Bright Future Ahead for C*STAR Students, page 12.

Cancer Community @ Illinois
FROM BENCH TO LIFE:
Better prevention, detection, diagnosis, and treatment
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ON THE COVER
Above, from left to right: Evijola Llabani, Mahdieh Jadaliha, and Elizabeth Awick are the inaugural Cancer Scholars for Translational and Applied Research (C•STAR) program graduate students. Read more about this innovative CC@IL educational program from each student’s perspective, on page 12.

PATHWAYS
A publication of the Cancer Community at Illinois, University of Illinois at Urbana-Champaign. Each issue highlights the interdisciplinary and translational work being done within the community by faculty, staff, students, and external partners.

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I am pleased to inform you that campus has re-affirmed its commitment to making our community successful after a review in 2015. In particular, I appreciate the support provided by the IHSI, my home department of Bioengineering, and the College of Engineering in helping us continue our work. It is a special pleasure for our community to have Dr. Margaret Browne Hunt continue in her role of supporting and nurturing our efforts.

Another academic year has passed and our community continues to innovate and expand. Our faculty ranks grow with innovative new investigators. This year, for example, we welcome Dr. Anna Arthur who is a joint University-Carle hire in the area of cancer nutrition. Our community members continue to excel in conducting notable studies, obtaining federal grants and receiving various awards. Our first cohort of Cancer Scholars for Translational and Applied Research (C*STAR) students was extremely successful, and took advantage of the opportunity to interact with our Carle partners within the clinical setting. We are a community of students (high school, undergraduate, graduate and postdocs), staff, faculty, and community members.

This year, the Cancer Community at Illinois also launched an advocacy group geared toward bringing in patients and caregivers to inform cancer research on campus. I particularly appreciate the efforts of professors Zeynep Madak-Erdogan, Food Science and Human Nutrition, and Erik Nelson, Molecular and Integrative Physiology, in this regard. In addition to launching their own research laboratories, they have worked tirelessly for the community.

We have much to look forward to in the upcoming year. We will continue to expand our educational programs, the research HSStart high school program; the undergraduate Cancer Scholars Program, and the graduate the Cancer Scholars for Translational and Applied Research (C*STAR) program. A new NIH-supported training program, the tissue microenvironment training program, will bring more students into our community and help our faculty collaborate more effectively in this area.

While the past few years have seen us establish and grow, over the next few weeks, we will be soliciting ideas from the community regarding areas of research interests. In the fall, we plan to have meetings and workshops with you—our community and partners—to hear from you in real-time, but also to keep you abreast of our collective activities.

The 2016-17 academic year will be an exciting one for our community and we hope you will join us on this continued journey.

FROM THE DIRECTOR

STEERING COMMITTEE

Milan K. Bagchi
Molecular & Integrative Physiology

Stephen A. Boppart
Electrical & Computer Engineering

Timothy M. Fan
Veterinary Clinical Medicine

Barbara Fiese
Human Development & Family Studies

H. Rex Gaskins
Animal Sciences

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Electrical & Computer Engineering

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Pathology

PATHWAYS Spring/Summer 2016
Anna Arthur is an assistant professor and Sylvia D. Stroup Scholar in nutrition and cancer within the Department of Food Science and Human Nutrition at the University of Illinois. She is also an oncology dietitian nutritionist at Carle Cancer Center. Prior to joining Illinois and the Carle Cancer Center, Dr. Arthur earned a PhD in nutritional sciences and a Master of Public Health from the University of Michigan School of Public Health. She then went on to complete a postdoctoral fellowship with the University of Alabama at Birmingham’s R25 Cancer Prevention and Control Training Program funded by the National Cancer Institute. She has received several fellowships and awards for her research from organizations such as Susan G. Komen, the American Institute for Cancer Research and the Academy of Nutrition and Dietetics. Dr. Arthur’s lab focuses on conducting translational research in the areas of nutrition and cancer epidemiology and survivorship. The overarching objectives of her research are to 1) conduct observational epidemiologic studies to determine how diet and nutritional status are associated with cancer outcomes such as recurrence, survival and quality of life, as well as with biomarkers of cancer progression and prognosis; 2) translate the findings of these observational studies to clinical intervention trials that will have the potential to inform the development of new clinical nutrition recommendations and medical nutrition therapies for cancer patients and survivors.

Illinois researchers continue to make strides to improve cancer detection, prevention, diagnosis, therapy, and quality of life.

The Cancer Community at Illinois (CC@IL) is the focal point for cancer-related activities across campus and helps nucleate new programs and ideas to advance cancer research and healthcare. Bringing together campus research, education, engagement, and economic development resources for collective success, we focus campus attention on cancer to build an environment that enables faculty, staff, and students to achieve goals in this area.

We also catalyze large projects, specifically focused on applying science, engineering, and technology to cancer. Believing that our unique and comprehensive strengths enable us to mount challenges that few other universities are poised to consider, we seek to develop projects and training programs that lead to significant research and translational gains while providing novel opportunities for our students.

The CC@IL is a program of the Interdisciplinary Health Sciences Initiative (IHSI) and is also supported by the Beckman Institute for Advanced Science and Technology and the Department of Bioengineering.

To learn more about our programs, activities, and opportunities and to get involved with the community, please visit our website, cancer.illinois.edu. We welcome your interest and look forward to seeing you at one of our events very soon.
The Cancer Community at Illinois is pleased to welcome five new members to its steering committee: John Erdman, Brendan Harley, Thendkurussi (Kesh) Kesavadas, Zeynep Madak-Erdogan, and Erik Nelson. We are also pleased to report that H. Rex Gaskins will begin serving as the chair of the Cancer Community at Illinois steering committee. These faculty members will begin their duties in August 2016.

John Erdman

John Erdman is Emeritus Professor of food science and human nutrition, professor of internal medicine and professor of nutrition in the Division of Nutritional Sciences at the University of Illinois at Urbana. Dr. Erdman’s training and expertise encompass the nutritional and physiological biochemistry of man and animals. He has authored over 200 original research articles on these subjects and has over 350 total publications including other articles and chapters. His H-Index in the Web of Science is 50.

Dr. Erdman is a member of a variety of professional organizations including the American Society for Nutrition (ASN), the Institute of Food Technologists (IFT), and the American Heart Association (AHA). He is past President of the American Society for Nutritional Sciences (now ASN), has been elected Fellow for ASN, AHA and IFT. He has served on 27 committees for the Institute of Medicine (generally through the Food and Nutrition Board [FNB]), National Academy of Sciences (NAS). He served on the FNB for nine years, six as vice chair and as chair of the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes (DRIs) and chair of the Committee on Military Nutrition Research. This committee published the report “Nutrition and Traumatic Brain Injury” in 2011. For his extensive contributions to the NAS, he was named as Lifetime National Associate of the NAS in 2001 and was elected as a Member of the Institute of Medicine (now National Academy of Medicine), NAS in 2003. Other honors include: receipt of the Samuel Cate Prescott Award for Research and the William Cruess Award for Teaching from IFT; the Dannon Institute Mentorship Award from ASN; being named as an Original Member in Agricultural Science by ISI as an Highly Cited Researcher (top 0.05%); and several University of Illinois Excellent and Outstanding Teaching awards. He is a member of the Board of Trustees of the International Life Sciences Institute-North America. He is senior editor of the 10th Edition, Present Knowledge of Nutrition published in 2012, and serves as the chair of the Interdisciplinary Health Sciences Initiative Advisory Board. Dr. Erdman received his BS, MS, MPH, and PhD in food science from Rutgers University.

H. Rex Gaskins

H. Rex Gaskins obtained his PhD in nutritional sciences with a research focus in cell biology from the University of Georgia in 1989. From 1989-92, he completed postdoctoral studies in mouse genetics at The Jackson Laboratory in Bar Harbor, Maine. He is now a professor at the University of Illinois with appointments in the Departments of Animal Sciences and Pathobiology, the Division of Nutritional Sciences, and the Institute for Genomic Biology.

Research in his laboratory focuses on host-intestinal microbiota interactions as they pertain to inflammatory disorders and colorectal cancer and redox regulation of cell fate. A particular interest has been microbial mechanisms of hydrogen disposal in the colon and how hydrogen sulfide (H2S), the respiratory end product of hydrogenotrophic, sulfate-reducing bacteria, impacts the colonic epithelium. His lab demonstrated that H2S modulates the expression of genes involved in cell-cycle progression and triggers both inflammatory and DNA repair responses in nontransformed intestinal epithelial cells, and together with Professor Michael Plewa, provided the first evidence that exogenous H2S is a potent genotoxin at concentrations many-fold less than have been measured in the human colon. They then proved that H2S induces DNA damage in the absence of cellular metabolism, and that this damage was mediated by free radicals. Most recently, they demonstrated that the colonic mucosa of healthy human subjects is persistently colonized by all the three groups of hydrogenotrophic microbes; reductive acetogens, methanogenic archaea and sulfate reducing bacteria. Together, the findings underpin working hypotheses that aim to define the nature of syntrophic interactions among fermentative bacteria and hydrogen utilizing microbes and how diet may influence those relationships to impact risk for colorectal cancer.

Brendan Harley

Brendan Harley received a BS in engineering sciences from Harvard University (2000) and an ScD in mechanical engineering from MIT (2006). After a post-doc in immunology at Children’s Hospital and Harvard Medical School in Boston, Dr. Harley joined the faculty at the University of Illinois at Urbana-Champaign in 2008 where he is an assistant professor in the Department of Chemical and Biomolecular Engineering and a faculty member at the Institute for Genomic Biology. Dr. Harley is the co-founder of UK-based Orthomimetics, Ltd. (recently acquired by TiGenix, Ltd.), which currently has a biomaterial for arthroscopic osteochondral repair in Phase I clinical trials.
Dr. Harley and his research group have been developing biomaterial systems to explore the practical significance of how cell and matrix-based cues can be optimized to improve biomaterial bioactivity and the mechanistic details of how individual cells sense, integrate, and respond to multiple extrinsic cues. This work has recently focused on developing spatially-patterned microenvironments containing multiple classes of matrix, biomolecule, and cell-based cues to drive stem cell self-renewal, differentiation, tissue biosynthesis, and to alter cancer malignancy. These macro- and micro-scale patterns allow researchers to spatially and temporarily tune the matrix and cell microenvironment surrounding individual cells or cell populations, and then quantitatively analyze cell response to these materials at the signal transduction, gene expression, and functional levels. Currently, the Harley Lab is developing graded biomaterial substrates for the regenerative repair of multi-tissue orthopedic insertions. They are also creating multi-gradient biomaterials to investigate fundamental questions regarding niche-mediated (matrix elasticity, ligand presentation, and paracrine-mediated signaling) regulation of hematopoietic stem cell behavior; these materials are also of significant value for probing the influence of the local tumor microenvironment on glioblastoma cell malignancy.

THENKURUSSI (KESH) KESAVADAS
Thenkurussi (Kesh) Kesavadas received his PhD in industrial engineering from Pennsylvania State University in 1995. He is the director of Health Care Engineering Systems Center at the University of Illinois at Urbana-Champaign. He is also a professor of industrial and enterprise systems engineering with affiliated positions in the Departments of Bioengineering and Computer Science.

His research interests are in the areas of medical robotics and simulation, virtual reality in design, haptics, and human-computer interaction. Dr. Kesavadas has been in the forefront of virtual reality and its application to medicine since this field was in its infancy. A winner of multiple awards recognizing his visionary contributions, he developed the world’s first stand-alone virtual reality Robotic Surgical Simulator RoSS and also co-founded two start-up companies. He co-invented the HoST simulation environment for training surgeons on cancer treatment using da Vinci Surgical Robot for procedures such as prostatectomy, hysterectomy and cystectomy.

Dr. Kesavadas is the “Engineer in Chief” of the Jump ARCHES collaborative partnership between the College of Engineering at Illinois and health care providers at OSF HealthCare and at the University of Illinois’ College of Medicine at Peoria. Dr. Kesavadas also serves on the Curriculum Committee of the new Carle Illinois College of Medicine. He is a member of the Simulation Technology Committee for American College of Surgeons (ACS), is a member of IEEE, and is a Fellow of American Society of Mechanical Engineering.

ZEYNEP MADAK-ERDOGAN
Zeynep Madak-Erdogan is the director of Women’s Health, Hormones and Nutrition Lab at University of Illinois at Urbana-Champaign. She received her BS degree in molecular biology and genetics from Bilkent University in 2002. After completing her PhD and postdoctoral studies on “Mechanisms of Estrogen Receptor Action,” she joined the Department of Food Science and Human Nutrition at Illinois in 2014. Her lab uses “systems biology” approaches to understand how nutrients and hormones impact breast cancer outcomes and identify biomarkers and associated molecular mechanisms driving more aggressive breast cancers. In addition to mentoring several undergraduate and graduate students, she has taught courses in the areas of diet, nutrition and cancer, and toxicology. She has received several awards including the NIEHS Pre- and Post-doctoral Research Training Program in Endocrine Developmental and Reproductive Toxicology Fellowship, Women in Endocrinology Young Investigator Award from the Endocrine Society, and the Mary Swartz Rose Young Investigator Award from the American Society of Nutrition.

ERIK NELSON
Erik Nelson joined the Department of Molecular and Integrative Physiology at the University of Illinois at Urbana-Champaign as an assistant professor in August 2014. He received his PhD in comparative endocrinology from the University of Calgary, Canada. He completed his postdoctoral training in the Department of Pharmacology and Cancer Biology at Duke University School of Medicine.

The research of Dr. Nelson is focused on the elucidating the endocrine and metabolic control of cancer pathophysiology. He is specifically interested in the molecular physiology behind how obesity and hypercholesterolemia contribute to cancer progression. His work has found that a metabolite of cholesterol 27-hydroxycholesterol, can bind to and activate the estrogen receptors, promoting breast tumor growth. 27-hydroxycholesterol was also found to increase breast cancer metastasis, a striking finding considering that the majority of breast cancer patients will eventually succumb to metastatic disease, not to the primary tumor. His laboratory is currently working on determining the mechanisms behind this observation and how other endocrine factors influence metastasis. The major goal is to develop novel lifestyle or therapeutic strategies to prevent and treat metastatic disease. This research is of incredible importance, given the current obesity crisis and that the majority of breast cancer patients will eventually relapse with metastatic disease.
The Cancer Community at Illinois (CC@IL) is pleased to announce it has named its long-time faculty coordinator, Rohit Bhargava, as director for a three-year term.

Bhargava, who has served as the CC@IL faculty coordinator for the past four years, will begin this role immediately. With his exceptional research productivity and experience in leading the CC@IL, he will spearhead efforts to unite researchers in the effort to find better ways to prevent, detect, diagnose, and treat cancer. The CC@IL provides resources for cancer-related activities across the campus, nucleates new programs related to cancer research, and fosters connections with clinical partners.

Bhargava, a professor in the Department of Bioengineering, is deeply involved in cancer research, with extensive grant funding for numerous projects. One example is a project aimed at developing innovative cancer imaging techniques to determine the risk of lethal prostate cancer upon initial diagnosis. This project, “3D Prostate Histochemometry to Predict Disease Recurrence,” has been awarded $1,606,899 over four years by the National Cancer Institute (NCI) of the National Institutes of Health.

Bhargava received his PhD from Case Western Reserve University and his undergraduate degree from the Indian Institute of Technology, New Delhi. He has a full time faculty affiliation with the Beckman Institute for Advanced Science and Technology, is a research affiliate at the Mills Breast Cancer Institute at Carle Foundation Hospital, and has played a central role in the Interdisciplinary Health Sciences Initiative's (IHSI) support of cancer-related research. His fields of professional interest are infrared spectroscopic imaging, cancer pathology, probes for molecular imaging, polymer structure, and numerical methods for image processing.

The CC@IL is supported by IHSI, the College of Engineering, the Department of Bioengineering, and the Beckman Institute for Advanced Science and Technology.

H. Rex Gaskins Honored with SEBM Distinguished Scientist Award

The Society for Experimental Biology and Medicine (SEBM) honored H. Rex Gaskins, professor of immunobiology, with a 2016 Distinguished Scientist Award. The award was presented at the Experimental Biology Meeting in Chicago, April 22-26.

Kong Receives Campus Awards

Hyunjoon Kong, associate professor in chemical and biomolecular engineering, has received the 2016 Campus Distinguished Promotion Award, given by the Campus Committee on Promotion and Tenure for excellence within the recipient’s field. Kong also received the College of Engineering Dean's Award for Excellence in Research.

By Sue Johnson
Hergenrother Honored with Innovation and Excellence Awards

Paul Hergenrother, professor in chemistry, received the Innovation Transfer Award from the 2016 Innovation Celebration, a joint venture between the Champaign County Economic Development Corporation, University of Illinois, and Parkland College to recognize entrepreneurial spirit on campus and in the community.

Hergenrother was also the recipient of this year’s UCB-Ehrlich Award for Excellence in Medicinal Chemistry. He was cited for outstanding contributions to chemical biology and anticancer drug discovery. He is a co-founder of the anticancer drug development company Vanquish Oncology.

Boppart Wins Startup and Society Awards

Two of Stephen Boppart’s startups, Diagnostic Photonics and Photonicare, won first and second place respectively at the iBIO Propel Center’s business plan competition. Boppart’s lab at the Beckman Institute for Advanced Science and Technology was the birthplace of the foundational technology for both of these companies. Boppart serves as the chief medical officer at both companies.

Boppart also received the 2016 IEEE Engineering in Medicine and Biology Society Technical Field Award.

Kilian Receives NSF CAREER Award

Kristopher Kilian, professor in materials science and engineering, was awarded a 2015 National Science Foundation CAREER Award for the project “Mechanochemical Signaling during Somatic Cell Reprogramming.”

Kranz Given College of LAS Alumni Achievement Award

In October 2015, David M. Kranz received the University of Illinois College of Liberal Arts and Sciences Alumni Achievement Award. Kranz, professor in biochemistry, was honored for his strong research and entrepreneurial record. Much of his work focuses on therapies that make use of the body’s T cell receptors—a critical player in the immune system’s response to foreign invaders.

Bashir Named Fellow of BMES

Rashid Bashir, bioengineering department head and professor, was named a Fellow of the Biomedical Engineering Society (BMES). Fellow status is awarded to BMES members who demonstrate exceptional achievements and experience in the field of biomedical engineering with a record of membership and participation in the Society.

Madak-Erdogan Receives Young Investigator Award

Zeynep Madak-Erdogan, professor in the food Science and human nutrition, was named the Mary Swartz Rose Young Investigator Award from American Society of Nutrition. This award is given to an investigator within 10 years of postgraduate training, for outstanding research on the safety and efficacy of bioactive compounds for human health.
Only a few cells in a cancerous tumor are able to break away and spread to other parts of the body, but the curve along the edge of the tumor may play a large role in activating these tumor-seeding cells, according to a new University of Illinois study. Using engineered tissue environments in various shapes and patterns, the study of skin cancer found that the more curved the cell cultures were, the more cancer cells at the edges displayed markers of stem cell characteristics—the key to spreading to other tissues. This has potential for furthering our understanding of cancer as well as developing personalized treatment plans.

Kilian hopes that the patterned, engineered tissue environments will give researchers a new way to find and culture cancer stem cells, which have been very elusive in conventional cultures—less than one percent of cells, he said. Beyond the fundamental science of finding and understanding these cancer-spreading cells, he also sees engineered tumor environments as having therapeutic applications in personalized medicine.

"You can imagine a patient has a particular tumor. You could engineer that in a dish, and using the patient's own cells, you could develop a model of their specific tumor to test out drugs," he said. "If you could take a patient's cells and within days have microtumors that you could use to screen all the available drugs, then an oncologist would be able to prescribe a treatment that's tailor-made for the patient that targets both the tumor cells and these elusive cancer stem cells that currently we can't see."

"There's a lot more work to be done, but we're very excited about how a very simple materials property of a growing tumor might be a culprit of the disease spreading. We think it opens up a new avenue of investigation for drug development, guiding surgery, and understanding progression and spreading of cancer," Kilian said.

The researchers did a number of tests in their engineered environments to confirm tumor-spreading ability, such as genetic analysis. They also tested other cancer lines—human cervical, lung and prostate cancers—and found that they responded to the patterned tumor environments in the same way. Then Kilian's group teamed with Fan's group to test the skin-cancer stem cells in live mice, and found that the cells taken from the patterned environments were much more likely to cause tumors than cells taken from a conventional flat dish. "We found that many more mice developed tumors when given the cells that we had engineered to have these stem cell characteristics, and they had a much higher incidence of metastasis in the lungs," Kilian said. "In a tumor, similarly, regions that develop these kinds of shapes may activate cells that can then escape and form more tumors. This may allow surgeons to look at the perimeter of a growing tumor and use the shape to guide their assessment of which regions could be more problematic—where they need to take out more tissue around the tumor and where they may not need to take as much."

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The American Cancer Society and the National Science Foundation supported this work. Kilian is affiliated with the Carl R. Woese Institute for Genomic Biology, the department of bioengineering and the Micro and Nanotechnology Laboratory at Illinois.

Kilian’s group specializes in tissue engineering to create models of tumors, in order to more accurately study cancer processes in a culture dish.
Clinical trials of the anti-cancer agent PAC-1 are continuing to expand, thanks to a $7 million angel investment from an anonymous contributor who originally invested $4 million to help get the compound this far in the drug-approval pipeline.

The U.S. Food and Drug Administration also granted PAC-1 orphan drug status for the treatment of glioblastoma multiforme, a deadly brain cancer. This designation is meant to encourage development of drugs to treat rare diseases or conditions affecting a small subset of the population. Some steps in the approval process are aided or expedited for orphan drugs. An estimated 12,120 new cases of glioblastoma are expected in the U.S. in 2016. The median survival with standard-of-care therapy is 14.6 months.

PAC-1 targets an enzyme, procaspase-3, which is elevated in cancer cells. When activated, this enzyme spurs cell death. The drug first showed promise in the treatment of pet dogs with spontaneously occurring cancers.

A Phase I clinical trial of PAC-1 in human cancer patients began in 2015 and has so far involved about a dozen patients with a variety of late-stage cancers. The human trial is being conducted at the University of Illinois Cancer Center in Chicago and at the Sidney Kimmel Cancer Center at Johns Hopkins University. A Champaign-based company, Vanquish Oncology, is the regulatory sponsor for the research.

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Some of the preclinical studies—in cells, mice, rats and dogs—suggested that PAC-1 could aid in the treatment of glioblastoma, a disease for which there are few therapeutic options. “We know that PAC-1 can be safely combined with curative intent radiation therapy and oral temozolomide in dogs with primarily glioma, or brain tumors,” said Fan, who has worked closely with veterinary neurologist Dr. Michael Podell and veterinary radiation oncologist Dr. Jayme Looper of the Chicago-based MedVet Medical and Cancer Centers for Pets to conduct clinical trials of the drug in pet dogs. “Surgical resection, radiation and temozolomide is the standard treatment regimen for glioblastoma,” Hergenrother said.

A second component of the Phase I trial will test PAC-1 in combination with temozolomide in human glioblastoma patients whose tumors have returned after standard treatment, he said.

“We’ve been at this now for more than 10 years, and we’re excited to be able to continue down this road,” Hergenrother said. “It takes a lot of time, a lot of effort and a lot of money to do human clinical trials. So to have the means to expand access to PAC-1 from a dozen patients to, we hope, hundreds, is very exciting. That is what will allow us to get some definitive data on the drug.”

“PAC-1 is one of only a few drug agents developed and tested in animals and in humans at a single institution,” said Dr. Arkadiusz Dudek, a physician and professor of hematology and oncology at the University of Illinois at Chicago who is directing the human clinical trials of the drug. “It is gratifying to see new funding to allow this work to continue.”
A new surgical tool that uses light to make sure surgeons removing cancerous tumors “got it all” was found to correlate well with traditional pathologists’ diagnoses in a clinical study, showing that the tool could soon enable reliable, real-time guidance for surgeons. The interdisciplinary research team led by Stephen Boppart, a University of Illinois professor of electrical and computer engineering and of bioengineering, performed the study on 35 patients with breast cancers at the Carle Foundation Hospital in Urbana, Illinois. The results appear in the journal Cancer Research.

One difficult but crucial determination for surgeons and tissue pathologists is figuring out where a tumor ends. A solid tumor may be easily identifiable, but the tissue around the main body of the tumor, known as the margin, may contain cancerous cells as well. Because of this, excess tissue surrounding the tumor is typically removed, but the question lingers of whether any cancer cells remain to re-emerge later as tumors. “In almost all solid-tumor surgeries, there’s a question of margins,” said Dr. Boppart, who also is a medical doctor. “Typically, surgeons will remove the tissue mass that contains the tumor and will send it to the lab. The pathologist will process, section and stain the tissue, then examine the thin sections on microscope slides. They look at the structure of the cells and other features of the tissue. The diagnosis is made based on subjective interpretation and often other pathologists are consulted. This is what we call the gold standard for diagnosis.”

Surgeons could use the hand-held OCT probe to determine whether any cancerous tissue remains in the cavity after a tumor is removed, reducing the risk of recurrence or additional surgical procedures. The new device is a hand-held probe based on a technology called optical coherence tomography (OCT) that uses light to image tissue in real time. Cancer cells and normal tissue scatter light differently because they have different microstructural and molecular features, Boppart said, so OCT gives physicians a way to quantitatively measure the cellular feature of a tumor. Surgeons can pass the OCT wand over a section of tissue and see a video on a screen, with no special chemical stains or lengthy tissue processing required. “In many cases, you can’t tell the difference between cancer cells and normal tissue with the naked eye, but with OCT they’re very different,” said Boppart, who also is affiliated with the Beckman Institute for Advanced Science and Technology at the U. of I.

In the clinical study, surgeons treated patients according to the standard surgical procedure, but OCT data were collected from the margin of the tumor cavity and the margin of the removed tissue mass during surgery so that the results could be compared later. The study found that the OCT device analysis identified the differences between normal and cancerous tissue with 92 percent sensitivity and 92 percent specificity. They also found that the way that OCT spotted cancer in the removed tissue was closely correlated with the results from the postoperative pathology reports, which often came days later. “For the first time, this study demonstrates the use of OCT for imaging tumor margins within the tumor cavity, in the patient, during surgery,” Boppart said. “It is likely better to check to see if any residual tumor cells might be left behind, rather than checking the tissue mass that was taken out. Then, the surgeon can intervene immediately.”

The researchers will continue clinical studies with the OCT device, looking at other types of solid-state tumors. Diagnostic Photonics, a start-up company Boppart co-founded that also collaborated on the study, is commercializing the OCT probe technology for broader use. “Ultimately, new technological innovations like this in medicine and surgery are going to improve our health care and save lives. That’s when this work will be most rewarding,” Boppart said.

The National Institutes of Health supported this work.
One year after the launch of the new, one-of-a-kind educational opportunity at Illinois, the graduate students, professors, and clinicians involved in the Cancer Scholars for Translational and Applied Research (C★STAR) program are giving it high praise.

Funded by the University of Illinois and the Carle Cancer Center, the C★STAR graduate program is coordinated by the Interdisciplinary Health Sciences Initiative (IHSI). The program fosters translational research and was developed to encourage near-term benefits to patients served by Carle and in the greater Champaign-Urbana community. Specifically, C★STAR program functions include:

- Matching graduate students with a UI faculty mentor and a Carle physician mentor for the duration of the research project;
- Focusing research on clinically-relevant projects related to cancers of the breast, prostate, lung, gastrointestinal tract and gynecological areas;
- Allowing students and faculty to participate in grand rounds at Carle, site-alternating workshops, and joint seminars.

The C★STAR program provides each student with up to three years of funding for their research, subject to an annual review of progress. Curious about the program’s impact after its first year, we interviewed each of the current C★STAR Carle program graduate students and their mentors.

**ELIZABETH AWICK**

*Research Project:* Relationships among physical activity, quality of life, and cognitive function in breast cancer survivors

*UI Faculty Mentor:* Edward McAuley, Kinesiology and Community Health

*Carle Physician Mentor:* Dr. Kendrith Rowland

**Tell us a short overview of what your C★STAR research project entails.**

A lot of research out there has suggested that individuals who go through cancer, not only the diagnosis but also the treatment for cancer, have reported some sort of loss of mental acuity after treatment. It’s the phenomena now known as “chemo brain.” For this particular study, we looked at female breast cancer survivors between the ages of 30 and 60. In our study the women came in and actually did a graded exercise test and that gave us an objective measure of their cardio respiratory fitness so that we could also investigate how fitness might play a role in that relationship. After they gave us a VO2 max test, they came in on two separate occasions that were counterbalanced to prevent any sort of “cheating” on the cognitive tasks. In the first session, they performed cognitive tasks then walked on the treadmill for 30 minutes. As soon as they finished walking, participants completed the cognitive tasks again, then rested and completed them a third time exactly an hour after the exercise was finished. On their second visit, participants did the cognitive tasks and then rested for 30 minutes and then they did the cognitive tasks again. So we were comparing the effects of one bout of moderate-intensity aerobic exercise on “chemo brain” cognition.

**What have you found most beneficial about being involved in the C★STAR program?**

The most beneficial part for me was the multi-disciplinary aspect of the program. Having both Dr. Rowland and also Dr. McAuley’s input was integral to looking at this project from different angles. I haven’t had much experience on the clinical side of research. It was wonderful to actually get in the clinic and shadow Dr. Rowland and be able to talk to the women one on one, right when they’re there, rather than when they’re removed—just data—as in other breast cancer studies I have done. I’ve seen a lot of women who are 10, 15 years out of treatment. It was really great to have the “bedside” aspect and to build my knowledge base in that area.

This experience has definitely made me more interested in the ground level application of research and how we can translate what we’re doing and bring it into these clinic offices. I can see myself expanding my research in targeting women with large scale physical activity and interventions. In other words, instead of just focusing on survivorship, intervening right after cancer diagnosis—before and during treatment—to cover the whole cancer continuum.
MAH DIEH JADALIHA

**Research Project:** Characterization of IncRNA to identify markers and drug targets

**UI Faculty Mentor:** Kannanganattu Prasanth, Cell and Developmental Biology

**Carle Physician Mentor:** Dr. Partha Ray

Please describe the research project you have been working on as part of C*STAR.*

In our lab we are working in the context of breast cancer progression. We’ve screened several long non-coding RNAs (lncRNAs), of which the role in breast cancer progression is largely unknown. Among them, there is a lncRNA called MALAT1 that we studied further, and observed it going up in metastatic breast cancer cell lines, as well as in patients. It is a cancer biomarker.

We observed when MALAT1 is not present, metastasis and tumor progression decrease. We studied different patients from several different databases and we observed a specific group of patients called lymphoma negative patients, triple negative subtype. We observed that in these patients with a higher level of MALAT1, survival decreased dramatically. So in this study, we proposed that MALAT1 could be a potential marker for these patients. And it is of great clinical importance because it is important to know who should get chemotherapy—and who should not—among lymphoma negative patients.

What has been unique about the C*STAR* program experience?

Being able to come to Carle has been such an interesting opportunity. I was able to shadow Dr. Ray and visit patients to see what their main problems and challenges were. I was able to get some samples from patients and study our molecule in actual patients from Carle, which we included in our paper. I saw how collaborative patients are and how happy they are to be involved. I saw some hope in their eyes that there is research going on between the University of Illinois scientists and Carle that may help future patients; they are happy to help with our research if it will benefit the next generation.

EVIJOLA LLABANI

**Research Project:** Fluorometric microculture cytotoxicity assay for personalized medicine

**UI Faculty Mentor:** Paul Hergenrother, Chemistry

**Carle Physician Mentor:** Dr. Maria Grosse Perdekamp

Give us an idea of your C*STAR* research project and what you’ve been working on.

I work in an anti-cancer, small molecule development lab group interested in screening the library of compounds that are really complex and diverse into different types of cancer cell lines. For my research, I conducted a phenotypic screen and tried to figure out which compounds would cause the most toxicity to cancer cells. Once I had a lead compound then I would do what we call structure activity relationship where we try to understand a little more of the parts of the molecule and what is needed for activity. I have tested the lead compound on colon, ovarian, pancreatic and breast cancer cells and it shows great activity and toxicity in all. Mainly for the past year I have been focusing on identifying the target—why this lead compound is so toxic to cancer cells. We have tested the compound in mice as well; so we inject cancer cells in mice (as a model) and see how treatment with the compound retards cancer cell growth.

How do you think the C*STAR* program will help you in the future?

I am at a point in my graduate career and development where I have to decide which way I want to go. Am I going to go to academia, industry, or clinical research? Being involved in the C*STAR* program opened up my eyes that it’s not just academia or industry, but I could actually be doing clinical research and see the translational part of drug discovery. It is really helping me develop as a well-rounded scholar. C*STAR* is helping me understand the IRB part of research has been very useful. I didn’t know that protocols needed all this privacy information, details and step by step checkpoints. It’s very useful to actually grow as a scholar, not just know the science part of things. It has informed and inspired me about other opportunities besides what we are traditionally told as scientists. I’m actually considering having a career in clinical research. I like helping out and seeing the patient side, their struggles, and that what we are doing can help them.
During the 2015-16 academic year, the CC@IL welcomed its first cohort of researchHS tart students. The program, supported by UI alumnus Ira Cohen and his wife, Debra, offers high school students the opportunity to be mentored through one-on-one interactions with faculty, staff, fellows, and graduate and undergraduate students at Illinois. The students were introduced to scientific research (specifically, cancer research) and provided with exposure to career opportunities related to preventing, detecting, diagnosing, and treating cancer. Students were mentored in the labs of professors Rohit Bhargava, Wawrzyniec (Wawosz) Dobrucki, Brendan Harley and Dipanjan Pan. Kathryn, Caroline, Angela, and Isabella will all start a new challenge—higher education—in fall 2016. In their own words, this is how the researchHS tart experience prepared them for what lies ahead.

KATHRYN FINN
Truman State University, Missouri
Major: Biology
ResearchHS tart was an amazing experience! Participating in the program was very beneficial. I will admit that doing the internship let me know I did not want to go into Bioengineering, but I feel that is okay. Even if a student leans away from Bioengineering, they have had a chance to really experience it. It might also let that student realize what they do want to major in.

CAROLINE MILLER
Miami University, Ohio
Major: Biochemistry
Thank you for the researchHS tart program. It was a great way to get into research and I can’t express my gratitude enough! Not only did I learn valuable lab techniques, research methods and how to use many different types of lab equipment, but I also discovered my passion for searching endlessly for answers. This summer has prepared me for a lifetime of learning and my career in the sciences and medicine.

ANGE LAW
University of Illinois at Urbana-Champaign
Major: Computer Science
I had an incredible experience working on the IR ‘stainless staining’ project last summer. My participation in the researchHS tart program allowed me to experience the collaborative and interdisciplinary environment of a research group while working on an interesting project related to cancer detection. It made me more aware of the great potential of computer science and technology in improving the medical field, a type of research that I hope to further pursue as an undergraduate student. ResearchHS tart gives the incredible chance to find out if you enjoy research, and it is definitely worth your time as long as you come with the mindset to learn, ask questions (everyone is really friendly, supportive, and willing to help), and explore your interests (there are so many fascinating research topics being pursued at Illinois). Thank you so much for the research opportunity.

ISABELLA LEE
University of Illinois at Urbana-Champaign
Major: Computer Science
One of the greatest benefits of researchHS tart is stepping into the shoes of a cancer researcher. I was treated like a valued member of the lab, rather than just a naive high school student, and I feel like that played a crucial role in giving me the true experience of a researcher. Rather than simply shadowing my mentor, I was given my own project and the freedom to run the tests and analyses necessary for completing the project, similar to a shortened (simplified) version of what a researcher might be expected to do. This experience will be what you make of it, however, so the more involved you are with your research, the more meaningful the program will be. I remember going home at the end of the day and continuing to work on things like image analysis because not all research has to be done when you are physically in the lab. This program really convinced me to pursue a career involving research, which is something that I might not have been able to determine until later, had I not participated in researchHS tart.

The Cancer Community at Illinois hosted a National Cancer Moonshot Initiative Town Hall Meeting on June 17 at the Beckman Institute for Advanced Science and Technology in Urbana. More than 50 faculty, staff, physicians, and community members attended and shared their thoughts on how cancer researchers at the University of Illinois at Urbana-Champaign and local physicians and advocates can contribute to the National Cancer Moonshot Initiative in unique ways. Comments and suggestions from the town hall meeting were recorded and summarized, and the CC@IL drafted and submitted a response to the National Cancer Institute. You can read the complete report at www.cancer.illinois.edu. For more information about the Cancer Moonshot, visit www.whitehouse.gov/CancerMoonshot.
On Tuesday, April 19, the Cancer Research Advocacy Group (CRAG) was launched on the University of Illinois’ Urbana campus. CRAG, which is being spearheaded by faculty members Erik Nelson and Zeynep Madak-Erdogan, will promote interactions between cancer survivors, researchers, and clinicians.

As part of the launch festivities, Jamie Holloway, an Illinois alumnus and patient advocate in Washington, D.C., visited campus. She spoke to a packed room of graduate students in the morning, a faculty group at noon, and then attended the CRAG kickoff reception in the evening. Her insights as a scientist and breast cancer survivor were inspirational and informative as CRAG is getting off the ground at the University of Illinois.

CRAG’s goals are to promote innovative, evidence-based, patient-centered, translational research through the inclusion of cancer advocates. They plan to increase discussion among survivors, researchers and the clinicians treating cancer that will eventually lead to better outcomes for all three groups. Survivor/advocate and clinician feedback can inform research, which in turn can help produce new clinical trials.

For more information on CRAG, visit www.cancer.illinois.edu/engagement/crag.
‘Kesem,’ the Hebrew word for “magic,” is what the Camp Kesem volunteers at the University of Illinois work to make for kids in Illinois who have been affected by their parents’ cancer. Since 2007, when the U of I Camp Kesem chapter began, student volunteers have created a fun escape for children in central and western Illinois dealing with their parents’ cancer, in the form of a week-long summer camp.

Executive board leaders Shannon Bonds and Aaron Graves predict they will have around 120 campers attend Camp Kesem in summer 2016, a large jump from the 15 campers who attended the first summer in 2007. The camp’s goal is to embrace the large and overlooked population of children—over three million in the United States—dealing with their parents’ cancer and help them through any academic, social, emotional, or developmental problems they might have as a result. Kids between the ages of six and 16 can attend camp for the week at Fort Benson Camp in Mount Carol, Illinois. Camp Kesem is led by college students and is free to all campers. The week includes activities like sports, arts and crafts, and drama, as well as “cabin chats” which give children the opportunity to share their experiences.

“It’s a bit different from other camps because we really want the kids to have the ‘it’s all about me’ moments, because a lot of them deal with so much. When their families go through so much stress, it can take a lot away from the kids being in the spotlight. We want to give that to them,” says Bonds.

Bonds and Graves expect that they will have a team of about 60 members who will train to become counselors for summer 2016. However, these volunteers will contribute more than just one week out of their summer for the cause. Much of the Camp Kesem impact is in providing year-round support for campers. This means that counselors in outreach positions do their best to show their support to their campers throughout the entire year. They attend their campers’ sporting events, dances, and plays and hold camp reunions in the fall.

In addition to outreach activities, counselors must help with fundraising which is extremely important to ensure all families can send their kids to camp, free of charge. Each counselor much raise $500 on their own, as well as take part in various fundraising events. The biggest fundraising event of the year is a benefit dinner called Make the Magic. This happens in February when the entire Camp Kesem U of I chapter, their family and friends gather for an evening of food, entertainment, and plenty of information and stories about Camp Kesem.

This year, the 4th annual Make the Magic Benefit Dinner is on February 20 at the Irish American Heritage Center in Chicago. The event is open to the public and the purchase of a ticket includes dinner, drinks and parking. For more information on the event and to purchase a ticket, visit the benefit page here.

To learn more about Camp Kesem at the University of Illinois and their mission, visit their Facebook page here or watch their summer 2015 video. If you would like to make a donation to the 2016 summer camp, visit their donation page at campkesem.org/illinois/donate.
NEW STUDENT GROUP SPREADS THE LOVE

By Meghan Olin

Love Your Melon (LYM), an apparel brand founded in 2012 and run by college students across the United States, has been active on the University of Illinois campus since 2014. Love Your Melon’s mission is to give a hat to every child in America who is battling cancer. To reach this goal, LYM recruits “College Campus Ambassadors” from over 300 educational institutions, including the University of Illinois at Urbana-Champaign, to help with the marketing and sales of their products.

Sophie Lanser, an Illinois engineering student and Crew Captain of LYM on campus, became interested in Love Your Melon when she was searching online for a winter hat to purchase. The rest is history. Since the chapter’s start in December 2014, Lanser said she has been surprised by the success of LYM and the support it has received.

The 20-member team relies heavily on fundraising events and social media to drive people to the LYM website. Fifty percent of the proceeds from each purchase goes toward providing a hat for a child with cancer. Each online purchase can be linked to U of I by selecting the school’s name from a drop down tab during the purchase. Every time someone makes a purchase in U of I’s name, the campus crew gets a certain amount of “credits.” A high number of credits means the crew receives special incentives and recognition from the national LYM branch. As of now, U of I sales have been growing at a rate that is pleasing to Lanser. “When we reached 200 credits, the LYM organization awarded free hats to all of our U of I crew members. They are really great about providing us with incentives and helping us reach our goals,” she explained.

To get more information about Love Your Melon at U of I, visit their Facebook page. To purchase official merchandise to support the Love Your Melon cause, as well as their partners CureSearch and The Pinky Swear Foundation, visit loveyourmelon.com.

LOVE YOUR MELON IMPACT

Love Your Melon is a unique organization that was founded by college students and depends largely on college students to fulfill its mission. Since its beginning in October 2012:

- More than 11,000 students at 740 different US colleges and universities have joined a LYM Campus Crew, to date.
- LYM donated 51,264 hats at 705 LYM events across the U.S. in 2015, surpassing its original goal of donating 45,000 hats to children undergoing cancer treatment.
- 50 percent of net proceeds from all LYM product sales are donated to LYMs 501(c)(3) nonprofit partners in the fight against pediatric cancer.
- In late 2015, LYM reached its goal of donating one million dollars to pediatric cancer research.

Impact statistics from loveyourmelon.com
While biological understanding has long focused on understanding the behavior of single cell types, there is a growing realization that the microenvironment of a tissue may determine its fate. Hence, a quantitative understanding of the tissue microenvironment (TiMe) is critical for advancing biomedical science and healthcare in applications ranging from regenerative medicine to managing the burden of cancer.

University of Illinois at Urbana-Champaign researchers are leading the charge in this area with expertise in biology and bioengineering, computational methods and imaging. The National Institutes of Health (NIH) is also recognizing Illinois’s excellence in TiMe by awarding a National Research Service Award Institutional Training Grant to the Urbana campus. This funding will help develop the next generation of scientific leaders. Illinois faculty member Rohit Bhargava is the PI of this award and more than 35 Illinois faculty from across campus will contribute to this new interdisciplinary training program for graduate students.

The program, which will be supported by the Beckman Institute for Advanced Science and Technology, the Department of Bioengineering, the Interdisciplinary Health Sciences Initiative, and the Cancer Community at Illinois, will integrate several technological approaches in TiMe-related studies using the biological contexts of disease and development. Bhargava, professor in bioengineering and the director of this NIH training grant, says the program will provide the students with intensive mentoring and systematic activities designed to enhance their research abilities and subsequently lead to novel translational advances.

“Our training program is distinctly advantaged by the University of Illinois’ strong history of successful graduate training,” said Bhargava, “This includes a commitment to diversity and individuals with disabilities, a culture of productive collaboration, a vibrant and productive bioengineering department, and strong institutional support.”

H. Rex Gaskins, faculty member in the Department of Animal Sciences, will serve as deputy director for the training program. The funding will support at least eight trainees for up to two years each. Students will be drawn from across campus via a competitive application process that is now open through August 1, 2016. More information on the TiMe training program, including details on how to apply, visit the Cancer Community at Illinois website.

Using the newly developed chemical imaging technology, in combination with an examination of the tumor microenvironment, the study will compare the results with existing standards to predict the chance of recurrent prostate cancer.

By Sue Johnson

By the Beckman Institute Communications Office

Image courtesy of Bhargava lab.
GRANTS

Stephen A. Boppart  
GlaxoSmithKline, “Center for Optical Molecular Imaging” (01/01/2016 – 01/01/2019)

Paul J. Hergenrother  
National Cancer Institute, “A novel strategy to overcome resistance in Temozolomide-Refractory Glioblastomas” (07/02/2015 – 06/30/17)

John A. Katzenellenbogen  
Department of Defense Prostate Cancer Synergistic Idea Development Award, “Development of mechanistically distinct androgen receptor antagonists and degraders for the treatment of advanced castration resistant prostate cancer” (07/01/15 – 03/31/18)

David M. Kranz  
National Cancer Institute, “Influence of structurally related self-peptides on T-cell mediated therapies” (07/01/15-06/31/17)

PUBLICATIONS


Smith SN, Harris DT, Kranz DM. T cell receptor engineering and analysis using the yeast display platform. Methods Mol Biol. 2015; 1319:95-141.


The Interdisciplinary Health Sciences Initiative (IHSI) at Illinois exists to catalyze, connect, support, and engage health sciences research across the University of Illinois at Urbana-Champaign campus. To that end, we unite researchers around health program areas, one of which is the Cancer Community at Illinois.

IHSI research development specialist Margaret Browne Huntt works to grow the Cancer Community and its collaborations and partnerships. She works directly with Steering Committee members and manages the day-to-day activities of the CC@IL.

If you would like more information about the research, education, or engagement opportunities the Cancer Community at Illinois offers, contact Margaret today.

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For the latest health sciences news, lecture, and event information, visit the IHSI website: healthinitiative.illinois.edu

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