

Medical Solutions

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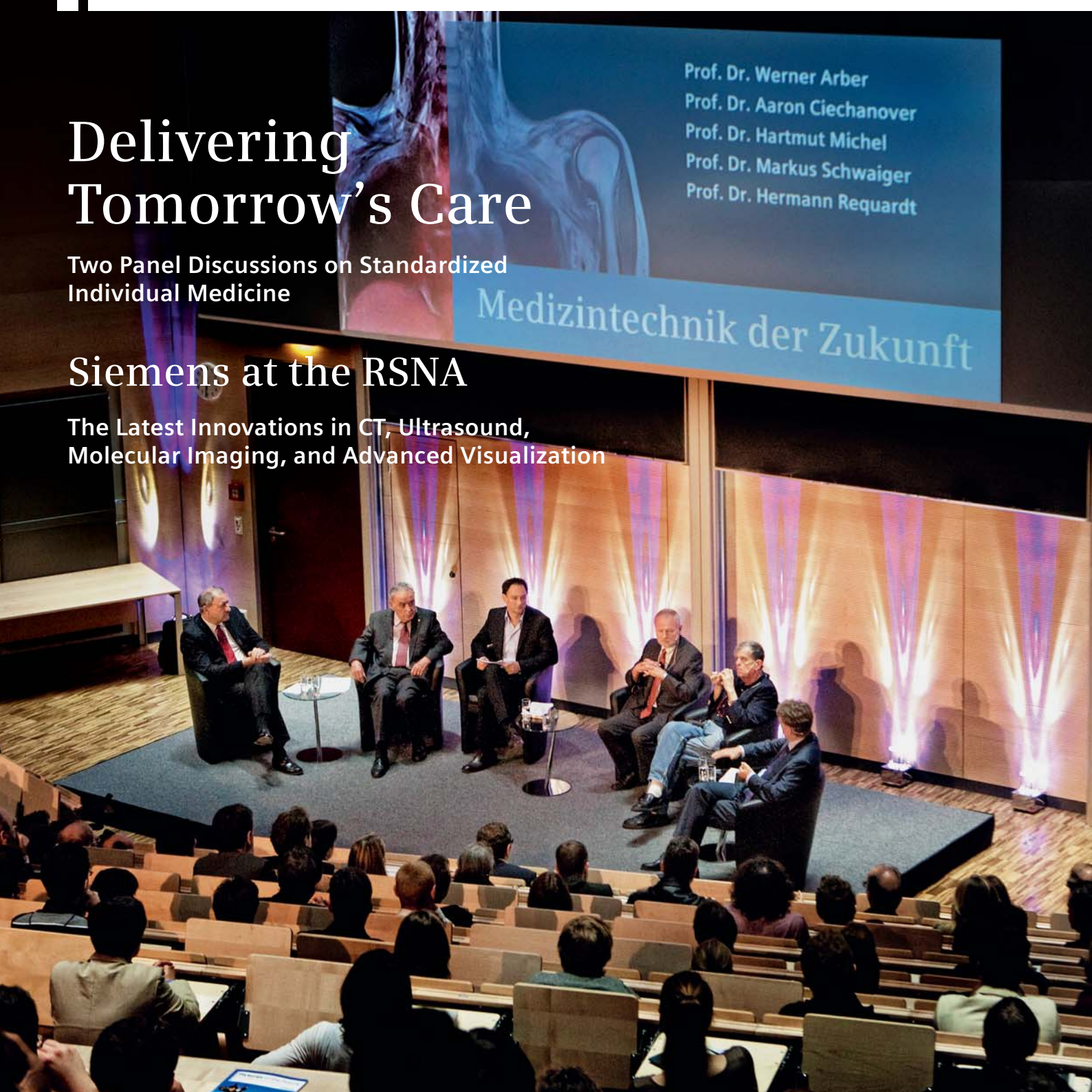
SIEMENS

Delivering Tomorrow's Care

Two Panel Discussions on Standardized
Individual Medicine

Siemens at the RSNA

The Latest Innovations in CT, Ultrasound,
Molecular Imaging, and Advanced Visualization



Prof. Dr. Werner Arber
Prof. Dr. Aaron Ciechanover
Prof. Dr. Hartmut Michel
Prof. Dr. Markus Schwaiger
Prof. Dr. Hermann Requardt

Medizintechnik der Zukunft



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Images, leading the way.

Together, let's celebrate the clinical image and its potential to improve care for more patients around the globe.

The medical image continues to grow in importance for the diagnosis and treatment of diseases. As a direct result of the imaging innovations of the past decades, today diseases can be detected earlier and better. Treatment decisions can be made with higher confidence based on more specific clinical information. Medical procedures get less and less invasive, with reduced dose and less open surgery. And, higher affordability

of imaging and higher productivity with imaging enable more and more nations around the globe to give their populations access to modern care. With that, imaging today contributes significantly to advancing human health. We at Siemens are passionate about innovation that advances human health. Together with you we want to celebrate the medical image and its potential to do just that.

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Answers for life.



Hermann Requardt,
Member of the Managing Board of Siemens AG
and CEO of the Healthcare Sector

Paradigm Shift

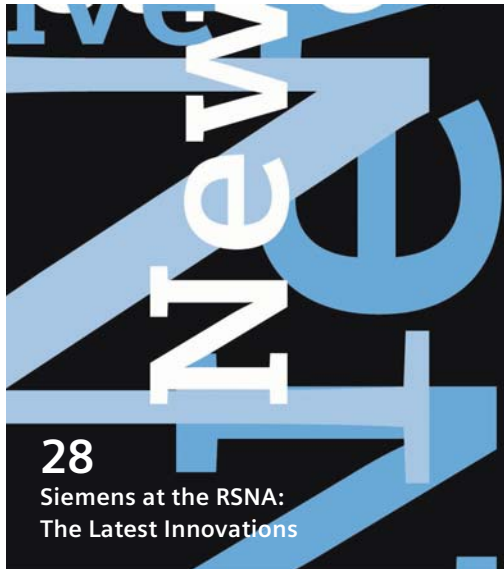
Radical change frequently occurs almost unnoticed. We do not witness transition immediately in our everyday lives; instead, we sense it in the debates between visionary experts. These are focal points of cognition, which may soon become the nucleus of a new innovation cycle or the core of a paradigm shift. We have been observing and accompanying a transition of this nature in recent times, which hides behind the catchword “individualized medicine.” The term is misleading, as medicine must, per se, remain homogeneous; it would be impossible to create seven billion separate forms of medicine for each of the world’s current inhabitants. However, through research, we are starting to understand that specific diseases require varied approaches based on the patient’s individual predispositions. The treatment pathways derived from evidence-based medicine are a humble beginning. However, the orientation toward knowledge-based medicine, i.e., applying the best available scientific knowledge to clinical decision-making, contains a paradigm shift away from an experienced-based approach to one anchored in sound scientific insights.

And herein lies a challenge, confirmed by two debates involving scientists from the fields of medicine and economics that came together in Erlangen and in the wake of the Lindau Meeting of Nobel Prize Winners in the Klinikum rechts der Isar in Munich: Medical practitioners must be persuaded to implement the transition from experience to science. Experience can only be acquired through time, whilst knowledge can be retrieved from databases. This debate must be conducted compassionately, as neither the necessary discussions nor better medicine would be possible without the participation of medical professionals. The relationship to patients will also change: if we aim to fathom the entire history of a disease, from emergence to remission, we must collect, save, and evaluate data from individuals long before they succumb to illness. This also requires a completely different understanding of disease, rendering pathogenesis largely obsolete as the guiding principle of medicine. Finally, there is no avoiding the question of finance. As long as state-run funding agencies concentrate on basic research

while new examination and treatment methods and adaptations in clinical processes are curtailed by the permanent flow of new, short-term cost-benefit assessments, innovations will only make slow progress. The cost-effective nature of innovations and process adaptations is accepted in almost every field – apart from healthcare policy. This should not be lamented, but changed through a joint approach by all stakeholders – patients, physicians, payers, pharmaceutical, and medical device industry. Not only are innovations and process changes economical, they also help prevent intrinsic suffering when specific diseases are discovered before they flare up. It is both exciting and extremely satisfying to sense the onset of this new era in debates, and a privilege to participate in it during research and development.

Yours sincerely,

A handwritten signature in black ink, appearing to read "Hermann Requardt".



Cover Story



10 Personalized Healthcare

Two recent, prominently cast panel discussions focused on the future of medical technology and knowledge-based health-care delivery. Nobel Laureates Werner Arber, Aaron Ciechanover, and Hartmut Michel talked about patient participation, social consensus, and new financing models with the CEO of Siemens Health-care, Hermann Requardt, and Markus Schwaiger, from University Hospital Klinikum rechts der Isar, Munich, Germany. In another panel, Requardt, Heinrich Iro from the University Medical Center Erlangen, Germany, and Peter Oberender of the University of Bayreuth, Germany, asked physicians to achieve a new balance between experience and knowledge.

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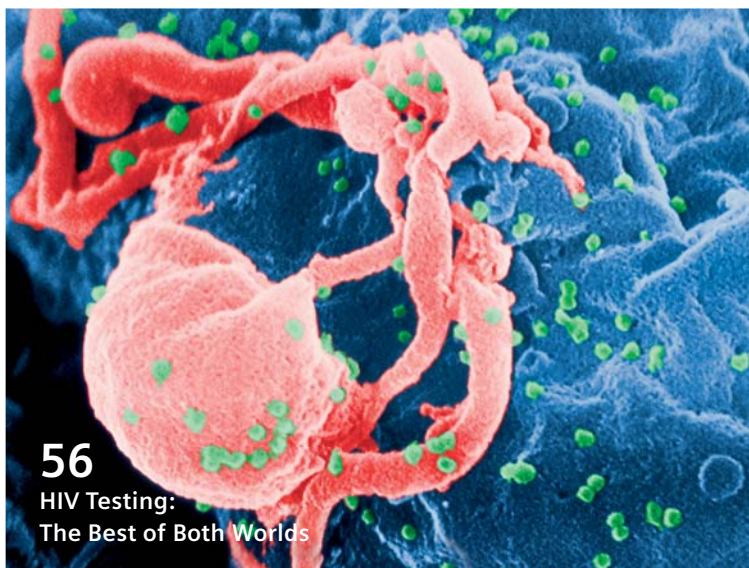
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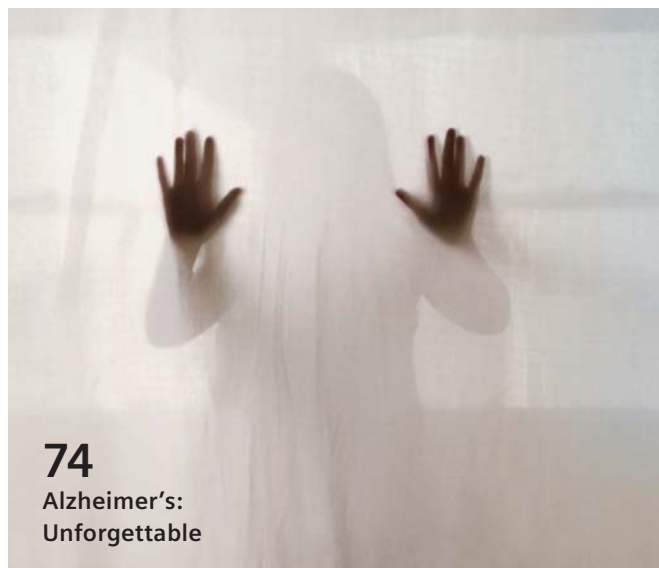
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A Radical New Way in Fluoroscopy

Luminos Agile is a radical new way to view fluoroscopy. It is the first patient-side controlled system with a dynamic flat detector, height-adjustable table, and true dual-use capability for fluoroscopy and radiography. The large 43 x 43 centimeter (cm) (17 x 17 inches) flat detector delivers high-quality distortion-free dynamic and static imaging in fluoroscopy, with an up to 116 percent larger field of view than previous systems. The table height range from its lowest point at 65 cm (26 inches) to its highest point at 112 cm (44 inches) allows for easy patient transfer, especially for patients with limited mobility, and an ideal working height for each operator. The weight capacity of up to 275 kilograms (606 pounds), and the 60 cm (24 inches) wide patient opening allows a broader range of patients to be examined. The space-saving and open design of Luminos Agile enables easy access to patients from all sides.

With the Ysio® option, customers select a combination of a ceiling-suspended tube, wireless detector (wi-D), and Bucky wall stand to provide true dual-use capability in the Luminos Agile as a fully digital, fully integrated radiography system. The resulting expansion in examination range and patient throughput increases the utilization and productivity of the system. Luminos Agile offers the comprehensive CARE (Combined Applications to Reduce Exposure) dose reduction program, which decreases radiation exposure for patients and medical staff without compromising image quality. With Luminos Agile, clinics can achieve imaging excellence, simplify their workflow, and prepare for the patient care challenges of today and tomorrow.



The high weight capacity and the wide patient opening of Luminos Agile allows for a broader range of patients to be examined.

www.siemens.com/luminos-agile



An Easy Way to Meet Immunoassay Testing Needs

Siemens' new IMMULITE® 2000 XPi Immunoassay System improves workflow and increases productivity for medium- to high-volume laboratories. Its new design, created considering customer input, offers enhanced software and new features that allow labs to run specialty and routine testing on a single platform. It is a continuous, random-access analyzer with one of the broadest menus available, and it features a wide range of connectivity options. Immunoassay testing is important for diagnosis and therapy of various diseases. With the help of the IMMULITE 2000 XPi analyzer, small concentrations of substances in the blood can be determined. New automated functions, such as constant system availability or sample loading without pause, improve efficiency and productivity. Enhanced software improvements, including AutoStart capability for automated, routine maintenance and quality-control scheduling, increase walk-away time. Downtime is reduced with the system's tube-top, sample-cup capability, which enables the testing of small samples with minimal handling and no re-labelling.

Ease of use, proven reliability, and one of the largest automated immunoassay menus available – the IMMULITE 2000 XPi system underlines the significance Siemens attaches to its IMMULITE family of products, which has delivered excellent reliability for more than 20 years: "We are proud to expand the IMMULITE family of products and continue delivering the reliable immunoassay testing solutions on which our customers depend," said Dave Hickey, CEO, Chemistry, Immunoassay, Automation, and Diagnostics IT, Siemens Healthcare Diagnostics.

Welcome to the MAGNETOM Family, Dot!

Magnetic resonance imaging (MRI) can be very complex, and hospitals have to deal with a lot of challenges in their everyday clinical life to achieve best patient care.

Patients are different, users are different, and clinical requirements are different. To help combat these challenges as well as to achieve consistent and more reproducible results, Siemens developed Dot™ (Day optimizing throughput).

The MAGNETOM® family is further showing its commitment to a secure platform for the future. Dot, MRI's most comprehensive workflow solution, will be available on more Siemens' scanners: the MAGNETOM Verio 3 Tesla system and the

MAGNETOM Avanto 1.5 Tesla system¹. More MRI users around the world will be able to experience the benefits of exam personalization, user guidance, and automation – soon for even more clinical indications than excellent before with three new Dot engines. The Spine Dot Engine¹, the Breast Dot Engine¹, and the Large Joint Engine¹ will be available on MAGNETOM Aera 1.5 Tesla and MAGNETOM Skyra 3 Tesla systems.

Dot users around the world have reported on their experience and satisfaction with this comprehensive MRI workflow solution.



“With Dot, we can now ensure our examinations are far more reproducible and of excellent quality.”

Arnaud Lambert, Technologist
Imagerie Médicale Saint Marie, Osny, France

“As a manager of a busy MRI unit, I’m under constant pressure to ensure that the waiting list is kept as short as possible. Of course, one way to achieve this goal is to shorten examination times – and the Cardiac Dot Engine has enabled me to do this.”

Matthew Benbow, Superintendent Radiographer,
Royal Bournemouth Hospital, Bournemouth, UK



Find out what other customers around the world are saying about Dot and interactively explore the Dot engines by accessing the link below. This site is even optimized for mobile devices as well.

¹ This product is under development and not commercially available yet. Its future availability cannot be ensured.

www.siemens.com/growing-Dot

More Transparency for Radiation Dose with New Data Analysis Tool

With a variety of radiology devices from Siemens, the dose received by each individual patient is recorded in a standard file format, which allows the future use and analysis of this data. These are the so-called DICOM dose structured reports – DICOM SR. Until now, this data has been archived in DICOM SR but was not processed any further. However, dose protocols will be requested from institutions like the U.S. Food and Drug Administration (FDA) in the near future.

Now, Siemens is adding CARE Analytics to its portfolio of CARE (Combined Applications to Reduce Exposure) applications. The new software tool allows for the analysis and evaluation of dose received by patients during an examination with

computed tomography (CT) systems, X-ray, fluoroscopy and mammography devices, and angiography systems. It can be installed on any office computer connected to the hospital network and extracts dose-related data from the reports, to be displayed, for example, in Microsoft® Excel® format. Using data edited this way, medical staff is able to compare the dose given during different examinations with another in order to further improve scan protocols. In addition, it is possible to ascertain the dose a patient has received on different systems over a series of examinations. Dose reporting between multiple hospitals is also possible. The increased transparency helps clinicians improve their working



practices, be more cognizant of dose that was given in the past and hence, strike a balance between the necessary image quality and the radiation dose.

www.siemens.com/low-dose

Enough with the Backlog

Patients at the Skåne University Hospital in Malmö, Sweden, are aware that the wait time for magnetic resonance imaging (MRI) examinations is now considerably shorter than several months ago. And the head of radiology, Professor Lars Bååth, MD, is happy that his employees can potentially examine up to eight more patients per day.

A team of Siemens consultants played a major role in this success story. They examined the reasons for the long wait times, the strikingly long examinations times, and the high backlog. Within five days, the team determined the number of daily MRI scans taken with the hospital's MAGNETOM® Symphony Tim system as well as the time required for each examination, and interviewed the physicians responsible as well as the radiological technicians. They also observed the planning of the examinations and patient preparation. Also, the data from Siemens Utilization Management were analyzed and compared with the best practice data of hospitals in Sweden, Great Britain, and Germany.

What the consultants proposed to the Skåne team turned out to be both simple and effective: Prepare patients for the examination outside the examination room and improve

cooperation with referring physicians. Reduce the average protocol duration per patient to 20 minutes, bundle similar examinations, and reduce the number of staff involved in scheduling and examination planning. And finally, extend the operating time of the system to late afternoon and also use the lunch hour for less complex examinations.

The results: As compared to previous numbers, it is now possible to examine up to eight additional patients each day at the Skåne University Hospital. This will eliminate the backlog within a short time. To maintain or even increase the utilization rate, the team meets on a regular basis to discuss and improve the processes. "We have previously employed several other consulting companies to identify room for improvement in the radiology department, with mixed results," says Bååth, who is full of praise for the Siemens consultants. "One problem was that they weren't prepared for the complexity of healthcare environments. Siemens had the right experience and demonstrated deep understanding to deliver what we asked for and make feasible improvement proposals easy to implement. Siemens also used benchmarking, which made the results much more useful."

New Standard in Liver Fibrosis Assessment

Siemens' Enhanced Liver Fibrosis (ELF)[™] blood test¹, available outside the U.S. on the ADVIA Centaur[®] Immunoassay Systems, is an innovative, automated, standardized direct biomarker panel for the assessment of liver fibrosis – a leading indicator of chronic liver disease (CLD), such as cirrhosis and liver cancer, which are among the top ten causes of death worldwide.^{2,3} The ELF test offers clinicians a quick, reliable, minimally invasive test option to assess liver fibrosis with results in less than one hour. With the addition of the ELF test, Siemens is currently the only company to offer an integrated portfolio of diagnostic solutions for managing liver health, which includes routine chemistry tests, hepatitis serology tests, viral load testing, and ultrasound systems. The test assesses the severity of liver fibrosis by combining three direct serum biomarkers – hyaluronic acid (HA), procollagen III amino terminal peptide (PIIINP), and tissue inhibitor of metalloproteinase 1 (TIMP-1) – in an algorithm. The result is an ELF score, which correlates to the level

of liver fibrosis assessed by liver biopsy,⁴ the current standard of care for liver fibrosis diagnosis.

The ELF test has been clinically validated on an IMMUNO-1 auto analyzer in an international multicentre study with a mix of patient groups, including viral hepatitis, non-alcoholic fatty liver disease (NAFLD), and alcoholic patient groups. Additionally, a 7-year follow-up study involving more than 450 patients has shown that the ELF markers are at least comparable to liver histology at predicting clinical outcomes of CLD.⁵

¹ Not available for sale in the U.S.

² Griffiths et al., (2005) "Leading Causes of Death in England and Wales – How Should We Group Causes?" *Health Statistics Quarterly* 28:6-17.

³ Bosetti et al., (2007) "Worldwide Mortality from Cirrhosis: An Update to 2002," *Journal of Hepatology* 46(5):827-39.

⁴ Rosenberg et al., (2004), "Serum Markers Detect the Presence of Liver Fibrosis: A Cohort Study" *Gastroenterology* 127:1704-1703.

⁵ Parkes et al., (2010) "Enhanced Liver Fibrosis Test Can Predict Clinical Outcome in Patients with Chronic Liver Disease," *Gut* (online Aug 2010).

The DCA Vantage Analyzer Now Connects to Clinical Information Systems

The rising need for more flexible connectivity among hospitals, clinics, and physician offices, while still protecting patient information, has led Siemens to announce its new, enhanced version of the DCA Vantage[™] Analyzer, a point-of-care (POC) immunoassay analyzer for diabetes management. Managers of point-of-care testing have been demanding better connections between POC analyzers and the associated healthcare organization so test results can be automatically transmitted to the laboratory and hospital information system, and eventually to the patient's electronic medical record.

To facilitate the transfer of data between the POC device and clinical information systems, the POCT1-A2 communication protocol comes standard. The DCA Vantage Analyzer, configured for Version 3.0 Software, is one of the first hemoglobin A1c (HbA1c) POC analyzers in the

industry to use the POCT1-A2 communication protocol. The simplified connection enables results to be available in the patient electronic record and the additional security offers customizable operator access. The system also functions on an easy-to-use interface and has the ability to connect to a third-party POC data manager.

The system is now also equipped with advanced security that prevents unauthorized users from accessing information and protects patient records. Security is not compromised with the significant increase in the number of operator IDs that can be stored, which has been expanded to one thousand, thereby leading to better control in busy environments.

With flexible data management, users can feel confident with simplified result interpretation that stems from more comprehensive information. The newly



added enhancements are important to POC managers who conduct tests from remote sites with multiple operators, and are responsible for the compliance and quality of testing, putting the focus on providing a clinically proven and trusted POC analyzer to assist in the management of diabetic patients.

Professor emeritus Werner Aber, PhD, University of Basel, Switzerland

Professor Hartmut Michel, PhD, Director, Max Planck Institute of Biophysics, Frankfurt am Main, Germany

Professor Hermann Requardt, PhD, CEO, Siemens Healthcare, Erlangen, Germany

Professor Aaron Ciechanover, PhD, Director, Rappaport Family Institute for Research in Medical Sciences, Israel Institute of Technology, Haifa, Israel

Professor Markus Schwaiger, MD, Director, Nuclear Medicine Clinic and Polyclinic, University Hospital Klinikum rechts der Isar, Technische Universität München, Munich, Germany

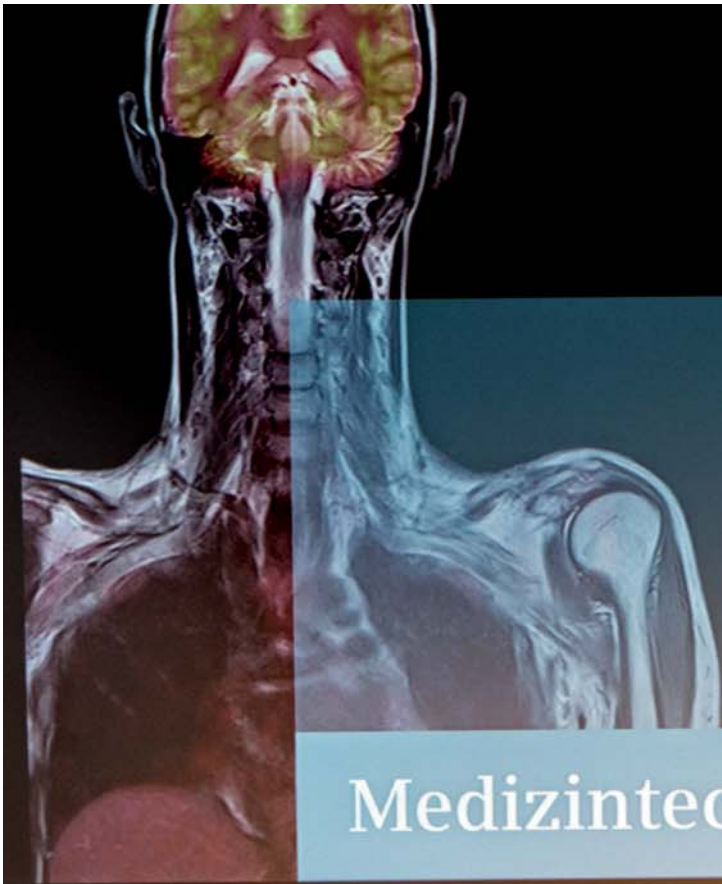


Delivering Healthcare – Tomorrow

Two recent, prominently cast panel discussions focused on the future of medical technology and knowledge-based healthcare delivery. Nobel Laureates Werner Arber, Aaron Ciechanover, and Hartmut Michel talked about patient participation, social consensus, and new financing models with the CEO of Siemens Healthcare, Hermann Requardt, and Markus Schwaiger, from University Hospital Klinikum rechts der Isar, Munich, Germany. In another panel, Requardt, Heinrich Iro from the University Medical Center Erlangen, Germany, and Peter Oberender of the University of Bayreuth, Germany, asked physicians to achieve a new balance between experience and knowledge.

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Prof. Dr. Werner Arber
Prof. Dr. Aaron Ciechanover
Prof. Dr. Hartmut Michel
Prof. Dr. Markus Schwaiger
Prof. Dr. Hermann Requardt

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Participation in the Future of Medical Technology

Experts from the fields of academia, industry, and medicine agree: innovative medical technologies have the potential to make important contributions to solving future health problems; but, social consensus, voluntary patient participation, and new financing models are needed if we are to realize these benefits in practice.

By Martina Lenzen-Schulte, MD

“Medical Technology of the Future” was on the agenda of Nobel Laureates Professor Werner Arber, PhD, Professor Hartmut Michel, PhD, and Professor Aaron Ciechanover, PhD, as well as Professor Hermann Requardt, PhD, CEO of Siemens Healthcare. Professor Markus Schwaiger, MD, Director of the Nuclear Medicine Clinic hosted the meeting in the main lecture hall of University Hospital Klinikum rechts der Isar.

Right after the traditional annual meeting of Nobel Laureates in the town of Lindau, Germany, three of the Laureates attended a public podium discussion on the medical technology of the future, held at Technische Universität München, Germany. The participants were Professor Werner Arber, PhD, Professor Aaron Ciechanover, PhD, and Professor Hartmut Michel, PhD, as well as the CEO of Siemens Healthcare, Professor Hermann Requardt, PhD. Professor Markus Schwaiger, MD, Director of the Nuclear Medicine Clinic at University Hospital Klinikum rechts der Isar, hosted the meeting.

SCHWAIGER: I am pleased to welcome you to this roundtable discussion. It is both telling and logical that we are holding this discussion at Technische Universität München, where the Faculty of Medicine was founded with the aim of enabling the closest possible cooperation with the engineering sciences.

REQUARDT: It is precisely this combination of practical medical knowledge and technical expertise that is especially interesting for the industry. We aim to supply devices, equipment, and software that, first, boost efficiency, since relevant information can be gleaned selectively from thousands of images, for instance. And second, we also want to boost effectiveness, to not only enable primary diagnoses, but also to enable statements as to whether therapies will be effective.

MICHEL: I see the big plus in advanced medical technology in the description of individual metabolic processes. We know that up to 30 percent of all drugs have avoidable undesired effects, and that widespread medications such as aspirin only work properly on a certain percentage of patients, since some people lack certain enzymes. If you know what those factors are, a lot of things become predictable. I imagine that it would be worth-

while to exploit this knowledge, which is partly based on the genome, for future drug-based therapies.

CIECHANOVER: New medical technologies will hopefully also help us to identify and track a pathological condition right when it develops. We know that in cancer, tumor cells begin circulating very early on, sometimes employing various tricks to hide. We can discover them, and we need to get to the point of being able to make even very tiny quantities of these tumor cells visible. It is evident that biomarkers will develop into a key technology in this area.

ARBER: It is important to point out that our bodies are also home to a gigantic pool of microorganisms – just think of intestinal flora – many of which we still can't culture in the lab, which is why our knowledge of them is still limited. Modern medical technologies could help illuminate these areas.

SCHWAIGER: I count in particular on new technologies when it comes to making reliable statements as to whether a treatment will be effective, and for which patients. Thus far, it has traditionally taken weeks or even months before we

can say whether a tumor, for instance, will respond to a given chemotherapy. It should be a big goal of our's to determine this earlier than before. Once we can do so, we will be able to spare patients from undergoing useless treatments, prevent bothersome side effects, and reduce costs.

REQUARDT: The fear that these advantages would benefit only a small percentage of patients is only partly justified. We know that diagnosis and treatment become less expensive as soon as the methods involved can be used on a broad basis, for larger groups of people. But that isn't enough when it comes to building knowledge-based systems in the long term. In this regard, we need to move away from old structures, because society has to start investing right now so that relevant data can already be collected.

CIECHANOVER: That takes us into a minefield of ethical questions. Does that mean we want to collect private information across the board? I advocate a voluntary system. Why? Because the medical field has developed in this direction. Let me describe it in four stages: First, we can glean *personalized* information about a patient, which, second, provides us with the *predictive* knowledge we need to make statements about the future, such as his or her high cholesterol increases the risk of heart attack. Then, third, we can take reasonable *preventive* action, such as recommending that the patient take statins. But – and this, fourth, is the crucial point – we need *participation*, we have to get the patient involved in the decision-making. The patient has to consent. The doctor-patient relationship is no longer a relationship of power.



The panelists agreed that innovative medical technologies have the potential to make important contributions to solving future health problems – under the right circumstances.

“I experienced the enthusiasm when the genetic code was cracked. Now, we have had to recognize that between the genome and the phenotype, there are still many steps in gene regulation and epigenetics.”

Professor emeritus Werner Arber, PhD, University of Basel, Switzerland





“Knowing a patient’s individual metabolic pathways enables the use of medicine on a substantially better targeted basis, namely more safely and effectively, and that can help cut costs considerably.”

Professor Hartmut Michel, PhD, Director, Max Planck Institute of Biophysics, Frankfurt am Main, Germany

ARBER: Plus, we should be highly skeptical in terms of what we might achieve by mapping an individual's genome. I experienced the enthusiasm when the genetic code was cracked. Quite a few of our colleagues then thought we'd understand everything soon. Now, we have had to recognize that between the genome and the phenotype, there are still many steps in gene regulation and epigenetics.

MICHEL: The knowledge we derive from the genome might not be everything we need. But nonetheless, we can use detailed genetic analyses to predict that changing just one single base sequence in the DNA will change a receptor in a way that a medication can no longer attach well to it. The medication's efficacy might be reduced one-thousand-fold. And that applies to very widespread substances, such as beta blockers. But we do need to protect data to make certain that individuals do not suffer negative consequences from others gaining access to their genome.

CIECHANOVER: I am highly optimistic that these issues will be solved. We might be able to motivate large numbers of patients to participate in these developments. More and more patients agree that they have to take responsibility for their own health. They understand very clearly that they have to take preventive steps and that they will also need these new technologies. The medical knowledge that is publicly available will also contribute in this regard. We will probably see the advent of something like the medical version of Wikipedia, maybe a Medicinedia or Wiki Medicine.

SCHWAIGER: I do, though, see another task that I think has not been addressed adequately. There is the risk that the growing body of specialized knowledge and technologies will not be applied. For example, some PET scans are part of the standard medical care in Switzerland, with reimbursement as a matter of course, while we here in Germany are still debating whether applying these methods is justified. It does, of course, take a lot of labor-intensive steps to prove that a new technology is in fact more effective than conventional methods. In this regard, we also need the help of funding agencies



With regard to collecting private health information, Ciechanover advocates a voluntary system.



Looking at the long term, Requardt promotes investments in early, individualized diagnostics.

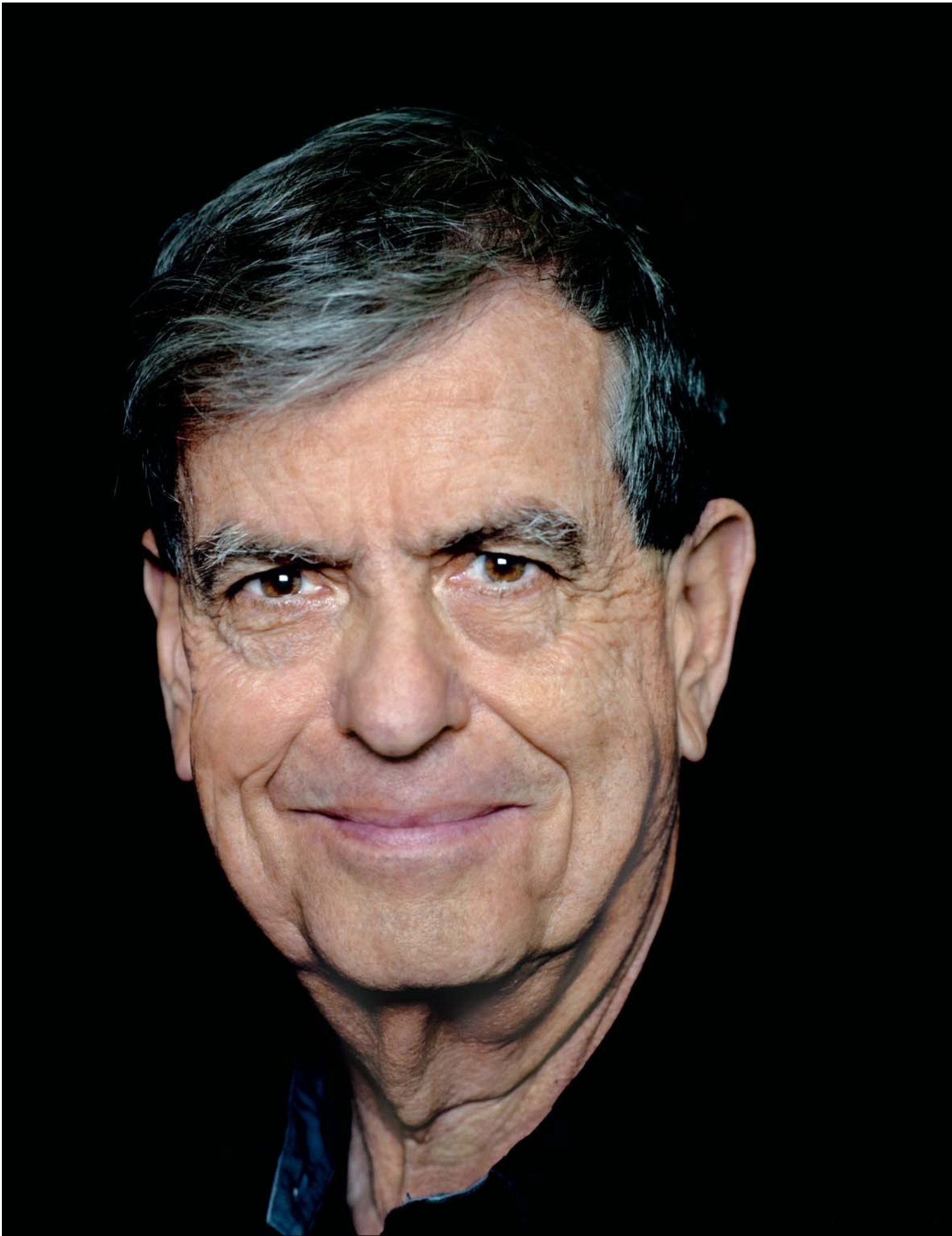


Michel asks how dwindling healthcare resources should be allocated.

“There is a need in the overall economy to make medical care more individualized. It will be crucial to ensure that the existing models of healthcare are adjusted to new scientific findings.”

Professor Hermann Requardt, PhD, CEO, Siemens Healthcare, Erlangen, Germany





“Medicine has become participatory. We need social consensus on issues of financing healthcare services. Medical professionals alone, at any rate, don’t have the right to decide when a medical measure is still financially justified or not.”

Professor Aaron Ciechanover, PhD, Director, Rappaport Family Institute for Research in Medical Sciences, Israel Institute of Technology, Haifa, Israel



“Future medical technology will demand the integration of expert knowledge. Within clinical organizational structures, but most especially in training next-generation medical professionals, that means we need to break down outdated boundaries between specific disciplines.”

Professor Markus Schwaiger, MD, Director,
Nuclear Medicine Clinic and Polyclinic,
University Hospital Klinikum rechts der Isar,
Technische Universität München, Munich, Germany

to build that evidence. That's why it's disappointing that most large funding agencies devote so much more support to fundamental research rather than to clinical studies.

REQUARDT: I think another issue is that we still spend most of our money toward curative purposes. We aren't willing to pay a lot until something starts to hurt. But before that, when the patient doesn't feel anything yet, and simply generating knowledge costs money, investments are difficult. In light of demographic trends, though, we urgently need to resolve these kinds of fundamental issues.

MICHEL: That's exactly why we can't get around political decisions as to how dwindling healthcare resources are to be allocated, or whether we want to inject more money into the system. After all, we are moving toward an increasing level of sophistication and refinement in diagnostics, which will initially be more expensive the more individualized it is. For example, we could isolate soluble fragments of the HLA [human leukocyte antigen] from the blood plasma of each individual patient and analyze the peptides bound to these soluble HLA fragments to determine very early on whether tumor antigens are present anywhere in the patient's body, and then in the long run look for the tumor with increasingly narrowly targeted imaging methods.

REQUARDT: That could definitely turn out to be worthwhile. Right now, though, we can only absorb that kind of innovation by splitting the costs. In the long term, however, it might well be worthwhile to invest a lot of money in early, individualized diagnostics. The issue then is no longer to treat a tumor at an advanced stage, which is expensive, but rather to detect it very early on, or even to take preventive action.

CIECHANOVER: I think education will be the key. After all, even the public health system won't be able to cover all the costs in the future. Restrictions are on the rise in Israel, too. We need health education to enable patients to make decisions in the first place regarding which measures they truly want, and which they don't.

ARBER: Sometimes you have to be patient for many years before something catches on in society. Scientists proved long ago how harmful smoking is to the entire organism, but that knowledge did not filter down to the broader society until just recently. It takes a certain level of social pressure before rational findings can be put into practice.

Martina Lenzen-Schulte, MD, is a physician, medical journalist, author, and presenter. Her work appears in highly regarded medical journals and in general-interest media.

The opinions reflected in this article are those of the speakers and do not necessarily reflect those of Siemens Healthcare.

Expert Profiles

Professor Werner Arber, PhD, worked and taught as a microbiologist at the Biozentrum of the University of Basel, Switzerland, until his retirement. He received the Nobel Prize in Medicine in 1978 for the discovery of restriction enzymes and their importance to molecular genetics.

Professor Aaron Ciechanover, PhD, is a biochemist and researcher at the Israel Institute of Technology, in Haifa. He received the Nobel Prize in Medicine in 2004 for the discovery of how cells precisely control the breakdown of proteins through a protein called Ubiquitin.

Professor Hartmut Michel, PhD, is the Director of the Max Planck Institute of Biophysics in Frankfurt, Germany. He received the Nobel Prize in Chemistry in 1988, in recognition of his discovery of processes that play an important role in plant photosynthesis.

Professor Hermann Requardt, PhD, has been the CEO of the Siemens Healthcare Sector since 2008. Requardt, who holds a doctorate in physics, has been a member of the Managing Board of Siemens AG since 2006, initially as head of global research activities.

Professor Markus Schwaiger, MD, has been the Director of the Nuclear Medicine Clinic and Polyclinic at University Hospital Klinikum rechts der Isar, which is affiliated with Technische Universität München (TUM), in Munich, Germany, since 1993. He has also served as Dean of the Department of Medicine at TUM for many years.

Zeroing in on Targeted Therapy



Nowadays, drug response rates are often low. But, if medicine has an increasing wealth of knowledge about the individual biology of as many people as possible, doctors' abilities to help individuals will improve steadily as well. In the ideal case, this leads to standardized individual treatment – what we call zeroing in on targeted therapy. But if targeted therapy is to have any chance of success, physicians must achieve a new balance between experience and knowledge.

By Claus Peter Müller von der Grün

All people are similar in some ways and different in others. That is also true of the individual tumor biology of cancer in different patients. "New findings in biology have changed the way we understand disease," says Professor Heinrich Iro, MD, Medical Director of the University Medical Center Erlangen, Germany. "Not everyone responds to a medication the same way. We want to know why and when it works – or doesn't." Examining this difference and charting courses of diagnosis and treatment that will ideally be successful in the individual case is the goal of what is now called "personalized" or "individualized" medicine. The term is "unfortunate" as Professor Hermann Requardt, PhD, CEO of Siemens Healthcare, admits: "We won't end up practicing six billion different kinds of medicine." Iro objects that the term suggests that the individual component has been lacking in medicine so far, but medicine always focused on the individual.

Calling this approach "individualized medicine" is also misleading because it suggests, in Requardt's words, that, through its manifold differentiation, it would finally lead to an "intelligent standardization" of medicine. And that, in turn, according to Iro, demands that "we collect and analyze as much data as possible." Science needs to describe individuality, fully exploring it and then typifying it, either with specific hypotheses in mind or through data mining, to ensure that detail is added bit by bit to the vision we have of the infinitely complex variations of real life, making it the basis of the kind of targeted medicine Iro and Requardt are talking about.

There is no question that the practice of medicine today lacks precision. Professor Peter Oberender, PhD, Director of the Center for Research on Social Law and Health Economics at the University of Bayreuth, Germany, uses a vivid image, speaking of "shotgun therapy." Not all of the hunter's shots actually hit the duck as it takes flight. And if the shooter does not miss the bird entirely, that is due to a combination of luck and skill. Similarly,

this approach to treatment can have far-reaching side effects.

Many Medications Are Rarely Helpful

Requardt has data to back it up. The drug response rate is 25 percent for cancer treatment, 30 percent for Alzheimer's disease, 50 percent for arthritis of the joints, 57 percent for the treatment of diabetes, and anywhere from 30 to 60 percent for drug therapy for depression.¹ These data in turn point to one conclusion: That we cannot afford this kind of "shotgun therapy" in the actual sense of the term, since financial resources in medicine are scanty and likely to stay that way. "Linearly extrapolated, despite personalized medicine, health spending in Germany will rise from 300 to 520 billion euro between now and 2025," Requardt says. And merely spending a lot does not always mean big returns: While figures for health spending climbed nearly 50 percent in Germany between 1995 and 2008, total health expenditures skyrocketed by 150 percent in the United States in the same period.² Despite the spending increases, average life expectancy in the U.S. is 1.5 years less than in Germany.³ Cost-effectiveness and good medicine, thus, are not necessarily mutually exclusive. In fact, the one presupposes the other. After all, every euro – or dollar – can only be spent once within the system. Wasted funding is simply unethical. We need to practice moderation – and not just to save ammunition. For ethical reasons in particular, we cannot "take

aim" at a person with a certain therapy if we know that the therapy is not likely to be effective, but will only do harm. In that regard, individualized medicine is a challenge for all of us, requiring that we make several paradigm shifts at once. Requardt predicts that the pharmaceuticals industry, for example, will have to accept that as treatments become more precisely targeted, there will be fewer blockbuster drugs.

Who or What Does Medicine Serve?

Medicine itself will change, too. "A doctor's actions used to be primarily guided by experience. That's why the prevailing opinion was that an old doctor was a good doctor. Now, though, medicine is becoming more and more based on knowledge," Iro says. "But once knowledge is present," Requardt says, describing the difference between knowledge and individual experience, "you can give it away or sell it, but it definitely moves around in the world." So does that mean the shift toward personalized medicine represents a dialectical leap toward a new kind of quality?

Patients will also have to be more realistic in terms of their expectations regarding medicine. That may be tough. While social healthcare systems currently have to offer every patient almost every service, the likelihood that each service will help or not help each person is similar, which will change in the future. While one patient will have access to treatment that fits perfectly, another will have to



Heinrich Iro from the University Medical Center Erlangen, Germany, Peter Oberender of the University of Bayreuth, Germany, the moderator and Hermann Requardt, CEO of Siemens Healthcare (from left) agreed that today's practice of medicine lacks precision.



Iro, Oberender, and Requardt (middle) roused the audience's interest (left) by discussing more effective therapies and fewer side effects that may be enabled by targeted medicine. Requardt used a stroke workflow as an example of best-in-class practice elements (right).

face the reality of being part of the minority for which there is likely to be no help at all. But aside from issues of rationing care from the standpoint of cost-effectiveness, should we be permitted to deny any person the possibility of an effective treatment if that treatment is sure to be harmful, but there is still a chance, however slim, that it will help?

Knowledge Can Be Frightening

Another, even more challenging issue will be how to handle the new knowledge if it points the way to the future. Members of a discussion panel are far removed from the individual case, so they want to know more. Says Iro: "We doctors are keen on data, even if we don't know what it can be used for. Our job is to establish and gather findings, store them, and then analyze them in the light of more recent findings." Requardt urges that cell samples be taken from infants for DNA analysis. Perhaps that will help the child at some point later in life. Oberender, for his part, complains that the German public is too fearful and calls for greater openness in various fields, such as preimplantation diagnosis. But, the public asks whether there will be unintended consequences. The intentions behind collecting and analyzing data are good, but what about

the consequences? Is the transparency of this new approach toward medicine ensured?

Elsewhere, doctors who are committed to individualized medicine are offensively discussing the ethical implications of these methods. How should we handle patients in which we know, to a certain degree of probability, that he or she will develop a certain disease at a certain age? Should the doctor tell the patient about it, burdening him or her with such information? Even if there is no treatment yet?

The Past Slows the Future

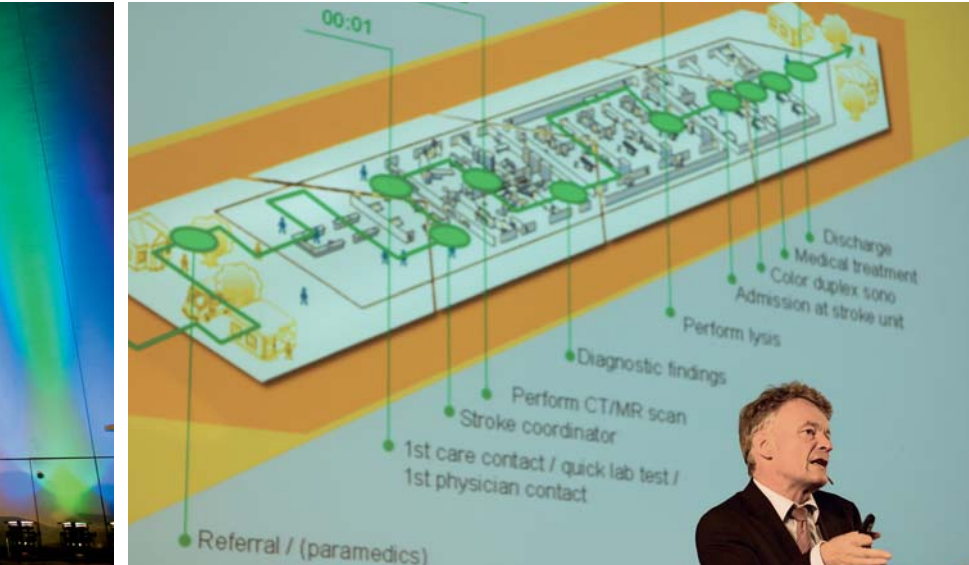
What will personalized medicine be like in the year 2050? We are separated from that future not only by a span of four decades, but by more than a century of existing public policy, a period during which country-specific social systems have formed and become established in the respective societies. That is true for all of us: the U.S., where social benefits are mainly provided by employers; the UK, with its National Health Service; and Germany, with its system of statutory health insurance, which was first introduced in Imperial Germany back in 1883, survived both the Nazi regime and Socialism, and has been considered virtually

immune to reform for more than half a century of democratic practice. Is the past slowing down the future?

Health economist Oberender has grave doubts about the adaptability of the healthcare system, noting that while the three academics in Erlangen talk about individualized medicine, policymakers in Germany cannot even set the boundaries between outpatient and inpatient care. Unlike other countries, Germany has a double, parallel system of care provided by specialists, both in outpatient practices and at hospitals, where patients are seen on an inpatient basis. Meanwhile, Oberender says, doctors are fighting – successfully – against transparency with regard to quality, because that would mean they would be under tighter controls. Pay for performance, he says, is what is needed instead. To assess medicine properly, Oberender urges that we should finally measure outcomes instead of inputs. Iro disagrees, saying that cost-effectiveness changes the reality, also in medicine. One-fifth of all hospitals would disappear from the market.

Evidence Trumps Eminence

So what about 2050? Physicist Requardt believes we will be living in an "enlightened society that does not fear knowl-



Summary

Challenge:

- Thus far, a large number of medications are ineffective for many people, since no two people are alike
- As a result, the drug response rate is low, reaching only 25 percent in cancer therapy and at most 60 percent for antidepressants
- This “shotgun therapy” needs to become more precise. The goal is “individualized” or “personalized” medicine, or even better, “targeted” medicine

Solution:

- Biology changes our understanding of diseases
- Medical professionals need information about the individual biology of as many patients as possible
- Intelligent analysis of the complex wealth of information available can serve as the basis for standardized therapy for individual cases

Result:

- Personalized medicine is still in the early stages
- It can help to utilize resources, which are always scant, more efficiently within healthcare systems
- Above all, though, it can help treat one patient on a targeted basis while also sparing another a treatment that has no benefits, but does do harm and costs scarce resources

edge.” On our way there, he says, individualization of medicine will lead to its optimization along the treatment chain. Economist Oberender points out the problem of trying to assess future human needs: “We want to be informed about everything, but our responses are sensitive when it comes to ourselves.” As a result, he views the chances of any preventive action with some skepticism, saying that the primary way to bring about behavioral changes is through financial incentives. At the same time, he emphasizes education, knowledge, and transparency, which leads to controls and from there, to quality.

“Not There Yet”

To Oberender, targeted medicine absolutely requires a culture of openness toward information technology. But Germany’s planned electronic health card, an intelligent memory card for every patient, similar in size to a credit card, has still not been introduced despite lengthy efforts. Doctors, he says, fear that they will lose power when evidence-based medicine displaces traditional “eminence-based” medicine. The new flood of knowledge erodes old positions; doctors need to become agents, advisors to patients. The picture Iro paints is neither especially

bleak nor especially bright. He believes that translational medicine, which straddles the gap between preclinical research and clinical development, will yield treatments for a number of diseases that are still incurable today, but, he continues, “We won’t manage to do it all. Medicine will remain opaque in a lot of respects. And we don’t know whether gathering and analyzing all this information will mean people will live longer, since the only thing we test right now is whether a certain tumor responds to a certain agent.” Iro is convinced that medicine will remain “personal” in the future, as it was in the past. Patients will not be squeezed into a formula so that a doctor from some university of applied sciences can reach the right treatment recommendation at the push of a button. Iro believes doctors will not refuse to change, and the old kind of doctor will not die out, since future physicians will combine experience and knowledge: “We’re on our way, but not there yet.”

Claus Peter Müller is a correspondent for the Frankfurter Allgemeine Zeitung for the states of Hesse and Thuringia. He joined the publishing group in 1986 and has worked since then on issues of healthcare policy and the healthcare sector.

¹ Source: Brian B. Spear et al., “Clinical Application of Pharmacogenetics,” *Trends in Molecular Medicine* (May 2001)

² “Innovationsimpulse” study, Federal Ministry of Economics and Technology, March 2011

³ <http://apps.who.int/ghodata/?vid=710>. Last accessed Aug. 30, 2011

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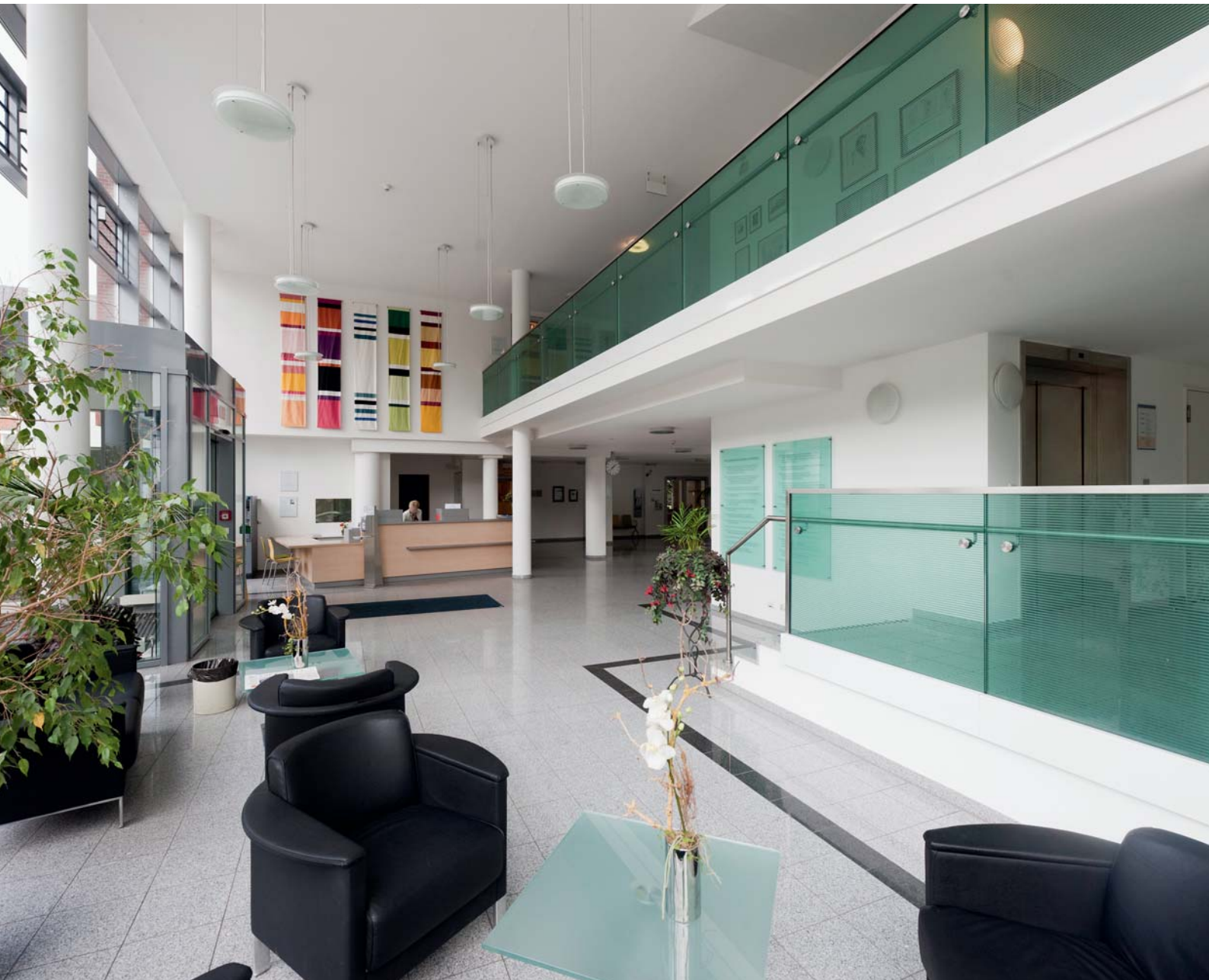
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Excellent – And Efficient, Too

The new SOMATOM Perspective scanner packs the latest innovations, not only in computed tomography, but also in total cost of ownership.

By Eric Johnson





6,700 inpatients and 4,500 outpatients are treated annually in the Israelitische Krankenhaus' modern facilities.



"Human kindness is the crown of all virtues," was the guiding motif of Salomon Heine, who endowed the Israelitische Krankenhaus Hamburg in 1839.

In Iceland, Greece, Portugal, even the United States, few governments have been spared the painful process of putting the knife to any expense that can be cut. As they scour their ledgers for line-items to delete, one obvious target is healthcare, much of which is funded directly or indirectly by the state.

Even in relatively prosperous, generous Germany, "spending is getting tighter and tighter, reimbursements are shrinking and shrinking," radiologist Johann-C. Steffens, MD, notes. At his radiology department in Hamburg's Israelitisches Hospital, the pressure to balance budgets continues to increase. "More than ever before," he says, "we are really keen to assess the costs and benefits of everything we do."

Driven by that focus on value for money, Steffens recently reached a major decision not to cut spending but rather to cut a check. Bringing in a brand-new SOMATOM® Perspective¹ computed

tomography (CT) scanner from Siemens will, he expects, drop the clinic's total cost of ownership (TCO) in CT. Meanwhile, the Siemens system will boast the latest in technology as well as comfort for patients and operators.

Give Me an E for Efficiency

Front and center of the SOMATOM Perspective scanner is its so-called "eMode". With the push of a single button, the scanner puts itself through an internal routine that optimizes all parameters of a scan to balance dosage and image quality while also minimizing wear and tear on the system. Coupled with this is a new service approach from Siemens: customers with a dedicated service contract who run the SOMATOM Perspective scanner in eMode for more than 80 percent of its operating time will be rewarded with one of several valuable service benefits. Fulfilling the preconditions, customers can, for example, choose

preventive maintenance out of prime working time or reduction of service cost for the following year. Then, there are the other perks. Full installation takes only one day. The SOMATOM Perspective scanner's relatively small size – a footprint of 18.5 square meters – lower power consumption, and reduced heat dissipation all spell reductions in cost. Yet while the SOMATOM Perspective scanner's TCO profile should warm even the coldest accountant's heart, this is no stripped-down scanner. Siemens has

Cutting Edge and Stellar Performance

By Amy K. Erickson

In an acute care setting, where seconds can mean the difference between life and death, fast, high-quality computed tomography (CT) images provide radiologists with information that is critical to making a proper diagnosis. CT images are used for a variety of clinical scenarios in the emergency department, such as identifying tears in the aortic wall, rips in the bowel, or finding tiny subtle fractures in the cervical spine, which – if undiscovered – could result in patient paralysis. “In a trauma setting, you want to obtain the best image quality possible, because we often have to make decisions very quickly about catastrophic injuries,” says Savvas Nicolaou, MD, a radiologist at Vancouver General Hospital in British Columbia, Canada. “Having high-quality images gives me greater confidence when making clinical decisions.”

In addition to clear images, Nicolaou notes that it is important to use the lowest possible radiation dose. “For example, if you have a 23-year-old woman with chest pain, you need to do a CT scan to exclude aortic dissection, coronary embolism, or myocardial infarction,” explains Nicolaou. “However, we want to minimize the radiation dose to that young woman because the breasts, thyroid, and other organs are very sensitive to radiation.”

At the German Heart Center in Munich, Jörg Hausleiter, MD, relies on CT images to identify any narrowing or atherosclerotic plaques in a patient’s coronary arteries. “The normal coronary artery is only three millimeters in diameter, so we are talking about very, very tiny structures,” says Hausleiter. “We need to have a very high spatial resolution to detect changes in the coronary arteries. The higher the spatial resolution, the higher our capability to detect these changes.”

To provide leading radiologists like Nicolaou and Hausleiter with CT images at the highest spatial resolution and lowest dose, Siemens is launching a revolutionary new generation of detectors: The Stellar Detector, the first detector with full electronic integration. Debuting at the 2011 RSNA in Chicago on the



Savvas Nicolaou makes a point of achieving high image quality at low dose, a combination he expects the new SOMATOM Definition Edge¹ CT scanner to master with ease.

SOMATOM Definition Flash, its full electronic integration – or TrueSignal Technology – minimizes electronic noise. This increases the signal-to-noise ratio, especially when scanning at low signals or with low radiation. It is also the enabler for the unique Edge Technology¹. It allows the generation of 0.5-millimeter (mm) slices and thereby delivers a spatial resolution of 0.3 mm. In the past, thinner slices delivered more image detail, but suffered from higher image noise at the same time. The unique Stellar Detector minimizes the intrinsic electronic noise due to the full electronic integration. With this, the increased spatial resolution now becomes suitable for clinical routine. Based on the new Stellar Detector, Siemens additionally introduces the SOMATOM Definition Edge¹. Using the latest technology from the Flash, it is bound to be the new reference in single source CT.

“As radiologists, we can’t forget that ultimately, we need to make a diagnosis,” says Nicolaou. “The future of radiology is heading toward optimizing low-dose imaging while maintaining diagnostic image quality.” With the SOMATOM Definition Edge scanner from Siemens, the future is already here.

Amy K. Erickson is a freelance writer and communications consultant specializing in medicine, biotechnology, and health, located in San Francisco, California, U.S.

¹ Under development, not for sale in the U.S.

fitted it with the latest innovations in CT technology.

Still Tricked Out

iTRIM (Iterative Temporal Resolution Improvement Method) enables the SOMATOM Perspective scanner to cope with high-speed movement and therefore be used in cardiac CT. iTRIM improves image quality in cardiac imaging for systems not offering the highest rotation

speeds by providing a superior temporal resolution compared to conventionally reconstructed CT images, while maintaining the same overall image impression.

With its unique Interleaved Volume Reconstruction (IVR), the system has been designed to detect even the smallest diagnostic details by using information from 128 slices. Thanks to IVR and iTRIM, the SOMATOM Perspective scanner is

suited for any clinical field, including reliable cardiac imaging. Moving from his current 16-slice scanner to 128 slices, says Steffens, will also reduce the occurrence of artifacts. “We’ll get better coverage and less interference.”

Finally, the SOMATOM Perspective scanner offers the latest in dose reduction, a topic that keeps penetrating the consciousness of patients. Says Steffens, “Patients are more concerned than ever

“More than ever before we are really keen to assess the costs and benefits of everything we do.”

Johann-C. Steffens, MD, Director, Radiology Practice,
Israelitisches Hospital, Hamburg, Germany



about exposure.” One antidote here is CARE Dose4D™. This technique of real-time tube current modulation based on the patient’s actual size and shape leads to a significant reduction of radiation dose.

Another is the use of Iterative Reconstruction (IR), which has long been known and applied in other fields, but until recently, to use it with CT imaging in conventional clinical medicine was simply too time-consuming. The computer took too long to calculate the images. With SAFIRE² (Sinogram Affirmed Iterative Reconstruction), Siemens introduced its first raw data-based iterative reconstruction. SAFIRE achieves up to 60 percent³ dose reduction for a wide range of applications, delivers superior image quality, and shows an excellent reconstruction speed of up to 15 images per second. SOMATOM Perspective brings SAFIRE into daily routine.

The last twist in dose-reduction comes from detectors made of Ultra-Fast Ceramic (UFC), which have become a key feature in CTs that predate the SOMATOM Perspective scanner. UFC outperforms conventional detectors, which require more radiation to generate an equal-quality image.

Amid the concern for cost optimization and high performance, SOMATOM Perspective’s designers still remembered its day-to-day associates. For operators, there is a full complement of “ease your workday” features. Accessories such as FAST Planning, FAST Cardio Wizard,

Workstream 4D, syngo® user interface, and Storage box help technicians go faster, with less effort.

Chillaxed

So, what about the “end-users” – patients undergoing scans? SOMATOM Perspective provides another important message: more comfort. The Siemens’ Illumination Moodlight™ in the gantry can create an atmosphere that is more welcoming than clinical. Most of all, says Steffens, the speed and accuracy of the SOMATOM Perspective scanner are a comfort in themselves. With the SOMATOM Perspective, it is possible to perform scans within the 50-centimeter scan range with high image quality in only 5.21 seconds. “Patients spend less time holding their breath, rolling, or stretching, and fewer scans are required. For patients such as ours who tend to be seriously ill,” he adds, “this can be a major relief. Less effort and less time spent in a CT scanner, yet still excellent clinical results.”

Eric Johnson, based in Zurich, Switzerland, writes about technology, science, and business.

Summary

Challenge:

- Meet the disparate demands of cost consciousness and top technology in CT, while keeping in mind the needs of patients and scanner operators

Solution:

- A CT scanner with eMode for efficient 128-slice imaging, and the latest in low dosage
- A full complement of “ease your workday” features, plus added comfort for patients

Result:

- The new SOMATOM Perspective CT scanner squares the circle of economics and performance and aims to delight operators and patients with its user-friendliness

Further Information

[www.siemens.com/
SOMATOM-Perspective](http://www.siemens.com/SOMATOM-Perspective)

¹ Under review, not for sale in the U.S.

² In clinical practice, the use of SAFIRE may reduce CT patient dose depending on the clinical task, patient size, anatomical location, and clinical practice. A consultation with a radiologist and a physicist should be made to determine the appropriate dose to obtain diagnostic image quality for the particular clinical task.

³ The following test method was used to determine a 60% dose reduction when using the SAFIRE reconstruction software: Noise, CT numbers, homogeneity, low-contrast resolution and high-contrast resolution were assessed in a Gammex 438 phantom. Low-dose data reconstructed with SAFIRE showed the same image quality compared to full-dose data based on this test. Data on file.

One Plus One Is More Than Two

Ultrasound is recognized as the most patient-friendly imaging modality of all. But finding your way around an ultrasound image is not always easy. Using modern computer technology to fuse live ultrasound images with computed tomography or magnetic resonance imaging data sets provides ultrasound with an add-on-navigator. Fusion ultrasound¹ has the potential to improve patient care, reduce radiation exposure, and save time – provided that the process of fusion itself is quick and automated.

By Philipp Grätzel von Grätz, MD

Using ultrasound for medical diagnostics requires an ability to think multidimensionally. While a computed tomography (CT) scan consists of a series of horizontal slices cut in parallel through the body every few millimeters, an ultrasound image can be more complicated to grasp. But this represents no problem at all for Dirk-André Clevert, MD, Associate Professor of Radiology and Section Chief of the Interdisciplinary Ultrasound-Center at the University of Munich's Klinikum Grosshadern, Germany. When Clevert examines a patient's abdomen with ultrasound, the movement of the probe comes automatically to him.

It looks easy, but actually it is not. To understand ultrasound images, doctors need to be able to picture a three dimen-

sional model of the anatomy in their mind during every second of the procedure. And, they need to be able to look at this virtual model from any direction. On a CT or magnetic resonance (MR) image, a normal abdominal aorta has nearly the same appearance. And in a standard projection, it is always located close to the spinal cord. With ultrasound, there is no such clarity; the visualization of the aorta relative to other organs is partially dependent on patients' body habitus, the operator, and also the transducer's scanning angle.

Since ultrasound is quick, comparably cost effective, and patient friendly, while CT or MRI imaging is superior in terms of providing a complete overview of the anatomy, this begs the question: why not

bring both imaging modalities together and have the best of both worlds? Why not do with ultrasound and CT or MR imaging what has already been done with PET and CT imaging?

"Fusion Ultrasound is Ready for Clinical Routine"

Says Clevert: "The concept of fusion ultrasound is straightforward. I use ultrasound in the same way I always do, but in addition, the system superimposes a CT or an MRI dataset. And this means that I am no longer confined to the limited field of view that ultrasound offers.

Thanks to the superimposed CT or MRI anatomy, I always get the whole picture." Clevert has been working with fusion ultrasound since 2005. "The technology



Fusion imaging provides the doctor with all the spatial information with which he is familiar from CT or MRI, but there is no need for additional radiation or the additional use of nephrotoxic contrast media.

has evolved impressively since then. And I really think that it is now becoming interesting not only for big academic centers like ours, but also for smaller hospitals, and, indeed, for radiologists in private practice." To understand the scope of fusion ultrasound and how it can be so interesting for modern hospitals in times of ever increasing patient turnover, it is necessary to look at the different scenarios in which the technology can be used. On the one hand, there are diagnostics and follow-up diagnostics. Patients with a liver tumor, for example, have to have their liver checked regularly in order to identify morphological changes early. Patients who have undergone an operation on an aortic aneurysm and have a stent graft implanted in their aorta also

need to be monitored because of the risk of dangerous leakage. The most straightforward way to perform this kind of monitoring is to carry out CT scans at predefined intervals. "But this means exposing the patient to radiation repeatedly, which is far from ideal," says Clevert. Ultrasound can do the job in many cases. But comparing one ultrasound examination to another later on, or to a CT or MRI scan that has been done before, can be challenging. This is why many radiologists still prefer CT or MRI imaging for this kind of follow-up diagnostics. "With fusion imaging, we can use ultrasound and still have all the advantages of CT and MRI imaging. Most of these patients had a CT or MRI scan at some point in the past. We take this old data set, feed it into the

ultrasound system and do the actual follow-up examination using ultrasound only." What Clevert then sees on screen is no longer the standard ultrasound image, but an ultrasound image embedded into the CT or MRI anatomy. Fusion imaging provides the doctor with all the spatial information with which he is familiar from CT or MRI, but there is no need for additional radiation or the additional use of nephrotoxic contrast media. In addition to diagnosis and follow-up, image-guided interventions are the second area of application in which fusion imaging has the potential to revolutionize daily imaging routines. "Using fusion imaging for intervention means that we can be far more confident when we place a needle, without having to turn on the



“I really think that fusion ultrasound is now becoming interesting also for smaller hospitals, and, indeed, for radiologists in private practice.”

Dirk-André Clevert, MD, Associate Professor of Radiology,
Section Chief, Interdisciplinary Ultrasound Center, Klinikum Grosshadern,
University of Munich, Germany

Summary

Challenge:

- Provide a fusion ultrasound system with an optimum workflow
- Enable on-demand use of the technology without having lengthy planning for examinations

Solution:

- Replace the external cube-shaped magnetic field generator with a flat plate transmitter that is far more effective
- Provide an innovative auto-registration procedure that superimposes ultrasound and CT/MRI data sets within seconds

Result:

- Better image quality and better comparability, particularly during follow-up
- Less radiation exposure both in diagnostics and in interventions
- Ability to reduce costs by reducing the need to repeat low-quality MRI or CT exams and instead combining them with ultrasound

fluoroscopy all the time,” says Clevert. Relying on ultrasound, or at least partly relying on ultrasound, for interventions again reduces the amount of radiation for the patient. It means less need for iodine contrast media and thus less strain on the kidneys. But it is also good for the interventional radiologist who is exposed to far higher doses of radiation than most of his patients due to the many procedures he has to perform on a daily basis.

On-Demand Fusion Ultrasound No Longer a Dream

Given its numerous advantages, how is it that fusion imaging has not already become a mainstream tool in clinical routines? One answer is that, as of yet, the use of fusion imaging has been hampered by cumbersome workflows. “In the early days, it sometimes took up to two hours to prepare for image fusion,” Clevert explains. Another problem with some ultrasound fusion systems is that they require markers to be placed on the skin during the CT examination in order to be able to register the ultrasound images with the CT images later on. This is not always practical, since the doctor has to know at the time of the CT that he intends to use fusion ultrasound at a later point in time. Problems like these have prevented the theoretical advantages of fusion imaging from being exploited in practice, because fusion imaging often necessi-

tates detailed planning well in advance. Those days are gone, though. Clevert is using a Siemens ACUSON™ S Family ultrasound system for research purposes that has been equipped with the necessary software and hardware for state-of-the-art fusion imaging: “Today, patients come to us with a DVD that contains a CT or MRI scan and we decide on-site whether or not fusion ultrasound would be helpful for this particular patient. Feeding the data into the system is a question of one to two minutes.” The important point here is that this works with every CT or MRI data set that fulfils the conventional DICOM standard, irrespective of whether the scan was taken inhouse – in which case it can be retrieved directly from the picture archiving and communication system – or in the private practice of a radiologist weeks beforehand. With the ACUSON S Family, fusion ultrasound is now available on demand.

Autoregistration Reduces Fusion to a Matter of Seconds

Having uploaded the CT or MRI data set, Clevert has to register (or superimpose) the data with the ultrasound data. Similar to uploading data, registration in fusion ultrasound has long been a time-consuming procedure. “There are some systems that require a point-based registration, which means that the doctor has to manually mark corresponding points on the

CT or MRI and on the ultrasound images in order to properly superimpose both modalities," says Clevert. By contrast, registration with the Siemens technology is fully automatic. "Under normal circumstances, registering the ultrasound with the CT or MRI images can now be done in a matter of seconds," says Clevert. A key feature of the S Family ultrasound system integral to the auto-registration procedure is an innovative magnetic field generator. It is integrated into a flat plate that is placed directly beneath the patient during the ultrasound examination. A magnetic field generator is indispensable in fusion ultrasound because the system has to "know" the exact position of the ultrasound transducer. The S Family systems alternatively offer a conventional magnetic field generator, which looks like a small box that is placed next to the patient. "We need the conventional generator occasionally, especially when we perform fusion imaging during a CT examination. But for the majority of patients, we use the flat plate generator because it has a far better performance," says Clevert.

Saving Time and Money while Improving Patient Care

Given all the advantages of fusion ultrasound, Clevert is convinced that the time has come for the technology to enter clinical routine across the board: "A lot of time can be saved if we do not have to organize an additional MRI or CT examination. And fusion helps us to provide better and less intrusive care." Clevert has no doubt that fusion ultrasound is cost-effective as well. "It is easy to calculate: if I save one or two unnecessary MRI examinations per day thanks to fusion ultrasound, I will not only save money but also reduce our MRI waiting lists, thereby improving patient care." Clevert uses fusion ultrasound predominantly for patients with abdominal diseases. He specializes in patients with liver disease. "But the scope of the technology is not limited to the abdomen," he says. "You can potentially use it on all organs that can be accessed by ultrasound." Recent publications^{2, 3}, for example, reported on positive experiences in

patients with joint disease. Interventions in patients with liquid formations in the extremities or any other form of soft tissue pathology could also be good candidates for fusion, according to Clevert. Learning the technology is not difficult either, at least for someone who knows how to handle ultrasound: "After the third patient, I felt comfortable."

Philipp Grätzel von Grätz is a medical doctor turned freelance writer and book author based in Berlin, Germany. His focus is on biomedicine, medical technology, health IT, and health policy.

The Best of Both Worlds

By Doris Pischitz

At the RSNA 2011, Siemens launched the premium, multi-specialty ACUSON S3000™ ultrasound system, which can perform fusion imaging in a very detailed and fast way. The combination of ultrasound with other imaging methods improves the quality of medical care by fusing an existing, 3D computed tomography (CT) or magnetic resonance (MR) image with a real-time ultrasound image.

To date, fusion techniques have required bulky transmit-and-receive equipment to track the patient's anatomy in real-time. Also, patients needed to lie completely still during the entire exam to prevent elaborate manual realignments before the examination could continue. The ACUSON S3000 system overcomes these limitations.

As hardware components, the ACUSON S3000 system features a magnetic field generator, placed at the patient's side, or a magnetic field generator integrated into a flat plate, which is placed under the patient and provides enhanced performance. Additionally, it includes innovative automatic registration software, meaning no manual points or plane registration are necessary. This auto-registration provides extremely fast automatic registration of the data, allowing quick and easy re-registration should the patient position change, thus helping minimize examination time.

For data registration, the DICOM data set from the CT or MRI is uploaded to the ultrasound system. Standard DICOM volume data sets of all cross-sectional CT or MRI examinations can be used for image fusion. Most of the patients will be examined in the supine position to mimic the situation of the CT or MRI setting. After successful automatic registration and image fusion, the registered CT or MRI images will be simultaneously shown on the ultrasound monitor with the respective ultrasound sectional plane. Additionally, two CT or MRI planes could be used simultaneously to improve the visualization of the lesion. All ultrasound techniques such as duplex-US, color Doppler, or contrast-enhanced ultrasound can be integrated in this image fusion examination.

Doris Pischitz is chief editor of Medical Solutions.

¹ Fusion ultrasound in a works in progress.

² Klauser AS, De Zordo T, Feuchtner GM, Djedovic G, Weiler RB, Faschingbauer R, Schirmer M, Moriggl B. Fusion of real-time US with CT images to guide sacroiliac joint injection in vitro and in vivo. *Radiology*. 2010 Aug;256(2):547-53. Epub 2010 Apr 14.

³ Iagnocco A, Perella C, D'Agostino MA, Sabatini E, Valesini G, Conaghan PG. Magnetic resonance and ultrasonography real-time fusion imaging of the hand and wrist in osteoarthritis and rheumatoid arthritis. *Rheumatology (Oxford)*. 2011 Aug;50(8):1409-13.

Further Information

www.siemens.com/ACUSONS3000

Expanding Routine 3D Reading Capabilities



In early 2012, Siemens will release a highly sophisticated new version of *syngo.via*. It offers innovative and cutting-edge applications for almost all modalities. Some radiologists had the chance to preview the software at a *syngo.via* user conference in Austria – and were impressed.

By Oliver Klaffke



The new *syngo*[®].via¹ offers various innovative applications that will facilitate the work of radiologists and interventional radiologists in a multitude of ways. Long-awaited features have been developed for oncology, angiography, cardiology, and neurology. The new applications widen the clinical spectrum. "Siemens has listened carefully to their customers' feedback and now presents a system with both new, clinically valuable features as well as functions," say French radiologists Jean-Paul Abecassis, MD, and Denis Pariente, MD. They were among the radiologists who had the chance to see the first presentation at the First International *syngo.via* User Conference in St. Wolfgang, Austria, in September 2011.

What is particularly important for radiologists is the largely expanded range of applications. All the modalities have seen a large increase in the number of applications available, whether they are computed tomography (CT), magnetic resonance imaging (MRI), or molecular imaging (MI). And additional applications have been added for interventional imaging. "The CT and MRI features impressed me most," says New Jersey-based radiologist William F. Muhr Jr., MD. In his view, it was important to add more MRI applications to the new version of *syngo.via*. The additional features will be of great help in the daily practice of radiologists. *syngo.via*'s cross-modality functions are also very useful. "It helps

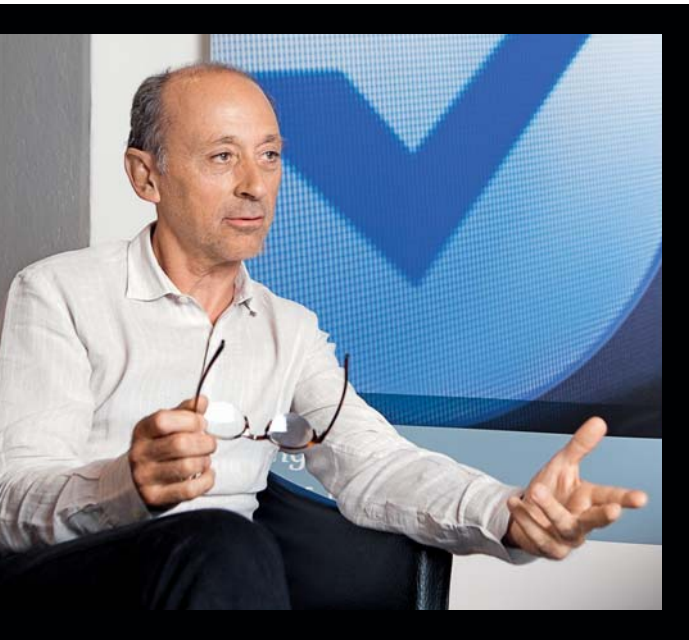
a lot to have CT, MRI, or PET [positron emission tomography] images on the same monitor side by side," Muhr says. "We need all the information on just one screen."

Better, Faster, More

The marvel of *syngo.via* is the system's ability to give radiologists fast access to images that are ready for reading, and to help streamline the workflow of a radiology department in general. With *syngo.via*, radiologists' work becomes very efficient, as more could be done in less time: cases are ready sooner. The combination of automated image pre-processing, computer-aided detection tools, and the fast access to data from computers linked to the system² is the key to *syngo.via*'s success. More than 1,000 customers worldwide have already installed *syngo.via*. They all benefit from Siemens' cutting-edge technology.

This innovative approach is taken further with the new release, promising an even more enhanced and efficient workflow, as well as higher productivity for clinicians who use medical images. New diagnostic and interventional applications, novel and flexible ways to use the predefined workflows, and widened options to access data are at the core of the update.

One of the new features that impressed radiologists at the preview was the Pulmonary Embolism Computer-Aided Detection tool (*syngo*.CT PE CAD³) available for



“Siemens has listened carefully to their customers’ feedback.”

Jean-Paul Abecassis, MD, Radiologist Consultant,
Paris, France

“In the end, it’s the patient who benefits.”

Christoph Thomas, MD, Radiologist,
Tübingen University Hospital, Germany



“The flexibility of *syngo.via* will enhance the diagnostic quality as well as save a lot of time.”

Kim McNulty, MD, Clinical Director for CT,
Waikato Hospital, Hamilton, New Zealand





“The multiple server access of the update is what we welcome very much.”

Denis Pariente, MD, Radiologist Consultant, Paris, France



“The new functions are really impressive.”

Steven W. Falen, MD, PhD,
Medical Director, Northern California PET Imaging Center,
Sacramento, California, U.S.



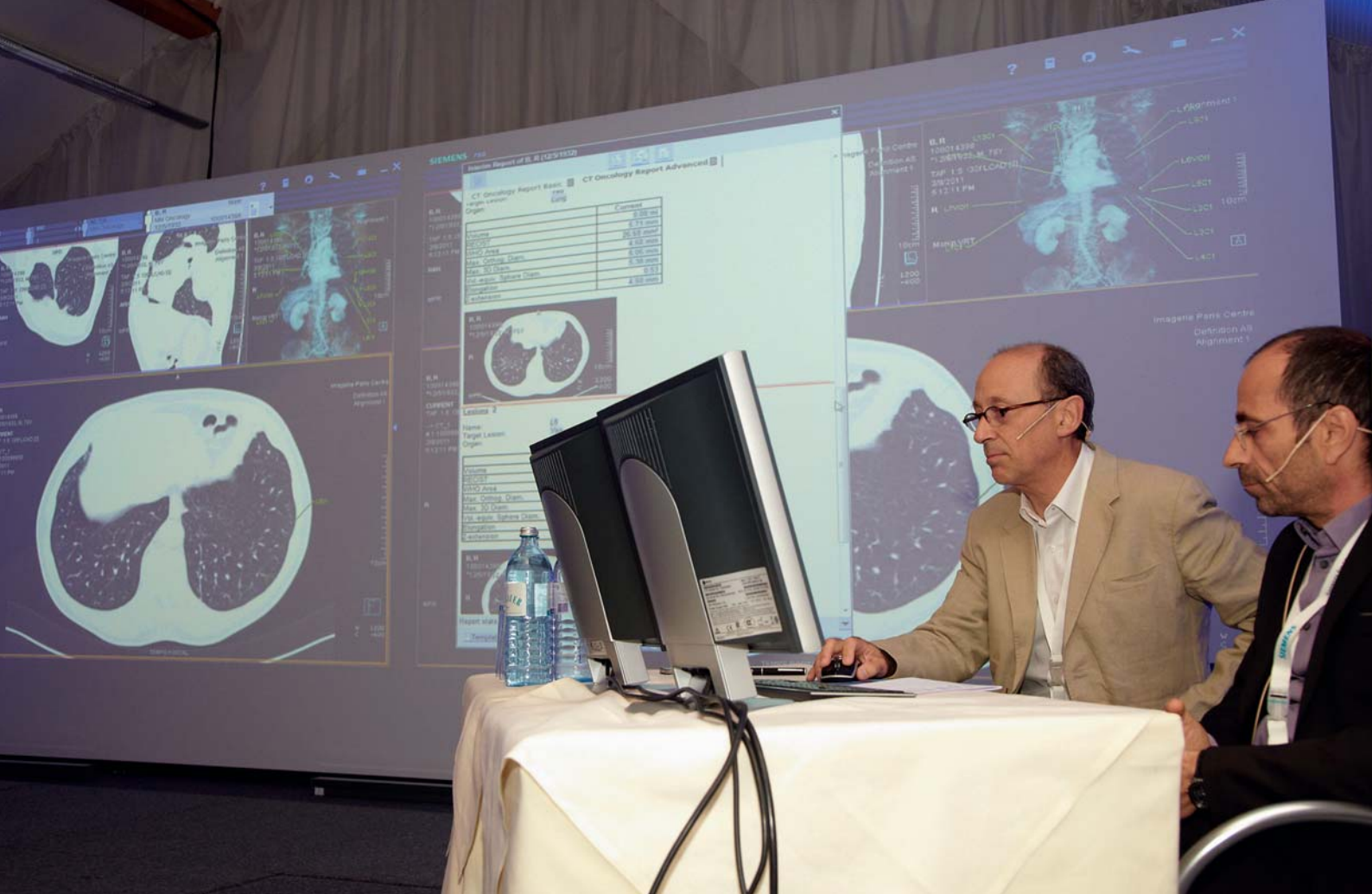
“What is very important to us is safety of patient data.”

Nicky Isaac, CT Technical Adviser,
Waikato Hospital, Hamilton, New Zealand



“It helps a lot to have CT, MRI, or PET images on the same monitor side by side.”

William F. Muhr, MD, CEO,
South Jersey Radiology Associates, New Jersey, U.S.



CT. "It's a fantastic opportunity that will surely facilitate our work considerably," says radiologist Christoph Thomas, MD, of Tübingen University Hospital, Germany. On the screen, the lung is shown in bright colors, indicating the status in different areas. Those affected by embolism are dark, almost black, and can be spotted immediately. By just a mouse click, important parameters appear on the screen while reading the images. This helps radiologists to get a better understanding of the patient's conditions more reliably and faster. Everybody involved in diagnostic workup knows that getting things right can be a tricky business when looking at radiological images to spot the extent of pulmonary embolism. So, the new *syngo.via* version offers a novel and faster way to make a proper diagnosis. No studies have been conducted yet, but it seems obvious that patients might benefit from radiologists using CAD Pulmonary Embolism (*syngo.CT PE CAD*)³ and *syngo.via*. "I think this is a major breakthrough," says Thomas.

Radiologists will certainly like other novel diagnostic tools, too. Think about the Automated Bypass Segmentation (*syngo.CT Cardiac Function*). It offers automatic segmentation and labeling of the main coronary arteries (RCA, LM, CX) as well as of the major coronary branches and saphenous vein grafts (SVG). Another new functionality for CT supports the treatment planning prior to a transcatheter aortic valve implantation (TAVI). The workflow CT TAVI Planning allows users to combine the assessment of the aortic annulus with the evaluation of the peripheral vessels.

The *syngo.CT PE CAD*³ and the CT Automated Bypass Segmentation (*syngo.CT Cardiac Function*) tools are but a few examples of an even larger range of new cutting-edge applications.⁴ For each modality, Siemens has designed new and exciting features. "The new functions are really impressive," says Steven Falen, MD, a radiologist based in Sacramento, California, U.S. "For oncological follow-up exams, the system now offers up to eight time points, whereas in former versions only two could be displayed." This will

help to make following patients easier and guiding therapy more effective.

Detect More with Dual Energy

Since the introduction of the SOMATOM® Definition as the first Dual Source CT, Dual Energy helped to make diagnoses faster and more reliable. The new *syngo.via* will take Dual Energy support a step further. The new Dual Energy applications especially impressed Thomas. He sees considerable advantages for diagnosing kidney stones and hence choosing the right treatment. *syngo.CT DE Calculi Characterization* visualizes the chemical differences in kidney stones, making it possible to differentiate uric acid stones from other stone types. Thereby, urologists get all the information needed to choose the best treatment for the patient. "In the end, it's the patient who benefits," Thomas says. Besides *syngo.CT DE Calculi Characterization*, five additional new Dual Energy CT applications are available for the new *syngo.via* software version.

Leaving the Path

One of the most important features of *syngo.via* is the availability of predefined workflows when dealing with, for example, a cardiology or an oncology patient. Following the workflow, the radiologist is "guided" through the diagnosis. The layout of the workflow is well adapted to the very needs of the particular case and the user is guided through it step by step.

Although the defined workflows are a substantial progress in radiological practices, they are sometimes perceived as too restricting by some radiologists. There are cases and circumstances when one wants to leave the predefined path to have a look at an aspect that just grabbed the radiologist's attention because very often patients have multiple ailments. A tumor patient will eventually have cardiac problems. When reading the images in the "onco workflow," the radiologist might wish to have a quick look at these from the cardiologist's perspective. In this case, it would be most convenient to switch from the onco to the cardio workflow and swiftly back again. The new *syngo.via*

Customers got an exclusive preview presentation of the functionalities of the new version of *syngo.via* at the first international user meeting.



Workstations were set up to offer participants the opportunity to fully explore the new version of *syngo.via*.



offers this kind of flexibility. "This will enhance the diagnostic quality as well as save a lot of time," comments Kim McAnulty, MD, clinical director for CT at Waikato Hospital, Hamilton, New Zealand. To do this with earlier versions of *syngo.via*, users had to close the case and load it again to access the data using a different workflow. "This cost considerable time," says McAnulty. "Doing it on the fly would be very advantageous." Now radiologists have the chance to leave the predefined workflow, pursue a different way, and come back to the routine procedure.

However, leaving the predefined workflow too easily might pose a threat to long-needed standardization in radiology. "It's not flexibility that is lacking in radiology in most cases, it's the lack of standardization that is the real problem in our field," warns Muhr.

Data Access from Anywhere²

Abecassis and Pariente welcome the update's multiple server access. They run a private radiology consultancy in Paris and the different modalities are hosted at different sites within the French capital. Their daily challenge is to ensure the availability of patient data regardless of where they are and where the patient is treated. "Having access when we are rotating between our facilities would be of great advantage," they say. Enhancing communication was of utter importance when designing *syngo.via* in the first place. No wonder the new version offers new ways to foster collaboration between radiologists. Its "remote function" will further help smoothen the workflow. A second radiologist – even at a different site – can join the reading online.

"What is very important to us is safety of patient data," says Nicky Isaac, CT Technical Adviser at Waikato Hospital. *syngo.via* helps ensure that patient data will remain confidential, even if several radiologists have access to the system at different sites. Data security is on the top of the agenda when Siemens takes on the challenges of mobile computing. Part of the future of radiology will surely

be mobile and Siemens will play a leading role. Two *syngo.via* Apps⁵ for the iPad⁶ have recently been launched allowing access to cases wherever one is, provided a connection to the Internet is available. Faster access to one's cases and getting them done is what *syngo.via* promised in the first place.

Oliver Klaffke is a science and business writer based in Switzerland. Among other publications, he has written for New Scientist and Nature in the past.

¹ *syngo.via* can be used as a standalone device or together with a variety of *syngo.via*-based software options, which are medical devices in their own rights.

² Prerequisites include: Internet connection to clinical network, DICOM compliance, meeting of Siemens minimum hardware requirements, and adherence to local data security regulations.

³ This product is not commercially available in the U.S.

⁴ The herein displayed and described features and applications are medical devices in their own right.

⁵ The *syngo.via* Mobile applications are not for diagnostic use.

⁶ The iPad[®] is a trademark of Apple Inc., registered in the U.S. and other countries.



Wolfgangsee provided a scenic backdrop for the international meeting participants.

Summary

Challenge:

- Use *syngo.via* to improve cross-modality functions
- Develop more diagnostic tools for MRI, MI, and CT in *syngo.via*

Solution:

- The latest version of *syngo.via*, launched in early 2012

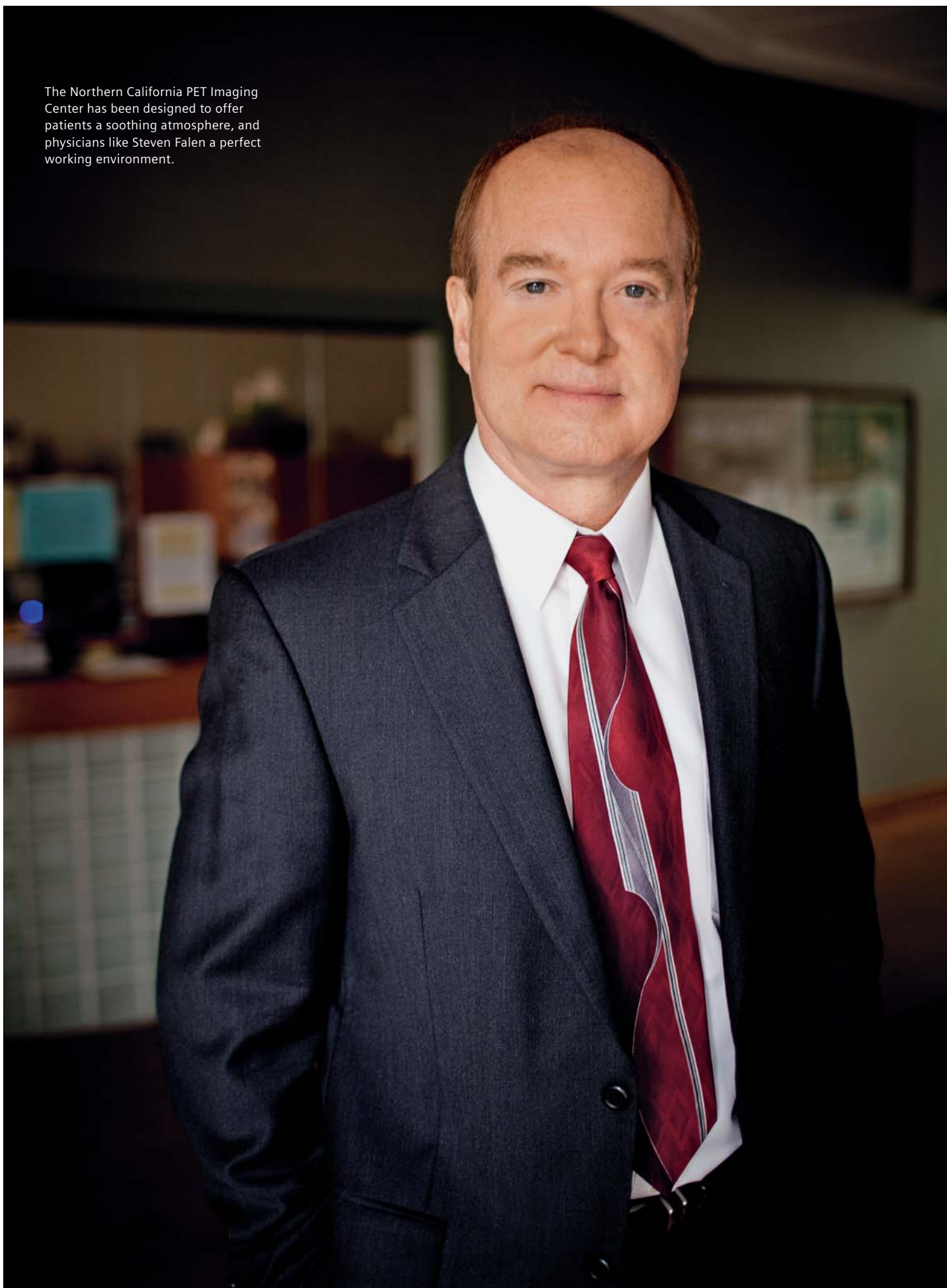
Result:

- More seamless, more efficient workflows
- More can be done quickly in radiology departments

Further Information

www.siemens.com/syngo.via

The Northern California PET Imaging Center has been designed to offer patients a soothing atmosphere, and physicians like Steven Falen a perfect working environment.



A Measure in Time

Advanced quantification methods in molecular imaging for oncology, neurology, and cardiology provide clinicians with exceptional, patient-specific data about disease and response to therapy. In short, these measurements truly can direct “personalized medicine,” helping ensure the best treatment for each patient.

By Diana Smith

Modern hybrid imaging techniques can be employed to collect both quantitative metabolic and anatomic information, particularly in oncology, cardiology, and neurology applications. This allows physicians to “spot the enemy” in patients earlier and more precisely than ever before, monitor disease, and make individual adjustments in the treatment path. The new Biograph® mCT redefines quantification in positron emission tomography/computed tomography (PET·CT) and provides high image quality, paving the way for physicians and patients to chart the best course for the future.

Setting the Standard

The Northern California PET Imaging Center (NCPIC) in Sacramento, California, U.S., has long been a pioneer in multi-modality imaging. Opened in 1992, the not-for-profit, community-benefit facility was the first outpatient PET imaging center in the United States. Today, the facility continues to be an imaging leader, serving as a specialty referral site for research studies in oncology, dementia, stroke, and cardiovascular disease.



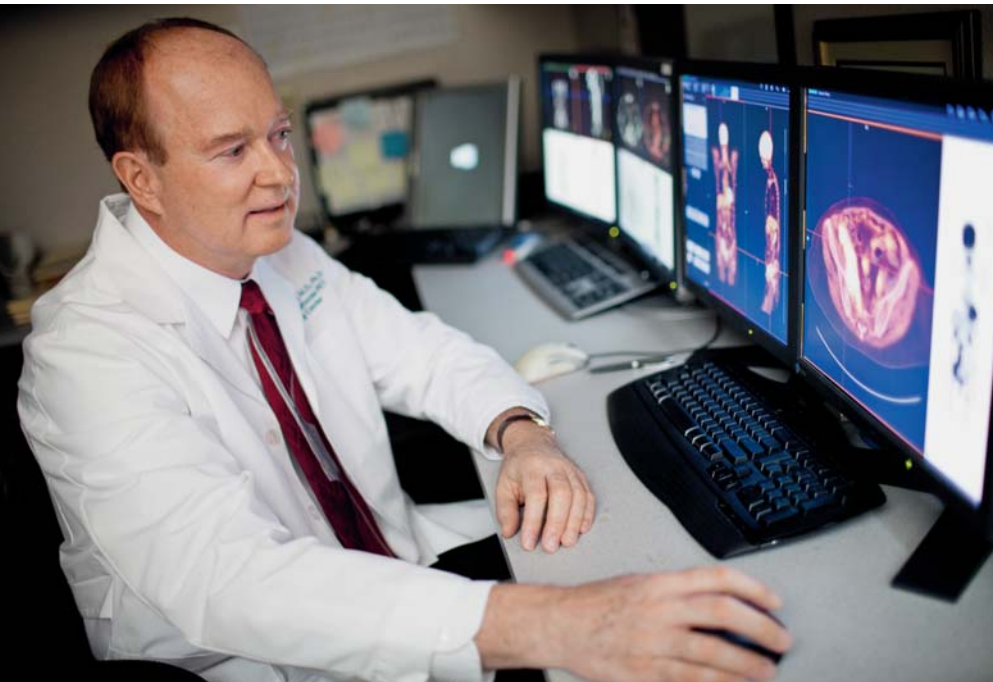
“Accurate and reproducible quantification of changes in metabolic activity of a tumor helps monitor treatment success.”

Steven Falen, MD, PhD, Medical Director,
Northern California PET Imaging Center,
Sacramento, California, U.S.

NCPIC is involved in clinical research with new radiopharmaceuticals and research that supports the use of PET imaging for new indications. The center has invested in the most state-of-the-art imaging technology available and delivers cutting-edge diagnostic capabilities in an integrated imaging environment. For thousands of patients, that means faster and more comprehensive answers to a wider range of medical concerns than ever before.

Steven Falen, MD, PhD, a radiologist and nuclear medicine physician, has served as Medical Director of the Northern California PET Imaging Center for six years. Working with Siemens, the Center upgraded to what they considered to be the best PET·CT on the market, the Biograph mCT scanner. The Biograph mCT is located at the main facility in Sacramento, while a mobile unit with a Biograph 6-slice high-resolution scanner makes the rounds to different hospitals in the area.

According to Falen, advanced PET·CT technology has significant benefits for patients. Biograph mCT provides exceptional image quality combining the



Biograph mCT combines the structural detail of CT with the ability of PET to detect and quantify changes in cell function – all in one noninvasive exam.

structural detail of CT with the ability of PET to detect and quantify changes in cell function – all in one noninvasive exam. “As a result, we can pinpoint the presence or spread of disease and can accurately identify its precise location,” says Falen. “With the exceptional resolution we have now, we are able to see smaller and smaller lesions, so we can detect and characterize disease earlier and stage it better.”

Earlier Detection, Better Response

Over time, clinicians can follow a patient, quickly determine response to therapy, and allow treatment to be tailored to the specific individual. This quantifiable data at each stage permits a more individualized and customized management of treatment, sparing the patient unnecessary procedures, radiation exposure, and emotional distress.

With a wide bore and short tunnel, the scanner’s large, open scanning zone accommodates a variety of patients, from pediatric to adults up to 500 pounds (227 kilograms) and helps alleviate a

sense of claustrophobia some patients may experience in conventional PET-CT systems. “Even in very large patients, the images are clearer, with less background noise, making it easier to identify and evaluate lesions,” explains Falen. He adds, “Our new mCT scanner offers four times the sensitivity of our previous scanner. And in general, for most exams, the scanning times have been cut in half. Previously – again, depending on the patient – most studies took from a half hour to an hour. A whole body scan, top of head to tip of toes, for a melanoma patient, typically took an hour. It had to be done in two parts, too. When you have to take so long, especially for cancer patients in pain, this is very difficult.” Shorter scan times facilitate less distortion from patient movement as well. “An ultra-high resolution brain study takes ten minutes,” reports Falen. “An F-18 sodium fluoride PET-CT bone scan of the lumbar spine can be completed in three minutes. We have patients who specifically ask to come here because of the reduced scan times and high quality of diagnostic results.” The Northern California

PET Imaging Center performs about 300 PET-CT studies a month.

Quantification Methods for Oncology

“The majority of studies we perform are for oncology – about 90 percent,” says Falen. “Most often, we see patients with lymphoma, breast cancer, lung cancer, and GI and colon cancer. But we do see just about every type of cancer. We’ve known for some time that glucose uptake in cancer cells is increased because of the increased metabolic demands of these rapidly dividing tumor cells,” explains Falen. Therefore, for an oncology study, a patient will typically receive an injection of a radioactive glucose-based radiopharmaceutical, or sugar molecule, called FDG (fludeoxyglucose), which accumulates in cancer cells more than in healthy cells. From the information obtained about cellular activity, physicians can determine if an abnormality is malignant or benign.

Even very small tumors can be detected, allowing for identification and treatment earlier and more accurately than ever. Additionally, advanced scans can show extent of disease. Physicians can determine the activity and location of cancer cells in different parts of the body based on detected radioactivity levels, potentially eliminating the need for painful and costly diagnostic surgery. “Ideally, we use the FDG scan to determine stage of disease, whether it’s localized or involves different organs or other parts of the body,” says Falen. “That helps determine the best clinical treatment strategy, that is, surgery, chemotherapy, radiation therapy, or a combination of these modalities.”

Most importantly, advanced and reproducible quantification of changes in metabolic activity of a tumor helps physicians monitor treatment success of the disease. “With one scan, we can tell if treatment is working or not,” says Falen. Chemotherapy leads to changes in cellular activity that is detectable and, with the new mCT, also accurately measurable often before structural changes can be measured. This allows physicians to observe how patients are responding

to treatment after only one or two treatment cycles, possibly leading to treatment modifications if a patient is not responding to a therapy.

Upon completion of treatment, physicians can track recurrence of cancer. The bottom line is that the earlier the diagnosis and the more accurate the assessment of the therapy response, the better the chance for successful treatment.

Applications in Neurology

For patients with neurological conditions, FDG PET-CT scans can show precise areas of increased or decreased glucose metabolism in the brain, determining the type, extent, and progression of disease. "For example, in Alzheimer's disease, there is a characteristic pattern of decreased biomarker uptake in the posterior temporoparietal association cortex," explains Falen. "In neurological studies, we are most often asked to differentiate between Alzheimer's disease, frontotemporal and other dementias. It's important to distinguish between Alzheimer's and different types of dementia because they require different types of therapy. We can also tell how severe the changes are in the brain. This is an area of great interest right now. New PET imaging radiopharmaceuticals are in clinical trials now and should be available for use in the near future."

Another neurological indication is for patients who have had brain tumors that were surgically removed. PET-CT allows physicians to track recurrence. Additionally, if a patient has experienced an epileptic seizure, physicians can use information obtained from PET-CT to pinpoint the focus of a seizure.

Cardiology Studies

Cardiology studies can play a critical role in diagnosing and evaluating extent of disease, determining heart tissue function and developing treatment strategy. At the Sacramento imaging center, the two main areas of clinical applications for cardiology are myocardial viability and myocardial perfusion studies.

"In myocardial viability studies, PET-CT imaging with FDG is used to determine and quantify the viability of heart muscle,

and whether it has been permanently damaged due to decreased or absent blood flow," says Falen. "If heart tissue has died because of restricted blood flow or myocardial infarction, the heart cannot function normally. Determining the amount of damage and the percentage of the heart affected helps the cardiologist or cardiac surgeon decide on appropriate treatment. If there is FDG uptake, the heart is viable, so if a surgeon does a coronary operation, there is a good chance the patient will gain some heart function. On the other hand, if we see that there is no uptake, it means that it is scar tissue, and putting the patient through surgery probably won't help at all."

In myocardial perfusion studies, PET-CT is used to reveal whether coronary artery disease (CAD) is present. Perfusion studies absolutely quantify and determine if blood flow is restricted by narrowing of the coronary arteries. In these cases, PET-CT imaging with an ammonia N-13 tracer is used to provide an accurate, noninvasive assessment of the coronary arteries. "This is an interesting type of radiopharmaceutical," explains Falen. "It's only got a ten-minute half-life." The tracer is therefore produced on-site. The big three – cancer, neurological conditions, and cardiovascular disease – are among the most devastating and costly illnesses in existence. However, advanced quantification methods in molecular imaging provide new ways and more precise measurements to detect, diagnose, and direct treatment. For patients, whether newly diagnosed or over time, individually tailored treatments result in better outcomes.

Diana Smith is a freelance writer specializing in health and medical topics based outside of Austin, Texas, U.S.

Summary

Challenge:

- Obtaining precise, quantifiable functional, anatomical, and molecular information for patients with cancer, cardiac, or neurological conditions
- Improving the ability of physicians to determine disease accurately and choose the right treatment path
- Enhancing the ability of physicians to monitor treatment outcomes and adjust treatment based on quantitative data, thereby increasing chances of positive outcomes for patients with disease
- Providing stellar image quality while using lowest achievable dose and maximum speed
- Providing a high-quality imaging environment for patients that is widely accommodating, comfortable, and reliable

Solution:

- Harness the unprecedented technology of Siemens' next-generation Biograph mCT to obtain a level of information not previously available
- Improve imaging modality quality and function to more accurately determine both the molecular and structural changes within the body faster and with the lowest dose possible
- Increase the use of PET-CT as a treatment-monitoring tool, allowing physicians to use quantitative data to see how well patients are responding to treatment

Result:

- High accuracy and reproducibility for diagnosis, staging, and treatment response with Siemens' next-generation Biograph mCT
- Achievement of highest quality diagnostic results with the fastest scan and lowest achievable dose
- Maximized workflow efficiencies and patient comfort
- Improved patient knowledge of health status, alleviating concern about presence of disease and improving patients' and their families' emotional states

Further Information

www.siemens.com/mi

Smart, Green, and Efficient: The American Heart Institute

One of the newest members of the Siemens Green+ Hospitals family, the American Heart Institute in Nicosia, Cyprus, provides high-quality care for a fraction of the cost typical of most other modern care centers. With Siemens leading the medical equipment concept, design, planning, and equipment procurement, AHI is an efficient, green hospital with a patient-centric focus.

By Matt Nash

At 8 a.m. on almost any day of the year, the Mediterranean island of Cyprus is plated in gold. While many seek shade to avoid the sun's strong rays, the solar-powered American Heart Institute (AHI) is harnessing that power to help run its hospital and keep costs low. Fully conceptualized, designed, and equipped by Siemens, AHI is a state-of-the-art cardiac care center and the first "green" hospital in the Middle East.

Investments in sustainable healthcare infrastructure require a balanced concept that puts economy and ecology in harmony. The Siemens Green+ Hospitals initiative thus supports the three success factors for sustainability in hospitals – green, quality, and efficiency – with an equal weight. As one of the Green+ Hospitals Siemens is involved in around the world, AHI has achieved excellence in all three dimensions. For example, AHI gets

some 80 percent of its power needs from renewable sources. The building makes use of both solar and geothermal energy, says surgeon and co-founder Marinos Soteriou, MD. Soteriou and partner Christos Christou, MD, first started AHI in a smaller facility. Keen to expand about a decade ago, they wanted bigger, better, and – most importantly – different.

"As physicians, we wanted to make a difference in more than one way," Soteriou says. "We wanted to show people that, in principle, anyone who is building nowadays should show some consideration for the environment. Basically, our motto was that we care for the ailing patient, but at the same time we care for the ailing planet."

"Big Bet" Pays Off

Soteriou also notes that one of the largest costs for any hospital – aside from staff,

he says with a smile – is the energy bill. The new, larger AHI – which specializes in adult cardiovascular and cardiothoracic surgery, kidney transplants, neurosurgery, general surgery, and orthopedics – uses only 40 percent of the energy that the old facility consumed. In an increasingly competitive market, and with an eye to putting Cyprus on the map as a destination for medical tourists, Soteriou and Christou decided to build green in what Soteriou calls "a big bet."

He refuses to divulge just how high the costs were and are to build and run AHI, but he is confident that they succeeded in winning that bet. "We really did manage to achieve tremendous savings without compromising patient care or quality of standards," he says.

Cost saving, Soteriou explains, is a long-term goal, with capital costs high in the hospital's early years. That said, for a



modern facility with the latest technology, the cost of care from the patient's pocket-book is lower than one would expect. Soteriou says that AHI is middle-market in terms of expenses for patients.

Technology Enhances Efficiency and Comfort

Energy savings go a long way in helping keep costs down. The hospital's roof is fitted with some 300 photovoltaic panels, which produce around 100 kilowatts-peak (kWp) of power – or enough to supply ten U.S. homes completely for a year, according to data from the U.S. Energy Information Administration. AHI is also surrounded by 40 boreholes, each 100 meters deep, which heat and cool the facility using geothermal energy. To maximize patient comfort, Soteriou says, heating and air conditioning in patient

rooms does not blow out of vents. Instead, pipes that carry hot or cold water zigzag just above the ceiling panels to heat or cool the rooms and hallways of AHI.

The building itself, which won the 2011 GreenBuilding Award from the European GreenBuilding Programme, is also designed to minimize energy use. According to the GreenBuilding Programme, the hospital uses 54.5 percent less energy than other buildings on the island compared to Cypriot building codes, and will save 350 megawatt hours of electricity each year. All windows on patient rooms are covered on the outside with movable white panels, which reflect the punishing midday sun to keep rooms cool, cutting down on air conditioning costs. However, reducing energy bills is not the only thing that maximizes savings



By selecting the latest technology, the American Heart Institute hopes to enhance care by enabling procedures to be done much faster and much more accurately, thereby cutting down on patient risk and improving results.

and makes AHI an up-and-coming leader in patient care. Early on in their plan to build the new hospital, Soteriou and Christou turned to Siemens to actualize their vision.

“Siemens was involved in the design, execution, and installation of medical and non-medical technology,” says Soteriou. “Obviously, we have state-of-the-art equipment. We almost have an exclusive partnership with Siemens in that respect. The idea is that by selecting the latest technology, you can optimize care in the sense that things are done much faster and much more accurately, cutting down on patient risk and improving results to a great extent.”

High-quality medical equipment also boosts efficiency, Christou explains. Using a Siemens Artis zee® cardiovascular imaging system, AHI boasts the latest in hospital technology – a hybrid operating room.

“A lot of procedures now are done endovascularly with the collaboration of surgeons,” Soteriou says, “so surgeons and interventional cardiologists or interventional radiologists work together now. You can do part of the procedure with the X-ray system, and then the surgeon can perform his task in the same room – you don’t have to move the patient. Our hybrid OR provides the angiographic suite and the surgical suite.”

A hybrid OR is good for the patient, because he or she does not have to be wheeled around the hospital, which decreases the chance of infection and complication, Christou says. Indeed, AHI pays particular attention to hygiene. Its executives opted to suspend all equipment in the hospital from the ceiling. This includes all equipment next to the hospital’s 50 patient beds and nine intensive care unit (ICU) beds. Suspending equipment enables fast, easy and thorough cleaning.

Soteriou says that the emphasis on keeping rooms spic-and-span also helped to reduce building costs during construction. In each room, toilets, sinks, and shower stalls came prefabricated, meaning as one complete piece. This material was less expensive to install and is easier to clean, since each piece



“Our motto was that we care for the ailing patient, but at the same time we care for the ailing planet.”

Marinos Soteriou, MD, Surgeon,
Co-Founder, American Heart Institute, Nicosia, Cyprus

“High-quality medical equipment also boosts efficiency.”

Christos Christou, MD, Co-Founder,
American Heart Institute, Nicosia, Cyprus



is one seamless unit with no cracks, corners, nooks, or crannies for dirt to hide in.

A “Smart” Hospital

As important as all of the hospital’s physical equipment is to keeping it running smoothly and efficiently, the backbone that supports the entire project is almost entirely hidden from view. The AHI is also a “smart” hospital, Soteriou says. Siemens implemented a building management system that not only monitors but responds to the hospital’s needs, he says.

“The building management system is basically a smart computer,” Soteriou explains. “It’s software. It optimizes the energy use of the building by controlling the function of the building in general – heating, cooling, fresh air supply, shading, and of course lighting as well. All of these functions consume a lot of energy in any building. By controlling them, you can achieve economies of scale, because you don’t waste energy where you don’t need it,” he adds.

AHI is covered with sensors and activators to feed the intelligent building management system, which is always on and can be remotely controlled and monitored. Combined with the latest in information technology advances, AHI is also on its way to being completely paperless. While that saves trees, it also ups productivity and streamlines workflow. Doctors can access patient files from anywhere in the hospital – or remotely, should they need to – which, given that the files are electronic, also helps circumvent that age-old problem of difficulty reading a doctor’s handwriting.

Patient Comfort a High Priority

Green energy and efficient systems that reduce costs are welcomed additions to the hospital, but the real goal behind AHI for Soteriou and Christou is providing the highest-quality care for patients. One way to achieve that is through pioneering procedures. While the latest in medical equipment certainly helps reduce the time patients spend in the hospital, AHI is also known for performing coronary angiograms and angioplasty through



The American Heart Institute is built to look nothing like what it actually is. Located on the highest point of Nicosia, its landscaping concept is aimed at providing scenic views for patients.

the wrist instead of through the groin, as is typical, Soteriou says. "That increases the patient comfort level, and, at the same time, patients can walk shortly after the interventional procedure. They don't have to lie in bed for several hours. It also cuts down on costs, since patients can go home three hours after the procedure. With a conventional technique, they have to be admitted to a hospital bed and stay there for eight hours or so. These patients [who have had the wrist procedure] can stay in a small lounge that we have upstairs. We call it the 'Radial Artery Club' because we puncture the radial artery to go in and do that," he says.

Along with new, less invasive procedures to boost patient morale, Soteriou points out that the entire building is designed to look nothing like what it actually is. "We worked on the concept that the words 'hospital' and 'hospitality' come from the same root. It is with that in mind that we proceeded to make this hospital look more like a hotel," he says.

The hospital's grounds are filled with ancient – some more than 1,600 years old – Cypriot olive trees. Soteriou says the hospital's landscaping concept is aimed at providing scenic views for patients – something they believe helps speed up recovery. AHI is located on the highest point of Nicosia, the Cypriot capitol, and from all directions enjoys an iconic view of the low-slung island city.

Inside, the hospital is just as naturally beautiful. The first thing to greet a patient upon entering AHI is a glass-enclosed atrium – which doubles as a waiting room – filled with trees. Tall, with broad, thick, green leaves, the schefflera and alstonia trees are native to Cyprus and require limited amounts of sunlight, which is why they were chosen for their new indoor homes. Above them is a frosted skylight that allows enough natural light to keep them healthy but also minimizes the sunshine pouring into the atrium, which would heat it up and require more air conditioning.

This inviting atrium, like the rest of the hospital, is filled with sculptures, murals, and paintings – part of what Soteriou says reflects his and Christou's view that "every patient is a piece of art."

***Matt Nash** is a freelance journalist who has been living in Beirut, Lebanon, since 2007. He frequently writes on advances in green technology and telecommunications.*

Further Information

www.siemens.com/greenplushospitals

Summary

Challenge:

- Build a state-of-the-art hospital that is environmentally friendly
- Implement innovative new procedures to enhance quality of care
- Enhance efficiency and energy savings to cut costs

Solution:

- Implement Green+ Hospitals concept
- Harness solar and geothermal energy and cut energy use with an advanced building management system
- Invest in top-quality medical technologies and conduct standard medical procedures in new, less-invasive ways
- Establish latest IT advances throughout the hospital

Result:

- An advanced, green cardiac care center with 50 patient beds and nine ICU beds
- Up to 80 percent of energy need created from renewable sources and overall energy consumption reduced by more than 50 percent
- A hybrid operating room with the latest in imaging technology and a new method for performing coronary angiograms and angioplasty through the wrist instead of through the groin, reducing patient recovery time post-procedure
- Almost paperless hospital
- Winner of 2011 New GreenBuilding Award

The Best of Both Worlds

St. Mary's Medical Center in Evansville, Indiana, U.S., chose the Siemens ADVIA Centaur XP Immunoassay System for its reliability, accuracy, and ease of use. The microbiology staff at the 300-bed hospital was pleased to find that the immunoassay system also came with the exceptional service and support provided by Siemens.

By Sameh Fahmy, MS

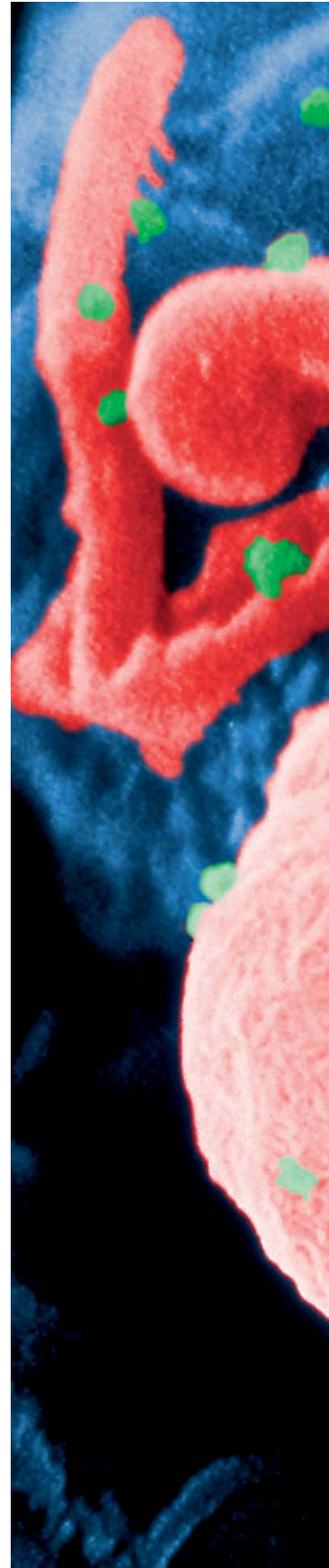
Efficiency, accuracy, and reliability were all attributes that Microbiology Supervisor Marcia Morgan and her colleagues at St. Mary's Medical Center in Evansville, Indiana, U.S., were looking for in a new immunoassay system. After thoroughly comparing analyzers and visiting hospitals throughout their region, Morgan selected the Siemens ADVIA Centaur® XP system to automate HIV and hepatitis testing for the 300-bed hospital, its referring physicians, and a local nonprofit organization that provides free healthcare to those in need. As expected, the ADVIA Centaur XP system dramatically reduced the amount of time it takes for clinicians to receive results while also improving accuracy. What exceeded the expectations of Morgan and her staff, however, was the personalized attention they received from Siemens, from the purchasing process to setup, validation, and beyond. "When we need to talk to somebody at Siemens, we have

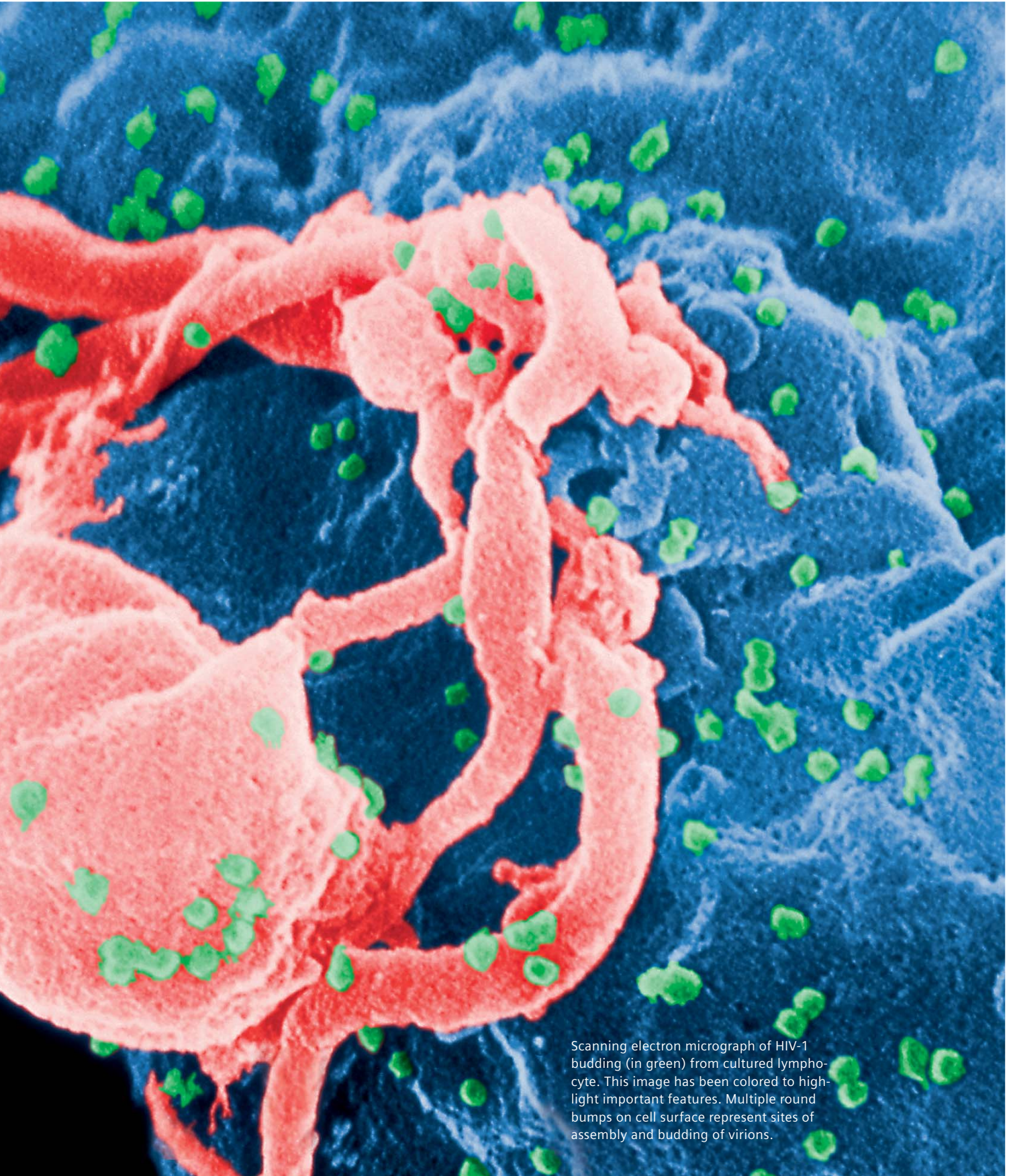
met them and know them," Morgan says. "It helps develop a family feeling."

"Strong Advantages"

For years, St. Mary's relied on a manual HIV testing system that required several operator steps at various stations in the laboratory. The entire process, from sample preparation to result, took up to three hours. In mid-2010, the vendor notified the hospital that the manual testing would be discontinued by the end of the year, so Morgan and her colleagues immediately began exploring other options.

Since St. Mary's core laboratory uses an analyzer that does not offer hepatitis testing, the microbiology laboratory performs hepatitis and HIV testing for the hospital. To maximize efficiency, Morgan needed a system that could automate both tests. That initial criteria quickly narrowed the choices to just four systems,





Scanning electron micrograph of HIV-1 budding (in green) from cultured lymphocyte. This image has been colored to highlight important features. Multiple round bumps on cell surface represent sites of assembly and budding of virions.



“The lab is always changing, and the Centaur has helped us survive the increase in workload.”

Marcia Morgan, Microbiology Supervisor,
St. Mary's Medical Center, Evansville, Indiana, U.S.

and Morgan considered factors such as sensitivity, specificity, cost, and user-friendliness when comparing the ADVIA Centaur XP system to other instruments. Morgan says, “There were a number of features that we thought were strong advantages for the Centaur.” Buffers and reagents for the ADVIA Centaur XP system are ready-to-use, while other systems require that they be reconstituted. The availability of local service technicians is appealing. Morgan adds that the ADVIA Centaur XP system’s small footprint would allow it to fit easily into their existing space. The ADVIA Centaur XP system uses disposable pipette tips, which reduces the risk of sample-to-sample carryover and eliminates the need to wash the sample probes. In addition, the system has a throughput of up to 240 tests per hour, which Morgan says easily accommodates the workload at the hospital.

Before finalizing the decision, Morgan and staff visited two hospitals in nearby Nashville, Tennessee, that use the ADVIA Centaur XP system. She and her staff saw firsthand how easy it was to load samples and to add buffers and reagents. The hospitals also shared their quality control

records, which demonstrated consistently good results using the ADVIA Centaur XP system. “The fact that it is used by 20 hospitals in this area was impressive,” Morgan said. “We knew that it was accepted by these hospitals as a good system, so that helped in the decision.”

A True Partnership

In addition to gaining a state-of-the-art immunoassay system, the staff at St. Mary's received access to training, both in person and online, through Siemens. The immunoassay regional business manager gave Morgan and her staff a review of HIV and other infectious disease testing that helped bring them up-to-date on the rapidly changing field. Morgan points out that viruses are not well represented at the microbiology conferences she and her staff attend, which made the review particularly helpful.

Medical Laboratory Technician Carol Wehr also attended a two-and-a-half day training session on the ADVIA Centaur XP system, where she learned about its basic operation. Morgan says that while such trainings are not unusual, the fact that Siemens offers an additional train-

ing opportunity, in which the same staff member can receive advanced training or another staff member can receive the basic training, helps ensure that technicians are well versed in the operation of the system. Wehr supplemented the in-person training with a Siemens Web-based training that re-emphasized important points regarding the operation of the system. "It was a good refresher course and really easy to navigate," Wehr says, "and you get continuing education unit [CEU] credits for it."

When the ADVIA Centaur XP system was installed at St. Mary's, a Siemens technical specialist was there to set up and validate the system as well as provide on-site training for all of the technologists who would be using the system. Morgan notes that the technical specialist continued to be a resource well after the setup and validation were complete and that the Siemens sales specialist also thoroughly supported them. Before the instrument was shipped, he met with Morgan and shared a list of reagents the laboratory would need for its initial order. He also studied the installation site and notified the hospital's staff of a specific type of required electrical outlet. "Everything went very smoothly because we were aware of that issue up front," Morgan says.

Wehr says the high level of support that she and her colleagues received from Siemens, beginning with their initial product inquiry, continues to this day. "I just called them the other day with a question the technical specialist couldn't answer but she said she would take it further," Wehr says. "And within half an hour, she had an answer for me and called me back, which I thought was pretty fast."

Impressive Results

St. Mary's installed its ADVIA Centaur XP system in March 2011, and Morgan credits it with dramatically improving the efficiency and accuracy of HIV testing at the hospital. Whereas the manual system took up to three hours from sample preparation to result, the ADVIA Centaur XP system provides results in approximately 45 minutes, Morgan says. And,

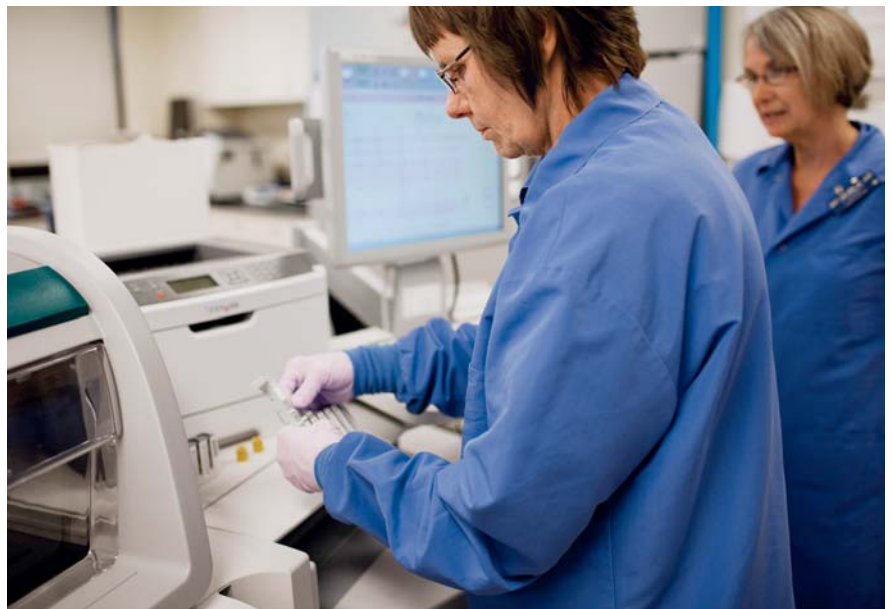
since the system is fully automated, the technician can focus on other tasks after the samples are loaded.

The speed at which the ADVIA Centaur XP system delivers results allows the laboratory to provide results to physicians faster. "We used to do HIV tests on Mondays, Wednesdays, and Fridays only, because it was so labor intensive," Morgan says. "Now, it can be done five days a week."

Wehr has noted improved accuracy using the ADVIA Centaur XP system, as well. "With the previous system, I was getting quite a few false positives with HIV," she says. "We'd have to send the samples out for Western blot testing, and they'd come back negative. With the Centaur, I've sent out two and they both came back positive – I don't get medium or indeterminate. If it is positive, that gives the doctor a chance to start treatment sooner than if the patient's status is not known." The ease of use that other hospitals spoke of during the site visits quickly became apparent. Wehr says the 360-degree status light, which displays system information using simple color codes, is visible from anywhere in the laboratory and allows her and her colleagues to quickly respond to any system issues. The high-



The ADVIA Centaur XP system's ease of use and improved accuracy became apparent quickly at St. Mary's Medical Center.



Samples and reagents can be added or removed at any time, even while the system is running, thereby further enhancing productivity.

A Dream Come True in Africa

An innovative program that provides HIV-positive patients in Africa with nutritional assistance as well as viral load monitoring and highly active antiretroviral therapy (HAART) is saving lives.

Although AIDS is a worldwide health threat, sub-Saharan Africa bears a disproportionate burden.¹ In 2002, the Community of Sant'Egidio, a Christian organization based in Rome, Italy, launched a program known as DREAM (Drug Resource Enhancement against AIDS and Malnutrition) to provide HIV-positive patients in Africa the same level of care that patients in Western nations receive. The program, which is free of charge to patients, now has 33 DREAM Centers and 20 molecular biology laboratories in 10 countries. With the support of Siemens REACH (Resources Embracing Africa with Care and Hope) program, DREAM has carried out 540,000 CD4 cell counts and 276,000 viral load tests. Through DREAM, 65,000 people have received antiretroviral therapy and 14,000 children have been born healthy to HIV-positive mothers.²

Giovanni Guidotti, MD, DREAM Program Coordinator, says the success of the program shows that the dream of halting the AIDS pandemic in Africa can become a reality.

Why is it important that HIV prevention and treatment occur together?

GUIDOTTI: From the very beginning, we have said that treatment works as a prevention system. And now, the international and scientific community has become convinced through several studies. Recent studies published by *The Lancet* and *The New England Journal of Medicine* demonstrate clearly that patients on treatment with a very low or undetectable viral load are not likely to transmit the disease.^{3,4} The evidence is also clear for what's called vertical transmission, when a mother who is HIV positive delivers a baby. If she's on treatment, it is almost impossible for her to transmit the virus to the baby.⁵

How and when did Siemens get involved with the DREAM Program?

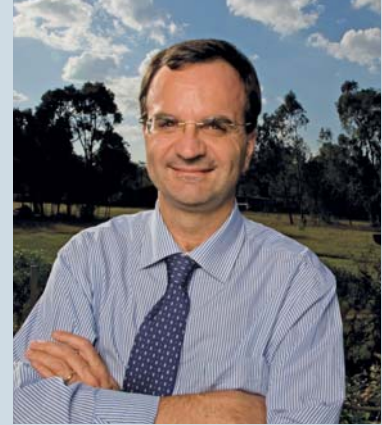
GUIDOTTI: Siemens has worked with us from the very beginning. In 2001, we started a negotiation with Siemens to acquire the viral load system. We also asked Siemens to train our staff, not only on how to use the system but also how to maintain it. One of the challenges in Africa is that you can introduce the best technologies, but maintenance can sometimes be very slow to reach the site, so we had to do something innovative.

How has the Siemens VERSANT® 440 Molecular System performed in your clinics for viral load monitoring?

GUIDOTTI: It is a very solid system that is working very well. It's easy to use, even for laboratory technicians who are not very experienced. Pollution of the samples is not a problem, so the risk of false results is very low.

Why is resistance testing using the OpenGene® DNA Sequencing System an important component of the DREAM Program?

GUIDOTTI: At the moment, we have patients who have been on treatment for eight or nine years, so the ability to continue treatment and monitor viral resistance is very important to us. We also used it for a study called SMAC (Safe Milk for African Children). In Malawi, we monitored viral resistance in pregnant women and showed clearly that treatment is not only safe, but also guarantees safe breastfeeding. We have very good results: 98 percent of our children born to HIV-positive women test negative after the program.⁶ Thanks to this effort that our staff in Malawi made with Siemens, the World Health Organization introduced the possibility of treating mothers and pregnant women, even after the delivery during the breastfeeding period, with antiviral treatment.⁷ In terms of morbidity and mortality, this



Dr. Giovanni Guidotti coordinates the DREAM program.

is an impressive gain for newborn children.

What are your future goals for the DREAM Program?

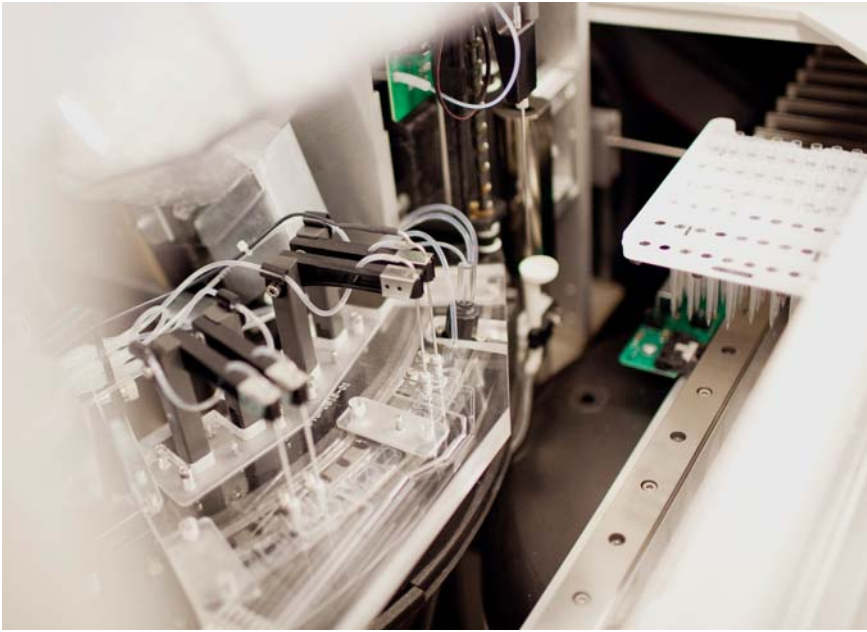
GUIDOTTI: The future goal for the DREAM Program is to offer universal access to treatment for all HIV-positive patients in Africa. Even in this historic time of economic crisis, this is our ambitious goal – to eradicate the pandemic.

Further Information

www.siemens.com/reach

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Since the ADVIA Centaur XP system is fully automated, the technician can focus on other tasks after the samples are loaded.

“Siemens additional Web-based training course was a good refresher and really easy to navigate – and you get CEU credits for it.”

Carol Wehr, Medical Laboratory Technician, St. Mary's Medical Center, Evansville, Indiana, U.S.

resolution touchscreen is intuitive and simplifies the execution of tasks. Samples and reagents can be added or removed at any time, even while the system is running, which further enhances productivity. Daily and monthly maintenance is automated to save staff time.

Morgan says the addition of the ADVIA Centaur XP system and the efficiency that it provides came at an ideal time for St. Mary's. Within the past three years, the hospital has added testing for endotoxin, shiga toxin, and *Clostridium difficile*. The use of the ADVIA Centaur XP system has allowed St. Mary's to accommodate this increased workload without increasing staff. The hospital is consider-

ing adding Siemens' fully automated Vitamin D Total assay. Vitamin D testing for St. Mary's is currently done by an outside reference laboratory, so having the test conducted at the hospital would eliminate the costly and time-consuming process of boxing and shipping samples, while also allowing physicians and their patients to receive results faster. “The lab is always changing,” Morgan says, “and the Centaur has helped us survive the increase in workload.”

Sameh Fahmy, MS, is an award-winning freelance medical and technology journalist based in Athens, Georgia, U.S.

Summary

Challenge:

- Automating HIV and hepatitis testing
- Improving staff productivity, skills, and knowledge
- Increasing the number of tests that can be performed without increasing staff
- Addressing unexpected maintenance issues without disrupting productivity

Solution:

- Siemens ADVIA Centaur XP Immunoassay System's comprehensive and constantly growing assay menu, which includes both HIV and hepatitis
- Siemens' basic and advanced in-person staff training and Web-based educational opportunities that provide continuing education credits
- Maximizing staff productivity through the automation, reliability, and rapid throughput of the ADVIA Centaur XP system
- More than 4,000 Siemens support technicians around the world, providing support at the customer's convenience – on-site, online, and by phone

Result:

- Increased productivity with ADVIA Centaur XP system's throughput of up to 240 tests per hour
- Staff well versed in the operation of equipment and up-to-date on advances in diagnostic testing
- Laboratories function at peak efficiency, maximizing staff resources
- Disruptions and downtime minimized through rapid and responsive customer care

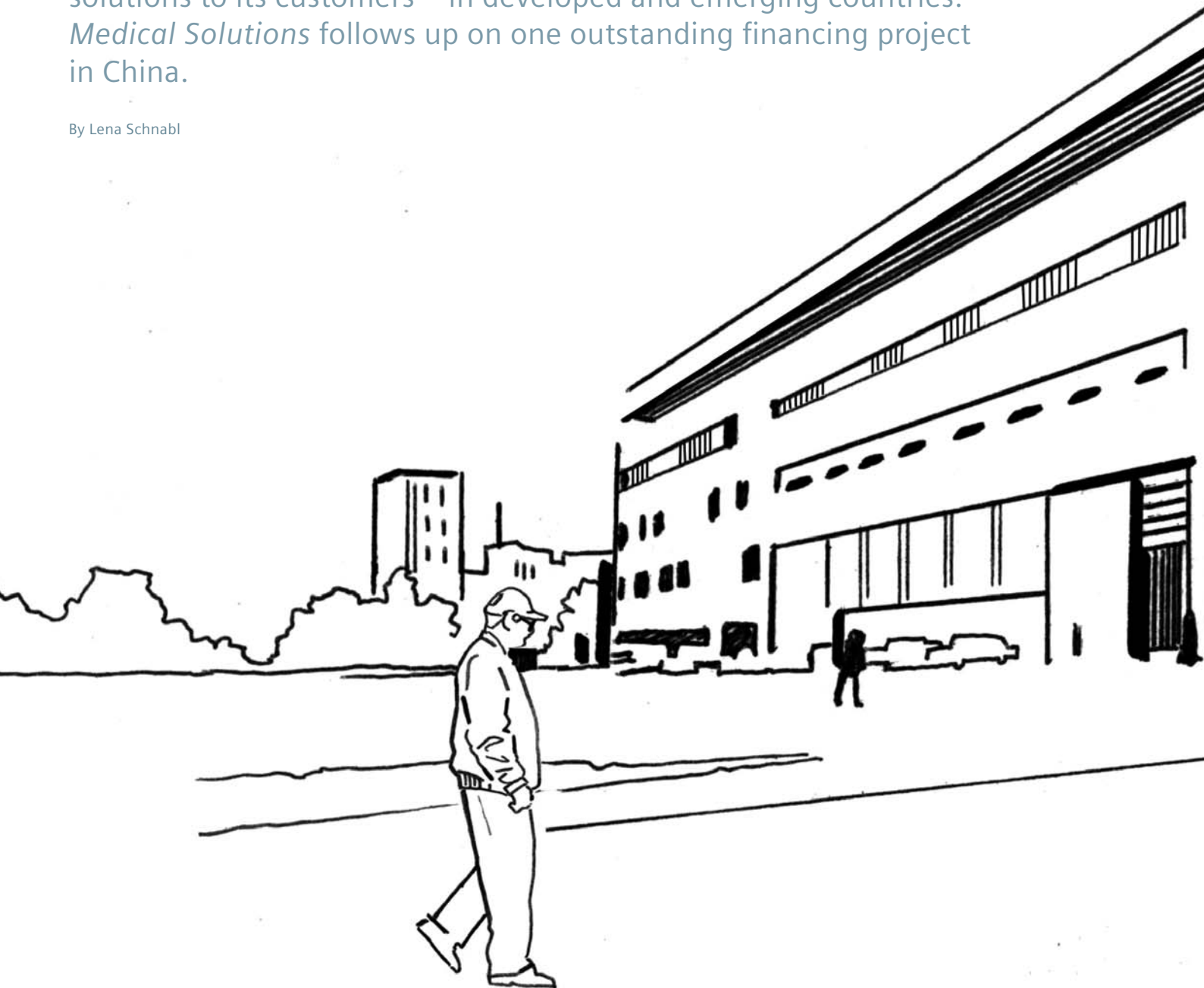
Further Information

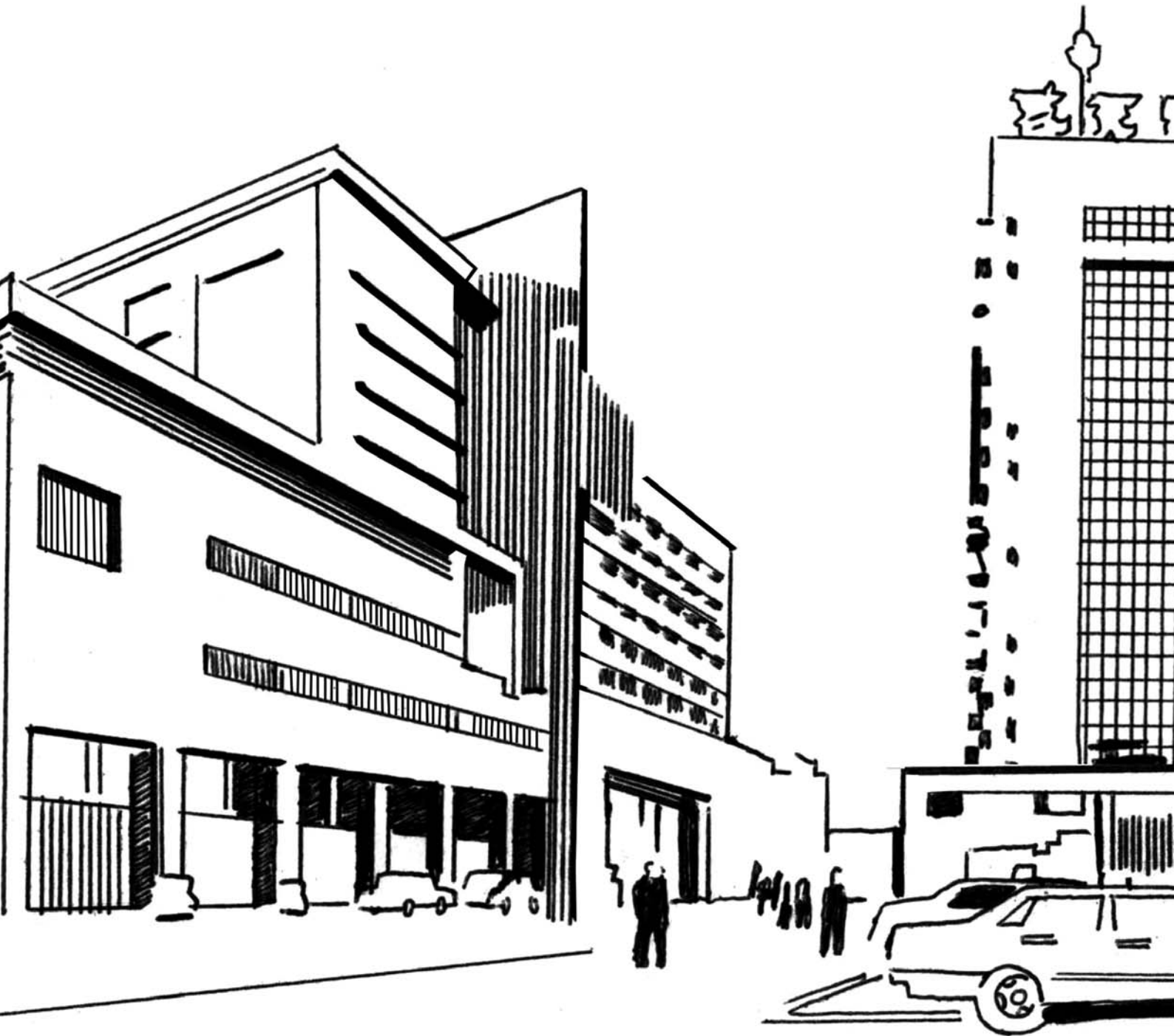
www.siemens.com/advia-centaur

Financing Solutions for Emerging Markets: Eyes on China

Improving patient care in times of capital pressure is a key challenge in our time. Siemens Healthcare together with Siemens Financial Services offers advanced medical equipment and tailored financing solutions to its customers – in developed and emerging countries. *Medical Solutions* follows up on one outstanding financing project in China.

By Lena Schnabl





The Affiliated Hospital of Jining Medical College, Shandong is a provincial general hospital, famous for its diagnosis and treatment of cardiovascular diseases, and its neurology department.



“SFS just started its business in China when we placed the first order, and it has been growing with us, too.”

Hu Wenjie, Vice President,
Affiliated Hospital of Jining Medical College,
Shandong, China

Building a Future with Deep Roots: The Affiliated Hospital of Jining Medical College

For six years now, Siemens Financial Services (SFS) and the Affiliated Hospital of Jining Medical College, Shandong, China, have worked together to help resolve the hospital’s capital shortage. The Affiliated Hospital of Jining Medical College was founded in 1987 and is a provincial general hospital that integrates clinical treatment, education, research, prevention, healthcare, and rehabilitation. It is famous for its diagnosis and treatment of cardiovascular diseases as well as its neurology department. SFS was chosen as a financing affiliation because of its customer-oriented, tailored, and convenient approach. SFS began business in China when the hospital placed its first order in 2005, and since, has continued to grow together with the hospital. The clinic has repeated orders with SFS three times and is now equipped with medical systems such as computed tomography (CT) and magnetic resonance (MR) scanners. Siemens spoke about the partnership with Hu Wenjie, the Vice President of the Affiliated Hospital of Jining Medical College, Professor Wu Guanghua, the head of the Affiliated Hospital of Jining Medical College, and Yang Gang, the Vice President of Siemens Finance and Leasing Ltd. China.

Ms. Hu Wenjie and Professor Wu Guanghua, could you tell us why you have been affiliated with SFS since 2005?

HU: We adopted the financing approach to solve the hospital’s capital shortage problem. We did have capital pressure in 2005 as we established a new 60,000-square-meter building. But, medical equipment purchasing was also a must for us. To solve the problem, we thought we could try the forward financing solution. **WU:** Also, most of our professional medical equipment is from Siemens, for example CT, MR, and monitoring equipment. So, it is very easy and convenient for us to combine the purchase with financing. Siemens Healthcare and Financial Services come to our hospital to communicate and finalize all the details and our staff does not even need to walk out of the hospital.

Do you think that financing solutions are becoming more important for hospitals in China nowadays?

HU: Definitely. I believe financing is a very important solution for hospitals to solve their capital shortage problems, especially from insufficient cash flows.

What other SFS assets can Chinese customers benefit from?

YANG: The unique asset of SFS is the combination of financial service with

Financing Medical Equipment

- **SOMATOM® Emotion 16** 16-slice CT scanner; outstanding clinical performance and highly advanced clinical applications; dose saving features such as CARE Dose4D
- **AXIOM® Aristos VX Plus** digital X-ray imaging system including tiltable flat detector stand, ceiling-suspended X-ray tube stand, optional trolley; imaging of extremities, upright and recumbent examinations; optimized workflow and connectivity features
- **MAGNETOM® Verio** benchmark MRI; 3 Tesla field strength, 70-centimeter Open Bore and Tim® (Total imaging matrix); wide range of clinical applications
- **ARCADIS® Varic** advanced multipurpose C-arm; broad range of applications like orthopedics, trauma, vascular surgery, and urology; streamlined workflow; outstanding image quality



“Most of our professional medical equipment is from Siemens.(...) So, it is very easy and convenient for us to combine the purchase with financing.”

Wu Guanghua, Head,
Affiliated Hospital of Jining Medical College,
Shandong, China

technology solutions. Siemens is one of the few global companies that can provide this complete solution in the Chinese market. So, this is a very big differentiator.

How did the hospital develop during the six-year cooperation with SFS?

HU: After three repeated orders with SFS, our hospital expanded up to a certain degree and our medical treatment was improved. SFS just started its business in China when we placed the first order, and it has been growing with us, too. In other words, our hospital really benefited from the establishment of SFS China.

Lena Schnabl, MA, is an editor at Medical Solutions and holds a degree in Chinese and Japanese Studies as well as in Politics. She regularly writes about imaging methods and sustainability in healthcare.

Further Information

www.siemens.com/finance

Summary

Challenge:

- Increasing need for high-quality medical equipment
- Capital pressure in emerging markets from the need to implement healthcare infrastructure
- Capital pressure in mature markets due to aging population

Solution:

- Siemens Financial Services (SFS) expands into emerging markets
- Siemens' unique combination of equipment purchase and financing solutions
- Flexible solutions such as forward financing offered by SFS

Result:

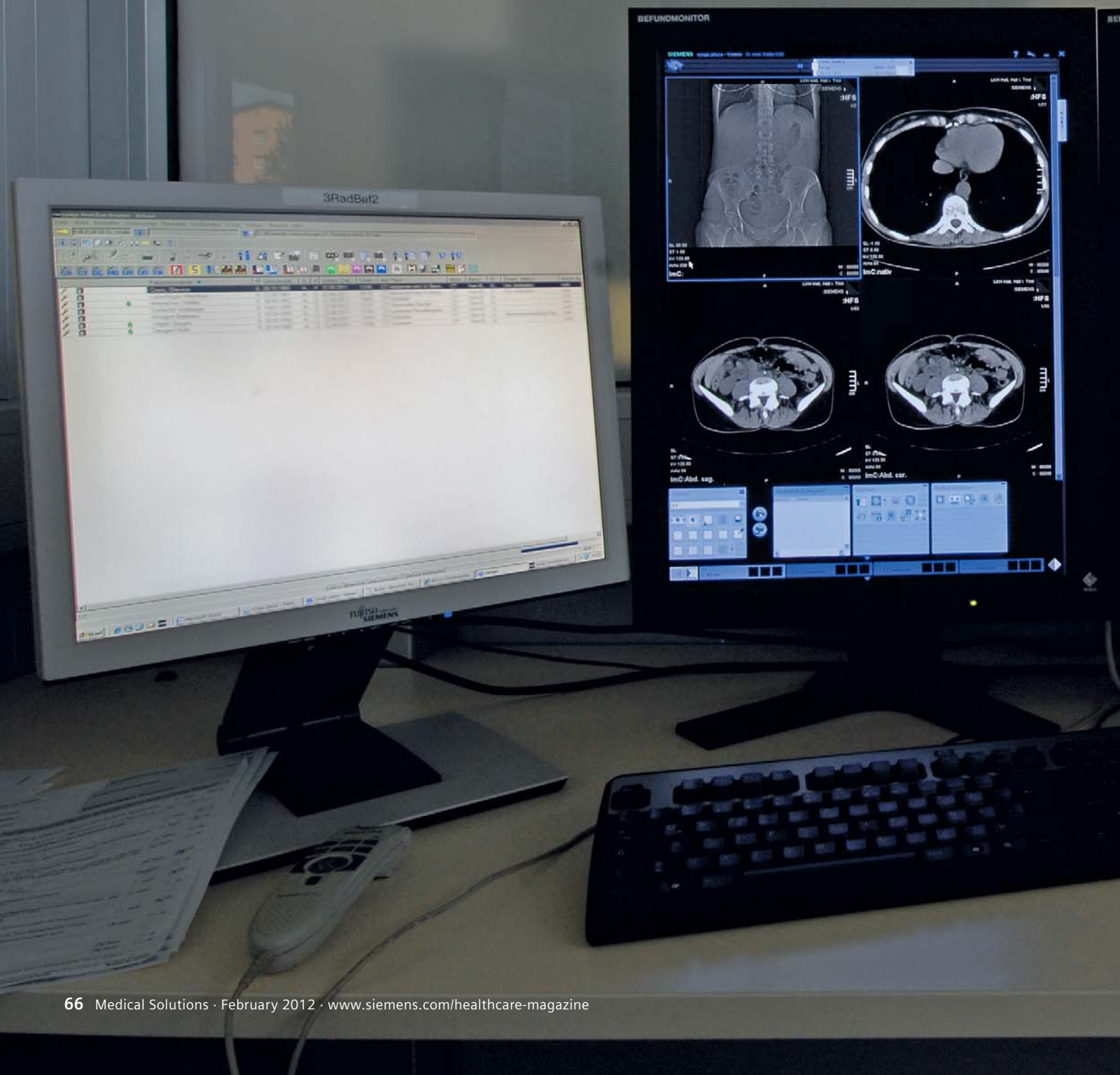
- Hospitals can be equipped with a wide range of medical systems, including entry-level as well as high-end CT and MR scanners
- Hospitals can expand their services without capital pressure
- Hospitals can offer improved patient care



What a Difference a Day Makes

Efficiency increased after Hall Regional Hospital in Hall, Austria, introduced *syngo.plaza* and *syngo.share*.

By Oliver Klaffke





"Everything was prepared for our migration to *syngo*®.plaza and the switch was done overnight," says Gerhard Egender, MD, Head of Hall Regional Hospital in Hall, Austria, a dedicated radiologist and aficionado of technological innovation. The radiology department in the hospital recently introduced *syngo*.plaza, the Siemens picture archiving and communication system (PACS).

The new Siemens system boosted the department's efficiency immediately and has continued to do so ever since. It helped free staff from tiresome tasks, and

allowed radiologists to do what they do best – applying their medical skills. Since radiologists can now spend more time looking at the images and devoting their energy to completing the diagnosis, work quality has improved. "The results are fantastic," says Egender. "I'm glad we made that decision and had *syngo*.plaza installed."

Spending time waiting for images and patient files is still part of radiologists' daily routine in most hospitals – but no longer at Hall Regional Hospital. Wasting time was a burden for many years. At Hall,

the workflows are highly organized now and inefficient tasks have been replaced by improved and highly efficient ones. Thanks to *syngo*.plaza, dead time is cut down dramatically. As a result, the daily work is dealt with better and faster than ever before. "Nowadays, we are able to finish 95 percent of our cases the same day," Egender says.

Getting to the Heart (and Lungs) of the Matter

Siemens' sophisticated PACS *syngo*.plaza offers faster access to radiological data,

such as computed tomography (CT), magnetic resonance (MRI) or positron emission tomography (PET) images. It provides a wide range of diagnostic applications and special tools. These are of great help in pursuing well-defined workflows when a radiologist has to deal with certain indications, for example, when working on a lung cancer patient or a cardiology case.

To increase efficiency, *syngo.plaza* provides patient images and relevant data in the most comprehensive and suitable way. Time-consuming sorting is therefore eliminated. Instead, physicians can focus on reading and making diagnoses. For example, *syngo.plaza*'s sophisticated diagnostic applications such as the Findings Navigator, which automatically tracks and lists findings and measurements, are of great value when managing oncology cases and following changes in tumor size and shape. With these applications, tumors can be highlighted and those notations saved so at the next exam, tumor progression is easier to follow.

What is of special importance is the rapid availability of prior patient data. With just a few clicks, the radiologist can call up older images on the screen. "There is no need to go to the archive personally or even to order the older images," Egender says. Whether they are from a CT, MR, PET, or X-ray exam, the images are stored in *syngo.plaza* and can be viewed and worked with almost immediately. Since *syngo.plaza* allows radiologists to log in from any¹ computer in the hospital – or even remotely¹ – there is no need to wait for a vacant workstation to do the reading. The days of lining up to access patient data are definitely over. Many tasks that in the past were done by radiologists or technicians are now taken over by the *syngo.plaza* software. "In a nutshell," Egender says, "*syngo.plaza* helps us to concentrate on our job as radiologists."

The Future of Integrated Image Sharing

Hall Regional Hospital has a close cooperation with nearby Innsbruck University Hospital, so sharing data is important.

When it comes to emergency cases, it is crucial to make findings available to the other institution as fast as possible. Since Hall and Innsbruck are located just a few miles away from Austria's most beautiful – and busiest – ski resorts, both hospitals see many injured skiers and snowboarders every season. Depending on the severity of the case, these patients are transferred to one of the hospitals. *syngo.share*², the unified, patient-centric clinical image management and image sharing system, helps the hospitals share patient images and findings between the two sites. "With the Siemens software, the communication between specialists is greatly facilitated for the benefit of the patient," Egender says. The new *syngo.share* software enables the hospital to efficiently access and share



"With *syngo.plaza*, communication between specialists is greatly facilitated for the benefit of the patient."

Gerhard Egender, MD, Head,
Hall Regional Hospital, Hall, Austria

patient data beyond DICOM formats. This helps to greatly improve the daily routine of radiologists when it comes to providing access to patient data beyond radiological images, such as multimedia files of endoscopy studies and ultrasounds, PDFs of laboratory reports, and more than 300 arbitrary file formats. In the past, these were stored in different archives and not readily available. With *syngo.share*, the work of radiologists is even more efficient than it already is with *syngo.plaza*.

Workflow Improvement: A Team Effort

Introduction of the Siemens systems took a bottom-up approach. Everybody in the radiology department was involved in drafting the new optimal workflow. It was important to get the medical as well as the technical staff involved. Their support is crucial, as every new technology is a major change in the daily work routine and might easily lead to frustration when the staff is not on board with it. "Our team is very open to technical innovation," Egender says. "They clearly saw their chance to improve working conditions with *syngo.plaza*." Today, *syngo.plaza* offers a considerable workflow improvement, not only to the medical, but also the technical and administrative staff. The routine reading is done with *syngo.plaza* and the technicians can spend their time on more worthwhile tasks that cannot be completed by a computer. Working with both *syngo.plaza* and *syngo.share*, is a great way to optimize the workflow in a hospital. Additionally, Hall Regional Hospital installed a new voice recognition system within the radiology information system *syngo* Workflow. The radiologists dictate their findings, which are then automatically transcribed by sophisticated software. The administrative staff checks for misprints and controls the quality. Since the typing workload has gone down, the staff has taken over new tasks. Thanks to *syngo.plaza*'s archive retrieval functions, the file room clerk spends less time looking for prior images and is dealing more with patients at the reception desk. "Everybody is very happy with the new



With nine specialist departments, more than 500 beds, and a staff of 1,300, Hall Regional Hospital offers comprehensive care and treatment to its patients.

situation, as their work is more interesting nowadays," Egender says.

One Supplier for All Needs

When evaluating the potential of increasing workflow efficiency, Egender wanted a solution provided by just one supplier. "If you have more than one company involved in running a complex system, you almost always end up with problems at the interfaces, and each party blames the other," Egender says. Time and money are lost, and management capacity is tied up solving the dispute and getting the system working again. At Hall Regional Hospital, it is Siemens who supplies the radiology department's hardware and software, helping ensure smooth and seamless workflows. "I wanted to have just one supplier, and Siemens turned out to be the one," Egender says. The company delivered: The entire Siemens systems enable Egender's team to work better, faster, and achieve more with less.

Oliver Klaffke is a science and business writer based in Switzerland. Among other publications, he has written for New Scientist and Nature.

¹ Prerequisites include: Internet connection to clinical network, meeting of minimum hardware requirements, and adherence to local data security regulations.

² *syngo.share* is a medical device of ITH icoserve technology for healthcare GmbH, Innsbruck, Austria. *syngo.share* is only available in some European countries.

Summary

Challenge:

- Increase the efficiency of the radiology department and go paperless and filmless
- Find one supplier able to meet all of the hospital's needs

Solution:

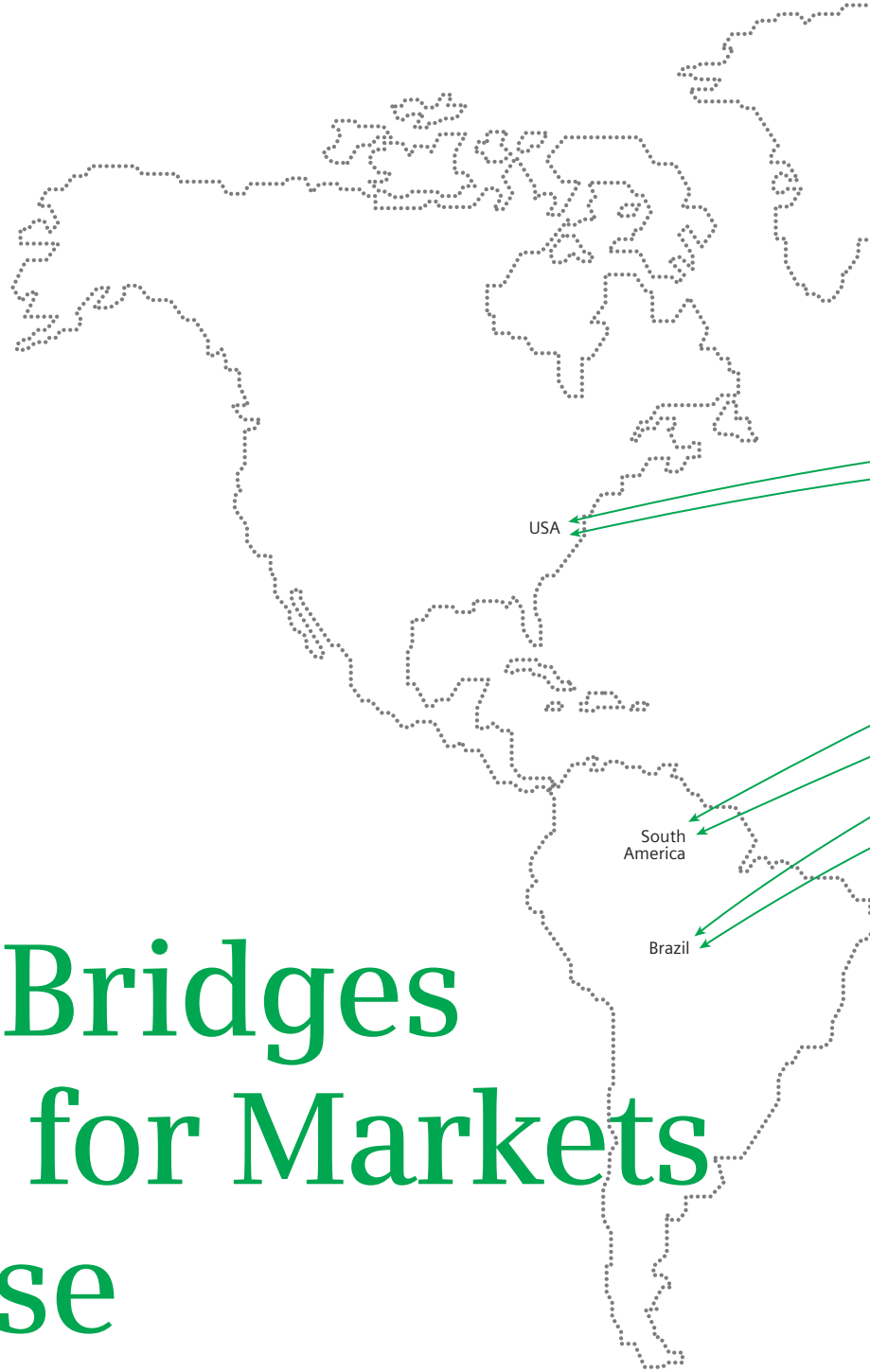
- Siemens *syngo.plaza* offers efficient workflow for routine reading and supports medical as well as technical staff with their tasks
- Siemens *syngo.share* makes patient data available in more than 300 file formats within the hospital and to cooperating partners

Result:

- Greatly increased efficiency – 95 percent of all cases can be validated in the same day
- More time available for dealing with patients

Further Information

www.siemens.com/syngo.plaza
www.siemens.com/syngo.share



Building Bridges of Access for Markets on the Rise

When it comes to purchasing medical equipment in emerging economies, price is often the key issue. Siemens Healthcare has been developing products to meet the special needs of those fast-growing economies.

By Tanja Berbalk



Demographic change has long since found its way into the world's growing economies. China, for example, a country with more than 1.3 billion inhabitants, is the most populated country on earth. It is expected that by 2050, the resident population aged 65 years and older will have tripled. Although China's major cities define the pace of the 21st century, most of the country's rural regions are still deeply mired in the pre-industrial age. Those areas will need access to technologies that help them secure a healthier future for themselves. Facing those facts, the Chinese healthcare system will need to prepare to provide all-encompassing access to medical care – by taking an aging, fast growing, and rural population into account. At the beginning of 2011, the Chinese government published the 12th version of its five-year economic plan for the advancement of healthcare: Within the framework of healthcare reform, up to US\$250 billion are to be invested in the Chinese healthcare system over the next five years – this corresponds to a 100 percent increase as compared to the past five years.

In India as well, the government acknowledged the need for more health expenditures. Since almost 85 percent of the population has no access to medical

care, the country is about to more than double its healthcare budget to almost two percent (US\$20 billion) of its gross domestic product (GDP).



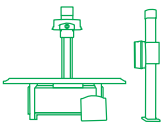
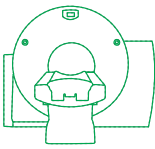
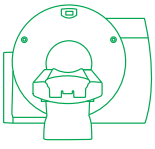
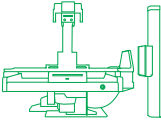
Taking these tremendous changes into account, the investment bank Goldman Sachs identified the BRIC nations – an acronym that is made up of the first letters of Brazil, Russia, India, and China. Goldman Sachs considers these nations to be at similar stages of economic development. The combined population of those four countries is 2.8 billion and accounts for about 40 percent of the global population. BRIC growth rates of four to ten percent far outpace those of the most industrialized countries like Germany, Japan, the UK, or the U.S. The BRIC acronym is sometimes extended to "BRICK" to include South Korea or "BRICS" to include South Africa. In December 2005, Goldman Sachs published a list of eleven countries that may experience a similar type of dynamic growth as the BRIC nations have. These "Next Eleven" (N-11) countries are Bangladesh, Egypt, Indonesia, Iran, Mexico, Nigeria, Pakistan, the Philippines, South Korea, Turkey, and Vietnam. All of these countries are facing an increasing need for access to healthcare, but are also struggling with low budgets. Although urban areas may

have well-established standards of medical care, rural areas are still lagging behind.

Intelligent Innovations for Emerging Economies

Siemens Healthcare is committed to helping people around the world gain access to healthcare, thereby raising the standard of healthcare in both urban and rural areas of fast-growing economies. This is why Siemens Healthcare developed a broad product range aiming to support clinicians and hospitals and improve public health in these countries. With smart innovations, healthcare providers in emerging countries are given access to high-quality medical devices at prices they can afford. At the same time, Siemens' innovations are developed to require little maintenance effort. And in addition, they are focused on ease-of-use so that only minimal staff training is necessary. All of this helps healthcare providers in emerging economies deliver basic healthcare to their patients on a routine basis. Products that meet the needs of emerging nations are detailed in the acronym "S.M.A.R.T.," which stands for products that are: simple, maintenance friendly, affordable, reliable, and timely to market – in other words, products that are

S.M.A.R.T. Products Overview: Developed, Produced, and Sold in Growing Economies

	<i>Product</i>	<i>Developed/produced</i>	<i>Main markets</i>	<i>Installed base</i>	<i>Customer advantages</i>
	MAGNETOM ESSENZA Magnetic Resonance System	Co-developed in Shenzhen, China ; Erlangen, Germany; and Oxford, UK; produced in Shenzhen and Erlangen	Asia (China, Japan, Korea), Europe, U.S., South America	more than 700 systems	Highly efficient 1.5T MRI system due to low installation and power requirements, streamlined workflow, and advanced MR technology. Delivering excellent image quality for demanding clinical routine
	ACUSON X300™ and ACUSON X300 PE Ultrasound Systems	Bundang, Korea	Europe (incl. Eastern Europe), Russia, Asia (China, Korea, India), South America	approximately 9,000 systems	Excellent clinical performance, image quality, and innovative technologies
	Multix Select DR Radiography System	Co-developed in Shanghai, China , together with Goa, India, Getafe, Spain, and Forchheim/ Erlangen, Germany	China, India, Brazil	launched in fall 2011	First choice for the entry-level digital radiography segment – with proven technology at an economical price-level
	SOMATOM Spirit Computed Tomography System	Shanghai, China , and Forchheim, Germany	China, India, Japan, Brazil	more than 2,000 systems	Modern, easy, reliable
	SOMATOM Emotion Computed Tomography System	Shanghai, China , and Forchheim, Germany	U.S., Germany, China, Japan	more than 7,000 systems	Perfection in image detail, clinical efficiency simplified, savings in every scan
	Luminos Select Fluoroscopy System	Shanghai, China , together with Getafe, Spain, and Forchheim/Erlangen, Germany	China, India, and South Asian Countries	launched in fall 2011	Select Siemens fluoroscopy system technologies at an economical price level, offering a fully digital workflow and improved productivity without compromising diagnostic quality

tailored to meet the needs of the local region. Therefore, Siemens has been strengthening its global knowledge network. The company set up research and development facilities in emerging economies such as India and China, and also shifted more responsibilities in product management, local sourcing, manufacturing, service, and sales structure to these countries. After all, employees originating from these countries know best what their people need. S.M.A.R.T products

are designed for healthcare providers to save costs; be it for short-distance delivery, for energy supply, or for the system's maintenance during the entire product life cycle. This is where Siemens customers can truly benefit.

Smart Magnetic Resonance and Computed Tomography Imaging

Close collaboration between the Siemens headquarters and local developers is

key for the success of these cost-efficient products. The SOMATOM® Spirit computed tomography (CT) scanner is one example of an innovative S.M.A.R.T. product. The scanner was developed in Shanghai, China, together with colleagues from Forchheim, Germany. It is also produced in China. 90 percent of the system's components come from Chinese manufacturers, instead of importing parts to the country from Europe or the United States. Other successful products from the

S.M.A.R.T. portfolio are the CT scanners: SOMATOM Emotion 6 and 16. Similar to SOMATOM Spirit, the scanners are manufactured in China, where local suppliers are also involved. The results: robust, low-maintenance CT scanners that are easy to operate and a solid value in terms of price and costs of ownership.

Thanks to these efforts, institutions with relatively restricted budgets can now afford CT as well as magnetic resonance imaging (MRI) technology. Since 2007, the MAGNETOM® ESSENZA MR scanner, as another example, has been built at the Shenzhen plant in China. It has been developed by a global Siemens development network in Shenzhen, Erlangen, Germany, and Oxford, UK. MAGNETOM ESSENZA helps cut energy requirements and installation space, as well as associated construction costs, without compromising image quality.

While nearly all the components were initially imported, today most of them are procured from Chinese suppliers. Siemens is thereby helping develop local procurement chains and addressing the entire value chain in this core market. Local production and short transport distances have also allowed for a significant reduction in production costs. Clearly, Siemens aims to pass these cost savings in the production phase to its customers.

Siemens researcher Wang Jianmin was part of the global development team. "Although MAGNETOM ESSENZA doesn't offer all the functions of systems in the higher market segment, it delivers impressive results for the majority of applications in daily hospital operations," he says. This makes the scanner an attractive alternative for customers who do not require the most advanced imaging performance.

Entry-Level Radiography and Fluoroscopy

The C-arm interventional fluoroscopic X-ray systems of the MULTIMOBIL family are further examples for a truly S.M.A.R.T. product. Produced in Goa, India, the systems meet the extremely strict price demands and basic needs of emerging countries. A thorough analysis of ways to improve the C-arm's camera and image processing module has not only led to

improving the system's resolution, but also to a dramatic reduction in price. In addition, Siemens' latest digital radiography system, Multix Select DR, was solely designed for the needs of cost-sensitive customers. The new, easy-to-use X-ray system supports virtually all radiographic applications and helps physicians acquire high-quality images rapidly. It is attractive to small and medium-sized hospitals in emerging economies, as well as to small hospitals and physicians' practices in industrialized countries. "The system focuses on the essential requirements of customers who are looking for an entry-level system for digital radiography," says Meng Xi (Michelle) Zhang, product manager for radiography at Siemens Shanghai Medical Equipment (SSME). This makes Multix Select DR attractive to customers that previously used only analog radiography equipment. "Often, hospitals have only this one system and use it to examine 150 to 200 patients per day," Zhang says. "In one of the hospitals, the physicians examined up to 400 patients each day! Customers accept that the Multix Select DR does not have all the functions of high-end systems, but still offers high-quality images at a cost-effective price."

Redefining Roles

First and foremost, products from the S.M.A.R.T. portfolio (read more in the product table on the left page) are developed for and already proven in emerging countries; however, they are now also finding their way into more advanced healthcare markets. The Shenzhen production site for MAGNETOM ESSENZA MR scanners, for example, is now producing the same systems for customers all over the world – 80 percent of the produced systems are exported. As for the SOMATOM Spirit CT, more than 2,000 were sold worldwide, 70 percent of them outside of China.

Some S.M.A.R.T. products are used as inexpensive backup units in some hospitals, relieving high-end products that are needed for more complicated diagnoses, thereby increasing throughput for routine exams. Hence, the biggest beneficiaries of S.M.A.R.T. products will be physicians

Summary

Challenge:

- The need to establish basic healthcare in emerging countries, especially in rural areas
- Customers are in need of products with basic features for daily routine
- Mounting cost pressure in healthcare

Solution:

- S.M.A.R.T. products from Siemens: Simple, maintenance-friendly, affordable, reliable, and timely to market products for basic medical demands

Result:

- Truly addressing local needs by developing and manufacturing products in emerging economies
- Bringing basic and affordable healthcare to low- and mid-income countries
- Addressing the entire value chain in core markets

and, ultimately, patients in both the emerging and industrialized economies. Both have access to products that are affordable and of high quality.

Tanja Berbalk has a degree in sociology, marketing, and communications. She is an editor at Medical Solutions.

Further Information

www.siemens.com/healthcare



Unforgettable

Years of dedication pay off at the University of Tennessee Medical Center, where, with the help of Siemens imaging equipment, researchers have a clearer picture of Alzheimer's disease, the degenerative and eventually fatal disease that afflicts more than 35 million people worldwide.

By Ron French

On a good day, it takes 20 minutes to travel the 12.5 miles from McGhee Tyson Airport to the gleaming new entrance of the University of Tennessee (UT) Medical Center in Knoxville, Tennessee, U.S. Add rush-hour traffic, and the trip is at least half an hour. Add an accident, and it can take hours.

Inside the medical center, Alan Solomon, MD, and Jon Wall, PhD, study a different kind of traffic pattern. Inside the healthy human brain, signals zip along neurons at 100 meters per second remembering anniversaries, calculating tips at restaurants, writing poetry. Some brains work so effi-

ciently that they recall everything they have ever seen or done. But in brains afflicted with Alzheimer's disease, traffic routes begin to break down. Signals slow or stop altogether. Eventually, the patient dies. Yet this killer remains a mystery to physicians. By the time it is suspected, irreversible damage has occurred in the brain. It cannot be definitively diagnosed until the patient is dead and an autopsy performed. Why some people develop Alzheimer's disease and some people do not is still unknown.

While a cure for Alzheimer's disease may still be a long time away, research under-

way in Knoxville aided by state-of-the-art Siemens imaging equipment, is offering insights into the complex world of the brain and offering new hope for early detection – and treatment – of this degenerative disease. “Even if we don't cure it, we may be able to slow the disease to the point that patients die of something else,” says Wall.

A Global Epidemic

The numbers are staggering: There are more than 35.5 million people around the world afflicted with Alzheimer's disease¹; in the United States alone, someone is



“Alzheimer’s is an epidemic that currently has no cure.”

Alan Solomon, MD, Head,
Human Immunology and Cancer Program,
University of Tennessee Medical Center,
Knoxville, Tennessee, U.S.

diagnosed with generative disease every 69 seconds²; without advancements in treatment, one in eight U.S. baby boomers (those born between 1946 and 1964) are expected to be struck by the disease.³ “It’s an epidemic that currently has no cure,” says Solomon.

The cost of care globally is more than US\$600 billion⁴, and that amount is expected to skyrocket in the next few decades. Deaths from Alzheimer’s disease are growing⁵, with the number of people afflicted projected to triple by 2050⁶. Alzheimer’s disease research has been stymied for years by the nature of the disease. Ninety percent of what is known about the disease has been discovered in the past 15 years. Today, researchers believe Alzheimer’s disease is caused by the formation of beta amyloid in the brain, which forms hard, insoluble plaque that

builds up in spaces between the neurons. In early stages, plaque builds in the hippocampus, and patients experience memory loss. As the plaque builds, destroying more connections, it spreads to the cerebral cortex, which damages language, reasoning, and conscious thought. In the most severe stage, widespread buildup causes the brain to atrophy. Patients lose the ability to communicate or move, and the body shuts down.

Researchers Struggle with the Disease

While the outward symptoms of Alzheimer’s disease are as obvious as they are devastating, it has been frustratingly difficult for doctors to see how the disease progresses.

“One of the biggest problems with Alzheimer’s disease was doing a good clinical

trial, because the definitive diagnosis was only available at autopsy," says Wall. "If you had an amyloid-busting therapy for Alzheimer's disease patients, you couldn't discern whether it worked or not until the patients were dead. These are multi-hundred-million-dollar, multi-year trials, because you couldn't have an instant readout of amyloid load."

Solomon, Head of the Human Immunology and Cancer Program at the UT Medical Center, is world-renowned for his research on amyloids, spending much of his career searching for answers to currently incurable diseases while working at the University of Tennessee Graduate School of Medicine.

He teamed with Wall, Director of the Preclinical and Diagnostic Molecular Imaging Laboratory at the University of Tennessee Graduate School of Medicine, to search for ways to attack amyloids, a nasty mutation of naturally occurring proteins, which they believed to be a root cause of diseases ranging from Alzheimer's disease to Type 2 diabetes to rheumatoid arthritis.

In particular, they studied amyloidosis, a rare but fatal disease that attacks organs. After the death of one of his patients more than a decade ago from amyloidosis, Solomon made a vow to the patient's husband that he and his team were committed to doing something to affect the disease. "When I make a promise," Solomon says, "I try to keep it."

A Mouse, an Antibody, and Siemens

The first breakthrough came when Wall and his colleagues discovered an antibody that bound to amyloid plaque. Then, using a Siemens microCAT+SPECT (computed tomography and single photon emission computed tomography) preclinical imaging scanner (a machine built to scan small animals used in research) and a tracer compound, researchers were able to capture images of the antibodies in the bodies of mice – in essence, mapping the location and extent of amyloid plaque. Wall and his team were the first in the world to image some forms of amyloids.

The implications were enormous, and not just for sufferers of the rare disease.

If they could image one type of amyloid plaque in a mouse, it was possible they could image beta-amyloid in human brains. If so, the imaging would be a huge breakthrough in Alzheimer's disease research.

When the same antibody-tracer-imaging regimen resulted in the same amazing images in about 60 percent of humans tested – a result Solomon calls "spectacular" – the researchers were convinced they were on the right path.



A Biograph mCT is used in trials to see if a certain antibody-tracer-combination* is able to image beta-amyloid deposits* in human brains.

* The product/feature (mentioned herein) is not commercially available. Due to regulatory reasons its future availability cannot be guaranteed.

In the fall of 2011, the UT Medical Center began human trials to see if the results can be replicated with Alzheimer's disease. Siemens has been an eager partner in the program, providing the Center's researchers with the latest imaging equipment, including a Biograph® mCT that Wall and Solomon will use for the Alzheimer's disease research. Siemens also provided the medical center with an Inveon, a state-of-the-art triple modality imaging device that delivers positron emission

tomography (PET), single photon emission computed tomography (SPECT), and computed tomography (CT) imaging capabilities in a single system for pre-clinical research. The center received the scanner as part of an agreement with Siemens to be a luminary training site for Siemens customers. Doctors and researchers from around the world will come to Knoxville to learn the imaging techniques honed there.

"We're lucky with the relationship with Siemens," says Wall. "They've allowed us to do basic research and applied research on animals and humans with the best scanners that are currently available."

A New Era

That research led to this moment, when Solomon and Wall feel they are on the cusp of a new era in Alzheimer's disease research. "The ability to do high-resolution imaging has come a long way in the last ten to 15 years," says Wall. "The advent of PET-CT and PET-MR has a major place in imaging the brain. What PET imaging allows you to do is monitor response to therapy. There are a lot of things being developed to treat Alzheimer's disease, and now that we've developed this amyloid imaging component, you can monitor the amyloid load at the start and the end and tell if you're holding the patient stable."

In simplest terms, the antibody-tracer-imaging regimen, for which Solomon and Wall were granted a patent, could quicken the pace of Alzheimer's disease diagnosis and research. "This research is being done solely here, in this one place, UT Graduate School of Medicine at University of Tennessee Medical Center, and it's really a remarkable accomplishment," says Solomon.

Years of research in laboratories with imaging mice, where Siemens equipment has been indispensable, may soon pay dividends for patients around the world. Wall pictures a day when preventative tests determine which healthy people have high levels of amyloid in their bodies that make them prime candidates for Alzheimer's disease. Doctors could then begin treatment for individuals in these high-risk categories to stave off the



“If you can delay the onset by ten to 20 years, Alzheimer’s becomes manageable.”

Jon Wall, PhD, Director,
Preclinical and Diagnostic Molecular Imaging Laboratory,
University of Tennessee Graduate School of Medicine,
Knoxville, Tennessee, U.S.



Dr. Jon Wall (left) and Dr. Alan Solomon teamed up to search for ways to attack amyloids, which they believe to cause diseases from Alzheimer's disease to Type 2 diabetes to rheumatoid arthritis.

Summary

Challenge:

- Breaking the code of amyloids, believed to be a cause of numerous currently incurable diseases, including Alzheimer's disease
- Finding a way to image amyloids to aid diagnosis and research
- Finding an imaging solution to help doctors determine whether potential treatments are reducing or stabilizing amyloid loads in organs

Solution:

- Discovery of an antibody that sticks to amyloids by researchers at the University of Tennessee Graduate School of Medicine, allowing them to be radiolabeled with a tracer and imaged with a Siemens Biograph mCT

Result:

- Possibility that researchers will be able to more quickly determine what experimental treatments could halt the progress of Alzheimer's disease, smoothing the path to more effective care
- Increased chances for early detection, giving patients a chance to stave off the devastating effects of Alzheimer's disease for years
- New hope that the disease may become manageable in the not-too-distant future

onset of the disease. "If you can delay the onset by ten to 20 years, the disease becomes manageable," says Wall. Solomon imagines a time when Alzheimer's disease is not a death sentence, but a chronic disease people live with for decades, like HIV and some cancers today. As a result of the breakthrough, the University of Tennessee Medical Center is creating the Alzheimer's Disease and Amyloid Imaging Center, to augment the world-class research program in both animals and patients. It will be a leading center in the world focused on amyloid research and imaging.

All imaging modalities will play a role in research and treatment, according to Solomon. "PET-CT is the most promising

and exciting modality for amyloid research," says Solomon. Solomon and Wall do not know where their research will take them next. But they think they are on the right track, and pushing the accelerator.

Ron French is a writer and analyst for The Center for Michigan, a policy think tank focusing on economics, education, health, and the environment. He lives in Okemos, Michigan, U.S.

¹ <http://www.alz.co.uk/research/statistics>. Last accessed Sept 14, 2011

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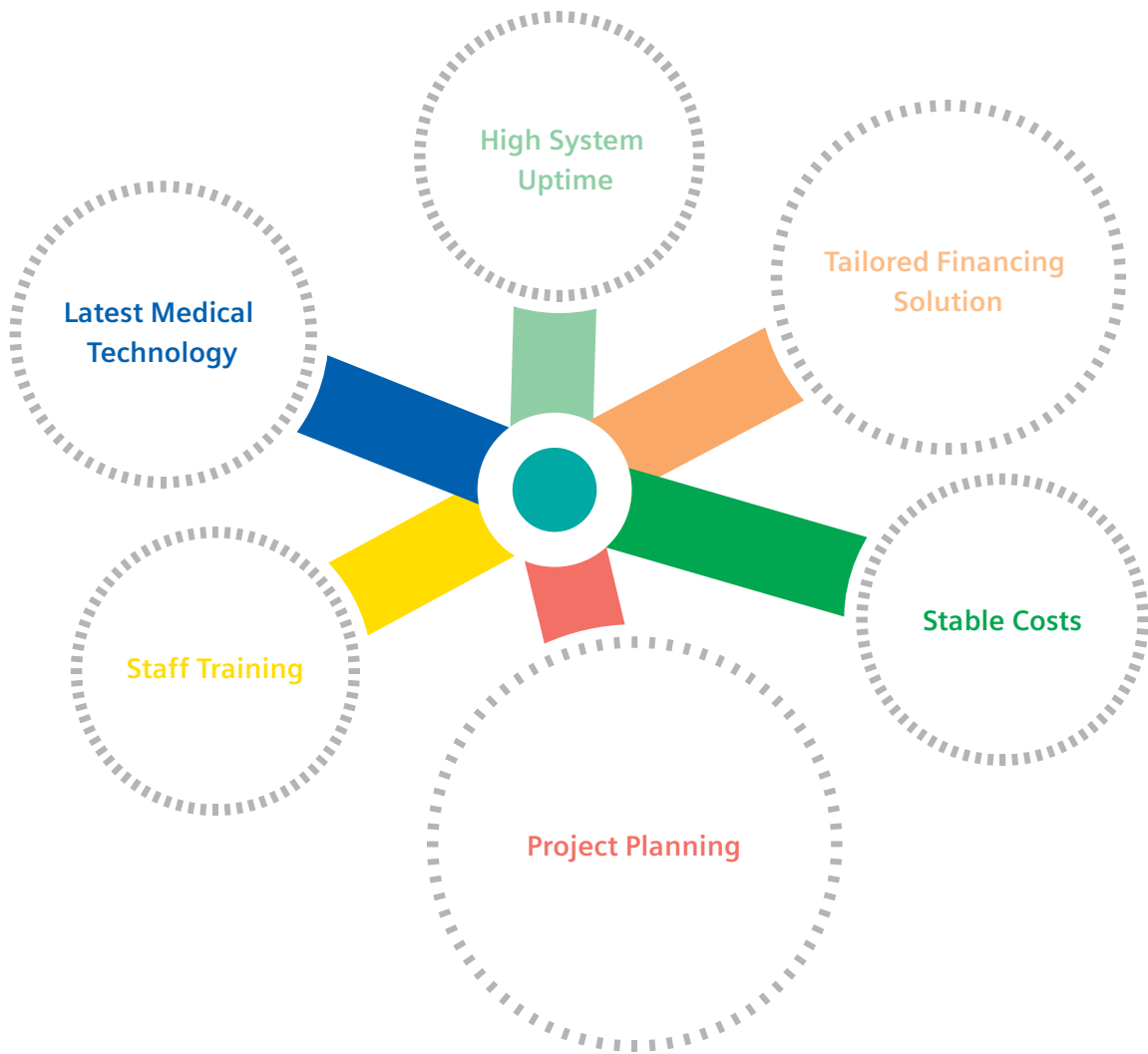
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⁶ Alzheimer's Disease International (ADI), World Alzheimer Report 2009, p. 8

Further Information

www.siemens.com/neurology



Competence Creates Confidence – Confidence Creates Partnership

The issues facing hospitals all over the world are becoming more complex: Who can provide us with advice during project planning stages? Who offers technology to put our corporate strategy into practice? Who can support us in keeping costs stable? Who can help us keep uptime in our system landscape? Who will train our staff for optimum use of state-of-the-art medical technology? And who can offer all of it from a single source?

By Anette Handt

With its local sales teams, Siemens maintains close physical proximity to its customers and pinpoints the right responses to customers' individual needs. Customers receive strategic and technical services, along with support on financing issues. Siemens Healthcare and Siemens Finance & Leasing teamed up to build this kind of all-in-one solution for hospital operator Evangelisches Krankenhaus Bielefeld (EvKB), Germany, signing a ten-year partnership agreement. Together, the EvKB full-service medical facility and Bethel's affiliated Mara Hospital have around 1,500 beds, 30 specialist departments, and 4,200 employees, making them one of the largest hospital operations in the state of North Rhine-Westphalia and a leading employer in the city of Bielefeld. EvKB and the Mara Hospital treat around 53,000 inpatients and more than 73,000 outpatients every year. The Christian facility focuses on a number of specific areas, providing care to patients at three locations. Decision-makers at EvKB realized, also for the entire region, that growth – and with it, economic security – is only possible if discerning, well-informed patients receive outstanding clinical services. When it comes to implementing the EvKB corporate strategy, having a stable partnership with a high-performance medical technology expert over the period of several years is crucial.

Right away during the preparations for the project, employees of the regional Siemens sales unit assembled a core team with the right skills for the job. The result is a comprehensive provisioning model for radiology and nuclear medicine. Within the next ten years, Siemens will provide more than 80 medical technology products, including large systems such as magnetic resonance imaging (MRI), computed tomography (CT), and X-ray units, along with ultrasound systems.

The provisioning model agreed upon between the parties includes several modules: planning, procurement of medical technology, innovation, training, workflow, Integrated Service Management (ISM), and financing. This full-spectrum package was put together because innovative, cost-effective, and functional overall solutions are the only way to manage

the complex tasks that hospitals face. After the agreement was signed, the decision-makers at EvKB commented on the long-term partnership. Among them were Günther Wittenberg, MD, the head physician at the Institute of Diagnostic and Interventional Radiology, Neuroradiology, and Pediatric Radiology, who is also a university lecturer; Friedhelm Niehues, head of construction, engineering, and IT; and Heiner Meyer zu Lösebeck, PhD, who was the Managing Director at Evangelisches Krankenhaus Bielefeld from September 2007 to January 2012.

Dr. Meyer zu Lösebeck, what were the factors that motivated you to decide on a partnership concept with Siemens?

MEYER ZU LÖSEBECK: Quality demands are rising among both patients and employees. To keep patients loyal to the hospital and recruit and retain medical staff, you need to have a hospital that is equipped with state-of-the-art technology. It was clear to us that we needed to do something. And for that, you need a high-performance partner for medical technology and employee training. We decided to incorporate radiology and nuclear medicine into this partnership agreement. We found a good partner in Siemens.

We are talking about medical technology, innovations, services, financing, workflow optimization, and training, now and in the future. Why did you decide to go forward with such an extensive project?

MEYER ZU LÖSEBECK: In addition to purchasing equipment, the innovation concept was an important element, considering that the contract runs for ten years. After all, development is still ongoing – in areas where we are currently the leader in terms of performance, we still want to have state-of-the-art equipment ten years from now. We decided on a full-service contract so that the equipment will always be up-to-date on maintenance and ready to operate. The workflow, too, needs to be optimized, so we are also purchasing consulting services. Then, too, we need to have employees who can handle the new, advanced devices. In short, we decided

to buy the whole package. There are only a few providers that can offer the entire package, and we wanted everything from a single source.

To what extent does Siemens – and the partnership agreement – help you reach your corporate goals?

MEYER ZU LÖSEBECK: Our main goal as a company is to serve patients and the market. That is only possible if we develop with the market – also with regard to advanced medical technology. That said, it is also important for us to achieve our strategic corporate goals: Costs need to remain manageable. In a capped market, it is hard to survive if you don't grow. The Siemens contract will help us achieve that growth.

What convinced you that Siemens was the right partner for this long-term project?

MEYER ZU LÖSEBECK: Siemens made the best offer. Siemens is the technology leader and also the market leader in many areas. When the whole package had been put together, it was clear that we would want to go ahead with the partnership. We have already had good experiences with them. In the end, the existing cooperation between us was another factor in our clear decision in favor of Siemens.

Let's talk about work processes: Which issues do you consider especially important in terms of quality of medical care and workflow?

MEYER ZU LÖSEBECK: We need to make sure that maintenance and travel times are minimized and that analysis and interpretation activities are centralized. We are investing in a completely new radiology unit, with building and equipment. Our highly qualified employees will then be able to engage in analysis and interpretation on multiple systems at the same time, plus they will be prepared for teleradiology between hospitals.

Speaking of workflows, let's turn to the clinician. Dr. Wittenberg, your radiology unit is being rebuilt and will be equipped with state-of-the-art medical technology. Which systems will you use

“We will have a new building that delivers optimum examination options for patients, optimum examination results for clinical staff, and optimum results in terms of cost effectiveness as well.”

Friedhelm Niehues, Manager, Construction, Engineering, and IT,
Evangelisches Krankenhaus Bielefeld (EvKB), Bielefeld, Germany



“In a capped market, it is hard to survive if you don’t grow. The Siemens contract will help us achieve that growth.”

Heiner Meyer zu Lösebeck, PhD, former Managing Director,
Evangelisches Krankenhaus Bielefeld (EvKB), Bielefeld, Germany

“Over the entire ten-year term of the contract, we will hold training sessions on an ongoing basis so that we can get the very best performance out of our new equipment for our patients.”

Günther Wittenberg, MD, University Lecturer, Head Physician,
Institute of Diagnostic and Interventional Radiology, Neuroradiology, and Pediatric Radiology,
Evangelisches Krankenhaus Bielefeld (EvKB), Bielefeld, Germany



in the future, and what services can you offer your patients?

WITTENBERG: We will receive a number of new systems in our newly built radiology department: a SOMATOM® Definition Flash CT scanner, a MAGNETOM® Skyra MRI unit, a system for biplane angiography, and in nuclear medicine, the Symbia® S single-photon emission computed tomography (SPECT) system, to name just a few. These methods – particularly Dual Source CT – will allow us to provide our patients with optimum care in terms of cardiac imaging. And in neurology, we will be able to offer new methods such as perfusion of the whole brain. The new CT scanner will let us significantly lower radiation doses, which is especially

important when examining children. Due to the fast speed, we also no longer need to sedate little children. The big innovative jump for us in angiography is syngo® DynaCT, which allows you to have CT-like images during the intervention. In nuclear medicine, doctors will be able to use the Symbia S to scan patients at a lower dose, and scan times will be significantly reduced. Nowadays, all of that represents an outstanding starting point when it comes to optimizing patient care.

The clinical processes you use will change when the new methods are put in place. What kinds of improvements do you expect to see?

WITTENBERG: Each patient should be available for other diagnostic and therapeutic measures as soon as possible. We are currently developing a road map to make that possible, with special attention to short examination times and excellence in diagnosis, which will benefit both our patients and the hospital.

How will you integrate your staff into the new medical technology landscape?

WITTENBERG: Employees have had the opportunity to contribute their experiences and state their expectations right from the start. When we were choosing the equipment, we asked our experts many questions, including how they

would optimize their imaging. We plan to train employees early on, something that should go well with Siemens. Over the entire ten-year term of the contract, we will hold training sessions on an ongoing basis so that we can get the very best performance out of the equipment for our patients.

Your Mara location is home to the world-renowned Society for Epilepsy Research. In the future, the site will work with MAGNETOM Verio, a 3 Tesla MRI scanner. What do you hope this new development will achieve in terms of both research and epilepsy surgery?

WITTENBERG: MAGNETOM Verio will allow us to visualize local lesions that cause epilepsy and also depict nerve pathways. That will make it possible to operate on patients who suffer from epileptic seizures, where intervention would have been too risky before.

Mr. Niehues, Integrated Service Management, or ISM, is being introduced in your organization. What factored into the decision to contract with Siemens for all aspects of service management?

NIEHUES: At EvKB, we're talking about a total of about 8,000 pieces of equipment from about 300 different manufacturers. Maintenance is extremely difficult to manage with our own staff in radiology and nuclear medicine. Because the equipment used for radiology and nuclear medicine is so complex, manufacturer service is a must. That means placing a contract for the whole imaging package of 80 systems is a logical step for us. Right within our facility, we have a site manager who has the necessary expertise, and we have set the ambitious target of achieving availability figures of 98 percent on the individual units. That's how we came together.

The fact that you work across three sites means that there are a lot of interfaces. You decided in favor of *syngo.via*¹. What do you hope to achieve with this choice?

NIEHUES: The IT equipment at the hospitals is the result of historical developments. Over the past few years, we've had good

results in terms of creating a network that extends to the different sites. Now, with *syngo.via*, we have the opportunity to have even more data come together. One hugely important factor as we make these changes is having a uniform user interface. Employees can access the system and interpret images from different sites. That's a critical point for us. It means that we will have very high quality values in terms of patient care at all sites.

You plan to replace about 30 ultrasound systems that offer a broad range of functions for different users. Why did you choose ultrasound systems from Siemens?

NIEHUES: The main reason is that we want to support the clinical users by providing a uniform user interface. Nowadays, an ultrasound unit can be used on an interdisciplinary basis, across various fields of medicine, depending on its capacity utilization. With a uniform user interface, the user can focus much more on the medical issues in front of him or her, which will be helpful.

How do you think the construction of the new radiology unit and workflow fit together?

NIEHUES: Building a new hospital involves a lot of different requirements. There's the managing director, with his cost expectations, and then there are the head physician and the doctors, with their goals of achieving optimized workflows and equipment provisioning – and then us, the ones who put it together with bricks and mortar while also having to implement extensive technical rules. We got Siemens involved in the process very early on as our partner, because even we can't always keep track of all of the manufacturer-specific aspects involved at the same time.

To do that, I needed Siemens' expertise very early on, and Siemens definitely provided it. The end result will be a building that delivers optimum examination options for patients, optimum examination results for clinical staff, and optimum results in terms of cost effectiveness. That's why we're all sitting down at the same table.

Summary

Challenge:

- Maintain state-of-the-art healthcare at all times in a rapidly modernizing market
- Obtain valuable advice during hospital project planning
- Keep costs stable for several years
- Achieve high system landscape uptime
- Train staff for optimum use of state-of-the-art medical technology
- Improve clinical working processes
- Obtain service from a single source

Solution:

- Planning, delivery, implementation, and management of medical technology for radiology and nuclear medicine for a ten-year period
- "Rent-and-invest" solution with monthly flat-rate payments for equipment, service, financing, and training as well as upgrades
- Financing installment payments on a "pay-as-you-earn" basis, with payments based on ongoing revenue

Result:

- Planning and budget transparency over a longer period
- Using state-of-the-art technology without straining the budget and liquidity
- Strengthening and ensuring ability to make investments based on own performance
- Freeing up resources to focus on core competencies
- Lowering costs through package solutions

¹ *syngo.via* can be used as a standalone device or together with a variety of *syngo.via* based software options, which are medical devices in their own rights.

Anette Handt has years of communications experience at companies and agencies in the field of medical technology. She is currently the director of the communications agency Handt IN Handt Kommunikation, based in Hamburg, Germany.



“How Can I Help You?”

The doctors at the Karlsburg hospital in Germany specialize in first-class treatment of cardiovascular diseases. When they need to rule out stroke in a cardiac patient, they use the Artis zeego angiography system for a head scan. Although well-trained in the usage of the newly acquired system, the radiologists only have limited experience postprocessing brain images. The hospital calls Siemens for technical support and becomes the first customer in Germany to receive remote application support.

By Tanja Berbalk

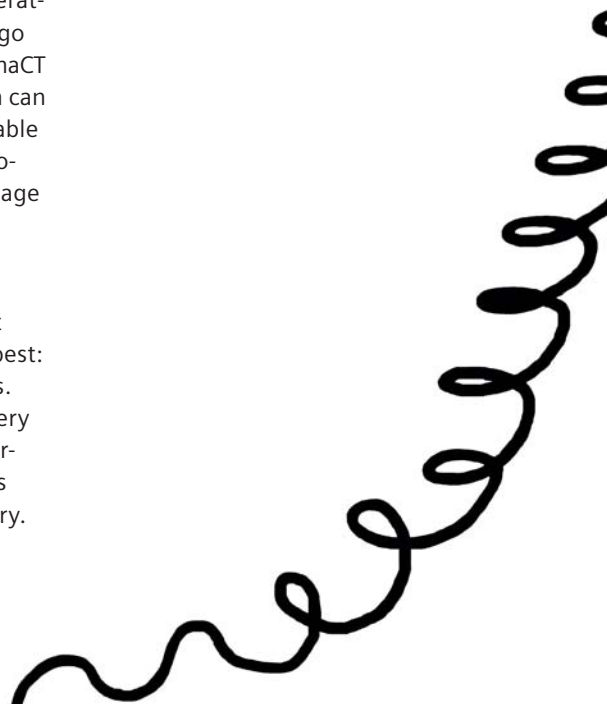
Today's medical environment is increasingly complex. This is especially true of the medical technology that helps medical professionals generate images of the body and postprocess such images at clinical workstations. The more advanced the technology, the more specialized the knowledge required to operate it. Siemens is aware of this need for expert knowledge and offers customers technical trainings and support directly after purchase, so that they can make the best out of the acquired equipment.

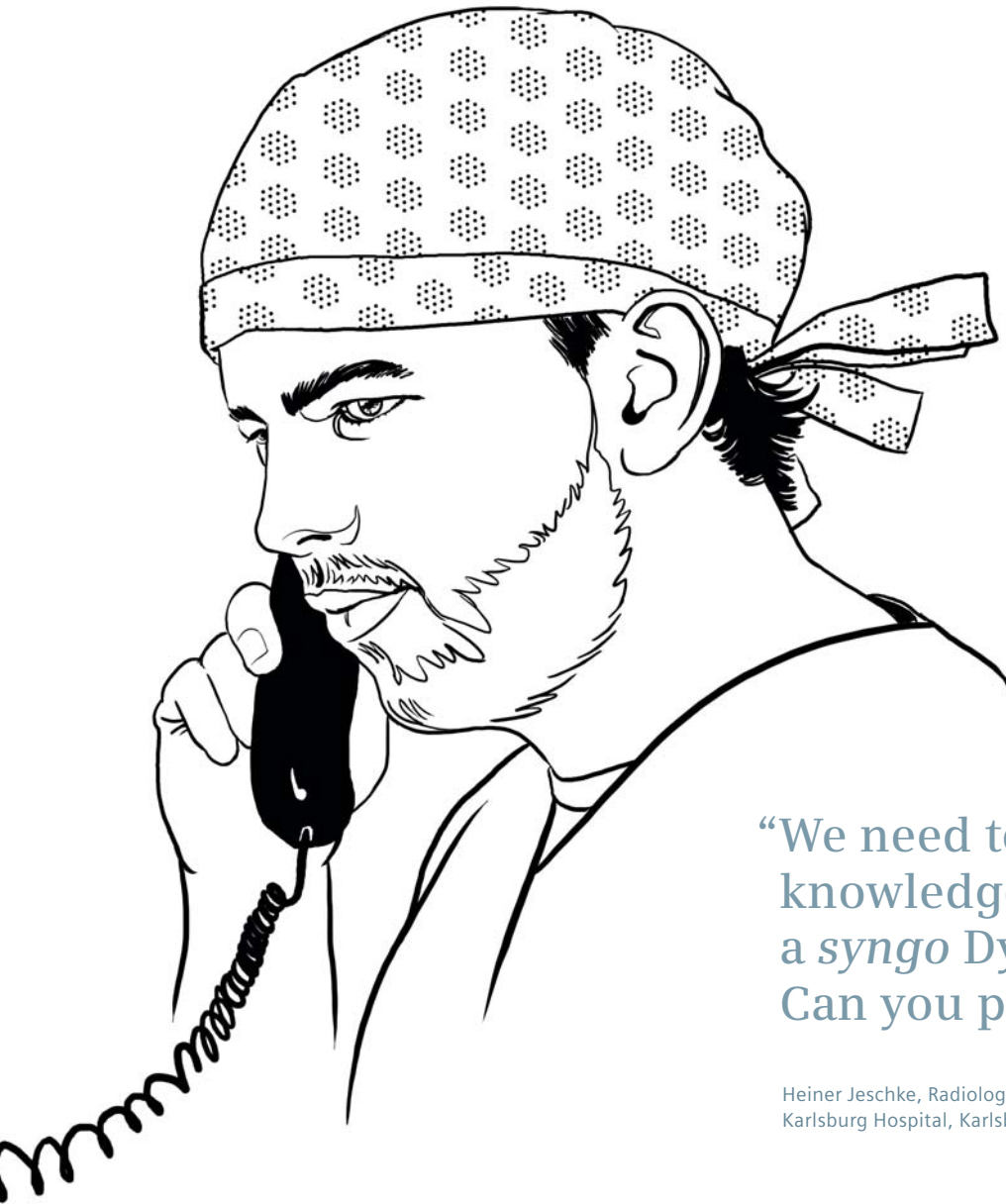
Just like any other Siemens customer, the Karlsburg hospital, near the Baltic coast in Germany, received technical and applicational trainings for its newly acquired Artis zeego® angiography system. The hospital is a renowned center for the treatment of heart disease and diabetes, and is one of the region's most advanced, best-equipped medical centers in cardi-

ology. Each year, the hospital manages about 10,000 inpatients in the fields of cardiac, thoracic, and vascular surgery as well as diabetes and metabolic disease. For about a year now, the hospital has been home to a high-tech hybrid operating room (OR) featuring an Artis zeego system from Siemens. The *syngo*® DynaCT application integrated into the system can be used to generate images comparable to those yielded by a computed tomography (CT) scan and with similar image quality.

Fast Diagnosis Needed

Day in and day out, the physicians at Karlsburg hospital do what they do best: cardiac treatments and interventions. Recently, they performed heart surgery on a male patient. Although the intervention went well, the patient shows neurological abnormalities in recovery.





“We need to refresh our knowledge to postprocess a syngo DynaCT brain image. Can you please help?”

Heiner Jeschke, Radiology Technologist,
Karlsburg Hospital, Karlsburg, Germany

Stroke is a rare but possible risk after cardiac surgery. The doctors immediately need to scan his brain. They decide to use Artis zeego and *syngo* DynaCT to scan the patient's head, since the hospital's CT scanner is currently not available, and ask Heiner Jeschke, radiology technologist, to perform the scan in the hybrid OR. In the OR, he moves the flexible C-arm around the patient in a 220 degree rotation and conducts the scan. But, when they postprocess the clinical images, the physicians find artifacts and cannot eliminate them. The team cannot rule out the suspected hemorrhage. “We took earlier

imaging training as a basis, but this was a very special case with a special medical question, and we did not have enough practice in postprocessing brain images,” explains Jeschke.

Experts Meet Experts

If radiologists need to refresh their operational knowledge, customers can call Siemens to receive ad hoc Remote Assist. Together with Christian Lehrkamp, an engineer and medical technologist at Karlsburg hospital, Jeschke calls the Siemens UPTIME Service Center, whose number is tagged on the workstation's

keyboard. At the other end of the line is Andrea Pumpert, an application specialist at Siemens specifically trained to explain clinical applications in the field of neurology. Jeschke outlines the problem to her over the phone, but Pumpert can only find a solution if she is able to see the specific case. That solution is easier to understand if she can actually show it to Jeschke and not just describe her remedy. With this in mind, Pumpert decides to establish a Remote Desktop connection. With approval from Jeschke and Lehrkamp, she uses a secure Internet connection to connect directly to the



Heiner Jeschke (top left) assists in postprocessing a brain scan in the hybrid OR (bottom right). Jeschke requires support from Siemens and calls the Siemens UPTIME Service Center to immediately receive help. Christian Lehrkamp (bottom left), passionate about the hospital's latest technology, demonstrates a heart surgery video.

Summary

Challenge:

- Application support
- Artifacts on clinical images
- Speedy postprocessing to enable a fast diagnosis

Solution:

- Support is just a phone call away: Application specialist at the Siemens UPTIME Service Center establishes a secure Internet connection to the customer's workplace
- Customer receives real-time support via Remote Assist
- An application specialist shows the customer which parameters need to be adjusted for diagnostic images

Result:

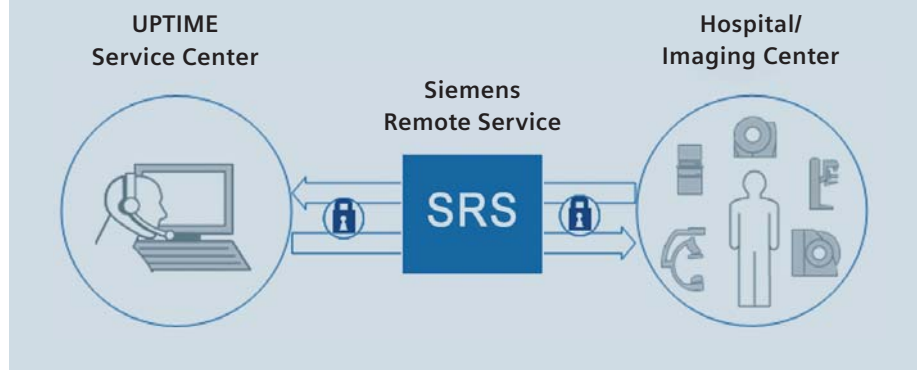
- Fast and straightforward assistance for any given technical and clinical situation on a 24/7 basis
- Refreshed knowledge with convenient access to highly qualified personnel on the customer's schedule
- Easy and cost-efficient training of clinical staff

The Remote Application Services Principle

As soon as a deviation occurs, customers can just call their local Siemens UPTIME Service Center. A sticker on their workstation keyboard indicates the hotline number, which is available 24/7. If possible, Siemens takes appropriate action remotely instead of on-site. To make sure that customers, their processes, and their patient data stay protected, Siemens provides services based on Siemens Remote Service (SRS) via a reliable, bidirectional IT infrastructure, based on a powerful and secure Virtual Private Network (VPN). Gateways allow networks that are based on different protocols to communicate with each other. And, a special Internet Protocol Security provides for the security, authenticity, and integrity of the communication via the IP networks.

Siemens is one of the first manufacturers of medical systems worldwide to implement an internationally valid information security management system (ISMS) for the remote service of medical devices. This has been certified by TÜV Süd in Germany according to the international standard ISO 27001.

Siemens Remote Application Services are an option within the service contract and available for selected X-ray, computed tomography, magnetic resonance, and mammography systems.



workstation in the hybrid OR and sees exactly what the two users see in front of them on the screen. Now, Jeschke turns control of the mouse over to Pumpert, allowing her to postprocess the images in a way that eliminates the artifacts. Jeschke is happy to have learned more about processing *syngo* DynaCT images via the Remote Application Service. "The Remote Assist with Ms. Pumpert worked great! She showed me, right with the mouse cursor, which settings lead to

optimal postprocessing of the brain image and which buttons I have to click in the program interface to accomplish that."

The diagnosis is just as pleasing: The doctor in charge is now able to rule out intracranial bleeding. And, it is all possible within just 25 minutes – the amount of time that elapsed between the initial call and the solution. "The hospital's Internet connection was very fast. Aside from data security, that's the most important

requirement when it comes to providing successful remote support," Pumpert comments. She knows why the problem occurred: "The radiology team did everything right when they performed the head imaging. If the data set had been unusable, I wouldn't have been able to help. The patient was intubated, which made it hard for the radiologists to see what they wanted to see. Then, the only problem was postprocessing the image. The customer had not angled the head



“The phone support was smooth, fast, and uncomplicated. The help we got from the other end of the line was highly capable.”

Christian Lehrkamp, Engineer and Medical Technologist,
Karlsburg Hospital, Karlsburg, Germany

correctly in the settings. Reconstructing the transversal layers allowed us to work around the artifacts, letting the radiologist see precisely the layers he needed in order to make a diagnosis.”

Service: An Important Element of Performance

Lehrkamp followed the Remote Application Service the entire time and is impressed by the fast and smart solution: “The phone support was smooth, fast, and uncomplicated. The help we got from the other end of the line was highly capable. And, all of it yielded extremely pleasing results!” In fact, the Remote Application Service offers a host of benefits on both sides of the phone connection. When weighing the factors of quality, time, and costs, Remote Assist is a fast, easy supplement to on-site support. Lehrkamp established the hospital’s IT almost six years ago and has been moni-

toring the systems to ensure they run smoothly ever since. At the start of his time in Karlsburg, he played a critical role in modernizing the hospital and advising the hospital management with purchasing decisions. He initiated market comparisons to find the right advanced medical equipment to meet his expectations in terms of digitization, workflow planning, and enhanced efficiency. The final decision was in favor of Siemens. Now, all patient data and the clinical images are present in digital form, and all of the hospital’s imaging units are linked together via local area network (LAN). With its 230 beds and 10,000 patients per year, good workflow planning and low medical equipment downtime are crucial to Karlsburg hospital’s success. A full package from Siemens makes it possible to achieve both. “Imaging systems from Siemens offer optimum image quality. Just as important is reliable IT

as well as excellent service in case our employees reach a point where even their expert knowledge isn’t getting them anywhere. In all three areas – image quality, IT, and service – Siemens is far ahead of other manufacturers,” says Lehrkamp.

Tanja Berbalk has a degree in sociology, marketing, and communications. She is an editor at Medical Solutions.

Further Information

[www.siemens.com/
remote-service](http://www.siemens.com/remote-service)



The Turkish Healthcare System

By Kamil Adalet, MD, Professor of Cardiology and Vice-Chancellor at the University of Istanbul, Head of the Department of Cardiology at the Istanbul Faculty of Medicine, University of Istanbul, Turkey

Turkey is a parliamentary democracy with a separation of executive, legislative, and judiciary powers. The Turkish Grand National Assembly is the legislative body acting on behalf of the nation. The President is elected by the people, and the Council of Ministers is headed by the Prime Minister. Turkey is situated in both Europe and Asia. The country has a population of 72.5 million people (2008) and an average annual population growth rate of 1.45 percent. Turkey has been a candidate for membership to the European Union since 1999 and is in the upper-middle-income country group, according to the new classification of the World Bank. The development of health system institutions is mainly undertaken by the Ministry of Health, the Ministry of Labor and Social Security, the Ministry of Finance, parliamentarian commissions, the State Planning Organization, the Social Security Institution, the Council of Higher Education, military institutions, and other rele-

vant organizations and institutions. In addition, professional organizations such as the Turkish Medical Association, chambers of doctors, and other non-governmental organizations all have roles in the policy-making process. Furthermore, international organizations such as the World Health Organization, the Organization for Economic Co-operation and Development, the World Bank, and the International Monetary Fund have been involved in different ways.

Unification Process

Healthcare reform initiatives date back to the beginning of the 1990s, but the implementation phase only began after the start of the Health Transformation Program in 2003. Before 2003, the Turkish healthcare system was a mix of private and public sector institutions and had a four-part health delivery system: 1) the Ministry of Health, 2) the Social Insurance Organization, 3) University

hospitals, and 4) the private sector (hospitals, clinics and polyclinics, doctors' offices, pharmacies, laboratories). However, publicly owned hospitals – with the exception of university hospitals or military hospitals – were transferred to the Ministry of Health in 2005. As a result of this unification, healthcare provision can currently be described as tripartite: 1) the Ministry of Health, 2) University hospitals, and 3) the private sector. The Ministry of Health runs large-scale healthcare facilities (health centers, family health centers, population health centers, tuberculosis control dispensaries, cancer early diagnosis-screening hospitals, outpatient clinics, and hospitals). The Ministry of Health is the main provider of primary and secondary healthcare services and the only provider of preventive health services. The university hospitals should provide tertiary healthcare, but in practice they provide health services at all levels.

Facts & Figures

Turkey has accomplished remarkable improvements in terms of health status in the last two decades. Major health indicators such as life expectancy, infant mortality rate, and maternal mortality have considerably improved. However, despite these improvements, infant mortality and life expectancy at birth are still not compatible with other European countries and the USA. Average life expectancy reached 71.8 for male and 76.8 for female, and 74.3 for total in 2010. Infant mortality rate decreased from 117.5 to 10.1 per 1000 between 1993 and 2010. There are still regional discrepancies in terms of the infant mortality rate between the Eastern and Western parts of Turkey. Both the high level of infant mortality and regional discrepancies can be attributed to low socioeconomic conditions in some parts of the country, low education levels of females, and the high prevalence of infectious diseases.

As in other countries, the number of elderly people is growing in Turkey. As a result of rapid changes in the social structure, elderly people have an increasing need for state support and professional services. This need is met by both public and private agencies.

The main causes of death are ischemic heart disease followed by cerebrovascular diseases. The increasing rates of cancer are an alarming public health issue.

During the past ten years, the numbers of academic staff in medical facilities increased from 6,798 to 9,970, and the number of students graduating from medical school from 4,925 to 5,138. Between 2006 and 2010, the number of physicians increased from 104,475 to 123,447; the number of dentists increased from 18,332 to 21,432; and the number of nurses increased from 82,626 to 114,772. Although the number of physicians per 100,000 people (158.2) has grown moderately but steadily over the last two decades, it is still significantly below that of the European Union average. Similarly, the number of nurses per 100,000 people (320) is the lowest among its European neighbors. In addition to insufficient numbers, geographical distribution is still an important problem. Hospital care is delivered both by public and private hospitals. In 2010, there were 1,439 hospitals, of which 843 were owned by the Ministry of Health, 62 were owned by universities, and 489 were owned by the private sector. The rest were owned by other public organizations, such as the Ministry of Defense. Hospitals provide both inpatient and outpatient care.

Between 2002 and 2010, the number of hospital beds increased from 159,771 to 199,950 and the total hospital visits from 124,313,659 to 302,984,218. During that same period, the number of surgical operations increased from 373,439 to 8,614,789; organ transplantations from 744 to 3,336; and magnetic resonance and computed tomography imaging procedures from 5,817,090 to 7,567,064.

The use of medical technology in 2000 and 2008 is shown in Table 1. The ratio of general satisfaction with healthcare services increased from 39.5 percent to 73.1 percent between those years.

Table 1. Medical Technology in Turkey

Medical technology (Number of units)	2000	2008
Computed tomography systems	121	329
Magnetic resonance imaging systems	18	200
Intensive care beds	869	6633
Ambulances	618	2029
Neonatal intensive care beds	665	2918

Number of Nurses per 10,000 Resident Population (2006)

29



Number of Physicians per 10,000 Resident Population (2006): 16



Number of Hospital Beds per 10,000 Resident Population (2006): 27



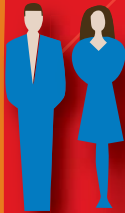
Total Expenditure on Health per Capita (2005): US\$ 383

Public Expenditure on Health as % of Total Expenditure on Health (2005): 71.4

Total Expenditure on Health as % of GDP (2005): 5.7

Male Life Expectancy at Birth (2006)

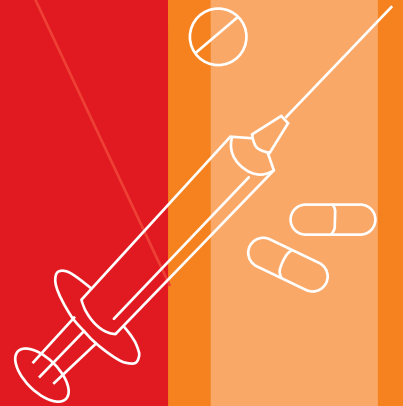
71



Female Life Expectancy at Birth (2006)

75

Population in Thousands (2006): 73,922



Sources: WHO Core Health Indicators (http://apps.who.int/whosis/databas@/core/core_select.cfm). Last accessed Sept. 27, 2011

¹ Saglik Bakanligi Istatistikleri. 2010 [Turkish Ministry of Health Statistics Yearbook 2010]



Recent reforms have put special emphasis on the reorganization of primary care services. A family practitioner system was introduced as a pilot program in 2004. This model is currently being implemented in most of the 81 provinces. Family practitioners are general practitioners providing primary care to the population. They are paid on a capitation basis with incentives for preventive activities. The major drawback of the system is the lack

increase is mainly due to improvements in the public provision and financing of health services that decreased the share of out-of-pocket expenditures. Prior to 2003, a number of health insurance funds operated. The Government Employees Retirement Fund, established in 1949, was financed by contributions from active civil servants to cover retired civil servants and their families. The Active Civil Servant Scheme, established in 1965, was financed through allocations from the government budget to institutions employing active civil servants. The Social Insurance Organization, founded in 1964, covered the largest segment of the population – blue- and white-collar workers in the public and private sectors. It was financed by premiums based on payroll wages. The Social Insurance Agency of Merchants, Artisans, and Self-Employed was established in 1971, and since 1987 has offered health benefits covering the self-employed financed by revenues from the self-employed. The Green Card Scheme, which was created in 1992 as a social assistance mechanism to cover poor people earning less than one-third of the minimum wage, was financed from the Ministry of Health budget. In 2005, Green Card holders were given access to outpatient care and pharmaceuticals, and Social Insurance Organization beneficiaries were given access to all public hospitals and pharmacies. In addition to these main programs, some of the institutions (banks, insurance companies, corporations, etc.) had funds to cover the health expenditures of their employees.

“Turkey is moving from a system of multiple insurance schemes to a single-payer system intended to provide the whole population with access to a wide range of healthcare services.”

Kamil Adalet, MD, Professor of Cardiology, Vice-Chancellor, University of Istanbul; Head Department of Cardiology, Istanbul Faculty of Medicine, University of Istanbul, Turkey

of a referral system between primary, secondary, and tertiary care.

Spending

Turkey spent €461 per capita on healthcare in 2008. Turkey finances healthcare services from various sources. Social insurance contributions take the lead, followed by government sources, out-of-pocket payments and other private sources. According to the most recent National Health Accounts (NHA) data, 41.0 percent of funds came from social health insurance in 2006, followed by 31.4 percent from government sources, 19.3 percent from out-of-pocket payments, and 8.3 percent from other private sources. Total expenditure on health as a proportion of gross domestic product (GDP) has risen from 2.4 percent to 5.6 percent between 1980 and 2008. This

A Decade of Reforms

The General Health Insurance Scheme (GHIS) came to the forefront as part of the third wave of healthcare reform attempts, which started in early 2003 and aimed to organize, provide financing, and deliver healthcare services. This was going to be done in three ways: by unifying social security institutions under a single roof, pooling fragmented social health insurance schemes under a single legal arrangement that ensures unity in norms and standards, and eliminating payments without premiums from the

social insurance system and managing them in a single entity.

In 2007, legislative measures mandated that all Turkish citizens have access to free primary care, even if they were not covered under the social security system. Under the Health Implementation Decree of 2007, benefits across the formal health insurance schemes of Social Insurance Organization, the Social Insurance Agency of Merchants, Artisans, and Self-Employed, and the Government Employees Retirement Fund were further harmonized. A new law established a single agency in 2006 under the Ministry of Labor and Social Security, merging the Social Insurance Organization, the Social Insurance Agency of Merchants, Artisans, and Self-Employed, and the Government Employees Retirement Fund under one umbrella – the Social Security Institution. The Active Civil Servant Scheme and the Green Card Scheme were fully integrated in 2010.

The GHIS is compulsory, has universal coverage, and is based on residency criteria. The system includes all Turkish citizens, as well as refugees and foreigners who have resided legally in Turkey for more than one year and do not have health insurance coverage from another country. Family members of the insured aged under 18 years of age are also insured automatically. The age for dependent children can be extended to 25 years

under the condition of continuing education.

Funding

The main funding source for GHIS is payroll taxes, and the revenue is centrally collected and managed by the Social Security Institution. The new scheme involves three different contribution mechanisms. The dominant mechanism is compulsory social insurance contributions, followed by state contributions and user charges. The GHIS has both contributory and non-contributory elements. Social insurance contributions are mainly earnings-based and are shared between employers and employees. Tax revenues fund healthcare for non-paying portions in addition to funding public health activities, medical education, and research. The Social Security Institution limits the amount that private hospitals can charge 30 to 70 percent above the price paid by the Social Security Institution.

Turkey has set up a single funding agency by merging all existing public schemes and including the uninsured segment of the population to pool risks and resources nationwide. The pooling of funds is centralized in the Social Security Institution, which, as the single purchaser in the health sector, is responsible for purchasing healthcare from providers on behalf of the insured population. According to the GHIS, health services are provided

through contracts made between the Social Security Institution and national or international competing healthcare providers and/or by means of reimbursing the costs of health services that are bought by the insured and dependents in accordance with the law.

One of the significant features of the GHIS is that it provides the family physician with an income based on capitation alongside salary. Payment mechanisms for state hospitals are determined by the GHIS. Fixed-price payments for outpatient and inpatient procedures based on the Current Procedural Terminology and International Statistical Classification of Diseases and Related Health Problems were introduced in all Ministry of Health and university and private hospitals under contract with the Social Security Institution. In the near future, a case-mix-based payment system called Diagnosis-Related Groups (DRG) is expected to be introduced. Through an application called Performance-Based Supplementary Payment, health professionals working in public hospitals receive substantial additional payments from the hospitals' revolving funds in accordance with performance.

Medicines are obtained through private pharmacies, and dispensing outpatient prescriptions from hospital pharmacies is not allowed. Pharmacies can sell other commercial products such as contracep-



Kamil Adalet, MD, is a professor of cardiology, Vice-Chancellor and Head of the Department of Cardiology at the Istanbul Faculty of Medicine at the University of Istanbul in Turkey. An expert in arrhythmias, he has written dozens of scientific papers on this and other topics. He has chaired several committees and served as a keynote speaker at national and international cardiology congresses and symposiums. He serves on the advisory boards of nearly 20 medical journals, including the *International Journal of Cardiology*, the *Journal of Turkish Interventional Cardiology*, and the *Anatolian Journal of Cardiology*.

Adalet is a member of the European Society of Cardiology, the Turkish Society of Cardiology, the Turkish Medical Association, and the European Atherosclerosis Society. He is currently also Chairman of the Board of Istanbul University Hospitals and President of the Istanbul Society of Cardiology.

“The main challenges that remain are to implement the outstanding reform initiatives and to address sustainability issues.”

Kamil Adalet, MD, Professor of Cardiology, Vice-Chancellor, University of Istanbul; Head, Department of Cardiology, Istanbul Faculty of Medicine, University of Istanbul, Turkey

tives, personal hygiene items, baby products, and cosmetics.

Concluding Remarks

The Turkish healthcare system has undergone a radical change through the realization of the legislative and enforcement stages of a longstanding reform process relating to the healthcare system and financing aspect. Accordingly, Turkey is moving from a system of multiple insurance schemes to a single-payer system intended to provide the whole population with access to a wide range of healthcare services. The GHIS reform can constitute a powerful engine for achieving universal coverage and enhancing equity and solidarity in the Turkish healthcare system.

The main challenges that remain are to implement the outstanding reform initiatives and to address sustainability issues. This includes extending the family practitioner scheme to the whole country, instigating an effective referral system from primary to higher levels of care, improving the supply of healthcare staff,

introducing and extending public hospital associations that aim to grant autonomous status to public hospitals, and improving patient rights.

Becoming a Doctor

Becoming a medical doctor is extremely difficult in Turkey, and maintaining the profession is even more difficult. Two million students compete to enter one of the nine or ten top high schools in Turkey. This is a first and important step for those who want to pursue a medical education later, but only 10,000 of them can achieve this target. After that, about two million students compete to enter medical school, and only 5,000 of students achieve that goal each year. Medical education takes six years. After graduation from medical school, every physician is required to complete two years of compulsory service in a deprived area – a tool to balance geographical inequalities. In addition, one-and-a half years of compulsory military service must be completed by every male. To earn the right for specialization training, another competitive exam must be passed. The average duration of specialization training, with a very low salary, is four years. Seven or eight times a month, participants are required to perform 36 hours of continuous duty at the hospital. After passing a challenging exam to become a medical specialist, another two-year compulsory service is mandatory.

At age 35, medical specialists can work at the state hospitals, but, due to the low income, most also work at a private office or hospital after eight hours of public duty. At the university, medical doctors can win the right to work in the private sector after attaining the title of professor – and reaching the age of 45. In January 2010, Turkey adopted a law banning dual practice for health personnel working for public facilities. The aim of this law is to use the health workforce more efficiently and effectively while also eliminating the problems arising from dual practice.

The new law strictly prohibits private activities after public duty, even after eight hours' work at the public hospital, but salaries are still limited. The intro-

duction of a performance-based payment system in Ministry of Health and University Hospitals has not dramatically changed the income. To implement these policies, politicians and the media have influenced people's attitudes, physician-patient relationships have been negatively affected, and respect for physicians has almost disappeared. As a result of these problems, doctors have been very unhappy and restless. On the other hand, the professional activities of physicians have been significantly restricted, not only in the public sector, but also in private offices and hospitals. It is very difficult to find a job in a private hospital due to limitations on the government's rules. These developments will surely result in many bright young people not selecting the medical profession, and the quality of medical education will fall. In the short term, this policy appears to be in favor of the people, but in the long term, it may have disastrous effects.

The opinions reflected in this article are those of the author and do not necessarily reflect those of Siemens Healthcare.

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Fast and Cost-Effective Preoperative Assessment of Bleeding Risk

The new INNOVANCE® PFA-200 System¹ from Siemens uses state-of-the-art technology for rapid in vitro testing of platelet function, simulating hemodynamic flow conditions of platelet adhesion and aggregation in a vascular lesion.

The system measures platelet plug formation in a small whole blood sample (800µL), and reports a “closure time” in five to eight minutes.

The INNOVANCE PFA-200 System offers sensitive detection of acquired, inherited, or drug-induced platelet dysfunction in multiple clinical settings. It serves as a valuable adjunct for the optimized clinical outcome of therapeutic interventions, and supports decision-making algorithms in transfusion medicine.

In combination with traditional coagulation screening tests such as Prothrombin Time and Activated Partial Thromboplastin Time, the INNOVANCE PFA-200 System provides the appropriate level of sensitivity to functional defects of hemostasis. Through preoperative detection of patients with impaired primary hemostasis and convenient monitoring of presurgical therapy, the system can effectively support preoperative bleeding risk management. Additionally, the INNOVANCE PFA-200 System can check whether cardiovascular patients on aspirin therapy experience the therapeutic benefit from this medication by demonstrating aspirin-induced platelet function inhibition. While most other analyzers only measure the effect on platelet aggregation, the Siemens’ analyzer measures the ability of aspirin to prevent platelet plug formation.

Some common “screening tests” may fail to detect a number of mild bleeding disorders that could cause substantial bleeding. In contrast, the PFA-200 system has been shown to effectively identify patients with a bleeding risk due to platelet function deficiency. With the INNOVANCE PFA-200 System, most patients with prolonged closure times manifest abnormalities in primary hemostasis that could place them at risk for bleeding and transfusion needs during and after surgery.

Learn how the new INNOVANCE PFA-200 System makes workflow more efficient – take a virtual tour by accessing the link below.

¹ Not available for sale in the U.S.



www.siemens.com/innovancepfa-200

Cardiology Customers Share Their Experiences



Antonio Dager, MD, with his team performing transfemoral aortic valve implants, Angiografía de Occidente in Colombia



Angio Hybrid Room at CCM, Monaco

In a series entitled *Cardiology Customer Experiences*, Siemens features four stories in which customers share their experiences in cardiology. These include the Monaco Cardiothoracic Center (CCM), the University Medical Center Mainz, Germany, the Elisabeth Hospital in Essen, Germany, and the cardiology group Angiografía de Occidente in Cali, Colombia.

The CCM is the first Siemens European Reference Center for Cardiovascular Medicine. A Siemens' collaborator since its founding in the 1980s, CCM is a remarkable clinic, pioneering interdisciplinary collaboration and the creation of the first hybrid operating room in Europe in 1989. The hospital is equipped with the most advanced Siemens systems available, such as high-end computed tomography (CT) and magnetic resonance imaging (MRI) scanners, as well as software for three-dimensional interventional imaging.

As of September 2011, Elisabeth-Hospital's Cardiology and Angiology Clinic joined Monaco's Cardiothoracic Center as Siemens' second European Reference Center for Cardiology. The clinic integrates interventional and noninvasive cardiology into one management team, creating an environment for optimized clinical workflow. This not only minimizes risk exposure in every patient, but also helps achieve higher therapeutic efficacy and lower costs.

The University Medical Center Mainz is one of Siemens' outstanding customers as well. It implemented 4D echocardiogra-

phy in its clinic, using a Siemens ultrasound system. This enables 4D echo in a single heartbeat and thus a more comprehensive view of the heart and its pathologies. Volume stress echocardiography is an innovative part of coronary artery disease (CAD) evaluation, providing wide availability at a low cost and without ionizing radiation.

Cali in southwestern Colombia is in the vanguard of a revolution in minimally invasive cardiovascular procedures. Since March 2008, the head of the clinic, Antonio Dager, MD, and three associates have performed 70 transfemoral aortic valve implants (TAVIs). Dager uses a Siemens C-arm imaging system, which features all CARE dose-saving technology, to help him diagnose and treat patients with minimal radiation. Together with its customers, Siemens, as a long-term partner, will continue providing systems, applications, consulting, and IT solutions that enable cardiovascular caregivers to efficiently deliver the highest quality outcomes amidst continuously changing healthcare dynamics.

www.siemens.com/esc-experiences

Color Wall Poster on Tissue Strain Analytics for Breast Lesions

Conventional ultrasound criteria such as irregular margins, shadowing, microlobulations, echogenicity, and shape can be applied to help distinguish benign from malignant breast lesions. In addition, the compressibility of a breast lesion can be used as a further criterion since, in general, breast cancer tissue is stiffer and less pliable than the adjacent normal breast tissue.

A new color wall poster from Siemens Healthcare illustrates tissue strain imaging through clinical examples using Siemens' proprietary suite of elastography and acoustic radiation force imaging (ARFI) strain technologies: eSie Touch™ Elasticity Imaging Technology, Virtual

Touch™ Tissue Imaging, and Virtual Touch™ Tissue Quantification¹ Technologies. The clinical examples were provided by Dirk-André Clevert, MD, from the Interdisciplinary Ultrasound-Center at the University of Munich's Klinikum Grosshadern, Germany.

To order this practical guide on tissue strain analytics for breast lesions, please access the link below.

¹ Virtual Touch applications are not available in the United States.

www.siemens.com/strain

Imaging Techniques for Pediatric MRI¹



Motion correction with syngo BLADE in pediatric patients

Magnetic resonance imaging (MRI) examinations of children require a particular set of skills and expertise in order to successfully obtain diagnostic images with minimal distress to the patients and their family.

In the Siemens MR Expert Magazine *MAGNETOM Flash*, Glenn Cahoon of the Royal Children's Hospital in Melbourne, Australia, gives insight into his work in MRI with young patients. Cahoon pro-

vides an overview of the challenges in the MR setting, which arise from the children's anatomy, physiology, and behavior.

Besides describing the possibilities in coil selection, sequences, and imaging techniques suited for pediatric MRI, the guide also gives practical recommendations that can help young children comply with the MR procedure and minimize the use of anesthesia in this

vulnerable population. To access this helpful guide, please use the link below.

¹ MR scanning has not been established as safe for imaging fetuses and infants under two years of age. The responsible physician has to decide about the benefit of the MRI examination in comparison to other imaging procedures.

www.siemens.com/MAGNETOM-Flash-Pediatrics

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Henkestrasse 127, 91052 Erlangen, Germany

Responsible for Contents: Michael Sigmund

Director of Content & Messages: Thomas Reichert

Chief Editor: Doris Pischitz

Editorial Team: Tanja Berbalk, Emily Smith

Production: Norbert Moser

All at: Henkestrasse 127, 91052 Erlangen, Germany

Phone: +49 9131 84-7529, Fax: +49 9131 84-4411

email: editor.medicalsolutions.healthcare@siemens.com

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independent Medien-Design, Munich, Germany

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Art Direction: Horst Moser

Layout: Claudia Diem, Mathias Frisch, Julia Hollweck,

Irina Paschenko, Luitgard Schüller

Editorial Coordination: Christa Krick

Photo Editor: Anja Kellner, Florencia Serrot

All at: Widenmayerstrasse 16, 80538 Munich,
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Global Siemens Headquarters

Siemens AG
Wittelsbacherplatz 2
D-80333 Munich
Germany

Global Siemens Healthcare Headquarters

Siemens AG
Healthcare Sector
Henkestrasse 127
D-91052 Erlangen
Germany
Telephone: +49 9131 84-0
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Local Contact Information

Asia/Pacific:

Siemens Medical Solutions
Asia Pacific Headquarters
The Siemens Center
60 MacPherson Road
Singapore 348615
Telephone: +65 9622-2026

Canada:

Siemens Canada Limited
Healthcare Sector
1550 Appleby Lane
Burlington, ON L7L 6X7
Canada
Telephone + 1 905 315-6868

Europe/Africa/Middle East:

Siemens AG, Healthcare Sector
Henkestr. 127,
91052 Erlangen
Germany
Telephone: +49 9131 84-0

Latin America:

Siemens S.A., Medical Solutions
Avenida de Pte. Julio A. Roca No 516, Piso 7
C1067ABN Buenos Aires
Argentina
Telephone: +54 11 4340-8400

USA:

Siemens Medical Solutions USA, Inc.
51 Valley Stream Parkway
Malvern, PA 19355-1406
USA
Telephone: +1 888 826-9702