Seaweed and fireflies brew may guide stem cell treatment for peripheral artery disease

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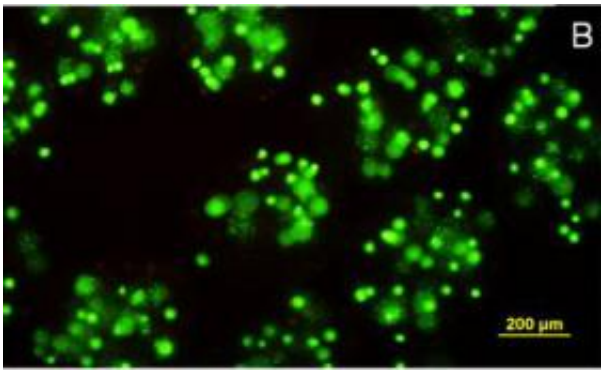

A microscopic view of stem cells inside X-ray visible bubbles, which protect the cells from rejection by the immune system.

An unlikely brew of seaweed and glow-in-the-dark biochemical agents may hold the key to the safe use of transplanted stem cells to treat patients with severe peripheral arterial disease (PAD), according to a team of veterinarians, basic scientists and interventional radiologists at Johns Hopkins.

In a preliminary "proof of concept" study in rabbits, Johns Hopkins scientists safely and successfully delivered therapeutic stem cells via intramuscular injections and then monitored the stem cells' viability once they reached their targets.

A report of the study by Johns Hopkins radiologists is scheduled for

presentation at the Society of Interventional Radiology's 34th annual scientific meeting March 10.

Stem cells hold promise in treating PAD by reconstituting or increasing the number of blood vessels to replace or augment those choked off by plaque buildup. A chronic condition that can lead to amputations and even death, PAD is marked by vastly reduced circulation of blood in vessels feeding the legs and other "peripheral" body parts, and affects as many as 10 million Americans. Many cases can be treated with angioplasty or stents, similar to approaches used in coronary artery disease, but for some patients with extensive disease conventional treatment is not feasible, researchers say.

Among the technical hurdles to improving blood flow in such patients, according to Dara L. Kraitchman, V.M.D., Ph.D., associate professor of radiology at Johns Hopkins, is a means of telling doctors whether injected stem cells are staying alive and reaching the right targets to grow and develop into the needed new tissue.

This is critical, Kraitchman says, because the body's own immune defenses may recognize the potentially helpful donor stem cells as foreign invaders and try to destroy them, and also because traditional radioactive labeling agents, or tracers, which are normally used to track cells, can be toxic to stem cells.

To overcome rejection of the stem cells by the body's immune system — in this case, rabbit immune systems — they first created a novel "capsule" derived from seaweed, which was used to surround and protect the rabbit stem cells from attack by the host's immune system. Within the seaweed capsule, they added X-ray contrast agents to allow the capsules to be seen on X-ray angiography. Next, they engineered the stem cells within the capsules to produce luciferase, the same bioluminescent chemical produced by fireflies, which is highly visible

under bioluminescence imaging.

"Once we were able to trick the immune system into not attacking the cells, we had to know they arrived at their destination and were living," says Kraitchman. "We could use standard X-ray angiography of blood vessels to see the transplanted cells. When they lit up like fireflies at night, we knew they were still alive."

"Hopefully, this new technology will one day pave the way for treating humans," says Frank Wacker, M.D., director of vascular interventional radiology at Hopkins and visiting professor of radiology. "We look to the day when we will be able to perform targeted delivery of stem cell to treat PAD in patients who may be facing amputation or death."

Source: Johns Hopkins Medical Institutions