

*Bioengineering,
Biotechnology, and Imaging*

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Research Goal 1

Define optimal procedural approach for patients with digestive disorders amenable to either endoscopic, image-guided or minimal access surgery

- RCT
- Registry
- Defined outcomes: efficacy, morbidity and mortality, QOL, cost

Research Goal 1

Objectives

- Evaluate efficacy and outcome measures, including quality of life, for innovative surgical technologies.
- Perform a cost analysis of new surgical methods compared to traditional procedures.
- Conduct rigorous studies of physiologic and immunologic response to minimal access surgery to determine if biologic advantage exists for these procedures.

Research Goal 2

Develop innovative technology for the diagnosis and treatment of luminal disease.

Research Goal 2

Objectives

- Develop and validate a method to perform “molecular” biopsy of luminal abnormalities in real time.
- Develop improved endoscopic instrumentation for therapeutic endoscopy.
- Develop improved virtual endoscopy technology to access the luminal space of the GI tract.
- Define mechanisms of scar tissue formation in the gastrointestinal tract.

Research Goal 3

Use tissue engineering and regenerative medicine approaches to develop innovative treatments for digestive diseases.

Research Goal 3

Objectives

- Identify and isolate local stem cell populations in the GI tract for tissue engineering applications.
- Develop scaffolds, both naturally occurring and synthetic, to support growth and differentiation of cell populations indigenous to the gastrointestinal tract.
- Develop tissue engineering and regenerative medicine methods for esophageal and small bowel disorders.

Research Goal 4

Expand the application and integration of imaging and procedural technologies to deliver targeted interventions with minimal tissue injury to patients with digestive disorders

Research Goal 4

Objectives

- Develop new PET tracers for clinical use including markers of proliferation, tumor specific antigens, markers of apoptosis, and inflammation.
- Develop intraoperative high-energy gamma and beta detectors to enhance intraoperative localization.
- Develop energy delivery and real-time tracking devices to optimize local image-guided interventions.
- Develop navigation and control devices to allow single-port laparoscopic procedures, intraluminal procedures, and natural orifice surgeries.

Research Goal 5

Develop high-fidelity interactive simulators of the digestive system.

Research Goal 5

Objectives

- Define the optimal use of simulation in training the procedural workforce
 - Metrics, transference, competency assessment, acquisition of new technologies
- Define the value of simulation in developing new procedures
 - Procedural design
 - Prediction of outcomes
- Develop high-fidelity simulators to allow multimodality procedural rehearsal

Major Challenges/Steps To Achieve Goals

- Translational and clinical research
- Academia-industry collaboration
- Regenerative medicine
- Fostering research teams

Major Challenges/Steps To Achieve Goals

Translational and Clinical Research

Challenge: Advances require interaction of disciplines not traditionally aligned in academic environments: clinicians, engineers, computer scientists, imaging, molecular pharmacy

Steps:

1. State-of-the-art workshops
2. Consortia of integrated research programs
3. Funding requirements
4. Dual training programs: bioengineering – surgery
5. Development of non-traditional disciplines and training pathways
 1. Surgery- gastroenterology
 2. Radiology – surgery – GI

Major Challenges/Steps To Achieve Goals

Academia-Industry Collaboration

Challenge:

- Financial interests preclude open collaboration between industry and investigators.
- IP interests hamper productive collaboration with small cap partners.
- COI concerns limit PI interaction with major industry partners

Steps:

1. Educate investigator workforce re IP management
2. Develop more effective policies to allow industry collaboration and manage COI

Major Challenges/Steps To Achieve Goals

Regenerative Medicine

Challenge:

- The gastrointestinal tract is comprised of many complex structures
- The gastrointestinal tract has been viewed as too complex an organ to make progress in RM

Steps:

- Symposium on regenerative medicine research in the digestive system with input of other system leaders
- Consortium of investigators
- Partnership with organ failure and repair clinicians with RM/TE investigators

Major Challenges/Steps To Achieve Goals

Fostering Research Teams

Challenge:

1. Biotechnology research requires collaboration between diverse disciplines
2. Biotechnology research requires very high cost tools and technologies

Steps:

1. Develop network of high-density research centers in areas of emphasis: imaging, robotics, devices,
2. Develop infrastructure for AV integration to link research facilities - share images, robotics, simulation
3. Target resources to interdisciplinary research teams