

## The Effects of Simulated Microgravity on Microbial Gene Expression-NSBRI Funding

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The initial funding (PDAF #4) was used for post-doctoral fellow, Dr. Gary Schultz. After the first year, he was replaced by the current fellow, Dr. Don Tucker (PDAF #2). Although ongoing current research is a continuation of these earlier projects, it should be noted that the initial results obtained contributed to the successful effort by Dr. G. E. Fox and Dr. R. C. Willson to obtain major funding from the National Space Biomedical Research Institute (NSBRI). That funding was responsible for multiple publications in the current year. The ongoing work on the current PDAF provided significant preliminary results for the recently announced award from the Office of Biological and Physical Research to Dr. G. Fox and Dr. R. Willson.

## The Effects of Simulated Microgravity on Microbial Gene Expression-Astrobiology Center

George E. Fox [UH]

This mini-grant project contributed to the preliminary results presented to NASA as part of an Astrobiology Center proposal that was submitted in early 2003 but not funded. The project is currently on hold but may be incorporated into a joint proposal by Dr. G. Fox and Dr. M. Travisano at a later time.

## Rapid Identification of Unexpected Bacterial Pathogens in Space Environments

George E. Fox [UH] / Richard C. Willson [UH]

This mini-grant project also contributed key preliminary results to the successful NSBRI application discussed above. In addition, this work underlies several grant applications in the area of biodefense that Dr. G. Fox and Dr. R. Willson may submit in the future. The key finding of the project, the existence of 16S rRNA signature oligonucleotides, resulted in a 2002 publication in *Bioinformatics*:

Zhang, Z., R. C. Willson, and G. E. Fox. "Identification of Characteristic Oligonucleotides in the 16S Ribosomal RNA Sequence Dataset," *Bioinformatics* 18 (2002): 244-50.

[This paper was highly recognized by the lay science press during 2003, being featured in several stories including:

Ananthaswamy, A. "Getting to Grips with Mystery Space Bugs," *The New Scientist* 177.2380 (1 Feb. 2003): 20.

"Fighting Bacteria in Space," BBC News (15 Nov. 2002) <<http://news.bbc.co.uk/2/hi/science/nature/2480357.stm>>

Rayl, A. J. S. "Above and Beyond," *The Scientist* 12.24 (9 Dec. 2002): 26.

*Odyssey Magazine* (2003).

## Coordination Polymers For Nanofibers

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### Abstract

Microporous metal-organic polymers have found a wide range of technological applications, such as molecular separation and pollution prevention in air, liquid, and water systems, where they can be used as ion exchangers and molecular sieves. These novel zeolite-like materials may be fabricated into nanomaterials. One of the key factors for the success of fabricating metal-organic nanomaterials is the synthesis of desirable metal-organic polymers that can be suitable for nanomaterials fabrication. Exploration in this project has produced several novel microporous metal-organic polymers.

**S**YNTHESIS AND FABRICATION OF FUNCTIONAL MATERIALS represent one of the great challenges in current research. The microporous metal-organic polymers have found a wide range of technological applications such as molecular separation and pollution prevention in air, liquid and water system, where they can be used as ion exchangers and molecular sieves. These novel zeolite-like materials may be fabricated into nanofibers. This project is designed to produce novel microporous metal-organic polymers desirable for generation of metal-organic nanofibers.

### Experimental Activity, Results and Discussion

Among the new metal-organic polymers synthesized in our laboratory,  $\{[Cu_2(IN)_3] \cdot I_5^{-5/6} \cdot H_2O\}_\infty$  (IN: isonicotinato)<sup>1</sup> is an unusual polyiodide inclusion metal-organic polymer with a novel 3-D nano hollow-channel open-framework synthesized via an oxidation reaction route under hydrothermal conditions. The diameter of the channel is about 1.15 nm, slightly smaller than that of carbon nanotubes (~1.4 nm).

$[Cd(NA)_2]_2$  (NA = nicotinato), a new three-dimensional (3-D) neutral coordination polymer, has been synthesized under hydrothermal reaction conditions. The structure consists of distorted square pyramidal cadmium centers coordinated by two independent nicotinato ligands. One nicotinato ligand is tridentate; the other one is bidentate to cadmium metal centers. Every two cadmium atoms are bridged by two carboxylate groups of the tridentate nicotinato ligands through *O*(2) and *O*(4) atoms to form a binuclear cadmium unit:  $Cd_2(NA)_4$ . The *O*(4) atom is at the apical site while the two pyridyl groups and the other two oxygen atoms are at the equatorial positions. The formation of the binuclear units created eight-member rings, which are then linked by nicotinato ligands to result in large 24-member rings. There are four eight-member rings on each 24-member ring: two eight-member rings at trans-position to each other are perpendicular to the other two eight-member rings. Four 24-member rings connect to each eight-member ring, via covalent bonding to the binuclear cadmium centers: two 24-member rings are perpendicular to the other two 24-member rings. The propagation of the 24-member rings and eight-member rings extends into three directions to result in a 3-D open framework structure.