

DANIEL BURRUS'

TECHNO TRENDS

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THE BIG IDEAS THAT ARE
CHANGING EVERYTHING

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The Virtual ER Is Here Today, Saving Time and Money

By Daniel Burrus, CEO of Burrus Research

Twenty years ago, I predicted that when the exponential and predictable progress of processing power, storage, and bandwidth—what I called the three digital accelerators—reached the levels we would have by 2010, we'd start seeing virtual hospitals, which would lower costs, improve efficiency, and ultimately change healthcare. In my latest New York Times best seller *Flash Foresight*, I wrote that the digital accelerators are now here, and so is the virtual ER.

Of course, a virtual ER can't treat broken legs or emergencies that need hands-on medical procedures. But every day there are a large number of people in U.S. hospital ER waiting rooms who don't need that sort of high-level medical attention.

A number of years ago, an ER doctor named Dr. Alan Roga was working his shift and noticed that there were a lot of patients using the ER for non-emergency treatment. This is expensive and time consuming for everyone involved, the hospital as well as the patient. Dr. Roga wondered, "How many illnesses are routinely treated in the ER that don't require hands-on diagnosis and treatment? What kinds of things could I diagnose and treat by just seeing someone via a video connection, hearing their symptoms, and reviewing their medical history?" He knew he was on to something.

It didn't take long to validate his thinking. Statistics from health insurance companies as well as a National Ambulatory Medical Care survey revealed that of the 136 million annual ER visits, over 66% are non-emergencies. In addition, 70% of patients do not have same-day access to their doctor, and the average ER visit costs \$2,028.

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TECHNOLOGY NEWS HIGHLIGHTS

Afterlife for Car Batteries

By the year 2020, it's estimated that there will be about one million used batteries from electric vehicles coming available for secondary use every year. And while these batteries are no longer



within spec for keeping a car running on the road, they may have up to 80 percent of their capacity left. So, researchers at Oak Ridge National Laboratory are looking at ways to squeeze a little more life out of them before they're recycled.

Working in conjunction with the U.S. Department of Energy (DOE), General Motors (GM) and ABB Group, they've designed a new platform that utilizes old lithium ion batteries to provide back-up energy to businesses and homes. The system, which is made up of five Chevrolet Volt batteries, can provide 25 kilowatts of power and 50 kilowatt-hours of energy. The group has also demonstrated that a similar battery pack can store electrical power and feed it back to the grid. The platform would not only reduce energy costs, but allow for increased grid stability and reliability.

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3D Printed Trachea

In an unprecedented example of how 3D printing is likely to transform medicine, an infant was recently saved by a bioplastic windpipe that was constructed using a 3D printer.

Kaiba was born with tracheobronchomalacia, a condition in which the



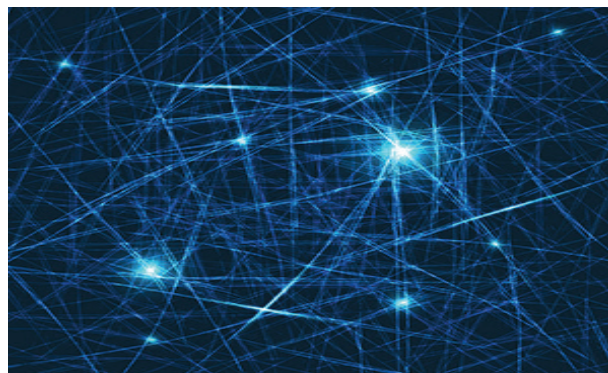
airway walls are weak and prone to collapse. Using high resolution images of his trachea and bronchus, computer-aided design (CAD) software and a 3D laser printer, doctors were able to create a personalized splint that was surgically sewn around his airway. Within three weeks, Kaiba was taken off ventilator support. The splint will provide a scaffold to help Kaiba's windpipe grow properly. In about three years it will be reabsorbed into his body, leaving his own stronger, healthier airway that will continue to grow with him.

Tracheobronchomalacia affects about 1 in 2,200 babies to varying degrees. Although most outgrow the condition by the age of 2 or 3, severe cases, such as Kaiba's, can be life-threatening.

This is a good example of how 3D printing is enabling the personalization of medical implants.

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“Thinking” Computers



Machine learning continues to make enormous strides as researchers refine computer processes to better simulate the functions of the brain. While large amounts of data can help supercomputers (such as IBM's Watson) predict the most likely answer to a question, data mining alone cannot discern the meaning of a sentence. Machine learning is the key to helping computers actually develop strategies for solving problems.

This was recently demonstrated in a global competition of computer shogi (Japanese chess) programs and five professional shogi players where the computers took the five-game match with three wins, one loss and one draw. In designing these programs, computers processed records of previous shogi games to “learn” how to win. A project is now underway to test whether a computer can pass the Japanese nationwide college admission test by 2016 and the University of Tokyo entrance exam by 2021.

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Dirt-Proof Paint



A self-cleaning paint has been developed that mimics the complex leaf structure of the lotus plant to minimize adhesion of dirt particles and microbes. Made with titanium oxide and silica, the paint acts as a photocatalyst when exposed to ultraviolet light; breaking down air pollutants (e.g. gas emissions, oils and organic molecules) that may collect on its surface and inhibiting discoloration. Because it's also hydrophobic, water droplets flow off the surface without being absorbed into the paint, taking dirt and dust particles with it.

The environmentally-friendly coating differs from other similar types of paint mainly because the use of locally-sourced additives makes it much more affordable. By reducing the need for frequent washing, the associated water usage and the surface damage to building exteriors caused by detergents and high pressure washers, it's expected to cut down significantly on building maintenance costs. A version for automotive use is also in the works.

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Cloning Stem Cells



Researchers recently made a tremendous advance toward the production of human embryonic stem cells (hESCs) using a cloning technique similar to the one that created Dolly the sheep sixteen years ago. Since scientists discovered a way to turn ordinary skin cells into what are known as induced pluripotent stem cells (iPS cells) interest in hESCs had been waning. iPS cells behave somewhat like hESCs, however, it's been shown that iPS cells tend to accumulate mutations and abnormal gene activations as they multiply. So the quest continued.

In 2007, embryonic stem cells were created using monkey egg cells and the Dolly cloning method. In this latest research, the technique was applied to human egg cells fused with skin cells to produce colonies of hESCs that can theoretically turn into any type of tissue needed. The process was successful on about half of the donated eggs, and some of the resulting hESCs have been able to be turned into healthy tissue.

This work may someday make it possible for new tissues and organs to be generated using a patient's own cells, effectively eliminating any risk of rejection.

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Bakery-Scan is expected to become commercially available in the U.S. soon at a price of about \$20,000. It can also be adapted to identify other items by shape and color, such as fresh produce or medications.

For information: Brain Corporation, QRC-1301, 5665 Morehouse Drive, San Diego, CA 92121; Web site: www.brain-corporation.com

Smart Cash Register



A new system called Bakery-Scan uses point-of-sale (POS) visual recognition to automate the check-out process. It addresses a need that plagues many businesses where employee turnover is high and learning curves need to be reined in.

For example, one Tokyo bakery – finding it costly and time-consuming to train its employees on the names and prices of more than a hundred varieties of baked goods – resorted to cellophane wrapping and bar codes to increase speed and accuracy. But sales dropped by over 65% because customers didn't like their bread pre-packaged. So they dropped the bar codes and switched to using a system that uses a camera positioned above a backlit counter. Images of the merchandise are compared to a database of products to identify the item and its price with an accuracy of 98 percent. If the system isn't sure, it will give the operator a list of possibilities, and use their selection to fine-tune its own definitions and become more accurate over time.

Microorganism Power

An innovative, patented process for converting carbon dioxide (CO₂) into highly pure methane is ready for licensing accord-



ing to its developer. The method is based on the natural metabolic processes of microorganisms called “archaea” – one of the oldest living species on earth – and stands alone in the category of “4th generation” biofuels.

First, second and third generation biofuels rely on the availability of large amounts of biomass and have the disadvantage of competing with arable land for food crops. The new process uses a highly-controlled bioreactor system to convert CO₂ and hydrogen directly into methane, which can later be used to generate electricity.

An important application of this for harnessing renewables (such as wind and solar) and storing their energy for later use. As renewable power is generated, it can be used to drive an electrolytic reaction to remove hydrogen from water. Rather than needing to store the hydrogen (which has proven to be problematic and, therefore, expensive) it can be used, in turn, for the methane-generating reaction. The stable, storable methane can then be tapped as needed.

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Quartz Data Storage



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A new medium for archiving digital data has been developed that utilizes thin slivers of quartz, fused together to form multiple layers. Data is recorded using a laser and can be read with a standard optical microscope. At four layers thick, the storage density is only a little better than a CD, however, additional layers can be added to increase the amount of information.

Due to its remarkable durability, the technology has been dubbed “semi-perpetual” storage, and is expected to be used initially for storing historical legacies, public documents and even personal data that people wish to preserve for generations. It’s not only waterproof, resistant to chemicals and undamaged by weather – it’s also highly heat resistant. Even after being subjected to temperatures of 1000 degrees Centigrade for two hours, data could be read without degradation, leading developers to believe that long-term storage on the order of hundreds of millions of years may be possible.

The Virtual ER Is Here Today, Saving Time and Money

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Soon after, Dr. Roga created Stat Doctors. Based in Phoenix, Arizona, Stat Doctors is a virtual ER offering anytime, anywhere care that can treat conditions such as allergies, arthritic pain, asthma, bronchitis, cold and flu, ear infections, insect bites, pink eye, rashes, respiratory infection, sinusitis, sore throat, sprains and strains, sports injuries, skin inflammation or cellulitis, and many more. All of these conditions and more can be treated using the virtual ER.



Stat Doctors is a web-based virtual ER. Currently, a hospital, healthcare provider or employer signs up for Stat Doctors and then puts all of their members or employees into the Stat Doctors system. To date, Stat Doctors has developed an impressive track record of not only dramatically lower costs, but they also serve patients far better as evidenced by their high patient satisfaction scores. In fact, 99% of their patients say they would recommend and use Stat Doctors

again. Currently Stat Doctors has over 750 board certified emergency room doctors and that number is growing rapidly. And in the future, I would predict that they will offer individuals the ability to enroll and have access to their service directly.

I recently used Stat Doctors because I had the first signs of a sinus infection, and I had to fly out to Asia the next day to give a speech. My doctor's office did not have any openings to see me, so I decided to try Stat Doctors. I had already pre-registered and given them my medical history. So all I had to do was log-in. And since the service is available 24/7, I didn't need an appointment. Within 10 minutes I was connected to a board certified emergency room MD.

During that 10 minute wait, the doctor was reviewing my medical history, and I was reading his bio so I knew who I'd be speaking to. When the 10 minutes was up, a SKYPE-like video on my laptop turned on and I was connected to the doctor via visual communications. I told the doctor my symptoms. He determined that I had a viral sinus infection and that I didn't need a prescription, but he did recommend some helpful over-the-counter medications. I followed through on the suggestion and by the next

day I was already feeling better and on my way to Asia.

If I had needed a prescription, I would have selected a local pharmacy and I would have been able to pick up my prescription in a few hours.

I thought the system was fantastic. Even better, my out-of-pocket cost was only \$60, a fraction of the \$2,028 I would have paid if I had gone to the ER. Plus I didn't have to drive anywhere. I did the visit from the comfort of my home. I could've done it from a hotel room, from an airport, or anywhere. Best of all, I didn't have to wait in a hospital ER.

Stat Doctors is a pioneer in virtualizing emergency room service. And thanks to smart phones, health apps, and diagnostic sensors that plug into the smart phone, we'll be doing more and more remote health diagnostics in the near future. In fact, in a few more years, it will be common for doctors to once again make house calls ... only it'll all be done virtually.



Watch Daniel Burrus' latest Know What's Next Video on the Virtual Emergency Room at www.YouTube.com/DanBurrus



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