



Health, Medicine and Biotechnology

# Bucky Paper Supports Retinal Cell Transplantation

## Bucky Paper As An Artificial Support Membrane In Retinal Cell Transplantation

NASA has invented a Carbon Nanotube (CNT) support membrane, called bucky paper, which can be used as an experimental therapy for repairing the retinal system of an eye. Retinal Pigment Epithelial (RPE) and Iris Pigment Epithelial (IPE) and/or stem cells are deposited on the bucky paper, which is then implanted adjacent to/or below the retina to transfer cells to this space. This holds promise to restore diseased photo receptors where retinal damage or degeneration has occurred as in such leading causes of global and U.S. blindness as age-related macular degeneration (AMD), and diabetic retinopathy (DR). Bucky paper can also provide a framework for release of anti-neovascular drugs and act as a barrier to combat the proliferation of abnormal blood vessels in DR. Both diabetes and AMD are expected to rise sharply worldwide as the population ages and becomes more obese. AMD is the most common form of blindness in people age 65 and over.

### BENEFITS

- Supports promising Rx for prevalent eye diseases like age-related Macular Degeneration
- Supports promising Rx for prevalent eye diseases like Diabetic Retinopathy
- Great precision during surgical handling
- Allows nutrients, waste, oxygen and carbon dioxide to diffuse easily
- Easy to handle
- Excellent substrate for cell transplantation
- Support material is biocompatible
- Serve as a surface for growing selected cells or sheets of cells
- Controllable range of porosity
- Does not spontaneously roll up or form creases

technology solution



# NASA Technology Transfer Program

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## THE TECHNOLOGY

Bucky paper possesses the necessary attributes for therapeutic cell transplantation to the eye. It is a strong, flexible, and porous membrane, which when surgically implanted, allows nutrients, waste, oxygen and carbon dioxide to diffuse easily through its CNT mesh. Bucky paper can be made rigid, but can still be conformed to the shape of the inner retina with appropriate fabrication. It allows for great precision and easy handling during intraocular surgery as it does not curl or roll up.

Bucky paper is prepared from crude preparations of Single Wall Carbon Nanotubes (SWCNTs) synthesized by a laser ablation technique. The support membrane used in the retinal experimental therapy had a thickness in the range of 50 100 m and an area density in the range of 700 1500 gm/cm<sup>2</sup>. When properly prepared, bucky paper serves simultaneously as a substrate for cell growth and as a barrier for selectively preventing growth of unwanted biological tissues such as blood vessels. Bucky paper was fabricated at the NASA Ames Research Center Nanofabrication Facility at Moffett Field, CA.



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## APPLICATIONS

The technology has several potential applications:

- ➔ Medical devices
- ➔ Molecular nanotechnology
- ➔ Biomolecular computing
- ➔ Space missions
- ➔ Healthcare
- ➔ Nanobiotechnology
- ➔ Nanomedicine
- ➔ Neuromorphic engineering
- ➔ Astromedicine
- ➔ Cell transplantation

## PUBLICATIONS

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