THE ASATT SENSOR

Volume 1, Number 1

January, 1991

THE QUARTERLY NEWSLETTER OF THE

AMERICAN SOCIETY OF ANESTHESIA TECHNOLOGISTS AND TECHNICIANS

STA Puts Out Welcome Mat for ASATT

The Society for Technology in Anesthesia (STA) is a recently-formed association of the users and manufacturers of anesthesia technology, who have joined to promote the efficient application and development of that equipment. Its president, N. Ty Smith, MD of the University of California at San Diego, has contributed this introductory article for the ASATT newsletter. - ed.

I was delighted when asked to write a few words for the newsletter for your exciting new society. Many of us have watched with great interest and enthusiasm as the different groups interested in the role of anesthesia technicians and technologists first got together, organized, grew, and finally joined under the banner of one national society. The fact that this whole process took place so rapidly says many things to many people. Most importantly, it says that the role of the anesthesia technician and technologist is important and will become increasingly so for the foreseeable future. The continuing push for safer anesthesia has resulted, among other things, in an increasing emphasis on monitoring. At the same time, patients seem to be sicker and surgery more complex for everyone involved. Traditionally, physicians and nurses have received very little training or continuing education in technology, and the process that selects them almost plays-down technology. Someone has to help with the ever increasing amount of equipment being wheeled into the operating room. And that someone is rapidly becoming the anesthesia technicians and technologists.

Thus, we work together every day in the operating room, helping each other out. By the same token, our societies should work together, with the common goal of improving patient care. We should search for ways to help each other not only in the operating room, but outside of it. This is where our societies come in.

What we can do for each other relates to the fact that we share another important goal - the education of our members in the use of technology in the operating room and intensive care unit. The STA has several approaches to education, and would be delighted to share them with you. Let me describe them briefly, so that you can take advantage of them. First is the *Journal of Clinical Monitoring*, which is the more formal means of communication among those who develop and those who use anesthesia technology. ASATT members are encouraged to contribute to the *Journal*. Guidelines for manuscripts can be found in each issue of the Journal. Manuscripts can be submitted for peer review by sending them to the San Diego office. The second way of communicating is the *STA Newsletter*. The Newsletter is less formal and more rapid than the Journal. It is intended to be provocative, and for those of you who have some pet peeves to share, this is your opportunity. Send submissions to:

continued on page 7

Presidents Message...

by Dennis McMahon

This first formal edition of the ASATT newsletter is our primary means of meeting our goals of communication and education within our ranks. In this and future issues, we will provide brief reviews of current technology, reports on new equipment or techniques, and notices of problems with specific devices. As an organizational letter, it will also provide a forum for individual members to describe their employment setting and typical duties, for regional societies to report recent and future activities, and for news of progress toward the formal training and certification of anesthesia technologists. The newsletter will be published quarterly, in the first weeks of January, April, July, and October.

In our field, a sensor is any device (an electrode, a transducer), by which information is detected and processed to be displayed for the benefit of patient care. The newsletter name, *The Sensor*, aptly describes its role of collecting information from and for the community of anesthesia techs, ultimately for the benefit of patient care. But a newsletter is only as good as the membership it represents, and we we'd like to see an active society reflected in its publication. A small minority should not - and cannot - be the only source of material. If you have any inclination toward writing an article on a pertinent topic, or if you have suggestions on additional features, let's hear from you. It's *your* newsletter.

The holiday season and the weather have conspired against us in meeting

continued on page 4

Types and Uses of Monitors in Anesthesia

by
Alberto Gonzales, Senior Anesthesia Tech.
St. Luke's / Roosevelt Hospital, N.Y.C.

In recent years, we have seen a surge in the number of patients requiring hospital services. As the health care system becomes stressed with budgetary restraints and personnel shortages, there may be a greater tendency for accidents to occur. These can lead to patient injuries, costly financial consequences, and adverse publicity.

A great deal of technology has been developed to insure that patients do not suffer injury when undergoing surgery. In order to guard against adverse consequences for both patients and hospitals, we as anesthesia technicians are responsible for a variety of equipment. Monitoring systems are not meant to be substitutes for the observational skills of anesthesia care-givers, but rather are additional tools to assist these specialists in assessing the physiologic and anesthetic status of the patient. As anesthesia technicians, we should be familiar with the following monitors in our field:

Anesthesia Machine Monitors These are effective in helping the anesthesiologists to measure the concentrations of gases in the patient breathing system, to detect pressure in the system, and indicate the flow with each breath.

Oxygen monitors measure the concentration of oxygen delivered by the machine and to alert the anesthesiologists to any deviation below a minimum level. Any deviation can cause serious problems resulting from hypoxemia. *Flow meters* indicate the amount of gas being delivered with each breath or in each minute, and *pressure monitors* guard against failures due to leaks. Two types of alarm are available in pressure monitors: a low airway pressure alarm and a high pressure alarm. The former allows the clinician to set the unit at a pre-determined pressure level and will aid in detecting problems such as disconnection in the gas line as well as any leaks. The high airway pressure alarm will assist in detecting a blockage in a patient's airway or an obstruction anywhere in the breathing system.

Patient Monitors *Blood pressure monitors* are valuable in monitoring fluctuations in a patient's vascular system. The blood pressure will vary a great deal under anesthesia, depending on the surgery and on his or her general condition. Monitoring the blood pressure can be achieved either by noninvasive or invasive methods. Invasive monitoring provides a distinct advantage over noninvasive methods when second-to-second fluctuations must be monitored. Usually, a catheter is placed in a convenient artery to monitor the systemic pressure. A central venous catheter is used to measure pressure in the right heart. This catheter can be attached to a manometer for measuring central venous pressure (CVP). Another catheter called the Swan-Ganz catheter is used to measure pressure in the left heart by means of pulmonary capillary wedge pressures (PCWP). Noninvasive methods usually involve the automatic taking of blood pressure by means of a cuff around a limb which senses small pressure pulses as it is deflated. The *electrocardiogram (ECG)* has been an essential in anesthesia for decades. It detects and displays the small voltages of the heart during each heartbeat, and indicates the patient's pulse and cardiac status. *Pulse oximeters* indicate the oxygenation of the hemoglobin in the patient's blood. They enable anesthesiologists and anesthetists to observe the percentage of hemoglobin in the blood that is carrying oxygen. Any abnormality will cause tissues to starve for lack of oxygen. *Capnometers* measure the concentration of carbon dioxide (CO2) during the patient's respiratory cycle. It is only in recent years that it has become commonplace in the operating rooms. Changes in several aspects of the patient's

continued on page 7

Images...

Regional Seminar at Syracruse, NY
October 6, 1990

L to R: George Mann, Meeting Director & Alberto Gouzales

Ricki Kallish at the ASATT display in the ASA exhibit hall.

ASATT at Las Vegas
October 21, 1990

Peter Chase with opening comments.

L to R: Grace Kelly, Wes Simpson, Jami Blue, Shelley Jones

1990 Officers, L to R: Dennis McMahon, Lee Amorin, John Spaulding, Chris Patterson

The View From... by Brenda Jones

St. JOSEPH'S HOSPITAL

Asheville, North Carolina 28801

St. Joseph's Hospital is a three-hundred thirty-one bed regional medical referral center for western North Carolina, and one of the state's major medical health care facilities. St. Joseph's offers diagnostic, surgical, and acute care for patients within a fifty mile radius of Asheville. The hospital employs approximately thirteen hundred personnel. Our medical staff consists of about three hundred sixty physicians representing every aspect of the medical profession. St. Joseph's is supported by the Sisters of Mercy which is a non-profit organization, and receives no support from outside sources.

St.Joseph's has six major inpatient operating rooms, and an additional two cystoscopy rooms. Our outpatient center is adjacent to the inpatient O.R. It has four rooms and a lithotripsy suite. We have a total of fourteen anesthetizing locations. Each anesthetizing site has an Ohmeda Modulus II Plus anesthesia system.

Our complement of ECG monitors is divided between Physio Control and Siemens models. The 1991 budget will bring in additional Siemens units for standardization of all our ECG monitoring.

The Anesthesia Department employs five anesthesia technicians, including myself as the Anesthesia Coordinator. Our duties vary from preventative maintenance to setting-up for axillary blocks, CVP lines, arterial pressure lines, and Swan-Ganz catheter placements. Each technician is required to be a Jack-of-all-Trades, expected to be able to set-up or assist with any procedure required for anesthesia support, so that the anesthesiologist need only put on a pair of gloves and start the procedure. Each kit is opened and arranged to the physician's preference.

The anesthesia technician staff here are employed by the hospital, but are under the direction of the anesthesiology group, Western North Carolina Anesthesiology, Inc. We feel this is a wonderful arrangement, since the anesthesiologists know how hard we work to achieve a good working anesthesia department. ■

Continuous Sv02

Fred Fetzer, D.O., Staff Anesthesiologist Will Steffek, Anesthesia Technician
The Marshfield Clinic, Marshfield WI

The value of continuous monitoring of the oxygen saturation in critically ill patients has been recognized for many years. However, the development of a simple, reliable, and accurate instrument for this monitoring is relatively recent.

SvO2 is the measurement of the oxygen saturation of the blood within the pulmonary artery. In order to help understand continuous SvO2, we should know a little bit about the basic physiological principles involved. SvO2 accurately reflects the balance between the body's oxygen supply and demand. It does not tell us if the cardiopulmonary system is adequately meeting the oxygen demand of the tissues as defined by the Fick equation:

$$\text{Cardiac Output} = \frac{\text{02 consumption (ml/min)} \times 100}{\text{Arterial 02 content - Venous 02 content}}$$

If we modify the Fick equation to solve for SvO2, we discover that it is dependent on four major factors:

1. SaO2 - the arterial oxygen saturation
   Normal value: 95 - 99%
2. Hb - the hemoglobin content
   Normal value: 13 - 15 gm/dl
3. CO - the cardiac output
   Normal value: 4 - 8 L/min
4. VO2 - the oxygen consumption at the tissues Normal value: 225 - 275 ml/min

The first three of these variables are related to the total oxygen delivery (DO2), which is the volume of oxygen delivered each minute to the tissues.

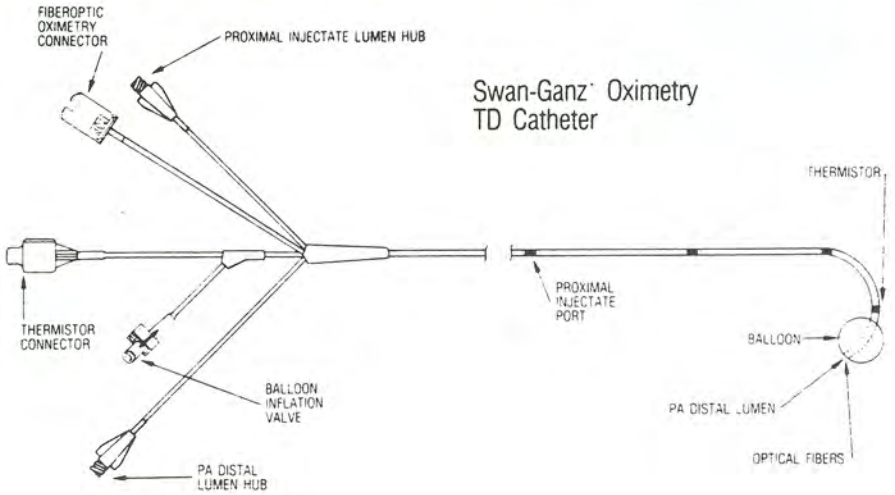
$$DO2 = CO \times SaO2 \times Hb \times 1.34$$

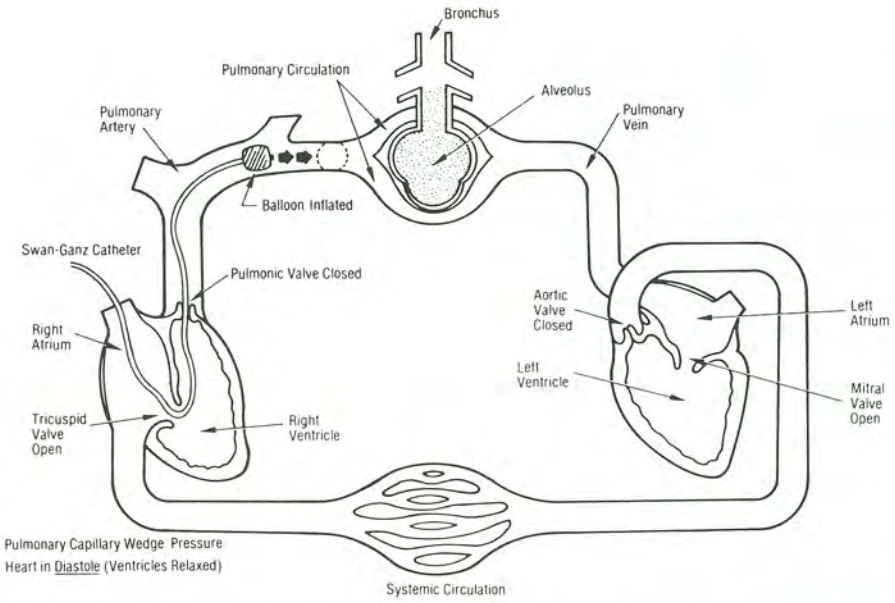
In the resting patient, 900-1000 ml/min is normal. Note that a decrease in any of these first three variables will decrease oxygen delivery to the tissues. The fourth variable, VO2, is oxygen consumption, or how much oxygen the tissues utilize.

If we simplify things, we can think of SvO2 as reflecting the equilibrium between oxygen delivery and oxygen consumption. We all remember from "Reaganomics" the concept of supply and demand. Essentially, this is what SvO2 is telling us. Think of it as a scale: One side is the O2 delivered to the tissues, while the opposite side is the O2 consumed in order to perform cellular function. If the supply is sufficient to meet the demand, then the scale is balanced - SvO2 is normal. From this we can begin to appreciate the tremendous clinical value of monitoring SvO2: it tells us if *tissue perfusion* is adequate. In the final analysis, this is actually the most important factor in hemodynamics. There is one other important factor. In order to keep SvO2 normal (and hence the O2 delivery and consumption in balance), the body has certain compensatory mechanisms in case one of the variables changes. Under normal circumstances, cardiac output is the normal compensatory factor. For example, if the hemoglobin falls (as in anemia), or if the SaO2 falls (as in hypoxia), or the O2 consumption increases (as in exercise), the body will compensate by increasing cardiac output to maintain adequate O2 delivery.

SvO2 is not a newly-discovered phenomena; it has been measured for years in the cardiac cath lab and during cardio-pulmonary bypass. Also, the physiologic principles of SvO2 and O2 delivery and consumption have been known for years. What is relatively new is the development of a catheter that can provide continuous SvO2 measurements. This catheter first became clinically useful in the early 1980's, and it provided two significant advances. First, there is *continuous* rather then intermittent ability of measurement. This is analogous to pulse oximetry which allows for continuous SaO2 monitoring as opposed to the intermittent measurement obtained by arterial blood gases (ABG's) in the clinical laboratory. Second, it allows for the constant bedside monitoring of the patient, not confined to the cath lab, the O.R., or other specific locations.

The Oximetrix Corp. was the first to successfully develop this system. A specialized pulmonary artery catheter is used. Incorporated into this catheter are two small fiberoptic bundles; one carries a red light of three distinctive wavelengths which is emitted at the distal tip of the catheter residing in the vessel. Depending on the oxygen saturation of the hemoglobin, a certain portion of the light is absorbed, while the remainder is reflected off the red blood cells in the pulmonary artery. The reflected light is then picked up by the second fiberoptic bundle and returned to the electronics module connected to the catheter, where this light signal is interpreted as the percent saturation of hemoglobin. In essence, it functions under the same principles as the pulse oximeters that we are familiar with. The difference is that here we are measuring the O2 saturation of mixed venous, not arterial blood. The newer catheters have a





proximal port for central venous pressure (CVP) measurements and cardiac output injections, a distal port with balloon for pulmonary artery wedge pressure measurements, as well as the thermistor used for cardiac output readings.

Now we can take a brief look at specific situations to further appreciate the clinical implications afforded by SvO2. The net result of the four variables defined above produces a normal SvO2 of 60 - 80%. This means that venous blood returning to the heart still contains a relatively large amount of O2, and hence a "safety cushion" is present. Under extreme circumstances, the tissues are capable of extracting O2 down to an SvO2 level of 31%. Suppose you are monitoring a patient and notice a gradual but significant drop in SvO2. What does it mean? Should we do anything? The answer is *Yes!* A markedly abnormal SvO2 indicates that there is inadequate oxygenation at the tissue level. This situation could lead to a downward spiral if not corrected, since inadequate oxygenation will cause anaerobic metabolism which will lead to lactic acidosis and finally death. When SvO2 falls below 60%, this indicates that there is cardiac decompensation because the heart cannot supply sufficient flow to match the O2 demand. Below an SvO2 of 53%, lactic acidosis will occur. Prolonged periods at 32% produces unconsciousness, and 20% SvO2 will result in irreversible cellular damage.

Therefore, the significance of continuous SvO2 monitoring is that it provides for early warning of potentially serious cardio-respiratory problems. In fact, it is one (if not the most) sensitive warning devices of change. Declines in SvO2 will usually appear far earlier than changes in blood pressure or other hemodynamic variables, thereby providing more valuable time to investigate and correct the problem. It is important to recognize that once SvO2 has dropped significantly, immediate action should be taken to diagnose which of the variables is abnormal. This may include cardiac output and vascular resistance determinations, and evaluation for any potential cause of increased oxygen consumption.

Once the diagnosis is established, appropriate therapy and intervention can be initiated. Here another feature of continuous SvO2 is seen, because it allows for constant monitoring of the effectiveness of therapy. It can also frequently reduce the number of additional cardiac output readings, ABG's, or other lab work.

Finally, let us not forget some of the myths and controversies surrounding continuous SvO2 catheter usage. Early on, there were some people who objected to their usage because they provided no
injection port for CVP. However, newly designed catheters provide this feature. Another objection was that there was great inaccuracy in readings. This problem has been confined to those catheters using two wavelengths of light. Catheters on the market today use three wavelengths, which have provided very good correlation and minimal drift. Others have objected to the cost of these catheters. If it can decrease the number of arterial- or mixed-venous blood gases, hemoglobins, or cardiac outputs, it will rapidly pay for itself. With appropriate patient selection, vigilant monitoring, and correct intervention, these catheters are indeed cost-effective. Some claim that the catheters never seem to provide them with useful information. A majority of the time they will reflect normal SvO2 values, but that is what we want for the patient. On the other hand, only a few incidents of decreasing SvO2 will demonstrate its value.

Unfortunately, the catheter can't do it all. It must rely on an individual who understands what the numbers mean and what to do about them. Too often, ignorance of understanding SvO2 prevents more personnel from using it. Thus, when a new technology is introduced, adequate inservicing and orientation are vital. ■

Presidents Message...

continued from page 1

our immediate objectives since the annual meeting last October, but I can report progress being made in three areas:

- *Membership Drive* New ASATT brochures and applications have been printed and distributed to the regional directors for mailing to prospect hospitals and departments. Also, a brief "press release" article has been submitted for publication in two anesthesia specialty newsletters.
- *Liaisons* We have established contacts with representatives of both the ASA and the AANA, and will develop these for our shared benefit. Both organizations have been invited to contribute to our newsletter.
- *Society Management* We are exploring possibilities with several companies for the management of ASATT business (membership roster, renewals, newsletter distribution, etc.) Stay tuned.

TECHNICIAN CROSSWORD

by Dianne Holley

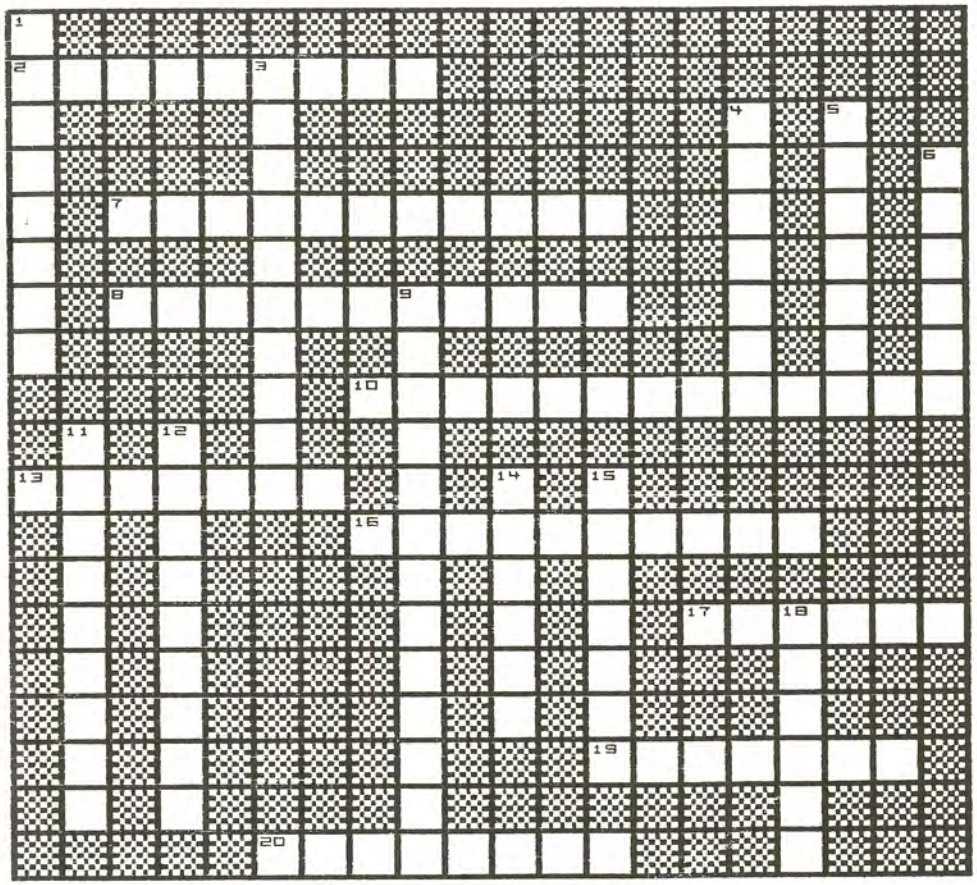
ACROSS:

2. LOCAL ANESTHETIC THAT ALSO SUPPRESSES CARDIAC ARRHYTHMIAS.
7. AN ABNORMALLY FAST HEART BEAT.
8. A "PVC" IS A PREMATURE _____ CONTRACTION.
10. A TEMPORARY MEANS OF VENTILATION DURING AN EMERGENCY CAN BE ACHIEVED BY A _____ CATHETER.
13. A LARGE VESSEL USED FOR EMERGENCY ACCESS TO THE HEART IS THE INTERNAL _____.
16. THE MOST SERIOUS COMPLICATION OF INFUSION THERAPY.
17. THE STANDARD ZERO REFERENCE POINT FOR A TRANSDUCER IS AT THE RIGHT _____.
19. AIR BUBBLES CAN CAUSE _____ OF ARTERIAL WAVEFORMS.
20. BLOOD PRESSURE IS BASED ON CARDIAC OUTPUT AND _____ VASCULAR RESISTANCE.

DOWN:

1. ANALYSIS USED TO DETERMINE ARTERIAL ACID/BASE STATUS.
3. ANY ABNORMAL WAVEFORM SEEN IN THE ECG.
4. TECHNIQUE USED TO MINIMIZE I.V. CATHETER INFECTIONS.
5. I.V. FLUIDS CONTAINING THIS ARE EXCELLENT CULTURE MEDIUMS.
6. FORCEPS USED TO GUIDE ENDOTRACHEAL TUBES INTO THE LARYNX.
9. HEART MEASUREMENT OBTAINED USING A THERMODILUTION CATHETER.
11. USED TO ASSIST IN PASSING A CATHETER IN SOME VASCULAR CATHETERIZATIONS.
12. HEART AND LUNG FUNCTIONS ARE MEASURED BY MEANS OF A _____ ARTERY CATHETER.
14. MAY BE USED IN AN ENDOTRACHEAL TUBE TO ALLOW IT TO BE "MOLDED".
15. PRESSURE EXTERNALLY APPLIED TO FACILITATE ENDOTRACHEAL INTUBATION.
18. A COMMON SITE FOR ARTERIAL CATHETERIZATION IS THE _____ ARTERY.

Reference: *Textbook of Advanced Life Support*, Second Edition
American Heart Association, 1987



Answers to previous puzzle:

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AUSCULTATION    FLUID
   A             U  N
   P          C CELLS
TRANSDUCER    L  L  P
   O          A  C  I
   MASSSPECTROMETER
   E    H    K  L  O
 E T    V       L  M
 ELECTROLYTES    S  E
 G R    L  H     W  T
        T  E INFRARED
 K RADIAL  R       N R
 O      G  M       G
PRESSURE   O      GASES
 O         M       N
 T  OXIMETER       Z
 K         T
DOPPLER   TEMPERATURE
 F         R
 F
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TYPES & USES... *continued from page 1*

condition can affect the exhaled carbon dioxide. Monitoring of capnometry allows more precise control of arterial carbon dioxide.

These are the more commonly-used monitors that we have available in this specialty. As this equipment becomes more widely used and more sophisticated, there will be a need for well-educated technicians with greater knowledge and skills in the application of anesthesia technology. By understanding monitors, we can provide skillful technical support to anesthesiologists and anesthetists. We can contribute to maintaining a high level of patient care and consequently minimize the possibility of adverse medical and financial consequences in our health care system. ■

STA WELCOME ASATT... *continued from page 1*

Jeffrey Feldman, M.D.
333 Cedar St.
New Haven, CT 06510
EMail: Feldman@Yalemed.bitnet

If you wish to remain anonymous, the Devil's Advocate column is a perfect venue. Those who would like to contribute to that column may write to:

Ms. Gerri Kuzava, International Convention and Travel Service
128 E. Court St
Hastings, MI 49058

Still another means of communication is by attending the STA meetings. Our first annual meeting is being held this month, from the 18th through the 20th, at Disney World at Orlando, Florida. This and future meetings will include experts in the design and application of anesthesia technology such as E.C. Pierce, J.S. Gravenstein, Alan Ream, Glen Pelikan, etc. In addition, STA meetings will include numerous scientific presentations and manufacturer exhibits. We have tried to keep the registration fees down, and the nonmember registration includes one year's membership.

These are the approaches for sharing our mutual interests that come to mind. Many of you may have additional ideas; let us know. Any suggestions may be directed either to your regional ASATT director or to me. The STA exists to serve. It can't serve unless we hear your ideas and needs. Again, let us know. ■

Regional Society Activities

Let us know what's happening in your area!

Send a brief report of your recent and future activities to the editor by March 22, 1991.

Photos (black & white, 3x5, captioned on back) are also welcome.

Massachusetts -
The *Northeast Society of Anesthesia Technicians* held a symposium on anesthesia equipment on December 12th, and will be holding meetings monthly in the Boston area. The Society was recently recognized by the Massachusetts Society of Anesthesiologists.
For further information:
Robert Newell at 617-789-3089.

New York -
The *New York State Anesthesia Technology Association* met with an ad hoc committee of the NY State Society of Anesthesiologists last month, and also had an exhibit at the NYPGA in New York City on the 9th. George Mann of SUNY-Syracuse met with the Northeast Society in Boston on the 12th. The NYSATA meets monthly in the Rochester area.
For further information:
George Mann at 315-464-4640.

North Carolina -
A preliminary meeting of anesthesia technicians is planned in February or March in the Raleigh area, to explore the formation of a state/regional society.
For further information: Sonya Scott at 704-324-3699, or Darlene Bolick at 704-324-3287.

Texas -
In mid-December anesthesia techs from several Austin area hospitals formed the *Texas Society of Anesthesia Technology*, and they met on January 12th to discuss their agenda for expanding membership to an increasing proportion of the state. They hope to have all areas of the state represented in time for the annual Texas Society of Anesthesiology meeting next summer.
For further information: Dianne Holley at 512-323-1000, ext 4037.

Ohio -
The *Ohio Society of Anesthesia Technicians & Technologists*, formed just over a year ago, has been meeting monthly in Cleveland. They plan a full-day workshop on Saturday, April 27th, covering topics on infection control, preventative maintenance, and environmental safety.
For further information: Wilma Frisco at 216-541-5710.

Florida -
Preliminary contacts have been made, and the first full meeting of a Florida state association of anesthesia technologists is planned for July, with exhibitor support, in the Orlando area.
For further information: Ed Vasquez at 407-897-1529.

Washington -
The *Northwest Society of Anesthesia Technology* recently changed to quarterly meetings with multiple topics, beginning with their January 26th meeting. A full-day seminar on anesthesia technology is planned for July 27th in Seattle.
For further information: Lee Amorin at 206-223-4189.

Colorado -
The *Colorado Society of Anesthesia Technicians* changed officers last month, and they will resume meetings this coming quarter in Denver. A **Short Course for Anesthesia Technicians** will be held at Breckenridge, January 25-28, sponsored by the University of Colorado School of Medicine.
For further information: Jamie Blue at 303-270-8275.

California -
The *California Association of Anesthesia Technologists and Technicians* held a seminar on ECG monitoring last fall at Santa Clara Valley Hospital, and holds meetings in several localities each quarter.
For further information:
Kathi Morgan at 408-299-6341. ■

American Society of Anesthesia Technologists & Technicians
P.O. Box 22492, San Francisco, CA 94122

MEMBERSHIP APPLICATION

(please print or type)

Last Name _____ First Name _____

Home Address _____

City _____ State/Province _____ Zip/Mail Code _____

Home Phone _____

Employer _____

Address _____

City _____ State/Province _____ Zip/Mail Code _____

Business Phone ( ) _____ FAX Number ( ) _____

May ASATT release your name to other members? ☐ YES ☐ NO

Are you a member of an ASATT-affiliated society? ☐ YES ☐ NO

If so, which society? _____

Membership Categories:

Active	$ 45	_____
Active, Member of Affilated Society	$ 30	_____
Associate*	$ 60	_____
Corporate / Institutional*	$100	_____

*These categories provide all rights and privileges of active membership except holding office, chairing committees, and voting.

MAKE CHECKS PAYABLE TO ASATT

_____ Signature

_____ Date