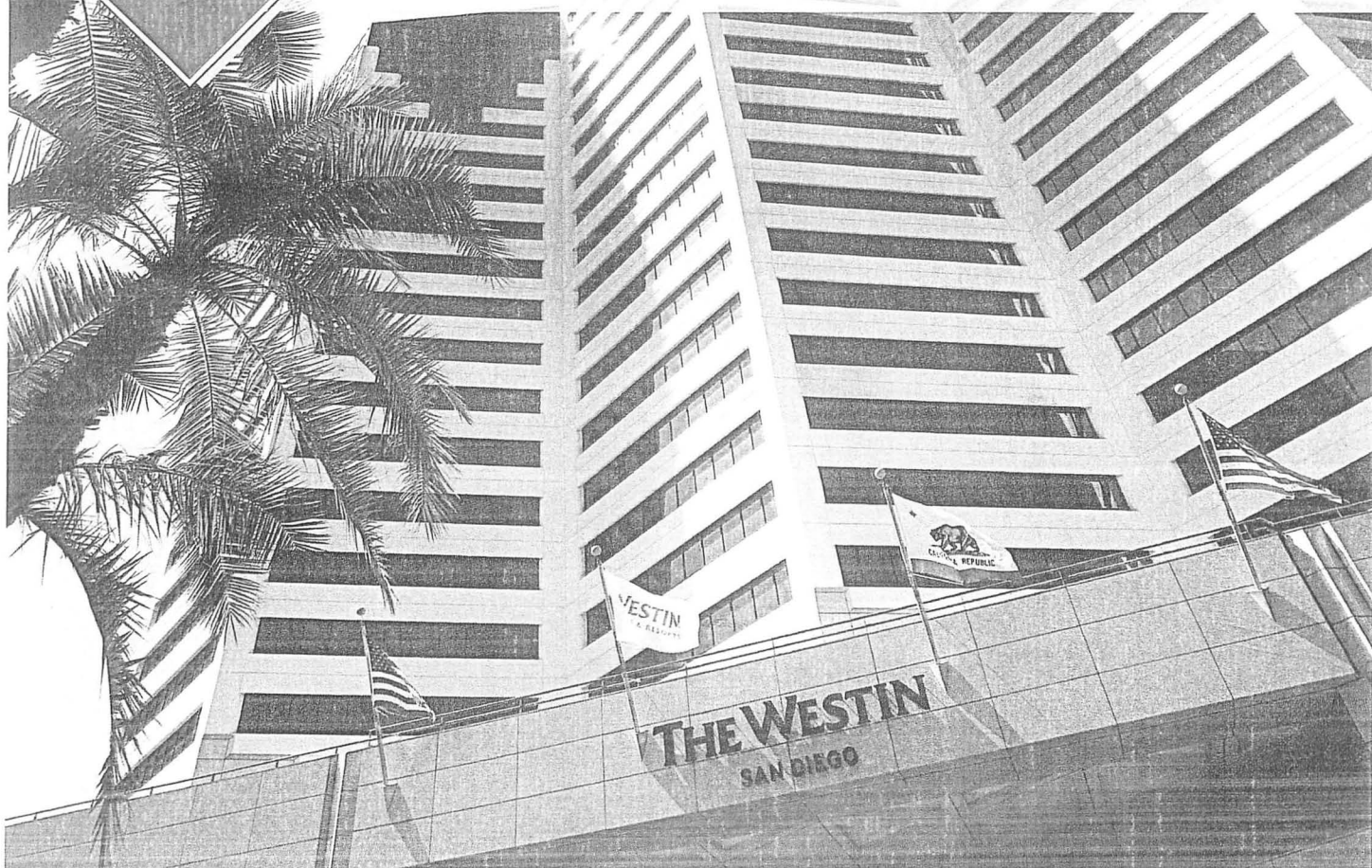




# Society for Technology in Anesthesia



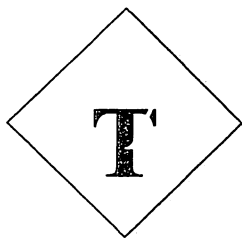
## STA 18th Annual Meeting & 28th Computers in Anesthesia Meeting

January 16-19, 2008

Westin San Diego at Emerald Plaza • San Diego, California

## MEETING SYLLABUS

Society for Technology in Anesthesia  
2 Summit Park Drive, Suite 140 • Cleveland, Ohio 44131  
Phone: 216.447.7864 • Fax: 216.447.8970  
Email: [STAhq@AnesTech.org](mailto:STAhq@AnesTech.org) • Web: [www.AnesTech.org](http://www.AnesTech.org)



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216-447-8970 (Fax)  
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The Society for Technology in Anesthesia (STA) is an international membership-based non-profit organization. Members are physicians, engineers, students and other non-physicians who represent the users, teachers and developers of anesthesia-related technologies, computing, and simulators.

The Society for Technology in Anesthesia (STA) is pleased to be a Component Society of the IARS and the sponsor of the Section in *Anesthesia and Analgesia* on Technology, Computing and Simulation. *Anesthesia and Analgesia* is STA's Official Journal.

## 2008 Board of Directors

### President

Mike Jopling, MD  
*Ohio State University*

### Immediate Past President

Julian M. Goldman, MD  
*Massachusetts General Hospital*

### President Elect

David Feinstein, MD  
*Beth Israel Deaconess*

### Secretary

D. John Doyle, MD, PhD, FRCPC  
*Cleveland Clinic Foundation*

### Treasurer

David Seitman, MD

### At Large Members

Heidi Hughes  
George Hutchinson  
Hanne Storm  
James Szocik  
Chris Wiley

## 2008 Chairs

### 2008 Annual Meeting

#### Program Chair

Mohamed Rehman, MD  
*St. Christopher's Hospital for Children*

### 2008 Abstract Chairs

Kirk Shelley, MD, PhD  
*Yale University*

### Leslie Jameson, MD

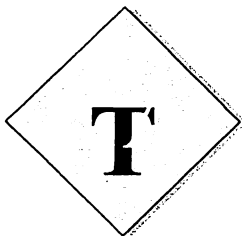
*University of Colorado Health  
Sciences Center*

### 2008 STA @ ASA Breakfast Panel

Mohamed Rehman, MD  
*St. Christopher's Hospital for Children*

### 2008 Ty Smith Dinner

Robert "Butch" Loeb, MD  
*University of Arizona*



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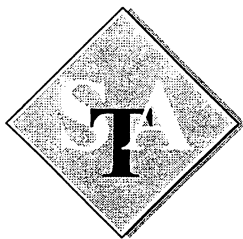
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### **STA 18th Annual Meeting & 28th Annual Computers in Anesthesia Meeting**

On behalf of the program committee and the Board of Directors, welcome to this year's STA meetings. We would personally like to thank the outstanding faculty who have generously given their time to prepare and present their lectures and demonstrations.

Please make every opportunity to network with our corporate member exhibits, faculty and members during the meeting. This type of learning is important and beneficial to everyone. STA is a unique organization whose members represent the practice of anesthesiology as well as industry involved in development and production of technologies used by anesthesiologists in education and medical care. Interaction between the members is one of the strengths of STA. If you are interested in becoming more active in STA and its educational programs, please contact one of the Board members. We welcome participation and involvement at all levels.

Michael Jopling, MD  
STA President



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## STA 2008

### MISSION STATEMENT

The Society's mission is to improve the quality of patient care by improving technology and its application. The Society promotes education and research, collaborates with local, national, and international organizations, sponsors meetings and exhibitions, awards grants, and recognizes achievement.

### MEETING OBJECTIVES

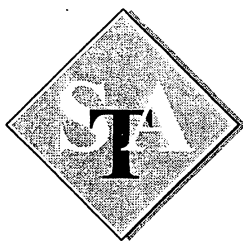
- Explore the many facets of anesthesia-related technologies in use now and in the future.
- Recognize the ergonomics of the anesthesia work environment.
- Discuss how departments determine the need and access options for new technologies.
- Define the use of anesthesia information systems to improve patient care, research and utilization of resources in today's healthcare climate.
- Discuss the procedures for planning, designing and implementing to build operating rooms of today that are ready for new future technologies.

### CME ACCREDITATION STATEMENT

This activity has been planned and implemented in accordance with the Essential Areas of the Accreditation Council for Continuing Medical Education through the joint sponsorship of the Society for Technology in Anesthesia (STA) and the International Anesthesia Research Society (IARS). The IARS is accredited by the ACCME to provide continuing medical education for physicians. The IARS designates this continuing medical education as meeting the criteria for a maximum of *fifteen and ½ (15.5) AMA PRA Category 1 Credit(s)*.<sup>1</sup> Each physician should claim only those hours of credit that he/she actually spent in the educational activity.

### SPEAKER AND PRESENTER DISCLOSURE STATEMENT

The International Anesthesia Research Society (IARS) adheres to ACCME standards regarding industry support of continuing medical education. Disclosure of faculty and commercial relationships, if any, will be made known at the activity. Speakers are also expected to openly disclose inclusion or discussion of any off-label, experimental, or investigational use of drugs or devices in their presentations.



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## STA 2008 Speakers and Moderators

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**Charlotte Bell, MD**  
New York University School  
of Medicine  
New York, New York

**Rick Cnossen**  
Technical Working Group chair,  
Continua Health Alliance Manager,  
Medical Device Interoperability Standards  
Digital Health Group  
Intel Corporation  
Hillsboro, Oregon

**Richard M. Cooper, MD, FRCPC**  
Toronto General Hospital  
Toronto, Ontario, Canada

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**Steven Dain, MD, FRCPC**  
University of Western Ontario  
London, Ontario, Canada

**Franklin Dexter, MD, PhD**  
University of Iowa  
Iowa City, Iowa

**D. John Doyle, MD, PhD, FRCPC**  
Cleveland Clinic Foundation  
Cleveland, Ohio

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**Richard Epstein, MD**  
Thomas Jefferson University  
Philadelphia, Pennsylvania

**David Feinstein, MD**  
Beth Israel Deaconess Medical Center  
Boston, Massachusetts

**Jeff Feldman, MD, MSE**  
University of Pennsylvania  
School of Medicine  
Children's Hospital of Philadelphia  
Philadelphia, Pennsylvania

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**Julian Goldman, MD**  
Massachusetts General Hospital  
Boston, Massachusetts

**PhiladeWilliam Hersh, MD**  
Oregon Health & Science University  
Salt Lake City, Utah

**David Holmes, MD**  
Mayo Clinic  
Rochester, Minnesota

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**Leslie Jameson, MD**  
University of Colorado  
Health Sciences Center  
Denver, Colorado

**Mike Jopling, MD**  
Ohio state University  
Columbus, Ohio

**Harvey Kirk, AIA**  
Principal, Steffian Bradley Architects  
Boston, Massachusetts

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**C. Dean Kurth, MD**  
Cincinnati Children's Hospital  
University of Cincinnati  
College of Medicine  
Cincinnati, Ohio

**Robert "Butch" Loeb, MD**  
University of Arizona  
Tucson, Arizona

**Luis Melendez**  
OR Clinical Engineering  
Massachusetts General hospital  
Boston, Massachusetts

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**George Nussbaum, PhD, RN**  
US Army Health Facility  
Planning Agency  
Falls Church, Virginia

**Michael O'Reilly, MD**  
University of Michigan Medical Center  
Ann Arbor, Michigan

**John Pawlowski, MD**  
Beth Israel Deaconess Medical Center  
Boston, Massachusetts

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**Christopher Quartararo, MD**  
Beth Israel Deaconess Medical Center  
Boston, Massachusetts

**Ira Rampil, MD**  
University at Stony Brook  
Stoney Brook, New York

**Mohamed Rehman, MD**  
Children's Hospital of Philadelphia  
Philadelphia, Pennsylvania

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**David Reich, MD**  
Mt. Sinai School Of Medicine  
New York, New York

**Anthony Sestokas, PhD, D.ABNM,  
F.ASNM**  
Surgical Monitoring Associates  
Springfield, Pennsylvania

**Michael Vigoda, MD, MBA**  
University of Miami Leonard M. Miller  
School of Medicine  
Miami, Florida

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**Dwayne R. Westenskow, PhD**  
University of Utah  
Salt Lake City, Utah

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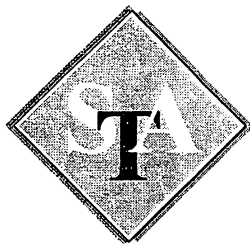
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## STA 2008 Anesthesia Essentials

### Wednesday, January 16, 2008

0830 - 0900	<b>Introduction</b> Need assessment	<b>Charlotte Bell, John Pawlowski, Christopher Quartararo, David Feinstein, Jeff Feldman</b>
0900 - 0930	<b>Session 1 – Mini Talks</b> A Typical Day Anesthesia Machine for non-clinicians Anesthesia Basics	<b>Charlotte Bell Jeff Feldman David Feinstein</b>
0930 - 1030	<b>Session 2 – Preoperative Evaluations/Record Keeping</b> Introduction to topic Structured preop evaluations Small groups (4-5 / group) Patient interview Discussions: Written records vs AIMS What's important – why do we interview (good question) Review AIMS records	<b>Christopher Quartararo</b>  John Pawlowski Charlotte Bell David Feinstein Jeff Feldman
1030 - 1045	<b>Break</b>	
1045 - 1145	<b>Session 3 – What is Anesthesia? - General Anesthesia</b> Introduction to topic Simulator session Drugs – effects on vital signs, mental status, etc. Participants do the cases in a small group with charting	<b>John Pawlowski</b>  Christopher Quartararo Charlotte Bell David Feinstein, Jeff Feldman
1145 - 1245	<b>Session 4 - What is Anesthesia? - Regional and MAC</b> Introduction to topic Simulator session Drugs – effects on vital signs, mental status, etc. Participants do the cases in a small group with charting	<b>Christopher Quartararo</b>  John Pawlowski Charlotte Bell David Feinstein, Jeff Feldman
1245 - 1345	<b>LUNCH</b>	
1345 - 1500	<b>Session 5 – "Interesting Cases"</b> Introduction to topic Simulator session Drugs – effects on vital signs, mental status, etc. Participants do the cases in a small group with charting	<b>John Pawlowski</b>  Christopher Quartararo Charlotte Bell David Feinstein, Jeff Feldman
1500 - 1615	<b>Session 6 – Troubleshooting / Wrap-Up</b>	<b>Charlotte Bell, John Pawlowski, Christopher Quartararo, David Feinstein, Jeff Feldman</b>



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## STA 2008 Daily Program Schedule

### Wednesday, January 16, 2008

0730 - 0930	Emerald Foyer	Anesthesia Essentials Registration
0830 - 1415	Crystal Ballroom 2	<b>Anesthesia Essentials (formerly Anesthesia "101")</b> C. Bell, D. Feinstein, J. Feldman, J. Pawlowski, C. Quartararo
0800 - 1500	Pearl Room	STA Board of Director's Meeting
1530 - 1930	Emerald Foyer	STA Annual Meeting Registration
1800 - 1930	Emerald Ballroom	Welcome Reception in Technology Showcase Area

### Thursday, January 17, 2008

0700 - 1500	Emerald Foyer	Registration
0700 - 1400	Emerald Ballroom	Technology Showcase and Poster Area Open
0700 - 0800	Emerald Ballroom	Continental Breakfast in Technology Showcase Area
0800 - 0815	Crystal Ballroom	<b>Opening Remarks, Meeting Overview</b> Michael Jopling, STA President Mohamed Rehman, 2008 Annual Meeting Program Chairman
0815 - 1000	Crystal Ballroom	<b>Technology of Monitoring the Brain: Sleep and Oxygenation</b> Technology of Brain Monitoring for Anesthetic Drug Effect Ira Rampil, MD, University at Stony Brook, Stony Brook, New York  Goals/Objectives – To review the fundamental pharmacology and physiology of general anesthesia; to review the epidemiology of unintended recall during anesthesia; to review the principles of operation and algorithms of commercially available monitors; to review 2007 major events in monitoring  C. Dean Kurth, MD, Cincinnati Children's Hospital, Cincinnati, Ohio  <b>Technology of Monitoring the Brain and Spine</b> Anthony K. Sestokas, PhD, DABNM, F.ASNM, Surgical Monitoring Associates, Springfield, Pennsylvania  Goals/Objectives – To review current technologies for intraoperative monitoring of spinal cord function; to discuss anesthesia considerations for optimal assessment of spinal cord function
1000 - 1030	Emerald Ballroom	Break and research poster walk-arounds





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## Thursday, January 17, 2008, continued

1030 – 1230 Crystal Ballroom

### **Designing Operating Rooms For Today**

#### **The Challenge of Balancing Simplicity with Future-proofing**

Julian Goldman, MD, Massachusetts General Hospital,  
Boston, Massachusetts

#### **The Military OR Requirements**

George Nussbaum, PhD, RN, US Army Health Facility Planning Agency,  
Falls Church, Virginia

#### **State of the Art OR Design**

Harvey Kirk, AIA, Principal, Steffian Bradley Architects,  
Boston, Massachusetts

Goals/Objectives – To convey to the audience a sense of the structure and  
function of the contemporary operating room design issues.

**Putting it all together** – Luis Melendez, OR Clinical Engineering,  
Massachusetts General Hospital, Boston, Massachusetts

1230- 1330 Emerald Ballroom &  
Emerald Foyer

Box lunch, Show & Tell

1330 - 1430 Crystal Ballroom

**Oral presentation of interesting abstracts** – Leslie Jameson, MD,  
University of Colorado HSC, Denver, Colorado

1430 - 1500 Emerald Ballroom

Break, Research Poster Walk-arounds, and Technology Showcase

1500 - 1800 Opal, Diamond Rooms

Sponsored Focus Groups – TBD

1830 - 1930 Emerald Foyer

Banquet Registration

1900 Crystal Ballroom

**STA Banquet**

## Friday, January 18, 2008

0700 - 1400 Emerald Foyer

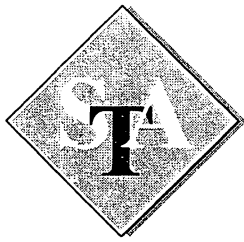
Registration

0700 - 1400 Emerald Ballroom

Technology Showcase and Poster Area Open

0700 - 0800 Emerald Ballroom

Continental Breakfast in Technology Showcase Area



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## **Friday, January 18, 2008, continued**

0800 - 0915 Crystal Ballroom

Keynote Speaker – William Hersh, MD

Oregon Health & Science University

**Think Globally, Act Locally: The National Health Information Infrastructure**

Goal/Objectives – To provide an overview of the motivations and major activities in electronic health records and health information exchange in regions, states, and nationally. To describe the barriers to them and how they may be overcome.

0915 - 1030 Crystal Ballroom

**National Health Information Network** – Update on Plug n play, data dictionary Task Force

**National Technology Agendas:** Moderator: M. Jopling

**Update on Interoperability Healthcare Initiatives**

Julian Goldman, MD, Massachusetts General Hospital, Boston, Massachusetts

**Terminology? Ontology? Dictionary? Or, "What's in a name?"**

Steven Dain, MD, FRCPC, University of Western Ontario,  
London, Ontario, Canada

Goals/Objectives – This presentation will: List the alphabet soup of Standards Development Organizations relevant to anesthesia and critical care; Help students appreciate the need for standardized terminologies; Identify recent developments on standardized vocabularies for medicine and anesthesiology; Discuss the application of standardized ontologies to Anesthesia Information Systems

**Turning Clinical Requirements into Usable Technology**

Rick Cnossen, Technical working Group Chair, Continua Health Alliance, manager, Medical Device Interoperability Standards, Digital Health Group, Intel Corporation, Hillsboro Oregon

1030 - 1100 Emerald Ballroom

Break - Technology Showcase and Poster Viewing



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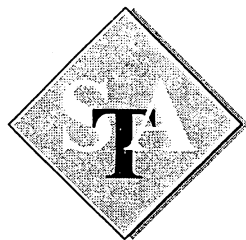
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## Friday, January 18, 2008, continued

1100 - 1230	Crystal Ballroom	<b>Airway Technology : Seeing is Believing</b> – Moderator: D. John Doyle  <b>Airway Management – The Impact of Technology on our Algorithms</b> Richard M. Cooper, MD, FRCPC, Toronto General Hospital, Toronto, Ontario, Canada  Goals/Objectives – This presentation will: demonstrate how topical anesthesia and light delivery systems enabled the development of direct laryngoscopy; demonstrate the limitations of direct (line-of-sight) laryngoscopy and how current airway management algorithms remain rooted in this technology; argue that our existing definitions of airway problems contribute to our failure to capitalize on newer technologies  <b>Advanced Imaging of the Respiratory System</b> David Holmes, MD, Mayo Clinic, Rochester, MN  Goals/Objectives – This talk will describe advances in biomedical imaging technology and image analysis, illustrate applications to the cardiopulmonary system; predict future advances extrapolated from current leading edge research; discuss issues with effective translation from advanced research to clinical practice  <b>The New World of Video Laryngoscopy</b> – D. John Doyle, Cleveland Clinic Foundation, Cleveland, Ohio
1230 - 1330	TBD	<b>Annual Business meeting luncheon and Gravenstein award</b> Presiding – Mike Jopling, STA President  <b>Gravenstein Award Winner</b> <b>Dwayne R. Westenskow, PhD</b> <b>University of Utah, Salt Lake City, Utah</b>
1330	Off Site	Educational Activities: USS Midway and Harbor Tour, Balboa Park, Dinner in Old Town
1330 – 1400	Emerald Ballroom	Technology Showcase

## Saturday, January 19, 2008

0630 - 0800	<del>Open</del> Room	STA Board of Director's Meeting #2
0700 - 1300	Emerald Foyer	Registration
0700 – 1100	Emerald Ballroom	Technology Showcase and Poster Area Open
0700 - 0800	Emerald Ballroom	Continental Breakfast in Technology Showcase Area



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## Saturday, January 19, 2008, continued

0800 - 1000

Diamond Rooms

**AIMS: Panel - Moderator Mohamed Rehman**

### **Change of AIMS structure in the last decade**

Mohamed Rehman, MD, Children's Hospital of Philadelphia, Philadelphia, PA

### **Improving compliance and safety**

Michael O'Reilly, MD, University of Michigan Medical Center,  
Ann Arbor, Michigan

### **Pay for performance and improving revenues using AIMS**

David Reich, MD, Mount Sinai School of Medicine, New York, New York

Goal/Objectives: The learner will understand: the impact of the Surgical Care Improvement Program and Physician Quality Reporting initiatives on the practice of anesthesiology; The means by which AIMS can facilitate compliance with pay-for-performance measures; the means of implementing a professional charges electronic voucher from an AIMS system.

### **Improving productivity using AIMS**

Franklin Dexter, MD, PhD, University of Iowa, Iowa City, Iowa

Goals/Objectives: The principal way that an AIMS can be used to increase productivity is as a source of data to choose the hours into which cases of each specialty are scheduled. This is a source of data not much different from an OR information system, but including all anesthetizing locations. The second strongest way for an AIMS to increase anesthesia productivity is to guide afternoon and weekend staff scheduling. The third, but weakest, way for an AIMS to increase productivity is by guiding decision-making on the day of surgery.

1000 - 1030

Emerald Ballroom

Break, Research Poster Viewing and Technology Showcase

1030 - 1130

AIMS Breakout Sessions

Diamond 1

**Quality Assurance:** Michael O'Reilly and Jeff Feldman

Diamond 2

**Improving Productivity and Scheduling:** Frank Dexter and Richard Epstein

Topaz Room

**Improving Bill Capture:** David Reich and Michael Vigoda

Opal Room

**Improving Functionality and Usability of Today's AIMS Systems:**  
David Feinstein and Butch Loeb

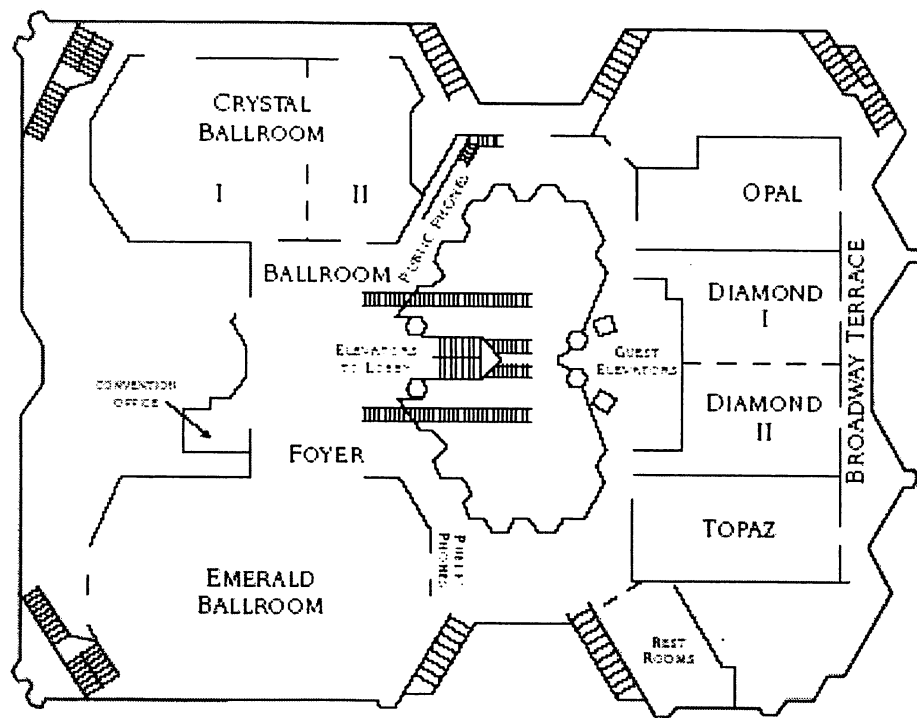
11:30 - 12:30

Diamond Rooms

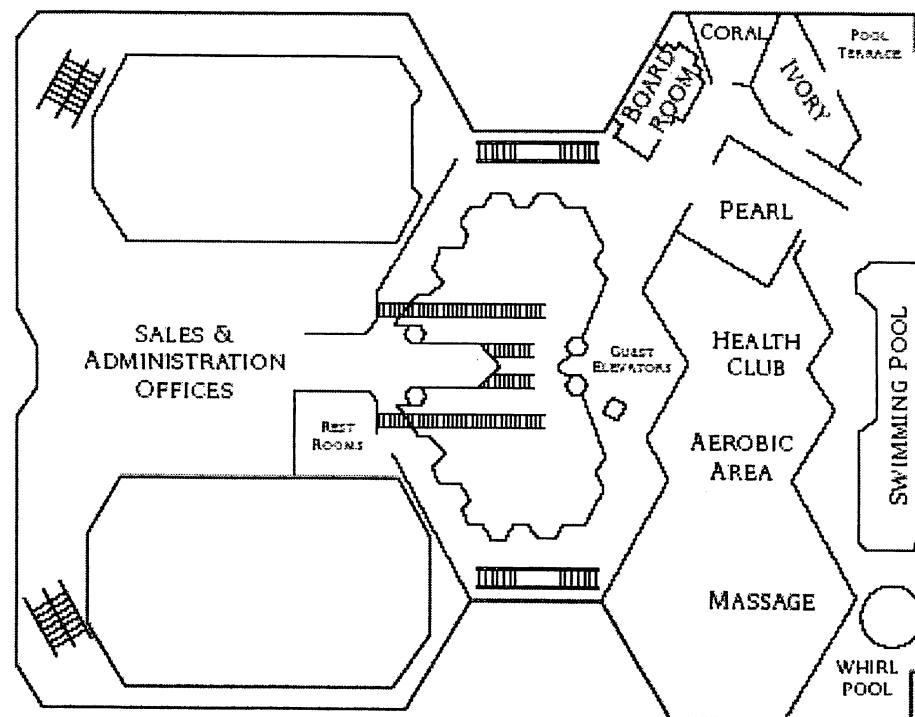
**AIMS Breakout Groups' Presentations - Moderator Mohamed Rehman**

1230

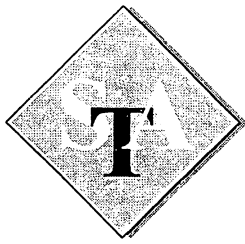
STA Meeting adjournment



SECOND FLOOR



THIRD FLOOR



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### Offsite Educational Activities

**Our contract with Arrangements Unlimited requires a minimum registration.**

**Registration will be conducted on site.**

#### **Harbor Tour and the USS Midway**

**1:30-5:30 PM • Cost: \$65.00**

Board the impressive 1001 foot USS Midway. On Saturday morning, January 10, 2004, the majestic Midway made her final journey from North Island Naval Station, across the bay to her final berth at the Navy Pier. Commissioned in 1945 she served proudly until 1992 during the Korean War, Vietnam and the Persian Gulf. She inspired all who served on her and now her "Midway Magic" will continue to inspire visitors from around the country and the world and chronicle the achievements and sacrifices of those who defended our nation.

#### **Onboard Simulators available!**

Strike Fighter 360 Now Open! – Two people enter the simulator for a 2-minute pulse-pounding aerial combat ride where you control all the action! Strike Fighter 360 pilots can roll, somersault, spin and skyloop as they fly missions! Fly today in these brand new state-of-the-art simulators! Additional \$8 per rider paid onsite, flights are on a first come, first served basis. Open 10:00 AM – 4:45 PM daily.

Mach Combat: Stationary flight simulator. Options include going head to head against the enemy or landing on the USS Constellation, a decommissioned aircraft carrier. Additional \$25 for single ride; \$30 for double riders paid onsite on a first come, first served basis.

Motion Simulator: Groups enter the simulator for an exhilarating experience akin to the thousands of naval aviators who flew off Midway. Additional \$6 per rider (can hold up to 13 riders) paid onsite.

While on your one hour Harbor Tour enjoy panoramic views of the San Diego city skyline and see modern US Naval vessels, the historic and majestic Star of India, bustling shipyards the spectacular Coronado Bay Bridge, awesome aircraft carriers, glamorous yachts and so much more.

#### **Balboa Park**

**1:30-5:30 PM • Cost: \$74.00**

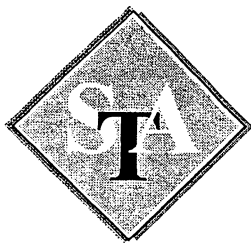
Come join us for a fun-filled day of arts and culture! Balboa Park has it all...whether you fancy folk art and fossils, or are crazy about planes, trains, and automobiles, beautiful masterpieces and well-preserved mummies, all await you in the largest cultural museum complex west of the Mississippi. You'll also find great mementos at Balboa Park's museum shops. Guests will receive a passport good for admission to up to four museums.

#### **Dinner in Old Town**

**6:30-10:30 PM • Cost: \$85.00**

Your fiesta tonight is at Casa Guadalajara. This spectacular Mexican restaurant is a welcoming landmark for Old Town San Diego, capturing the "Spirit of Mexico" at its best. The ambiance of Casa Guadalajara is reminiscent of a gracious hacienda deep in Mexico. Guests will dine on award winning regional Mexican cuisine.

Fun, festive and delicious food is what Casa Guadalajara is all about. Nestled in Old Town, this beautiful hacienda with a floral covered courtyard with a decorative fountain is a picturesque location to have a group dinner.



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**The following invited speakers have voluntarily acknowledged the below disclosure information:**

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Consultant - Verathon Medical, Inc.

Stock Shareholder - Verathon Medical, Inc.

Other Financial Support - Travel Expenses

Jeff Feldman, MD, MSE

Honorarium - Draeger Medical

Michael O'Reilley, MD

Consultant, GE Healthcare

Stock Shareholder - Docusys

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Other Financial Support - Masimo Corporation

Ira Rampil, MD

Grants/Research - Hospira, GE Healthcare

Consultant, Astra-Zeneca, Hospira, GE Healthcare

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**The following invited speakers have disclosed that they have no actual or potential relationship(s) that have bearing on the subject matter of this activity:**

Charlotte Bell, MD

Steven Dain, MD, FRCPC

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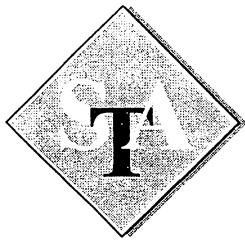
Harvey Kirk, AIA

Robert Loeb, MD

David Reich, MD

Anthony Sestokas, PhD, DABM, FASN

Michael Zigoda, MD, MBA



# Society for Technology in Anesthesia

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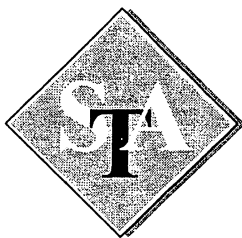
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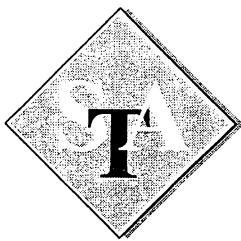
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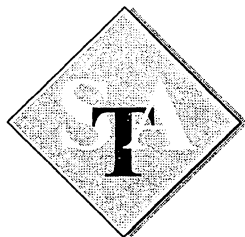
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## STA 2008

### Select Lecture Summaries

Richard Cooper, MD, FRCPC

**Airway Technology : Seeing is believing – Past, Present and Future:** This presentation will demonstrate how topical anesthesia & light delivery systems enabled the development of direct laryngoscopy. The presentation will demonstrate the limitations of direct (line-of- sight) laryngoscopy& how current airway management algorithms remain rooted in this technology. The presentation will argue that our existing definitions of airway problems contribute to our failure to capitalize on newer technologies.

Steven Dain, MD, FRCPC

**International Technology Agenda- Terminology? Ontology? Dictionary? Or, What' in a Name?:** List the alphabet soup of Standards Development Organizations relevant to anesthesia and critical Care.

Appreciate the need for standardized terminologies.

Identify recent developments on standardized vocabularies for medicine and anesthesiology.

Application of standardized ontologies to Anesthesia Information Systems

William Hersh, MD

**Think Globally, Act Locally: The National Health Information:** Provide an overview of the motivations and major activities in electronic health records & health information exchange in regions, states, & nationally. Describe the barriers to them & how they may be overcome.

Harvey Kirk, AIA

**State of the Art OR Design:** To convey to the audience a sense of the structure and function of the contemporary operating room design issues.

David Reich, MD

**Pay for performance and improving revenues using AIMS:** The learner will understand:

1. The impact of the surgical Care Improvement Program & Physician Quality Reporting Initiatives on the practice of anesthesiology.
2. The means by which AIMS can facilitate compliance with pay-for-performance measures.
3. The means of implementing a professional charges electronic voucher from an AIMS system.

Anthony Sestokas, PhD, DABM, FASN

**Technology of Monitoring the Brain and Spine: Sleep and Oxygenation:**

1. Review current technologies for intraoperative monitoring of spinal cord function.
2. Discuss anesthesia considerations for optimal assessment of spinal cord function

# Is Direct Laryngoscopy Obsolete?

Richard M. Cooper B.Sc. M.Sc. M.D. FRCPC<sup>a,b</sup>

Interestingly, the father of laryngology, Manuel Garcia (1805-1906) was neither an anesthesiologist nor an otolaryngologist.<sup>1</sup> He was an opera instructor intrigued by the larynx, a seemingly simple organ capable of producing a rich range of sounds. Not only are these short bands of tissue occasionally able to produce extraordinarily beautiful music, they are the principal means by which we communicate. Many people including teachers, religious leaders, entertainers and alas politicians and lawyers depend upon the larynx for their livelihood. Even minor laryngeal injuries to them can result in significant disability. The vocal cords are even more densely innervated than the muscles responsible for facial expression.<sup>2</sup> Moods and attitudes are conveyed through extraordinarily subtle alterations in voice as evidenced by our ability to communicate with infants and domesticated animals even when our words have no meaning. The larynx is a deceptively complex instrument that we can better understand using stroboscopic instruments that allow synchronization of light and vocal fold frequencies. Slight variations in vocal fold tension produce sound when tracheal air, under pressure, is presented to them. To produce quality and variable sound, their mucosal surfaces, particularly their edges, should be smooth, pliable, elastic, capable of close apposition, and very precise adjustments of tension. These folds produce the sound; the pharynx, oral cavity and nose serve as a resonating chamber. As laryngoscopists, it is important for us to make every effort to perform our tasks with the greatest of respect for so sensitive and vital a structure.

Yet consider how we achieve our airway objectives? We open the mouth widely, extend the neck, insert cold steel between the teeth, apply upward force, distracting and compressing the tongue, elevating the mandible, applying tension to the delicate tonsillar pillars, engaging the vallecula or epiglottis and hoisting it skyward in an effort to visualize a structure that evolution has concealed for our own protection. Each one of these maneuvers is capable of resulting in injury. And each may fail to achieve its objective. If we are only partially successful, we may introduce an endotracheal tube (ETT) without having completely visualized the target.

Prior to the introduction of the LMA, airway management hadn't changed very much since Janeway performed tracheal cannulation in 1913. We have continued to use the same crude line-of-sight laryngoscopes Miller and Macintosh patented in 1941 and 1942 respectively. These devices are inexpensive, pervasive and difficult to learn. To some extent, this expertise helps define our specialty. Yet we know that even in the best of hands, there are patients with anatomical characteristics that do not favor successful glottic visualization. Furthermore, we know that there is an irreducible number of patients, perhaps 8.5-10.1%<sup>3,4</sup> in whom a laryngeal view cannot be obtained. In routine surgery, minor and moderate-major difficulties were encountered in 37 and 8% respectively of attempted intubations employing direct laryngoscopy (DL).<sup>5</sup> So far, our attempts at finding an intubating position that achieves alignment of the "anatomical axes" has yielded the flexion/extension (sniffing), neutral, simple extension and flexion/flexion positions.<sup>6,7</sup> It would appear that we've exhausted the combinations but have yet to find a position that achieves the objective.

To date, our focus has been on serious injuries and catastrophes associated with intubation.<sup>8-10</sup> These include failed or delayed intubations, esophageal, cervical, dental, laryngeal and tracheal injuries, mediastinitis, persistent or profound hypoxia, aspiration, brain injury and death. And we know that poor or failed glottic exposure is associated with multiple attempts at laryngoscopy,<sup>4</sup> hypoxemia, hypercapnia, hypertension, unanticipated ICU admission and injuries to the teeth, trachea and esophagus<sup>11</sup> as well as cardiac arrest and death.<sup>12</sup>

There are an increasing number of alternatives to intubation (e.g. face-mask and a vast array of supraglottic airway devices). Likewise, there are numerous ways of intubating not requiring DL. Some of these are blind techniques (eg. digital intubation, ferromagnetic, lightwand, supraglottic conduits, blind nasal) and some are visual (bronchoscopic- or lightwand-assisted via LMA). Up to now, our gold standard for managing the anticipated DA has been flexible bronchoscopic intubation (FBI). In skilled hands, this remains the best, and occasionally the only approach likely to succeed. Flexible bronchoscopes were designed for versatility, not specifically for intubation. They can be used to place endobronchial tubes and blockers, look through tracheostomies, for diagnostic procedures like bronchoalveolar lavage and biopsies. Their complexity also makes them expensive, complex and fragile. But let's look at another aspect of FBI. Assuming that we are able to direct the bronchoscope into the trachea, it is not uncommon to encounter difficulty advancing the ETT over the bronchoscope.<sup>13</sup> In fact, in the awake, spontaneously breathing patient, this is often the most challenging—and for the patient, the most irritating—part of intubation. Johnson et al. demonstrated that in 48 awake adults with either known difficult airways or cervical spine injuries, the ETT impinged upon the right arytenoid (42%) or the interarytenoid soft

tissues (11%), often requiring multiple attempts with ETT rotation. Others have reported an even higher incidence of such difficulties (40-90%).<sup>13</sup> FBI involves visually-directed placement of the bronchoscope; thereafter, the bronchoscope functions much like a gum elastic bougie. Maktabi et al. described three patients who underwent FBI and suffered glottic injuries including vocal cord bruising, extensive supraglottic swelling and a very large pharyngeal hematoma.<sup>14</sup> Clearly, such injuries are better than hypoxia, brain injury or death, but perhaps such injuries can be reduced if we can achieve glottic visualization, even in those challenging patients, observing ETT placement and advancement. Perhaps, newer purpose-specific fiberoptic stylets and laryngoscopes or videolaryngoscopes will enable us to accomplish this.

The ASA Closed Claims Analysis found that only 17 of 87 intubation-associated laryngeal injuries were associated with “difficult intubations.”<sup>8</sup> Other studies lead to the conclusion that most laryngeal injuries are unrelated to the duration of intubation. Either we don’t know what “difficult intubation” means or intubation, as conventionally performed is problematic.<sup>14</sup> Mencke and co-workers randomized 80 adults with *normal airways* to intubation with or without a neuromuscular blocker. They found that the NMB was associated with better intubating conditions, a lower incidence of sore throat and fewer “vocal cord sequelae” (hematoma, mucosal thickening and granuloma) as determined by videolaryngostroboscopy.<sup>15</sup> Such complications were more common among patients in whom intubating conditions were less favorable. Postoperative hoarseness can be quite persistent but rarely comes to our attention. When either severe or persistent, it can be quite disruptive to our patients.

Laryngeal edema may be a consequence of placing a round tube through a triangular opening. This is consistent with the observation of Tanaka et al.<sup>16</sup> who measured laryngeal resistance before and after anesthesia administered via either ETT or LMA. They also performed endoscopic comparisons of the vocal cords of the two groups. They found higher laryngeal resistance and evidence of vocal cord swelling in the patients who had been intubated, though none of these intubations had been. Is this a condemnation of the ETT *per se*, rather than the ease of its insertion?

If we regard postoperative hoarseness or “vocal cord sequelae” as complications of airway management, it provides incentive for us to refine our techniques. Is it not incumbent upon us to identify the causes of such injuries and to strive to reduce or eliminate these complications? Should the lack of postoperative hoarseness become a new quality indicator?

As discussed above, FBI essentially involves the blind manipulation and advancement of the ETT over a flexible stylet. Especially with a “difficult airway, when we are successful, we expect the patient to be grateful for our talents despite the discomfort they may experience. While glottic injury has been reported, it appears to be rare—but could this be because we haven’t looked for it? (Heidegger has recently demonstrated that when experienced operators performed FBI in 270 adults unconscious adults with *normal airways*, there was no increase in vocal cord sequelae compared with DL and NMB.<sup>17,18</sup>) It seems logical that visualized placement and advancement of the ETT is likely to result in less laryngeal injury. DL has been our standard method of achieving this. Unfortunately, we must acknowledge that even in the best of hands, DL fails to reveal the glottis in a significant number of cases. Furthermore, we are not particularly good at predicting the patients in whom DL is likely to fail. It’s time to correct our terminology—laryngoscopy that doesn’t reveal the larynx is not difficult laryngoscopy, *it is failed laryngoscopy*.<sup>19</sup> Our airway assessment tools have been calibrated specifically for DL; and faulty though they are for DL, they likely have limited relevance to techniques other than DL.

In their classic paper, reiterated in a recent editorial, Cormack and Lehane recommended the use of the “Oxford introducer” in situations when the epiglottis but not the larynx could be seen.<sup>20,21</sup> This device is now generally known as an Eschmann Introducer (or gum elastic bougie, GEB). In fact, they estimated that such a view occurs in 1/2000 obstetrical airways, a figure that seems to be much lower than other studies. Combes et al.<sup>22</sup> prospectively evaluated a strategy that employed the GEB after two unsuccessful attempts at intubation by DL. One hundred patients out of 11,257 (0.9%) adult patients, unexpectedly could not be intubated and a GEB was used in 89. This was successful in 80/89 but required two or more (blind) attempts in half these cases. Undoubtedly, this low-tech approach is partly responsible for the popularity of this technique, but we have to question whether a blind 90% solution (“successful” on the first attempt in only 41% of patients) is an admirable strategy?

Rigid fiberoptic laryngoscopes (eg. WuScope [Achi Wu], Bullard [Gyrus ACMI], Upsherscope Ultra [Mercury Medical]) have been on the market for nearly two decades. They have their champions, able to demonstrate the utility of these devices in the management of many patients with difficult airways.<sup>23,24</sup> None is dependent upon a line-of-sight and all provide high quality laryngeal exposure with very limited tissue distraction or compression. Each device is compatible with standard video equipment enabling the display and/or recording of the laryngoscopy and intubation. Furthermore, each device positions the operator's eye, centimeters proximal to the larynx offering a view of ETT placement and advancement through the vocal cords. They were developed specifically for laryngoscopy and intubation and lack the versatility of the flexible bronchoscope. The fiberoptic channels are protected within a rigid scope and are therefore resistant to damage. Compared with flexible bronchoscopes, the acquisition and maintenance costs are low. Why then, do they enjoy such limited popularity?<sup>25,26</sup> Despite their utility, they have significant learning curves—though probably less than that required for either DL or FBI—but lack a sufficient cadre of committed enthusiasts. Unfortunately, even the manufacturers and distributors lack the commitment to support these products.

Several promising devices have recently become available,<sup>23</sup> including though not limited to the EVO/Viewmax [Truphatek], Videomacintosh [Storz], GlideScope® [Verathon], McGrath [McGrath Aircraft Medical/LMA NA] the Airtraq [Prodol, King Systems Corp, USA] and the Pentax-AWS among others. These devices make use of prisms, telescopes or CMOS technology to look around the anatomical corners. EVO employs an inexpensive telescope angled at approximately 45 degrees; the Videomacintosh uses a fiberoptic bundle coupled to an internal videocamera, directed approximately 25 degrees from the line-of-sight; the GlideScope (GVL) consists of embedded LEDs to provide a light source and non-fogging colour CMOS camera aligned at 60 degrees from the line-of-sight; the McGrath has a sliding (one-size-fits-all), disposable blade and a small, LCD panel attached to the handle; the Airtraq is a prism-based disposable device with an LED light source and a tube-slot for the ETT. These devices are all relatively easy to use. Some have been more thoroughly investigated than others, with manikins, normal and challenging airways. A comprehensive review of these devices is beyond the scope of this presentation. At the present time—and bearing in mind, the author's disclosure—the GVL has been the most thoroughly tested. An early multi-centered study among largely anesthesiologists with limited GVL experience yielded 99% Cormack-Lehane I or II views and 96.4% intubation success.<sup>27</sup> More recent studies involving anesthesiologists with formal GVL training, yielded laryngeal views that were always equal to or better than direct laryngoscopy. An example of this is a recent study reported from Vienna.<sup>28</sup> (<http://www.ijam.at/volume04/clinicalinvestigation01/default.htm>) Krasser et al. first performed DL and then GVL and attempted intubation on 442 patients with a selection bias favoring difficult DL. All GVL intubations were successful, 437 on the first attempt. Laryngeal exposure was achieved using GVL in every patient despite not being able to accomplish this in 102/442 patients using DL.

Another exciting approach involves the co-application of more than one device to achieve intubation. The recently introduced LMA C-Trach® and the intubating LMA (Fastrach®) in combination with a lightwand<sup>29</sup> or FBI are examples of this. Doyle has described the GVL to facilitate instruction of FBI since it enables the mentor to see precisely where the bronchoscope is placed.<sup>30</sup> Used thusly, the GVL also provides tongue retraction, directs the placement of the FBI and most importantly, enables the operator to observe the insertion and advancement of the ETT through the glottis. Levitan has recently modified the Shikani Seeing Optical Stylet (Clarus, Minneapolis MN), and proposes that this be used in conjunction with a DL, GVL, McGrath or other such device. Laryngoscopy is performed using a laryngoscope and an ETT, loaded onto a Levitanscope (LS) is introduced under the epiglottis. The operator then diverts his attention from the laryngoscope to the eyepiece of the LS, observing the insertion and advancement of the ETT. (<http://clarus-medical.com/airway-management/Documents/LevintanClientSheet.pdf>)

DL is a legacy technique. It was introduced at a time when the alternatives were a facemask or surgical airway. We are now have a wealth of supraglottic airway devices and are able to safely avoid intubation in a significant number of patients. But when intubation is deemed appropriate, fiberoptic and video-technology can generally provide a laryngeal view, even in patients in whom this was previously presumed to be difficult or impossible. Our current airway assessment is predicated on mask ventilation and DL. Difficult mask ventilation no longer means difficult ventilation. An airway predicted to be difficult has little relevance when techniques other than DL are employed. The terms “difficult laryngoscopy” and “difficult tracheal intubation” require new definitions if we are to advance airway management and exploit the new technologies.



To summarize the advantages of these new techniques over DL:

- The high upfront costs of videolaryngoscopes may be offset by predictable operating costs. Compared with FBI, they are robust and more resistant to damage.
- Fiberoptic and videolaryngoscopes produce a higher proportion of successful laryngeal visualizations than DL.
- Laryngoscopy that fails to reveal the larynx is failed laryngoscopy.
- Intubation that succeeds despite failed visualization is a near miss.
- When DL fails, we try harder. More forceful elevation and multiple attempts are associated with greater morbidity and mortality.
- Many of the newer techniques are easy to learn and can be easily introduced into our practice. This is more applicable to videolaryngoscopy than rigid fiberoptic laryngoscopy.
- Ideally, the technique should be suitable in challenging settings (blood, secretions, rapid sequence intubation, poor oxygenation, awake patient) and resistant to fogging.
- Old airway management was about getting the tube in. New airway management is about achieving this with minimal discomfort and post-operative vocal morbidity.
- We should not reserve the best methods for only our most difficult patients. They should be offered to all our patients. This will provide our patients with the best care. It will ensure that we gain experience with the techniques we select and an appreciation of their limitations and value.

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# Terminology? Ontology? Dictionary? Or, “What’s in a name?”

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## terminology

- □n. (pl. terminologies) the body of terms used in a subject of study, profession, etc.
- DERIVATIVES terminological adj. terminologically adv. terminologist n.
- ORIGIN C19: from Ger. Terminologie, from med. L. terminus ‘term’.

## ontology

- □n. the branch of metaphysics concerned with the nature of being.
- DERIVATIVES ontological adj. ontologically adv. ontologist n.
- ORIGIN C18: from mod. L. ontologia, from Gk Zn, ont- ‘being’ + -logy.

## metaphysics

- □pl. n. [usu. treated as sing.]
- 1 the branch of philosophy concerned with the first principles of things, including abstract concepts such as being and knowing.
- 2 informal abstract talk; mere theory.
- DERIVATIVES metaphysician n.
- ORIGIN C16: representing med. L. metaphysica (neut. pl.), based on Gk ta meta ta phusika ‘the things after the Physics’, referring to the sequence of Aristotle’s works.

## dictionary

- □n. (pl. dictionaries) a book that lists the words of a language in alphabetical order and gives their meaning, or their equivalent in a different language.
- ORIGIN C16: from med. L. dictionarium (manuale) or dictionarius (liber) ‘manual or book of words’, from L. dictio (see diction).
- From the Oxford English Dictionary

In recent years the development of ontologies—explicit formal specifications of the terms in the domain and relations among them have been moving from the realm of Artificial-Intelligence laboratories to the desktops of domain experts.<sup>2</sup>

An ontology defines a common vocabulary for researchers and clinicians who need to share information in a domain. It includes machine-interpretable definitions of basic concepts in the domain and the relations among them.

There are multiple reasons for constructing a standardized vocabulary:

- To share common understanding of the structure of information among people or software
- To provide a standardized terminology for use in Anesthesia information systems
- To provide a standardized terminology for quality assurance, audits and outcomes research
- To separate domain knowledge from the operational knowledge
- To analyze domain knowledge consistently within individual centres and between centres, nationally and internationally.

The Data Dictionary Task Force (DDTF) was created at the 2000 ASA meeting by the Anesthesia Patient Safety Foundation (APSF) as a result of their workshop on Anesthesia Information Management Systems and their role in outcomes research and data collection. The DDTF, chaired by Dr. Terry Monk, is a multinational multidisciplinary committee represented by anesthesiologists, informaticians and commercial anesthesia information system representatives.

After 2002, the committee allied themselves with SNOMED CT, the clinical terminology division of the College of American Pathologists (CAP). SNOMED CT was one of the most widely used ontologies of clinical medical terms.

SNOMED CT was created in January 2002 by the merger and restructuring of SNOMED RT (Reference Terminology) and the UK National Health Service (NHS) Clinical Terms Version 3 (also known as the Read Codes). SNOMED CT cross maps to such other terminologies as ICD-9-CM, ICD-10, Laboratory LOINC. It supports ANSI, DICOM, HL7, and ISO standards.

In 2003, The National Library of Medicine (NLM), on behalf of the U.S. Department of Health and Human Services, entered into an agreement with College of American Pathologists for a perpetual license for the core SNOMED CT. In 2006, the Canadian Health Infoway<sup>iii</sup>, on behalf of the Canadian government also entered into an agreement to license SNOMED CT.

In April 2007 SNOMED CT was acquired by the International Health Terminology Standards Organisation (IHTSDO<sup>iv</sup>). Its vision<sup>v</sup> is:

- To enhance the health of humankind by facilitating better health information management;
- To contribute to improved delivery of care by clinical and social care professions;
- To facilitate the accurate sharing of clinical and related health information, and the semantic interoperability of health records;

To better reflect the DDTF's international scope, the committee is now known as IOTA, the International Organization for Terminology in Anesthesia and meets at least monthly via telephone and web conference and during international anesthesia meetings.

The goals of IOTA is to model terms for AIMS and provide a standard set of terms with version control available from the web for use internationally. IOTA is using the Protégé-OWL editor is an extension of Protégé that supports the Web Ontology Language (OWL). OWL is the most recent development in standard ontology languages, endorsed by the World Wide Web Consortium<sup>vi</sup>. These terms are submitted on a regular basis for inclusion in SNOMED CT and HL7.

In May 2005 the new HL7 Anesthesia Special Interest Group was formed<sup>vii</sup> with the following vision statement:

"Anesthesiologists and other healthcare professionals involved in peri-operative patient care will use clinical information systems that meet the healthcare needs of patients and which provide timely and accurate information both at the acute point of care and elsewhere."

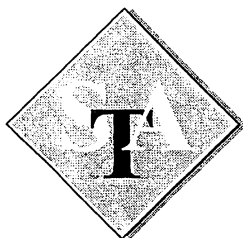
Its mission is to support the overall HL7 mission to create and promote IT standards by defining peri-operative data standards pertinent to anesthesiology that enhance anesthesia and national peri-operative performance measurement.

The IEEE and ISO 11073 working groups are committed to using the IOTA and SNOMED CT terms

Together these initiatives will provide a common tool for data sharing for audit and outcomes research with the end result of reducing error and improving patient safety.

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### **STA 2008**

#### **Poster Timetable & Abstract Presenter Disclosure Information**

##### **Poster Setup:**

Wednesday, January 16

8:00 a.m. - 3:00 p.m.

Thursday, January 17

Before 7:00 a.m.

##### **Authors will be in attendance with their posters during the following times:**

Thursday, January 17

7:00 a.m. - 8:00 a.m.

10:00 a.m. - 10:30 a.m.

2:30 p.m. - 3:00 p.m.

Friday, January 18

7:00 a.m. - 8:00 a.m.

10:30 a.m. - 11:00 a.m.

Saturday, January 19

7:00 a.m. - 8:00 a.m.

10:00 a.m. - 10:30 a.m.

**Poster take down: Saturday, January 19, 12:00 p.m. - 1:00 p.m.**



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## STA 2008

### Presenter Disclosure Information

**The following abstract presenters have voluntarily acknowledged disclosure information:**

Ludwik Fedorko, MD, D.Phil

Equity in Thornhill Research Inc., a UHN spin-off company that Developed Duo Check

John Graybeal, MD

Clinical scientist at Masimo Corporation

David Lain, PhD, FCCP

Employed by Oridion Capnography, Inc.

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Hamilton Medical

**The following abstract presenters have disclosed that they have no actual or potential relationship(s) that have bearing on the subject matter of this activity:**

Renee Blanding, MD

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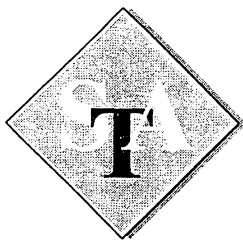
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1	The "best fit" curve for the transesophageal echocardiography short axis left ventricular ejection fraction and radionuclear "gold standard" relationship is curvilinear	Alian, A, MD and Rafferty, T, MD
2	Accuracy of Detecting a Change in the Auditory Heart Rate in a Simulated Operating Room Environment	Eric Chou, Brad Slavin, Simon Ford, Jeremy Daniels, Joanne Lim, J Mark Ansermino
3	The Severinghaus Empirical Relationship And Its Implications For The Stability Of Compartmental Pharmacokinetics	Christopher W Connor, MD PhD, James H Philip, MEE MD
4	Digital Video Recording for the Operating Room	John D. Cooper, MD Renee Blanding, MPH MD
5	Significant decrease of cerebral oxygen saturation during single lung ventilation measured using absolute cerebral oximetry	TM Hemmerling, MD DEAA, MC Bluteau MEng, R Kazan, D Bracco, MD FCCM FMH EDIC
6	The 'Analogscore': a novel score to monitor intraoperative pain and its use for remifentanyl closed-loop application	TM Hemmerling MD DEAA, MSc, S Charabati, B.Eng, E Salhab, MSc, D Bracco MD FCCM FMH EDIC, Pierre A. Mathieu, PhD
7	Unilateral ventilation during gastroesophagectomy detected by absolute cerebral oximetry	TM Hemmerling MD DEAA , R Kazan, MC Bluteau MEng, D Bracco MD FCCM FMH EDIC
8	Inter-hemispheric cerebral saturation differences during thoracic surgery with lateral head positioning	D Bracco, MD FCCM FMH EDIC, MC Bluteau MEng, R Kazan, TM Hemmerling MD DEAA
9	Performance of a novel closed-loop propofol system	S Charabati, B.Eng, B Dubois, D Bracco, MD FCCM FMH EDIC, P. A. Mathieu, PhD, TM Hemmerling, MD DEAA, MSc
10	Smart Alarm Respiratory Analysis (SARA™) Used in Capnography to Reduce Alarms During Spontaneous Breathing	Joshua Colman, MS, Joseph Cohen, BS, David Lain, PhD FCCP
11	Successful Installation of an Anesthesia Information Management System	Robert G. Loeb, MD Catherine Angleton, RN
12	The Impact of Computer Video Games on Predicting Fiber-optic Intubation Skills	M. Molyneux, I. Jenkins





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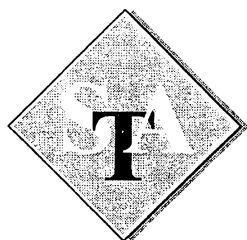
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13	"RAD-57 Rainbow CO-Oximeter in detecting methemoglobin during Upper GI endoscopy – A Case Report"	Udaya B. Padakandla, MD
14	Gas Man Version 4 Advances Inhalation Kinetic Education with Advancing Technology	James Philip MEE, MD Hal Franklin BS
15	Effect of Hypoventilation on Emergence and Reanesthetization after Volatile Anesthesia	Stanley Leeson MB, BCh, FRCA James H Philip MEE, MD
16	Proposal for wireless transmission of non-invasive respiratory data to the servo module of an opioid infusion-pump for real-time patient-safety feedback control	Rafferty, TD, Passik, CS, Fusco, DS
17	Predictive Call Point Allocation Utilizing an Electronic Tracking and Assignment System	Brian Rothman, MD, James Berry, MD, Paul J St. Jacques, MD
18	An Electronic Patient Information Display Can Replace Traditional Handwritten OR Whiteboards	Brian Rothman, MD, Nimesh Patel, MA, Paul J St. Jacques, MD
19	Improved Vigilance with Context Relevant Physiological Monitoring	Jackie Tappan, Jeremy Daniels, Brad Slavin, Joanne Lim, J Mark Ansermino
20	Development of a global standard for anaesthetic workstations	Carl Wallroth PhD, Mark Graber, Alan Green MS, Norman Jones PhD, Helmut Thiemann MS, Gerald Panitz MS, Dave Osborn MEE, Jeremy Sloan MD, Dwayne Westenskow PhD
21	Development of a Standard for Physiologic Closed Loop Controllers in Medical Devices	Carl Wallroth PhD, Julian Goldman MD, Jürgen Manigel PhD, Dave Osborn MEE, Thomas Roellike MD, Sandy Weininger PhD, Dwayne Westenskow PhD
22	Development of standards for emergency anaesthetic workstations	Carl Wallroth PhD, Alan Green MS, Andreas Hirn MD, Norman Jones PhD, Terry Longman MS, Gerald Panitz MS, Dave Osborn MEE, Hansel de Sousa MD, Dwayne Westenskow PhD



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23	Development of a Standard for the Interoperability of Medical Devices	Carl Wallroth PhD, Julian Goldman MD, Jürgen Manigel PhD, Dave Osborn MEE, William Weinstein PhD, Sandy Weininger PhD and Dwayne Westenskow PhD
24	Development of a Standard for Reducing Use Errors with Medical Devices	Carl Wallroth PhD, Peter Carstensen BME, Dave Osborn MEE, Gerald Panitz MS, Charles Sidebottom PE, Matthew B Weinger MD, Michael Wiklund MS, Dwayne Westenskow PhD
25	Benefits of a Cooperative Effort by the Departments of Anesthesiology and Obstetrics and Gynecology to Replace a Hand Written Delivery Log with an Electronic Solution	Erik Eckman, B.S., Kelly W. Smith, M.D., Kevin Wethington, M.D., Nathan L. Pace, M.D., M.Stat.
26	An Experimentally-derived Mathematical Model of Patient Controlled Sedation	Mandel (?)
27	Monitoring to Improve Ventilation Safety During Sedation and Analgesia	Jonathan B. Waugh PhD, Yulia Khodneva MD, Chad A. Epps MD
28	CVI Predicts Intraoperative Somatic Responses Better Than Heart Rate	Chandran V. Seshagiri, PhD, Chuck Smith, BSEE, and Scott D. Greenwald, PhD
29	A method for producing predictable transitions in response probability for mixed-effect models of propofol/remifentanyl using single-syringe infusion	Jeff E Mandel MD MS
30	Improving Patient State Identification with Integrated Graphic Data Presentation	Robert Albert; Noah Syroid; James Agutter; Dwayne Westenskow
31	Clinical evaluation of JCAHO compliant OR point-of-care medication labeling method	Ludwik Fedorko, Joseph Fisher, Esther Fung, Rita Katznelson



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32	Research in the simulated OR: working within constraints to create the illusion of control	S. Jenkins, MBBS, FANZCA, D. Liu, BEng(Hons), T. Leane, RN, GDPH, GDNursSci, P.M. Sanderson, PhD, FASSA
33	Interruptions, distractions and situation awareness in advanced display studies	D. Liu, BEng(Hons), T. Grundgeiger, DiplPsych, P.M. Sanderson, PhD, FASSA, T. Leane, RN, GDPH, GDNursSci, S. Jenkins, MBBS, FANZCA
34	Simulator evaluation of head-mounted displays for patient monitoring	D. Liu, BEng(Hons), S. Jenkins, MBBS, FANZCA, P.M. Sanderson, PhD, FASSA, T. Leane, RN, GDPH, GDNursSci, M.O. Watson, PhD, W.J. Russell, MBBS, DIC, FANZCA, FRCA
35	Auditory Masking Potential of Common Operating Room Sounds: A Psychoacoustic Analysis	Omair Toor, DO, Ryan Twilley, BS, Richard McNeer, M.D., PhD
36	Negative pressure applied to the forearm with a tourniquet produces greater venous dilatation than a tourniquet alone	Gary Lau I, Vivek Kulkarni, Clifford Schmiesing, E John Harris Jr and John Brock-Utne I
37	Pleth Variability Index is Independent from Perfusion Index Absolute Value	Maxime Cannesson MD, Julia Reckers MD, Christoph Fink, Olivier Desebbel, John Graybeal, Angela Grünhagen, Jean-Jacques Lhot MD PhD
38	Internet Use on Computers Used as Anesthesia Information Management Systems (AIMS)	Sina Shah-Hosseini, MSE, Omar Viswanath, Jonathan Beus, BS, Travis Foster, PhD Jim Scott, BS, Mohamed Rehman, MD
39	Digital Archiving at the Wood Library and Museum	Franklin L. Scamman, MD