Welcome to a new year for the University of Arizona Cancer Center’s Act Against Cancer, our publication that focuses on our unwavering mission to prevent, detect and cure cancer.

In our laboratories and our clinics, our efforts are centered on precision medicine – finding and using the right tools at the right time for the right outcomes for each individual who has cancer or who may have the genetic makeup that could make her or him susceptible to cancer.

This issue of Act Against Cancer profiles several of our researchers whose work is narrowing the focus to create an environment in which precision medicine becomes the standard for quality cancer care.

Last fall, we quietly introduced a new format for this publication in order to give us the ability to present these researchers’ works in the most interesting, eye-catching ways possible.

Thank you for your continued support of the University of Arizona Cancer Center.

On the cover:

Ghassan Mouneimne, PhD, combines the eye of a visual artist with the mind of a research scientist to explore ways to prevent cancer cells from spreading.

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“A Note to Our Readers”

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“Science as Art”

“The Dance” - Dr. Joyce Schroeder’s lab

The golgi “protein sorter” of these normal cells is shown here in orange, and their nuclei is shown in blue. All the cells point their golgi in the same direction, as if they are holding hands and engaging in a dance in unison.
Dr. Mouneimne, an assistant professor of cellular and molecular medicine and a University of Arizona Cancer Center researcher, is among the nation’s finest young cell biologists, but what makes his work unique is his talent in microscopy and graphic design.

“My brother is an architect, so I always figured he was the one born with the artistic, visual talent,” Dr. Mouneimne said. “But as I've started doing more microscopy and incorporating more graphic design into my presentations, it’s actually allowed me to see things differently.”

Dr. Mouneimne was born and raised in Beirut, Lebanon. He came to New York in 2001 to study at the Albert Einstein College of Medicine. That is where he first started dabbling with graphic design programs. He was constantly searching for various ways to help illustrate his findings for his cell biology peers.

Dr. Mouneimne completed his post-graduate work at Harvard Medical School, where his interests in graphics and cell biology merged to help make him one of the most innovative, exciting researchers in his field. He joined the faculty at the UACC in October 2013.

At first, he primarily used Adobe Photoshop simply to highlight the areas of a cell he wished to discuss in his presentations. As his proficiency with the software grew, his latent artistic abilities came to the surface, as many of his images started to look more like works of art than standard PowerPoint slides.

“A lot of our work in this field is visual in nature,” Dr. Mouneimne said. “So it only makes sense to me to make those visuals appear as dramatic and captivating as possible. It helps me explain what would otherwise be very complex ideas in a much simpler way.”

Image integrity, of course, is Dr. Mouneimne’s top priority. Images, no matter how eye-catching, are useless if they don’t convey the correct information or if they present a cell out of its proper context.

“There is a very fine line between image presentation and image manipulation,” Dr. Mouneimne said. “The ultimate purpose of these images is to always present the data in a clear and faithful manner.”

In his lab, Dr. Mouneimne focuses primarily on why some breast cancer cells remain within the original tumor site, while other cells become invasive and metastatic — the most dangerous types of cancer cells.

“The spreading of tumors to secondary organs is one of the primary causes of death in cancer patients, and we don’t have effective treatment strategies for that stage,” Dr. Mouneimne said. “Therefore, the therapeutic regimens targeting cancer cell invasion would be extremely valuable for cancer management and treatment.”

Developing those therapies, of course, is incredibly challenging. Cancer cells are plastic, adaptive, and tough to pin down. The vast majority of treatment strategies focus on shrinking the tumor, and often fail when cells metastasize.

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the primary tumor and eliminating those cancer cells. But Dr. Mouneimne believes he and his colleagues are on the way to identifying ways that would allow researchers to identify and treat those “travelling cells” before they can migrate through the connective tissue and create tumors in other parts of the body.

“Metastasis is a very inefficient process. Many cancer cells die before making it to the secondary site, and many don’t develop a tumor even after they do reach other organs.” Dr. Mouneimne said. “It’s a rare event, but when it does happen, it’s incredibly destructive. Our goal is to identify cancer cells at the earliest steps of metastasis and prevent them from spreading to other organs.”

Changes in a cell’s cytoskeleton (“The backbone of the cell,” said Dr. Mouneimne) are what affect a cell’s shape and behavior. His lab has determined that the structure of actin is what differentiates a healthy cytoskeleton from an unstable one. Dr. Mouneimne is looking into how distinct modes of actin cytoskeletal reorganization, which are driven by intracellular and environmental signals, cause changes in multiple basic cellular processes and how several different combinations of these changes could promote invasion.

Two of the proteins that regulate actin cytoskeletal organization are profilin-1, which promotes cell migration and invasion in some contexts, with potentially deadly consequences, and profilin-2, which can suppress these functions by associating with the protein EVL (pronounced “evil”). In this context, “evil” is a good thing.

“We checked the levels of profilin-2 in mammary cells, and it was significantly lower and it played an important role in regulating the migratory behavior of normal mammary epithelial cells and of breast cancer cells.”

Dr. Mouneimne then used time-lapse imaging to track the ways in which these proteins (specifically profilin-1 and -2) influence cell migration. Microscopy was vital in allowing Dr. Mouneimne’s lab to follow through on its hypothesis—proliferate expression of EVL to prohibit cell migration/invasion and possibly cancer metastasis.

The treatments that could potentially arise from Dr. Mouneimne’s work wouldn’t necessarily attack the original tumor, but prevent that tumor from spreading to other parts of the body to wreak havoc on otherwise healthy tissue.

“The rates of cancer recurrence and metastasis have been reduced significantly during the last decade thanks to personalized treatments that fit individual patients, but there is still a lot of work to be done in this area,” Dr. Mouneimne said.

The significance of this work is potentially staggering. Dr. Mouneimne finds that many traditional breast cancer treatments, while successful in treating the original tumor site, actually lower the levels of EVL and create a situation that may promote the spreading of any cancer cells that do happen to survive.

“We’re still in the process of looking at this disease from every angle possible to determine which types of treatments make the most sense for individual patients,” Dr. Mouneimne said.

From the microscope to the computer screen, Dr. Mouneimne is looking at angles few have even thought to explore.

Recently, Dr. Mouneimne has developed ways to animate his images to fully illustrate various cell migration patterns. Many of Dr. Mouneimne’s images and animations are available at his website: mouneimne.arizona.edu.
CELL BIOLOGY
Gregory C. Rogers, PhD

Dr. Rogers’s lab has published numerous papers in high-level biomedical journals detailing the molecular mechanisms cells use to maintain stability of their genomes. A stable, steady genome leads to a happy, healthy cell. An unstable genome, therefore, can result in chromosomal instability, which Dr. Rogers refers to as CIN.

The more Dr. Rogers and his team learn about CIN, the more they learn about what causes cells to duplicate in unhealthy ways. “Successful research is all about the questions you ask,” Dr. Rogers said. “Right now, I feel like our lab is asking the right questions, and we’re getting close to some big answers.”

Charting healthy, stable activity could potentially lead to breakthroughs in understanding these unhealthy, unstable activities, which could generate potential genetic interventions to prevent the formation of cancer.

GENOME SEQUENCING
George Watts, PhD

Dr. Watts is one of the nation’s preeminent gene and exome sequencers. His work in this field has led to some tremendous discoveries in the field of cancer therapeutics, as well as a deeper understanding of what causes cancer at its most basic genetic level.

HIGH-RISK GENETICS
Christina Laukaitis, MD, PhD, FACP

A large part of Dr. Laukaitis’s research aims to identify patients at high risk for cancer due to strong family history or positive genetic test results and to incorporate prevention strategies to reduce cancer risks. “My professional goal is to provide individual risk assessment and to implement a cancer prevention protocol before metastatic cancer develops in people at high risk of cancer because of genetic factors,” Dr. Laukaitis said.

Out of the roughly 300 patients currently being monitored in the UA Cancer Center High-Risk clinic, Dr. Laukaitis estimates that approximately 75 of them have a genetic risk factor that could be tracked to serve as an indicator for the most precise potential interventions.

For more information on these and other research projects taking place at the UACC, please visit our website at arizonacancercenter.org.

At the University of Arizona Cancer Center, our researchers are joining forces to make precision medicine the new standard of care for cancer patients worldwide.

“The genomics core, we have the ability to sequence the shortest, most functional genes in a cost-effective and rapid fashion, which allows us to study the codes typically used to translate into healthy proteins,” Dr. Watts said. “This also means we can see the defects and mutations that take place in that sequencing, which can then help us zero in on the most effective ways to treat each patient.”

Currently, Dr. Watts and his crew are looking to sequence the exomes of new patients as soon as they walk in the door, so their oncologists can deliver personalized care from day one.

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From genome sequencing to cellular biology to clinical application, the team at the UACC approaches its research from all angles to deliver the most forward-thinking, state-of-the-art cancer care.
Better Than Ever: Season 14 Review

For what started as a one-off event, Better Than Ever (BTE) has stuck around for quite a while. The program, a grassroots effort designed to foster a healthy and active lifestyle in the fight against cancer, just completed its 14th season.

With donations still coming in, the program has raised nearly $40,000 for the year, adding to the more than $1.8 million the program has generated since its inception.

These funds, all allocated to UA Cancer Center researchers, have been used to fund more than 45 different research projects. The money that BTE provides to our researchers is critical in collecting evidence in support of larger research grants from other organizations, such as the National Institutes for Health.

During the season, BTE members participate in a number of cycling and running/walking events throughout Tucson. This year will be especially memorable for our riders — in the 31 years of El Tour de Tucson, this was the first one accompanied by rain. But the flash floods, eleventh-hour route changes, and cold weather could not stop BTE! A special thank-you goes out to those riders.

The fall season was also marked by some change. Stanley Donahoo jumped on board as the new program coordinator. He is very excited to be working with such an engaging and supportive group, and hopes to maintain the wonderful dynamic that former coordinator Marisa Allen worked so hard to create.

Be on the lookout for more exciting developments as BTE prepares for its spring campaign. We look forward to the future, and hope you will join us and become “Better Than Ever” yourself!

For more information, please go to arizonabte.org

A new drug that is being researched at the University of Arizona Cancer Center aimed at pancreatic tumors may be delivered more effectively by being encapsulated by nanoparticles.

Dr. Meuillet is working with Joseph Kobes, a Biomedical Engineering graduate student in the laboratory of Mark “Marty” Pagel, PhD, to make a nanoparticle formulation that will effectively carry the drug to the tumor site. The team is using FDA-approved nanoparticles for the testing.

The drug – PHT-477 – was developed at the UACC by Emmanuelle Meuillet, PhD, MPhil “Marty” Pagel, PhD. The team is using FDA-approved nanoparticles for the testing.

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University of Arizona Cancer Center member Donato Romagnolo, PhD, MSc, is leading a study that suggests that external environmental and dietary factors in pregnant women may have an impact on future breast cancer risk for the offspring.

His team’s research suggests that various environmental and dietary conditions during pregnancy can activate the aromatic hydrocarbon receptor (AhR), which functions as a cellular sensor, leading to impaired mammary gland development in the womb. This event can, eventually, increase the offspring’s susceptibility for breast cancer — particularly if exposure to these external factors happens during key gestational development periods.

To view more news & notes from the UACC, go to azcc.arizona.edu/news
Your Impact

With your support, the University of Arizona Cancer Center (UACC) can fund new research initiatives as they emerge and accelerate our ability to prevent, detect and treat cancer.

Giving to the UACC provides opportunities for discovery, promotes education and enables our scientists and physicians to expand hope. Help us achieve these essential goals by choosing to become a partner. Together, we can save and change lives.

For more information, please contact (800) 327-2873 or send an e-mail to development@uacc.arizona.edu.