba. When I was the first year student, I took the class taught by Professor Kaichiro Yanagisawa (unrelated) of genetics, and I realized that modern biology is very exciting. In the meantime, I had the opportunity to meet with physical science and engineering professors, joined a group of young researchers of mathematical engineering, and was exposed to fields such as medical informatics and quantitative analysis. In 1985, when I was a sixth-year medical student, I also wrote an original paper on the subject of cell cycle.

Sankai : That's quite early.

Yanagisawa : I came up with a quantitative model by myself and performed mathematical simulation of the cell cycle. The experiment was conducted at the Lawrence Livermore Laboratory in the United States for three months each in the winter and summer of 1984. The cell cycle was experimentally measured by flow cytometry, which was state-of-the-art at that time, and simulated with the Cray-1.

Sankai : Cray-1, it was a supercomputer of the era wasn't it? It must have been pretty special to be able to have access to an envi-

ronment with Cray-1 in your days.

Yanagisawa : I didn't even study for entrance exam in high school, but there was an award in my high school that commended me for excellent research in science. I decided to take it with a friend who was strong in software and we made a personal computer from scratch. Created a simple interpreter programming language using assembler language.

Sankai : That's amazing.

Yanagisawa : After I entered graduate school, I became so involved in experimental biology research that I was far away from actually using quantitative methods. But I've always had a sense of crisis. This is because, even though we were doing joint research with the mathematical sciences, we sometimes did not understand each other. I thought this was very bad. **That's why when I applied for this program to the MEXT Graduate School of Excellence, I argued that "we should have a double mentor system." Students were always assigned to two supervisors to force them to learn medical biology on the one hand and physical sciences/engineering/informatics on the other.**⁴ For example, students from engineering will have direct access to clinical medicine from the first year, just like Prof. Sankai. They are still young and can absorb a lot if exposed. I think that such an environment will cultivate

outstanding talents.

Sankai : It is nice that we agree that the target is "people." There are a lot of things in the natural sciences that exist without the presence of humans, but "people" cannot be the target without the existence of humans. In that sense, Humanics is a place where this image of people provides a certain directionality while medicine and engineering can march forward as one.

Yanagisawa : It's just right for the times. When I entered graduate school, it was difficult for biology to generate data anyway, but in the age of omics, it became relatively easy to get large amounts of biological data. Biology students in Humanics are now trying to use mathematics and informatics as tools. Eventually, I think we will go one step further from here, which will lead to biological theory and concepts from the mathematical side.

Sankai : What is important and at the core of this interaction is "evolving together". Before I got my doctorate in graduate school, I was actually considering reentering the university to learn medicine from the basics. Instead, a professor advised me, "why don't you try to coordinate with medicine." Now that I think about it, I'm very grateful for his advice as this accelerated my growth beyond my imagination. I really believe that you, Professor Yanagisawa, also see Humanics as a

curriculum that develops people, and medicine and engineering are really compatible.

Yanagisawa : For example, medicine literally uses engineering as a tool, but in fact, you will not be able to produce sharp results in bioinformatics, for example, unless you have a truly deep understanding. And there are extremely few good bioinformaticians in Japan. If you don't understand mathematical principles, you can't be an expert, and the language is quite different in the first place. It is essential to be able to handle both worlds of biomedical science and physical sciences/engineering/informatics.

Sankai : However I think it's very important that you are able to clearly depict the concept behind the language in your head, and not just have a superficial understanding of the language. A high-level understanding of the language should allow you to jump to the next stage of thought and discussion instantly. Isn't this Humanics a program born with that in mind? Time is limited, so while we can never be sure if we can reach the goals we place ourselves, Humanics can act as a trigger for some people who may go all the way. It is important for Humanics to become a field that allows for constant growth in a person so that they can navigate life in this society.

Yanagisawa : Ph.D. Program in Humanics has

conducted an entrance examination twice a year so far, and there were 12 applicants for the winter exam in 2019. In the 2020 class, 14 students have passed. Enrolled students are outstanding, and there are many international students. This time, we also did an overseas entrance exam.

Finally, would you like to give a message to students who are planning to take Humanics?

Sankai : I have only one message. Whatever your goal may be, become a pioneer who enjoys every moment of their journey. You may encounter many obstacles, but our time in life is limited. **I want you to never forget the wonder and excitement of exploring new areas in your field.**⁵

Yanagisawa : What I often say to young people is to study what they think is really interesting. If you don't find it genuinely interesting yourself, there's no way you can explain the excitement to others. That's why in choosing Humanics, I want you to pursue questions and perspectives that you feel are truly really interesting. I want you to do something that you can boast about, "this is interesting" not just because someone said, "it would be interesting if you did this." You don't have to force others to understand it. It's more important to keep believing in yourself that this is really interesting.

4. Double mentor system in Humanics (Fig. 2)

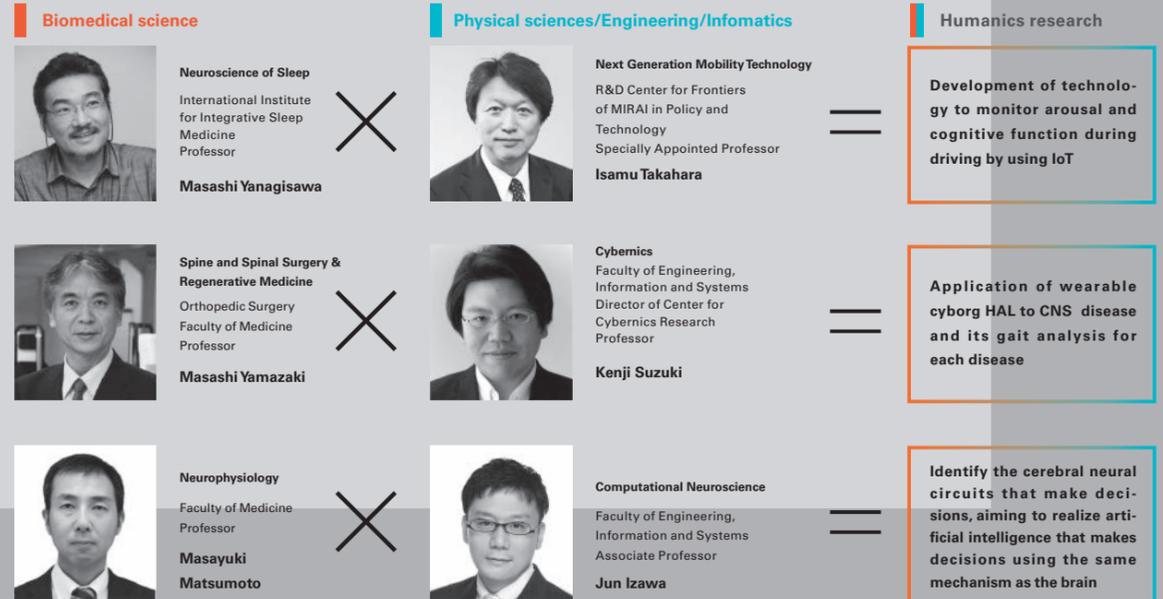
Students earn a Ph.D. degree through the "double mentor system", in which faculty members from both biomedical sciences and physical sciences/engineering/informatics initiate a research collaboration to provide guidance to students. "Reverse mentor system" means that students impart knowledge from one field to another and act as a bridge between different research fields. Students will learn bi-disciplinary expertise as well as communication skills.

5. Career path of Humanics students (Fig. 2)

- Researchers creating a new interdisciplinary field
- Entrepreneurs who industrialize complementary technology of human function
- Medical doctors with knowledge of cybernetics and informatics
- Government administrators who can make a novel plan of medical administration

Fig. 2 Example of Humanics research

Biomedical science x physical sciences/engineering/informatics enables doctoral research based on joint research that fuses two fields.



Four features of our Program

- Pre-admission program**
- Double mentor system**
- Reverse mentor system**
- Collaboration with outstanding research institutions**

Feature 3

Learning with friends from all over the world

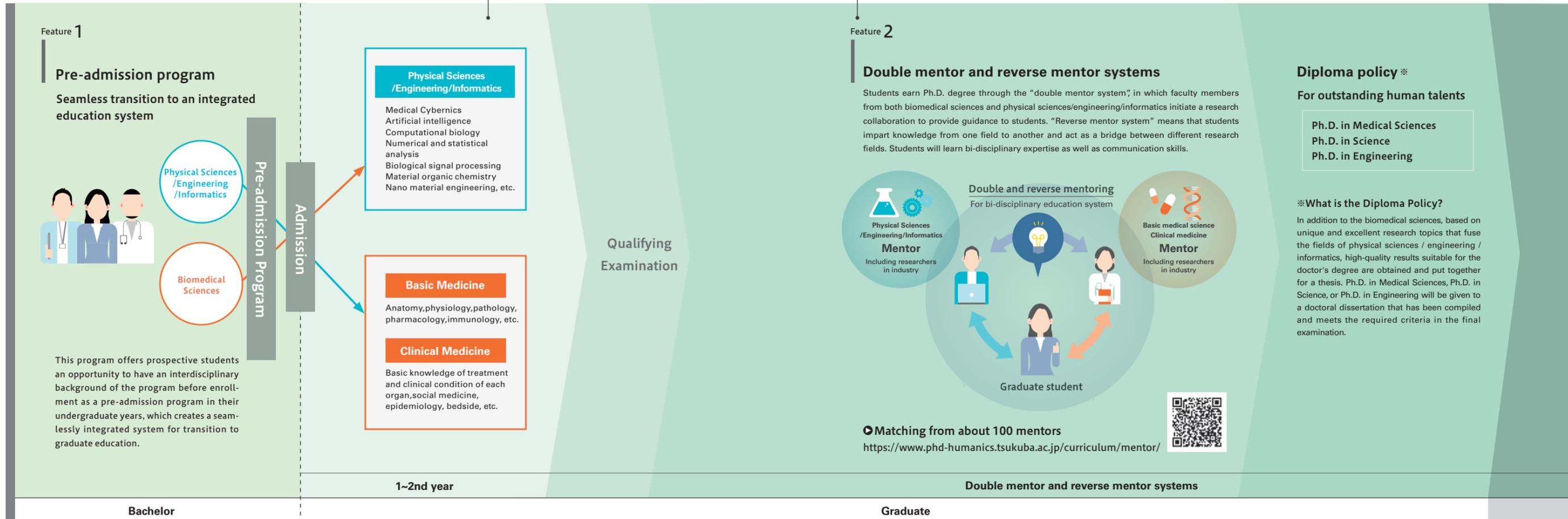
We have curriculums in English so that you can earn Ph.D. degree with English taught classes. Also we have multilingual staff to support your student life. You will be able to meet students from all over the world with different backgrounds, so you can exchange ideas with each other and cultivate internationality. We have travel grants to support your domestic/international researches.

Feature 4

Combination of biomedical sciences and physical sciences/engineering/informatics

The program is supported by a variety of research centers and companies from biomedical sciences and physical sciences/engineering/informatics

- Private companies
 - CYBERDYNE Inc.
 - Toyota Motor Corporation (R&D Center for Strategic Frontiers in Social Planning)
 - Hitachi, Ltd.
 - S'UIMIN Inc.
- Research centers
 - International Institute for Integrative Sleep Medicine (WPI-IIS)
 - Center for Cybernics Research
 - R&D Center for Precision Medicine (PMC)
 - National Institute of Advanced Industrial Science and Technology (AIST)
 - National Institute for Materials Science (NIMS,WPI-MANA)
- Overseas Universities
 - University of California, Irvine
 - University of Bordeaux
 - National Taiwan University



Extensive curriculum to develop human talents in the field of Humanics

In Ph. D. Program in Humanics, students study basic/clinical medicine or physical sciences/engineering/informatics through lectures and exercises. With e-learning and PBL, students are specialized in bi-disciplinary research under a double mentor system. In addition, through taking entrepreneurship education, internships, overseas lab rotation, etc., we will help students cultivate motivation and negotiation skills to play an active part in the world.

Students having graduated from a 6th year course of a university or one with a master's degree may be eligible to apply for a QE even in the first year if they have sufficient academic achievements.



Interdisciplinary learning through practices and exercises

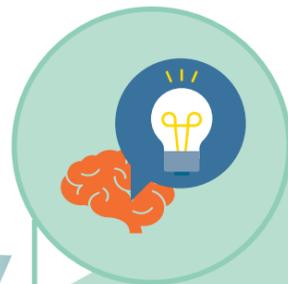
- International laboratory (1 month)
- Internship (1 month)
- Appropriate Technology



QE by the end of the 2nd year

Evaluated for the ability to propose a research plan in the area of Humanics

QE : Qualifying Examination, a test to evaluate the ability of proposing a research plan in the area of Humanics. The test period depends on the degree of achievement (the second year in the standard)



Integrated research of biomedical sciences and physical sciences/engineering/informatics

Cultivating capability to generate the ZERO to ONE task based on interdisciplinary learnings



Dissertation Defense
5th-year-end in the standard

Degree completion requirements

- Having passed QE
- Obtaining 45 credits or more
- Research results equivalent to original papers published in peer-reviewed international journals
- Achieving the required score of the portfolio type achievement evaluation

Quality assurance by portfolio-based achievement evaluation

Humanics Competencies



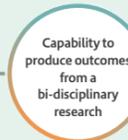
The capability to integrate two or more research fields based on doctoral-level knowledge and skills in biomedical sciences and one of physical sciences/engineering/informatics.



The capability to understand and explain the global trends in biomedical sciences and physical sciences/engineering/informatics.



The capability to formulate a new paradigm and overcome difficulties by conducting integrated research through bi-disciplinary expertise.



The capability to execute a bi-disciplinary research to implement the academic and social impacts of the integrated researches toward society.

Becoming an outstanding Ph.D. talent creating new industries and interdisciplinary fields based on Humanics research!

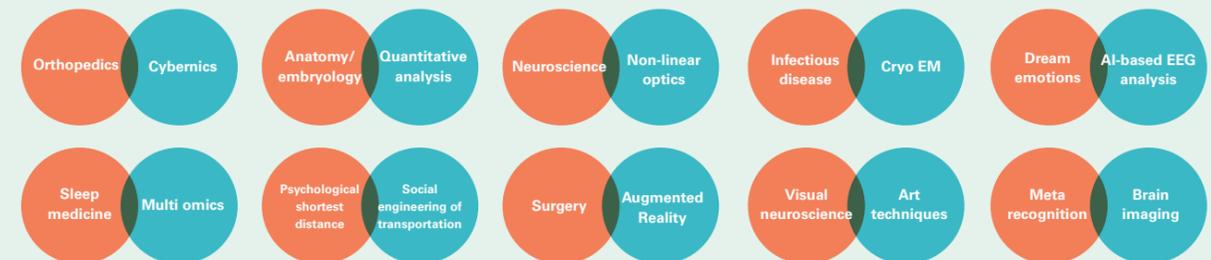
Ph.D. in Medical Sciences
Ph.D. in Science
Ph.D. in Engineering

- Researchers creating a new interdisciplinary field
- Entrepreneurs who industrialize complementary technology of human functions
- Medical doctors with knowledge of cybernics and informatics
- Government administrators who can make a novel plan of medical administration etc.

Integrated Research Humanics is pursuing

In Humanics - that brings together knowledge from various fields to create new science and technology, research born from your ideas may change the future of society and each of us.

Humanics research example



Shinichi Miyazaki

After working as a medical intern, he entered the program. He is currently conducting sleep research to uncover "why organisms sleep" by genetic methods in nematodes.

- 8:00 ● Arrival at the laboratory
Checking the schedule for the day, checking the papers, and preparing for the experiment if necessary
- 9:00 ● Progress report or Journal Club
- 10:00 ● Behavior experiments using nematodes
- 11:30 ● Move + Lunch
- 12:15 ● class (class of analysis method using spectroscopic analysis, a physics class)
- 15:00 ● Visualization of internal molecules and structures of nematodes by multi-modal nonlinear optical imaging (experiment at Kano Lab)
- 17:00 ● Move
- 17:30 ● Experiment DNA work and behavior experiment Tomorrow's experiment preparation
- 19:30 ● Return home (dinner at home)

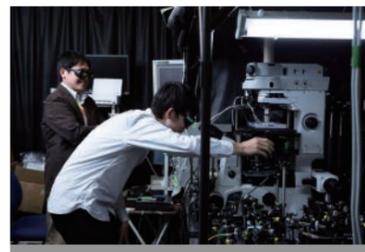
Even if the learned knowledge did not relate to the research at present, it should be useful someday

I got a bachelor's degree from University of Tsukuba School of Medicine. I worked as a medical doctor before entering this program. My desire for continuing basic research grew, and I decided to enter graduate school. One of the most attractive features of this program is actively promoting fusion research. Recently, fusion research, which creates new things by multiplying two different research fields, is mainstream. Under Prof. Yu Hayashi, a leading researcher of nematodes, I explore the biological role of sleep using genetics and neuroscience. The second mentor is Prof. Hideaki Kano of the Graduate School of Science and Technology (Professor of Kyushu University; visiting professor of University of Tsukuba). In Kano Lab, my theme is nonlinear optics applied for microscopes to identify biomolecules by manipulating laser.

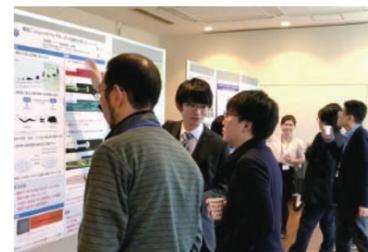
In the future, I would like to become a principal investigator. The double mentor system is advantageous for achieving my goal because I can learn a lot from two different researchers is significant. This program provides us a pleasant environment. Students can concentrate on their research without worrying about daily life because of full financial support. Studying new fields with pleasure is essential for a student who wants to enroll in this program. Since students in this program have to learn many things in a different area, we often run into a wall. Of course, I also frequently have difficulty studying in another research field. However, I often find that new knowledge is closely related to my research later. Now I believe that all of the experience should be useful, even if it seemed not to link to my research.



Most of the day, I am studying nematode sleep under my mentor, Prof. Hayashi.



The Kano laboratory several times a week for lab meetings and experiments to perform nonlinear optical imaging of nematodes.



Poster presentation at the symposium sponsored by division of living-cells spectroscopy in the Spectroscopical Society of Japan.

Michelle Jane Clemeno Genoveso

International student from the Philippines. She is conducting research on the involvement of host factors during viral infection, and now she is enthusiastic about cryo-electron microscopy and single particle analysis of proteins.

- 8:40 ● Attend class (Basic Computational Biology)
- 11:25 ● Lunch (at home or university cafeteria)
- 12:30 ● Check emails
- 13:00 ● Attend Business leader Seminars
- 15:00 ● Experiment in Iwasaki laboratory (Structural Biology)/ Consultation with Iwasaki Sensei
- 17:00 ● Go back to Kawaguchi laboratory (Infection Biology)
- 18:00 ● Kawaguchi laboratory seminar
- 20:00 ● Go back home
- 20:30 ● Dinner (Own cooked food)
- 21:30 ● Programming practice

I take on challenges without fear.

I enrolled in this program after transferring from the Master's Program in Frontier Medical Science. I have been interested in computer science and engineering for a long time. Still, I could study only medicine and biology in my current program. However, the Humanics program allows me to study medicine, computer science, and engineering altogether.

When I entered the program, I chose the laboratories of molecular virology and structural biology. Moreover, I had the opportunity to learn computer science and engineering through lectures and lab rotation. As an international student, I appreciate that all classes are taught in English. I also communicate with my two mentors in English. We regularly set meetings and share our ideas. It is always exciting for me to relay and discuss one of my mentors' views to the other and vice versa.

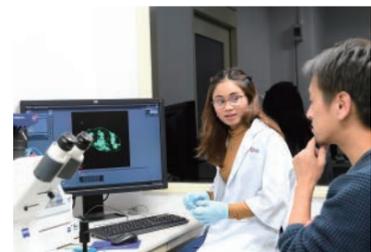
This program offers excellent support for the

students, such as the travel grant from the first year of enrollment. Through this support, I participated in a summer course at the University of Edinburgh (UK) and a training course at the Okinawa Graduate University, both in my first year. In the future, I will take advantage of this support to attend more academic conferences, both domestic and overseas.

After graduation, I plan to continue my research as a Postdoc in Japan. It is my way of giving back to Japan for the support I received during my graduate studies. I would be happy to apply what I learned from these two fields to solve society's current problems. It may not be easy to understand a new area, but I hope that the new students will be inspired to take on the challenges without fear. Because at the end of the day, no matter how difficult it may get, you will get through everything as long as you love what you are doing.



In Iwasaki lab, we use cryo-electron microscopy to reconstruct the 3D structure of proteins and protein complexes for a deeper understanding of their functions and interactions.



In Kawaguchi lab, I perform most of the biochemical experiments to clarify the molecular mechanism behind the process called phase separation.



Through the Humanics travel grant, I was able to join a summer program and visit top-level universities and institutes in the United Kingdom.

Ph.D. Program in Humanities

CROSS TALK

Michelle Jane Clemeno Genoveso

Research area : Infectious disease/cryo-electron microscopy
Mentors : Faculty of Medicine Prof. Kawaguchi Atsushi
Life Science Center for Survival Dynamics Prof. Iwasaki Kenji

Seioh Ezaki

Research Area : Orthopedic Surgery/Cybernetics
Mentors : Faculty of Medicine Prof. Yamazaki Masashi
Faculty of Engineering, Information and Systems
Prof. Suzuki Kenji

Shinya Nakata

Research Area : Sleep medicine/Bioinformatics
Mentors : International Institute for Sleep Medical Science
Prof. Yanagisawa Masashi
Faculty of Medicine Prof. Ozaki Haruka

Learning from different fields opens up new possibilities.

Seioh: I was studying robotics and medicine before entering this program, so it was very natural to move to Humanities where I could study two fields, but Michelle also moved from another program right? How did you know about Humanities?

Michelle: I was taught by my supervisor. I was introduced to the Humanities Degree Program when I was thinking about going from a master's program to a doctoral program. I thought that this program will be a great opportunity to meet not only researchers from my field but also experts in engineering and computer science.

Shinya: I also felt fascinated to be able to learn not only one field but also other fields. I was thinking of getting a Ph.D. from the beginning, and wanted to learn as much as possible when I was a graduate student. But I think engineering and informatics would have been difficult to study without entering Humanities.

Michelle: Shinya, when is your happiest moment?

Shinya: After all, I enjoy taking classes in other fields. It would be a good time to get together with Humanities members. I get a lot of stimulation from my classmates. The research content is different.

Seioh: The good thing was we have chance to spend a time together in classes and summer programs with other Humanities students, so that we could understand each other well. I also liked QE. I was glad to receive many comments from professors in different field.

Michelle: The students can build great camaraderie because aside from taking classes together, they also participate in seminars, workshops and even out of the country summer programs. As Ezaki said, the QE was challenging for us because we are the first batch however, we did our best to set a good example for the next batches of Humanities students.

Shinya: Before I entered Humanities, I couldn't imagine much about collaborative research with a different field, but I gradu-

ally became able to imagine while taking classes or visiting other laboratories.

Seioh: I loved the AI class. Basic mathematics and physics were taught in the class. What especially impressed me was, the professor gave us lot discussion chances during the class from philosophical perspectives. Thinking about "what is intelligence?" and "what is AI" from fundamental view was a totally new experience.

Michelle: Before entering Humanities, I thought that engineering and informatics serve as powerful tools for solving problems in medical science. However, through Humanities I realized that the fusion of these fields (medical science, engineering and informatics) creates a brand new discipline that offers more efficient solutions to the challenges in the society.

Seioh: You used the Travel Grant, right? I also joined the summer program at the University of Edinburgh and was inspired by the overseas research facilities. After experiencing academic discussions and

presentations during the summer seminar, I got a confidence of presenting about my research. Then, I attended a number of conferences overseas. You will get the opportunities to participate in your first experience without hesitation, so your motivation for research will increase.

Shinya: That's right. The hurdles to participate in overseas conferences are quite high unlike in Japan, so I am grateful for the student travel grant. I intend to use it when attending overseas conferences. Furthermore, Humanic's economic support does not need to be repaid. When research gets busy, I don't have time to work part-time. By the way, what do you do to improve your skills?

Seioh: I participate in workshops and lectures voluntarily to learn the techniques required for own research. In the medical-engineering collaboration field, it is often difficult to completely follow up the trends only with literature. The workshops allow us to meet teachers who are active in foremost line in various fields, so exchanging contacts will increase our chances to get new knowledge. I think it's also a valu-

able opportunity to explain our research and get their advice.

Michelle: I try to take full advantage of all learning opportunities. I participated in several cryo-electron microscopy training workshops and practiced programming to enhance my skills. In parallel, I also try to carry out several biochemical experiments. But the most important thing for me is to have regular discussion with my mentors.

Shinya: That's very important. I'm in the lab of my deputy mentor teacher right now, participating in bioinformatics-related journal clubs and reading circles to learn the math necessary to use informatics, and spending time there is very exciting and fun I do. It may be great to focus on your interests.

Seioh: I think it is difficult for anyone to try to raise the two specialized fields studied in Humanities to the same level. Rather than understanding the specialty from the basics, we have to consider how can we grasp the big flow and relate them to our specialty? If we can see that, I think that everyone can play an active role in our required place.

to keep in mind when learning Humanities. What is Michelle's future dream?

Michelle: I want to be a bridge between medical science, engineering and computer science. I would like to be able to work with medical scientists and engineers and smoothly share ideas with them. What is Seioh's dream?

Seioh: I want to create a society where people can stay healthy and live longer, without visiting hospitals too much. I want to explore new ways of embodiment as well. From now on, not only engineering technology for treating diseases but also applied science that expands human perception and body functions will be pursued, so I am looking forward to its evolution.

Shinya: I don't know yet whether it's academia or industry, but in the future I want to work as a researcher. I think that new discoveries and flexible ideas come from a wide range of knowledge, so I want to gain a variety of knowledge through Humanities.

Seioh: Humanities has a lot to learn, so I think we can still grow a lot. I am looking forward to meeting everyone in the future.

Michelle: Then we will discuss again!

Admission Information

Ideal candidate

We will welcome students who have studied either **biomedical sciences** or **physical sciences/engineering/informatics**, and who are willing to study the other discipline and fuse them together. People who have worked as a physician or an engineer are also very welcome.

Number of Students to be Admitted and Language

- Number of Students to be Admitted

Approximately 15 (Total number of students enrolled in spring, fall and working individuals)

- Degree

Either a Ph.D. in Medical Sciences, Ph.D. in Science, Ph.D. in Engineering

- Language used in Examination

English (responses in Japanese is acceptable)

- Entrance exam information

For the latest information, please see the website.

<https://www.phd-humanics.tsukuba.ac.jp/en/admission>



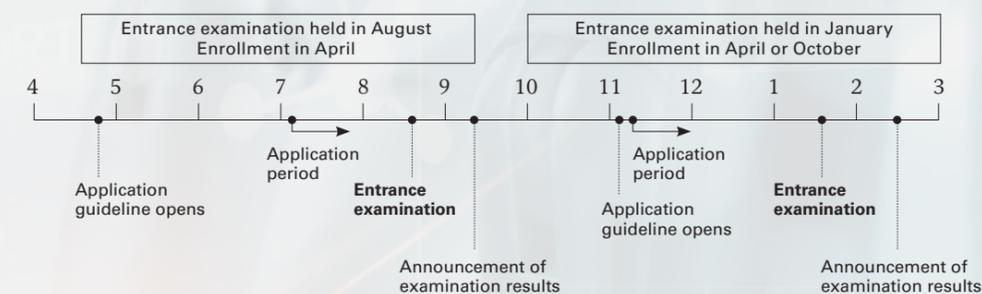
Various Supports (as of May 2022)

Students of Ph.D. Program in Humanics, judged as excellent in studies/researches, are financially supported so that they can concentrate on the studies and researches.

Financial Supports	Equivalent to Master's program Before passing Qualifying Examination <ul style="list-style-type: none"> Financial supports according to their research contribution based on TA, RA, and Reverse Mentor work TA/RA support equivalent to half tuition
	Equivalent to Doctoral program After passing Qualifying Examination <ul style="list-style-type: none"> Education and Research Support Expenses (planned for 160,000 to 180,000 yen/month) Tuition: Full exemption Amount of the above supports will be decided based on results of entrance examination, outcome of participation in programs and research, results of Qualifying Examination, operating expenses of the program, and other factors. In addition, students who are judged as excellent in academic achievement by the university's regulations are eligible for tuition fee exemption as described above.
Support for overseas studies & research activities	Program will support for expenses related to overseas studies & research activities, such as joint research and presentations at international conferences, conducted by students on their own initiative at universities and research institutions overseas. Amount of the support is decided based on the Travel Grant application and the operating expenses of the program (planned for up to 300,000 yen/year for domestic or 400,000 yen/year if it includes overseas activities).
Student dormitory	Student dormitory has been established to offer students excellent study environment along with the opportunity to experience autonomous civic life. For further information regarding room, equipment and monthly rent, please refer to the website below. http://www.tsukuba.ac.jp/en/students/campus-life/accommodation

Annual schedule of entrance examination

We have the entrance examination twice a year, one in late August and the other in late January or early February.



Application steps

STEP 1 Contact the two desired mentors

After confirming the research field of each faculty mentors, contact two desired mentors by e-mail and ask for a permission. Choose one mentor from biomedical sciences, and also choose another mentor from physical sciences/engineering/informatics. Decide which mentor is your main mentor.



Ph.D. Program in Humanics
Mentors list
<https://www.phd-humanics.tsukuba.ac.jp/en/mentor/>

STEP 2 Application (web entry)

The following submissions are required.

- Applicant information
- Research plan (about 1000 words in English)
- It is necessary to submit a TOEIC official certificate or a scorecard for TOEFL test takers.
- Desired mentors; one from biomedical sciences, another from physical sciences/engineering/informatics.
- Recommendation letter from the dean of your department or your supervisor
- Examination fee

For details, please refer to the application guidelines.

STEP 3 Admission

Oral examination I concerns (1) knowledge in biomedical sciences, physical sciences, engineering and informatics, (2) ability to adapt two different fields of study, and (3) linguistic proficiency.

Oral examination II concerns your research project proposal upon admission and career plan.