

# The Golden Age of Clinical Engineering: Digital Convergence and IT Partnerships

By Elliot B. Sloane, Ph.D.

**T**here is no doubt that digital technology is changing the face of health care. But what effect will it have on your career as an engineer or technician?

The following article focuses on the impact of the rapid changes in digital technologies, and may help you make better decisions for yourself.

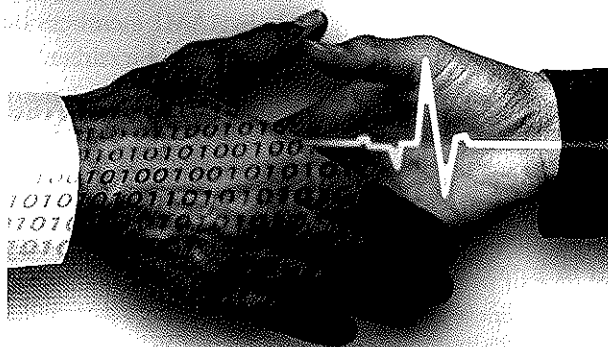
The phrase "digital technology" in this context is intended to include computers, digital signal processors, diverse data communication techniques, information management, patient data acquisition devices, and related technologies.

What follows is a brief perspective of how we got to this stage, a discussion about the changes that are occurring in the industry, and the impact these changes are having on everyone's career decisions. The article also includes two interviews with information technology and clinical engineering executives about their experiences, which highlight some of the common ground and disputed issues.

In addition, the story looks ahead to the AAMI Conference & Expo in June, and the abundant sources of information available at the conference about digital technology.

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## How did we get to this point?

There is so much to discuss about the emergence (finally) of an era of digital convergence for clinical engineering and information technology. The questions addressed in this article, however, are a specific subset: where are we headed, and where do the clinical engineer, biomedical

equipment technician, and information technologist fit in this scheme?

You may be asking yourself "What has precipitated these issues?" Here are 13 technological and social developments that I believe contributed to this emerging reality:

1. High-quality, low-cost digital-to-analog (DAC) and analog-to-digital conversion (ADC) devices,
2. High-quality, low-cost analog transducers, including the video chips used in digital cameras,
3. Low-cost microprocessors and memory chips,
4. Very low-cost communication interface chips,
5. Accepted communication standards for local area networks (LANS), Internet Protocol (IP), and emerging Wireless Application Protocols (WAP),
6. Standardized database management (DBMS) tools that allow efficient and reliable storage of data, text, graphics, video, and sound,
7. Standardizing radiologic image sharing and storage systems (PACS),
8. Widespread legal and technical acceptance of digital signatures,
9. Proven and acceptable methods to encrypt and decrypt data to protect it from prying eyes,
10. Low-cost, reliable computer systems (PC, mid-range, and mainframe) that afford easy, standard user interfaces for recording of business and clinical information,

"No amount of finger pointing is going to undo a patient injury or death. Neither will finger pointing suffice if the business office is shut down by an X-ray being sent to a remote doctor."



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11. Government laws requiring efficient and secure storage and transmission of digital patient information (HIPAA),

12. Widespread public acceptance of personal computers and the World Wide Web for business and family activities, and

13. Continued severe economic pressure that demands the use of systems, technology, and trained employees to reduce labor costs by increasing individual efficiency while also improving quality.

There are probably many more developments that you might choose to add to this list. For me, however, these items form the core catalytic elements that have led us to the rebirth of clinical engineering in the information age.

### Information Technologies in AAMI 2001's Sessions

A glance at this year's AAMI conference schedule shows just how much the above trends have influenced the session topics. The Information Technology track—which I am co-chairing with Bridget A. Moorman, CCE, clinical systems engineer at Kaiser Foundation Hospital—is only one of the forums where these topics will be discussed. For example, Health Insurance Portability and Accountability Act (HIPAA) will be the focus of a daylong training session developed by the American College of Clinical Engineering (ACCE) during the conference. This ACCE Symposium will explore the legal and technical issues surrounding compliance with the new and complex law that will have federal and state ramifications. (For more information about HIPAA and its impact on clinical engineering, flip to the Clinical Engineering Management column in this issue of *BI&T*.) Several other conference tracks tackle the issues

of PACS and LAN/WAP topics in much more detail.

The Information Technology track will also provide clinical engineers and biomedical equipment technicians with education to help them rise to the challenges of this decade. As active health technology practitioners and researchers realize, no single set of courses can possibly answer all of the existing and emerging questions in this field. The topics of the conference sessions were selected and designed to provide new and valuable information to help AAMI members become more effective and successful in their career.

### A Brief Crystal Ball View

Something of a "sea change" certainly seems to be in the air. In November 1998, General Electric Medical Systems announced that it had received federal antitrust clearance to buy Marquette Medical Systems. That added a huge and successful physiologic monitoring suite to GE's substantial imaging and information systems empire.

Then, in July 2000, Siemens Medical Engineering Group announced that Shared Medical Systems had become a wholly owned subsidiary. This added the largest medical billing and patient record information business to Siemens' already burgeoning imaging, physiologic monitoring, and ventilation product portfolio.

Four months later, Royal Philips Electronics agreed to acquire Agilent Technologies' Healthcare Solutions Group. That acquisition, when approved and completed, will allow Philips Medical Systems to add networked physiologic monitoring, home patient care, and automated defibrillator technologies to its prestigious imaging and information technology stable.

What does this all mean? A couple of years ago, GE seemed to be the only company that had a really serious investment in a full portfolio of interconnected, or interconnectable, healthcare products. With their addition of Marquette Systems to their company, they span patient monitoring, radiology, Hospital Information System (HIS), and telecommunication technologies. Now, two of their fierce competitors have made similar moves. Perhaps that is mere coincidence, but I doubt it. That much money would not be changing hands for appearance alone.

Finally, there is the recent celebration for Jeffrey Immelt, 44, president and chief executive officer of GE Medical Systems. Immelt's successful strategy and implementation of GE Medical Systems growth must

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make sense to his boss, the famous Jack Welch. Immelt was just named to be Welch's replacement as GE's president and chairman-elect.

These don't seem likely to be random chaotic events. My conclusion is that the really BIG money is being poured into health care technology once again because of its serious profit potential. It would seem that the pendulum has begun to swing back in favor of medical technology, and, from my vantage point, information technology has provided the catalytic energy for this to occur. The stage is finally set for health care to reap the same types of supply-chain efficiencies that powered more traditional businesses like Dell and Wal-Mart to such profitable growth. (Although I will admit that it seems hard to use "Dell" and "traditional" in the same sentence, its entry into the Dow-Jones Industrial Average speaks for itself. Dell has become the standard of manufacturing performance by which others are measured.)

The changes in medical technology are being leveraged upon information technology, and that has become the hot new area for the clinical engineering community to master. As it turns out, that is neither trivial nor impossible. It does, however, require us to take a hard look at where we are and where we are going. That rationale is the impetus for all of the IT related sessions at this year's conference, and what the rest of this article will begin to address.

### Successful Career Planning and Choices for Clinical Engineers and Biomedical Equipment Technicians: A New Chapter?

On Monday afternoon, June 11, the Information Technology track will take time out from the technical and management discussions at the AAMI conference to examine a very interesting, important, and controversial subject: Where are the career opportunities, challenges, and needs for clinical engineers and biomedical equipment technicians?

Certainly this is not a new question. I know that I have wrestled with it for more than 25 years in my own career, and I have many engineering and technician friends who have done the same. What seems to be new, however, is that this issue has now arrived at the doorstep of most, if not all, of our colleagues. The issue is real, personal, and it cannot be denied or ignored. It seems likely that many or most of us will face decisions in the

next few years that will affect our job performance, income, and our satisfaction.

Therefore, we have assembled a team of senior clinical/biomedical engineering and information technology managers to speak during this panel. The topics they will cover include:

- Who "owns" the information technology responsibilities in hospitals?
- Which careers are going to be better: clinical/biomedical engineering or information technology?
- How can the two activities be successfully managed, and staffed, to meet the needs of the employees, caregivers, and institution management?

As a preview to the panel discussion, I interviewed two industry leaders who are among those scheduled to speak at the conference on June 11: LeDonna Shedor, CIO and director of the MIS Department at Centra Health in Virginia; and Alan Lipschultz, director of clinical engineering at Christiana Care Health Services in Connecticut. Shedor brings to the table the information technology perspective, while Lipschultz offers *BI&T* readers the clinical engineering perspective.

### An Information Technology Perspective

*LaDonna Shedor joined Centra Health in 1991, following the merger of Lynchburg's two community hospitals into a single health care delivery system for the area's quarter million residents. She brought more than 30 years experience in healthcare computing to the task of consolidating services and building a service-oriented organization.*



LaDonna Shedor

**Q:** Please tell us a bit about your health system.

**A:** This system has two primary hospitals and 38 outreach sites. There are 650 licensed beds, but only about

LaDonna Shedor began her professional career in data control, and includes experience in the management of most aspects of technology. After spending 20 years in industry, she joined Centra Health—a major health care provider in central Virginia—in 1991.

During her career, she has led the use of Network Computing to improve services and contain health care costs by using expanded networks to link the extended health care community and cross-organizational teams to undertake technology projects.

450 are actually in use. The system was informally formed by two community hospitals around 20 years ago, but they legally joined only eleven years ago.

**Q:** What is the scope of your department's responsibility?

**A:** We manage all of the central information servers, the networking, and the telephone systems. We are also responsible for setting the strategic direction for IT. At times, it feels like we're "herding chickens," too! We do a lot of custom programming, rather than purchasing turnkey systems. We built our own data model, for example, instead of using one from a company like SMS (now a division of Siemens Medical Systems.) For example, we bought SAS software for data analysis, which allows us to create the reports that we want.

**Q:** What is the source or focus of those tools?

**A:** The Hospital Information System (HIS) is the real impetus for creating and customizing our own software. Because of our location in the community, we have around 85% of the local population in our databases. This is a neat situation, and it allows us to create powerful reports.

**Q:** Do you use a database management system, or have you written your own data management software?

**A:** We have been using IMS as the predominant tool, but we are planning to convert to more flexible tools in the near future.

**Q:** How large is the computer environment that you support?

**A:** There are approximately 1300 PCs, and an additional 700 dumb terminals. Also, there seems to be a virtually infinite number of printers out there! "I can't print!" is one of the most common problems that we have to deal with.

**Q:** Do you use the Internet as well?

**A:** Yes, both an Intranet and an Extranet are in use. The Intranet is used by staff and the Extranet is used for patients. We are also evaluating Nortel's Virtual Private Network (VPN). The VPN would allow us to connect the different sites to our computer network by the Internet, instead of paying for telephone costs.

**Q:** How large is your staff?

**A:** There are 60 people on the staff, and they do all of the work themselves.

**Q:** How is the system supported during and outside of the weekday work hours?

**A:** There is an IT Help Desk that answers and resolves problems. This function is staffed by the majority of the department, too. Over the last several years, we have gone from 20% to 60% of the staff being on call.

**Q:** What volume of calls are supported?

**A:** There may be 2-300 calls per day, and up to 2500 calls per month. We are building a Help Desk Knowledge Database using a tool named Tivoli, which is allowing us to retain the experience that our Help Desk acquires to improve ongoing support.

**Q:** Does the Help Desk support other types of questions too, since it is a 24x7 service?

**A:** We would like to extend our Help Desk support to Clinical Engineering activities too. However, the nurses seem to object to that suggestion. They are used to personal attention from the specialized clinical engineering person, and are not comfortable relying on Help Desk support.

**Q:** Is the Help Desk an example of a collaboration opportunity with clinical engineering?

**A:** If we can begin using the same type of Help Desk tools for clinical engineering, that could help save critical resources and could also increase efficiency.

**Q:** How do the two departments work together? Is there a clear delineation between each department's role and responsibility?

**A:** No, there's not really a completely clear separation. We often have to work together to address issues. This really came to a head when we helped install a vendor's patient monitoring system that was married to the HIS.

**Q:** What happened in the situation?

**A:** We wanted to know how to test the patient monitoring system prior to just turning it on. The manufacturer really had no formal plan, and they thought our questions were "trite." They said that they were FDA-approved, and therefore no separate testing was needed or warranted. We wanted to validate the system's performance prior to use, the same way we do before accepting an IT vendor's, and the manufacturer did not really even understand our question.

**Q:** Are there other differences that you see between the CE and IT department roles or activities?

**A:** There are lots of differences in the day-to-day issues, and in work patterns. The implementation and

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support of systems is vastly different. Medical device manufacturers and vendors seem to do installations or repairs, and then leave. They do not do production testing to make sure that the whole system is working.

**Q:** Are there other differences that you perceive between CE and IT activities?

**A:** Yes, they have more of a "baling wire" approach to fixing things, which we have learned to avoid.

**Q:** How effectively have the two departments collaborated overall?

**A:** That seems to ebb and flow. In about four years of joint efforts, there are projects that demand a lot of collaboration, and then there are periods with less interaction.

**Q:** What types of conflicts occur?

**A:** Sometimes the hardware folks point the finger at the software folks, and sometimes vice versa.

**Q:** Are there differences that you perceive in the staff from each department?

**A:** Yes, the CE staff brings more technical discipline, and more "nuts and bolts" understanding. The IT staff is more systems minded.

**Q:** Do you find that there are any career conflicts between the two groups?

**A:** There seem to be job security issues, especially on the part of the CE staff. There may be a perception that IT staff is being paid better.

**Q:** Is that perception true? Is IT staff being paid better?

**A:** Yes, it seems that way. It has been difficult to find and retain IT staff.

In 1973, Alan Lipschultz earned a master's degree in electrical engineering from Washington University in St. Louis. For the next 16 years, he served as director of clinical engineering at Waterbury Hospital in Connecticut.

Since 1989, he has been employed as director of clinical engineering at Christiana Care Health Services, formerly called the Medical Center of Delaware. He has overseen a major expansion of his department, and led efforts to select and install several new medical equipment systems.



Alan Lipschultz,  
CCE

**Q:** Do you hear a lot of those issues?

**A:** It seems to come up a lot. When I attended a local biomedical society meeting, they expressed a sense that they were being co-opted.

**Q:** Are there any other opportunities for CE and IT staff collaboration?

**A:** Yes. I think that keeping current is a real challenge for us all. The CE and IT departments can share the educational opportunities, which will benefit us both.

### A Clinical Engineering Perspective

*For nearly 30 years, Alan Lipschultz has served as a clinical engineering director, including for the last 12 years at the Christiana Care Health Services—previously known as the Medical Center of Delaware. He has expanded the clinical engineering program at Christina from 3 to 19 full-time employees, and led efforts to select and install several new medical equipment systems.*

**Q:** Tell me about the situation at Christiana.

**A:** We are really full, and the busy flu season has not even started. We are using hallway space for patients, too. We have 80 nursing home patients in our hospital as well, because there are no appropriate nursing homes for discharge.

**Q:** Tell me how the IT and CE departments are organized.

**A:** The CE department reports to the Senior VP of Facilities and then to the COO. The VP of Information Systems reports directly to the COO. That is a change in structure, by the way. The VP of Information Systems used to report to the CEO. However, the COO did not believe that gave enough motivation for customer focus, and it was recently changed.

**Q:** How do the two departments interface?

**A:** There is no formal interface. We share the same mission statement, of course. We also participate on ad hoc committees together at times. A member of the IT staff is also on the Technology Management Committee, of which I am also a member.

**Q:** Are there less formal ways that the CE and IT staff interact?

**A:** Yes. Usually, there is an IT analyst assigned to each department, such as the cath lab, radiology, or oncology. The CE department has its own staff assigned to each department as well.

**Q:** Is there overlap in the two teams' roles?

**A:** Yes there is. The IT department analyst primarily addresses software. The hardware issues often overlap on both departments' staff, however.

**Q:** Do you have any improvement ideas to suggest from your experiences? Any "gee, we should have done things differently" thoughts?

**A:** Yes. For example, we have set up a radiology Web server for the doctors. There is no PACS system yet, and this system was designed to meet the existing need and resources. However, it is not clear whether to call an IT or a CE person if there is a problem. Since clinical engineering is only in during weekday work hours, I have thought that maybe we should let IT screen the calls at their Help Desk. They can contact us if the problem seems likely to need our involvement.

**Q:** Where is the boundary in that type of problem? If there is a problem with the radiology Web services, how would the responsibility be decided?

**A:** CE has to determine if the image is actually com-

ing out of the radiological device in the first place. In other words, is the modality itself the source of the failure? If not, then the boundary can be hard to decide. A cabling problem would need to be ruled out. That may involve "pinging" the Internet Protocol (IP) address of the network server from the radiological device side to determine if the LAN, the server, or some other component is the problem.

**Q:** Does that imply that you are using IP throughout the hospital?

**A:** Yes, we have standardized on a single Windows/NT net throughout the hospital for all communication.

**Q:** Doesn't that raise some potential for overloading the Network? What if there are large packets, say from a PACS server, that tie up the network? Couldn't that adversely affect the reliability of time-critical patient information, or slow down crucial activities?

**A:** Yes, that is why we do a lot of planning. We try to make sure that we always have excess bandwidth capacity, so that we are only using maybe 20% at any time.

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**Q:** Have you divided up the responsibility for the computer hardware?

**A:** It depends on the brand. For example, CE supports the Agilent equipment. IT, on the other hand, supports the Compaq equipment. For example, our ultrasound equipment has a standard output for a Compaq server, so IT supports that server.

**Q:** Do you both have 24 hour support capability?

**A:** No, only IT has 24x7 support.

**Q:** How about the telecommunications system. Does IT support that?

**A:** No, not at present. Telecommunications is supported by a separate facilities group.

**Q:** Are there conflicts or confusion on the user side, since the responsibilities are divided up between CE and IT? Is there finger pointing?

**A:** Sometimes there is.

**Q:** What new skills do clinical engineers and biomedical equipment technicians need to succeed with this mixture of responsibilities?

**A:** We have to learn to "talk the lingo." For example, I need to understand enough about TCP/IP protocols to deal with things like static vs. dynamic addressing schemes. Hardware-wise, there is little technical difference. CE staff need much the same technical knowledge and ability as the IT staff.

**Q:** Are there areas that aren't important from the CE side?

**A:** We don't need to handle the network management details.

**Q:** Do BMETs and CEs need a broader view, and broader skills than in the past?

**A:** Yes and no. Yes, the CE staff need to have an understanding of the whole interconnected system. On the other hand, the basic skills of troubleshooting by isolating problems is still the same as before.

**Q:** What important interdepartmental communication challenges do you have?

**A:** I continue to reinforce that we need to help each other find solutions. Sometimes it can be hard to recruit, train, and retain people in CE and IT who are willing and able to help each other succeed.

## Expert Slated to Discuss IT Role in Health Care

Henry J. Soch, a veteran medical imaging expert, will deliver a keynote address focused on the role of information technology in the future of health care at AAMI's annual conference in June.

In his presentation, Soch will discuss how the changes in technology can be incorporated into tools to improve medical care and change the economics of the health care industry. He will discuss the top trends that will impact health care in the coming year, review the three factors that are converging to create an entirely new health care landscape, and explore the opportunities that this convergence will create for those willing to move at "Internet Speed."

Soch, vice president of consulting services and e-business at Philips Medical Systems, has more than 27 years of experience in the medical imaging industry. For the last 23 years, he has worked for Philips, where he has been responsible for clinical training, product development, product management, and marketing management for a broad range of products. Currently, he is responsible for the development and deployment of Philips' E-business initiatives in North America.

Soch, who has lectured extensively around the world, serves as president of the Institute for Research on Internet Use in Healthcare, a think tank dedicated to researching and identifying best-practices in the application of Internet technologies to benefit healthcare professionals and consumers.

He is scheduled to deliver his speech on Tuesday, June 12, during the AAMI 2001 Annual Conference & Expo in Baltimore. The conference will also feature two other keynote speakers: David M. Link, executive vice president of Expertech Associates; and Jaron Lanier, one of the originators of real-time surgical simulation and telesurgery.

**Q:** Have you heard similar stories from other hospitals?

**A:** I have been talking to CE groups around the country, and I often hear "IT folks just do not understand what goes on in the clinical environment." From my point of view, that is our job. We need to educate and train the IT staff. They need to learn to appreciate the urgency of some of our problems. I feel that I am fortunate, because many of our IT staff come from the chemical industry. For example, they seem to already understand the importance of round-the-clock support.

**Q:** Have you encountered much "baling wire," fix-it mentality in the CE community?

**A:** Yes, there is some truth to that. I keep working to sensitize the CE staff to the bigger picture. I let them

know that I don't want them to do "baling wire" fixes as the everyday rule. I realize that certain urgent and critical problems need to be fixed ASAP, not delayed for a systemic resolution. The systemic problems need to be isolated and fixed too, however.

**Q:** Does the IT department understand your needs?

**A:** I think that our IT department has a really good hospital and health care viewpoint. For example, IT has hired nurses and other clinical specialists as analysts and managers. They have helped train those clinicians, and that seems to have allowed IT to provide better support for the departments.

**Q:** Are those changes due to better salaries in the IT department?

**A:** Money is on the IT side now. Still, it is also good

## IT Professionals Confirmed to Speak

Information technology—and its future role in health care—will be the focus of several sessions at AAMI's Annual Conference & Expo in Baltimore. But in a marked departure from previous AAMI sessions, several IT professionals—who either consult for or work in IT companies—will be the featured speakers, including at these four sessions on the opening day of the conference, June 9.

### **Clinical Information Systems from a Systems Engineering Perspective**

*Speaker:* Bridget A. Moorman, MSBME, CCE, Kaiser Foundation Hospitals

The session will help participants understand the different interfaces in a clinical/biomedical system, assess functions between the interfaces, explore where vendors are marketing products within the systems, and identify gaps in the current product offerings.

### **What Health Level Seven (HL7) Can Do For You**

*Speaker:* Mike Henderson, Eastern Informatics, Inc.

HL7 is a commonly used protocol for communicating clinical information between systems. Conference-goers will learn what HL7 messages look like, how they are used in inter-system communications, what they can and cannot do, and how to avoid potential problems.

### **Application Service Providers in Health Care IT: Back to the Future**

*Speakers:* Dean Athanassiades, BSIE, MBA, Hewlett-Packard Co.; and Karen Fitzmaurice, BSEE, MBA, Agilent Technologies, Inc.

Participants will learn about the latest IT product offerings: Application Service Providers (ASP). The product concept offers staggered outsourcing capabilities of certain IT functions, such as database serving and security. With many clinical information system providers moving toward this model, participants will learn how to compare ASPs to other information technology delivery models, both current and in the past, and the benefits and pitfalls of the ASP model to health care organizations.

### **Health Care Information Technology Levels**

*Speaker:* Alan Portela, Clinicomp

When the information technology community models the pieces necessary for a fully integrated health care information system, several modules or pieces are identified and arranged in a pyramidal structure that identifies the information flow and module interfaces. Those who attend this session will be given an understanding of this pyramid, its modules, how they inter-relate, and how one can use the pyramid to evaluate information systems and their integration to an all-encompassing health care information system.

for the whole organization. I do not think that it is necessarily an unfair payment imbalance, because it is all based on market demands.

**Q:** How would you advise a CE or BMET to develop her/his career?

**A:** I think that there are advantages and disadvantages to both the IT and the CE careers. Some decisions move you closer to patient care, and others move you away. Each person must evaluate the trade-offs and make a choice. However, I think that CEs and BMETs will be worth more if they improve their IT skills.

### Discussion

Where does this all leave those of us who are still interested in having a career in health care technology? It seems to me that several conclusions are obvious.

Some very BIG investments are being made to take advantage of the convergence of medical and information technology.

Information technology management and support is similar, but different from, medical technology support. The technology itself is different, the emphasis is different, and the level of direct patient involvement is different.

Clinical engineering management and support is similar but different from information technology. The patient and clinician contact is often very, very high; the consequences of mistakes have a human immediacy that is undeniable; and many of the historic support and management processes have been more individually tailored than current IT processes.

And, as Alan Lipschultz so clearly states, "We have to work together." No amount of finger pointing is going to undo a patient injury or death. Neither will finger pointing suffice if the business office is shut down by an X-ray being sent to a remote doctor.

To this end, at least, a lot of education, communication, and related effort will be needed for all parties if patients and clinicians are going to obtain the full benefit of future systems. This benefit is not isolated to patients and clinicians, however. It mushrooms to directly affect families, companies, investors, and the government very, very quickly.

The AAMI 2001 Conference Planning Committee is well aware of the importance of these issues, which is the reason for such emphasis this year. Some of you are in the midst of grappling with really difficult career decisions. Should you leave your clinical roots to pursue a

better paying IT role? Should you have to? Would you enjoy pure business-oriented IT, or is the patient contact and impact worth an economic trade off? How can you get the best of both worlds? How can you be part of the solution, not part of the problem?

Is failure really an option? With a rapidly aging, active population I think that in this case, success is the only option. The efficiency and efficacy of health care can only be improved if we take advantage of the systems of tools that are emerging. Everyone will have to learn new skills to succeed. That includes doctors, nurses, information specialists, engineers, technicians, administrators, and, yes, even patients and families.

If you have hesitation and reluctance, join the crowd. The best thing that I can do to make you comfortable may be to name some of our own who are successfully navigating these challenges. John D. Hughes, Jr. comes to mind as a stellar recent example. Hughes made the move from the Washington Hospital Center to Computer Sciences Corp.'s Healthcare Group. Quite a bit longer back, Dr. Phil Katz moved his Biomedical Engineering department into PC support as early as the mid-eighties. Caroline Campbell, Dr. Yadin David, Bridget Moorman, and Ira Tackel also come to mind as other terrific examples of clinical engineering professionals who have expanded their careers to encompass aspects of information technology.

Come on in, the water is great! I hope that you will join us at this especially exciting conference, where we will continue the discussion with many more voices. Bring your sleeping bags because it might be a long afternoon!

Oh yeah, if WAP, IP, LAN, HL7, PACS, HIPAA or anything else in this article "seems like Greek to you," make sure that you reserve a seat with us at the entire AAMI 2001 Conference! See you in Baltimore this June.

*The author would like to gratefully express a special "thank you" to Alan Lipschultz and LaDonna Shedor for generously sharing their time and expertise for this article. Their candid feedback and leadership example is invaluable to us all.*

**In the next issue of BI&T . . . Michael R. Blumberg and Robert L. Snyder—both of D.F. Blumberg Associates, Inc. in Pennsylvania—write about "The Strategic Impact of Information Technology Convergence on Healthcare Delivery and Support Organizations."**