

THE POWER OF EVERY **ONE**

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Добро пожаловать  
Bienvenidos  
Bun Venit  
Willkommen  
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Καλωσορίσατε  
Bienvenue  
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शुभकाम



## DEAR FRIENDS,

Cleveland Clinic enjoyed a remarkable year in 2014. We achieved notable distinction in patient care, research and education. We built on our legacy of achievement and strengthened our commitment to quality, affordability and innovation. With a relentless focus on the patient, we are determined to lead in the new era of health and medicine.

American healthcare is at an inflection point. Value has replaced volume as the basis of reward. Moving ahead, everyone in healthcare will be expected to do more with less. This means change, and change is what people fear most. But Cleveland Clinic will not veer from its mission. We are doubling down on our mission, caring for the patient of today while building for the patient of tomorrow.

Cleveland Clinic set a new annual record for outpatient visits in 2014 — almost 6 million across all our facilities. We continued to see the highest-acuity patient population in America. We ranked No. 1 in both heart care and urology

in *U.S. News & World Report*, and in the national top ten for 11 other specialties.

We expanded our integrated healthcare system with new buildings in Avon, Ohio, and Weston, Florida; groundbreaking for the new Cancer Building on our main campus; and plans for the new Health Education Campus in partnership with Case Western Reserve University.

By any measure, we've had a very successful year. But the world of healthcare is changing, and we are in the process of adapting. In 2014, we launched The Power of Every One, an ambitious \$2 billion philanthropic campaign to be completed in time for our 100th anniversary in 2021. This campaign is necessary to support our goals for the years ahead and to ensure that all our communities will continue to have access to the finest healthcare services.

Our past successes are the result of acting as a unit and putting patients first. We will remain true to our mission. To accomplish this, how

and where we provide care will change. Yesterday, our founders innovated for today. Today, we must innovate for tomorrow. Our caregivers will do what is necessary to make the changes to ensure superior quality, access and affordable care. We believe in the future of Cleveland Clinic.

Sincerely,



**Delos M. Cosgrove, MD**  
CEO and President, Cleveland Clinic



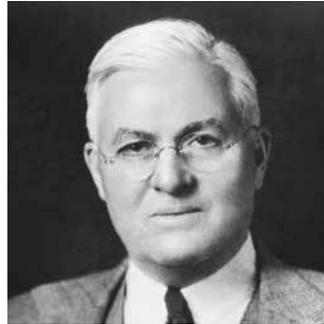
**Robert E. Rich Jr.**  
Director and Chairman of the Board

# THE STRENGTH OF THE INDIVIDUAL WAS THE STRENGTH OF THE GROUP.

— GEORGE W. CRILE, MD  
ONE OF THE FOUR FOUNDERS OF CLEVELAND CLINIC



FRANK E. BUNTS, MD



GEORGE W. CRILE, MD



WILLIAM E. LOWER, MD



JOHN PHILLIPS, MD

Cleveland Clinic is based on teamwork. Our strength is the strength of individuals working together in a common cause. Every one of our caregivers is committed to giving every one of our patients the best outcome and experience. Every one of our supporters and each member of our community plays an important role in this great cause.

That's "The Power  
of Every One."

That's the Cleveland Clinic way.

THE POWER OF

# EVERY DECISION

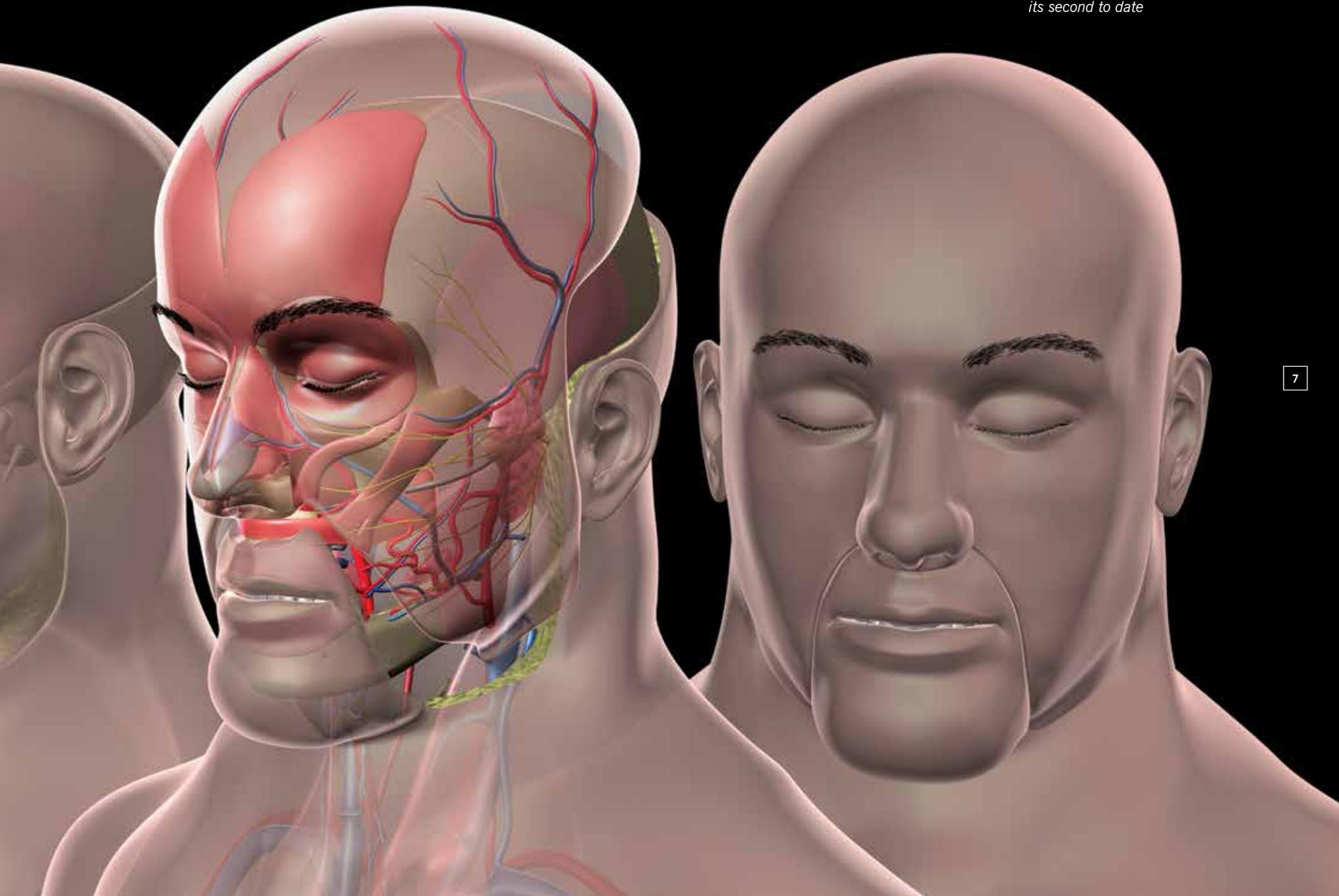
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## ANOTHER FACE TRANSPLANT COMPLETED

Cleveland Clinic's second face transplant was performed in 2014 by a team led by Francis Papay, MD, of the Dermatology & Plastic Surgery Institute with Maria Siemionow, MD, PhD. Ninety percent of the patient's face was transplanted, his sight was preserved, and blood flow was restored to the forehead and scalp. The team — including specialists in plastic surgery, ophthalmology, otolaryngology, vascular surgery, anesthesiology, dentistry and dermatology — navigated countless treatment decisions to make the 24.5-hour surgery a success. For more about this remarkable operation, visit [clevelandclinic.org/facetransplant](http://clevelandclinic.org/facetransplant).



*Medical illustrations depicting three stages of Cleveland Clinic's most recent face transplant — its second to date*



# 2014 CLINICAL AND RESEARCH ACHIEVEMENTS



Members of the multidisciplinary team behind Cleveland Clinic's second near-total face transplant

## Face Transplant Includes Several Firsts

A multidisciplinary team of caregivers led by Francis Papay, MD, Chair of the Dermatology & Plastic Surgery Institute, and Maria Siemionow, MD, PhD, performed Cleveland Clinic's second near-total face transplant. The procedure, which involved transplantation of vascularized composite allograft tissue of the face, orbits and maxilla, took over 24 hours to complete. Most of the scalp was transplanted, along with the forehead, upper and lower eyelids, eye sockets, nose, upper cheeks and jaw, upper teeth, facial muscles and nerves, skin, and salivary glands. The procedure marked the first time the bilateral internal maxillary arteries and their branches (including the superficial temporal arteries) were transplanted to supply vascularity to the scalp, forehead and upper face. It also included reconstruction of the left orbit in a successful attempt to preserve vision in the patient's one remaining eye, a first for a facial transplant. The procedure was made possible in part by a grant from the Armed Forces Institute of Regenerative Medicine.

## Mobile Stroke Treatment Unit Trims Intervention Times

**"The mobile stroke treatment unit essentially brings the emergency room to the patient."** — Peter Rasmussen, MD, Neurological Institute

The Neurological Institute introduced a mobile stroke treatment unit — complete with its own lab, CT scanner and specially trained personnel — to diagnose and begin treatment of potential stroke patients at the scene of symptom onset and en route to the hospital. A team from the Cerebrovascular Center, directed by Peter Rasmussen,

MD, is among the first in America to offer a mobile stroke treatment unit, and they have improved the concept with innovations that include the use of telemedicine to allow neurologists to manage cases remotely. The mobile unit has so far enabled caregivers to treat patients with anti-platelet therapy within a mean of 19 minutes of getting into the mobile unit — far sooner than the 60-minute window recommended by guidelines. The unit is projected to save between \$2 million and \$4 million in its first year through savings in post-acute stroke therapy.

## First in Ohio to Implant Leadless Pacemaker

**"These leadless devices operate on a different level of technology thanks to miniaturization and nanotechnology."**

— Daniel Cantillon, MD, Miller Family Heart & Vascular Institute

Daniel Cantillon, MD, of the Sydell and Arnold Miller Family Heart & Vascular Institute was the first in Ohio — and the third in North America — to implant the investigational Nanostim leadless pacemaker. The miniature device is implanted via catheter and consists of a heart rate-monitoring electrode, miniaturized software, a generator to stimulate pacing and a battery. The patient, who had a heart rhythm disorder, is doing very well. The Nanostim is similar to another investigational leadless pacemaker, the Micra, which Cleveland Clinic physicians also implanted in patients for the first time in 2014. Both devices, currently used only for single-chamber pacing, are being implanted as part of clinical trials required for FDA approval.

## Resected Hip Bones Promise New Source of Stem Cells

**“Use of stem cells from periosteum may open up unprecedented opportunities for treatment of disease and tissue and organ failure in a population of osteoarthritic patients born about four decades too early to bank their own cord tissue or blood.”**  
— Ulf Knothe, MD, DSc, Orthopaedic & Rheumatologic Institute

Surgeons usually discard the arthritic bone they remove during hip replacement surgery. But a new study indicates this tissue may be a rich source of adult stem cells that can be used to heal or repair failing organs or regrow tissue. Ulf Knothe, MD, DSc, of the Orthopaedic & Rheumatologic Institute was clinical leader of the study, which also involved scientists from the University of New South Wales, Australia; Ludwig Maximilian University, Germany; and University Hospitals Health System, Cleveland. The team collected periosteum-derived stem cells from femoral heads and parts of the thigh bones removed from patients during hip replacement. Stem cells taken from these adults aged 30 to 72 years all performed equally well in terms of stem cells’ most desired property: the ability to differentiate into other cells.

Published in: *Stem Cells Translational Medicine*

## Split Liver as Good as Whole Liver for Transplants

**“When you split the liver, you may have more complications, but they can be fixed and do not affect survival. We can increase the number of liver transplants because we can save two patients with one donor organ.”** — Koji Hashimoto, MD, PhD, Digestive Disease Institute

The liver is an organ that can be split in two and transplanted to regrow in two separate recipients. Until now, it was not entirely certain that patients receiving these

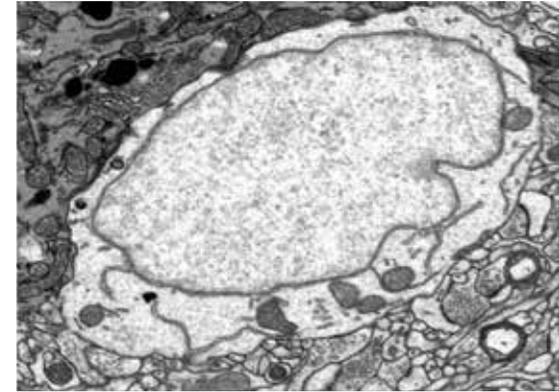
split liver, or hemiliver, transplants did as well as those who received whole liver transplants. Koji Hashimoto, MD, PhD, of the Digestive Disease Institute compared outcomes between 25 split liver transplants (10 left lobes and 15 right lobes) and 121 matched whole liver transplants. He found that, with the exception of some biliary complications, five-year graft survival for the split liver recipients was nearly the same as for the whole liver recipients. This finding could spur greater use of the split liver technique — and increase the number of donor organs available for patients who need them.

Published in: *American Journal of Transplantation*

## New Treatment Blocks TMJ Dysfunction Pain

**“A patient with more than eight years of debilitating TMJ dysfunction pain said she regained her life after the treatment. She is almost pain-free since the block five months ago.”**  
— Jianguo Cheng, MD, PhD, Anesthesiology Institute

The facial pain known as temporomandibular joint (TMJ) dysfunction affects millions of people. Until now, there has been no satisfactory treatment. A multidisciplinary team including Jianguo Cheng, MD, PhD, of the Anesthesiology Institute and Joseph Krajekian, MD, DMD, of the Head & Neck Institute has developed a novel and effective treatment to relieve TMJ dysfunction pain and restore function. It involves blocking the mandibular nerve, a branch of the trigeminal nerve, to relieve pain, relax the masseter muscle and reduce tension to the TMJ. Drs. Cheng and Krajekian have established a TMJ Clinic with targeted referrals to Richard Rosenquist, MD, of the Anesthesiology Institute; Karyn Kahn, DDS, of the Head & Neck Institute; and Judith Scheman, PhD, of the Neurological Institute, in addition to Drs. Cheng and Krajekian.



*Electron micrograph of an activated microglial cell from the pioneering paper from the lab of Bruce Trapp, PhD*

## Microglia Shown to Benefit Injured Brains

**“We could potentially harness the protective role of microglia to improve prognosis for patients with traumatic brain injury and delay the progression of Alzheimer’s disease, multiple sclerosis and stroke.”** — Bruce Trapp, PhD, Lerner Research Institute

Immune cells generally believed to aggravate chronic brain diseases have now been found to have a beneficial effect in traumatic brain injury. The normal immune function of these cells, known as microglia, is to consume cellular debris and dead neurons from nerve tissue. Until now, it was believed that microglia promoted inflammation damaging to healthy brain tissue after a traumatic injury. But a team of researchers led by Bruce Trapp, PhD, of the Lerner Research Institute found that microglia actually help synchronize brain firing, which protects the brain from traumatic brain injury and may help alleviate chronic neurological diseases.

Published in: *Nature Communications*



# CLINICAL AND RESEARCH ACHIEVEMENTS

## New Center Tailors Integrative Medicine to Children

**“Going beyond a child’s physical needs to address lifestyle and emotional needs can reduce the frequency of disease episodes, decrease stress from chronic illness and improve quality of life.”** — Benjamin Katholi, MD, Director, Center for Pediatric Integrative Medicine

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About 12 percent of U.S. children use some form of complementary medicine, according to the National Institutes of Health. To meet this demand, Cleveland Clinic Children's launched a Center for Pediatric Integrative Medicine to complement traditional medical care for patients with a range of difficult-to-manage chronic conditions. The center, located at Cleveland Clinic Children's Hospital for Rehabilitation, is one of only a few focused on using integrative medicine specifically in pediatric patients. It boasts a highly multidisciplinary staff and draws on a wide array of therapies including acupuncture, biofeedback, frequency-specific microcurrent therapy, myofascial release, osteopathic manipulation, hypnosis, yoga and many more. All are intended as a complement to, not a replacement for, traditional medical interventions for challenging chronic conditions ranging from anxiety to chronic pain to concussion and many others.

## Center of Excellence for CDKL5-Related Disease

A small number of infants are born with mutations in a gene called *CDKL5* that lead to early epileptic encephalopathy and severe neurodevelopmental delay. Because *CDKL5*-related disease has been recognized for little more than a decade, many unanswered questions swirl around it. The International Foundation for CDKL5 Research promotes understanding of the disease and development of a standard of care, and in 2014 it designated Cleveland Clinic Children's a CDKL5 Center of Excellence — one of only three institutions in the world to earn the distinction. The foundation cited the long-standing clinical and research initiatives around *CDKL5*-related disease among staff in Cleveland Clinic Children's Multidisciplinary CDKL5 Syndrome Clinic, which is directed by pediatric neurologist Sumit Parikh, MD. Children with *CDKL5*-related disease can see as many as 12 different specialists at the clinic and participate in a collaborative study that's building an international database to advance understanding and management of this serious condition.

## Pediatric Cath Lab Slashes Radiation Exposure

**“The risks of radiation exposure are dose-dependent and cumulative over time, which makes reduction of radiation exposure imperative in pediatric heart patients.”** — Lourdes Prieto, MD, Center for Pediatric and Congenital Heart Disease

Less is more. That was the philosophy behind the opening of a second pediatric catheterization lab in the Center for Pediatric and Congenital Heart Disease in 2014. The new cath lab is equipped with the latest detector technology, the Artis Q.zen angiography system, to reduce electronic noise and thereby allow cardiac imaging at much lower



*The School-Based Health Center is a pediatric office on wheels.*

radiation levels than previously possible. The technology reduces radiation exposure by as much as 50 percent without sacrificing image quality.

## Mobile Office Brings Care to Students

Cleveland Clinic Children's has launched a School-Based Health Center (SBHC) to serve students from kindergarten through 12th grade. The mobile, full-service pediatric office on wheels makes regular visits to participating schools to offer physical exams, diagnosis and treatment of acute conditions, reproductive healthcare, screening, first aid, immunizations and more. The SBHC is staffed by a pediatrician and an advanced practice nurse who work with a student's existing healthcare provider if the child has one — or who may become the child's provider if necessary. Students can visit Cleveland Clinic Children's facilities for needed care when schools are closed. The SBHC is an initiative of Cleveland Clinic Children's Physician-in-Chief, Giovanni Piedimonte, MD, and Community Pediatrics Chair Deborah Lonzer, MD. Genevive Falconi, MD, is Medical Director of the SBHC, which premiered in the Maple Heights School District in 2014 and will be rolled out to more Northeast Ohio districts in 2015.

### Taking the Lead with an Advancement for Early-Onset Scoliosis

**“This new device is a game changer in severe early-onset scoliosis because it lets us lengthen the growing rod in the office slowly over time as opposed to operating on the child every six months.”** — Ryan Goodwin, MD, Director, Center for Pediatric Orthopaedics

When scoliosis starts before a child’s skeleton is mature enough to be repaired with spinal fusion surgery — typically ages 10 to 12 — spinal growing rods may be needed to control the spine’s curvature in the meantime. Traditional growing rods are surgically attached to the spine and then lengthened over time to allow the spine to grow while still controlling the curve. Although effective, traditional growing rods require a new surgery every six to 12 months to lengthen the rod to keep up with the child’s growth. A new magnetic spinal growing rod known as MAGEC was approved by the FDA in 2014 to overcome the need for repeat surgeries, and Cleveland Clinic Children’s was among the first centers in the nation to use it. After the initial surgery to place the rod, the surgeon uses an external remote control to noninvasively lengthen the magnetically controlled rod as the child grows, avoiding the suffering and cost of further surgeries. The 5-year-old boy who received the MAGEC rod at Cleveland Clinic Children’s is doing well.

### Rising Robotics Use

Robotic assistance has long been the rage in many areas of adult surgery, but uptake has been much slower in pediatric surgery. Surgeons at Cleveland Clinic Children’s, led by Federico Seifarth, MD, of the Department of

Pediatric General Surgery, are helping change that by expanding applications of robotic surgical techniques to pediatric procedures, especially for delicate operations within small surgical workspaces. In addition to using robotic techniques for the more common Nissen fundoplication procedure, in 2014 Dr. Seifarth and colleagues helped refine robot-assisted techniques for a number of emerging applications, including choledochal cyst excision, congenital diaphragmatic hernia repair, excision of abdominal masses and adrenalectomy.

### Largest-Ever Studies of Autism in Twins and Females

**“These studies suggest, among other findings, that environment may play only a minor role in autism and that autism may be underidentified in females.”** — Thomas Frazier, PhD, Director, Center for Autism

While genetic contributors to autism are increasingly appreciated, environmental contributors appear to remain a factor, although their relative importance is unclear. To better tease out the role of nature vs. nurture, researchers from the Center for Autism, led by Center Director Thomas Frazier, PhD, published the largest study to date of clinically ascertained autism in twins. Their analysis of 568 pairs of identical or fraternal twins found that shared environment was not supported as a causative factor in autism, whereas genetic influences were strong.

Another gap in autism research surrounds the presence or absence of sex differences, as the vast majority of subjects in autism studies have been male. Dr. Frazier’s team addressed this gap with another 2014 paper, the largest and most comprehensive study to date of cognitive and



*Twin pairs like these sisters were included in a historically large study of twins with autism published by the Center for Autism.*

behavioral characteristics of females with autism. They found that females had lower levels of restricted interests but greater irritability and externalizing behavior compared with males, as well as weaker social communication skills, lower overall cognitive ability and poorer daily living skills.

Published in: *Journal of Autism and Developmental Disorders* and *Journal of the American Academy of Child and Adolescent Psychiatry* ■

*When stroke strikes, every second counts. The mobile stroke treatment unit houses equipment such as a portable CT scanner and a broadband video link to allow patients to start undergoing diagnosis and treatment by stroke specialists at the site of symptom onset.*





THE POWER OF

# EVERY SECOND

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## MOBILE STROKE TREATMENT UNIT HITS THE STREETS

Cleveland Clinic has deployed an advanced mobile stroke treatment unit (MSTU) thanks to a generous gift the prior year by the Maltz Family Foundation of the Jewish Federation of Cleveland. The MSTU, which allows immediate treatment of potential stroke patients anywhere, shows the power of one philanthropic gift to save lives and dramatically improve care. In 2014, the foundation made another gift supporting a second MSTU at Cleveland Clinic. Philanthropic gifts are more important than ever as government funding shrinks and the population ages. To meet this need, Cleveland Clinic has launched a historic \$2 billion campaign to keep itself at the forefront of medicine.

## Refining Urologic Surgery with Novel Robotic Approaches

### Robotic Partial Nephrectomy with Intracorporeal Cooling

**“Ours is the first center in the world to use this simple, low-cost and effective means of introducing ice into the patient’s body during surgery. It provides a longer window for surgery and allows patients with more complex renal tumors to benefit from the smaller incisions and shorter recovery times that robotic alternatives make possible.”** — Jihad Kaouk, MD, Glickman Urological & Kidney Institute

Surgeons need to cut off the blood supply to the kidney in order to perform robotic surgery. But the kidney can survive only so long without blood. This can turn more challenging robotic kidney surgeries into a race against

time. A team led by Jihad Kaouk, MD, of the Glickman Urological & Kidney Institute has found a novel way to lengthen operative time by surrounding the kidney with a bag of ice slush. This cools the tissue and extends its viability. The organ’s temperature is monitored intra-operatively to ensure it is being maintained at a proper level. The procedure was successfully performed on 28 selected patients.

Published in: *Urology*

### First Single-Port Surgery with Purpose-Built Robot

A Glickman Urological & Kidney Institute team led by Jihad Kaouk, MD, collaborated with industry to meet the need for a robotic system specifically designed for single-port surgery. Dr. Kaouk led the first surgical team to use the da Vinci Sp Surgical System for any type of single-port surgery, performing 19 operations with it and publishing long-term results after three years. They have concluded the system enables surgeons to perform a variety of major urological procedures safely and effectively through a single, small abdominal incision.

Published in: *European Urology*

### Robotics Revive Perineal Prostate Removal

**“This approach has the potential to become a new standard, especially for cases where the abdominal approach is challenging due to obesity or other factors.”** — Jihad Kaouk, MD, Glickman Urological & Kidney Institute

Although most prostate removal procedures today are performed through incisions in the abdomen, a perineal approach (i.e., through the crotch) used to be more common. Jihad Kaouk, MD, of the Glickman Urological & Kidney Institute is successfully reviving the perineal approach using robotic assistance, and he is the first in the world to describe it. He finds that robotic assistance overcomes the exposure difficulties presented by the perineal approach in conventional surgery while also improving efficacy with less blood loss.

Published in: *Journal of Endourology*

### Robotic Bladder Removal and Urine Diversion

Surgical removal of the bladder to treat cancer is ordinarily performed through an open approach. It is a major procedure with a high risk of complications. Surgeons including Georges-Pascal Haber, MD, PhD; Jihad Kaouk, MD; and Robert Stein, MD, of the Glickman Urological & Kidney Institute have refined a simplified minimally invasive robotic technique for this procedure. Working through a very small incision, they not only are able to remove the bladder but can create a tube to divert urine to a substitute reservoir called a neobladder. They have shown that cancer treatment outcomes using the robotic technique are as good as with the open technique.



Jihad Kaouk, MD, Glickman Urological & Kidney Institute



Blood & Marrow Transplant Program team members in action

### Blood & Marrow Transplant Program: High Volumes and a New Option

**“Haploidentical transplantation significantly broadens the donor pool and gives nearly all patients with blood cancers and life-threatening nonmalignant disorders who can benefit from transplant a chance to receive this treatment.”** — Navneet Majhail, MD, Director, Blood & Marrow Transplant Program, Taussig Cancer Institute

The Blood & Marrow Transplant Program has completed more than 4,000 blood and marrow (or hematopoietic cell) transplants since 1975 — almost 200 in 2014 alone. Most patients have leukemia, lymphoma or multiple myeloma. The program has improved prevention of transplant complications such as infection, rejection and bleeding; adopted safer pretransplant radiation and chemotherapy protocols; and identified new sources of hematopoietic cells.

Now patients who have trouble finding a human leukocyte antigen (HLA)-matched cell donor have a new option. Ideally, transplants are performed using an HLA-matched (genetically matched) sibling or unrelated donor. The Blood & Marrow Transplant Program now offers another option: haploidentical (or “half-matched”) transplantation. The procedure allows a patient to receive donor cells from someone who shares identity for only one HLA haplotype (parents, children or half-matched siblings). Cleveland Clinic began performing haploidentical transplantation in 2014 and is among a few select U.S. centers that offer the procedure routinely.

### Total Artificial Heart Sets Duration Record

**“This accomplishment is a breakthrough and could not have been achieved without a great team effort involving clinicians, researchers, engineers, veterinarians, technicians and animal monitors.”** — Kiyotaka Fukamachi, MD, PhD, Lerner Research Institute

A unique continuous-flow total artificial heart (CFAH) developed at Cleveland Clinic has been implanted in biological models and successfully achieved major milestones: a 30-day test and two 90-day tests of faultless operation. Throughout these chronic tests, the CFAH demonstrated excellent hemodynamic performance without anticoagulation or antiplatelet therapy. The device has a single moving part — a rotor — that floats on a magnetic field as it circulates the blood. The CFAH passively self-balances left and right pump flows and atrial pressures without sensors. The three-month experiment currently holds the world record for the longest operational duration by a total artificial heart with a single moving part.

### Bioprosthetic Valves Hold Up over the Long Haul

**“This study looks at over 12,500 implants going back to the first premarket valves implanted by Dr. Toby Cosgrove, who was a pioneer of this technique.”** — Douglas Johnston, MD, Miller Family Heart & Vascular Institute

A study led by Douglas Johnston, MD, of the Miller Family Heart & Vascular Institute is the largest ever to measure long-term outcomes after biological aortic valve replacement. The study showed these valves have excellent long-term durability, even in young patients. Studies of this kind are made possible by Cleveland Clinic’s enormous volume of valve surgeries and the Cardiovascular Information Registry, supported by a gift from the late Gus P. Karos, which has outcomes data going back to the 1960s.

Published in: *Annals of Thoracic Surgery*

### New Scoring Algorithm for Adrenal Tumors

Hundreds of thousands of CT scans are performed every year. Up to 5 percent of patients being scanned for any condition are found to have asymptomatic tumors on the adrenal glands. When tumors are discovered this way, assessing whether they are benign or malignant can be difficult. Current guidelines use adrenal mass size to stratify risk. For instance, the risk of adrenocortical cancer is 2 percent for adrenal masses less than 4 cm, 6 percent for masses 4 to 6 cm, and 25 percent for masses larger than 6 cm. Eren Berber, MD, of the Endocrinology & Metabolism Institute designed a new scoring algorithm that uses the hormonal activity at the first decision step followed by consolidated risk stratification, based on tumor size and CT density. The resulting score more accurately measures risk and may help many patients avoid unnecessary diagnostic surgery.

Published in: *Surgery*



Andre Machado, MD, PhD

### First Study of Deep Brain Stimulation for Thalamic Pain

**“Chronic pain is not only a somatosensory phenomenon. Affective and cognitive spheres are equally important in the experience of pain and suffering. Our approach aims to alleviate the affective sphere of pain and thus reduce pain-related disability.”** — Andre Machado, MD, PhD, Neurological Institute

Andre Machado, MD, PhD, of the Neurological Institute has completed a first-in-human clinical trial of deep brain stimulation (DBS) for refractory thalamic pain syndrome. The study is also the first controlled trial to assess the effects of DBS on the affective or emotional sphere of pain. Thalamic pain syndrome is a chronic condition usually caused by a stroke. Patients describe their pain as a constant and disabling burning or aching sensation. Dr. Machado targeted a specific area of the brain that is a key node in the networks that process mood and behavior. The study was carried out entirely at Cleveland Clinic with funding from the NIH Director’s New Innovator Award.

Presented at: Biennial Meeting of the American Society for Stereotactic and Functional Neurosurgery

### Protein Found to Be Key Player in Breast Cancer Spread

**“Until very recently, it was thought that Kindlin-3 was present only in blood cells. Our work shows that Kindlin-3 not only is present in breast cancer cells but also contributes to the abnormal behavior of these malignant cells. We now have a new therapeutic target to consider.”** — Edward F. Plow, PhD, Lerner Research Institute

A team led by Edward F. Plow, PhD, Chair of Molecular Cardiology in the Lerner Research Institute, found for the first time that a protein called Kindlin-3 drives breast cancer cells to migrate throughout the body. With his colleagues Khalid Sossey-Alaoui, PhD, and Elzbieta Pluskota, PhD, Dr. Plow showed that high levels of Kindlin-3 were associated with larger tumors that spread more rapidly and formed more new blood vessels than did smaller tumors. This groundbreaking research was selected as *The FASEB Journal*’s May cover article and was nominated by the Faculty of 1000 for being of special significance to the field of breast cancer research.

Published in: *FASEB Journal*

### ‘Intraoperative GPS’ Replaces X-Rays

**“In a conventional endovascular procedure under X-ray guidance, patients and caregivers are exposed to a certain amount of radiation. IOPS reduces the potential for radiation exposure for everyone involved.”** — Karl West, MS, Lerner Research Institute

Endovascular procedures are ordinarily performed in a surgical suite under the visual guidance of X-ray imaging called fluoroscopy. But researchers led by Karl West, MS, of the Lerner Research Institute have developed an

intraoperative positioning system (IOPS) capable of providing patient-specific guidance for endovascular procedures that could reduce X-ray exposure by 80 percent. Like a GPS, which superimposes the position of a car onto a map of the road, IOPS superimposes 3-D images of endovascular devices onto a 4-D mathematical model of the vascular anatomy in real time. The technology has been used in IRB-approved endovascular stent-graft surgery in two patients and will be commercialized by a Cleveland Clinic Innovations spinoff company called Centerline Biomedical.

### Pioneering Placement of DRG Stimulator for Leg Pain

**“We can precisely stimulate the left thigh or right foot if needed. The advantage is the ability to stimulate one or two levels of the spinal column, and one or both sides.”** — Samuel Samuel, MD, Anesthesiology Institute

Samuel Samuel, MD, of the Anesthesiology Institute is the first in the region — and among the first in the world — to implant a dorsal root ganglion (DRG) stimulator for relief of lower extremity pain. The DRG is a nerve bundle in the spine that modulates a number of signals related to chronic pain. The patient who received the DRG stimulator at Cleveland Clinic suffered from chronic pain in the left foot and is currently doing well. The neuromodulation procedure was performed as part of a multicenter clinical trial of DRG stimulation. The technique aims to improve on outcomes usually achieved through spinal stimulation by targeting the primary sensory neurons responsible for chronic pain in the lower extremities.

# CLEVELAND CLINIC INNOVATIONS: MAKING IDEAS REALITY

Executive Director Gary Fingerhut led Cleveland Clinic Innovations through its first year under a new organizational structure, exceeding key goals in all areas. A new commercialization operating model, called INVENT<sup>SM</sup>, was implemented to make it easier for innovators to bring inventions to market, and Innovations completed the year with its second-highest annual revenues since it was founded in 2004.

As the technology development, commercialization and corporate venturing arm of Cleveland Clinic, Innovations is responsible for translating the inventions of Cleveland Clinic caregivers and Global Healthcare Innovations Alliance partners into new products and therapies to improve patient care.

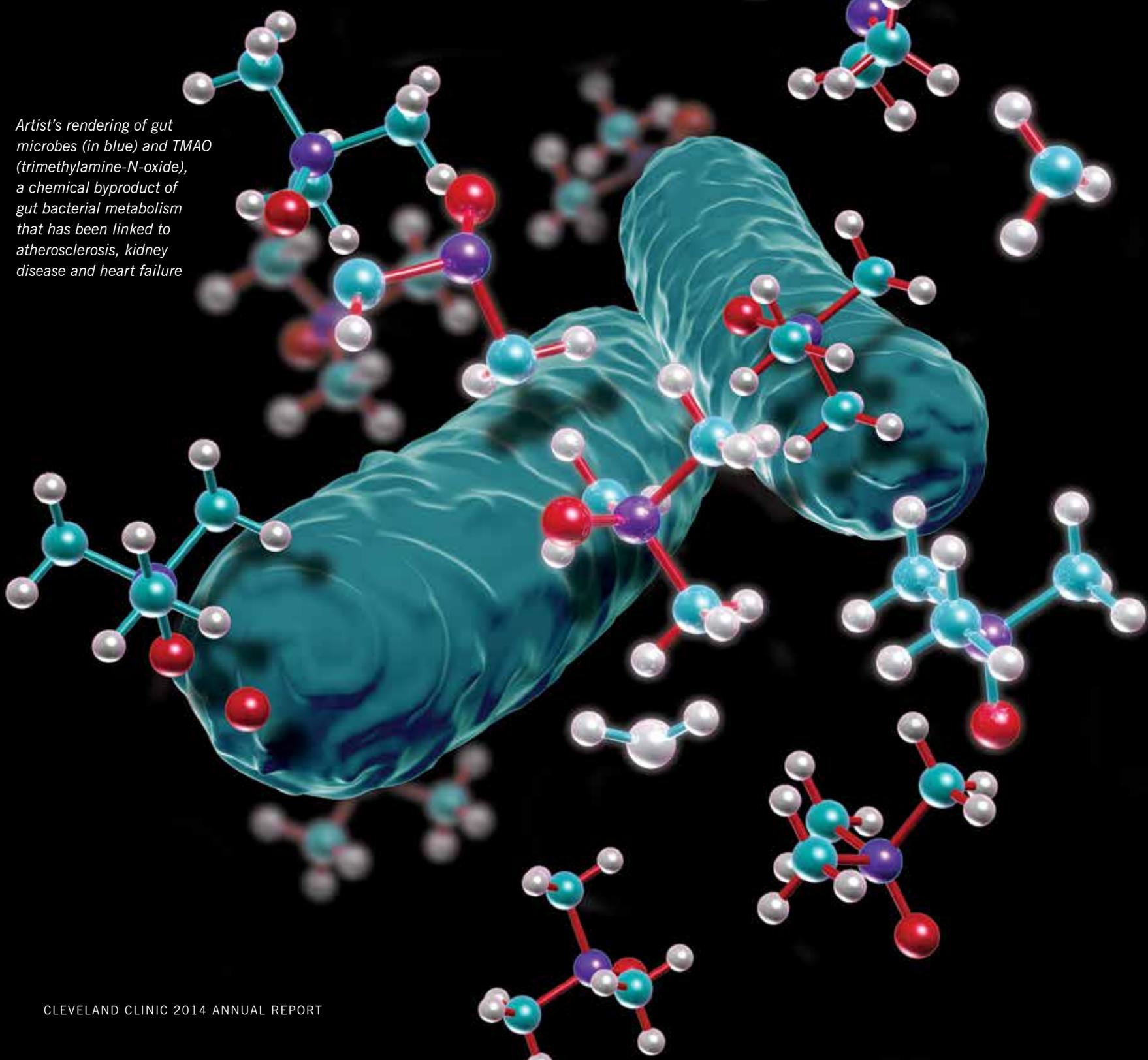
## 2014 Innovations Highlights

- Innovations launched its 71st spinoff company, ADEO<sup>™</sup>, an online marketplace for ready-to-purchase solutions commercialized by Cleveland Clinic and the Global Healthcare Innovations Alliance.
- Innovations was ranked the sixth most influential venturing unit within the global healthcare sector by Global Corporate Venturing, up from 12th in 2013.



- The 12th Annual Medical Innovation Summit, themed “Now, It’s Personal,” was the largest ever, drawing 1,700 attendees from 36 states and 18 countries. Popular new features included Innovation Base Camp, a program to share ideas for promoting innovation in an organization.
- Innovations was awarded approximately \$20 million in state of Ohio grants from Ohio Third Frontier Commission programs, including the Innovation Platform Program, the Technology Validation and Start-Up Fund, and the Ohio BioValidation Fund.
- Cleveland Clinic and Biogen Idec entered into an exclusive joint development agreement providing funds to complete development and clinical validation of a new mobile app, with an option agreement for a new license relating to the technology.
- Innovations spinoff companies closed equity investments totaling \$26.5 million.
- Various spinoff companies were monetized in 2014, including Alios BioPharma (a developer of therapies for viral diseases), which was purchased by Johnson & Johnson for \$1.75 billion, and MAKO Surgical (developer of a robotic arm-assisted interactive orthopaedic surgery system), which was purchased by Stryker for \$1.65 billion.
- Innovations launched INVENT, a proprietary series of processes, services and counseling to take an invention step by step down the road to commercialization. INVENT stands for Idea submission, Need assessment, Viability assessment, Enhancement, Negotiation and Translation. Each of these elements represents a deep range of medical, legal and advisory activities. Through INVENT, inventors have access to feedback from a comprehensive team of experts to foster better innovation and greater inventor satisfaction. ■

*Artist's rendering of gut microbes (in blue) and TMAO (trimethylamine-N-oxide), a chemical byproduct of gut bacterial metabolism that has been linked to atherosclerosis, kidney disease and heart failure*



THE POWER OF

# EVERY INSIGHT

## GUT BACTERIA LINKED TO MORE AND MORE DISEASES

A new chapter has been started in our understanding of cardiovascular disease. Teams from the Lerner Research Institute and Miller Family Heart & Vascular Institute led by Stanley Hazen, MD, PhD, and W.H. Wilson Tang, MD, have discovered a causal link between a chemical byproduct of digestion known as TMAO (trimethylamine-*N*-oxide) and the development of atherosclerosis, heart failure, kidney disease and possibly other ailments. TMAO, they have learned, is produced by gut bacteria digesting substances found in red meat, eggs and some other foods. They have developed a new blood test for TMAO that predicts cardiac risks and are developing new therapies based on their discoveries.

# NURSES EXCEL IN 2014



*A nurse in personal protective gear takes part in a Cleveland Clinic Ebola preparedness drill.*

## Taking the Lead in Ebola Readiness

News of an outbreak of the deadly infectious disease Ebola in Africa put caregivers worldwide on alert in 2014. The Stanley Shalom Zielony Institute for Nursing Excellence led timely efforts to ensure that Cleveland Clinic caregivers were prepared to address any potential cases:

- An Ebola response team was formed and drilled in Ebola response protocols.
- An enterprisewide Ebola website was launched with details on how to protect against, detect and respond to potential cases of the disease.
- A comprehensive isolation unit was built with street entry.

The object of these and many other efforts was to provide effective, compassionate care for any patients who might have been exposed to the disease, while ensuring that caregivers and the community had the highest level of disease protection. (In January 2015, Cleveland Clinic and other local hospitals formed a regional coalition for Ebola response, with MetroHealth Medical Center designated as Ohio's center for Ebola treatment.)

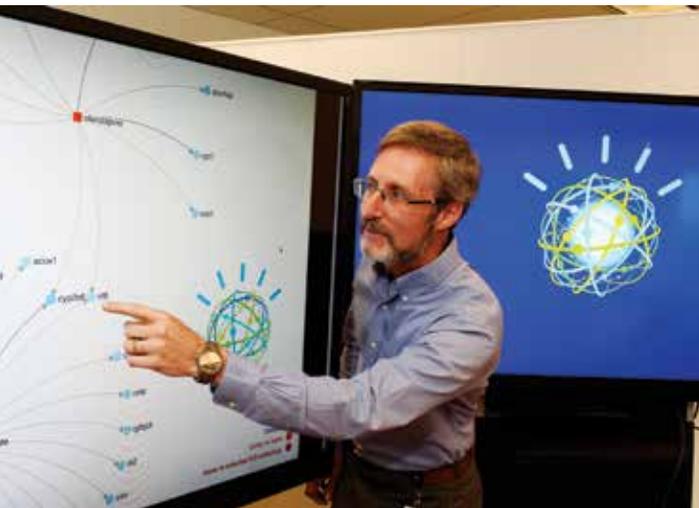
## Quality Payoffs Abound

The Zielony Nursing Institute continued to improve in quality, safety and efficiency in 2014:

- Comprehensive prevention initiatives have continued to result in significant reductions in patient falls and hospital-acquired pressure ulcers.
- Inpatient satisfaction scores are up in every category measured by the Centers for Medicare & Medicaid Services, and they continue to rise.
- Efforts to increase efficiency have cut admission documentation time in half and reduced supply costs by \$3.8 million.
- Hillcrest Hospital achieved Magnet recognition from the American Nurses Credentialing Center (ANCC), joining Cleveland Clinic's main campus and Fairview Hospital in earning this coveted designation.
- Lutheran Hospital and Cleveland Clinic Florida's Weston facility joined four other Cleveland Clinic hospitals as ANCC Pathway to Excellence designees.

## Research Surge Continues

Nursing research has been surging in recent years, with a record 140 studies underway in 2014. Zielony Institute nurses published 93 papers in 2014; 19 of these were research papers, of which 10 had a Cleveland Clinic nurse as first author. ■



An IBM scientist demonstrates the Watson cognitive technology, revealing protein pathways for biological research. (Jon Simon/Feature Photo Service for IBM)

### Plans for an Expanded Collaborative Relationship with IBM's Watson

**“Watson has the potential to enhance our current interpretation of data from genomic and exomic sequencing of patients with cancer. I am hoping to use Watson and therefore teach Watson about finding inherited mutations that predispose people and families to cancers.”** — Charis Eng, MD, PhD, Chair, Genomic Medicine Institute

Cleveland Clinic has been collaborating with IBM's Watson cognitive technology for many years. Now the Genomic Medicine Institute in the Lerner Research Institute is exploring its application to genomic analysis. The goal is to use Watson's cloud-based computing capabilities to personalize cancer treatment by matching

pharmaceuticals to specific genetic mutations. Watson can provide rapid analysis of high-volume data sets to identify potential gene alterations and generate new insights. At the same time, Watson “learns” from each new patient scenario, user interaction and research data set, building its knowledge base and enhancing its usefulness for future endeavors.

### Defining Success for Prostate Cryoablation

**“Cryotherapy can provide outcomes with disease control and morbidity comparable to those from surgery and radiation.”**

— J. Stephen Jones, MD, Glickman Urological & Kidney Institute

Freezing the whole prostate, or cryoablation, is a treatment technique for prostate cancer. J. Stephen Jones, MD, of the Glickman Urological & Kidney Institute and his team, including David Levy, MD, have established the first evidence-based definition of success following this treatment. They found that patients who achieve a prostate-specific antigen nadir below 0.4 will have very favorable outcomes and likely cure, whereas patients in whom this is not achieved are very likely to experience cancer recurrence within three to five years. Early awareness of this fact offers the potential for repeat or salvage treatment, depending on the clinical scenario.

Published in: *Journal of Urology*

### Lung Lavage Triumphs over Rare Condition

A multidisciplinary team led by Basem Abdelmalak, MD, of the Anesthesiology Institute and Daniel Culver, DO, of the Respiratory Institute has used a procedure called bilateral therapeutic whole lung lavage to treat a record

15 patients who have pulmonary alveolar proteinosis. Only a few centers worldwide are capable of using this technique, fewer offer lavage of both lungs on the same day and none have approached the volume performed at Cleveland Clinic. The procedure involves washing both lungs of the abnormally accumulated protein using large volumes of saline, up to 50 liters or more per lung. Appropriate diagnosis and treatment of this rare condition can spare some patients from lung transplant.

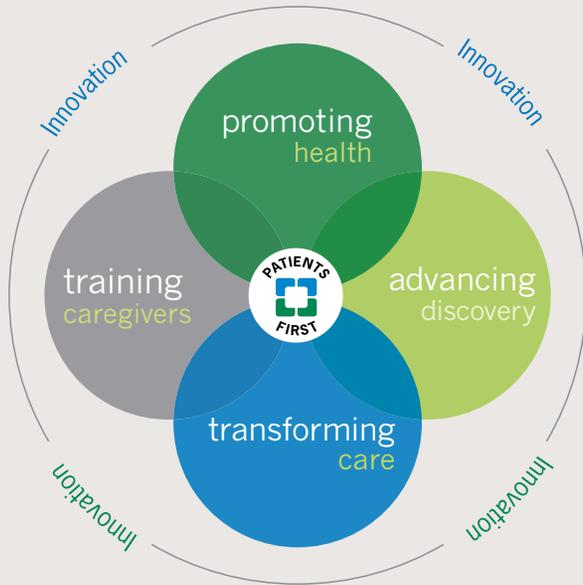
### Leading in Integrative Use of Chinese Herbal Therapy

**“Today's patients are looking for a medical model that addresses prevention and treatment of chronic disease using natural approaches in combination with Western medicine. They want caregivers who address the underlying root cause of disease and look at the whole person — mind, body and spirit.”**

— Melissa Young, MD, Wellness Institute

Cleveland Clinic is the first major medical center in America to offer Chinese herbal therapy among its complementary therapies. The treatment is offered solely by physician referral through the Tanya Edwards, MD, Center for Integrative Medicine in the Wellness Institute. Chinese herbal therapy can be prescribed on its own or in conjunction with acupuncture to treat a variety of conditions, from digestive issues to menopausal symptoms, as well as for preventive purposes. Chinese herbal therapy does not replace conventional therapies, and treatments are overseen by a physician.

# PHILANTHROPY AT WORK: THE POWER OF EVERY GIFT



The Power of Every One campaign supports four strategic areas.

In 2014, Cleveland Clinic launched The Power of Every One, a historic \$2 billion philanthropic campaign that continues until Cleveland Clinic’s 100th anniversary in 2021. The campaign name recognizes the power of each and every gift.

Following are some of these generous gifts made in 2014, which will further the campaign’s priorities of promoting health, advancing discovery, transforming care and training caregivers:

- The Maltz Family Foundation of the Jewish Federation of Cleveland made a \$1 million gift supporting an innovative mobile stroke treatment unit, the second such gift from the foundation. The unit is among the first of its kind in the nation, with every diagnostic modality and all medications needed for various types of stroke (see page 12). “There is no better or faster way to treat stroke,” says Peter Rasmussen, MD, Director of Cleveland Clinic’s Cerebrovascular Center.
- Sondra and Steve Hardis made a \$2.5 million gift to provide additional support for the two chairs they endowed previously, held by Charis Eng, MD, PhD, of the Genomic Medicine Institute in the Lerner Research Institute, and Alok Khorana, MD, of the Taussig Cancer Institute. This generous gift, in addition to the couple’s perpetual support, provides the researchers with immediate access to funds that will allow them to advance knowledge about thyroid cancer, the fastest-rising cancer of the past five years, and to initiate a comprehensive pancreatic cancer clinical research program.
- The Fred A. Lennon Charitable Trust made a \$2 million gift establishing the Lennon Diabetes Center, based at Cleveland Clinic’s Stephanie Tubbs Jones Health Center in East Cleveland. The center’s programs also are available at Cleveland Clinic family health centers in Beachwood, Solon, Twinsburg and Willoughby Hills. The gift also supports the Lennon Endocrinology Fellowship for one fellow entering the second year of training, *Healthy You* books for patients and a financial assistance program to help patients pay for medication and supplies. In addition, the trust made a \$1 million gift to Cleveland Clinic’s Cole Eye Institute.
- Cleveland Clinic Florida received a \$2.5 million gift for its new Maroone Cancer Center on the Weston campus, a joint contribution from AutoNation, America’s largest automotive retailer, and Racing for Cancer, a nonprofit founded by IndyCar champion Ryan Hunter-Reay to promote early cancer detection and prevention initiatives. Both organizations initially provided \$1 million, after which AutoNation pledged an additional \$500,000, or \$1,000 for every lap that Mr. Hunter-Reay completed as winner of the Indianapolis 500 in May.



Power of Every One Centennial Campaign co-chairs Stewart Kohl (left) and Larry Pollock kick off the campaign on June 9, 2014.

- A \$3 million gift by Orascom Construction Industries and Nassef and Sherine Sawiris established the Sir Magdi Yacoub International Fellowship in Pediatric Cardiology. In addition to supporting research and education in Cleveland, the fellowship allows for education and training of pediatric specialists from Egypt, who learn from their Cleveland Clinic counterparts. Mr. Sawiris, a member of the Cleveland Clinic International Leadership Board, previously established a fellowship in hepatology.

### Named Chairs

Philanthropy also created named chairs that help Cleveland Clinic's most accomplished clinicians expand the scope of their research and train fellows, interns, residents and medical students. Through the years, generous benefactors have created 107 named chairs, the most recent of which will advance research into the treatment of brain tumors and amyloid heart disease.

### Special Events

Each year, well-attended events further Cleveland Clinic's mission in Ohio, Florida and Nevada. In 2014, the first annual VeloSano Bike to Cure weekend, held July 19-20 in Cleveland, raised nearly \$2 million for cancer research. It drew 800 riders from 21 states, Canada and Abu Dhabi, as well as 700 volunteers. A \$1 million gift from The Power of Every One Centennial Campaign Co-Chair Stewart A. Kohl and his wife, Donna, established the event, which was supported by nearly 12,000 individuals from all 50 states and 23 countries.



*Ground was broken Sept. 29 for a new cancer outpatient facility on Cleveland Clinic's main campus (artist's rendering above) that will be supported in part by philanthropic gifts made to The Power of Every One Centennial Campaign.*

Signature fundraisers include the Cleveland Clinic Florida Ball; An Evening with Scott Hamilton & Friends, advancing programs of the Scott Hamilton CARES Initiative at the Taussig Cancer Institute; Cleveland Clinic Children's Gala;

and the Power of Love Gala presented by Keep Memory Alive on behalf of Cleveland Clinic's Lou Ruvo Center for Brain Health in Las Vegas. ■

THE POWER OF

# EVERY MIND

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## ENVISIONING A PEERLESS HEALTH EDUCATION CAMPUS

A new structure soon to rise on Cleveland Clinic's main campus will be like no other building on earth. The Cleveland Clinic Health Education Campus will bring the Case Western Reserve University School of Medicine, its Cleveland Clinic Lerner College of Medicine program, the Case Western Reserve School of Dental Medicine, the Frances Payne Bolton School of Nursing, and physician assistant and allied health training programs together at a single — and singular — site. The Health Education Campus is being designed by Foster + Partners with a mandate to create an environment to promote teamwork and prepare the next generation of caregivers for the emerging era of collaborative medicine.





*A large atrium is one of the most prominent architectural features of the new Health Education Campus being designed by Foster + Partners. The atrium will serve as a space where students from all the different training programs can mingle, share ideas and prepare for the new era of collaboration in medicine.*



Douglas Johnston, MD

### Sternal-Sparing Aortic Valve Replacement

**“We have what we believe is the broadest experience in Ohio with these newer sternal-sparing procedures for aortic valve replacement. We hope to parallel what we did with robotics, refining the safety and eventually taking the lead in volumes.”**

— Douglas Johnston, MD, Miller Family Heart & Vascular Institute

Cardiothoracic surgeons in the Miller Family Heart & Vascular Institute have begun a program of sternal-sparing aortic valve replacement that gives patients the benefits of a lifesaving operation with faster recovery and less pain. Traditional minimally invasive aortic valve repairs and replacements through the upper part of the sternum are routine at Cleveland Clinic, where surgeons have performed more of these techniques than at any other institution worldwide. The newer sternal-sparing surgery is performed through a tiny incision between the ribs, leaving the tissue in the center of the rib cage intact. More than 40 sternal-sparing aortic valve replacements have been performed, with zero mortality.

### Laser Retrieval of IVC Filter

Gordon McLennan, MD, of the Imaging Institute has performed Cleveland Clinic's first laser-assisted removal of an inferior vena cava (IVC) filter. An IVC filter is a metal device that is fitted into the large blood vessel below the heart to screen out dangerous blood clots before they can reach the lungs. IVC filters can be placed permanently or can be intended for removal once the danger of a clot has passed. If an IVC filter is left in the blood vessel too long, tissue can grow around it, making removal more difficult. In some cases, such as this one, permanent filters can push beyond the wall of the vein and cause pain from the metal touching the spine or organs. Dr. McLennan used a device known as



3-D volume-rendered image showing an IVC filter

an excimer laser sheath, which is ordinarily used to extract defective pacemaker leads. The excimer laser sheath can make a clean circumferential cut through dense fibrotic tissue. In this first Cleveland Clinic case, Dr. McLennan removed an IVC filter that had been in the patient's body for 20 years, making it one of the longest-implanted IVC filters ever removed by any method.

### Medical Physics Goes Online — and Systemwide

The Imaging Institute's Section of Medical Physics ensures quality and safety in the use of radiation and related issues. With one of the largest medical physics staffs in the country, it conducts exceptionally thorough testing of imaging equipment. In 2014, under the direction of Kevin Wunderle, MS, and Ryan Fisher, PhD, the section transitioned to an online system for tracking patient radiation exposure from fluoroscopic procedures within the Imaging Institute across all Cleveland Clinic locations. The system can now improve caregivers' awareness of potential skin effects based on a patient's radiation history at any other Cleveland Clinic facility. The new system enhances post-procedure patient instruction and streamlines compliance documentation.

# ARTS & MEDICINE INSTITUTE: AWAKENING A HOSPITAL'S SOUL

The Arts & Medicine Institute (AMI) integrates music therapy, art therapy, visual arts, performing arts, research and education into Cleveland Clinic's healing mission for patients, families and visitors. In 2014, AMI managed an expanding range of artworks and activities, including therapy and performance. It also published pioneering research and continued to reach out to communities locally and abroad.

## Spreading 'Concepts of Love and Care'

Iva Fattorini, MD, Chair of Cleveland Clinic Global Arts & Medicine Institute in Abu Dhabi, shared the institute's vision at the Aspen Ideas Festival and at international symposia in India, Istanbul and elsewhere. Both Dr. Fattorini and AMI Executive Director Maria Jukic, JD, addressed a quarterly meeting of the National Endowment for the Arts Interagency Task Force on the Arts and Human Development in Washington, D.C.

"The concepts of love and care don't come from business plans; they come from the heart, and they can awaken a hospital's soul," Dr. Fattorini told an audience in Abu Dhabi. "Many studies conducted around integration of



*Ballet students perform "The Nutcracker" in the SydeII and Arnold Miller Family Pavilion on Cleveland Clinic's main campus in December.*

arts and medicine have demonstrated improvements in health outcomes, quality of life and hospital patients' experience."

## Therapy, Performance, Education and More

In 2014, AMI offered increased hours of art therapy and almost 250 hours of music therapy per week. Musical performances were offered in a variety of settings every weekday of the year and selected weekends. Gifts and acquisitions have brought Cleveland Clinic's art collection up to more than 5,800 pieces. AMI personnel and volunteers gave 360 tours of the collection to individuals and groups from all walks of life.

AMI launched a musicians-in-residence program to train musicians to work in hospital settings and introduced music therapy to outpatients in the Taussig Cancer Center

as well as art therapy at Cleveland Clinic Florida. It also offered a course through Cleveland Clinic Learning Academy explaining art and music therapy.

## Research on Art and Patient Stress

Two caregivers in AMI's Art Program — Jennifer Finkel, PhD, and Bellamy Printz, MFA — worked with Meghana Karnik, MAA, to publish a groundbreaking survey of visitors and patients in *HERD: Health Environments Research & Design Journal*. Their paper, based on a survey of more than 1,000 inpatients, reported that over 80 percent of those surveyed were aware of Cleveland Clinic's artworks and that 61 percent overall indicated their stress levels improved because of the artwork. The rate of reported stress reduction was much higher among patients with breast cancer, generalized anxiety and other serious anxiety disorders. ■

# CLEVELAND CLINIC FLORIDA: DEVELOPMENT AND DISTINCTION

Cleveland Clinic Florida earned high rankings for the fifth year in a row in *U.S. News & World Report's* "Best Hospitals" survey. It was the highest-ranked hospital in Broward County and one of the top three among 68 hospitals in the Miami-Fort Lauderdale region. These distinctions were welcomed by Wael Barsoum, MD, of the Orthopaedic & Rheumatologic Institute, who was named Interim President of Cleveland Clinic Florida in April 2014.

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## Burgeoning Transplant Offerings

The facility's growing transplant program expanded further in 2014, receiving approval from the United Network for Organ Sharing to begin offering heart transplant services. Three heart transplants were performed in 2014. Cleveland Clinic Florida actively began its adult liver and kidney transplant programs the previous year and had performed more than 40 liver and kidney transplants through the end of 2014.

## Leadership in Digestive Diseases

Digestive Disease Institute surgeons at Cleveland Clinic Florida are among the few in the state to do endoscopic submucosal dissections and to regularly perform wide endoscopic mucosal resections. The Department of Gastroenterology has one of the most active small



Photo by John Stillman

bowel endoscopy programs in the country, with notable clinical research. It was the first to publish experience with a new extreme tip angulation colonoscope; has developed and published a new endoscopic pancreas function test for evaluating patients with chronic abdominal pain and possible chronic pancreatitis; is using radiofrequency ablation to treat small bowel angioectasia; and is the only program in South Florida performing flexible endoscopic Zenker's diverticulotomy.

## Readying a New Advanced Neurological Center

The Egil and Pauline Braathen Center (shown in photo above) opened in early 2015 on Cleveland Clinic Florida's Weston campus. It is the new home of the Pauline

Braathen Neurological Center and the Maroone Cancer Center. The Neurological Center features more than 15 integrated service lines as well as leading-edge interventional facilities and services. A comprehensive brain health program will be offered, along with new electroneurodiagnostic capabilities. The center also will offer the full slate of treatments for stroke, neuromuscular disease, multiple sclerosis, headaches, movement disorders, epilepsy and dementias.

Cleveland Clinic Florida's stroke services earned the facility designation as a State of Florida Comprehensive Stroke Center in 2014. ■

## Cancer-Related Gene Leads to Autism

**“Patients with autism with poor processing speed, working memory deficits and white matter abnormalities should be referred to a genetic counselor to determine if a *PTEN* mutation is present.”** — Charis Eng, MD, PhD, Chair, Genomic Medicine Institute

There is a strong genetic component to the development of autism, but no one has been able to pinpoint the exact genetic causes. Now Charis Eng, MD, PhD, Chair of the Genomic Medicine Institute, and Thomas Frazier, PhD, Director of the Center for Autism, have shown how a defect in a cancer-related gene (*PTEN*) can affect the brains of patients with autism. They discovered that patients with autism who also had mutations in the *PTEN* gene had severe abnormalities in their brains’ white matter, indicating problems with brain connectivity. These patients also had poorer processing speed and working memory compared with other patients with autism. The study opens the door to a more personalized approach to autism treatment.

Published in: *Molecular Psychiatry*

## Color Doppler Ultrasonography Confirms Location of Epidural Catheter

Literature reports indicate that epidural anesthesia and analgesia for pain relief may fail 13 to 32 percent of the time due to catheter misplacement or dislodgement. Yet there has been no practical bedside imaging tool to confirm proper catheter placement — until now. Hesham Elsharkawy, MD, of the Anesthesiology Institute has developed an ultrasound imaging technique to help confirm the position of an epidural catheter after placement. A flow of saline solution through the epidural catheter allows for visualization of the catheter by Doppler and M-mode

ultrasonography. This technique can provide timely assessment of the epidural catheter position — and may help avoid the need to reinsert the catheter.

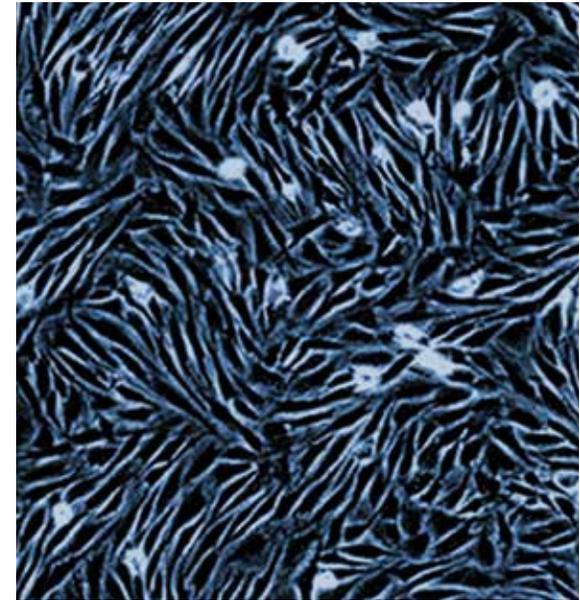
## Team Freezes Ovarian Tissue to Preserve Fertility

Cancer treatment is improving. Patients are living longer. But the treatments that lengthen life may also damage reproductive tissues. Young women who may be able to survive cancer but lose their fertility as the result of treatments now have a new option — cryopreservation. Tommaso Falcone, MD, Chair of the Ob/Gyn & Women’s Health Institute, together with colleagues Rebecca Flyckt, MD, and Nina Desai, PhD, has created a registry to freeze ovarian tissue for children and young women facing cancer treatments that put their fertility at risk. The technique involves removing a portion of one ovary, freezing it and transplanting it back into the body after cancer. This requires a degree of coordination between surgeons and lab personnel that most centers cannot provide. Cleveland Clinic began offering this vital service to patients in 2014.

## First U.S. Trial of Stem Cells for Multiple Sclerosis

**“Cell-based therapies are likely to be a big part of future medical practice. The particular cells we studied are the initial endeavor, but a number of more advanced cell therapies are being developed. There’s a good chance this is how we will treat a lot of diseases in the future.”** — Jeffrey Cohen, MD, Neurological Institute

Mesenchymal stem cells are found in bone marrow and have properties that inhibit immune activity while boosting tissue repair. These abilities may be able to reduce the symptoms and neural damage caused by multiple sclerosis (MS). Studies of these stem cells showed they could



*Mesenchymal stem cells in culture*

migrate from the blood to areas of inflammation and injury in the nervous system, develop into cells resembling nerve cells and create a tissue environment conducive to repair. Jeffrey Cohen, MD, of the Neurological Institute led a group of investigators from Cleveland Clinic, Case Western Reserve University, University Hospitals Health System and McGill University to complete a phase 1 study confirming the feasibility and safety of transplanting autologous, culture-expanded mesenchymal stem cells in patients with MS. It was the first formal trial of a repair-promoting cell-based therapy for MS in North America.

Presented at: Joint Meeting of the Americas and European Committees for Treatment and Research in Multiple Sclerosis

*Functional MRI activation maps during intracranial stimulation in a patient with epilepsy managed using the new method of studying brain connectivity*

THE POWER OF

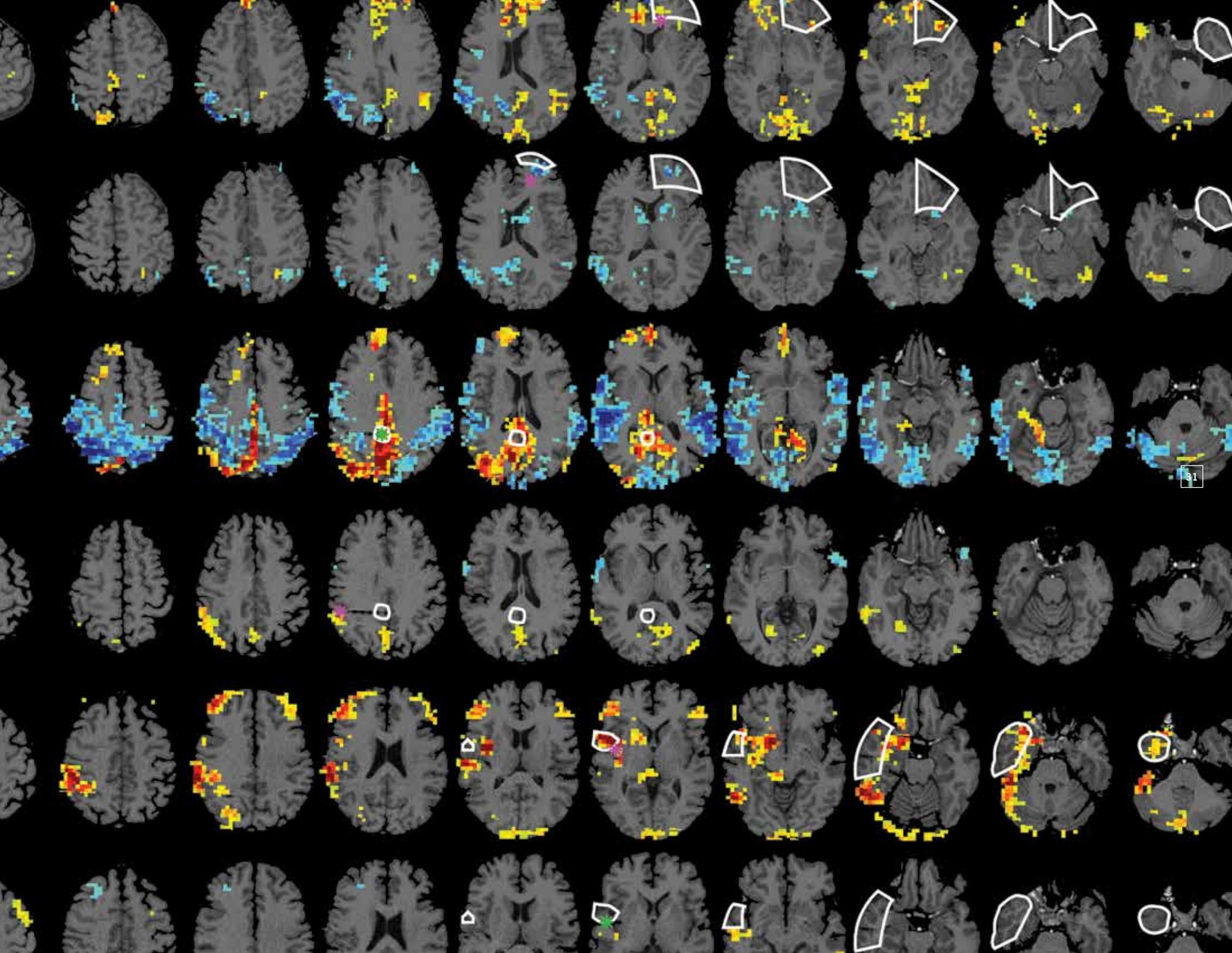
# EVERY DIMENSION

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## COMBINING BRAIN STIMULATION WITH fMRI TO PINPOINT SEIZURE SOURCES

A team from the Neurological Institute has developed a new way of visualizing brain connectivity that could make it easier to identify epileptic areas of the brain before surgery. Neuroradiologist Stephen E. Jones, MD, PhD, and neurosurgeon Jorge Gonzalez-Martinez, MD, PhD, combined direct intracranial electrical stimulation of the brain with simultaneous functional MRI (fMRI) to assess blood-oxygen-level–dependent response in brain areas suspected of being epileptic zones. The result was the ability to see — in real time and in four dimensions — how the entire brain reacted to the stimulation. They then compared the response to evoked electrical recordings from other intracranial electrodes. In four of the five patients tested, successful surgical outcome was consistent with the resection of brain regions that had high local fMRI activity.





### Alternative to Epidural for Post-Abdominal Surgery Pain

Patients undergoing major abdominal or colorectal surgeries traditionally receive an epidural to relieve postsurgical pain. The epidural comes with potential complications such as hypotension, fluid overload and possible bowel edema that may delay gastrointestinal motility. A specialized team in acute pain management from the Anesthesiology Institute has become the first to achieve success with a pain relief alternative — continuous bilateral quadratus lumborum blocks. This method delivers anesthetic medication to the area around the quadratus lumborum muscle in the lower back, from which it spreads to numb the nerves responsible for pain sensation at the area of surgery. The team — led by Loran Mounir Soliman, MD, and including Wael Ali Sakr Esa, MD, PhD; Hesham Elsharkawy, MD; Ehab Farag, MD; and Kamal Maheshwari, MD — is the first to report successful use of bilateral continuous quadratus lumborum indwelling catheters under ultrasound guidance. The technically challenging procedure allows pain control for a few days after these painful surgeries without the risks and side effects of epidural analgesia. The team has used the technique in 14 cases so far, with what it describes as excellent pain relief. The results have been submitted for publication.

### Charting Success in Lead Extraction

**“Quality is related to volume. The best outcomes require a multidisciplinary team that performs lead extractions consistently and often.”** — Bruce Wilkoff, MD, Miller Family Heart & Vascular Institute

As more and more patients are implanted with cardiac rhythm devices like pacemakers, there is a growing need to replace the leads of these devices, which are prone to infection and other complications. Cleveland Clinic has developed unsurpassed expertise in complex lead extraction procedures, as demonstrated in a study led by Bruce Wilkoff, MD, of the Miller Family Heart & Vascular Institute. The analysis of 5,521 lead extractions at Cleveland Clinic reported 95.1 percent complete procedural success and 98.9 percent clinical success, with low rates of complications and mortality — all in a complex patient population with multiple comorbidities.

Published in: *Heart Rhythm*

### Hybrid PET/MRI Clinical Program Launches

**“PET/MRI provides a comprehensive snapshot of a patient’s disease status before and after therapy, with enhanced safety, reduced cost and greater patient convenience. Integration of this novel modality into our imaging repertoire has been seamless and is expected to grow, thanks to the efforts of the PET/MRI team.”** — Shetal Shah, MD, Director of the PET Center, and Gregory Borkowski, MD, Chairman, Imaging Institute

PET/MRI is a new imaging technique now being offered by the Imaging Institute. It combines the contrast, detail and functionality of MRI with the biologic information offered by PET radiotracers. Under the direction of Shetal Shah, MD, Cleveland Clinic completed 185 PET/MRI scans in

2014, making it the national leader. The PET/MRI team includes diagnostic radiologists, nuclear medicine physicians, technologists, nurses and administrators. PET/MRI has many advantages over conventional imaging, including the ability to use two advanced imaging modalities simultaneously with lower cumulative radiation exposure; more accurate information for cancer staging, presurgical and radiation therapy planning, and post-treatment assessment; and safer post-anesthesia imaging evaluation of pediatric patients. In 2015, additional focused service lines will be introduced for oncology, cardiology and neurology patients.

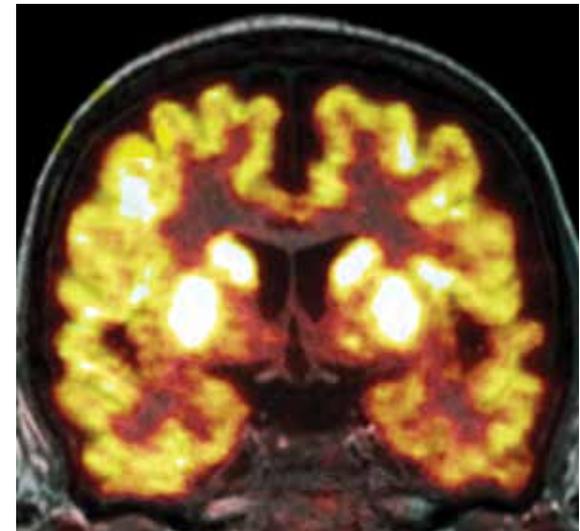


Image from the first pediatric PET/MRI brain examination conducted at Cleveland Clinic



Pablo Recinos, MD (left), and Raj Sindwani, MD

### Removing Skull Base Tumors Through the Nose

**“This endoscopic approach is a cutting-edge method of performing skull base surgery that affords significant advantages for the patient, including quicker recovery, less postoperative pain and no facial scars.”** — Raj Sindwani, MD, Head & Neck Institute

Tumors at the base of the skull have traditionally been removed by taking out a piece of the skull and exposing brain tissue. Cleveland Clinic neurosurgeons and head and neck surgeons are now collaborating on procedures that remove skull base tumors through the nose, without the need for craniotomy. Few other centers offer this two-surgeon, four-handed approach. The Minimally Invasive Cranial Base and Pituitary Surgery Program is co-directed by Raj Sindwani, MD, of the Head & Neck Institute and Pablo Recinos, MD, of the Neurological Institute. During the procedure, Dr. Sindwani navigates the instruments to the site of the tumor, and Dr. Recinos operates on the brain. Both are present throughout the entire procedure, which can last 10 hours. The patient wears a neuronavigation headband that allows the surgeons to see inside the skull during surgery.

### Robotic Surgery Without Opioids

**“This major advance speeds recovery without increasing pain. It is of social significance at a time when we are trying to reduce use of and dependence on prescription painkillers.”** — Georges-Pascal Haber, MD, PhD, Glickman Urological & Kidney Institute

A team including Georges-Pascal Haber, MD, PhD, of the Glickman Urological & Kidney Institute is the first to perform robotically assisted prostatectomies and cystectomies without the use of narcotics during or after surgery. The team successfully managed pain using lidocaine infiltration during surgery and NSAIDs after surgery. Having had no opioid painkillers, the patients recovered more quickly from anesthesia, requiring shorter stays in post-anesthesia care and shorter overall length of stay. The prostatectomy patients are discharged within 24 hours, making these prostatectomies outpatient procedures.

### Developmental Endoscopy Group Offers POEM, ESD

**“Developmental endoscopy — basically performing surgery through an endoscope — is being done at only a handful of U.S. institutions, and others are not doing it in the collaborative way made possible by Cleveland Clinic’s unique institutes model.”** — Matthew Kroh, MD, Digestive Disease Institute

At most medical centers, endoscopy (use of tubelike instruments to peer into the body) and laparoscopy (performance of surgical procedures through tiny incisions) are done by separate groups. But specialists in the Digestive Disease Institute have established a Developmental Endoscopy Group that combines these techniques to perform complex esophageal surgeries. Under Surgical Director Matthew Kroh, MD, and Medical Director Mansour Parsi, MD, the

group brings together gastroenterologists, general surgeons and colorectal surgeons to offer an unusual minimally invasive technique developed in Japan called peroral endoscopic myotomy (POEM) to treat achalasia, a constriction of the esophagus. The group also performs another Japanese technique, endoscopic submucosal dissection (ESD), which allows minimally invasive removal of early esophageal, gastric and colorectal cancers through an endoscope. The Developmental Endoscopy Group is also engaged in teaching these techniques, performing medical and surgical research, and working to develop new devices under a grant from Cleveland Clinic Innovations.

### New VEGF Variant May Be Cancer Inhibitor

**“It is remarkable that a small change in a protein sequence leads not just to a protein with a different function but to one with a function completely opposite to the original. In the context of cancer, the small extension changes a very ‘bad’ protein into a very ‘good’ one.”** — Paul L. Fox, PhD, Lerner Research Institute

A team led by Paul L. Fox, PhD, of the Lerner Research Institute has discovered a protein that inhibits the growth of cancerous tumors and slows development of new blood vessels that help cancers spread. The protein is a variant of vascular endothelial growth factor A (VEGF-A), a substance known to actually promote cancer growth. The researchers named the variant VEGF-Ax. The protein cuts off the blood supply to tumors and inhibits tumor development in animal models. It could have major implications for the use of existing anti-VEGF therapies and the development of new drugs.

Published in: *Ce//*

# UPDATES FROM ABU DHABI

## Cleveland Clinic Abu Dhabi: Final Preparations for 2015 Opening

Caregivers at Cleveland Clinic Abu Dhabi began seeing patients in the first few months of 2015. The new medical campus is located on Al Maryah Island in Abu Dhabi's financial district. Developed as a partnership between Cleveland Clinic and Mubadala Development Co., the investment and development company owned by the Abu Dhabi government, Cleveland Clinic Abu Dhabi will be one of the most specialized medical centers in the Middle East.

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"This is the first time a U.S. healthcare system has been replicated outside North America, including people, processes and technology," says Cleveland Clinic Abu Dhabi CEO Marc Harrison, MD. "We've learned a great deal about driving efficiencies, improving consistency and replicating culture in the process."

In addition to housing hundreds of beds and vast clinical space (see "By the Numbers" box, next page), Cleveland Clinic Abu Dhabi includes a conference center and a high-fidelity multidisciplinary simulation center for training. It will be among the world's most digital hospitals, sharing electronic medical records and seamless communication with Cleveland Clinic's other facilities half a world away. And it is one of only a few facilities in the region to achieve LEED Gold certification for sustainable construction, design and maintenance.

To staff the new facility, Dr. Harrison and Tomislav Mihaljevic, MD, Chief of Staff and Chief of the Heart & Vascular Institute at Cleveland Clinic Abu Dhabi, led the largest international physician recruitment effort ever undertaken (see "By the Numbers"). Patient care will be delivered through 12 institutes, including five Centers of Excellence:

- Heart & Vascular
- Neurological
- Digestive Disease
- Eye
- Respiratory & Critical Care

"We are already helping to change the face of healthcare across the region," says Dr. Harrison.

## Sheikh Khalifa Medical City Continues Modeling Care for the Region

Since 2007, Cleveland Clinic has managed Sheikh Khalifa Medical City (SKMC), Abu Dhabi's largest hospital and part of the Abu Dhabi Health Services Company (SEHA). "Our leadership team has established a solid foundation to advance the goals of the facility, elevating healthcare in the region to new levels," says Ben Frank, CEO of SKMC. "We are the flagship hospital in the SEHA system and are comparable to the best healthcare centers in the world."

SKMC continues to add services and improve quality and outcomes. Here are a few SKMC highlights from 2014:

- The cardiac arrhythmia team implanted its 1,000th cardiac pacing/defibrillator device.



*The 300-meter-long Gallery at Cleveland Clinic Abu Dhabi*

- SKMC was designated an American College of Cardiology International Center of Excellence.
- SKMC nurses won Press Ganey's NDNQI Award for Outstanding Nursing Quality.
- The Joint Commission International reaccredited SKMC for the third time, affirming its commitment to quality and safety.
- SKMC also received ISO 20000 Certification for best practices in IT service management. ■



## CLEVELAND CLINIC ABU DHABI BY THE NUMBERS

**4.4M** Square feet of building floor area

**13** Floors of critical and acute care inpatient units

**364** Beds (expandable to 490)

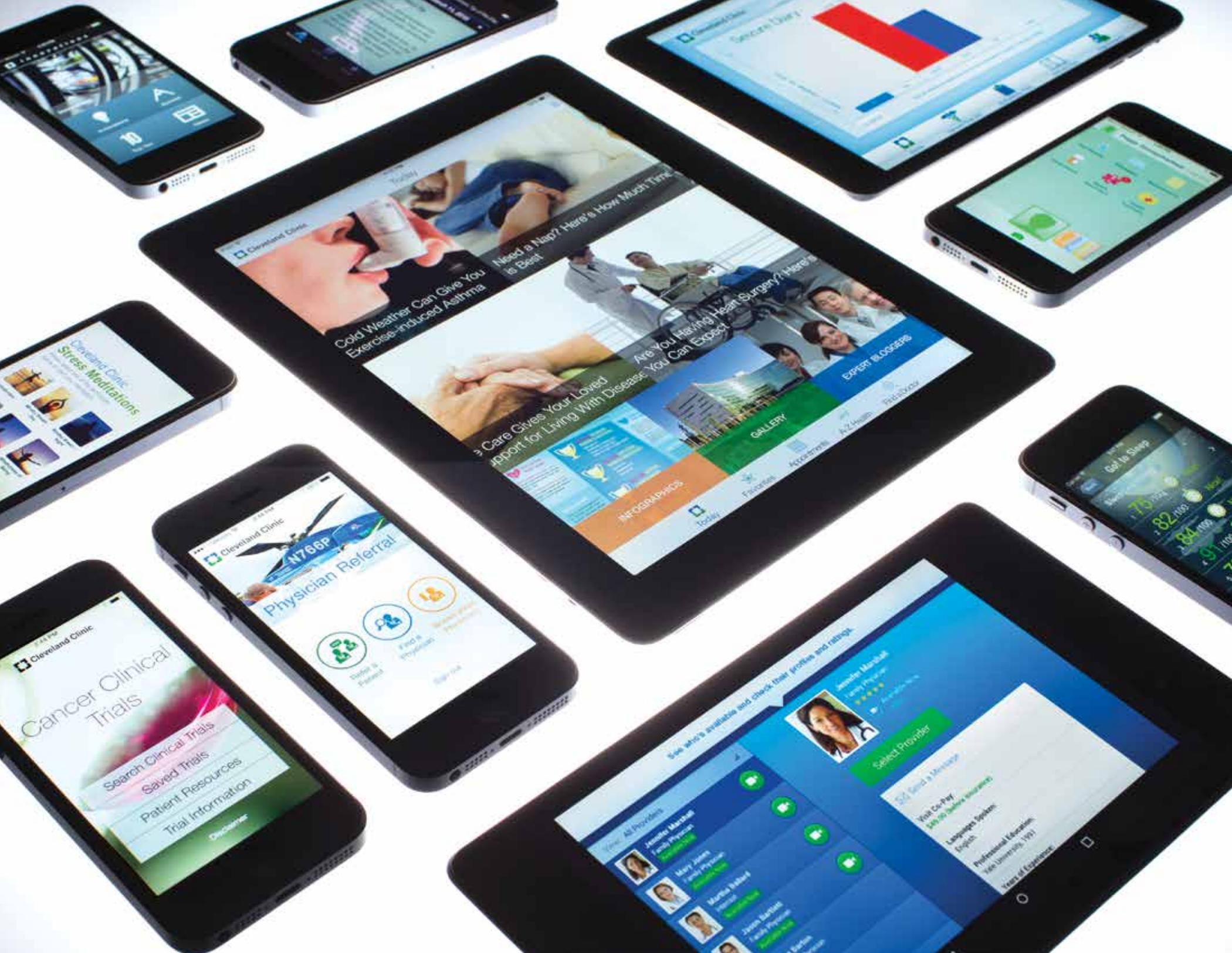
**3,000** Caregivers overall (by end of 2015)

**175** Physicians hired for medical staff

**> 9,000** Physicians who applied for the 175 medical staff positions

**40** Interviews each staff physician completed before being hired

**33** Percentage of hired physicians with prior Cleveland Clinic experience



Cleveland Clinic

### Cold Weather Can Give You Exercise-Induced Asthma

Need a Nap? Here's How Much Time is Best

### Care Gives Your Loved Support for Living With Disease

### Are You Having Heart Surgery? Here's What You Can Expect

EXPERT BLOGS

INFOGRAPHICS

GALLERY

Today

Favorite

Appointments

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### Stress Meditations

Discover new stress management techniques and guided meditations to help you relax and reduce stress.

Cleveland Clinic

### Physician Referral

Request a referral from a Cleveland Clinic physician.

Request a Referral

Find a Physician

Request a Referral

Cleveland Clinic

### Cancer Clinical Trials

Search Clinical Trials

Saved Trials

Patient Resources

Trial Information

See who's available and check their profiles and ratings.

Select Provider

Send a Message

Visit Our Site

Language Services

Professional Education

Years of Experience

All Providers

- Jennifer Marshall, Family Physician
- Mary Jones, Family Physician
- Martha Hubbard, Nurse
- Jane Barton, Family Physician
- Barbara...

Go To Sleep

7:30 PM

82% Humidity

84% Humidity

91% Humidity

Cleveland Clinic

### Search Query

Search results for [query]

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# EVERY USER

## HEALTH APPS ARE HAPPENING

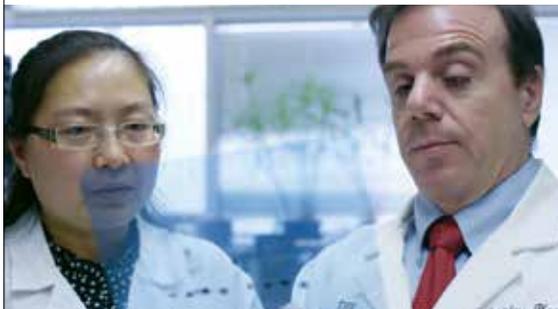
Cleveland Clinic is at the forefront of healthcare services moving onto personal mobile apps. Its flagship Cleveland Clinic Today app delivers wellness content and provides convenient access to personal health information through mobile devices. The MyChart electronic medical record app can be accessed anywhere. The C3 Concussion App makes it possible to diagnose head injuries on the sidelines of sports games. Cleveland Clinic physicians have developed or adopted dozens of apps for education and to help them better diagnose and manage disease through mobile platforms, and many more are in the works. Mobile apps extend the reach of Cleveland Clinic doctors and bring patients and caregivers closer together.

## Pioneering Heart Research from the Hazen Lab

### TMAO Linked to Heart Failure as Well as Atherosclerosis

**“These studies suggest TMAO testing may help identify those patients at greatest risk of developing heart failure and for whom more aggressive monitoring is needed. They also suggest TMAO testing may help tailor dietary efforts to the individual in hopes of reducing future risks among high-risk subjects.”** — Stanley Hazen, MD, PhD, Lerner Research Institute and Miller Family Heart & Vascular Institute

The presence of high levels of the digestive byproduct known as TMAO (trimethylamine-*N*-oxide) has been linked to a higher risk of death from heart failure. High levels of TMAO have already been shown to contribute to cardiovascular events like heart attack and stroke. The association of TMAO with heart failure — a chronic inefficiency in cardiac function — is new and equally significant. The research, which followed 720 heart failure patients over five years, was led by Stanley Hazen, MD, PhD, and W.H. Wilson Tang, MD, of the Lerner Research Institute and the Miller Family Heart & Vascular Institute.



Stanley Hazen, MD, PhD (right), with research associate Ying Huang, PhD

TMAO is produced when intestinal bacteria digest carnitine, a substance found in red meat and some energy drinks, and the compound commonly known as lecithin. The association of TMAO with cardiovascular disease and heart failure provides a new tool for assessing risk for these conditions.

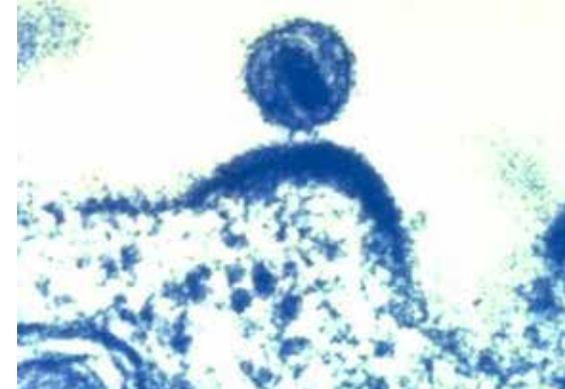
Published in: *Journal of the American College of Cardiology*

### HDL Dysfunctionality Identified

**“Now that we know what this dysfunctional protein looks like, we are developing a clinical test to measure its levels in the bloodstream, which will be a valuable tool for assessing disease risk and pursuing new HDL-targeted therapies.”** — Stanley Hazen, MD, PhD, Lerner Research Institute and Miller Family Heart & Vascular Institute

Known primarily for being cardioprotective, high-density lipoprotein (HDL) in some forms may also contribute to inflammation and atherosclerosis. Studies led by Dr. Hazen focused on the particular protein, apolipoprotein A1 (apoA1), that allows HDL to perform its beneficial function of transporting cholesterol to the liver for disposal. The studies found that when HDL is trapped inside the artery wall, the apoA1 becomes oxidized and contributes to development of dangerous plaque. Dr. Hazen and his team discovered the process and are developing a test to identify dysfunctional HDL.

Published in: *Nature Medicine*



*The human immunodeficiency virus (HIV) as it buds from a human immune cell (image courtesy of the National Institute of Allergy and Infectious Diseases)*

### HIV Prevention Modeling Group Advises WHO

**“It’s vital to understand when and where microbicides might be cost-saving with respect to averting future treatment costs and how microbicides match or come close to the impact and cost-effectiveness of existing HIV prevention methods. This understanding will stimulate an informed discussion among all stakeholders about the new products and guide investments in production, distribution, promotion and marketing.”**

— Ume Abbas, MD, Departments of Infectious Disease and Quantitative Health Sciences

Cleveland Clinic’s HIV prevention modeling group develops mathematical, statistical and computational models of the HIV epidemic and analyzes the potential impact of prevention, treatment and control strategies. The group, a collaboration with the University of Pittsburgh and the Pittsburgh Supercomputing Center, was among only four modeling teams worldwide chosen to advise the World Health Organization on the impact and cost-effectiveness of topical antiretrovirals (microbicides) for HIV prevention in women. Ume Abbas, MD, of the departments of Infectious Disease and Quantitative Health Sciences, leads the group and is principal investigator under an ongoing grant from the Bill & Melinda Gates Foundation (the first Gates Foundation grant to Cleveland Clinic) in support of the group’s modeling work.

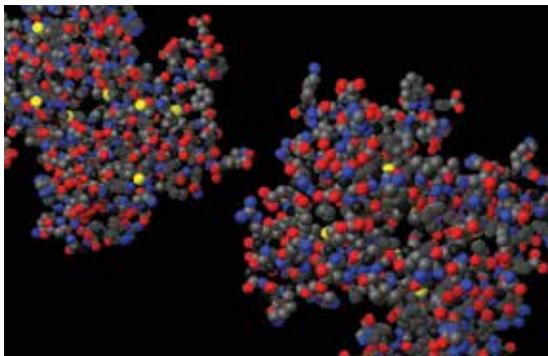
### Autoimmune Response May Lead to Cognitive Decline

**“S100B antibodies have already been described in Alzheimer’s dementia, chronic epilepsy and, more recently, repeated subconcussive episodes in football players — followed by an autoimmune response against the protein. This response may be an initial step in post-traumatic cognitive decline.”**

— Damir Janigro, PhD, Lerner Research Institute

The immune system may play a role in cognitive dysfunction associated with chronic epilepsy, Alzheimer’s disease and concussion. A study led by Damir Janigro, PhD, of the Lerner Research Institute focused on a protein called S100B that is normally found only in the brain but can be released into the blood as a result of blows to the head, seizures or Alzheimer’s disease. Dr. Janigro’s team found that S100B in the bloodstream mobilizes the body’s autoimmune system against the brain. Over the long term, repeated autoimmune assaults against the brain could result in chronic neurologic disease. If confirmed, the study would imply that management of brain injuries should include treatments to decrease autoimmune response.

Published in: *PLOS ONE*



3-D molecular model of the S100B protein

### Regulator Discovered for Obesity-Related Inflammation

Xiaoxia Li, PhD, of the Lerner Research Institute has identified a critical regulator in the pathways that lead to obesity-associated inflammatory diseases. Dr. Li further demonstrated that this regulator, the adapter protein MyD88, is involved in the detrimental effects induced by the accumulation of proatherogenic low-density lipoprotein and induces cells to adopt inflammatory characteristics. She has highlighted the diverse roles MyD88 plays in obesity-related inflammation and suggests that this regulator should be considered a target for new treatments for diabetes and obesity-related heart disease.

Published in: *Journal of Experimental Medicine*

### Bariatric Surgery Provides Enduring Control of Type 2 Diabetes

**“There is no drug or combination of drugs that comes close to what we have shown bariatric surgery can do to treat type 2 diabetes.”** — Philip Schauer, MD, Digestive Disease Institute

A follow-up to the landmark 2011 study showing that bariatric surgery successfully treats type 2 diabetes in obese patients has found that the treatment’s positive effects are still present three years later. Researchers found that nearly all the bariatric surgery patients were free of insulin, and many were free of all diabetic medicines, three years after surgery. The follow-up study also revealed that bariatric surgery patients had improved quality of life and reduced need for medications to control blood pressure and cholesterol. The 2011 study, known as STAMPEDE (Surgical Therapy and Medications Potentially Eradicate Diabetes

Efficiently), is the largest randomized trial with the longest follow-up comparing optimal medical therapy and bariatric surgery (plus optimal medical therapy). Philip Schauer, MD, of the Digestive Disease Institute led the initial study and this follow-up, along with senior author Sangeeta Kashyap, MD, of the Endocrinology & Metabolism Institute. The types of bariatric surgery used in the study were gastric bypass and sleeve gastrectomy.

Published in: *New England Journal of Medicine*

### New Drug Impacts Diabetes Markers but Not Mortality

**“This result shows the difficulties associated with these drugs, which often have complex metabolic outcomes and unpredictable therapeutic profiles. More research is needed to find ways to reduce heart disease in patients with diabetes.”**

— A. Michael Lincoff, MD, Miller Family Heart & Vascular Institute

An experimental drug that was hoped to be capable of reducing cardiovascular death, heart attack and stroke in patients with acute coronary syndrome and type 2 diabetes is not effective after all. So found a multicenter study led by A. Michael Lincoff, MD, of the Miller Family Heart & Vascular Institute. The drug, aleglitazar, had a positive impact on sugar and lipid levels, but this did not reduce cardiovascular events and death — the study’s end points. After enrolling more than 7,200 patients in 26 countries, the study was halted early for safety and efficacy. Aleglitazar is a member of a drug class called peroxisome proliferator-activated receptor agonists, which are being studied for their effect on both cholesterol and insulin sensitivities in diabetic patients.

Published in: *JAMA*

# EDUCATION INSTITUTE HIGHLIGHTS



2014 Cleveland Clinic Lerner College of Medicine graduate Brittaney Wilson-Harris, MD, is congratulated by Cleveland Clinic CEO Toby Cosgrove, MD, at the graduation ceremony for her class.

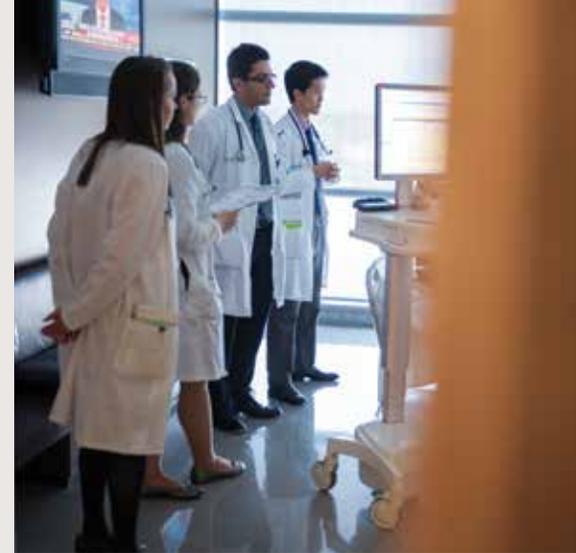
The Education Institute oversees Cleveland Clinic's educational mission, a key component of which is providing unparalleled educational opportunities to a global audience. Among the institute's varied offerings are medical student training, continuing medical education and one of the nation's largest graduate medical education programs.

## Cleveland Clinic Lerner College of Medicine (CCLCM)

CCLCM continues to attract exceptional students. The 2014 entering class had an average GPA of 3.81 and an average MCAT score among the top seven for medical schools nationwide — and equal to the average scores for medical schools at the University of Chicago and Columbia University. Likewise, CCLCM graduates experience enviable match results. In 2014, 50 percent matched to a top 10 *U.S. News & World Report* hospital, nearly half got their top choice for a match and nearly 70 percent matched to one of their top three choices. Nine graduates stayed at Cleveland Clinic to train. Faculty appointments to CCLCM are up to 1,180 from 1,067 in 2013.

## Continuing Medical Education

Physicians and other healthcare professionals around the world are required to keep their knowledge and skills current through participation in continuing medical education (CME) programs. Cleveland Clinic is a leading provider of CME activities in virtually all media and enjoys the highest accreditation level — accreditation with commendation — from the Accreditation Council for Continuing Medical Education. In 2014, the center offered 1,900 CME programs to 334,183 participants from around the world.



Clinical trainees and Lerner College of Medicine students often go on rounds together on Cleveland Clinic's main campus.

## Graduate Medical Education

Cleveland Clinic maintains one of the largest graduate medical education programs in the country. In 2014, 1,377 clinical trainees (residents and fellows) trained at Cleveland Clinic's main campus, Fairview Hospital, South Pointe Hospital and Cleveland Clinic Florida. Research trainees, including those at the Lerner Research Institute and Cleveland Clinic Florida, numbered 380. Cleveland Clinic offers 72 training programs approved by the Accreditation Council for Graduate Medical Education (ACGME) as well as 80 fellowship programs outside of ACGME oversight. More than 12,000 alumni from the graduate medical education program have taken their knowledge home, practicing medicine in some 70 countries around the world.

## Other 2014 Highlights

- The Healthcare Executive Education programs (Samson Global Leadership Academy and Executive Visitors' Program) have welcomed 465 executives from 40 countries, including the U.S., since their launch in 2011.
- The Center for International Medical Education annually welcomes 700 international physicians and medical students to Cleveland Clinic to participate in observerships, some of which are highly competitive.
- The Simulation and Advanced Skills Center held its first CME program, achieving exceptional attendance and filling all exhibitor spaces. The center has been accredited as a Comprehensive Education Institute of the American College of Surgeons until 2017.
- The Center for Medical Art and Photography held a special exhibition to celebrate 100 years of art and photography at Cleveland Clinic. The center traces its roots to an artist and photographer team that worked for the partnership of three Cleveland Clinic founders — George Crile, MD; Frank Bunts, MD; and William Lower, MD — prior to the formation of Cleveland Clinic in 1921.
- Health Sciences Education, which sponsors 16 internal training programs, implemented a medical assisting pilot program with Cuyahoga Community College to improve student clinical outcomes.
- The Centers for Medicare & Medicaid Services upheld a ruling of the Provider Reimbursement Review Board that cleared the way for Cleveland Clinic Florida to receive back funding for graduate medical education.



*The Center for Medical Art and Photography held an exhibition to celebrate 100 years of art and photography at Cleveland Clinic.*

- The Education Institute continued “Leading in Healthcare” as an integrated leadership development program that now includes administrators and nurses along with staff physicians. The current cohort includes 71 professionals. To date, 467 caregivers have participated.
- *Cleveland Clinic Journal of Medicine* launched a mobile phone app and optimized its website for mobile viewing, enhancing mobile access for thousands of users. ■

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# EVERY STEP

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## CARE PATHS ENHANCE VALUE IN TOTAL JOINT REPLACEMENT

Medical costs are rising. So is the demand for costly surgeries like hip and knee replacement. Doctors in the Department of Orthopaedic Surgery within the Orthopaedic & Rheumatologic Institute have launched an initiative to lower costs while maintaining the highest quality of care and outcomes. They have developed care paths to ensure that every patient gets the most effective and efficient care from initial examination to discharge and beyond. Using defined outcome measures, these evidence-based care paths have made joint replacement safer and more reliable. They are lowering costs, improving outcomes and increasing patient satisfaction.





*Total knee replacements, like the one illustrated here, are common and costly. The Total Knee Arthroplasty Care Path is helping to shorten hospital stays, reduce readmission rates and lower costs for patients undergoing these surgeries.*

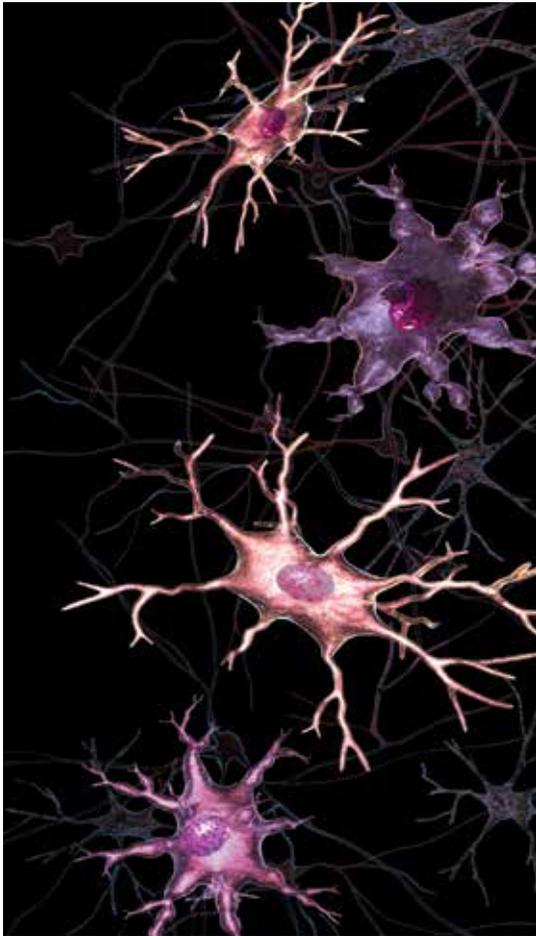


Illustration of brain microglia and neurons. Cleveland Clinic researchers have linked microglia-mediated inflammatory changes in the protein NLGN1 to memory loss.

### Protein Implicated in Memory Loss May Lead to New Alzheimer's Therapies

**“Alzheimer’s is a challenging disease that researchers have been approaching from all angles. This discovery could provide a new strategy for prevention and treatment.”**

— Mohamed Naguib, MD, Anesthesiology Institute

A protein that plays a critical role in memory loss associated with Alzheimer’s disease has been identified by a team led by Mohamed Naguib, MD, of the Anesthesiology Institute. The protein, neuroligin 1 (NLGN1), is known to be involved in memory formation. This is the first time it has been associated with memory loss. Dr. Naguib and his colleagues found that the epigenetic effects of neuroinflammation on NLGN1 disrupt the synaptic network of the brain, causing memory loss. The team previously synthesized a compound called MDA7 that can potentially inhibit the inflammatory process that modifies NLGN1. They are preparing for human studies on the safety of this class of compounds and have received support from the Alzheimer’s Drug Discovery Foundation to start this work.

Published in: *Nature Neuroscience*

### First Drug for Parkinson’s Psychosis Shows Promise in Late-Stage Trials

**“This is the first promising treatment for this major problem. It has been granted breakthrough therapy designation by the FDA.”** — Jeffrey Cummings, MD, ScD, Neurological Institute

More than half of all Parkinson’s disease patients experience hallucinations, delusions or other symptoms of psychosis. A new drug to treat psychosis in patients with Parkinson’s disease has successfully emerged from a phase 3 clinical trial led by Jeffrey Cummings, MD, ScD, Director

of Cleveland Clinic Lou Ruvo Center for Brain Health in the Neurological Institute. The study showed that the drug, pimavanserin, was able to reduce psychosis with few side effects. Pimavanserin, a serotonin receptor inverse agonist, may eventually be tested as a treatment for psychosis in other neurodegenerative diseases.

Published in: *The Lancet*

### MyFamily Genetic Tool Takes Off

**“Providers who are not genetics specialists need to be able to recognize the red flags suggesting heritable disease. MyFamily can help inform the primary care physician if there is indeed a risk of genetic disease — and whether or not patients should go forward with genetic counseling and genetic testing.”**

— Charis Eng, MD, PhD, Chair, Genomic Medicine Institute

Ten percent of all diseases have a strong genetic component. More than 16 million Americans have a genetic disease. Clinicians needed a simple, cost-effective way to identify patients with these diseases. Several years ago, Charis Eng, MD, PhD, Chair of the Genomic Medicine Institute, developed a tool called MyFamily to meet this need. It collects family history and deploys a decision-support platform that generates a customized risk assessment at the point of care. MyFamily is now in use by over 208 primary care physicians at 26 Northeast Ohio locations. Eventually, all Cleveland Clinic primary care physicians will use it. MyFamily has also been integrated into specialty practice, from the Ob/Gyn & Women’s Health Institute to the Miller Family Heart & Vascular Institute, with at least 25 specialists using it at 19 practice locations. Use of MyFamily was six times greater in 2014 than in 2013. MyFamily is now an integral part of preventive care paths for breast and colorectal cancer screening.

## Breath Analysis Breakthroughs

.....  
**“My sense is that breath analysis is the future of medical testing.”** — Raed Dweik, MD, Respiratory Institute  
.....

Under the leadership of Raed Dweik, MD, clinicians and researchers in the Respiratory Institute — in collaboration with investigators in the Lerner Research Institute, Digestive Disease Institute, Miller Family Heart & Vascular Institute and Cleveland Clinic Children’s — have published new findings on the use of exhaled breath analysis as a method to detect and identify a variety of diseases. All these discoveries — which involve diseases of the lung, liver, heart and bowel as well as obesity — promise to enhance patient care by making diagnosis possible earlier, with greater ease and at less expense.

### Breath Analysis in Pulmonary Arterial Hypertension (PAH)

PAH is a progressive and devastating condition characterized by vascular cell proliferation and associated with metabolic derangements. Currently used biomarkers are invasive and do not measure the underlying pathobiology of cell proliferation. On average, PAH diagnosis is not confirmed until two years after symptoms begin. In view of this need for better diagnostic tools, the team took breath and blood samples from patients with and without PAH, and discovered that the “breathprint” is different in those with PAH. Several specific compounds were found to be elevated, and exhaled ammonia levels correlated with disease severity.

Published in: *Chest*

### Breathprints Chart Metabolic Differences Between Lean and Obese Children

Obesity is associated with metabolic complications such as diabetes and fatty liver disease, but the mechanisms linking obesity and metabolic disease are not well-understood. The team studied the exhalations of 115 individuals ages 6 to 18 years, both lean and obese, and discovered that the obese children exhaled a distinctive pattern of volatile organic compounds. Several of these were determined to be potentially useful in understanding childhood obesity and related complications.

Published in: *Pediatric Obesity*

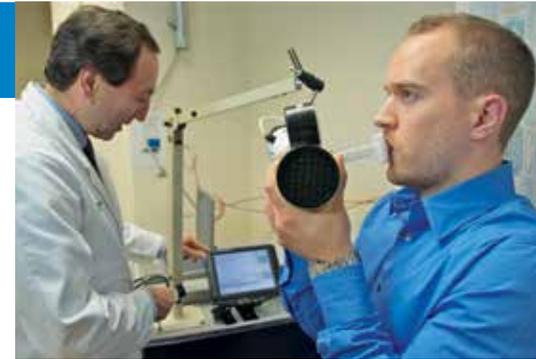
### One Breath May Detect Acute Heart Failure

There is currently no reliable way to identify patients with impending acute decompensated heart failure (ADHF) in time to initiate effective therapeutic interventions. To address this need, the team conducted a study of the volatile organic compounds found in the breath of patients diagnosed with ADHF. By analyzing single breath samples from 25 patients, the researchers found a pattern of volatile organic compounds clearly associated with the disease. These findings promise eventual development of point-of-care monitoring and screening tests.

Published in: *Journal of the American College of Cardiology*

### Breathprints Reveal Biomarkers of Alcoholic Hepatitis

Invasive liver biopsy is the gold standard for assessing hepatic fibrosis and cirrhosis, but it carries the risk of complications. Researchers searching for an alternative



*A patient breathes into a breath analysis device while Raed Dweik, MD, monitors the results.*

analyzed the exhalations of 40 subjects with alcoholic hepatitis with cirrhosis, 40 with cirrhosis not related to alcohol, and 43 controls. They found that volatile compounds in the breath samples made it possible to identify patients in each group — especially those with alcoholic hepatitis, which currently lacks a diagnostic test — and that levels of certain compounds moderately correlated with the severity of the disease.

Published in: *Clinical Gastroenterology and Hepatology*

### Diagnosing Malignant Biliary Strictures

A biliary stricture is a narrowing of the bile duct that may be indicative of various diseases, including cancer. Diagnosis of cancer by imaging and lab tests is challenging. Analyzing 96 breath samples, researchers found they could distinguish patients with malignant biliary strictures from those with benign biliary conditions by measuring certain volatile organic compounds in their exhalations.

Published in: *Gastrointestinal Endoscopy*

## Top Cause of Surprise Postsurgical Death — Heart Attack — Still a Challenge

**“Heart attacks remain the leading cause of unexpected death after routine surgery. Avoiding nitrous oxide does not help, clonidine does not reduce risk and causes hypotension, and aspirin does not reduce risk and can cause serious bleeding. Much additional work is needed to determine how to prevent postoperative heart attacks and how to treat them.”**

— Daniel I. Sessler, MD, Anesthesiology Institute

Three major study reports on patients who die unexpectedly within 30 days of routine surgery have pinpointed the leading cause: heart attack. Daniel I. Sessler, MD, of the Anesthesiology Institute’s Department of Outcomes Research was involved in these studies, which showed that 9 percent of surgical inpatients worldwide over age 45 have heart attacks after noncardiac surgery. Only 15 percent of attacks present with chest pain, with most being entirely clinically silent.

Effective interventions for preventing most postoperative heart attacks remain elusive. Medical centers around the world commonly give patients aspirin before and after noncardiac surgery to prevent heart attack and death. The drug clonidine was also thought to possibly be helpful. But two of the study reports noted above, both from a 10,000-patient international placebo-controlled trial, showed not only that these drugs are ineffective at reducing death or heart attack within 30 days of surgery, but that aspirin can cause serious bleeding and clonidine can lower blood pressure to dangerous levels.

Published in: *New England Journal of Medicine, Anesthesiology*



Janet Houghton, PhD

## Transcription Factor Shown to Be Key to Cancers

Janet Houghton, PhD, of the Lerner Research Institute studies the cellular and molecular factors that promote cancer at the most basic level, with the aim of identifying therapeutic targets and building knowledge to eventually make cancer care more personal and effective. Dr. Houghton is senior author of a high-impact study demonstrating that certain genetic transcription factors (substances that affect gene expression) are strongly implicated in a range of cancers and affect oncogenesis. One transcription factor in particular, GLI (including GLI1 and GLI2), is constitutively activated in cancers of the gastrointestinal epithelium as well as brain tumors, melanoma, pediatric solid tumors, and cancers of the liver, lung, breast and pancreas. Dr. Houghton’s study reveals the importance of GLI in cancer cell survival and makes the case for GLI as a high-priority target for new treatments.

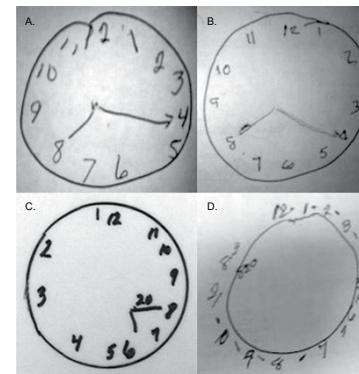
Published in: *Oncotarget* (cover feature)

## Cognition May Predict Heart Failure Readmission

**“As readmission numbers play a more important role in the economics of healthcare, more research must be done to identify ways to stem the tide of heart failure readmissions.”** — Eiran Gorodeski, MD, MPH, Miller Family Heart & Vascular Institute

A simple cognition test given at the time of discharge may be able to predict the likelihood that a heart failure patient will be readmitted to the hospital. So suggests research led by Eiran Gorodeski, MD, MPH, of the Center for Connected Care and the Miller Family Heart & Vascular Institute. His team administered a test called the Mini-Cog (a three-word recall and clock-drawing test) to 720 patients hospitalized for heart failure at Cleveland Clinic. They found that 30-day readmission and mortality rates were more than twice as high in patients whose tests showed cognitive impairment compared with patients whose tests did not show impairment. Among the cognitively impaired patients, those discharged to a skilled nursing facility had longer intervals before their first readmission event or death.

Presented at: American College of Cardiology Scientific Session



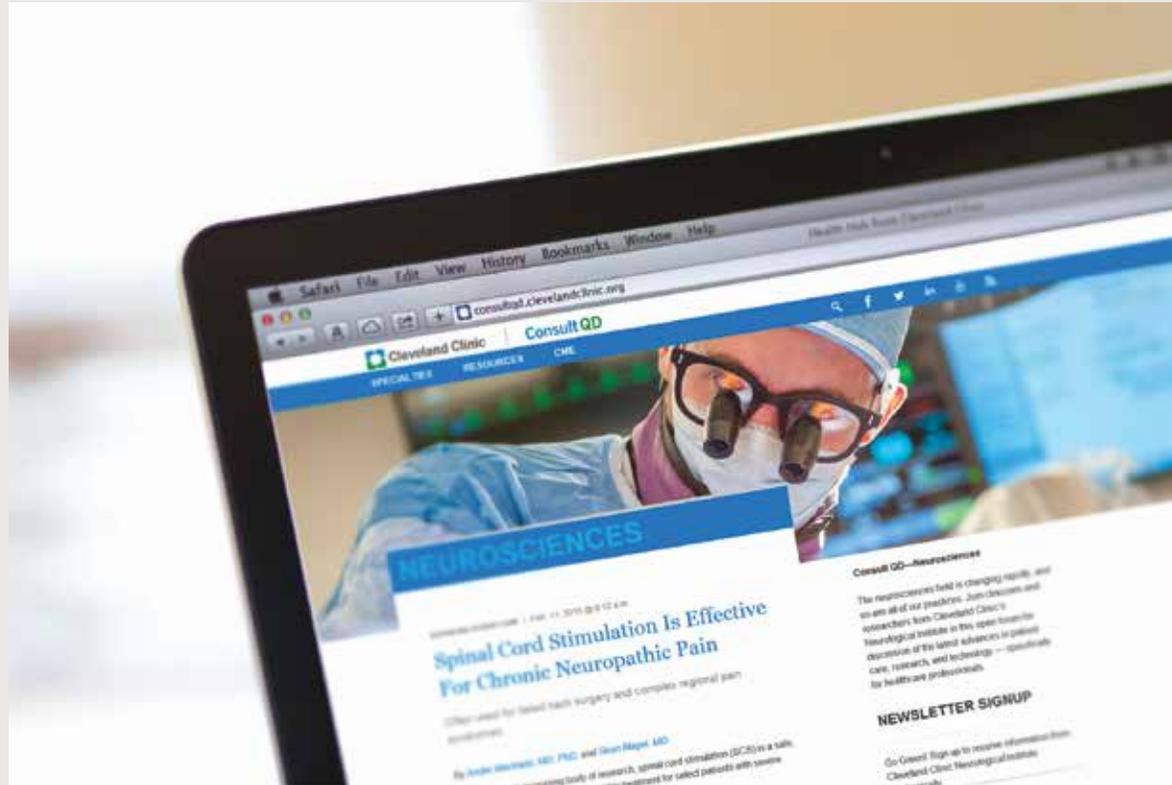
The clock-drawing portion of the Mini-Cog can reveal cognitive impairment.

# REACHING NEW HEIGHTS IN **DIGITAL COMMUNICATION**

“Social media gives us an opportunity to be a meaningful, helpful part of people’s everyday lives when they aren’t sick or don’t need our services. We can use social media to build a relationship with healthcare consumers that transcends time and space. If we are part of your life when you are well, perhaps you will consider coming here when you need care.” — Paul Matsen, Chief Marketing Officer, Cleveland Clinic, in *HealthLeaders Media*, June 11, 2014

Cleveland Clinic’s website (clevelandclinic.org) received more than 83 million visits in 2014 — a total that falls right between the populations of Germany and Egypt. The site regularly ranks as one of the two most visited hospital websites in America. More than 62,000 appointment requests were submitted online in 2014, and users of the MyChart medical record access portal rose to almost 2 million. Some 7,000 referring physicians linked to Cleveland Clinic through a website subpage called **DrConnect** that allows them to monitor their patients’ care.

Cleveland Clinic is also a national healthcare leader in social media outreach, with more than 1.2 million Facebook fans (the second most of any hospital in America) and over 344,000 Twitter followers. Cleveland



Clinic’s Twitter feed was named one of “The 140 Best Twitter Feeds of 2014” by *Time* magazine. HealthHub — Cleveland Clinic’s expert blog delivering breaking health news and insightful articles, videos and infographics from a variety of specialists — drew more than 29 million visits. Consult QD, a new blog for physicians and other healthcare professionals with expert content covering all major specialties, grew quickly in 2014, logging 161,000 visits in its first full year of existence. ■

*In addition to dispensing medications, the new Cleveland Clinic Specialty Pharmacy serves as a concierge, helping guide patients and caregivers through nearly any issue, from coordinating prior authorization to patient education to home delivery.*





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## SPECIALTY PHARMACY SERVICES LAUNCHED

Cleveland Clinic's high-acuity patient population includes individuals with rare, life-threatening conditions and limited treatment options. They often need scarce, unusual and expensive medications. The new Cleveland Clinic Specialty Pharmacy serves these patients as a provider, advocate and guide. It coordinates clinical pharmacy care, managing utilization and helping to find the most affordable alternative. It is the most advanced specialty pharmacy in the world.

# HEALTHCARE KIOSK PILOT: ‘PEOPLE LIKE THE TECHNOLOGY’

Cleveland Clinic rolled out a pilot program that places attended healthcare kiosks in family health centers and local retail pharmacies. The kiosks, known as HealthSpot stations, have been installed in the lobbies of two family health centers, on the campus of John Carroll University and in the pharmacy areas of two stores in the Marc’s pharmacy and grocery chain. A project of the Regional Operations Institute, HealthSpot stations are open during business hours and provide services at a cost of \$49. Patients can be advised or treated for low-acuity conditions such as fevers, colds, the flu, rashes, sore throat, respiratory infections and allergies.

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An attendant helps patients check in via a touch screen that is not linked to Cleveland Clinic’s electronic medical record. The HealthSpot station’s two-way high-definition video screen delivers a unique face-to-face experience between patients and medical providers. Each station houses an array of digital medical devices — stethoscope, scale, blood pressure cuff, pulse oximeter, thermometer, otoscope and magnascope — that stream medical information to provider and patient.

HealthSpot visits are later entered into a patient’s Cleveland Clinic electronic medical record, ensuring seamless communication and continuity of care. Several health insurance



companies currently cover these telehealth visits as they do regular office visits. Patients can also pay for their visit with cash, check, or credit or debit card.

“We thought we’d get more traction from younger patients, but it’s a mix,” Christopher Soska, Chief Operating Officer of Regional Hospitals and Family Health Centers, told the *Journal of AHIMA* (American Health Information Management Association). “People like the technology. They’re fascinated by it.” ■



### Quick, Accurate Online Colorectal Risk Calculator

**“Risk calculators like CRC-PRO are essential for effective medical decision-making. They are the backbone of personalized medicine that will ultimately improve care and lower costs.”** — Michael Kattan, PhD, Lerner Research Institute

Caregivers can predict a patient’s risk of colorectal cancer using a new online calculator developed by Brian Wells, MD, PhD, and Michael Kattan, PhD, of the Lerner Research Institute. Called Colorectal Cancer Predicted Risk Online (CRC-PRO), the calculator incorporates data based on an analysis of more than 180,000 patients from a longitudinal study performed at the University of Hawaii, which determined factors highly associated with colorectal cancer. The team is using the same approach to develop risk-prediction tools for other types of cancer and disease.

Published in: *Journal of the American Board of Family Medicine*

### First ‘Bloodless’ Hemipelvectomy with Tranexamic Acid

**“It was unclear if the tranexamic acid had an effect on bleeding during surgery. This synthetic amino acid has sometimes been associated with risk of seizures, although there were no such complications in this case. Further examination of tranexamic acid in a prospective trial is warranted.”** — Steven Lietman, MD, Orthopaedic & Rheumatologic Institute

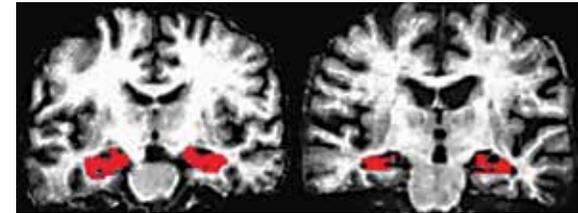
Steven Lietman, MD, of the Orthopaedic & Rheumatologic Institute has performed the world’s second reported external hemipelvectomy without blood transfusion — and the first to use tranexamic acid to reduce blood loss. A hemipelvectomy is the total amputation of the leg and half the

pelvis — an enormous operation that ordinarily involves major blood loss and multiple transfusions. To perform the operation without transfusion, the surgical team planned every step to reduce the need for blood. The patient, who is doing well, had painful bone cancer and would not accept blood for religious reasons.

### Thousands of Images Enter Electronic Records

**“The difference between a verbal description of a condition and an image of that condition is like the difference between hearing a description of the ‘Mona Lisa’ and actually seeing the painting. We physicians can write detailed reports of what we see, but sometimes just one look at the picture conveys all a caregiver or patient needs to know.”** — Cheryl Petersilge, MD, Imaging Institute

The Enterprise Imaging Program, directed by Cheryl Petersilge, MD, of the Imaging Institute, has put Cleveland Clinic ahead of all other American hospitals in incorporating medical imaging into the electronic medical record (EMR). The team is able to make images — of multiple types and generated by as many as 40 service lines — available at the point of care, via the EMR, to authorized caregivers, referring physicians and patients. The technology can consolidate, manage and index image records from multiple vendor sources to provide an ongoing record of patient images over time. And an Image Exchange Program allows patients to upload images to their physicians from home for purposes of observation and follow-up. The team expects nearly 300,000 non-radiology-acquired images over the next year and continues to seek new opportunities to use images in the EMR.



*Brain scans showing the hippocampus (red areas) in two subjects at genetic risk of Alzheimer’s in the study led by Stephen Rao, PhD. The subject on the left, who exercises regularly, has much larger hippocampal areas than the subject on the right, who is sedentary.*

### Exercise Can Protect Against Alzheimer’s

**“There is accumulating animal and human evidence that exercise is good not only for the body but also for the brain.”** — Stephen Rao, PhD, Neurological Institute

Exercise can effectively reduce the rate of brain atrophy in healthy older persons with an elevated genetic risk of Alzheimer’s disease (AD). A study led by Stephen Rao, PhD, of the Neurological Institute found that sedentary elders experienced a significant 3 percent decline in the volume of the hippocampus after an 18-month interval. The hippocampus is critical for memory and is an early site of neurodegeneration in AD. In contrast, elders at elevated risk who engaged in regular physical activity experienced no atrophy over the same period. The positive effect of exercise was not observed in persons at low risk for AD. A previous study led by Dr. Rao showed that regular exercise improved functional brain activity in persons at elevated risk for AD. The knowledge from both studies may significantly affect counseling on exercise for patients with an elevated genetic risk for AD.

Published in: *Frontiers in Aging Neuroscience*

## Cleveland Clinic Cited for Ethics Excellence

**“Our physician-leadership model really helps the effectiveness of our overall compliance program. Once the physicians have buy-in, things get done.”** — Don Sinko, Chief Integrity Officer

In 2014, Cleveland Clinic was again named one of the World’s Most Ethical Companies by the Ethisphere Institute. Other international observers have taken note of Cleveland Clinic’s achievements in meeting and exceeding standards and expectations in compliance. Mark Sands, MD, Chair of the Corporate Compliance Committee, and Don Sinko, Chief Integrity Officer, were interviewed for a cover story in *Compliance Today*, published by the Health Care Compliance Association. And the Brazilian magazine *Diagnóstico* featured Mr. Sinko and Cleveland Clinic in a cover story titled “O Hospital Mais Etico do Mundo” (“The Most Ethical Hospital in the World”).

## Robotic Joint Simulator Launched

**“simVITRO greatly reduces the cost and time from new research questions to new discoveries. It allows researchers to focus less on the robotics and more on the important thing: asking and answering clinical questions that will help patients.”** — Robb Colbrunn, DEng, Lerner Research Institute

The Lerner Research Institute’s BioRobotics and Mechanical Testing Core has created and launched a robotics testing technology for orthopaedic biomechanics research. Robb Colbrunn, DEng, and Tara Bonner, MS, developed the new system, known as simVITRO™, along with Ton van den Bogert, PhD, previously of the Lerner Research Institute. The system combines software, hardware and integration services to create a universal musculoskeletal simulator that can provide in vitro simulation of major joints including the spine, knee, foot/ankle, hip, shoulder, elbow, wrist



*Akron General Medical Center, the cornerstone of Akron General Health System*

and more. Surgeons may use it to plan and assess joint and spinal surgeries, test implants and measure how any number of variables can affect joint motion. With no comparable product on the market, simVITRO has already been adopted by three new research labs, and negotiations for worldwide distribution are underway.

## Influential Thinkers

Five Cleveland Clinic staff were recognized in Thomson Reuters’ Highly Cited Researchers list for 2014: Jihad Kaouk, MD, of the Glickman Urological & Kidney Institute; Vinod Labhasetwar, PhD, of the Lerner Research Institute; Steven Nissen, MD, of the Miller Family Heart & Vascular Institute; Brian Rini, MD, of the Taussig Cancer Institute; and E. Murat Tuzcu, MD, of the Miller Family Heart & Vascular Institute. The list covers authors in 21 main fields of science and the social sciences, honoring those publishing works designated by Essential Science Indicators as highly cited papers — meaning they are among the top 1 percent most cited in their subject field that year. Inclusion indicates that the authors’ work has consistently been judged by peers to be particularly significant and useful.

## Relationship Forged with Akron General

**“Our lengthy efforts to find the absolute best partner have culminated in this historic agreement. This partnership brings the world-class expertise of Cleveland Clinic even closer to patients in Summit and surrounding counties. We are very pleased to be working with Cleveland Clinic, the undisputed leader in healthcare delivery in Northeast Ohio.”**

— Thomas L. “Tim” Stover, MD, President and CEO, Akron General Health System

Cleveland Clinic became a minority owner of Akron General Health System in August 2014, making Akron General its exclusive health system partner in Summit County. The relationship combines the two organizations’ clinical expertise and resources to strengthen and improve access to high-quality, affordable healthcare services for patients in the region. As a provision of the agreement, Cleveland Clinic will make a substantial capital investment in Akron General Health System. In addition, each organization will have representation on the other’s board of directors. Continuation of Akron-based governance and management leadership for Akron General was important to both organizations.

A key part of the relationship is the opportunity for physicians in Akron to participate in Cleveland Clinic’s Quality Alliance. The Quality Alliance enables collaboration between independent and employed physicians to improve care quality, reduce costs, increase efficiency and enhance access to expertise, data and experience.

# HUMAN RESOURCES: CULTIVATING ENGAGED, DIVERSE CAREGIVERS

Every employee is a caregiver at Cleveland Clinic, Northeast Ohio's largest employer and the second-largest private-sector employer in Ohio. As the field of healthcare changes, Human Resources at Cleveland Clinic is committed to hiring and developing the next generation of healthcare leadership. It is dedicated to building a workforce of engaged caregivers fully prepared to meet the challenges of the new era.

"The quality of our workforce gives us a competitive advantage in attracting outstanding job candidates from across the country," says Joe Cabral, Cleveland Clinic's new Chief Human Resources Officer. "High-performing individuals prefer to work with colleagues who are committed to the organization and aligned with its mission."

Caregivers who are enthusiastic and committed to their work have higher patient satisfaction ratings, better safety records and better overall performance than those who are not. For this reason, Cleveland Clinic continually promotes and measures engagement among all caregivers. Eighty-seven percent of caregivers participated in a 2014 employee engagement survey overseen by Press Ganey. The results showed high levels of satisfaction with Cleveland Clinic's career development opportunities, recognition for a job well done, collaborative spirit, quality of care, and inspiration to go above and beyond what's expected.



*Opening ceremony of the 2014 Gay Games, held in Cleveland (photo by Bob Perkoski)*

## A Top 5 Health System for Diversity

"Cleveland Clinic is growing its global footprint during a time when patient demographics and our workforce are rapidly changing," says Mr. Cabral. "This requires a significant investment in and dedication to the work of diversity and inclusion so we are better prepared to address every opportunity and challenge before us."

In 2014, DiversityInc again recognized Cleveland Clinic among the nation's top 5 hospital systems for diversity. The recognition included commendation of Human Resources' Caregiver Resource Groups, which serve various cultural, ethnic, experience, gender and religious affiliations. These include the African-American Employee Resource Group, the Circle of Healers, ClinicPride, the Disability Task Force, Global Employees, The Interfaith Network, Military and Veterans, the Minority Physician Network, the Pan Asian Employee Resource Group, SALUD and Women in Search of Excellence.

## 2014 Gay Games

Cleveland Clinic Sports Health was the primary healthcare provider for Northeast Ohio events at the Gay Games, which were held for the first time in Cleveland in 2014. More than 20,000 people from close to 50 countries participated and visited. Physicians, nurses and certified athletic trainers logged 264 hours at the events. Cleveland Clinic created, sponsored and hosted a healthcare conference for athletes before the games, the first such conference in the games' history. James Hekman, MD, of the Medicine Institute offered a special educational session addressing lesbian, gay, bisexual and transgender (LGBT) healthcare for Cleveland Clinic physicians and other clinicians providing care to participating athletes.

Cleveland Clinic's main campus was named a "Leader in LGBT Healthcare Equality" in the Human Rights Campaign's Healthcare Equality Index 2014. ■

THE POWER OF

EVERY

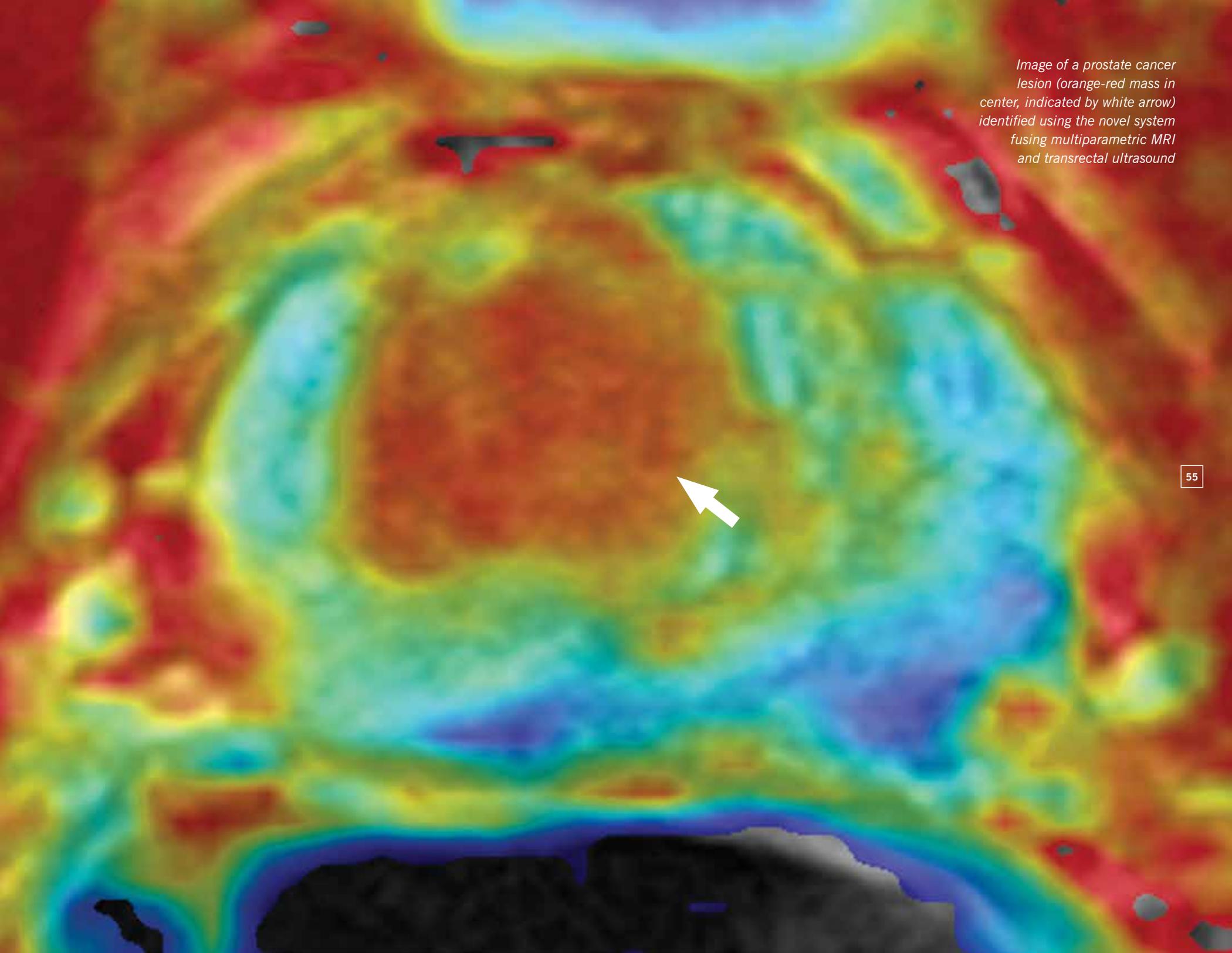
DIAGNOSIS

54

## FUSING MRI AND ULTRASOUND IN PROSTATE BIOPSY

Great care begins with accurate diagnosis. A new technology being used in the Glickman Urological & Kidney Institute fuses MRI and ultrasound images to increase the accuracy of prostate cancer diagnosis and enable doctors and patients to make the best possible decisions for care. The UroNav Fusion Biopsy System helps guide placement of the biopsy needle so that only the most aggressive tumors are sampled — and benign tumors are left alone. Cleveland Clinic became the first center in Northeast Ohio to offer this system in 2014.

*Image of a prostate cancer lesion (orange-red mass in center, indicated by white arrow) identified using the novel system fusing multiparametric MRI and transrectal ultrasound*



# REACHING OUT TO ADVANCE WOMEN'S HEALTH

**Speaking of Women's Health** is a women's health outreach program managed by Cleveland Clinic's Center for Specialized Women's Health. Holly L. Thacker, MD, of the Ob/Gyn & Women's Health Institute is Executive Director of this national nonprofit organization with more than 35,000 members. Its mission is to educate women and help them make informed decisions about health, well-being and personal safety for themselves and their families.

Speaking of Women's Health has held conferences and events attracting thousands of women in communities across the country. These events offer expert speakers, health screenings, nutritional advice and informational sessions to women, health-care systems and employers. Many of these event offerings are extended digitally via the organization's robust website, which also features free webchats, recipes, free e-newsletters (reaching more than 35,000 women nationwide), a health library, treatment guides and the "Ask Nurse Mary" Q&A column. Speaking of Women's Health activities give women access to a broad range of health services available through the Center for Specialized Women's Health, including the new, highly individualized CustomFit Physicals for Women, which combine convenience with comprehensiveness.

"Women are at the center of health within their families and in their communities," says Dr. Thacker. "They make 80 percent of healthcare decisions. Speaking of Women's Health provides information from credible experts in a fun and entertaining way, helping us take better care of ourselves and our families."



*A recent issue of the popular Speaking of Women's Health e-newsletter, which regularly features insights and advice from Executive Director Holly L. Thacker, MD, shown in the onscreen photo*

**Celebrate Sisterhood** is a Cleveland Clinic program dedicated to educating, energizing and empowering women of color to embrace self-care. In 2014, Celebrate Sisterhood held its annual multicultural women's health and wellness summit, "Building a Better You: Your Personalized Blueprint for Self-Care." Linda Bradley, MD, of the Ob/Gyn & Women's Health Institute is Chair of Celebrate Sisterhood, whose vision is to catalyze multicultural women to self-manage their health and advocate for their health transformation. Its website offers recipes, treatment guides and multicultural women's health information.

The 2014 Celebrate Sisterhood event drew 750 attendees to Executive Caterers at Landerhaven, with 300 others on the waiting list. Speakers included Cleveland Clinic CEO Toby Cosgrove, MD; television host Montel Williams; Mark Hyman, MD, Director of Cleveland Clinic's Center for Functional Medicine; and experts on a variety of health and wellness topics. Record numbers of health screenings were conducted, including for cholesterol, blood sugar and blood pressure, as well as HIV testing. For the first time, Celebrate Sisterhood was streamed live to the Ohio Reformatory for Women, the nation's largest prison for women.

"This Celebrate Sisterhood summit brought together the most coveted and inspirational speakers, dynamic topics and leading minds in health, wellness, personal finance and other subjects, for a landmark event that continues to spark conversation, stimulate advocacy and increase the exchange of ideas," says Dr. Bradley. "It prepares women to be beacons of change in our communities." ■



*A few of the speakers from Celebrate Sisterhood's "Building a Better You" summit: functional medicine expert Mark Hyman, MD (top), TV celebrity Montel Williams (below left) and Celebrate Sisterhood Chair Linda Bradley, MD (below right)*

# A GROWING FOOTPRINT THROUGH AFFILIATIONS AND ALLIANCES

Cleveland Clinic has entered into affiliations with national and regional partners that are seeking to improve clinical quality, patient care, medical education and research. Clinical affiliations promote value-added, high-quality clinical care to patients through the support, expansion and development of institute-driven integrated care strategies. Below are current relationships established by Cleveland Clinic in diverse areas of clinical care and innovation, along with their year of initiation.

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## Miller Family Heart & Vascular Institute

### *Clinical and Research Alliance*

- Baylor Scott & White Health — Dallas, Texas | 2014
- MedStar Heart & Vascular Institute — Washington, D.C., and Baltimore, Md. | 2013
- North Shore–LIJ Health System — Manhasset, N.Y. | 2014
- Piedmont Healthcare — Atlanta, Ga. | 2015

### *Heart & Vascular Institute Affiliates*

- The Bellevue Hospital — Bellevue, Ohio | 2013
- Cadence Health — Winfield, Ill. | 2010
- CHRISTUS St. Michael Health System — Texarkana, Texas | 2014

- Fisher-Titus Medical Center — Norwalk, Ohio | 2013
- King's Daughters Medical Center — Ashland, Ky. | 2014
- Novant Health — Charlotte and Winston-Salem, N.C. | 2012
- Saint Francis Medical Center — Cape Girardeau, Mo. | 2014
- Saint Vincent Hospital — Erie, Pa. | 2012
- Sequoia Hospital — Redwood City, Calif. | 2015
- Susquehanna Health — Williamsport, Pa. | 2014
- Valley Health System — Ridgewood, N.J. | 2015

### *Heart Surgery Affiliates*

- Cape Fear Valley Health — Fayetteville, N.C. | 2007
- Lake Health West — Willoughby, Ohio | 1997
- MetroHealth System — Cleveland, Ohio | 1998
- Rochester General Hospital — Rochester, N.Y. | 2004

## Orthopaedic & Rheumatologic Institute

### *Fellow members of the National Orthopaedic & Spine Alliance:*

- CORE Institute — Arizona | 2014
- OrthoCalifornia — Southern California | 2014
- OrthoCarolina — North Carolina | 2014
- Rothman Institute — Philadelphia, Pa. | 2014

## Glickman Urological & Kidney Institute Affiliates

- Charleston Area Medical Center — Charleston, W.Va. | 1988
- St. Vincent Indianapolis Hospital — Indianapolis, Ind. | 2009

## Taussig Cancer Institute Affiliate

- Cadence Health — Winfield, Ill. | 2012

## Neurological Institute Affiliates

- Fisher-Titus Medical Center — Norwalk, Ohio | 2013
- Western Reserve Hospital — Cuyahoga Falls, Ohio | 2013

## Bariatric & Metabolic Institute Affiliate

- Doctors Hospital at Renaissance — El Paso, Texas | 2014

## Global Healthcare Innovations Alliance

- MedStar Health (founding member) — Washington, D.C., and Maryland | 2011
- The Innovation Institute — Orange County, Calif. | 2013
- Marshfield Clinic — Wisconsin | 2013
- North Shore–LIJ Health System — Manhasset, N.Y. | 2014
- ProMedica — Ohio and Michigan | 2013
- University of Notre Dame — South Bend, Ind. | 2012

# 2014 U.S. NEWS & WORLD REPORT RANKINGS



**In the “HONOR ROLL” Top 4**

Cleveland Clinic ..... 4<sup>th</sup> | 11 years in a row

**Ranked No. 1**

Cardiology & Heart Surgery ..... 1<sup>st</sup> | 20 years in a row

Urology ..... 1<sup>st</sup>

**In America’s Top 3**

Diabetes & Endocrinology ..... 2<sup>nd</sup> | 3 years in a row

Rheumatology ..... 2<sup>nd</sup> | 7 years in a row

Nephrology ..... 2<sup>nd</sup> | 5 years in a row

Gastroenterology & GI Surgery ..... 2<sup>nd</sup> | 18 years in a row

Gynecology ..... 3<sup>rd</sup> | 3 years in a row

Orthopaedics ..... 3<sup>rd</sup> | 3 years in a row

Pulmonology ..... 3<sup>rd</sup> | 5 years in a row

**In America’s Top 20**

Ear, Nose & Throat ..... 6<sup>th</sup> | 22 years in a row

Neurology & Neurosurgery ..... 6<sup>th</sup> | 25 years in a row

Ophthalmology ..... 7<sup>th</sup> | 15 years in a row

Geriatrics ..... 9<sup>th</sup> | 21 years in a row

Pediatric Gastroenterology & GI Surgery ..... 11<sup>th</sup> | 4 years in a row

Pediatric Neurology & Neurosurgery ..... 11<sup>th</sup> | 7 years in a row

Cancer ..... 13<sup>th</sup> | 10 years in a row

Pediatric Urology ..... 13<sup>th</sup>

Pediatric Orthopaedics ..... 15<sup>th</sup>

Pediatric Pulmonology ..... 18<sup>th</sup>

Pediatric Cancer ..... 20<sup>th</sup>

**In America’s Top 50**

Pediatric Cardiology & Heart Surgery ..... 23<sup>rd</sup> | 6 years in a row

Pediatric Nephrology ..... 30<sup>th</sup>

Neonatology ..... 46<sup>th</sup>

Pediatric Diabetes & Endocrinology ..... 47<sup>th</sup> | 6 years in a row

# SELECTED 2014 AWARDS & HONORS

FOR CLEVELAND CLINIC



**UHC Quality Leadership Award**  
*From University HealthSystem Consortium*

**Stage 7 Ambulatory Award**  
*From HIMSS Analytics (Healthcare Information and Management Systems Society)*

**Corporation of the Year Award**  
*From Ohio Minority Supplier Development Council*

**Leader in LGBT Healthcare Equality**  
*From Human Rights Campaign's Healthcare Equality Index 2014*

**NorthCoast 99 — Northeast Ohio's Best Places to Work (9th year)**  
*From the HR services organization ERC*

**Top 10 Organizations for Leadership Development — Healthcare Organizations**  
*From National Center for Healthcare Leadership*

**Top 10 Hospital and Healthcare Systems for Diversity**  
*From DiversityInc*

**Visionary Employer Award**  
*From Milestones Autism Resources*

## FOR REGIONAL HOSPITALS AND FACILITIES

**Guardian of Excellence Award (Patient Experience)**  
*From Press Ganey*

- Richard E. Jacobs Family Health Center Emergency Department
- Sagamore Hills Emergency Department
- South Pointe Hospital
- Twinsburg Family Health and Surgery Center Emergency Department

**Commitment to Excellence Award**  
*From Press Ganey*  
Lutheran Hospital

**NDNQI Award for Outstanding Nursing Quality**  
*From Press Ganey*  
Sheikh Khalifa Medical City

**Magnet Recognition**  
*From American Nurses Credentialing Center*

- Main Campus
- Cleveland Clinic Children's Hospital for Rehabilitation
- Cleveland Clinic family health centers
- Fairview Hospital
- Hillcrest Hospital

**Pathway to Excellence Designation**  
*From American Nurses Credentialing Center*

- Cleveland Clinic Florida
- Euclid Hospital
- Lakewood Hospital
- Lutheran Hospital
- Marymount Hospital
- South Pointe Hospital

**ACTION Registry Get with the Guidelines Gold Performance Achievement Award**  
*From American College of Cardiology Foundation's National Cardiovascular Data Registry*  
Hillcrest Hospital

**Platinum Performance Achievement Award**  
*From American College of Cardiology Foundation's National Cardiovascular Data Registry*  
Hillcrest Hospital

**Get with the Guidelines**  
*From American Heart Association and American Stroke Association*

- **Gold Plus — Heart Failure**  
Cleveland Clinic Main Campus  
Cleveland Clinic Florida
- **Gold Plus — Stroke**  
Cleveland Clinic Florida  
Euclid Hospital  
Fairview Hospital  
Hillcrest Hospital  
Marymount Hospital  
Medina Hospital  
South Pointe Hospital
- **Silver Plus — Stroke**  
Lakewood Hospital

**Mission: Lifeline STEMI Receiving Center Gold Plus Award**  
*From American Heart Association*  
Hillcrest Hospital

**Top Performer on Key Quality Measures**  
*From The Joint Commission*

- Ashtabula County Medical Center
- Cleveland Clinic Florida
- Lutheran Hospital
- South Pointe Hospital

**Baby-Friendly**  
*From UNICEF/World Health Organization*

- Fairview Hospital
- Hillcrest Hospital
- Lakewood Hospital

**100 Top Hospitals for Patient Engagement**

*From Becker's Hospital Review and Axial Exchange*

Lutheran Hospital

**Safest Hospitals in the U.S.**

*From Consumer Reports*

Lutheran Hospital

**Top 50 U.S. Hospitals**

*From Healthgrades*

- Marymount Hospital
- South Pointe Hospital

**Distinguished Hospital Award for Clinical Excellence**

*From Healthgrades*

- Marymount Hospital
- South Pointe Hospital

**Patient Safety Excellence Award**

*From Healthgrades*

Euclid Hospital

**Fit-Friendly Worksites, Gold Award Recognition**

*From American Heart Association*

- Ashtabula County Medical Center
- Fairview Hospital
- Hillcrest Hospital

**ENVIRONMENTAL AWARDS**

**Circle of Excellence Award: Green Building**

*From Practice Greenhealth*

Cleveland Clinic Main Campus

**Circle of Excellence Award: Greening the OR**

*From Practice Greenhealth*

Cleveland Clinic Main Campus

**Circle of Excellence Award: Water**

*From Practice Greenhealth*

Lakewood Hospital

**Greenhealth Emerald Award**

*From Practice Greenhealth*

- Cleveland Clinic Main Campus
- Euclid Hospital
- Richard E. Jacobs Health Center
- Stephanie Tubbs Jones Health Center

**Greenhealth Partner for Change Award**

*From Practice Greenhealth*

- Beachwood Family Health and Surgery Center
- Brunswick Family Health Center
- Chagrin Falls Family Health Center
- Cleveland Clinic Florida
- Fairview Hospital
- Hillcrest Hospital
- Independence Family Health Center
- Lakewood Hospital

- Lutheran Hospital
- Marymount Hospital
- Medina Hospital
- Solon Family Health Center
- South Pointe Hospital
- Strongsville Family Health and Surgery Center
- Twinsburg Family Health and Surgery Center
- Willoughby Hills Family Health Center

**Partner Recognition Award**

*From Practice Greenhealth*

Wooster Family Health Center

**System for Change Award**

*From Practice Greenhealth*

Cleveland Clinic Health System

**LEED Gold Certification**

*From U.S. Green Building Council*

Cleveland Clinic Abu Dhabi

**Lighting Control Innovation Award**

*From Illuminating Engineering Society*

Fairview Hospital

**COMMUNICATIONS HONORS AND AWARDS**

**140 Best Twitter Feeds of 2014**

*From Time Magazine*

**eHealthcare Leadership Awards**

*From Strategic Health Care Communications*

**clevelandclinic.org**

- Platinum Award for Best Health/Healthcare Content (healthcare system category)
- Platinum Award for Best Overall Internet Site (healthcare system category)
- Platinum Award for Best Social Networking (healthcare system category)
- Gold Award for Best Doctor Directory (healthcare system category)

**clevelandclinic.org/myconsult**

- Gold Award for Best Care/Disease Management Site (hospital subsite/center of excellence category)

**clevelandclinicmeded.com**

- Platinum Award for Best Health/Healthcare Content (physician/clinician-focused site category)
- Gold Award for Best Overall Internet Site (physician/clinician-focused site category)
- Gold Award for Best Rich Media (physician/clinician-focused site category)

# FINANCIAL AND STATISTICAL HIGHLIGHTS

## CLEVELAND CLINIC

<b>PATIENT CARE</b>	<b>2013</b>	<b>2014</b>
Total outpatient visits	5,165,992	5,482,310
Emergency visits	100,779	112,042
Total admissions (excluding newborns)	54,998	53,722
Acute	54,671	53,337
Nonacute	327	385
Surgical cases	90,773	89,974
Inpatient	26,281	25,727
Outpatient	64,492	64,247

<b>EDUCATION</b>	<b>2013</b>	<b>2014</b>
Residents and fellows in training	1,793	1,757
Continuing medical education		
Programs	1,568	1,900
Participants	268,795	334,183
Accredited residency training programs	70	70
Allied health student rotations	2,189	1,832
Programs for allied health specialists	64	65

<b>RESEARCH</b>	<b>2013</b>	<b>2014</b>
Total grant and contract revenue	\$163M	\$168M
Total federal revenue	\$106M	\$98M
Total laboratory principal investigators	172	178

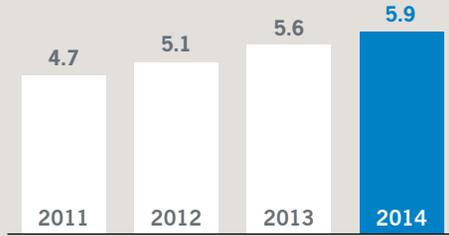
## CLEVELAND CLINIC HEALTH SYSTEM (CCHS)

<b>PATIENT CARE</b>	<b>2013</b>	<b>2014</b>
Total outpatient visits	5,567,066	5,927,711
Emergency visits	475,777	497,681
Total admissions (excluding newborns)	157,000	152,532
Acute	145,199	140,603
Nonacute	11,801	11,929
Surgical cases	194,982	192,646
Inpatient	57,084	55,560
Outpatient	137,898	137,086

<b>FINANCIAL HIGHLIGHTS (\$ IN THOUSANDS)</b>	<b>2013</b>	<b>2014</b>
Total operating revenues	6,450,159	6,687,379
Operating income	293,995	467,543
Total assets	10,951,799	12,267,560

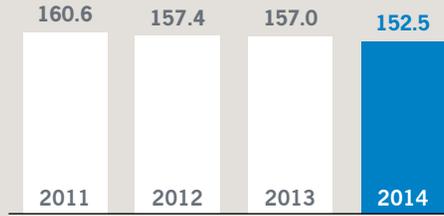
NOTE: Some figures for 2013 have been updated following revision of the 2013 annual report after its release.

**TOTAL OUTPATIENT VISITS**  
(CCHS)



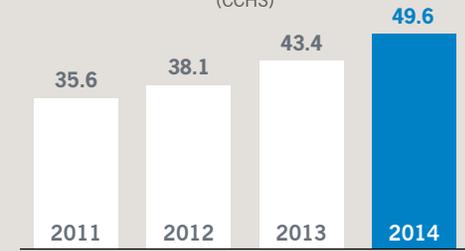
IN MILLIONS

**TOTAL PATIENT ADMISSIONS  
(EXCLUDING NEWBORNS)**  
(CCHS)



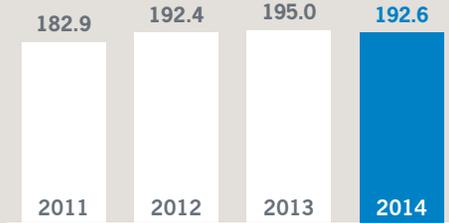
IN THOUSANDS

**TOTAL OUTPATIENT OBSERVATIONS**  
(CCHS)



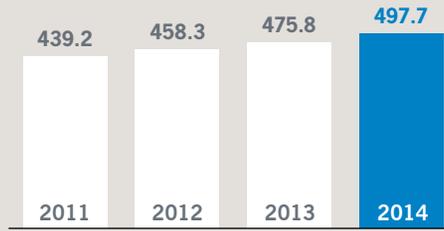
IN THOUSANDS

**SURGICAL CASES –  
INPATIENT AND OUTPATIENT**  
(CCHS)



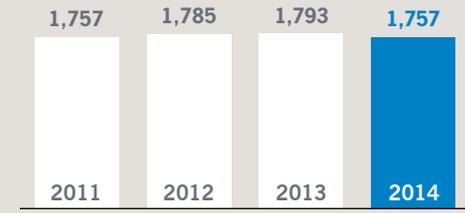
IN THOUSANDS

**EMERGENCY DEPARTMENT VISITS**  
(CCHS)

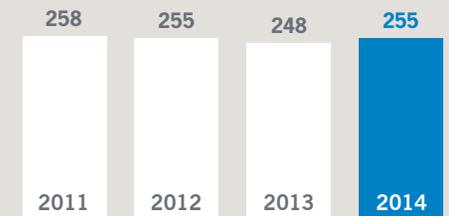


IN THOUSANDS

**EDUCATION –  
RESIDENTS AND FELLOWS IN TRAINING**  
(CCHS)

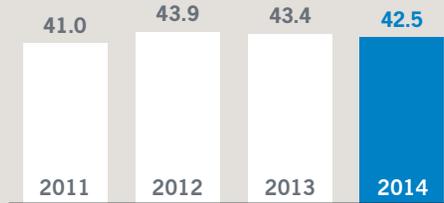


**RESEARCH FUNDING  
(ALL SOURCES)**  
(CCHS)



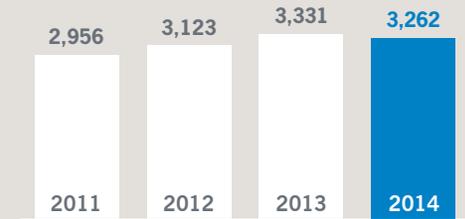
\$ IN MILLIONS

**CAREGIVERS –  
TOTAL EMPLOYEES**  
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