

# MEDICAL INNOVATORS

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## Thank you to the panel members:



Dr. Carl Gold  
Anesthesiologist  
St. Mary's Hospital



Dr. Donald Graham  
Chair, review panel  
Infectious Diseases  
Springfield Clinic



Dr. Shailesh Nandish  
Cardiologist  
Prairie Cardiovascular  
Consultants



Dr. Judith Knox  
Dermatologist  
Springfield Clinic



Dr. Kathleen Campbell  
Distinguished Scholar  
SIU School of Medicine



Dr. Jeffrey Bennett  
Professor, Psychiatry  
SIU School of Medicine

# W

elcome to the fourth edition of Medical Innovators, a program of the Sangamon County Medical Society. Medical Innovators recognizes the scientists, clinicians and other medical providers working within the Mid-Illinois Medical District on significant medical treatments, clinical trials and/or medical research.

Medical Innovators is a partnership among the Sangamon County Medical Society, SIU School of Medicine, Springfield Clinic and The Chamber. Special thanks to our sponsor, Illinois State Medical Society, and to the panel who reviewed the applications. We appreciate everyone's support to spotlight leading physician members and researchers.

This year's Medical Innovators were recognized in Clinical Treatments and Basic Science Research. Interestingly, five of the innovators are younger than 40, and received the distinction of "Young Innovator." This gives me great confidence about the future of medical innovation in our community. The innovators were presented at a reception on March 10, 2016, at the Memorial Center for Learning and Innovation.

As all our innovators reflect, Sangamon County medical professionals are engaged in incredibly innovative work that promises not just to support our county's citizens, but could have significant impact throughout the world.

– Carl Gold, MD,  
President, Sangamon County Medical Society



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## Thrombolysis for Intra-Ventricular Hemorrhage

### Medical Problem:

Intra-ventricular hemorrhage and obstructive hydrocephalus

### Treatment/Research Idea:

Dr. Abdelhak is using a minimally-invasive approach to evacuate the hemorrhage volume in areas to quickly prevent further damage. He is using catheter-based intra-ventricular thrombolysis.

### Project:

Intra-ventricular hemorrhage (bleeding inside the brain) is a catastrophic event that can lead to coma and death. Using a small catheter introduced into the brain like a straw and using powerful clot busters and flushes through the catheter, Dr. Abdelhak can suck the bleeding out of the brain before it causes serious damage. That should help quicken and improve recovery from the brain injury.

Treatment to relieve pressure usually includes surgical placement of a drain in the cerebral ventricles. These surgical drains tend to clog, which requires flushing and/or replacement, sometimes many times. In addition, clots do not dissolve easily, so it can take weeks for the intra-ventricular hemorrhage to resolve.

By placing a thrombolytic agent, tissue plasminogen activator (tPA) inside the cerebral ventricular system, the hemorrhagic clot can dissolve in two to three days and the surgical drains remain open, thus preventing deterioration. Removing blood reduces the risk of needing a permanent shunt.

### Experimental Innovation:

This approach has never been done in central or southern Illinois. Until now, it was only available in large cities such as Chicago or St. Louis.

### Benefit to the Community:

This method will expedite the recovery of these patients. Patients benefit from less time in the ICU, shorter duration of ventricular drain in place, fewer infections, faster recovery of consciousness, decreased need for a permanent shunt and reduced need for surgery.



### Tamar Abdelhak, MD

*Associate Professor, Neurology  
SIU School of Medicine  
Director, Neurocritical Care,  
Memorial Medical Center*

### Research Areas:

Minimally invasive cerebral hemorrhage evaluation; neurocritical care and outcomes based on comprehensive stroke program implementation.

### Project Origination: 2010



## **Glen Aylward, PhD**

*Professor Emeritus  
Departments of Pediatrics and  
Psychiatry  
SIU School of Medicine*

### **Research Areas:**

Developmental assessment/follow-up of infants and toddlers who are at established, biologic, and/or environmental risk.

### **Project Origination:** 2015

## **Bayley Scales of Infant and Toddler Development-IV**

### **Medical Problem:**

An estimated 12-15 percent of children have a developmental delay or disability, and early assessment enables timely intervention.

### **Treatment/Research Idea:**

Dr. Aylward is the first outside author to participate in the revisions to The Bayley Scales of Infant and Toddler Development, which is the international “gold standard” for infant assessment since 1969. This revision is known as Bayley-IV.

### **Project:**

The Bayley IV is an individually administered instrument that assesses the developmental functioning of infants and toddlers (ages 16 days to 42 months). Its primary purposes are to identify children with developmental delay and to provide information necessary for intervention planning. This revision will enhance the clinical utility of the instrument by: 1) improving sensitivity; 2) updating normative data (simultaneously on an international basis with the UK, Australia, France and Canada); 3) improving usability by reducing the complexity of administration and increasing ease of scoring; 4) including caretakers more in the evaluation

process to make the evaluation more “authentic;” and 5) developing new items to assess neurodevelopment and precursors to executive function.

### **Experimental Innovation:**

Dr. Aylward is writing new test items, deleting old ones, changing the scoring format to make the test more sensitive to subtle problems, and including parents more in the assessment procedure, thereby enhancing sensitivity in terms of identifying children who are developmentally at-risk. This instrument will enable timely assessment of five domains: cognitive, language, motor, social-emotional and adaptive functioning. In so doing, Dr. Aylward will enhance the predictive validity of early developmental assessment and better define each infant’s strengths and weaknesses so as to better design intervention strategies to enhance their development.

### **Benefit to the Community:**

Infants and children living in Sangamon County who are at risk for developmental delay or disability will benefit, as will the two- and three-year olds in the SJCH/SIU Pediatrics NICU developmental follow-up program. The Bayley-IV will provide professionals with a valid, reliable and comprehensive assessment.

## Cell Regeneration in the Ear to Restore Hearing

### Medical Problem:

Hearing loss affects more than 36 million Americans. No treatments are approved by the Food and Drug Administration to prevent or reverse hearing loss. Hearing aids and cochlear implants are commonly used but do not produce normal hearing.

### Treatment/Research Idea:

Hearing loss is commonly caused by exposure to loud noise, ototoxic drugs, aging, or disease that damages and kills the hair cells found in the cochlea of the inner ear. In humans, these cells do not regenerate and hearing loss occurs.

However, it is well established that non-mammals such as birds, reptiles, fish, and amphibians can regenerate hair cells and recover hearing function. Dr. Cox's goal is to investigate whether this process could happen in the newborn mouse inner ear where the cells are still immature.

Her findings have led to current studies of the hair cell regeneration process in mice, which are a much closer model to humans than birds or fish. Understanding the genes and proteins involved in the hair cell regeneration process in young mice is a first step to

stimulating successful hair cell regeneration in adult mice and translating these findings to humans.

### Project:

Dr. Cox is investigating:

1) the underlying molecular mechanism 2) the cells that act as the source of the regenerated hair cells 3) and the changes that occur as the mouse ages, which prevents hair cell regeneration from occurring in juvenile or adult mice.

### Experimental Innovation:

Previously, it was thought that mammals never regenerate hair cells. However, all previous work was performed on juvenile or adult rodents. Dr. Cox's work, in collaboration with colleagues at Stanford University, turns over this dogma and demonstrates that the immature newborn mouse is capable of hair cell regeneration.

### Benefit to the Community:

The number of those suffering hearing loss is increasing as the population ages and headphones increase in popularity. Dr. Cox's work aims to provide a treatment strategy that will make hair cell regeneration a feasible treatment for people with hearing loss.



**Brandon Cox, PhD**

*Assistant Professor  
Pharmacology  
SIU School of Medicine*

### Research Areas:

Hair cell regeneration as a treatment strategy for hearing loss.

**Project Origin:** 2009



### **Alberto Colombo, PhD**

*Biomedical Engineer  
Dept of Surgery; Division of Urology  
SIU School of Medicine*

#### **Research Areas:**

Using Shape Memory Alloys to develop a prosthesis for erectile dysfunction.

#### **Project Origination:** 2013

## **Thermal Activated Prosthesis Using Shape Memory Alloys**

#### **Medical Problem:**

Erectile dysfunction is a multifactorial disease that affects approximately 30 million American men and is continuing to rise with the increasing prevalence of diabetes, hypertension and cardiovascular disease. It occurs frequently in the general population and increases with age.

#### **Project:**

Dr. Colombo, working with Dr. Kevin McVary and a team of urologists developed a novel prosthesis that produces a simulated erection without pumps or reservoirs, but instead relies on the intrinsic, robust properties of a nickel-titanium (Ni-Ti, Nitinol) Shape Memory Alloys (SMA). The properties of SMA overcome the drawbacks of existing devices such as the presence of mechanical moving parts (pumps, valves and saline solution between reservoirs), leading to fewer complications related to placement and malfunction. The SMA ultimately extend the longevity and reliability of the prosthesis. This prosthesis simulates a more physiological erection compared to existing devices without the use of mechanical parts.

#### **Experimental Innovation:**

Most urologists are infrequent implanters and they often are not confident enough with the complex procedure that is required for existing prostheses. This prosthesis is easy to implant, does not have moving parts and will be well accepted by all surgeons and thus will make the prosthesis more acceptable to patients. Dr. Colombo is creating highly innovative technologies, including the characterization of the thermomechanical properties of a Nitinol and possibly the creation of a novel Nitinol alloy.

#### **Benefit to the Community:**

The project, in conjunction with the newly-created company Uronext, matches the Sangamon County community's novel spirit of innovation in highly valuable sectors such as medical translational research and has the potential to turn our research into novel opportunities for the community. This multi-disciplinary project will make a meaningful clinical impact in the urology field for the Sangamon County community as engineers and doctors work together to achieve better treatment for erectile dysfunction and improve patients' quality of life.

## Effect of High-dose Vitamin D in Hypertensive African Americans

### Medical Problem:

Hypertension, obesity and vitamin D deficiency in African Americans to help lower blood pressure and cause weight loss

### Treatment/Research Idea:

Dr. Flack's hypothesis is that high-dose vitamin D supplementation in African American hypertensives with severe vitamin D deficiency results in involuntary weight loss and lowers blood pressure. The reduction in blood pressure is over and above that attributable to the intensity and type of antihypertensive drug therapy.

### Project:

Dr. Flack reviewed almost 700 de-identified medical records in an urban hypertension clinic to study whether vitamin D lowered blood pressure and caused weight loss. The project suggests that vitamin D, a safe, cheap and readily available over-the-counter supplement, is useful in helping overweight African Americans with hypertension lower their blood pressure and lose weight. The data clearly show that giving vitamin D to all patients is not ideal. Rather, the likelihood of blood pressure lowering and the weight-loss benefit was linked to giving high-dose vitamin D to African American hypertensive patients with severe vitamin D deficiency.

### Experimental Innovation:

Though physiologically plausible, vitamin D has not been accepted as an effective therapy for either weight loss or lowering blood pressure. Dr. Flack's work clearly suggests the potential benefit of screening for low vitamin D levels in hypertensive African Americans and supplementing with oral high-dose vitamin D to those with severe deficiency. The use of vitamin D supplementation in this manner is highly innovative.

### Benefit to the Community:

The most direct benefit would be to the African American residents of Sangamon County with hypertension who are also overweight. Though vitamin D deficiency is more common in African Americans than Hispanics or Caucasians, non-African Americans with vitamin D deficiency could expect to see similar results.

Among persons with hypertension, including African Americans, Dr. Flack's data have shown that concurrent obesity is linked to pharmacological resistance to antihypertensive drug therapy. If proven, vitamin D might be a useful adjunctive therapy for millions of children and adults with severe vitamin D deficiency who are overweight with or without hypertension.



**John Flack, MD, MPH**

*Professor and Chair  
Dept of Internal Medicine  
Hypertension Section Chief  
SIU School of Medicine*

### Research Areas:

High-dose vitamin D, blood pressure and involuntary weight loss in hypertensive African Americans with severe vitamin D deficiency.

**Project Origination:** 2013



**Sabha Ganai, MD, PhD**

*Assistant Professor, Surgery  
Director, Gastrointestinal Oncology  
Simmons Cancer Institute at SIU  
SIU School of Medicine*

**Research Areas:**

Population-health barriers in colorectal screening; National rural-urban disparities in breast and thyroid cancer; Illinois disparities in esophageal and pancreatic cancer related to driving distance from high-volume cancer centers.

**Project Origination:** 2014

## Development of a HIPEC Program in Sangamon County

**Medical Problem:**

Peritoneal carcinomatosis, otherwise considered stage IV cancer.

**Treatment/Research Idea:**

Dr. Ganai is developing a Hyperthermic Intraperitoneal Chemotherapy (HIPEC) program at Memorial Medical Center.

**Project:**

HIPEC is a technique in which heated chemotherapy is directed into the abdominal cavity using a pump after tumor debulking is completed, while the patient is still in the operating room. The chemotherapeutic drug is circulated and heated increasing the ability to preferentially kill cancerous cells compared to healthy cells. Recent studies indicate that directing chemotherapy into the peritoneal cavity can be more effective and less toxic than delivering chemotherapy through the blood stream for certain tumor types.

The result is palliation and increased cancer survival. Properly selected patients who undergo cytoreduction with HIPEC may have long-term survival benefit not seen with intravenous chemotherapy.

**Experimental Innovation:**

Dr. Ganai is one of the first 50 surgeons in the United States with added board certification in Complex General Surgery Oncology. She is the Commission on Cancer (CoC) Cancer Liason Physician for Springfield. In September 2014, she performed the first HIPEC procedure in southern and central Illinois for a patient with peritoneal mesothelioma. Since then, she has treated nine other patients with pseudomyxoma peritonei, appendiceal cancer, or colorectal cancer with peritoneal metastasis, all with excellent outcomes. She is the only physician in the region specially trained in delivering this therapy.

**Benefit to the Community:**

Patients do not have to travel long distances to find experts in this technique. Dr. Ganai receives referrals from St. Louis, Chicago and Peoria, indicating potential to bring patients from other states as well.

## Tissue Engineering to Make People Whole Again

### Medical Problem:

Severe deformities and functional impairment as a result of patients losing their ears, nose, entire face or suffering from other skin defects.

### Treatment/Research Idea:

Dr. Neumeister is using tissue engineering to use patients' own bodies as a reparative organ.

### Project:

Currently, reconstructive efforts use other parts of a patient's body to create the needed organ. This type of reconstruction often leaves a significant defect and scarring on the donor site. Tissue engineering takes a few cells and develops an entire organ or composite tissue such as skin, bone, nerves and muscle so that donor sites can be minimized. The key aspect of this research is to use the patients' own adult-derived fat cells and hair follicles and grow them in a medium that allows specialization into different tissue types. The cells can be grown into specific organs and a blood supply can be applied to them so that they can be transferred as the patients' own tissue to reconstruct parts of the body.

### Experimental Innovation:

Dr. Neumeister is the only person working on regenerative medicine through the basic science of tissue engineering in southern Illinois, as well as the translational work of moving this type of research to the operating room and bedside. New innovations include developing skin that is hair-bearing with the use of hair follicle stem cells; modifying fat to form nerve cartilage and bone or peripheral nerve reconstruction; ear and trachea reconstruction; and actual bone reconstruction. Many applications have already been translated into clinical realities where the areas of tissue engineering are being investigated.

### Benefit to the Community:

Patients of Sangamon County receive highly innovative, state-of-the-art reconstruction that offers them a normal life following restoration of the tissues that are lost. Patients would have the opportunity to have hair-bearing tissue engineered skin to potentially save their lives and heal their wounds faster. Cancer patients (head & neck, breast and extremities) could have parts tissue engineered so that tissues from other parts of the body don't have to be used in the reconstruction.



**Michael Neumeister, MD**

*Professor and Chair,  
Dept of Surgery; Division of  
Plastic Surgery  
SIU School of Medicine*

### Research Areas:

Tissue engineering in the lab or on the body to replace body parts.

**Project Origination:** 1997



### **Arun Sharma, MD, MS**

*Assistant Professor  
Dept of Surgery; Division of  
Otolaryngology-Head and Neck Surgery  
SIU School of Medicine*

#### **Research Areas:**

Assessing quality of life and swallowing outcomes in patients who undergo TORS for treatment of their pharynx or larynx cancer and comparing these outcomes to similar patients who were previously treated with radiation or chemoradiation.

**Project Origination:** 2015

## **Robotic Surgery in Patients With Head and Neck Cancer**

#### **Medical Problem:**

Head and neck cancer causes much discomfort, disfigurement and alteration in function (especially breathing and swallowing), in addition to being life-threatening. Many of the traditional treatments for head and neck cancers have just as many side effects as the disease itself. However, robotic surgery allows for the removal of some head and neck cancers through the mouth without need for more morbid procedures or interventions. Evolving robotic technology allows cancers in this area to be treated with transoral robotic surgery or TORS while avoiding or minimizing need for radiation and/or chemotherapy.

#### **Project:**

The goal of Dr. Sharma's research is to determine the optimal use of TORS in the management of patients with cancers of the pharynx (throat). TORS is performed without any external incisions to completely remove cancers that previously would have required other surgeries or treatments. Functional outcomes (quality of life and swallowing) are important in patients with head and neck cancers and are being assessed in patients who undergo TORS.

TORS allows patients with certain head and neck cancers to be treated with minimal morbidity and disruption of normal structures while allowing for excellent visualization and manipulation in parts of the head and neck that are otherwise difficult to access surgically. This technology allows preservation of structures that are critical for normal swallowing and function.

#### **Experimental Innovation:**

Most otolaryngologists do not perform or have training in TORS. Dr. Sharma's work incorporates new technology in management of head and neck cancer. Dr. Sharma also has developed a training curriculum to teach TORS to residents.

#### **Benefit to the Community:**

Multiple treatment options for head and neck cancers are available. TORS, a relatively new technology, allows for a minimally-invasive surgical cure either without or with less chemoradiation. It also may allow for better quality of life and swallowing function for patients.

## Cancer Fighting Natural Killer Cells

### Medical Problem:

Kidney cancer makes up three percent of all cancers. Because this disease is often not detected until advanced stage, the best opportunity for long-term survival is complete or partial removal of a kidney. Patients may also be treated with proteins designed to improve immune cell function. Unfortunately, this treatment option has a low success rate (~15%) indicating that tumors prevent immune cell function.

### Treatment/Research Idea:

One particular type of immune cell, natural killer cells, normally destroy cancerous cells. Dr. Wilber has found that kidney tumors alter natural killer cells, causing them to promote and spread tumor growth, rather than inhibit it. He has identified two key factors produced by kidney tumors that are responsible for this effect. Current studies are designed to test ways to reverse it.

### Project:

The project aims to discover why the body's immune cells, specifically natural killer (NK) cells, are inadvertently supporting the development and spread of cancer and reverse this trait so that NK cells can actively fight cancer.

### Experimental Innovation:

Dr. Wilber has completed detailed studies of NK cell phenotype and function for six patients with advanced kidney cancer. He found natural killer cells present within kidney cancer have altered surface marker expression, are poorly cytotoxic, and express blood-vessel promoting factors compared to patient-matched peripheral blood NK cells. Using an experimental culture model, he determined that these effects are mediated, in part, by transforming growth factor-beta and low oxygen tension (hypoxia) factors with known roles in tumor development and metastasis. These studies are the subject of recently funded grants from the Simmons Cancer Institute and NIH/NCI. Dr. Wilber's collaborators include SIU faculty members Dr. Donald Torry, Dr. Sophia Ran, Dr. Shaheen Alanee, Dr. Wiley Jenkins and Dr. Kathy Robinson.

### Benefit to the Community:

His findings provide a foundation to guide the clinical management of future patients through early detection and treatment. Results may lead to future treatments that could extend the life of individuals with kidney cancer.



**Andrew Wilber, PhD**

*Assistant Professor  
Medical Microbiology,  
Immunology and Cell Biology  
SIU School of Medicine  
Director, Public Health  
Laboratory Sciences Program*

### Research Areas:

Genetic factors or risk factors that may contribute to the higher incidence of male kidney cancer in rural Illinois communities; understand how kidney tumors suppress the activity of natural killer cells.

**Project Origination:** 2013

# MEDICAL INNOVATORS HONOR ROLL

Thomas Ala, MD, 2009

Andrzej Bartke, PhD, 2006

Carol A. Bauer, MD, 2006

Jeffrey I. Bennett, MD, 2013

Michael J. Brenner, MD, 2013

Gregory J. Brewer, PhD, 2006

Kathleen Campbell, PhD, 2009, 2013

Donald M. Caspary, PhD, 2006

James T. Dove, MD, 2006

Gary L. Dunnington, MD, 2006

Randolph C. Elble, PhD, 2006

Rodger J. Elble, MD, PhD, 2006

John E. Godwin, MD, 2009

Donald R. Graham, MD, 2006

Stephen R. Hazelrigg, MD, 2006, 2013

Kim J. Hodgson, MD, 2006

Ziad F. Issa, MD, 2009

Richard E. Katholi, MD, 2009

Judith P. Knox, MD, 2013

John E. Kwedar, MD, 2009

Patrick H. McKenna, MD, 2006

Robert B. McLafferty, MD, 2009

Gregory Mishkel, MD, 2006, 2013

H. Dennis Mollman, MD, PhD, 2009

Dean K. Naritoku, MD, 2006

Steven D. O'Marro, MD, 2013

Ayman Omar, MD, PhD, 2013

Michael R. Pranzatelli, MD, 2006

Krishna A. Rao, MD, PhD, 2009

K. Thomas Robbins, MD, 2006

Khaled J. Saleh, MD, 2013

Bradley F. Schwartz, DO, 2006

Deborah E. Seale, 2006

Thomas G. Shanahan, MD, 2009

Stephen P. Stone, MD, 2006

Linda A. Toth, PhD, DVM, 2006

Christina M. Vassileva, MD, 2013

Andrew C. Wilber, PhD, 2013

Gayle Woodson, MD, 2006

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