Electronic Device Design, Part II

More medical devices are being designed with electronic components that enhance the overall functionality and/or efficiency of the product. It is interesting to theorize where these electronics may take healthcare. For this month's Perspectives, we received a large number of responses so be sure to check out the other Parts of this feature.

Looking ahead, what technology will educe the biggest breakthroughs in electronic medical devices?

John Zaleski
Ph.D.Medical Device Integration Consultant, www.medicinfotech.com *[1]*

Based on my experience, there are three specific technology areas that will draw out the biggest breakthroughs in medical devices. Bear in mind that there is, naturally, clinical functionality that will bring about great breakthroughs in terms of treatment at the point of care. However, in terms of large-scale, systemic impacts on society, the low-hanging fruit can be found in the following three areas.

•Real-time location of medical devices and association with patients via a common, standards-based methodology (e.g., barcode and radio-frequency identification). Associating patients with devices is mandatory to ensure positive patient identification and safety in an operational clinical environment.

•Standards-based (i.e., non-proprietary) data and information sharing among devices with emphasis on storage and retrieval of device data with enterprise health information systems. Ensuring compliance of individual devices—especially BP cuffs, glucometers, and spirometers—using an HL7 based standard will be necessary to ensure common communication and minimize custom development.

•Plug-and-play medical device operation with universally available, low-cost home-health monitoring appliances that can facilitate chronic disease management for the aging population. The ability to bring data to the family practitioner quickly and easily will be necessary to facilitate quality care for the ever increasing aging baby boomer population.

Les Landsberger
CTO, Microbridge Technologies

Oleg Grudin
VP Engineering, Microbridge Technologies

MEMS-enabled sensing of very low differential pressures will bring breakthroughs in medical fields related to respiratory function.

As the global population matures, medical care givers are seeing more and more

patients with age-related problems, not least of which is sleep apnea. The success of continuous positive airway pressure in the treatment of this disorder relies on accurate sensing of very low differential pressures in a breathing apparatus in order to collect specific information about the patient's breathing rhythm.

However, in order for these health advances to be practical on a wide scale, the equipment (apparatus for measurement of, and influence on breathing) must be made more mass-producible, resembling more sports equipment than lab instrumentation, more for home- and individual-care than for a medical installation, requiring little-to-no maintenance and/or supervision, and even being disposable. In order to move along this path, the sensors still need to have outstanding and robust performance, but also need dramatically reduced size and price points. Now MEMS-enabled sensors are emerging that meet these requirements, allowing the sensors to be placed directly into the breathing masks.

In general, many of the technical issues in respiration measurement are common to the whole respiration field, not only sleep apnea. Cost-effective measurement of air flow in breathing tubes, vents, and passages is finally being addressed by new MEMS-based sensors for very low differential pressures.

Dave Beckstoffer
Product Specialist, Portescap

Advancements in motor technology will provide major breakthroughs in electronic medical devices, in terms of power, efficiency, and "Green."

Design improvements in terms of motor construction and materials are creating a new generation of motors, providing higher output power for the same or lower input power. In multi-axis devices, the reduction in required power leads to less strain on the overall power requirements of the medical office or hospital. Considering the multitude of devices utilized in these environments, reductions in power levels can see great benefits by lowering energy costs. These powerful

motors can eliminate previous mechanical components, such as gears or belt drives, which extends the life of the device and allows it to operate more efficiently. Higher grade materials have also allowed the engineers to reduce the size of the motors themselves, again providing a direct benefit to the device designer. Reduction in device size provides a cleaner working environment for the employees of the office or hospital, limiting the chances of accidents.

Such advancements are allowing medical design engineers to begin to experience the benefits of higher power output motors. Overall device performance has increased, while input power requirements are on the decline.

Robert Stanton
Director of Technology, Omnetics Connector Corp.

Today's medical technology is very general and has not learned to focus on the individual DNA or stem cell personalities of each person. New devices that offer cell treatment chip technology programmed with individual personal DNA models are being developed using biological laser enhancement and control chips in combination with older methods of stem cell cup separation. Breakthrough devices that avoid cellular roadblocks will include bio-electrical equipment in a system that uses personal DNA and cell profile devices for individual analysis, coupled to cellular selectors and fusion systems. New cellular insertion devices for minimally invasive placement of hybrid cells in the affected body will complete the treatment. Main solutions will begin with cancer and degenerative biological systems.

L. Brooks Patterson
County Executive, Oakland County, Michigan

Here in Southeast Michigan, we just launched Oakland County Medical Main Street. Medical Main Street is a unique alliance of world-class hospitals, universities, and medical device and BioPharma companies creating a global center of innovation in healthcare, research and development, education, and commercialization in the life sciences industry. Because of our automotive engineering and manufacturing expertise, we feel electrical medical devices is where Medical Main Street will truly shine. There are four areas where the biggest breakthroughs will happen in this field.

•Nanotechnology — Our local Oakland University just launched the Nanotech R&D Institute and it's claiming to be part of the next "industrial revolution." With lighter materials and better electrical conductivity, we see that nanotechnology will make the electronic devices of the future lighter and much more durable.

•PLM (Product Lifecycle Management) — With the efficiency processes and lean production principles that the automotive industry invented, we feel that these same processes will allow the electrical medical devices of the future to be less expensive and of higher quality (zero defects, which is the current goal of the automotive industry).

•Wireless Technology/Integration — We see more of the devices being wireless and being able to communicate/integrate with the other devices in patient care. Medical Main Street is fortunate to have one of the highest concentration of IT companies/professionals in the country.

•Co-Development — With Medical Main Street, we feel new electronic medical devices will be brought to market faster. Our hospitals and device makers are working closer together to test products and quickly evaluate them for patient care. This co-development process between device makers and hospitals greatly reduces time to market.

As part of the government here in Michigan, we are happy to make these

connections with Medical Main Street companies and the rest of the world.

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