

# Bioengineering 2003

INTELLIGENT TECHNOLOGIES FOR THE BODY HUMAN

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## SYMPOSIUM ANNOUNCEMENT (4/15/03 update)

### Important Updates

- [Date changed to June 17 – 18, 2003](#)
- [Location changed to the Gilruth Center at NASA's Johnson Space Center in Houston, TX](#)
- Look for updates and registration on the BioE Web page (click [here](#) to go to page)

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## OBJECTIVES

Bioengineering, in the broadest definition of the field, contributes much to human endeavors in hostile environments – warfighters in a conflict half a world away, first responders at a homeland defense emergency, or astronauts living in the vast reaches of space. BioE 2003 will focus specifically on new and emerging bioengineering technologies of use to human operations in these challenging environments. It will also define overlaps between technology needs and solutions in the U.S. defense and space programs.

BioE 2003 will be a forum for NASA, academia, the military, and other government agencies. Unlike typical large-scale conferences that consist of presentations on individual experiments or studies, this symposium will be a small-scale, focused event. It is designed to bring technology developers and technology users together, allowing these potential collaborators to educate one other on technology needs and emerging solutions. Networking that results in or nurtures collaboration is the most valuable result of this symposium.

The **Advanced Technology Integration Group (ATIG)** of the Space and Life Sciences Directorate at the Johnson Space Center organizes two technology-focused symposia a year. These highlight areas of technology that are critical to both NASA and other government agencies, especially the military. They also encourage networking between NASA and others in the biomedical community, potentially resulting in collaborations for developing technologies. Such collaborations may yield solutions for life sciences and human operations in hostile environments.

Information from recent ATIG symposia are published online to reach the widest possible audience. Streaming media presentations (audio plus slides) are available for:

- Environmental Sentinels 2002, <http://advtech.jsc.nasa.gov/enviroSent.asp>
- Human Operations 2001, <http://advtech.jsc.nasa.gov/humanOps.asp>

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While the field of bioengineering covers diverse topics, the following list suggests technologies and technology areas of particular interest for BioE 2003 presentations. This list is not all-inclusive! **Any** important bioengineering technology or government program with the potential to advance human operations in both military and space environments will be considered.

### **Cellular and Molecular Analysis**

- Stressor detection from salivary, blood or tissue DNA; used for microgravity, disease, toxic exposure, countermeasure design and validation
- Measuring gene expression changes in individuals in response to illness, radiation or toxic exposure, or microgravity, as well as to determine pre-exposure susceptibility to stressors, disease, etc.
- Immune-strengthening pharmaceuticals, synthetic immune systems, synthetic antibody-like drugs, and immuno-modulators
- Pharmaceutical and nutritional treatments to reduce susceptibility to radiation damage
- Microencapsulated drugs and other novel delivery techniques that increase effectiveness or allow easy application in space or on Earth

### **Intelligent Critical Care**

- Computerized cognitive assessment after trauma, remote operations, toxic exposure or stress
- Devices that guide or support independent, self-administration of life-saving treatments
- Systems that guide non-physicians in placing ultrasound probes and interpreting data received
- VR systems with tactile feedback for training non-MD to perform simple medical procedures (e.g., clean/debride/suture wounds, intubate, draw blood, etc.)
- Head-mounted displays or glasses that display data unobtrusively (including VR or AR)
- Enhancement of wound healing and neural regeneration
- Administration of anesthesia in the field or in space without special equipment or special training
- Multimedia medical databases, including virtual reality presentation of medical information

### **Sensors and Sensor Networks**

- Wireless sensors that continuously measure important blood analytes
- Miniature, non-invasive microfluidic saliva sensor
- Sensors embedded in clothes or used as small patches on the body
- "Wear and forget" sensors for multi-day use by highly active individuals (e.g., soldiers, astronauts, firefighters, and first responders)
- Rapid, on-site genomic analysis for microbial identification in air and water
- In-place detection of food contamination in sealed, packaged foods
- Algorithms that determine physiological state from wearable sensor network and that account for clinical uncertainty and probabilistic measures

### **Biotechnology and Tissue Engineering**

- Novel and useful mathematical models of biological processes
- Computational fluid dynamic analysis to understand cellular changes induced by microgravity
- Tissue engineering, growth factors or other methods for organ regeneration or replacement
- Interfaces with biological systems to act as sensors that operate process control systems
- Engineering living reporter systems that can be used in exploration
- Automated and autonomous cell and tissue culture systems

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## APPROACH

With limited space and a focus on high-quality networking, BioE 2003 will be a small-scale, invitation-only event. The Gilruth Center allows for 100 participants, so we seek approximately equal representation from:

- 1) NASA centers involved in bioengineering,
- 2) the military and other government agencies, and
- 3) academic researchers and technology developers involved in bioengineering.

### PLEASE NOTE

- Participants and speakers **do not** pay a registration fee, but they are responsible for their own travel, hotel, and meal costs.
- We **do not** have any funds to defray these costs.

**To participate in BioE 2003, all prospective participants and speakers must complete a short online form.** All forms are available online at <http://advtech.jsc.nasa.gov/Forms/forms.asp>.

Prospective participants should complete the registration form to receive an invitation. Prospective speakers should use the request form to suggest a presentation topic.

Once registered and confirmed, participants will receive updates and schedules by email. Speaker and presentation information will be included in subsequent versions of this announcement.

### Day 1

The first day will feature a plenary session on government programs, specific technology needs, or emerging capabilities with presentations by government program managers, scientists, and engineers. These presentations will be broad in scope, covering many needs and technologies, rather than reports on a single technology or study. The goal is to learn about government technology needs and the programs that can form the basis of future collaborations in the competitive research environment.

### Day 2

The second day will consist of two parallel sessions on specific technology solutions. When speaker permission is given, presentations will be recorded and published online to allow everyone to hear both sessions.

## PRESENTATIONS

With time for as many as 30 half-hour presentations, prospective speakers are encouraged to propose a topic and title via the online form. Generally, presentations should address technology needs, opportunities for collaboration, and/or technology solutions.

While new and emerging technologies are of greatest interest, all speakers who have a solution in this area are encouraged to present. Often, existing technologies have not yet been applied to problems.

Where speakers permit it, the audio of presentations will be recorded. Recorded talks from both days will be published as streaming audio on the BioE Web page soon after the event. This allows the widest possible audience to learn from BioE presentations.

## LOGISTICS

Confirmed participants and speakers will be emailed an information packet that contains details on lodging, parking, directions, and more.

## SCHEDULE

The BioE 2003 schedule allows for as many as 30 half-hour presentations. It is still in work and will be updated regularly. The schedule will include ample breaks and networking sessions, as follows:

### Tuesday, June 17<sup>th</sup>

|       |                      |  |
|-------|----------------------|--|
| 09:00 | Overview             | Welcome (NASA ATIG/Stilwell and Mueller) |
| 09:30 |                      | NASA slot 1                              |
| 10:00 |                      | Military slot 2                          |
| 10:30 |                      | Break                                    |
| 11:00 |                      | Academic slot 3                          |
| 11:30 |                      | Government agency slot 4                 |
| 12:00 | Lunch                |  |
| 01:00 | Needs and Challenges | Slots 5 - 6                              |
| 02:00 |                      | Break                                    |
| 02:30 |                      | Slots 7 - 9                              |
| 04:00 |                      | Break                                    |
| 04:30 |                      | Slots 10 - 12                            |

### Wednesday, June 18<sup>th</sup>

|       |                                       |               |             |               |
|-------|---------------------------------------|---------------|-------------|---------------|
| 09:00 | Solutions 1                           | Slots 13 - 15 | Solutions 2 | Slots 23 - 25 |
| 10:30 |                                       | Break         |             |               |
| 11:00 |                                       | Slots 16 - 17 |             | Slots 26 - 27 |
| 12:00 | Lunch                                 |               |             |               |
| 01:00 | Solutions 1                           | Slots 18 - 19 | Solutions 2 | Slots 28 - 29 |
| 02:30 |                                       | Break         |             |               |
| 03:00 |                                       | Slots 20 - 22 |             |               |
| 04:00 | Technology demonstration or lab tours |               |             |               |
| 05:30 | Closing                               |               |             |               |

## NASA'S ROLE

As NASA's lead center for bioastronautics, the Johnson Space Center is responsible for many areas of research and operations related to bioengineering. Bioastronautics itself is the study of the biological and medical effects of space flight on human systems. Other NASA centers are involved with bioastronautics, bioengineering, and biotechnology research.

### General Resources

NASA's Office of Biological and Physical Research

<http://spaceresearch.nasa.gov>

Bioastronautics Critical Path Roadmap

<http://criticalpath.jsc.nasa.gov>

Glenn Research Center, Bioengineering Initiative

<http://microgravity.grc.nasa.gov/grcbio/bec.html>

Ames Research Center, Astrobionics

<http://astrobionics.arc.nasa.gov/>