NEWS in Science and Technology

from the

Connecticut Academy of Science and Engineering

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The following is an Executive Summary of the Academy's quarterly Bulletin (Vol. 23,4) that includes topics and issues in science and technology deemed by the Academy to be both timely and relevant to Connecticut's interests. Each item is briefly summarized from press releases and reports of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. Hyperlinks are included to the original online source, where more detailed information is available.

NOTE: Online versions of this newsletter and the Bulletin are available on the Academy website at www.ctcase.org.

FEATURE ARTICLE

➢ PERSONALIZED MEDICINE … The 'Medical GPS' of the Future?

Experts agree that personalized medicine, the use of genetic markers to help predict a person's likelihood of contracting illness or reacting badly to particular medications, will revolutionize the medical field. They also agree that integrating the technology of personalized medicine with traditional clinical assessments has the potential to be good for patients, doctors, insurers and pharmaceutical companies.

Why Personalized Medicine?

According Lawrence J. Lesko, director of the Office of Clinical Pharmacology in the Center for Drug Evaluation and Research at the US Food and Drug Administration:

- Ineffective rates for several classes of pharmaceuticals are relatively high for large numbers of people and some can cause side effects. Adverse drug reactions are the fifth leading cause of death.
- The number one reason patients don't take a prescription drug is because they are afraid that the drug will hurt them.
- Personalized medicine allows doctors to look at how a patient's body will process a given medicine.
- Personalized medicine can increase the predictability of results by 50% in some cases compared with standard medical treatment.

Lesko said using personalized medicine in this way can alleviate patient fears and inconvenience, reduce risks, and eliminate the use of ineffective medicines. He cites impediments to widespread use of personalized medicine as lack of awareness, fear, cost and insurance coverage.

What is Happening in Connecticut?

➢ CASE member Gualberto Ruaño is Director of Genetics Research at Hartford Hospital and president of Genomas. Ruaño and his staff, in collaboration with Hartford Hospital, work with clinicians to help guide treatment decisions for patients who have previously been unresponsive to their medication or have experienced onerous side effects.

- Ruaño and his staff focus on cardiology and psychiatry because of the opportunity to have a significant impact relatively quickly. They only diagnose patients for whom there is a clinically compelling reason to do DNA typing.
- In the last two years, they have helped treat 500 patients.
- DNA typing prior to prescribing the commonly used blood thinner warfarin, for example, has the potential to avoid 85,000 bleeding events and 17,000 strokes annually, thereby improving treatment efficacy, while reducing annual medical expenses by approximately $1.1 billion, according to Ruaño.
- Hartford Hospital, through its affiliate, Clinical Laboratory Partners, has a growing network of 40 locations in Connecticut that are authorized to perform blood draws for DNA typing at Genomas.

➢ The UCHC and the University of Connecticut in Storrs have invested heavily in DNA sequencing technology. CASE member Marc Lalande is professor and chair of the Department of Genetics & Development Biology at the University of Connecticut Health Center (UCHC) in Farmington. Lalande and his group educate clinicians about the potential infrastructure needs of personalized medicine. "We are conducting outreach to clinical departments in hospitals and private practice to help the medical community incorporate personalized medicine into practice."

➢ Lisa Namerow, attending physician, child and adolescent psychiatry, at the Institute of Living/Hartford Hospital Mental Health Network, says genetic testing can provide valuable information but doesn't eliminate all of the guesswork. "The test results don't always mean that the medication won't work, but rather that there is a higher likelihood of side effects or ineffectiveness."

What's Next?

- For personalized medicine to be successful, the business case must be made to pharmaceutical companies. Lesko says the companies understand that if their drugs aren't effective people will stop taking them. According to Lalande, physicians should consider providing genetic counseling services for people who seek genetic testing, "to ensure that the information is correctly interpreted." Lalande and his team are working closely with medical professionals in Connecticut to ensure information sharing and the growth of medical infrastructure to support demand.
- Ruaño imagines a tool similar to the GPS systems used in cars: "as we add more medicines to the database, the 'medical GPS' could immediately lead physicians and patients to their ultimate medical destination, resulting in quicker and more effective treatment. We have numerous opportunities to turn genetic variability into a clinical asset rather than a complication."

Read the whole story at www.ctcase.org/bulletin/23_4/23_4.pdf

NEWS FROM THE NATIONAL ACADEMIES

➢ Forest Management Important for Fresh Water Supplies

Forests process nearly two-thirds of the fresh water supply in the United States by cycling precipitation through the soil. Research shows how water is connected to and moves through forests and how forest structure and composition can alter water quantity and quality. A new report from the National Research Council recommends that future research include predictions about how future changes in landscape

will impact forest hydrology. Research should explore the direct and indirect effects of climate change on water yield and quality, as well as the consequences of wildfires, disease and manmade activity. To better understand implications of human activities, the report recommends scientists develop a next generation of hydrologic models and use remote sensing. The report also urges watershed councils and citizen groups to work with agencies to better protect and sustain water resources.

[http://books.nap.edu/catalog.php? record_id=12223]

➢ Are Board-Certified Teachers More Effective?

Congress asked the National Research Council to examine whether the process of passing the National Board for Professional Teaching Standards (NBPTS) actually identifies teachers who are better at helping students learn, as well as whether the process itself makes teachers stronger in the classroom. The report concluded that board-certified teachers do improve student learning. Students taught by board-certified teachers make greater gains on achievement tests than students taught by other teachers. The report recommended further research into whether the process itself improves teachers' classroom performance. Administrators could encourage board-certified teachers to teach in challenging schools or classrooms or to mentor their colleagues, yet there is little evidence that school systems are using board-certified teachers in these ways. The report concluded that board-certified teachers are unlikely to have the effects hoped for without broader endorsements by states, districts, and schools. It also recommended that NBPTS devote extra effort to continuously evaluating and improving its tests.

[http://books.nap.edu/catalog.php?record_id=12224]

➢ Boosting Fresh Water Supplies with Desalination

Pressure on the nation's limited fresh water resources is expected to continue to intensify. A recent report from the National Research Council explored desalination's potential for boosting future supplies. Advances in technology have reduced the high costs and energy needed for desalination. The process generates less than 0.01% of the water used in the United States, though plants exist in every state. Limited studies suggest that desalination may be less environmentally harmful than other ways to supplement water supplies such as diverting freshwater, but further research is needed. Researchers should also examine the longer-term ecological effects of disposing of the salt concentrate that remains and develop cost-effective, environmentally sustainable disposal options. The report added that several detailed environmental evaluations of new desalination plants also should be conducted, including ecological monitoring before and after a plant begins operating. Research and development are needed to continue lowering desalination's financial costs and energy use, the report said. The report noted that conserving water or transferring it from one use to another will, in most cases, remain a less expensive option than adding water through desalination.

[http://books.nap.edu/catalog.php?record_id=12184]

➢ Booklet Explores National Plant Genome Project

The National Academies have released "New Horizons in Plant Sciences for Human Health and the Environment," a free booklet that explores the potential of the National Plant Genome Initiative—a federal multi-agency project that coordinates research in plant sciences to understand and ultimately harness plants' properties to help meet agriculture, nutrition, energy, and human health needs.

[http://dels.nas.edu/plant_genome/report.shtml]

➢ EPA Stormwater Program Needs Major Overhaul

Radical changes to the US Environmental Protection Agency's (EPA) stormwater program are necessary to reverse degradation of fresh water resources and ensure progress toward the Clean Water Act's goal of "fishable and swimmable" waters, said a new report from the National Research Council. The current regulatory framework for stormwater, originally designed to address sewage and industrial wastes, has suffered from poor accountability and uncertainty about its effectiveness. The EPA asked the Research Council to assess its stormwater permitting program. To provide meaningful regulation, all stormwater and other wastewater discharge permits should be based on watershed boundaries instead of political boundaries, the report found. The program should integrate stormwater management and land management practices and focus less on chemical pollutants in the stormwater and more on the increased flow of water. A watershed-based permitting system should encompass all discharges rather than having many individual permits. Responsibility and authority for implementing watershed-based permits should be centralized with a lead municipality that would work in partnership with other municipalities. Lead municipalities should receive enhanced funding for the increased responsibility, the committee suggested. Stormwater management will be ineffective without also considering land use management, the report noted.

[http://www.nap.edu/catalog.php?record_id=12465]

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