Department of Gerontological Nursing and Wound Care Management

We wish to create a society that respects the beauty of aging and recognizes it to be a joyful process in life

Message from Prof. Hiromi Sanada, PhD, RN, CWOCN, FAAN

Aging is regarded as a natural process of human development and maturity. We are going to promote education and research to enhance the self-dignity, ability for self-care, and self-actualization of the elderly population in Japan so they can play an active role in society. With the goal of improving the quality of life of elderly persons, we are developing equipment and technologies for the prediction, prevention, diagnosis, and treatment of aging syndromes, such as pressure ulcers, incontinence, malnutrition, and pain, while maintaining individual independence and autonomy. Meanwhile, we have been actively developing translational research, which involves the bridging basic research to clinical applications, with an eye towards improving the state of wound care. Here, the findings and major outcomes of our basic research at the molecular biological level are returned to patients and community in the form of both instruments, developed through industry-academia collaboration, and the construction of evidence through clinical evaluation. It is through these endeavors that we aim to establish a new discipline combining nursing science and engineering.

With these clear goals, our progress can be readily seen. In October 2010, we established the Department of Life Support Technology, through a generous sponsorship by Molten Corporation. This group intends to reveal the cause of diseases and symptoms related to daily life activities, as well as to develop new monitoring systems and preventive measures to avoid disease. Our next major milestone took place in December 2012, with the creation of the Department of Advanced Nursing Technology, the aim of which is to adapt the art of nursing based on current clinical needs, with the cooperation of clinical staff in hospitals, companies, and the University of Tokyo. In February 2017, we started the Department of Skin Care Science. Researchers here are working to understand phenomena occurring in living organisms at the molecular level and realize essential interventions based on these mechanisms. The creation of new nursing technologies through the fusion of nursing and biology will undoubtedly contribute to the development of nursing as a science, as well as improve the wellbeing of persons who are dealing with the conditions accompanying aging. Finally, in April 2017, we opened the Department of Imaging Nursing. This laboratory uses state-of-the-art imaging technology and information technology such as AI to achieve a system that enhances the quality, speed and comfort of patient examinations. Also, in April 2017, the Global Nursing Research Center in the Graduate School of Medicine was established to strongly promote care innovation development research and nursing systems. This center fosters young researchers who will promote innovative interdisciplinary research based on nursing, and promotes cutting-edge research, while designing educational courses and creating curricula (postdoctoral program).

Our mission as educators is to assist new clinical researchers and coaches who desire to innovate the practice for geriatric syndrome to maximize the potential of each older person. We hope to share our outcomes with the rest of the world.
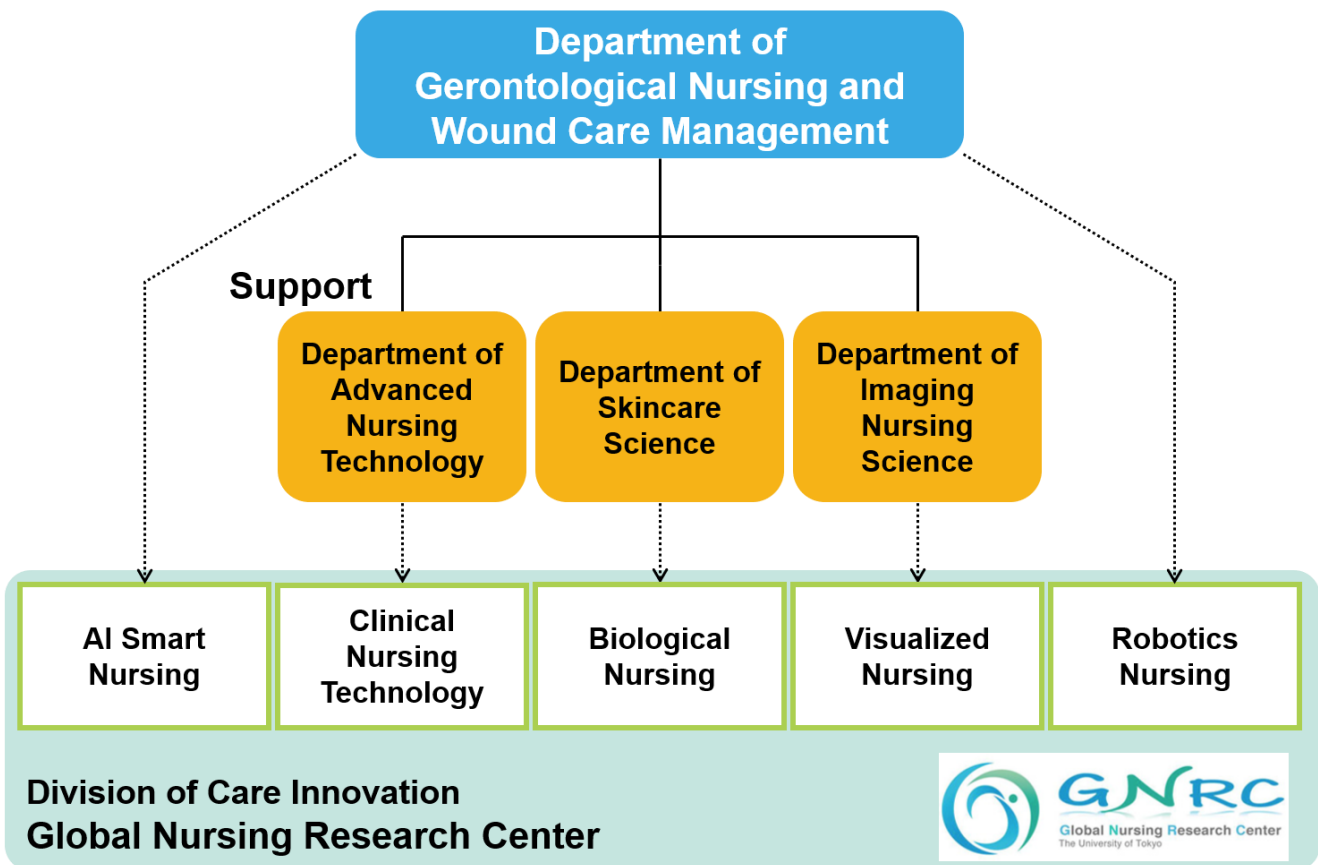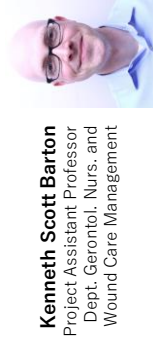
Hiromi Sanada

Framework for advanced nursing research

We intend to use the results of our research for the benefit of society. Our approach starts with field investigation to grasp and clarify the latent or current problems in clinical settings. The research that follows will be carried out with the cooperation of several academic and clinical fields. Consider our research process in bioengineering nursing which requires input from both basic biology and engineering, and which results in new device development and methods for clinical evaluation In this way, we promote innovative multi-disciplinary research that combines translational research and nursing.

Our main research theme is the development of prevention, diagnosis and treatment technology for wounds including pressure ulcer, leg ulcer and diabetic foot ulcer associated with essential activities of daily living. Elucidation of pathogenic mechanism is essential to developing technologies and must be verified in clinical research. We cover a wide range of research from basic research to clinical research and aim for medical innovation through development or use of novel technologies.

Mikihiko Karube, MSc
Cooperative Researcher
Dept. Imaging Nursing
Science(Fuji Film)

Mayumi Handa, MT
Cooperative Researcher
Dept. Imaging Nursing Science
(Fuji Film)

Gojiro Nakagami, PhD, RN
Associate Professor
Dept. Gerontol. Nurs and
Wound Care Management
Pressure injury, biofilm, signal
transduction, real-world data,
artificial intelligence

Aya Kitamura, PhD, RN
Assistant Professor
Dept. Gerontol. Nurs and
Wound Care Management
Pressure injury, assessment,
Wound infection, Robotic mattress

Yuko Mugita, PhD, RN
Assistant Professor
Dept. Gerontol. Nurs and
Wound Care Management
Skin physiological function,
skin disorders, bacteria, urea

Sanai Tomida
Research Support Staff
Skin assessment

Masaru Matsumoto,
PhD, RN
Project Lecturer
Dept. Imaging Nursing Science
Ultrasonographic evaluation of
pressure injury and colon

Takeo Minematsu,
PhD
Project Associate Professor
Dept. Skincare Science
Skin assessment,
skincare, hair growth,
skin regeneration

Sofoklis Koudounas,
PhD
Project Assistant Professor
Dept. Skincare Science
Skin health, incontinence,
incontinence-associated
dermatitis

Clinical Nursing

**Clarifying Clinical
Questions & Problems**

Clinical Evaluation

Clinical Dimension
(Research in Hospitals, Facilities and Community)

Hiromi Sanada, PhD, RN, CWOCN, FAAN
Professor
Dept. Gerontol. Nurs. And Wound Care Management
Director Global Nursing Research Center
Treatment-related R&D for vulnerable elderly,
prevention and management of pressure injuries,
lower extremity ulcers, diabetic foot ulcers, stoma,
skin care, incontinence

Basic Science
Dimension
(Cell/Animal Study)

**Clarifying Pathological
Mechanisms**

Molecular Biology

Nursing Engineering
Dimension
(Manufacturing)

**Developing Devices
and Products**

Engineering

Kojiro Morita,
PhD, RN
Project Lecturer
Global Nursing
Research Center
real-world data,
clinical epidemiology,
health services research

Toshiaki Takahashi,
PhD, RN
Project Assistant Professor
Global Nursing
Research Center
AI Nursing, infusion,
communication robot

Nao Tamai, PhD, RN
Project Associate Professor
Dept. Imaging Nursing Science
Visualized nursing,
cancer nursing,
wound care management

Kenneth Scott Barton
Project Assistant Professor
Dept. Gerontol. Nurs. and
Wound Care Management

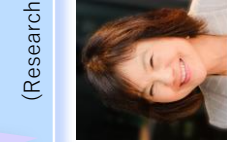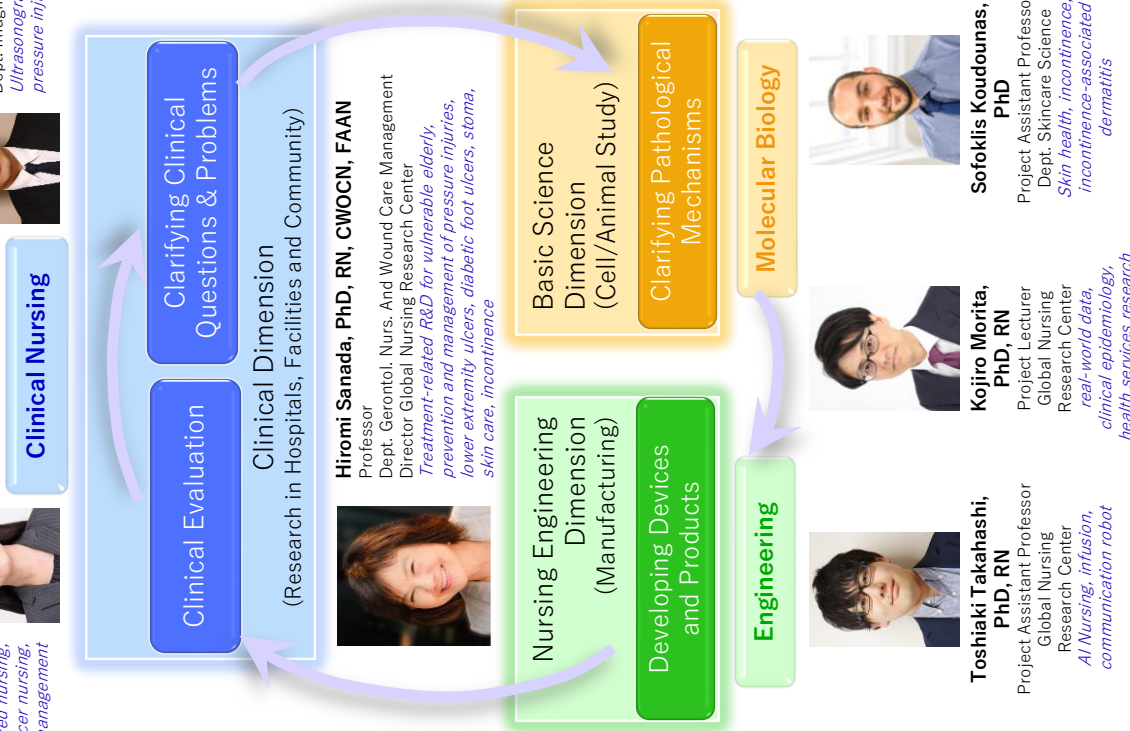**Yuka Miura, PhD, RN**
Project Assistant Professor
Dept. Imaging Nursing Science
Silent aspiration, aspiration
pneumonia, ultrasonography

Misako Nagata, PhD, RN, NP,
APHN-BC, CCRN
Project Assistant Professor
Dept. Imaging Nursing Science
Well-being, nature immersion, mixed
methods research

Ryoko Murayama,
PhD, RN, MW
Project Associate Professor
Dept. Advanced Nursing Technology
Nursing Technique, livelihood support,
pelvic floor disorder

Mari Abe, MHS, RN
Project Assistant Professor
Dept. Advanced Nursing Technology
Extravasation, Induration,
ultrasonography

Shiho Higashimura,
PhD, RN
Project Assistant Professor
Global Nursing
Research Center
Heat stroke, dehydration in
the elderly

Hiromi Tobe,
PhD, RN
Project Assistant Professor
Global Nursing
Research Center
Parenting, resilience,
emotion/stress management,
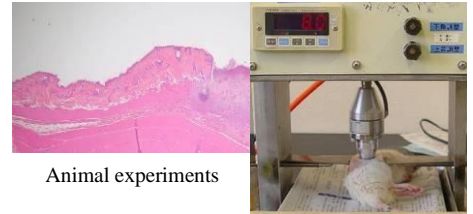*mindfulness*

3

Research activities in our departments

   We aim to develop new technologies and devices that maintain or improve the abilities of elderly people to meet their needs built on their independence and autonomy. We try to enrich the life of elderly people by helping to establish care programs and systems whereby they can lead independent lives with respect to their diversity in their values and lifestyle.
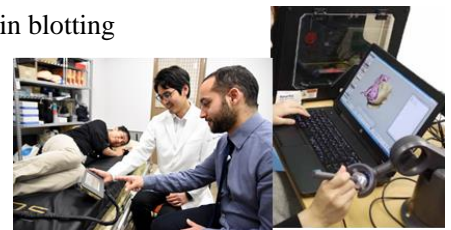
1.   Research themes

Basic science:

・Development of a new method to control wound infection by focusing on bacterial and host gene expression

Animal experiments

・Establishment of a new wound assessment method using wound exudate

・Development of non-invasive method to detect physiological state of skin: skin blotting

・Development of technologies for detecting biofilms on wounds

・Studies on wound healing mechanisms in animal models of diabetes mellitus
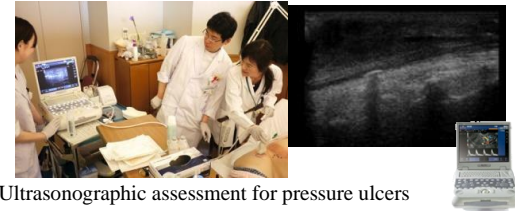
・Studies to elucidate mechanism of wound pain

Nursing engineering:

・Development of automatic control mattresses with interface pressure sensing system

・Development of non-invasive early detection techniques using ultrasonography and thermography

・Development of methods for early detection of complications with indwelling peripheral intravenous catheters using thermography

Engineering experiments

・Development of communication robot applications for the elderly

・Development of preventive pads for incontinence-associated dermatitis

・Application of text mining to nursing research

Field surveys:

・Development of a new method for pressure injury assessment

・Cross-sectional study of diabetic foot ulceration and its risk factors

Ultrasonographic assessment for pressure ulcers

・The effect of biofilm-based wound management on wound healing

・Cross-sectional study of drug-induced alopecia

・Cross-sectional study of lymphedema and its international comparison

・Evaluation of dressings for the prevention and treatment of pressure ulcers

・Development of assessment methods of constipation using ultrasonography

・Cross-sectional study of wheelchair basketball athletes' skin conditions

Thermographic examination for diabetic foot

・Investigation of the relationship between bed environment and infection of pressure ulcer by microbiome analysis

・Investigation of extravasation and its relating factors

・Outcome evaluation by the practice of graduates of Training System for Nurses Pertaining

2.   Our products

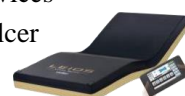・Pressure ulcer preventive/healing promoting devices

・Dressing to prevent/promote healing pressure ulcer

・Pressure sensing/monitoring mattress

・Pad for loose stool

・Biofilm detection tool

・Smartphone type ultrasound device

Wound-therapeutic Vibrator RelaWave®

Wound Preventive Skin Layer REMOIS® Pad

Pressure Sensing/Monitoring Mattress, LEIOS®

Pad for Loose Stool TakeCare® Loose Stool Absorbent Pad

Biofilm detection tool CC Steps Biofilm Detection Tool®

Smartphone Type Ultrasound Device iViz air®

3. Education

Graduate courses:

・Advanced gerontological nursing I, II (each 2 credits)
・Advanced wound care management I, II (each 2 credits)
・Gerontological nursing seminar I, II (each 4 credits)
・Gerontological nursing practical training I, II (each 4 credits)
・Wound care management seminar I, II (each 4 credits)
・Wound care management practical training I, II (each 4 credits)

Undergraduate courses:

・First-year seminar for natural sciences students

                                                    (2 credits)

・Clinical practice in health support (1 credit)
・Nosography (2 credits)
・Anatomy (1 credit)
・Gerontological nursing (2 credits)
・Clinical practice in life science (1 credit)
・Clinical practice in gerontological nursing (2 credits)
・Bioengineering nursing (2 credits)

Practice for undergraduate students

Students' seminar

4. Seminar

・Dissertation supervision
・Journal club
・Presentation rehearsal
・Report on academic conferences

・Clinical training: Pressure ulcer round, outpatient clinic for ostomates, outpatient clinic of foot care for diabetics

5. Members

Professor; Hiromi Sanada

Associate Professor; Gojiro Nakagami

Project Associate Professor; Ryoko Murayama, Takeo Minematsu,
                               Nao Tamai

Project Lecturer; Masaru Matsumoto, Kojiro Morita

Assistant Professor; Yuko Mugita, Aya Kitamura,

Project Assistant Professor; Mari Abe, Sofoklis Koudounas, Yuka Miura,
                Misako Nagata, Toshiaki Takahashi,
                Shiho Higashimura, Hiromi Tobe,
                Kenneth Scott Barton

Research Support Staff; Sanai Tomida

Cooperative Researcher; Mikihiko Karube, Mayumi Handa

Part-time lecturer; Junko Sugama, Masatoshi Abe, Atsuo Kawamoto, Etsuko Tadaka, Yuki Fukumura,
        Tomoko Akase, Makoto Oe, Kenji Omura, Yayoi Kamakura, Miyoko Kuwata

Visiting researcher; Yoshie Ichikawa, Tame Urai, Makoto Oe, Kazuhiro Ogai, Miho Oba, Toshihiro Ogura, Masushi
            Kohta, Taichi Goto, Kazuyuki Komichi, Hiroe Koyanagi, Misako Dai, Kimie Takehara, Hidenori
            Tanabe, Ayumi Naito, Mitsuo Neya, Daichi Araki, Hiroshi Noguchi, Shuhei Noyori, Mayumi
            Morisaki, Mikako Yoshida, Satoshi Yoshida

Administrator; Yukiko Watanabe, Akiko Katano, Yuko Miyashita

Students; seven PhDs, six masters

6. Recent articles

- Mori Y, Nakagami G, Kitamura A, Minematsu T, Kinoshita M, Suga H, Kurita M, Hayashi C, Kawasaki A, Sanada H. Effectiveness of biofilm-based wound care system on wound healing in chronic wounds. Wound Repair and Regeneration. 2019;27(5):540-547.

- Tsukatani T, Minematsu T, Dai M, Tamai N, Nakagami G, Sugama J, Takada C, Sanada H. Polymorphism analysis of candidate risk genes for pressure injuries in older Japanese patients: A cross-sectional study at a long-term care hospital. Wound Repair Regen. E-pub ahead of print. 2021. doi: 10.1111/wrr.12912.

- Kunimitsu M, Nakagami G, Kitamura A, Mugita Y, Akamata K, Sasaki S, Hayashi C, Mori Y, Sanada H. The combination of high bacterial count and positive biofilm formation is associated with the inflammation of pressure ulcers. Chronic Wound Care Management and Research. 2019;6:1-7.

- Noyori S, Nakagami G, Noguchi H, Mori T, Sanada H. Unintentional body movement parameters and pulse rate variability parameters are associated with the desire to void. Medical Engineering & Physics. 2019;68:116-121.

7. Recent Books

- *Nakagami G, Yokota S, Sanada H. Real-World Data-Based Care Innovation: Lessons Learned from Nursing Science. In: Matsushita H. (eds) Health Informatics. Translational Systems Sciences, vol 24. Springer, Singapore. 2021. https://doi.org/10.1007/978-981-15-3781-3_5*
This is the first book to approach healthcare informatics from the perspective of innovation. It introduces to the world the many innovations that Associate Professor Nakagami and his colleagues have achieved based on real-world data analysis.
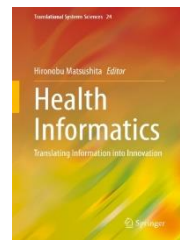
- *Sanada H, Mori T. Bioengineering Nursing: New Horizons of Nursing Research. New York: Nova Science Publishers Inc. 2014. ISBN-13: 978-1631173363*
The future development of nursing studies requires Bioengineering Nursing, because it enables us to recognize potential seeds in clinical settings on the basis of pathophysiology, perform evaluations using devices and engineering technology, and create tools while accurately reflecting clinical needs. This book is the first textbook of Bioengineering Nursing in the world.
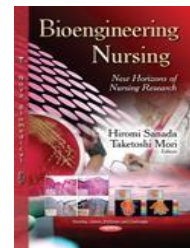
- *Oe M, Sanada H, Nagase T, Minematsu T, Ohashi Y, Kadono T, Ueki K, Kadowaki T. Chapter 4 Foot fissures in the patients with diabetes. In: Pavlovich D, Ivanovich S, eds. Fistulas and Fissures: Types, Symptoms, Causes, and Treatment. New York: Nova Science Publishers Inc. 2013;63-78.*
This textbook focuses on every kind of fistula and fissure, each pathophysiology, cause and treatment. Specialists in each field describe these topics respectively, and our Project Associate Professor Makoto Oe, introduces important factors that contribute to developing fissures in the diabetic foot.
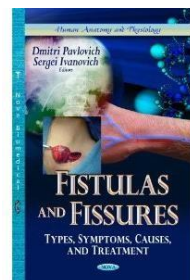
Department of Advanced Nursing Technology (Social Cooperation Program):
Nursing Technology to seek 'Never let patients endure suffering in health care'

Overviews

Technology in the field of medical diagnosis and treatment has made great strides in recent years, and nursing technology needs to evolve accordingly. Until now, nurses in hospitals and universities have frequently worked separately. The university setting, while contributing to the development of nursing through research has found it difficult to simulate the clinical setting. On the other hand, in the hospital environment, nurses have tended to progress professionally thorough their experience rather than through gaining scientific knowledge. Therefore, at the University of Tokyo, "Social Cooperation Program: Advanced Nursing Technology'' was established to aim at advancing nursing technology to promote team medical treatment and research involving clinical divisions, the nursing department, and the graduate nursing school.

Research Scheme

We will develop this new nursing scheme aimed at clinical needs (i.e., "Never let patients endure in health care.''), and we intend to introduce it globally. Through this program, nurses can study the subject of nursing scientifically, including research in epidemiology and molecule- and gene-related topics in cooperation with university professors. Furthermore, the technology and medical equipment developed by companies can now be evaluated in the hospital, offering new nursing technology suitable for needs at clinical sites.
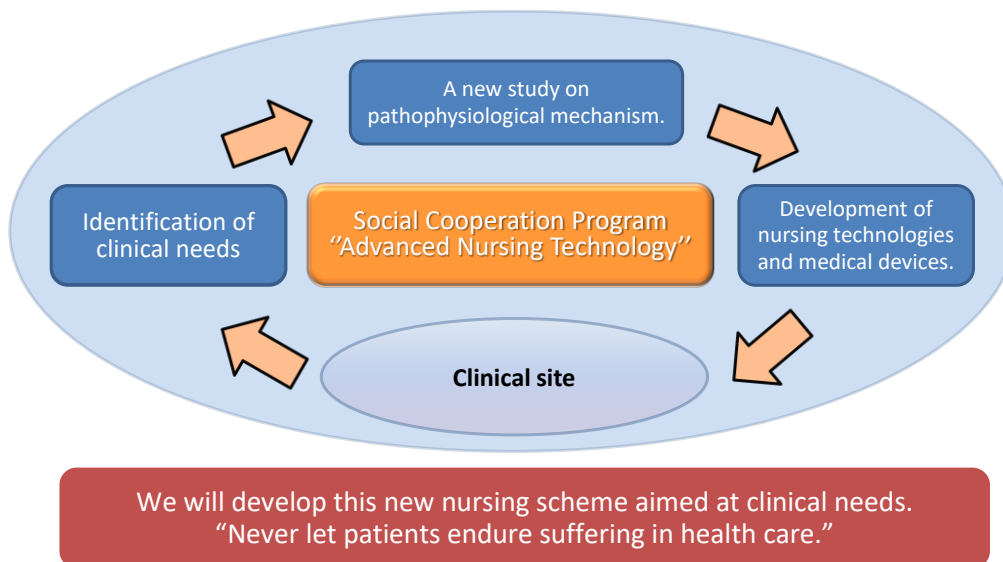
Project Associate Professor
Ryoko Murayama

Research Themes in 2021
・Evaluation of a new intravenous catheter for the prevention of extravasation
・Effectiveness of a catheterization program for the teaching skills of peripheral intravenous catheters, guided by ultrasonography
・Development of best practice for infusion therapy using PIVC

Department of Skincare Science (Social Cooperation Program): Technologies to protect vulnerable skin

Introduction

The skin is a unique organ which can be directly seen and touched, and in which sensory systems are distributed throughout. Therefore, any skin disorders can have profound effects on the physical and mental health of patients. The Department of Skincare Science was established in 2017 with the aim to develop novel technologies to protect vulnerable skin from the effects of aging, dermopathy, and systemic diseases. Currently, our department consists of one Project Associate Professor, Takeo Minematsu, and one Project Assistant Professor, Sofoklis Koudounas and receives financial support from Saraya Co., Ltd.

Research overview

We perform **biological nursing research**, which is the unified science of basic biology to understand the nature of a problem, and **practical nursing science** for the application of findings to the clinical field.

Skin blotting and **wound blotting** are our original techniques for skin and wound assessment. Conventionally, the physiological status of skin and wounds could only be examined through invasive biopsy. However, these techniques enable the non-invasive sampling of skin and wounds for further examination. Currently, we are working towards improvement of the accuracy of these techniques, as well as establishing their reliability and validity. In addition, our research is focused on establishing specific biomarkers to predict, identify, and examine abnormalities in the skin and wound tissues using the blotting techniques. With these goals in mind, our research is focused on **chronic dehydration** and **incontinence-associated dermatitis (IAD)** which are common complications in older adults.

Chronic dehydration was the first systemic condition in which skin blotting was applied. Despite its high prevalence among older populations, there are limited methods to effectively identify chronic dehydration in home-care settings. In our previous studies, using a modified blotting membrane, we found that taurine can be a promising biomarker for the early identification of chronic dehydration.

Project Associate Professor
Takeo Minematsu

Project Assistant Prof.
Sofoklis Koudounas

IAD is caused by prolonged exposure of skin to urine and feces and is recognized as a form of contact dermatitis. However, our research demonstrated that the pathogenesis of IAD is different. In particular, we showed that in fecal incontinence, overhydration of the skin by proteolytic enzymes leads to a reduced skin barrier function which facilitates the invasion of bacteria to the dermis leading to tissue damage. We are currently investigating the pathogenesis of IAD in urinary incontinent patients. These findings will allow us to develop new preventive care and treatment strategies.

We are also conducting research about **pressure injuries in wheelchair athletes**. In their pursuit of top performance, many wheelchair athletes push their bodies to the limit and their buttock are under constant pressure and therefore are at risk for pressure injuries. We are aiming to develop novel cushions to prevent pressure injuries in wheelchair athletes.

Major research themes for this fiscal year
► Identification of chronic dehydration by skin blotting
► Mechanisms of incontinence-associated dermatitis.
► Prediction and evaluation of pressure ulcers by blotting techniques.
► Development of novel cushion to prevent pressure injuries in wheelchair athletes.
► Identification of itching by skin blotting.

Department of Imaging Nursing Science (Social Cooperation Program): Visualization devices for physical assessments
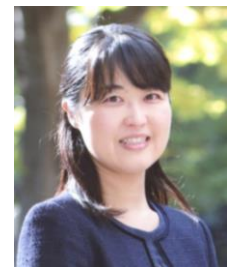
Overviews

Our vision is to realize a 'safe, secure, and comfortable nursing care' through visualized nursing technology. Currently, Japan is categorized as a "super-aged society", with an increasing number of older adults who are immobile, have dementia, or cannot voice their needs. In an effort to reduce the length of hospitalization of older adults, the Japanese government has put into place initiatives to promote in-home care for the elderly provided primarily by their families and local communities. Therefore, the need for research into new objective methods to assess symptoms in home care settings, including imaging technologies, has become more urgent. The introduction of telemedicine and advanced technologies for delivering nursing care in the homecare setting has become a priority to develop and implement these technologies in a reasonable timeframe. The Department of Imaging Nursing Science has conducted several projects, including the utilization of imaging technologies, the proposal of new nursing technologies, and the evaluation of new imaging technologies.

Research Scheme

Our department develops, evaluates, and promotes new nursing care, skills, and systems based on visualized nursing technologies for contributing to individual well-being. Especially, we focus on ultrasound devices as physical assessment tools. In addition, we educate nurse scientists who can provide nursing care using new imaging technologies.

Research Themes in 2021

➢ Evaluation of voiding dysfunction or defecation disorder, and the development of an assessment system
➢ Development of a system for determining the occurrence of aspiration using virtual reality, as well as an educational program for training nurses on the technique

Project Associate Professor
Nao Tamai

Project Lecturer
Masaru Matsumoto

Division of Care Innovation, Global Nursing Research Center:

Promoting multi-disciplinary and innovative nursing research

Overview of the Global Nursing Research Center

Against this backdrop of the population issues that Japan is facing, there are many voices calling for a transformation from a treatment that "cures" to treatment that "supports," as well as a change in nursing research. Specifically, we require the development of a multi-disciplinary research and educational environment that aims to foster young nursing care specialists who can lead innovations in medical care.

Global Nursing Research Center will start both the Division of Care Innovation and the Division of Nursing System to promote a cutting-edge, multi-disciplinary research model led by both full-time and visiting instructors. Moreover, we will design and develop educational courses to foster young researchers.
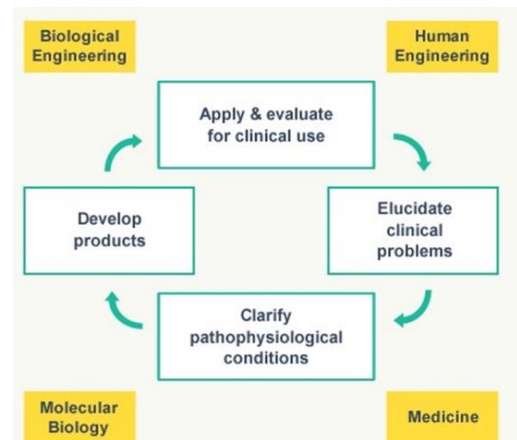
Model for care innovation

Overview of the Division of Care Innovation

In collaboration with scientists, engineers, and partners in the private sector, this division seeks to develop and disseminate medical care products that address some of the daily inconveniences experienced by individuals with health issues. The Division of Care Innovation is comprised of the following five fields:

Robotics Nursing: Professor Hiromi Sanada and Associate Professor Gojiro Nakagami

We develop and evaluate devices and programs with the aim of applying ICT technologies such as augmented reality (AR) and communication robots to the nursing field.

AI Smart Nursing: Professor Hiromi Sanada and Associate Professor Gojiro Nakagami

We focus on the development of AI-based smart nursing technology that uses artificial intelligence to detect and predict anomaly based on a variety of sensor data and recommend appropriate care.

Clinical Nursing Technology: Professor Hiromi Sanada and Project Associate Professor Ryoko Murayama

Through various collaborative efforts with specialists from diverse backgrounds, we will work to resolve issue in clinical nursing care at hospitals and other clinical settings.

Biological Nursing: Professor Hiromi Sanada, Associate Professor Gojiro Nakagami, and Project Associate Professor Takeo Minematsu

We will develop the field of Biological Nursing, which is a unified science combining the power of basic biology to understand the nature of a problem with practical nursing science to apply results to the clinical field.

Visualized Nursing: Professor Hiromi Sanada, Associate Professor Gojiro Nakagami, and Project Associate Professor Nao Tamai

To realize a safe and comfortable recovery, we will focus on the practice of nursing care and propose new technologies and care applications that leverage advanced imaging technologies.

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