CHANGING & SAVING LIVES:

Coulter Grants Foster Innovation, Collaboration

Imagine an expectant mother and her baby being accurately monitored for complications as the mother goes about her normal day. Imagine detecting a potentially lethal pressure sore before it even troubles the hospitalized patient. Imagine breast cancer surgery with an intraoperative test to evaluate the surgical margins right away. These life-changing technologies are closer to becoming a reality, thanks to grants from the Drexel-Coulter Translational Research Partnership program.

The Coulter program's focus is on bringing beneficial biomedical products to commercialization. To accomplish this, "a multidisciplinary approach is essential," explains Davood Tashayyod, M.S., Coulter project director. "Clinicians know what the unmet needs in health care are and what kinds of tools work in a patient care setting. At the same time, they need engineering expertise to develop relevant solutions."

The one-year awards, which provide around $100,000 in direct costs, help researchers accelerate their discoveries along the path toward clinical application. Supported by a $20 million endowment, the grants also foster an environment of synergy and collaboration between Drexel clinicians and the engineers of Drexel's School of Biomedical Engineering, Science and Health Systems. Four of six 2012-13 grants involve faculty from the College of Medicine.

Continuous Maternal/Fetal Monitoring

One Coulter-funded team is developing an innovative bellyband that continuously assesses maternal and fetal well-being. "We have monitored pregnant women and their babies in the same ways for 30 years," says co-principal investigator Owen Montgomery, M.D. (HU '81), chair of the Department of Obstetrics and Gynecology. "Right now, they can be monitored externally, which restricts movement and can be inaccurate; or internally, which is much more precise but highly invasive to mom and baby," he explains.

The smart fabric bellyband is knitted together from standard and conductive yarn on a specialized knitting machine. It can accurately monitor maternal and fetal heartbeats, as well as detect uterine contractions, and transmit the data wirelessly. This is a vast improvement over current external monitors, which lose track of the fetal heart if the baby moves. With the smart fabric bellyband, the entire garment continuously assesses the heartbeat. "Plus," Dr. Montgomery adds, "women can wear it comfortably at home or at work 24 hours a day, without being restricted to bed, which our current monitors require." The smart fabric bellyband provides "high quality, uninterrupted data that can be received remotely back at the hospital or anywhere in the world."

Averting Pressure Sores

Researchers focused on the prevention of potentially lethal pressure sores also received a Coulter grant. "These lesions affect 2 million to 3 million Americans every year," explains Michael S. Weingarten, M.D., professor of surgery and a co-principal investigator. "They're a major cause of morbidity and mortality [in hospitalized patients]," he adds, "and cost as much as a half million dollars to treat." His group uses infrared technology to detect the deep tissue injury that leads to pressure sores.

For the evaluation, near infrared light is beamed onto the skin using lenses. There is no direct contact with the skin and no patient discomfort involved. The hand-held infrared device measures hemoglobin concentration and oxygenation at several depths beneath the skin's surface. It is critical to assess damage at varying depths since clinicians do not know at precisely what depth pressure ulcers originate. If detected at an early stage, deep tissue injury might be reversible.

"We're hoping that this noninvasive device can be used to detect early tissue damage in at-risk patients, before it can be seen," Dr. Weingarten says. "Then, we can intervene with special mattresses or therapies to maintain skin integrity."

Better Breast Cancer Surgery

Advanced infrared technology could also prove life-saving for women who undergo a breast lumpectomy. According to Ari D. Brooks, M.D. (HU '92), associate professor of surgery and co-principal investigator, 30 to 60 percent of these women must return for additional surgeries because there is no reliable way to evaluate the tumor margins intraoperatively.

The technology being developed through this renewed Coulter grant allows patients to avoid the pain, inconvenience, and risk of a second operation, and begin therapy more quickly. “Since the 1980s we’ve been doing more and more conservative surgery for breast cancer,” Dr. Brooks explains. “The downside is that there’s no good technique to tell us if the tumor margin is clear of any cancer while we are operating. With a reliable intraoperative test for residual cancer cells after the initial excision, we can do any further excision required almost immediately.”

The procedure involves using quantum dots in staining tissue removed from the patient. If the tissue fluoresces over the course of 30 minutes, cancer cells are present; more tissue can then be excised and tested. Since all testing is done outside of the body, there is no risk to the patient. Clinical trials are currently in progress. “If we have convincing data from 20 or so patients … we’ll move forward with a commercial enterprise to help make it more widely available with a larger trial,” Brooks says.

Improving Intubation in the NICU

A fourth Coulter grant involving College of Medicine faculty is looking at the use of ultrasound in lieu of X-ray imaging to check the position of endotracheal tubes in neonates. Jane McGowan, M.D., professor of pediatrics and director of the neonatal intensive care unit at St. Christopher’s Hospital for Children, is co-principal investigator of the study, which is also investigating ways to improve the images, both by manipulating parameters of the ultrasound and by modifying the tube itself. (The project is described in detail in the College newsletter, *Pulse*.) If the study is successful, the findings could have broader clinical applications.

Moving Forward

“Our goal at Drexel is humanitarian. We do not aim to get any money back on the investment we are making,” says Tashayyod. Indeed, the ultimate hope of the Coulter program is to save or improve lives by putting deserving technologies into the hands of those who are poised to make a real difference for patients. ■

For more information about Drexel’s Coulter program and the grants described here, visit coulter.drexel.edu.