Innovation Forum I:
Engineers in Reproductive Surgery
(Didactic)

PROGRAM CHAIR
Alan H. DeCherney, MD

Peter Basser, MD
George Patounakis, MD
Professional Education Information

Target Audience
This educational activity is developed to meet the needs of residents, fellows and new minimally invasive specialists in the field of gynecology.

Accreditation
AAGL is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

The AAGL designates this live activity for a maximum of 1.50 AMA PRA Category 1 Credit(s)™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

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As a provider accredited by the Accreditation Council for Continuing Medical Education, AAGL must ensure balance, independence, and objectivity in all CME activities to promote improvements in health care and not proprietary interests of a commercial interest. The provider controls all decisions related to identification of CME needs, determination of educational objectives, selection and presentation of content, selection of all persons and organizations that will be in a position to control the content, selection of educational methods, and evaluation of the activity. Course chairs, planning committee members, presenters, authors, moderators, panel members, and others in a position to control the content of this activity are required to disclose relevant financial relationships with commercial interests related to the subject matter of this educational activity. Learners are able to assess the potential for commercial bias in information when complete disclosure, resolution of conflicts of interest, and acknowledgment of commercial support are provided prior to the activity. Informed learners are the final safeguards in assuring that a CME activity is independent from commercial support. We believe this mechanism contributes to the transparency and accountability of CME.
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Innovation Forum I:  
Engineers in Reproductive Surgery (Didactic)  

Alan H. DeCherney, Chair  

Faculty: Peter Basser, George Patounakis  

The advancement of minimally invasive surgery depends on the skill of the surgeon and availability of proper instrumentation. Collaboration between engineers and physicians is imperative in new product design and development, ultimately benefiting the patient with the least invasive approach.  

This session will illustrate how new instruments and technology are developed and how engineers are involved in the process: from idea, to design, to execution. Modern medicine and surgery have taken on tremendous complexity because of the initiative of engineers. We are now able to measure individual genes and perform surgery utilizing a robot. These are dramatic changes, all of which would be impossible without engineers; yet, engineers are often misunderstood. Our goal is to help you understand what engineers do and how they carry out their profession; this will allow you to better understand the technology that you use, and guide you in developing new technologies.  

**Learning Objectives:** At the conclusion of this course, the clinician will be able to: 1) Discuss how engineers collaborate with the medical community to design surgical instrumentation; 2) analyze the steps involved in bringing a surgical innovation from concept to commercial use in the operating room; and 3) develop new ideas for surgical instrumentation.  

**Course Outline**  

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<td>Innovation in Surgery</td>
<td>A.H. DeCherney</td>
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<td>10:30</td>
<td>Imaging Techniques: How Are They Developed and Applied?</td>
<td>R. Basser</td>
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<tr>
<td>10:55</td>
<td>Engineers and Development of Equipment for Reproductive Surgery</td>
<td>G. Patounakis</td>
</tr>
<tr>
<td>11:20</td>
<td>Question &amp; Answers</td>
<td>Faculty</td>
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<td>11:30</td>
<td>Adjourn</td>
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PLANNER DISCLOSURE
The following members of AAGL have been involved in the educational planning of this workshop and have no conflict of interest to disclose (in alphabetical order by last name).
Art Arellano, Professional Education Manager, AAGL*
Viviane F. Connor
Consultant: Conceptus Incorporated
Kimberly A. Kho*
Frank D. Loffer, Executive Vice President/Medical Director, AAGL*
Linda Michels, Executive Director, AAGL*
M. Jonathan Solnik*
Johnny Yi*

SCIENTIFIC PROGRAM COMMITTEE
Ceana H. Nezhat
Consultant: Ethicon Endo-Surgery, Lumenis, Karl Storz
Other: Medical Advisor: Plasma Surgical
Other: Scientific Advisory Board: SurgiQuest
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FACULTY DISCLOSURE
The following have agreed to provide verbal disclosure of their relationships prior to their presentations. They have also agreed to support their presentations and clinical recommendations with the “best available evidence” from medical literature (in alphabetical order by last name).
Peter J. Basser*
Alan H. DeCherney*
George Patounakis*

Asterisk (*) denotes no financial relationships to disclose.
INNOVATION IN SURGERY

alan decherney m.d.
PRAE/NICHD/NIH

Disclosure

I have no financial relationships to disclose.

THE IDEA FACTORY
Bell Labs and the Great Age of American Innovation
Jon Gertner

CREATIVITY

Serenipity
Hypothesis-driven research, based on many years study of the basic physiology of embryo development. Hypothesis developed and tested in animal models, including small rodent (mouse) and large animal (bovine and pig). Tested in human embryos donated to research. Tested in small scale single site clinical IVF study. Tested in larger multi-site clinical study. Assess clinical and cost effectiveness.

Ideal paradigm of hypothesis-driven basic research.

Evidence based surgery
Praise without end the go-ahead zeal of whoever it was invented the wheel; But never a word for the poor soul’s sake that thought ahead and invented the brake.

The Poet Laureate of the United States, Howard Nemerov, read a poem with these last lines at a joint session of Congress on the 200th anniversary of the convening of our nation’s first Congress.
Engineers and Development of Equipment for Reproductive Surgery

George Patounakis, M.D., Ph.D.
Program in Reproductive and Adult Endocrinology
National Institutes of Health

Disclosures

• I have no financial relationships to disclose.

Learning Objectives

• Identify the different phases of the engineering design process
• Apply the engineering design process to the development of new surgical equipment

Laparoscopy & Engineering Articles per Year

Minimally Invasive Surgery & Engineering Articles Per Year

Engineering

Definition:
"the application of science and mathematics by which the properties of matter and the sources of energy in nature are made useful to people"

Source: www.Merriam-Webster.com
Engineering Design Process
- Define Problem
- Think of Ideas
- Select Best Solution
- Prototype
- Test Prototype
- Present Results
- Redesign

Biomedical Engineering
- Biomedical Engineering
- Electrical & Computer Engineering
- Mechanical Engineering
- Chemical Engineering

Biomedical Engineering Example

Surgeon’s Role
- Define Problem
- Think of Ideas
- Select Best Solution
- Prototype
- Test Prototype
- Present Results
- Redesign

Defining the Problem
- Environment
  - Example: Sterilization
- Maximal Physical Dimensions
  - Example: Port size
- Human Interface
- Cost
- Safety

Minimally Invasive Surgery Design Specification Example
- Minimize movement across abdominal wall
- Decreases incision size needed
- Decreases trauma to abdominal wall
Solution: Remote Center of Motion

US Patent # 5,402,801 by Russell Taylor in 1995

Testing the Prototype

- Proof of concept
- Does not require human subjects
- May not expose “real-life” problems
- In vivo testing
  - Surgeon essential
  - Potentially dangerous
    - Early laparoscopy by Fervers in 1933

Haptic Feedback in Robotics

Haptic

Definition: “relating to or based on the sense of touch”

Source: www.Merriam-Webster.com

Haptic Displays

- Device that provides tactile information
- Example: PHANToM Arm

Do We Need Haptics in Robotics?

- Lacking haptics:
  - Increases learning curve
  - Increases surgical errors
    - Especially knot tying

van der Meijden 2009
Robotic Knot Tying

<table>
<thead>
<tr>
<th>Tension in Newtons (mean ± standard deviation)</th>
</tr>
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<tbody>
<tr>
<td>Tycron 2-0</td>
</tr>
<tr>
<td>Hand tied</td>
</tr>
<tr>
<td>Robot w/o haptic feedback</td>
</tr>
<tr>
<td>Robot w/ haptic feedback</td>
</tr>
<tr>
<td>p-value</td>
</tr>
</tbody>
</table>

Bethea et al. 2004

Will Haptics Make a Difference in Robotics?

- Early in engineering design
- Prototypes need more validation
  - In vivo testing
- Cost
- Safety

Culmer et al. 2012

Conclusions

- Innovation in minimally invasive reproductive surgery requires a multidisciplinary team approach
- Surgeons and engineers need to work together to develop the next generation of minimally invasive surgical equipment

References


Governor Arnold Schwarzenegger signed into law **AB 1195** (eff. 7/1/06) requiring local CME providers, such as the AAGL, to assist in enhancing the cultural and linguistic competency of California's physicians (researchers and doctors without patient contact are exempt). This mandate follows the federal Civil Rights Act of 1964, Executive Order 13166 (2000) and the Dymally-Alatorre Bilingual Services Act (1973), all of which recognize, as confirmed by the US Census Bureau, that substantial numbers of patients possess limited English proficiency (LEP).

California Business & Professions Code §2190.1(c)(3) requires a review and explanation of the laws identified above so as to fulfill AAGL's obligations pursuant to California law. Additional guidance is provided by the Institute for Medical Quality at [http://www.imq.org](http://www.imq.org).

**Title VI of the Civil Rights Act of 1964** prohibits recipients of federal financial assistance from discriminating against or otherwise excluding individuals on the basis of race, color, or national origin in any of their activities. In 1974, the US Supreme Court recognized LEP individuals as potential victims of national origin discrimination. In all situations, federal agencies are required to assess the number or proportion of LEP individuals in the eligible service population, the frequency with which they come into contact with the program, the importance of the services, and the resources available to the recipient, including the mix of oral and written language services. Additional details may be found in the Department of Justice Policy Guidance Document: Enforcement of Title VI of the Civil Rights Act of 1964 [http://www.usdoj.gov/crt/cor/pubs.htm](http://www.usdoj.gov/crt/cor/pubs.htm).

**Executive Order 13166,”Improving Access to Services for Persons with Limited English Proficiency”,** signed by the President on August 11, 2000 [http://www.usdoj.gov/crt/cor/13166.htm](http://www.usdoj.gov/crt/cor/13166.htm) was the genesis of the Guidance Document mentioned above. The Executive Order requires all federal agencies, including those which provide federal financial assistance, to examine the services they provide, identify any need for services to LEP individuals, and develop and implement a system to provide those services so LEP persons can have meaningful access.

**Dymally-Alatorre Bilingual Services Act** (California Government Code §7290 et seq.) requires every California state agency which either provides information to, or has contact with, the public to provide bilingual interpreters as well as translated materials explaining those services whenever the local agency serves LEP members of a group whose numbers exceed 5% of the general population.