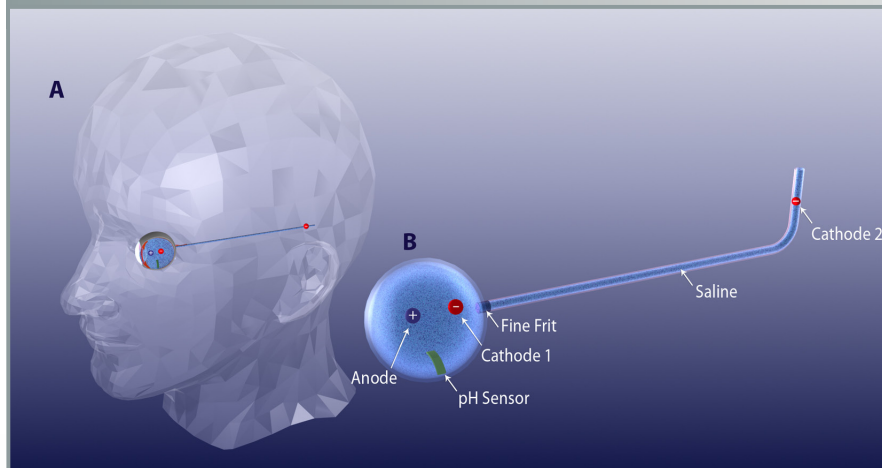


Metabolic Prosthesis for Treating Ischemic Diseases

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Technology Summary

ORNL researchers have developed a new approach for treating ischemic diseases that will deliver oxygen directly to affected tissues by electrolysis of body fluids. Numerous treatments currently exist or have been proposed for treating ischemic tissues, but most are invasive, involve chemicals, and/or have undesirable side effects. The ORNL metabolic prosthesis addresses most of these concerns.

While experiments with the metabolic prosthesis have been directed toward treating diabetic retinopathy and similar retinal problems, the device can be used to supply oxygen to ischemic tissues in other parts of the body, for example transplanted organs and tissues, or in the treatment of peripheral artery disease. However, the ORNL metabolic prosthesis is especially suited for the eye, which is sensitive to chemicals and invasive treatments. Whereas most treatments for ischemia of the eye address ameliorating damage after it has occurred, the metabolic prosthesis is designed to delay or completely suppress the onset of diabetic retinopathy by supplying oxygen directly to the retina and surrounding tissue before debilitating symptoms appear.

The metabolic prosthesis consists of an electrochemical system for production of oxygen by electrolysis of tissue fluids combined with state-of-the-art sensors to monitor fluid properties such as pH and oxygen content. The device is designed to be implanted and operated in fluid-containing biological tissue in or adjacent to ischemic tissue. Power will be supplied either directly or wirelessly, depending on the location of the ischemic tissue, from typical pacemaker-type power sources. Chlorine production and pH control can be achieved through a patented pulsed electrochemical technique.

Advantages

- Safer than introduction of chemicals, including steroids, into biological tissues
- Substitutes one treatment for numerous invasive treatments
- Less complicated than many of the current procedures (e.g., laser treatments and/or vitrectomy in diabetic retinopathy)
- Safer than hyperbaric oxygen treatment regimes
- Reduces the potential for damage following reperfusion
- Minimizes side effects compared to other treatment procedures

Potential Applications

- Treatment/prevention of diabetic retinopathy
- Prevention of retinal blindness resulting from other vascular diseases
- Treatment of peripheral artery and other ischemic diseases
- Oxygenation of transplanted tissues and organs

Patents

Elias Greenbaum, Mark S. Humayun, and Yu-Chong Tai. *Method and Apparatus for Treating Ischemic Diseases*, International Patent WO 2008/091559 A1, published on 31 July 2008.

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