Industry/University Center for Biosurfaces (IUCB)

The University at Buffalo (lead institution)

Understanding, predicting, and controlling the interactions of living and nonliving materials can overcome barriers to next-generation micromechanical and medical manufacturing while improving sanitation in food, air, and water processing

A National Science Foundation Industry/University Cooperative Research Center since 1988

Affiliated Institutions:

- *The University of Memphis*
- *New York State College of Ceramics at Alfred University*
- *University of Miami*

Center Mission and Rationale

The purpose of the Industry/University Center for Biosurfaces (IUCB) is to accomplish the following—

- To understand the interactions of all that is alive with all that is not
- Through such understanding, to predict how living cells interact with synthetic materials, and with other cells
- To control the speed and strength of biological surface interactions for the benefit of personal, public, and environmental health.

The Center's current goals are —

- To extend Center-standardized reference materials and experimental models of biomaterial and particle/tissue interactions for improved environmental health
- To apply useful, regulation-free "active" surface strategies capable of removing biofilms for improved sanitation, cleaning, and infection-control
- To develop new, relevant experimental models for evaluation of lubricity, friction, and wear in biological environments
- To identify new sterilization technologies for synthetic/prosthetic materials that will improve *in vivo* wear resistance and biocompatibility

Research Program

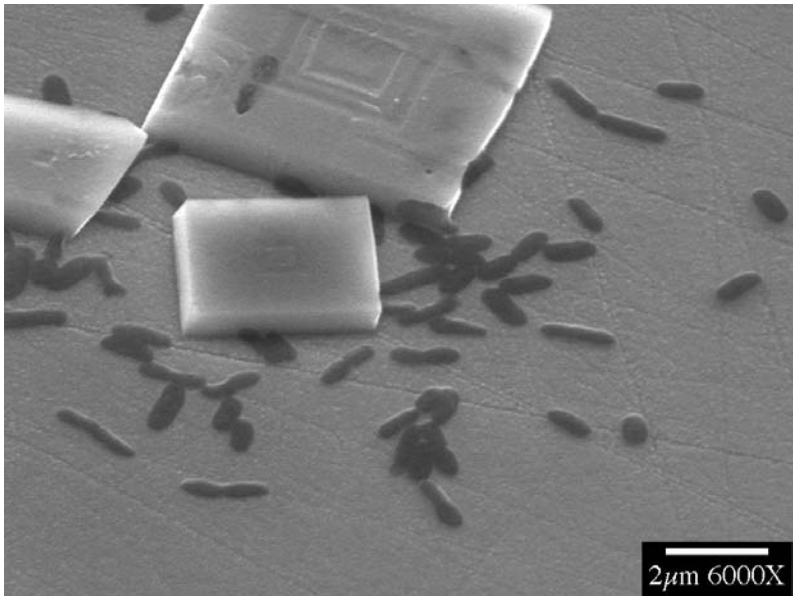
The Center for Biosurfaces conducts basic and applied research to control interactions of biomaterials and particles with living cell surfaces in medical, dental, and natural environments. The fields of bioengineering and biotechnology, occupational safety, and public health are addressed as toxic or infectious aerosols are detected, collected, and analyzed. The Center's research has led to several commercial nontoxic easy-release environmental coatings and safer medical products. Current Center projects include producing relevant environmental simulations of flowing biofluids (blood, tears, saliva, others) at and near contact surfaces, and documenting fundamental force, structure, and flow features capable of modulating cell attachment/retention at solid/liquid, gas/liquid, and solid/gas interfaces.

Special Center Benefits

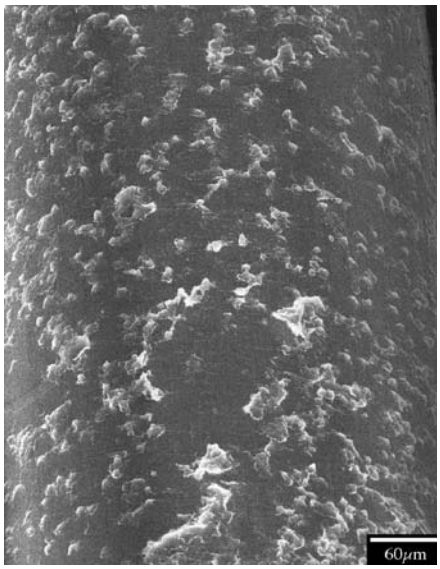
The Center's industrial sponsors receive priority attention for applied research needs. The Center has recently completed industrial projects in areas including —

- Surface characterization of metals, ceramics, and plastics
- Surface modification of polymers
- Evaluation of implant biocompatibility
- Prevention of mineral scale
- Development of advanced cleaning processes
- Certification of new sterilization processes
- Control of biofouling.

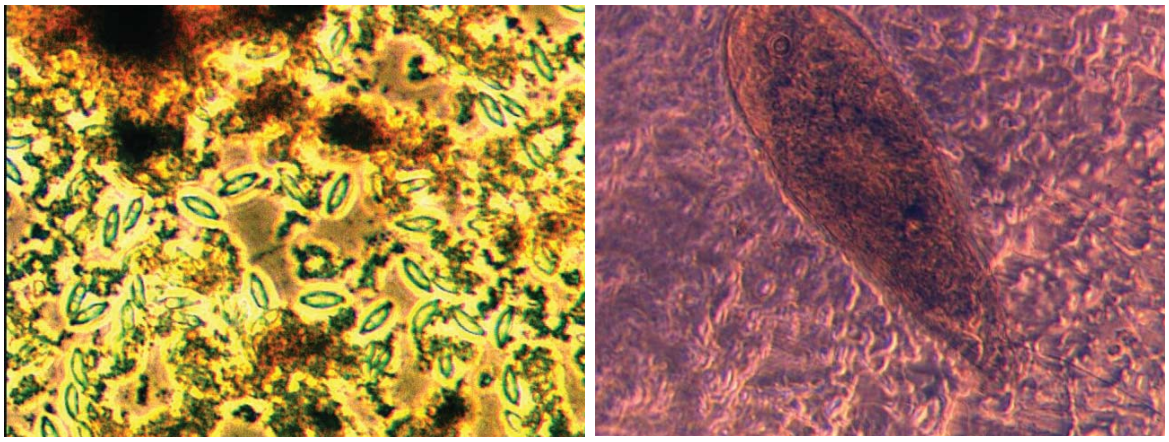
The Center's cooperating laboratories contain state-of-the-art equipment, uniquely applied to biological systems. For example, in addition to field emission scanning electron microscopes, a scanning Auger microprobe, electron spectrometer for chemical analysis, and electron spin resonance spectrometer – tools usually reserved for inorganic specimens and pure physics studies – are among many advanced instruments applied in the Center's biosurface projects.



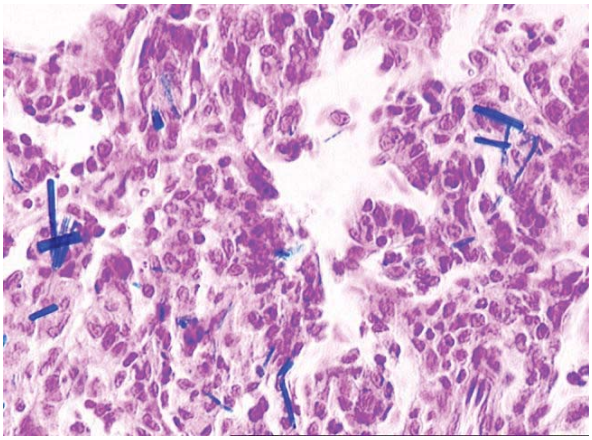
Working on an international "TIE" project with the University of Belfast, Northern Ireland, and four U.S. university Centers (Buffalo, two in Arizona, and the New Jersey Institute of Technology), the Center isolated and visualized the adhesion of distinctive microbes that enable novel semiconductor chip manufacture for biosensors.



Working with Cardiovascular Perfusion specialists, the Center has identified and visualized the cause of oxygenator failures during open-heart surgery and the Center is now developing thromboresistant coatings that safely and effectively preserve life-critical gas transfer.



Working with German, Israeli, and U.S. scientists, the Center has identified sources of bioinvasions, from European to U.S. waters, in the form of ballast organic biofilms (from ballast-water tanks of large ships). These dominant sources of transported microbes and associated protista are minimized by ballast tank coatings that control biodiversity while preventing biocorrosion.



Under IUCB sponsorship from major fiberglass manufacturers, the Center has located and microscopically visualized dissolving glass fibers within mammalian lung tissues, correlating glass fiber durability with specific compositional components and local cell chemistry changes.

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