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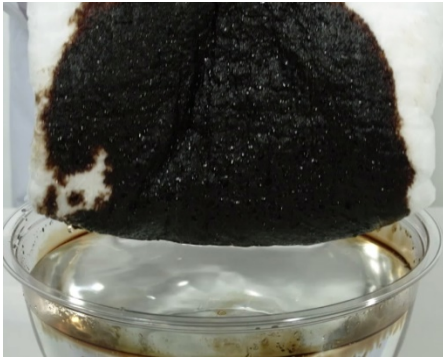
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OVERVIEW Department of Nano-Bioscience was established in April 2020 as a joint research course with the aim of maintaining and promoting the health of the people and contributing to the public interest of society as a whole.



In recent years, technology to regenerate organs lost due to aging, trauma, disease, etc. has advanced rapidly. As a leading player in next-generation regenerative medicine, we are paying attention to MAGIC FIBER developed by

MTEchX Co., Ltd. and ASPiA Co., Ltd. ([former Sasahara Co., Ltd.](#)). MAGIC FIBER



is a cotton-like material composed of extremely thin fibers several nanometers in diameter, but it has excellent characteristics of adsorbing oil but not absorbing water. Magic fiber was greatly utilized for oil treatment work in the oil spill accident caused by the heavy rains in northern Kyushu in August 2019, and the oil spill caused by the cargo ship stranding accident in mauritius islands in August 2020.

MAGIC FIBER that adsorbs oil

In addition, with national medical expenses exceeding 40 trillion yen, the importance of preventive medicine is becoming increasingly important with the goal of extending healthy life expectancy. As a new bearer of preventive medicine, we are conducting research with the support of ASPiA Co., Ltd., with the expectation of the function of oxygen nanobubbles and Ag⁺ water. Aging is a risk factor for motor diseases such as osteoporosis/ sarcopenia / osteoarthritis, lifestyle-related diseases, circulatory disorders, carcinogenesis, etc. In recent years, it has been clarified that aging changes in living organisms are not just physical degradation, but physiological activities actively controlled by molecular signals. This fact suggests that it is possible to prevent age-related changes by intentionally manipulating molecules. With the goal of elucidating the mechanisms of aging, disease onset, and metabolic disorders, we have focused on aging regulator, such as sirtuin genes and PAI-1, intestinal flora, HIF (Hypoxia Indible Factor), and so on. Professor GregG L. Semenza of Johns Hopkins University, Sir Peter J. Ratcliffe of The University of Oxford, and Professor William G. Kaelin of Harvard University discovered and found the transcription factor HIF-1, which reacts to and activates the hypoxic environment of cells. The 2019 Nobel Prize in Physiology or Medicine is fresh in our memory. HIF-1 controls degenerative ageing-related changes in tissues, including osteoporosis, but it has become clear that oxygen nanobubble water prevents abnormal activation of HIF-1.

RESEARCH CONTENTS

- ① Regenerative medicine using improved MAGIC FIBER as a scaffold

Magic fiber has a lot of flexibility in materials, teral structures, fiber thickness, etc. We will develop improved magic fibers optimized as scaffold for cells and growth factors, and promote regenerative medicine.

② Verification of the effect of oxygen nanobubble administration on hypoxemia

In collaboration with Gifu University, we have clarified that drinking oxygen nanobubble water prevents hypoxemia due to respiratory suppression under general anesthesia using beagle dogs. This result suggests that oxygen nanocapsules water may improve performance in hypoxic environments. As HIF-1 activation has been reported to be the cause of various degenerative changes and cancer malignancy, we will verify the therapeutic/preventive effects of oxygen nanobubble water administration.

③ Verification of antiviral effects of silver ionized water/ effects on infectious diseases

We will verify the antiviral effect, its persistence, concentration dependence, etc. of Ag⁺ water, which has been widely known for its antibacterial effects, and develop it for the purpose of combating the COVID-19 virus.

④ Elucidation of the mechanism of aging

In recent years, NMN (nicotinamide mononucleotide) has attracted attention as a health food because it activates the longevity gene sirtuin and is expected to rejuvenate. For many years, we focused on SIRT6, one of the sirtuin genes, and studied the aging mechanism of bone cartilage tissue, and found that aging of SIRT6 can cause osteoporosis and osteoarthritis of the knee. PAI-1 (Plasminogen Activator Indicator-1) is a marker of cellular aging and causes cellular aging on its own, but we are studying the function of PAI-1 in the metabolism of skeletal tissues. We found that PAI-1 inhibition prevents postmenopausal osteoporosis and age-related muscle weakness.

⑤ Elucidation of aging regulation mechanism by intestinal bacteria

There are a huge number of gut bacteria living in the intestines, numbering over 10-trillion. In recent years, the function of intestinal bacteria has attracted attention, and it has become clear that various networks are composed between intestinal bacteria and organs. We are focusing on the control mechanism of skeletal tissue by intestinal bacteria and are conducting research. Proanthocyanidin, one of the polyphenols, is attracting attention for its antioxidant properties, but its molecular weight is large and rarely absorbed from the digestive tract. In collaboration with Tohoku University, we found that oral intake of proanthocyanidins alters the intestinal flora and prevents bone loss and obesity in mouse ovariectomy models.

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