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Technology is Transforming Healthcare

I would like to personally welcome our readers to our Healthcare in the Digital Age issue of Doctor’s Advice magazine. We are extremely fortunate to have cutting edge medicine available in the Western New York region provided by our regional physicians in both health care systems as well as in private practice.

Technology in medicine is indeed a double edge sword, with great advances that are presented with great costs associated with them. In evaluating these technological advances, however, one must be aware of the large potential savings to health care. Monroe County Medical Society recently hosted a technology event, showcasing the innovation taking place right in our region in the areas of cardiology and interventional vascular radiology. Local experts Dr. Ian Wilson of Rochester Endovascular and Dr. Scott Feitell of the Sands Constellation Heart Institute, both gave an overview of some of the latest technological innovations in their respective fields.

Imagine artificial organs such as heart pumps that work long term to eliminate the need for heart transplantation. The technology has been present for many years; however, only recently have we had the opportunity to develop these devices for long-term use with advances in miniaturization of computerization and material engineering and molecular biology to prevent clotting. Continuous remote monitoring of blood pressures and heart failure devices was also discussed.

Think about Star Trek, our favorite sci-fi program, that has pushed ideas from the simple automatic sliding door openers to cell phones, to handheld body scanners, to the character ‘Data’ with his artificial eyes to allow vision in a blind person, robots doing precision surgery, by remote control. Most of these ideas are a reality, and if not yet, are on the horizon! Routine techniques such as a stethoscope examination can now be replaced by a digitally-enhanced earpiece to accurately decipher heart sounds. Even today in my office, we have the capability for patients to swallow a wireless, battery-operated camera in a pill, or ‘Pillcam’, to remotely study the inside lining of the intestinal tract without inserting endoscopes or having to perform surgery to do so.

Not all advances arise from the classic ‘tech space’. Many new advances are also coming in the field of molecular biology and pharmaceuticals, with new detection and treatment of cancers and other chronic diseases.

This is indeed a very exciting time to be in the medical field with advances only limited by the scope of one’s imagination. Please enjoy the enclosed articles and be inspired!
New Technologies Benefit Patient Care

Health Care in Rochester has always been at the fore nationally and internationally. Whether it is the latest medical or surgical treatments, Rochester health care providers have always found a way to be among the first to evaluate and adopt new treatment methodologies to benefit patients from the greater Rochester area and beyond.

This issue of *Doctors’ Advice* focuses on a number of areas where technological advances, or the digital age, have affected the medical field. Whether in the performance of procedures, or in our daily patient encounters, technology is impacting every aspect of our workflow. In the early days of electronic medical records, physicians and leaders in the greater Rochester area were among the first in the country to endeavor in the electronic sharing of medical records. The area’s regional health information organization (RHIO) was established to facilitate secure sharing of health care information across practices and hospitals.

Providing easy access to patients’ records allows better care with fewer repeat tests, and easy access to potentially critical health information, to make the most of the health care encounter in the office, emergency room, or any other health care setting, resulting in more efficient episodes of care. Fortunately, with demands for interoperability of medical records, which is addressed in this issue, the RHIO sharing model is being adopted on a wider scale.

Members of Monroe County Medical Society have always sought to answer the unanswered questions. How will a particular technology help as we diagnose, monitor, and care for our patients? What technology should be adopted or not? Our writers share with us a number of innovations that are rapidly changing what we do every day. Over two decades ago, Dr. Ray Lanzafame, author of, “Surgery of the Future Meets the Digital Age”, delved into the use of laser in surgery. He has been one of the national leaders in laser medicine, training, and ensuring certification of physicians involved in the use of this technology. The use of robotic technology, among others, are reviewed. It is most important to ensure all technologies are appropriately evaluated before they are deemed suitable for the patient care arena. As important is for the users to be appropriately trained for patients to truly benefit.

As much as technology is commonplace in medicine and surgery, it remains underutilized in certain areas, particularly in training. Many of us remember the unthinkable situation in which Captain Sully found himself a few years ago. He was flying out of LaGuardia, when a “bird strike” hit both of the plane’s engines. For a plane to have lost all of its engines at once to a “bird strike” had never occurred before. Yet, this is a scenario the captain had rehearsed in a flight simulator. Every passenger and crew walked out of the plane after a safe landing on the Hudson River. Rochester physicians and researchers are leading the way in developing innovative training models that provide realistic, “life-like” examples so physicians have the means to not only learn new techniques, but to maintain their skills. Increased adoption of such technology will be a great step forward in our quest to continuously better ourselves, as we strive to deliver the best care for our patients.

*Dr. Joseph is the W.W. Scott Professor and Chairman of the Department of Urology. He is Director of the Center for Robotic Surgery and Innovation. He also serves as Professor of Oncology at the Wilmot Cancer Center of the University of Rochester Medical Center.*
The golden age of health information technology (IT) introduced some exciting new technologies that are being used in our emergency departments and transforming the way we deliver care.

Electronic Health Record Interoperability
Interoperability is the ability of different information technology systems to share and use patient health information. Not only are healthcare organizations with the same electronic health record (EHR) system able to exchange information, we are now able to share information with organizations on different EHRs, as well as directly with pharmacies. Previously, if a patient was started on a new medication but couldn’t remember the name, the ED provider had to call the patients’ pharmacy, which is a time-consuming process. Thanks to this technology, we are often able to obtain the name and dose of the medication with a few clicks in the EHR.

Interoperability provides increased time savings and convenience for both the doctor and the patient. Additionally, there is an enormous cost saving attributed to this technology. Often, patients will come to an emergency department with ongoing symptoms after a recent hospitalization in a different hospital system. Traditionally, patients would undergo repeat testing, including costly imaging tests and possible re-admission. With advancements in interoperability, ED providers are able to see the results and paperwork from the previous hospitalization, which can decrease repeat testing, potentially avoid repeat hospitalization and reduce healthcare costs.

Ultrasound
While ultrasound machines are not new in the emergency department, their use is becoming more common. Thanks to machines getting smaller and faster, it is easier than ever to use them in emergency medicine. Using an ultrasound with patients in the ER has been shown to decrease the need for tests like CT scans which are costly, time-intensive, and expose patients to harmful radiation. Most importantly, it improves the emergency physician’s ability to rule out certain conditions, which can be crucial for critically ill or injured patients. With the availability of handheld-size ultrasound machines, I expect this technology to be used more frequently in the ER.

Smartphones
Smartphones have not only revolutionized our everyday lives, but also our ability to deliver care in the ED.

One of my favorite technologies to use in the emergency department is clinical photo capture. If an ED provider sees a patient with a rash, decides to start her on corticosteroids and refer her to a dermatologist, it could take several days to obtain a follow up appointment. By the time the dermatologist sees the patient, the rash could have changed or resolved, making it difficult to make an accurate diagnosis. Using the mobile application of our electronic health record system, I am able to take a photo and import it into my note for the dermatologist to see at the follow up visit. This solution is secure, as the images are never stored physically on my phone.

There are plenty of situations where clinical photo capture is improving patient care. Other examples of how smartphones are improving care include secure communication, mobile notifications and alerts, the ability to write orders and a host of clinical decision support tools.

by Justin Mazzillo, MD
Wearables

Another emerging technology worth mentioning is the increasing use of wearables. Smartwatches, the most common application, are able to monitor a person’s heart rate continuously. Patients who visit the ED with palpitations often show no symptoms by the time they arrive. Having a record of the previous heart rate data could help detect the presence of an arrhythmia. There are even applications that will alert a patient if the watch thinks an arrhythmia is present. There are many potential applications where wearables could improve emergency department care such as in patients with diabetes and sepsis.

Although advancements in health technology have added more complexity to our already demanding jobs, I believe the future is bright for both patients and clinicians because of these exciting technologies.

Dr. Justin Mazzillo serves as both the Assistant Medical Director of the Strong Memorial Hospital Emergency Department as well as the Assistant Chief Medical Information Officer with UR Medicine.

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Paging Doctor Google

By Brian Teng, MD, FACS, FASCRS
Rochester Colon & Rectal Surgery

No patient enters a colon & rectal surgeon’s office with excitement. The only part he/she finds exciting is probably the moment the visit is over. In the words of George Burns, “Happiness is hearing your proctologist say, “You can straighten up now.” In my line of work, patients often come to the office with limited knowledge about what we have to discuss. Odds are if you come to me to discuss your hemorrhoids, I will quickly figure out that your problems are actually due to something else. Lately though I do see patients coming in armed with information they have looked up or at least have read up on options via the internet. The information can range from useful information to false information. The challenge is how to separate the wheat from the chaff.

Dr. Google
The first thing most people do is use Google to look things up. The sources you get from this can vary in quality. Overall, Google’s algorithms are very good, so sources from big name institutions tend to pop up (Figure 1). When I performed a search for hemorrhoids you can see that sources include the Mayo Clinic, Harvard and then eMedicine. Whenever possible you should look to see who is writing the article. A trick of the trade for articles is the senior expert physician may be assigning these duties to the junior trainee. While there is nothing wrong with a trainee writing a well-researched article, you should be aware this happens.

Personally, when I use Google for searches, I am a fan of using scholar.google.com. It accesses research articles related to topics I am interested in. Obviously, I am taking advantage of my ability to understand the material. If you’re willing to take the time to try to understand these articles and identify weakness in them you can learn a lot about the reasoning behind treatment options that your doctor may offer for you. A good option to refine your Google search is to search for the society associated with the disease process as they may put out material for the general public (Figure 2). This will generally be written by the experts in that field. They will have compiled the results of the best research into a cohesive list of recommendations.

For instance, after searching for the term ‘hemorrhoid’ on the American Society of Colon & Rectal Surgeons (ASCRS) website you will find the following link: https://www.fascrs.org/patients/disease-condition/hemorrhoids. There is even a video produced by the society for the purpose of education.

Figure 2: Googling Hemorrhoids

Of course, information found on websites should not be relied upon for medical decisions, and you should consult with your physician for specific advice tailored to your situation.

Social Media
Nowadays, searching on Google may have become more passé. This is likely truer with patients with chronic diseases. If I am seeing a patient who has been dealing with a problem for a long time, they have probably already read through everything that Google has to offer and now are looking for more advanced options. Social media has completely taken over.

Figure 3: Colitis Ninja is an example of a person with a chronic illness using social media to share information.
Some of the biggest sites/apps include Twitter and Facebook. People are able to seek out others who have dealt with the same problems and found solutions (Figure 3). A drawback of using Facebook is that you will lose your anonymity. Many physicians and medical societies use platforms like Twitter to post alerts (Figure 4). As these posts are quite short, a few words are forced to make a big impact. I suspect that a lot of these posts are preaching to the choir. If you’re following a Twitter feed like the one for the American Society of Colon and Rectal Surgeons you’re probably staying on top of your colonoscopy screening.

Advocacy Groups

The advocacy groups related to a diagnosis you have been given can be helpful as they will also provide up-to-date information regarding treatment options. In addition, they may be sponsoring events you may want to participate in, like a 5K fundraiser, or give you information for a support group you could attend (Figure 5).

Message Boards

Finally, message boards that are independent of major social media sites like Facebook can give you the advantage of the public forum to learn about people’s own quests for health, but with more privacy (Figure 6). From some of these sites you can learn about clinical trials, and some of these will have physicians who are available to answer questions or help you identify questions you can ask of your own doctors.

With the power of the internet, people have more information than ever at their fingertips. It can lead to self-diagnosing that can lead to delays in proper treatment. A good primary care doctor or specialist still cannot be replaced. What the internet has provided though is better access for understanding. You have the opportunity to go to your doctor with a better understanding of what is going on and what the treatment options are. The hope with this knowledge is it hopefully gives you the confidence to pursue the treatment that will ultimately help you with your symptoms.

Figure 5: Online Advocacy Groups can get you in touch with events where you can meet people who have dealt with similar issues.

Figure 6: Smart Patients is an online community that allows you to communicate with other patients who have your diagnosis.

Brian Teng, MD, FACS, FASCRS is a colon and rectal surgeon who practices at Rochester Colon & Rectal Surgery. He went to the University of Minnesota Medical School and completed his general surgery residency at the University at Buffalo. He then completed his fellowship in colon & rectal surgery at Cedars-Sinai Medical Center in Los Angeles. Outside of work he enjoys watching his two daughters grow and discover the world around us.

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Open Your Eyes!  
Gene Therapy is Here

by Matthew Witmer, MD  
Retina Eye Associates of Western New York

If you have been thinking that gene therapy is the stuff of science fiction that will take decades to achieve clinical application, think again. During December of 2017, the FDA approved the first gene therapy for a genetic disease when it approved LUXTURNA™ (voretigene neparvovec-rzyl) (Spark Therapeutics, Philadelphia, PA) for the treatment of an inherited retinal disease. The medication is indicated for the treatment of patients with confirmed biallelic RPE65 mutation-associated retinal dystrophy.

Patients with this gene profile have lived their entire lives with visual impairment or blindness and have been repeatedly told by medical professionals that no treatment was available. These patients have typically been previously diagnosed as either Leber’s congenital amaurosis (LCA) (Figure 2A) or retinitis pigmentosa (RP) (Figure 2B). The approval of gene therapy for the eye was the culmination of decades of basic science and clinical research and was proof that gene therapy is a legitimate avenue for clinical therapies.

What is Gene Therapy?
Gene therapy is the transplantation of normal genes into cells in place of missing or defective ones in order to correct genetic disorders. This transfer of genetic material can be achieved using viruses as messengers.

In the case of biallelic RPE65 mutation-associated retinal dystrophy, the RPE65 gene encodes an important enzyme in the visual cycle. The loss of function of this gene can cause an inherited retinal disease that is progressive and blinding. LUXTURNA™ (voretigene neparvovec-rzyl) works by using an adeno-associated virus (AAV) to transfer the gene into the retinal cells. A phase 3 clinical trial with the medication revealed improved ability for a patient to complete mobility testing at increasingly dimmer levels of light. Patients that have undergone the treatment have described life-changing experiences after the treatment including the ability to see stars at night, recognize faces, and improved mobility.

Why the Eye?
The eye has long been thought to hold promise as a primary site for gene therapy success. There are several reasons for this and they include: 1) there are many inherited causes of blindness that are mediated by a single gene, which could be targeted with gene therapy; 2) the eye is an immune privileged site because the vitreous humor contains relatively few cells that initiate immune responses; 3) eyes come in pairs and allow for a potential control eye and treatment eye in clinical trials; 4) the monitoring of disease progression or regression is readily available with current imaging modalities; and 5) the eye provides a readily accessible organ for surgical manipulation by standard operating techniques. These are the same techniques that I use each time that I am in the operating room.

Why the adeno-associated virus as a vector (AAV)?
Adeno-associated virus is a 25-nm nonenveloped virus containing linear-stranded DNA. This virus is commonly selected for gene therapy trials because of its low immunogenicity and high tolerability. The virus is particularly valuable for gene therapy in the eye because of its high retinal affinity.

How does it work?
Luxturna delivers a functional copy of the RPE65 gene to cells that contain mutated versions of this gene. The AAV serotype 2 delivers this functional copy of the RPE65 gene to retinal pigment epithelial (RPE) cells. It is estimated that 1-2,000 people in the U.S. may be eligible for this therapy.
How is it done?
LUXTURNÄ™ (voretigene neparvovec-rzyl) is administered by subretinal injection during a vitreoretinal surgical procedure. The surgery consists of a standard vitrectomy in order to gain access to the subretinal space. The preparation of the medication is under sterile conditions and the medication must be administered within 4 hours of preparation. Once the pars plana vitrectomy is completed, a subretinal cannula is introduced into the eye and the site of the injection is identified (Figure 3). The recommended site is along the superior vascular arcade, at least 2 mm distal to the center of the fovea (Figure 4). The goal is avoid direct contact with the retinal vasculature or with areas of pathologic features, such as atrophy and scarring. 0.3 ml of volume is then injected subretinally.

What does it cost?
A central question with the advent of clinical gene therapy remains the price of such incredible innovations. Spark Therapeutics set the price of LUXTURNÄ™ (voretigene neparvovec-rzyl) at $425,000 per eye. Such an exorbitant price requires creative solutions to find a way to afford this. The manufacturer has allowed insurance companies to purchase the medication directly, rather than having treatment centers purchase it first. The pharmaceutical company also has suggested that the cost of the medication would be rebated if the sight of the patient does not sufficiently improve.

Future Directions
The advent of clinically available gene therapy treatments is monumental. This new age will change the way we manage patients with inherited retinal diseases. Many patients with inherited retinal diseases now merit genetic testing because this could influence treatment decisions. In addition, patients with other retinal dystrophies may be eligible for several of ongoing clinical trials using gene therapy. There are currently gene therapy clinical trials for the treatment of the following retinal conditions, including choroideremia, X-linked retinitis pigmentosa, Stargardt’s disease, Usher syndrome, Achromatopsia, and X-linked retinoschisis, among others. It is only a matter of time until additional gene therapy treatments become approved and are available to improve the lives of our patients. Keep an “eye” out for them.

Matthew Witmer, MD is a vitreoretinal specialist in private practice at Retina Associates of Western New York. His office is located in Brighton, NY. His practice consists of the medical and surgical treatment of diseases that affect the retina. He is originally from Rochester, NY.
SURGERY of the FUTURE
Meets the DIGITAL AGE

Exciting innovations are revolutionizing surgery for both patients and doctors.

by Raymond J. Lanzafame, MD, MBA, FACS

A teacher of mine once said that people will look back someday on much of what we think is cutting edge, and highly scientific care and will find that our practices were based on a lack of knowledge and were even barbaric. Think about some of the medical and surgical practices of past centuries. Cutting holes in people’s skulls, cauterizing wounds with hot irons, blood-letting, leeches and other practices have thankfully faded into surgical history. There undoubtedly will be many more therapies that will join them as we learn more and develop even more advanced techniques and technologies.

What will the surgery of the future be like? Will it be like the surgery in science fiction? Sci-Fi surgery often shows independent self-directed robots wielding laser beams that can cut, repair and transform tissues. Machines and humans are coupled to each other to work seamlessly. Functioning “bionic” prosthetic limbs and organs return heroes to “normal” or give them enhanced or superhuman capabilities.

Microminiaturization was featured in the 1966 Sci-Fi classic Fantastic Voyage. Scientists and the military inject microrobots into the body to repair damaged tissues and organs or to battle infections or other ills. Tissue fragments are used to reconstruct and regenerate whole individuals. This is a topic that Woody Allen pokes fun at in the classic movie Sleeper as he works to prevent doctors from cloning the Leader from his nose which was the only part of him that remained from an assassination attempt. The Fifth Element is regenerated from a small fragment of her finger in the movie by the same name. There are many more examples of futuristic surgery, and of course many where science and technology go haywire or are being used by a host of villains in the Sci-Fi and spy worlds.

What if any of these technologies are a reality or within the realm of possibility, and how will surgery be transformed in the digital age? There is an ongoing trend moving from invasive to less invasive and noninvasive procedures to treat disease. Blurring of the boundaries of surgery and surgical specialists is happening as doctors in various fields apply minimally invasive, image guided, endoscopic, endovascular and other techniques to solve increasingly complex problems.

Surgery and surgical care are being transformed by science and engineering to create new devices and technologies for clinical applications. We are witnessing the development of new ways to close wounds without using stitches or staples with the introduction of flexible endoscopic cameras and tools, and advanced tissue glues, sealants, and other novel technologies. It is possible to destroy tumors without an operation using MRI guided focused ultrasound ablation (MRgFUS). This advanced technology combines high intensity focused ultrasound (HIFU) with MRI imaging and is being applied to destroy tumors of the prostate and fibroids of the uterus nonsurgically. The so-called cyber knife and gamma knife are being used to treat brain tumors and other lesions. Further improvements in these technologies will enhance our ability to treat diseases and will replace more invasive procedures. Brachytherapy, radiofrequency ablation and selective targeted drug therapies are being applied more broadly. Advances in developing monoclonal antibodies and in creating and applying nanoparticles and other special molecules are being used to target tumors.

Advances in imaging and imaging technology are beginning to transform surgical diagnosis and therapy. The dream of performing real-time, tissue sampling and virtual microscopic examinations without having to perform a surgical biopsy is moving rapidly from the laboratory to clinical practice. Color 3D x-ray spectral CT imaging has recently been developed. This technology appears to have many advantages over present day MR imaging. It can identify a number of tissues and their make-up, not to mention the fact that it can be used in patients with metal implants.
are ushering in a new era of regenerative medicine and depicted in the mini-organs including liver, cartilage and cornea. These feats cells and 3D technologies to produce various tissues and kidneys in TED Talk presentations. Others have used stem urinary bladders and has demonstrated functioning printed 3D bioprinting technologies. He has produced and implanted He has successfully produced whole organs and tissues using Regenerative medicine is being combined with 3D printing and without being dependent upon donors for organs and tissues. The ability to produce on demand mesh, implants, tissues and organs is on the near-term horizon. Imagine being able to produce tissues and organs and to transplant them into a person without the need for immune suppressant drugs and without being dependent upon donors for organs and tissues.

Photoacoustic imaging uses specific wavelengths (colors) of light to probe tissues much like the way sound waves are used in ultrasound. This technology has been adapted for studies of blood vessels, and more recently, is being used for breast imaging. High resolution 2D and 3D images of breast tissue are captured after a single exposure and without having to squeeze or compress the breast tissue as is the case with current mammograms. Other applications have been developed to examine skin, subcutaneous and other structures. Since these technologies use laser energy for diagnosis, they have also been adapted to use those same wavelengths to destroy specific lesions.

Additive manufacturing and 3D printing technologies are advancing rapidly and are transforming a number of industries, including health care and surgery. The use of these technologies to produce full scale anatomic models for training and for preprocedure planning and practice, prior to an actual operation is becoming more common. Other applications include custom design and fabrication of orthopedic appliances and implants, as well as prostheses and other devices that are created to match the actual anatomy of a specific patient.

Robotic systems will continue to evolve, with enhanced ability to sense tissue texture and pressure, recognize and identify tissues with real time diagnostic capabilities, and improved visualization. Less expensive, smaller and less cumbersome systems will enable these devices to be used more widely. Some of these features are already being realized in systems that are near release from such giants as Medtronic and Verb Surgical which is a joint venture of Google's Verily Unit and Johnson and Johnson's Ethicon. There are many other potential entrants in the marketplace, including devices that can self-assemble within the body, flexible robotic instruments and yes, even microbots which have been demonstrated in laboratory environments. Intuitive Surgical is continuing to bring advanced procedures to people in remote and distant locations. The current systems still require a human surgical team at the patient's bedside in the operating room. This is not quite the entirely autonomous robotically controlled surgery commonly seen in Sci-Fi movies. However, Michael Treat from Columbia University has developed Penelope, a robotic scrub nurse that can recognize, learn, pass and exchange surgical instruments. Further refinements of assistants like Penelope can indeed bring us closer to the vision of surgery in the future as seen in the movies.

No discussion of surgery in the digital age would be complete without considering robotics and computer-assisted surgery. The concepts behind the introduction of robotic surgery in the late 1990s and the early 21st century reproduce the hand motions of a surgeon with greater precision, and provide high-definition 3-D video images thereby enhancing the surgeon’s ability to view the operative field. These features produce results that exceed the capabilities of human performance. It is possible to perform surgical procedures at extreme distances between the surgeon and the patient by computerized translation of the surgeon's actual hand motions to surgical instruments placed in the patient's body. The real-world demonstration of the capability and power of telesurgery was pioneered in 2001 by Jacques Marescaux of Strasbourg France and later by David Williams, a Canadian surgeon and NASA astronaut, and Mehran Anvari of McMaster University in Toronto who conducted the NEEMO project. The McMaster group also performed surgery in remote Yellow Knife in Canada's Northwest Territories from their laboratory in Hamilton Ontario. The limits of telesurgery are bounded by the time it takes for the motions executed by the surgeon at the surgeon's console to be translated into actions by the instruments placed in the patient's body.

The applicability of robotic systems in the extreme distances of outer space is impractical given the limits imposed by the time needed to transmit and receive communications between the master and the remote or slave unit. However, these efforts demonstrate the power of these technologies to bring advanced procedures to people in remote and distant locations. The current systems still require a human surgical team at the patient’s bedside in the operating room. This is not quite the entirely autonomous robotically controlled surgery commonly seen in Sci-Fi movies. However, Michael Treat from Columbia University has developed Penelope, a robotic scrub nurse that can recognize, learn, pass and exchange surgical instruments. Further refinements of assistants like Penelope can indeed bring us closer to the vision of surgery in the future as seen in the movies.

Regenerative medicine is being combined with 3D printing technologies by Dr. Anthony Atala at Wake Forest University. He has successfully produced whole organs and tissues using 3D bioprinting technologies. He has produced and implanted urinary bladders and has demonstrated functioning printed kidneys in TED Talk presentations. Others have used stem cells and 3D technologies to produce various tissues and mini-organs including liver, cartilage and cornea. These feats are quite extraordinary and while they aren’t to the extremes depicted in the *Fifth Element* and other Sci-Fi features, they are ushering in a new era of regenerative medicine and transforming transplantation surgery.

continued on page 14
standard laparoscopic instruments such as staplers in order to accomplish some portions of the operation.

Another feature of computer-assisted surgery that should not be overlooked is the ability of individuals with limited training and experience to successfully accomplish complex surgical tasks using these technologies. The ability to provide care in field forward and remote locations, including space or deep sea environments, is one of the features on the wish list of DARPA which was one of the original and major funders of research and development of these technologies.

Yet another area of computer assisted and robotic technology involves advanced image-guided solutions and a growing array of techniques that merge advanced visualization technologies that allow doctors to target and treat diseases using augmented reality systems. The surgeon is able to view internal organs from various perspectives with access to fine anatomical details. Augmented reality systems will allow the visualization of volumetric information projected directly on the patient's organ during an operation. Patrick Kelly demonstrated the potential of these techniques in the early 1980s. He was able to merge CT scan images and stereotactic positioning of patients with a CO₂ laser equipped with a scanner to perform delicate advanced neurosurgical procedures to remove brain tumors and other lesions. His early work is being refined with more modern technology. This is another example of future tech that may indeed usher in the capability of artificial intelligence directed surgery, bringing Sci-Fi closer to our daily reality.

This is a brief overview of current trends that are already transforming surgical care and that will further advance our capabilities in the future. The future is exciting and technology has much to offer. The seemingly fantastic procedures and technologies of Star Trek, Star Wars and Sci-Fi are no longer figments of fertile imaginations. They are increasingly becoming realities of the digital age.

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Q How do I know if I have the flu or if it’s just a bad cold?

A Short answer: You have the symptoms of a typical cold but feel like you’ve been hit by a train.
Long answer: As a pediatrician who has seen hundreds of patients with the flu over the past 17 years, I can say that there are a few symptoms that really stand out. Typically patients will present with symptoms that are common with many viral colds: runny nose, cough, sore throat, and fever. However, I tend to find that those with influenza frequently have significant muscle aches, especially of the lower back and calves, as well as chills, eye pain, and headaches. My partners and I have also recognized the “pajama sign” in our older pediatric patients: tweens and teens may come to an appointment dressed in their pajamas because they feel so lousy.

It can be difficult to determine if a patient has the flu or another virus, so it can be useful for a physician to obtain a flu test. Testing is helpful if the patient has had symptoms for less than 48 hours and he or she would like to try oseltamivir (the generic of Tamiflu) to reduce symptom duration by a little more than a day. Testing is also helpful if a patient has medical conditions that make influenza infection more dangerous or if there are other family members in the home that would benefit from taking oseltamivir to prevent infection. As always, these are great discussions to have with your own health care provider.

As a patient who has had the flu three times in the two decades since starting medical school, I can attest to the fact that no other illness has made me feel as bad as the flu, with the chills and muscle aches being the worst part of the illness. That is why I get the flu shot every year. While I admit that the flu shot is not perfect, I have been pleased that I’ve only had the flu three times despite being exposed to the virus for weeks at a time in the winter. Finally, I’m very aware that influenza and its complications killed about 80,000 people last year – reason enough to protect myself, my family, and my patients by giving them the flu vaccine.

This answer was provided by David A. Topa, MD, a pediatrician with Pittsford Pediatric Associates.
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