

HEALTHY LONGEVITY GLOBAL COMPETITION

2025 Catalyst Awardees

Sponsor: Agency for Medical Research and Development of Japan

Co-creating socially-inclusive eyecare model to overcome world preventable blindness and visual impairment

Principal Investigator	NAKAYAMA Shintaro, BA
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Co-Investigator(s)	SHIMIZU Eisuke, MD, PhD

PROJECT DESCRIPTION

Blindness and visual impairment greatly reduce people's quality of life and cause significant economic losses as well as medical losses. In the Universal Health Coverage (UHC) in Goal 3 of the SDGs set by the United Nations, WHO has positioned the prevention of blindness as one of the core issues to be addressed in achieving UHC.

Currently, there are 43 million people blind and 2.2 billion visually impaired, half of whom are blind or visually impaired due to preventable diseases. The majority of them are living in the marginalized areas where access to eyecare is difficult.

This is not only the case in developing countries where the absolute number of ophthalmologists is small, but also in the countries like Japan, where access to eye care remains not easy in remote islands and rural areas, and even in urban areas, there are many bedridden elderly patients with ophthalmologic diseases who have not been accessible to ophthalmologists. Poor visual function not only greatly reduces the quality of life of the elderly, but can also be a factor in the progression of dementia.

Our invention, Smart Eye Camera (SEC) can make a difference to the situation.

Through SEC, ophthalmic images taken with a smartphone can be shared with remote locations via an installed app, enabling remote medical care that connects ophthalmologists with underpopulated areas. Together with artificial intelligence of eye diseases developable through continuous usage of SEC, we will create innovative and socially-inclusive eyecare models to overcome preventable world blindness and visual impairment.

Development of a new device to facilitate the expansion of stroke rehabilitation opportunities in low and middle income countries using robotic technology

Principal Investigator	ARATA Jumpei, PhD
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Co-Investigator(s)	MUKAE Nobutaka, MD PhD; MASUDA Mai, M.S.CP; TANABE Tetsuro, BEc; BANDARA D.S.V., PhD; OSAWA Keisuke, PhD; WEIHENG Xue, M. Eng.

PROJECT DESCRIPTION

Currently, 80% of the medical device market is held by developed countries, which account for only 20% of the world's population. The basic idea of this research is to solve or mitigate this global issue by introducing state-of-the-art robot technology.

Stroke is known to have a significant impact on daily life in the prognosis, and the provision of such a device is expected to be highly effective in terms of maintaining motor function for the health and well-being of the elderly in their daily lives on a global level.

From a field survey in Thailand, the applicants found that stroke patients have limited rehabilitation opportunities, resulting in high spasticity in their hands and fingers, which significantly hinders their daily activities and causes disuse syndrome. To solve this problem, we are developing a device that can improve and prevent spasticity using robot technology, while being simple and inexpensive to construct.

In stroke rehabilitation, the quality and quantity of training is a major factor in successful stroke rehabilitation. Robotic technology enables the detection of movement by sensors and the prescription of movement by motors, thus high-quality training can be carried out without the intensive intervention of a specialist. This is expected to dramatically increase the amount and quality of training.

The applicants have accumulated experience in technology development through the R&D of the hand rehabilitation robot SMOVE (certified in Japan in April 2025, <https://youtu.be/mDxVarWe3ZY>). This study aims to extend the opportunity of healthcare in LMICs, closing the gap between different economic zones.

Development of a Next-Generation Nasal Therapeutic Vaccine HBNET-369 for the Curative Therapeutic Treatment of Hepatitis B

Principal Investigator	HIASA Yoichi, MD, PhD
PI Primary Affiliation	Ehime University
Co-Investigator(s)	KOHARA Michinori, PhD KOHARA Kyoko, PhD ODA Yasunori, PhD Yoshida Osamu, MD, PhD NAGAI Masahiro, MD, PhD

PROJECT DESCRIPTION

Approximately 250 million people worldwide are infected with HBV, and high cancer rates pose significant threats to healthy longevity. For the treatment of hepatitis B, achieving “functional cure,” defined as the absence of HBs antigen and undetectable HBV-DNA, is a critical goal. However, this is challenging with standard nucleoside analog therapy.

We have developed a therapeutic vaccine capable of achieving functional cure. Using a nasal administrative vaccine formulation that contains HBs antigen, HBc antigen, and a viscosity-increasing, carboxyl vinyl polymer (CVP), we conducted Phase IIa clinical trial for patients with hepatitis B. The results confirmed safety and demonstrated to achieve functional cure in 13.8% of cases.

As a next idea, instead of using the “HBs-S antigen”, we considered using the “HBs-L antigen”. The HBs-L antigen induces antibodies against the pre-S1 region and has higher antiviral efficacy than the HBs-S antigen. However, the HBs-L antigen has genotype-specific amino acid sequences, making it difficult to achieve pan-genotype efficacy. Therefore, we designed a hybrid antigen (HBs-Lh antigen) in which the HBs-L antigens of genotypes C and D are expressed in the same membrane. When the HBs-Lh antigen was administered to mice, it neutralizes HBV infection in all genotypes A, B, C, and D. Additionally, it strongly induced HBV-specific cytotoxic T cells (CTLs) compared to HBs-S antigen.

We have developed an innovative intranasal therapeutic vaccine formulation, HBNET-369, which contains HBs-Lh antigen, HBc antigen, and CVP. HBNET-369 is expected to lead to functional cure, and contribute to extending global healthy life expectancy.

New application for patients and physicians to treat migraine

Principal Investigator	KAWATA Yumi, MD, PhD
PI Primary Affiliation	Hedgehog MedTech, Inc.
Co-Investigator(s)	HASHIZUME Masahiro , MD, PhD TAKESHIMA Takao, MD, PhD

PROJECT DESCRIPTION

We are creating a migraine treatment app designed for people who suffer from migraines, along with a support tool for doctors. Migraine affects about one billion people worldwide and can seriously disrupt daily life, work, and emotional well-being—especially among people in their 30s and 40s. Many manage their symptoms only with painkillers, without addressing the underlying causes.

Our app offers cognitive behavioral therapy (CBT), a proven method that helps people change how they respond to pain. It supports better long-term management without relying too heavily on medication. What makes our approach unique is that the app can be used alongside a special tool for doctors, so patients and physicians can work together to find the best mix of medication and behavioral therapy.

By helping people reduce how often and how severely they experience migraines, the app supports better health over the long term. It also helps prevent problems linked to taking too much medication, such as rebound headaches. For older adults who still struggle with migraines, the app may also improve quality of life, reduce feelings of isolation, and support mental well-being.

The app is already developed and early trials showed a reduction of about 4 headache days per month. We plan to improve the design based on user feedback and start a clinical trial soon. The doctor tool will also be refined with input from healthcare professionals to ensure it's useful and easy to use.

Novel Molecular Targeted Nucleic Acid Therapy for Liver Fibrosis

Principal Investigator	KANEYAMA Shuri, PhD
PI Primary Affiliation	Showa Medical University
Co-Investigator(s)	SEIO Koji, PhD

PROJECT DESCRIPTION

This project will aim to develop an innovative antisense nucleic acid therapy targeting a novel intracellular adaptor molecule that regulates extracellular matrix (ECM) dynamics and tissue stiffness in the liver. This adaptor molecule is important for controlling hepatic stellate cell activation and abnormal ECM deposition. This adaptor has historically been considered “undruggable” by conventional small molecules or antibodies because of its structural and functional properties. By leveraging nucleic acid medicine, we can selectively and efficiently suppress the expression of this molecule, enabling direct therapeutic intervention for the first time.

Liver fibrosis, characterized by excessive ECM accumulation from chronic inflammation or injury, often progresses to cirrhosis, liver failure, or cancer, and currently lacks therapies that directly reverse fibrosis. Our approach will not only inhibit the progression of fibrosis but also promote the resolution of established fibrotic tissue by deactivating activated hepatic stellate cells, aiming for true reversal of liver fibrosis.

Importantly, this adaptor molecule is also involved in fibrotic processes in other organs and in the regulation of the tumor stroma in solid cancers. Therefore, while our initial focus will be on liver fibrosis, the therapeutic

platform that will be established through this research is promising for broader applications, such as the treatment of fibrosis in other organs and modulation of the tumor microenvironment in solid tumors. Ultimately, this project seeks to pioneer a new paradigm in molecular targeted therapy for fibrosis and cancer, contributing to healthy longevity and improved quality of life.

Pioneering anti-brain aging strategies based on novel regulatory system for neural activity

Principal Investigator	KUWAKO Ken-ichiro ,PhD.
PI Primary Affiliation	Shimane University
Co-Investigator(s)	None

PROJECT DESCRIPTION

Elucidating the mechanisms for the decline of brain function with physiological aging and finding strategies to deter this decline will be major steps toward establishing preventive medicine that extends the healthy life span of the brain. However, the molecular mechanisms underlying the age-related decline in neurological function remain largely unknown.

We recently discovered that the nuclear envelope LINC complex, which is involved in cytoskeletal regulation, plays a pivotal role in regulating neural activity levels via the axon initial segment (AIS), a structure essential for the initiation of action potentials. Furthermore, we found that “LINC complex-mediated AIS regulation” is disrupted with aging in mice, leading to abnormal neural excitability and a consequent decline in brain function. In this study, we aim to elucidate the molecular mechanisms of “LINC complex-mediated AIS regulation” and its age-related disruption, thereby uncovering the core biological processes driving brain aging. We will also investigate whether preventing this disruption in aged mouse brains can mitigate the associated functional decline. Additionally, based on these insights, we will develop protein-engineered molecular tools with enhanced anti-aging effects and assess their efficacy in human-derived neurons.

This research is highly innovative in that it pioneers anti-aging interventions grounded in a well-defined molecular mechanism implicated in brain aging. The establishment of preventive medicine that enables older individuals to maintain “younger brain” will be of great value in shaping future societies by increasing the number of people who remain cognitively active in ever-changing new social systems.

Platform Technologies for Antibacterial Capsid Development Toward Therapeutics Against Bacterial Infections

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PROJECT DESCRIPTION

This project aims to develop an innovative platform technology by engineering bacteriophage capsids to carry diverse genetic cassettes, enabling novel applications in antibacterial therapy, pathogen detection, and vaccine development. Our approach introduces precision antimicrobial modalities—such as CRISPR-Cas-guided bacterial targeting, surface-display-based specificity, and temperature-sensitive nanoparticle integration—that

effectively address intractable pathogens including drug-resistant bacteria, intracellular pathogens, and biofilm-forming species.

Research and development of a machine learning model and a self-check application for simple detection of subtle cognitive decline in MCI

Principal Investigator	KINOSHITA Setsuo, MSc
PI Primary Affiliation	Nippontect Systems co.,Ltd
Co-Investigator(s)	SHIGETA Masahiro, MD.PhD

PROJECT DESCRIPTION

Dementia is a significant challenge in Japan's aging society. Early detection of its precursor, mild cognitive impairment (MCI), is crucial as timely intervention can delay its progression. However, conventional assessment tools are often impractical for daily use due to their length and the need for skilled administrators.

The objective of this project is to develop an AI-powered healthcare application that enables self-monitoring of cognitive decline associated with MCI. The application, designed for use with smartphones, features a fully automated check-up in just 3–5 minutes, with users simply responding to voice prompts. This revolutionary approach eliminates the need for a tester and complex operations, overcoming the shortcomings of conventional tools. We aim for high accuracy, with both sensitivity and specificity exceeding 0.8, enabling early MCI detection in daily life. The app also generates new content for each test, making it suitable for continuous monitoring.

The app encourages timely lifestyle improvements and medical consultations by fostering early awareness of cognitive decline. This facilitates the early use of new Alzheimer's drugs, contributing to the prevention of dementia and the extension of a healthy lifespan. By helping the elderly maintain their independence, it also reduces the burden on families and carers.

This project will also expand the applications of AI in dementia prevention, potentially creating a new digital health market. Ultimately, the application can serve as a health support tool for entire communities, contributing to the development of a sustainable aging society.

Social implementation of dementia prevention interventions utilizing existing resources

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PROJECT DESCRIPTION

The J-MINT PRIME Tamba study (Japan-Multimodal Intervention Trial for the Prevention of Dementia PRIME Tamba) demonstrated the effectiveness of an 18-month multidomain lifestyle interventions which include exercise, cognitive training, healthy balanced diet, and lifestyle disease management for older adults with atherosclerosis risk factors.

Based on this evidence, the current proposal aims to implement dementia prevention strategies that are more socially sustainable and scalable. Previous interventions were executed in ideal conditions and frequently required substantial resources. It is not practical to expand such approaches to broader populations using the same model. Our proposed strategies leverage existing community infrastructure and health checkup systems to address this problem.

This proposal introduces two intervention methods. Firstly, we collaborate with “Iki-Iki Hyakusai Taiso” groups, community-based exercise programs for older adults. These groups conduct 30-minute stretching and strength training sessions using a DVD. We have developed “Nou-Pika Exercise,” which adds aerobic and dual-task components to the original program. Trained older adults from the same region monitor the intervention to promote community ownership and sustainability. Secondly, our focus is on the health checkup program for individuals aged 40 to 74. Those with risk factors such as hypertension or impaired glucose tolerance are encouraged to join a 90-minute weekly exercise class. The J-MINT PRIME Tamba model is the basis for this intervention's structure except that it adopts a hybrid format combining in-person and remote sessions. Effectiveness will be evaluated using web-based cognitive tests that older adults can self-administer and by analyzing medical and long-term care insurance claims data.