Winter greetings to all! We had another busy and productive fall semester full of progress in the Cancer Community (CC@IL). Cancer research is a priority at the University of Illinois at Urbana-Champaign. This was amply reflected in the enthusiastic participation of our faculty, students, and staff in CC@IL activities. Not only are there several exciting programs being developed, student interest remains very strong and the numbers and diversity of faculty interested in cancer continues to increase campus-wide.

Several developments are noteworthy - we welcomed new faculty and staff members to our community with a special poster session and welcome reception. We are hopeful that cluster hiring in this area will progress rapidly to further grow our community in exciting new directions. Our Annual Cancer Community @ Illinois Planning Meeting was held in October. Many thanks to the speakers, who provided updates on our Working Groups, external funding, collaborative initiatives, and other programs, as well as to our external partners who enthusiastically participated. Collaborations with Carle and cancer efforts through the Mayo-Illinois Alliance for Technology-Based Healthcare are going strong. Several new center and training efforts are underway. The Graduate Cancer Community remains very active with an excellent Seminar Series in full swing for 2014-2015.

I am especially pleased to report that we now have a full complement of educational offerings for our students. The highlight of our community during the past year has undoubtedly been the establishment of the high school-focused researchHSStart program, the undergraduate Cancer Scholars program, and the graduate student-focused C*STAR program.

Together with the Carle-Beckman postdoctoral fellows program, we now have cancer-focused educational programs at all levels. From virtually no educational programming just a few years ago to a full slate of opportunities for our students is progress we should be very proud of and thankful for. I would like to especially recognize the generous support of Ira and Debra Cohen and collaborations with the University of Chicago and University of Illinois at Chicago for the researchHSStart program. The undergraduate program was launched with support from the College of Engineering and the Academy for Excellence in Engineering Education. Excellent progress continues to be made with Carle in working together and providing new opportunities for students. I am especially grateful for their support for the innovative C*STAR program.

In addition to the spring Working Group meetings, plans are underway to hold spring discussion meetings in our four program theme areas: Diagnostic Technologies and Imaging, Molecular Mechanisms, Social and Behavioral Sciences, and Computational and Precision Medicine. Please be on the lookout for announcements of these events.

It is wonderful to see our community thriving! Thank you to all who make it happen and especially to our steering committee and staff! As always, I look forward to hearing from you.

- Rohit Bhargava
Welcome New Staff Member

Armgard Haken

received her B.S. and M.S. degrees in biology from the University of Illinois at Urbana-Champaign. She previously held positions at the university as visiting project coordinator in the Division of Nutritional Sciences and as a research specialist/laboratory manager of a corn processing laboratory in the Department of Agricultural Engineering. She joined the Bhargava Laboratory in September 2014 as visiting program manager and will manage cancer activities, grant submissions, and publications.

Welcome New Member

Erik Nelson’s research is focused on 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. His research goal is to develop novel lifestyle or therapeutic strategies to prevent and treat metastatic diseases.

Welcome New Staff Member

Armgard Haken received her B.S. and M.S. degrees in biology from the University of Illinois at Urbana-Champaign. She previously held positions at the university as visiting project coordinator in the Division of Nutritional Sciences and as a research specialist/laboratory manager of a corn processing laboratory in the Department of Agricultural Engineering. She joined the Bhargava Laboratory in September 2014 as visiting program manager and will manage cancer activities, grant submissions, and publications.

Super-model

Doctoral candidate Boon Chong Goh, of the Department of Physics and Theoretical and Computational Biophysics Group at the Beckman Institute, was chosen as a finalist for his image of an atomic model of the immature retroviral lattice of Rous sarcoma virus by the School of Chemical Sciences Science Image Challenge 2014. The contest recognizes outstanding images created through computer-assisted or traditional methods designed to inform, educate, and inspire.

Rous sarcoma virus (RSV) is a tumor-generating avian retrovirus, which causes sarcoma in chickens, and is one of the first oncoviruses to be discovered.

“Knowing the structure of immature RSV allows us to study its protein-protein interactions, which could be universal across all retroviruses,” Goh said.

Goh, working under advisor Klaus Schulten, generated this image using Schulten’s visual molecular dynamics, or VMD which is useful in the creation of simulations to aid in the analysis of living systems from the atomic to organism scale.
The Cancer Community @ Illinois welcomed faculty, physicians, external partners, staff, and students to the Fall Reception and Mixer at the Beckman Institute for Advanced Science and Technology. The event provided a special opportunity for young investigators to network with the community and improve their research, funding, and education endeavors.

- Over 70 faculty and graduate students presented posters.
- Faculty and staff attended from departments and units that included Animal Sciences, Beckman Institute, Bioengineering, Civil & Environmental Engineering, Food Science & Human Nutrition, Interdisciplinary Health Sciences Initiative, Kinesiology & Community Health, Materials Science & Engineering, Molecular & Integrative Physiology, Office of the Vice Chancellor for Research, School of Social Work, and Veterinary Clinical Medicine.
- Representatives from the Carle Cancer Center and American Cancer Society were the featured external partners.
At its third annual meeting in October, Cancer Community @ Illinois members gathered to give updates about ongoing cancer-related initiatives and programs, emerging areas of collaborative cancer research strength, and external funding applications.

Beckman Institute professor and Cancer Community Faculty Coordinator Rohit Bhargava highlighted achievements and developments serving to advance the cancer research enterprise at Illinois. Closer cooperation with clinical partners—specifically, a simpler IRB process and a student and physician cancer research program—has improved the research climate, Bhargava said.

Working groups concerned with Survivorship, Nutrition, and Physical Activity have been added to the Cancer Community’s collaborative research portfolio. Also, Bhargava cited an increase in campus support as integral to the growth of the Cancer Community.

Faculty cluster hiring around cancer research expertise, a proposed College of Medicine at Urbana-Champaign that plays to our campus’ strengths, and the creation of the Interdisciplinary Health Sciences Initiative (IHSI) to support and promote health research have all played a part in increasing the Cancer Community’s momentum.

Bhargava noted that while cancer is a leading research topic at Illinois, strengths are dispersed. He introduced a “bench to life” vision to focus and unite researchers.

“Rather than a ‘bench to bedside’ research approach to an acute disease, instead we focus on cancer across the lifespan and aim to make it a chronic, managed illness,” Bhargava said. “We use basic science and technology to improve cancer-affected lives. Cancer-free living inspires our research.”

Neal Cohen, IHSI Director and Beckman Institute professor, echoed Bhargava’s remarks and voiced his support of the Cancer Community’s vision.

“The Cancer Community is a poster child of faculty-driven research communities, of which IHSI will continue to encourage and support at Illinois,” Cohen said.

“It’s incredibly important to keep building and promoting this community, so that campus and the world can use it as an example.”

PHOTOS ON FOLLOWING PAGE:
Top row, from left: American Cancer Society’s Elizabeth Jablonski, Rashid Bashir, Bryan White, Barbara Fiese
Second row, from left: Carle’s Kendrith Rowland, Zeynep Madak-Erdogan, Carle’s Mark Zhang
Third row, from left: H. Rex Gaskins, Saurabh Sinha, Neal Cohen
Fourth row, from left: Jeffrey Woods, Jennifer Eardley, Vasmi Vasireddy, Ed Roy
Félix Recillas Targa, the head of the Institute for Cell Physiology at the National Autonomous University of Mexico (UNAM), spoke October 14 at Bevier Hall as part of a Topics in Nutrition special seminar in the College of Agriculture Consumer and Environmental Sciences (ACES).

He challenged the audience, comprised of graduate students and faculty, to think differently about how cancer cells form. His talk, “Epigenetic Regulation of the Human p53 Tumor Suppressor Gene by CTCF and Through Its Interaction with the Antisense RNA, Wrap53,” dealt with that premise.

His efforts, by way of epigenetics, focus on the structure of the genome which, if it begins to fail, can affect the expression of the DNA and, in turn, make way for the generation of tumor cells.

Associate Professor Hong Chen of the Department of Food Science and Human Nutrition, was instrumental in bringing Dr. Targa to speak at the university. Dr. Targa and Dr. Chen are collaborating on a project that is currently supported by a joint research partnership program between Illinois College of ACES and UNAM. They are studying the epigenetic mechanisms of colon cancer development by dietary factors.

Bioengineering professor Princess Imoukhuede is working to personalize cancer treatments through the inhibition of angiogenesis or the formation of the blood vessels that cancer needs in order to grow.

Imoukhuede determined that a certain subset of cells within the tumor microenvironment had very high levels of expression of one of these angiogenic receptors that could negate some of the effects of a common antiangiogenic drug. (Antiangiogenic drugs block receptors that encourage tumor growth.)

With this new understanding of the tumor microenvironment, knowledge of the number of receptors, and application of data to computational models that predict cancer drug efficacy, clinicians can determine the best individualized treatment option for each patient.

Cancer Community members Saurabh Sinha, professor of computer science, and Jun Song, professor of bioengineering and physics, are co-PIs of the project. Fellow community member C. Victor Jongeneel, director of bioinformatics at the Carl R. Woese Institute for Genomic Biology will function as the executive director of the center. Investigators hope to mine large amounts of data, while protecting privacy, for eventual application to improving human health.

Individualizing Treatments

Analyzing Big Data

Reprogramming Cells

Jiawei Han, professor of computer science, will lead a new Center of Excellence for Big Data Computing as part of the National Institutes of Health Big Data to Knowledge (BD2K) Initiative. This four-year award reflects collaboration between the University of Illinois and the Mayo Clinic. The new center is charged with developing new strategies to analyze and leverage the explosion of increasingly complex biomedical data sets, often referred to as Big Data.

Cancer Community members Saurabh Sinha, professor of computer science, and Jun Song, professor of bioengineering and physics, are co-PIs of the project. Fellow community member C. Victor Jongeneel, director of bioinformatics at the Carl R. Woese Institute for Genomic Biology will function as the executive director of the center. Investigators hope to mine large amounts of data, while protecting privacy, for eventual application to improving human health.

Understanding the reprogramming process may shed light on events that take place during the cellular transformation in cancer, an area in which Song has a particular interest. Song’s research program in computational biology and biomedicine aims to discover how gene expression is regulated.

His research has implications for the prognosis and treatment of cancer, in particular the often fatal malignant melanoma, or skin cancer.
High School Students Start Early on Cancer Research

The researchHSStart program is an 8-week cancer-focused research and career development experience for high school students from the Chicago and Champaign-Urbana areas. Hosted by the University of Chicago and the University of Illinois (Chicago and Urbana-Champaign), the research experience is the core of the program, providing hands-on, full-time immersion into a cancer research environment under the supervision of an established, funded investigator.

The goals of the program are to:

1. introduce students to scientific research (specifically cancer research).
2. promote career opportunities in the area of cancer.
3. help students gain knowledge in biophysics, biochemistry, immunology, and pharmacology.
4. help students gain an understanding of cancer and its impact on Illinois residents.

Students are mentored through frequent one-on-one interactions with a University of Chicago or University of Illinois faculty member and may be trained in technical skills by senior graduate students, fellows, or technical staff in the laboratory. Research projects are designed by mentors to be independent, limited, and achievable in eight weeks.

As an active member of the research group, students are expected to participate in laboratory meetings, seminars, and journal clubs as required by the mentor. Students will also participate in various workshops to gain a broader understanding of cancer and cancer-related careers, and develop critical problem-solving and presentation skills.

Topics to be covered during the eight weeks may include cancer epidemiology, cancer treatment, imaging, the molecular and biochemical underpinnings of cancer, immunology, pharmacogenomics of anticancer agents, engineering, biomarker development, anticancer agents development, experimental cancer therapeutics, and cancer disparities.

Find out more about the program at cancer.illinois.edu/researchHSStart.
The Cancer Scholars Program (CSP) is a new undergraduate training program sponsored by the Department of Bioengineering as part of the College of Engineering’s Strategic Instructional Initiatives Program (SIIP). SIIP is a competitive grant program that enables faculty teams to do large-scale innovation in undergraduate education. Administered by the College’s Academy for Excellence in Engineering Education (AE3), SIIP has achieved success by bringing Illinois’ outstanding research culture to teaching, including an engaged community, collaborative projects, faculty-led innovation, rigorous evaluation, and scholarly approach to pedagogical methods.

The ideas behind the challenge-inspired model are powerful—drawing on students’ passions early on, and providing them with a community in which to develop not only expertise, but also their identities as engineers and scientists. The CSP provides a unique, interdisciplinary student experience in a major health care challenge area. Below are the inaugural class members and their motivation for participating in the program.
At the end of their studies, most engineering students at Illinois engage in a senior design or project and join the workforce (including higher education), depending on which company/university offers them admission. This linear, one-track model works well for disciplinary training, but is often lacking in mechanisms to support further inquiry and engage consistently in an inspiring area of scholarship.

The CSP is designed to augment the traditional engineering training model, whereby there is inspired merging of education and a real-world problem (shown in the figure below).

The inaugural Cancer Scholars introductory course “Frontiers in Cancer Research” is a 1-credit-hour course introduced during the fall 2014 semester. The course features TED-type talks and discussion on the frontiers of cancer research.

Students met for 2 hours a week and a speaker provided a 30-minute overview of an important topic in cancer research. The next 90 minutes were devoted to understanding how engineering education is needed to solve the problem. The talks were designed to encourage critical thinking and help them seek further knowledge. In the subsequent spring semester, they are expected to join a research group and start research that will continue over the summer.

Each cancer scholar is paired with a graduate or postdoctoral mentor. In the fall of year 2, students attend a second discovery course focused on contemporary healthcare problems and the impact of science and engineering in the same format as the year 1 introductory course.

After year 2, students spend the summer in a clinical or patient-oriented setting to develop an appreciation of the real-world impact of their classroom and laboratory education. Departmental and other degree requirements will continue as per departmental guidelines. In year 3, students attend a course that focuses on the engineering process, fostering the identification of needs and potential engineering solutions, enabling them to identify a suitable project for senior design.

Towards the end of their undergraduate degree, students will be cross-trained in at least one other relevant discipline via an introductory course, as well as volunteer efforts for at least one semester.

A capstone experience will involve advanced coursework, including the base graduate course in the “cancer” track in bioengineering, and another course focused on entrepreneurship, advanced research topic, or policy.

“We in AE3 are excited about the early success of the Cancer Scholars Program, and believe it will motivate similar innovations elsewhere in the college. The creative structure, the emphasis on student engagement, and the rigor of the program exemplify our values for engineering education at Illinois.” — Laura Hahn, AE3 Director

For more information about the CSP program, visit cancer.illinois.edu/csp.
President-designate Killeen Visits the Beckman Institute and Learns of Cancer Scholars Program

Carle Foundation Hospital, through its Cancer Center and the University of Illinois at Urbana-Champaign (Illinois), will jointly launch the Cancer Scholars for Translational and Applied Research (C*STAR) Program during the fall 2015 semester. This graduate education program will foster translational research and near-term benefits to the patients served by Carle and to the Urbana-Champaign and surrounding communities.

The establishment of the C*STAR program will allow up to six students per year the opportunity to work with a Carle Cancer Center physician and an Illinois faculty member on a cancer-relevant project. Students will be given firsthand experience working on a clinically relevant project that addresses cancer prevention, detection, diagnosis, or treatment.

Programmatic activities will include having students and faculty members who are funded by the program participate in grand rounds, site-alternating monthly workshops, quarterly collaborative update meetings, and joint seminars held every other week.

Long-term goals include:

- developing the foundation for tangible translational outcomes.
- employing the program to attract high-quality clinician-scientists to Carle and translation-focused faculty to the university.
- fostering connections between Carle physician-scientists and Illinois faculty that lead to innovative research projects.
- more effectively including Carle physicians, resources, and facilities into multi-PI efforts.
- establishing faculty and clinician mentoring programs for graduate students.

For more information about the C*STAR program, go to cancer.illinois.edu/graduate.
Illinois’ Paul Hergenrother, the Kenneth Rinehart Jr. Endowed Chair in Natural Products Chemistry, and Susan Clare, a research associate professor of surgery at Northwestern University Feinberg School of Medicine, were keynote speakers at the Graduate Cancer Community @ IL Fall Symposium on September 16 at the Alice Campbell Center Alumni Ballroom.

Hergenrother spoke of his lab’s PAC-1 (pronounced “pack one”) drug that has proven successful in animal trials and recently gained FDA approval for human clinical trials (see story on page 16). The drug also works well in conjunction with other existing cancer therapies.

Illinois graduate student Mark Gryka was impressed with Hergenrother’s talk.

“In a research lab on a research campus, moving a drug from the RND stage through to actual clinical trial is huge. It’s the epitome of research.”

Clare assumed the podium after the well-attended poster session featuring work being done on campus by the graduate students. She is using her background as a PhD in chemistry, as well as her MD in surgery, to focus on the biological properties that cause breast cancer, specifically triple-negative breast cancer, in African-American women.

Both Clare and Hergenrother have witnessed the changing roles and opportunities facing researchers in today’s tight funding climate. They are aware of the urgency to create and sustain relationships between scientists and physicians.

Hergenrother cautioned the young scientists to be careful to not get caught in the “valley of death” where research often dies before it reaches a clinical trial. He advocated marketing one’s own drug therapy as he does with his company, Vanquish Oncology.

And Clare had some advice of her own.

“I think even if you’re a PhD and you don’t want to be a MD/PhD,” Clare told the audience, “We physicians are your best partners. And if we aren’t doing research and speaking your language, I think that’s going to be to the detriment of moving science forward.”

2014 – 2015 Seminar Series

The Graduate Cancer Community @ IL (GCC@IL) strives to unite students and researchers from different disciplines through their shared interest in the biological and environmental causes of cancer, as well as its social consequences.

Through its 2014-2015 Seminar Series, the organization enabled the broader campus community to come together in one place to learn about and discuss cancer-related issues with peers with whom they may not have otherwise have contact.

Six faculty members from the University of Illinois at Urbana-Champaign campus served as speakers this year. Collectively, their research interests spanned an array of relevant topic areas that include engineering, biological sciences, and social sciences. These professors approach cancer research with different mindsets and toolboxes, which is precisely what GCC@IL wanted to capture with the seminar series.

Jian Ma (Bioengineering) and Michael Oelze (Electrical and Computer Engineering) use their expertise in computation and imaging to improve understanding regarding the genetics and detection of cancer.

David Kranz (Biochemistry) and John Katzenellenbogen (Chemistry) seek to pioneer new therapies and diagnostics by promoting the understanding of the immune system and steroid hormones.

Elizabeth Jeffery (Food Science & Human Nutrition) and Karin Rosenblatt (Kinesiology & Community Health) highlight environmental causes of cancer by shedding light on the nutrition and epidemiology.
Get Cheeky, Get Swabbed: Delete Blood Cancer

Seventy-seven donors from around campus stopped by the Illini Union on Halloween to make an important, potentially life-saving donation to the Delete Blood Cancer Marrow Drive.

Volunteers from nine campus organizations, (Office of Volunteer Programs, Volunteer Illini Projects, Alpha Epsilon Delta Pre-Health Society, Students Today Leaders Forever, African Americans in Pre-Health, Water Aid, American Medical Women’s Association, Colleges Against Cancer, InterVarsity), helped with the first-time event on Illinois’ campus.

To learn more about the organization, visit deletebloodcancer.org.

PHOTO, from left: Cynthia Branch and Clair Sullivan.

“Swish and swallow,” said one volunteer. “Just to clean out the food and such.”

“One swab goes for one cheek and one swab goes for the other,” said another.

No needles. No blood.

Just some saliva.

That’s all the biological material the student volunteers needed to collect at their donor drive on October 31 at the Illini Union.

With any luck, it will be enough to save lives.

At least that’s what Clair Sullivan, an assistant professor in the Department of Nuclear, Plasma, and Radiological Engineering, had in mind when she thought to bring the international Delete Blood Cancer program to the university.

“When [my mother] was diagnosed with cancer, I was just getting ready to move out here to take a faculty job,” she explained. “The university was really great in accommodating for this emergency family situation of a brand-new, very serious cancer diagnosis. So now that my mom is feeling better and a year post-transplant, I really wanted to give something back to both the university as well as the overall blood cancer community.”

Sullivan told her story with her mom, Cynthia Branch, standing by her side at the drive.

“I had anaplastic large-cell lymphoma, and there are never enough of us at any one time over the world to do a good study so there’s very little treatment for it,” Branch said.

She went through one round of treatment that bought her five months of remission.

Then the cancer returned.

Because there are so few people with the type of blood cancer Branch had, and because scientists have not been able to study the disease, Branch volunteered herself, in her words, as “a lab rat” with the hopes that something might be learned.

“They told me right from the beginning if the chemo doesn’t work, there’s a stem cell transplant. Those are the only options you have.”

Branch’s cancer hadn’t spread to her bone marrow, so she was able to use her own stem cells, but that situation is far from the norm.

Seventy percent of patients diagnosed with blood cancer depend on a bone marrow donation from a complete stranger. Only thirty percent of patients are able to rely on a family member to provide a donation.

“A stem-cell transplant is such an amazing thing,” Branch said as she looked around the room filled with donors and volunteers from nine different registered student organizations.

“The term that’s used is ‘cure.’ It’s not a remission. It’s a cure and the cure is in somebody else’s cells. How great is that?”
Researchers from the Mayo Clinic and the University of Illinois embarked on a journey to expand upon existing biomarker identification during the first Mayo-Illinois Alliance Biomarker Discovery Workshop, held in Urbana.

The term ‘biomarker’ is broad, comprising all measurable indicators of a biological state or condition. Biomarker examples include specific molecules or proteins, imaging agents, or even genome sequencing tests that have the ability to inform physicians of a possible clinical dilemma.

Illinois’ Rashid Bashir, the Abel Bliss Professor of Electrical and Computer Engineering and head of the Department of Bioengineering and one of the workshop organizers, recognizes the enormous potential inherent in a multidisciplinary collaboration with Mayo.

“Mayo is a top-ranked institution with world-class faculty and clinicians doing clinical research and healthcare delivery. Mayo can provide a great opportunity for our faculty and students to do clinical translation work in bioengineering,” Bashir said.

The Mayo-Illinois Alliance began in 2010 to advance both research and clinical treatment options in healthcare. Since then, faculty and clinicians from both institutions have been working collaboratively on integrated research activities focusing on information-based medicine, genomics, and point-of-care diagnostics.

Dr. George Vasmatzis, director of the Biomarker Discovery Program within the Center for Individualized Medicine at the Mayo Clinic, Bashir, and a third organizer, Illinois associate professor of chemistry Ryan Bailey, devised three “grand challenges” to encourage collaboration between the two institutions and to use their varied backgrounds of expertise.

The Mayo-Illinois Alliance awarded funding to three collaborative research proposals, two of which dealt with identifying and evaluating novel cancer biomarkers.

“Good enough is just not good enough. We need to save more lives.”

During his talk, he highlighted several changes initiated during ACS’ recent restructuring and the resulting positive impact.

In continuing to move forward, he stressed that prevention, research, and access are the topics current researchers and policy makers should consider. He emphasized the need to promote prevention in public policy, double research, and provide access to quality health care.

Noted as a unifying thread among the three emphasis areas was advocacy and the role it plays. He explained that ACS is leading the movement to bring cancer under control in the 21st century through its highly visible cancer control enterprise and change agency.

While much progress continues to be realized he pointed out, “Good enough is just not good enough. We need to save more lives.”

On Your Mark: Mayo-Illinois Alliance Races to Discover the Next Cancer Biomarker

Partnerships

Dr. John Seffrin, president and chief executive officer (CEO) of the American Cancer Society (ACS), spoke before a standing room only crowd during his visit to the Urbana-Champaign campus in November. His talk, “Finishing The Fight Against Cancer: Opportunities to Save More Lives”, provided a roadmap of considerations for anyone committed to the fight.

Seffrin has been on the frontlines of the war against cancer for many years. This can be seen in his role as CEO of the ACS, and as one of the society’s roughly three million volunteers nationwide. Under his leadership, the ACS became the world’s largest voluntary health organization fighting cancer.

During his talk, he highlighted several changes initiated during ACS’ recent restructuring and the resulting positive impact.
A new drug that prompts cancer cells to self-destruct while sparing healthy cells is now entering phase I clinical trials in humans. The drug, called PAC-1, first showed promise in the treatment of pet dogs with spontaneously occurring cancers, and is still in clinical trials in dogs with osteosarcoma.

“The compound was discovered and is being developed based on the hypothesis that most cancers have elevated levels of an enzyme called procaspase-3,” said University of Illinois chemistry professor Paul Hergenrother, who discovered the anti-cancer effects of PAC-1 more than a decade ago. “Procaspase-3 is an enzyme that, when turned on, kills cells.”

Cancer cells, however, override this normal cell-recycling pathway, he said.

“Even though they have elevated levels of procaspase-3, cancer cells never turn the enzyme on. So they keep growing and become tumors,” he said. “PAC-1 restores the activity of procaspase-3 and, because the enzyme is elevated in cancer cells, it targets cancer cells over non-cancerous cells.”

Early tests of the drug’s effectiveness came when Hergenrother collaborated with University of Illinois veterinary clinical sciences professor Timothy Fan, who tested PAC-1 in his canine cancer patients. These clinical trials helped the researchers find the best way to deliver the drug—it is now in pill form for both human and canine patients—and led to new insights into the drug’s activity and potential, Fan said.

“One of PAC-1’s greatest strengths is that it synergizes with other drugs, increasing the anti-cancer effects of many compounds that are out there,” Fan said. “It also crosses the blood-brain barrier very well,” making it a good candidate for the treatment of brain cancer in humans and dogs, he said.

“Treatment for brain cancer is a huge area of need,” said Dr. Arkadiusz Dudek, a physician and professor of hematology and oncology at the University of Illinois at Chicago, who will direct the human clinical trials at the University of Illinois Cancer Center in Chicago.

“Currently, we do not have that many therapies available for glioblastoma multiforme,” the most common and malignant type of brain cancer. PAC-1 is one of only a few drug agents developed and tested in animals and in humans at a single institution, Dudek said.

The work in dogs led to the formation of the Illinois-based company Vanquish Oncology to develop this anti-cancer agent. Vanquish received initial support from the investment firm IllinoisVENTURES, and an anonymous “angel investor” provided the funding to move the drug through preclinical trials and gain federal Food and Drug Administration approval to begin a phase I clinical trial.

The trial, led by Dr. Oana Danciu of the University of Illinois Hospital and Health Sciences System in Chicago, opened enrollment to patients with advanced malignancies. Doctors will start the first patients at a low dose and gradually increase the dose and watch for side effects, the researchers said.

“Because this is the first time ever a human will take PAC-1, we will track the blood concentration of the compound over time at different doses,” Hergenrother said. Once they find the optimal dose, clinicians will start new trials in brain cancer patients at the University of Illinois Cancer Center and at Johns Hopkins University School of Medicine in Baltimore.

In the meantime, Fan and his colleagues hope to begin clinical trials of PAC-1 in pet dogs with brain cancer. They will look at PAC-1 in combination with radiation and in combination with temozolomide, a key brain cancer drug used in humans and dogs.
Pick Your Poison
Researcher Dipanjan Pan Transforms Toxins into Treatments

Bees, snake, or scorpion venom could form the basis of a new generation of cancer-fighting drugs, scientists from the University of Illinois at Urbana-Champaign (Illinois) have reported. They devised a method for targeting venom proteins specifically to malignant cells while sparing healthy ones, which reduces or eliminates side effects that the toxins otherwise would cause.

“We have safely used venom toxins in tiny nanometer-sized particles to treat breast cancer and melanoma cells in the laboratory,” says Bioengineering assistant professor Dipanjan Pan, who led the study. “These particles, which are camouflaged from the immune system, take the toxin directly to the cancer cells, sparing normal tissue.”

Venom from snakes, bees, and scorpions contains proteins and peptides which, when separated from the other components and tested individually, can attach to cancer cell membranes. That activity could potentially block the growth and spread of the disease. Pan and his team say that some of substances found in any of these venoms could be effective anti-tumor agents.

But just injecting venoms into a patient could have catastrophic side effects. Among these could be damage to the heart muscle or nerve cells, unwanted clotting, or bleeding under the skin.

So Pan and his team at Illinois set out to solve this problem.

He says that in the Brazilian yellow scorpion study, his group identified a toxin called TsAP-1.

To figure out how TsAP-1 would work inside a nanoparticle, they conducted computational studies where the team injected their synthetic toxin into nanoparticles.

“The peptide toxins we made are so tightly packed within the nanoparticle that they don’t leach out when exposed to the bloodstream and cause side effects,” Pan explained.

Instead they go directly to the tumor, where they bind to cancer stem cells, blocking their growth.

Pan continued to explain that synthetic peptides mimicking components from other venoms, such as those from snakes or scorpions, also work well in the nanoparticles as a possible cancer therapy.

He says the next step is to examine the new treatment approach in rats and pigs. Eventually, his team hopes to begin a study involving patients.

Pan estimates that this could be in the next three to five years.

We Have a New Look!
Visit our website to find out more information about the Cancer Community at Illinois at cancer.illinois.edu/.

If you would like to receive updates about community events and activities, subscribe to our mailing list at cancergroup@illinois.edu.
Cancer Community members (pictured, left to right), Elvira de Mejia, professor of food science and human nutrition, Paul Hergenrother, professor of chemistry, and Sandra Rodriguez-Zas, professor of animal sciences, were three of the six named 2014 University of Illinois at Urbana-Champaign (Illinois) Scholars.

The program recognizes excellence in teaching, scholarship and service. The designation is one of the highest honors the university grants.

### Rashid Bashir

**Bioengineering Professor and Department Head**

Elected a Fellow of the International Academy of Medical and Biological Engineering. Bashir was also selected as Chair of the Nanotechnology Study Section in the Center for Scientific Review of the National Institutes for Health.

### Rohit Bhargava

**Professor of Bioengineering**

To be inducted in the American Institute for Medical and Biological Engineering. Bhargava was also elected a Fellow of the Society for Applied Spectroscopy.

### Brendan Harley

**Assistant Professor of Chemical and Biomolecular Engineering**

One of six Illinois faculty members to be elected a 2014 Fellow of the American Association for the Advancement of Science. Harley also received the Everitt Award for Teaching Excellence from the College of Engineering.

### John Erdman

**Professor of Department of Food Science and Human Nutrition**

Received the Gilbert A. Leveille Award and Lectureship, awarded by the American Institute for Nutrition and the Institute of Food Technologists.

### Deborah Leckband

**Professor of Chemical and Biomolecular Engineering and Graduate Program Director in the Department of Bioengineering**

Honored as one of the newest Fellows of the Biomedical Engineering Society.

### Brian Cunningham

**Professor of Electrical and Computer Engineering**

Received a Technical Achievement Award from the Institute of Electrical and Electronics Engineers’ Engineering in Medicine and Biology Society. Cunningham was also appointed a Fellow of both The Optical Society and the National Academy of Inventors.

### Kristopher Kilian

**Assistant Professor in the Department of Materials Science and Engineering**

Received a National Science Foundation CAREER award to study somatic cell programming.

### Dipanjan Pan

**Assistant Professor in Bioengineering**

Named a Fellow of the Royal Society of Chemistry for his professional contributions to the chemical sciences. Pan joined the editorial advisory board of Molecular Pharmaceutics American Chemical Society.
Carle Receives NCI Grant for Community-based Research

In fall 2014, the Carle Cancer Center received a grant from the National Cancer Institute (NCI) Community Oncology Research Program (NCORP) to help fund cancer clinical trials.

This is an honor as Carle was chosen as one of 34 community site nationwide to receive the award. NCORP is an integrated national network established to:

1. design and conduct cancer prevention, control, and screening clinical trials.
2. design and conduct cancer care delivery research.
3. enhance patient and provider access to treatment and imaging clinical trials.
4. integrate disparity research questions into clinical trials and cancer care delivery research.

Ultimately, the goal of the NCORP is to bring researchers together with community-based physicians to conduct high quality clinical studies for cancer patients and for people at risk of cancer in local settings, where most patients receive their care. Areas of interest include reducing cancer risk and incidence, improving cancer care outcomes, expanding access to cancer care, increasing quality and balancing cost, and reducing cancer disparities.

Carle has been a participant in NCI trials for the past 31 years through NCORP's Community Clinical Oncology Program (CCOP).

One major change to the new grant program is the addition of Cancer Care Delivery Research (CCDR). The CCDR examines how social factors, financing systems, organizational structures and processes, health technologies, healthcare providers and individual behaviors affect cancer outcomes, access to and quality of care, cancer care costs, and the health and well-being of cancer patients and survivors.

Leading the CCDR efforts as co-investigators are Magesh Sundaram and Vamsi Vasireddy, two of Carle's oncologists. Serving in leadership roles for the Cancer Center, both physicians are committed to analyzing the process for the delivery of cancer care and finding better ways to serve the cancer community. Dr. Sundaram brings a wealth of oncology experience and was recently named in the top 1 percent in the nation in his specialty by U.S. News & World Report.

Dr. Vasireddy serves as the Assistant Medical Director of the Cancer Center and has practiced at Carle since 2006. His interests reside in hematologic malignancies, lung cancer, and cancer care delivery. In his current role, he facilitates the implementation of site specialization and oversees the quality of care delivered at the Cancer Center.

Be on the Lookout for these Upcoming Area Events!

| March | Relay For Life Activities  
| 3/14  | University of Illinois Armory  
|       | 1700 S. Fourth Street, Champaign  
|       | 5:30 p.m. Survivors Dinner  
|       | 7:30 p.m. Opening Ceremony  

| April | Coaches vs. Cancer Dinner & Auction  
| 4/15  | Hosted by Illinois coaches Groce, Beckman & Bollant  
|       | 5:30 p.m. Hilton Garden Inn, 1501 S. Neil Street  
|       | Champaign  

| April | Cancer Community Spring Reception hosted by the Carle Cancer Center  
| 4/23  | 3 p.m. Houseworth Conference Room  
|       | Carle Cancer Center (2nd Floor)  
|       | 509 W. University Avenue, Urbana  
|       | For more information, contact Janet Iverson at (217) 383-4018.  

| May | Carle Cancer Center Annual Cancer Survivors Retreat  
| 5/9  | 8 a.m. – 4 p.m. Allerton Park in Monticello  
|       | For more information, contact Kimberly Harden at (217) 383-458.  

| June | Relay For Life of Champaign County Survivor Dinner  
| 6/2  | 6 p.m. Faith United Methodist Church  
|       | 1719 S. Prospect Avenue, Champaign  

| August | American Cancer Society Day at the Ballpark  
| 8/2   | 1:15 p.m. St. Louis Cardinals vs. Colorado Rockies at Busch Stadium in St. Louis  

| August | Launch of the Cancer Scholars for Translational and Applied Research Graduate Program (C*STAR)  
| 8/24  | Visit cancer.illinois.edu/education/graduate.  

Carle Receives NCI Grant for Community-based Research