

not trigger an inflammatory reaction in the eye, it can be left in place after transplantation to serve as a basement membrane patch.

The attachment of RPE (see Figure 2), IPE, and/or stem cells onto the bucky paper may be enhanced by chemically modifying or coating the bucky paper with one or more biologically active substances. The ability to easily

make these modifications may serve as an important way of optimizing retinal cell transplantation for macular degeneration and retinitis pigmentosa and may facilitate other ophthalmologic applications as well.

This patent pending work was performed by David J. Loftus, Martin Cinke, and Meyya Meyyappan of Ames Research Center, Center for Nanotechnology, and by Har-

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Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Ames Research Center, (650) 604-5104. Refer to ARC-14940.

Using an Ultrasonic Instrument to Size Extravascular Bubbles

Measurements could be used to guide prebreathing of oxygen to reduce the risk of decompression sickness.

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In an ongoing development project, microscopic bubbles in extravascular tissue in a human body will be detected by use of an enhanced version of the apparatus described in "Ultrasonic Bubble-Sizing Instrument" (MSC-22980), *NASA Tech Briefs*, Vol. 24, No. 10 (October 2000), page 62. To recapitulate: The physical basis of the instrument is the use of ultrasound to excite and measure the resonant behavior (oscillatory expansion and contraction) of bubbles. The resonant behavior is a function of the bubble diameter; the instrument exploits the diameter dependence of the resonance frequency and the general nonlinearity of the ultrasonic response of bubbles to detect bubbles and potentially measure their diameters.

In the cited prior article, the application given most prominent mention was the measurement of gaseous emboli (es-

entially, gas bubbles in blood vessels) that cause decompression sickness and complications associated with cardiopulmonary surgery. According to the present proposal, the instrument capabilities would be extended to measure extravascular bubbles with diameters in the approximate range of 1 to 30 μm .

The proposed use of the instrument could contribute further to the understanding and prevention of decompression sickness: There is evidence that suggests that prebreathing oxygen greatly reduces the risk of decompression sickness by reducing the number of microscopic extravascular bubbles. By using the ultrasonic bubble-sizing instrument to detect and/or measure the sizes of such bubbles, it might be possible to predict the risk of decompression sickness. The instrument also has potential as a tool to guide the oxygen-prebreathing

schedules of astronauts; high-altitude aviators; individuals who undertake high-altitude, low-opening (HALO) parachute jumps; and others at risk of decompression sickness. For example, an individual at serious risk of decompression sickness because of high concentrations of extravascular microscopic bubbles could be given a warning to continue to prebreathe oxygen until it was safe to decompress.

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