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Okayama University research: Therapeutic potential of stem cells for treating neurodegenerative disease

(Okayama, 16 February) **Researchers at Okayama University report in *Scientific Reports* that a particular type of stem cell has therapeutic benefits for patients with amyotrophic lateral sclerosis (ALS), a fatal neurodegenerative disease that affects bodily motion and for which there is no cure yet.**

Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease resulting in the gradual loss of motor nerve cells (neurons) that control certain muscles, ultimately leading to fatal paralysis. As there is no cure for the disease, therapeutic strategies are highly needed. Now, Professor ABE Koji and Associate professor YAMASHITA Toru from Okayama University and colleagues have investigated the potential of a particular kind of stem cells ('Muse cells'), which can recognize damaged sites in the human body, for treating ALS. Experiments in mice reveal promising potential therapeutic benefits for ALS patients.

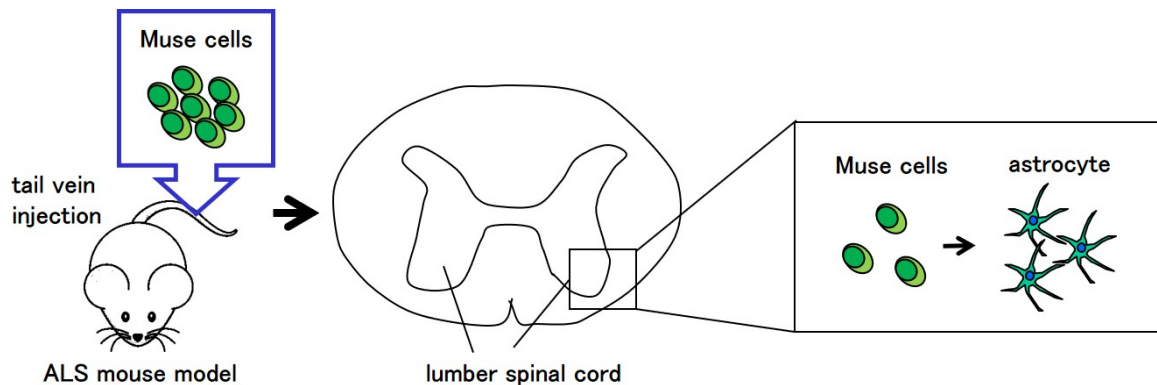
Muse cells are a kind of stem cell occurring in the bone marrow, blood and connective tissues in the human body. They can identify damaged tissue, and when injected, they can locate a damaged site — this is possible because Muse cells produce molecules that recognize substances created in damaged or apoptotic (dying) cells. Muse cells can not only locate the damage but also contribute to tissue repair, by transforming (differentiating) into healthy replacement cells. Inspired by this property, Abe and colleagues studied whether there is therapeutic potential in releasing Muse cells in ALS patients.

First, the researchers determined the best route for administering Muse cells. They compared the results for intravenous (into veins) and intrathecal (into the spinal canal) injections in mice. Intravenous injection gave the best results, with Muse cells appearing in different relevant body areas.

The scientists subsequently looked at the effect of intravenous administration of Muse cells into ALS mice. They established that the cells migrated to the spinal cord (a key part of the central nervous system). The Muse cells did not differentiate into neurons, but mainly into so-called astroglial cells. There are beneficial aspects associated with the latter, including stimulating the growth of nervous tissue and modulating inflammatory responses. The researchers' findings also suggested that the injection of Muse cells prevented the shrinking of muscle cells (amyotrophy) in ALS mice.

The study of Abe and colleagues represents a valuable result in the context of establishing a potential strategy for treating ALS. In the words of the scientists: "[Our] study successfully

achieved ... the systematic administration of Muse cells that showed a significant clinical benefit for the ALS mice model” and “Muse cells can be a promising cell resource for the treatment of ALS patients.”



Caption

Muse cells administered by tail vein injection reached the lumbar spinal cord and differentiated mainly into astrocytes.

Background

Amyotrophic lateral sclerosis: Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease affecting the part of the nervous system that governs bodily motion. It is characterized by a progressive loss of nerve cells controlling voluntary muscles. Symptoms at the early stage of ALS include stiff muscles, weakness in a limb and slurred speech. Due to the continued loss of motor neurons, control of the muscles needed for moving, speaking, eating and breathing is eventually lost, leading to paralysis and respiratory failure. There is no cure for this fatal disease. Existing treatments are aimed at improving the symptoms. Now, Professor ABE Koji and Associate professor YAMASHITA Toru from Okayama University and colleagues have started to investigate the therapeutic potential of Muse cells, which can recognize and cure damaged sites in the human body, for treating ALS. Experiments in mice have shown promising results.

Multi-lineage differentiating stress enduring cells: Multi-lineage differentiating stress enduring cells ('Muse cells') are a kind of pluripotent stem cell — that is, a cell that can differentiate into several 'standard' cell types encountered in the human body. They occur in the connective tissues of organs, bone marrow and blood. Muse cells were discovered in 2010 by the research group of Dr. Mari Dezawa. Muse cells can repair tissue in vivo, a property that has been investigated in mouse models with pathologies including muscle degeneration, stroke and spinal cord injury. Now, Abe and colleagues have performed a study addressing the potential of Muse cells for identifying and repairing damaged neurons in the context of ALS.

Reference

Toru Yamashita, Yoshihiro Kushida, Shohei Wakao, Koh Tadokoro, Emi Nomura, Yoshio Omote, Mami Takemoto, Nozomi Hishikawa, Yasuyuki Ohta, Mari Dezawa and Koji Abe. Therapeutic benefit of Muse cells in a mouse model of amyotrophic lateral sclerosis, *Scientific Reports* 10, 17102 (2020).

DOI : 10.1038/s41598-020-74216-4

<https://www.nature.com/articles/s41598-020-74216-4>

Reference (Okayama Univ. e-Bulletin): Professor ABE’s team

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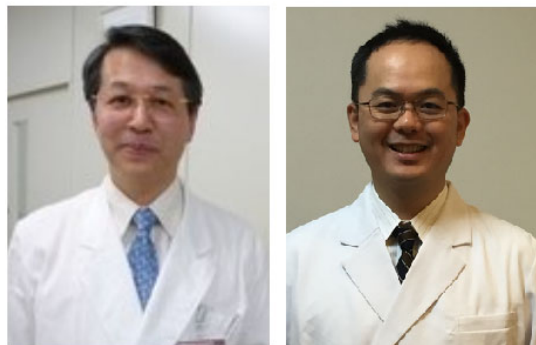
Correspondence to

Professor ABE Koji, M.D., Ph.D.

Department of Neurology, Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama University, 2-5-1 Shikata-cho, Kita-ku, Okayama 700-8558, Japan

E-mail: abekabek@cc.okayama-u.ac.jp

<http://www.okayama-u.ac.jp/user/med/shinkeinaika/english.html>



Professor
ABE Koji

Associate professor
YAMASHITA Toru

Further information

Okayama University

1-1-1 Tsushima-naka , Kita-ku , Okayama 700-8530, Japan

Public Relations Division

E-mail: www-adm@adm.okayama-u.ac.jp

Website: http://www.okayama-u.ac.jp/index_e.html

Okayama Univ. e-Bulletin: <http://www.okayama-u.ac.jp/user/kouhou/ebulletin/>

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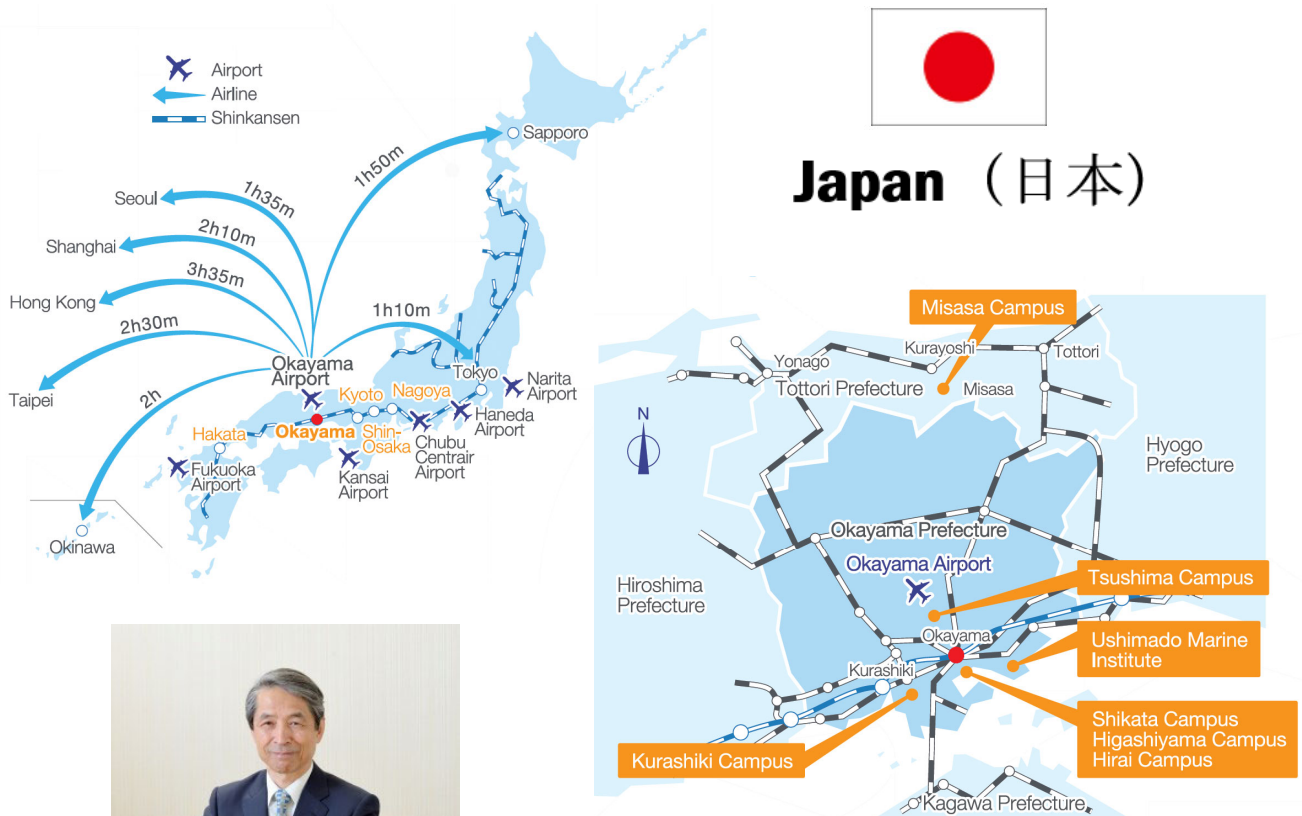
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Okayama University is located in the heart of Japan approximately 3 hours west of Tokyo by Shinkansen.

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Hirofumi Makino, M.D., Ph.D.
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