NATIONAL FOUNDATION FOR CANCER RESEARCH

Research for a Cure

2019 PROGRESS REPORT

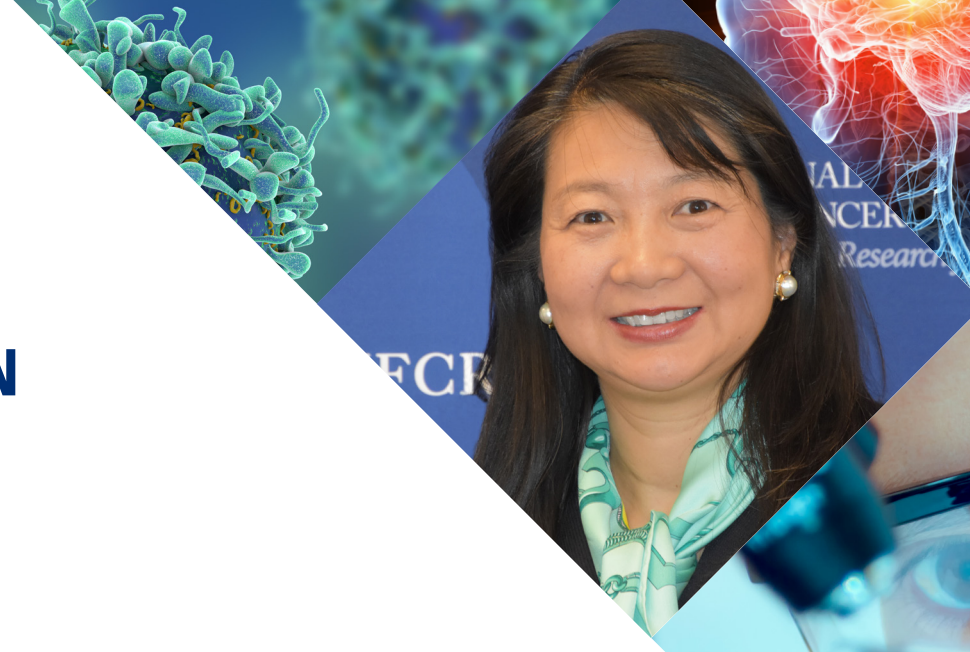
OUR MISSION

The National Foundation for Cancer Research (NFCR) was founded in 1973 to support cancer research and public education relating to the prevention, early diagnosis, better treatments and, ultimately, a cure for cancer. NFCR promotes and facilitates collaboration among scientists to accelerate the pace of discovery from bench to bedside. NFCR is committed to *Research for a Cure* – cures for all types of cancer.

OUR VISION

NFCR is committed to fighting cancer by funding high-risk, high-impact, and potentially high-reward discoveries in the labs and transforming them into life-saving treatments for cancer patients. Through global collaboration, NFCR is making unique impact on a new and accelerated path to cures. NFCR envisions a world without cancer!

FROM INNOVATION TO IMPACT



Dear Friends and Supporters,

A new era is dawning in the diagnosis and treatment of cancer, and 2019 was a pivotal year for the National Foundation for Cancer Research. Our mission is to fund "high risk and high impact" research with a singular focus on one absolute and immutable goal: research to cure all types of cancer. We are making a difference, and NFCR-funded scientists are continuing to make breakthrough discoveries.

However, discoveries are not enough. Too many scientific breakthroughs still remain at the bench and are not being translated into next-generation cancer therapies, diagnostics and prevention strategies. Unless and until we can bring these breakthroughs to clinical trials to gain FDA approval, patients will not benefit from the fruits of our labor. That is why in 2019 we launched the AIM-HI Translational Research Initiative to expand our mission.

NFCR's AIM-HI Initiative will harness the power of donors, entrepreneurial scientists, and business leaders by making the impact investments which will turbo charge the translation of promising discoveries from bench to bedside. It will bridge the gap between basic research breakthroughs and the clinical drug development with the ultimate goal of saving cancer patients' lives. The AIM-HI Initiative will also foster innovation by creating a sustainable program to invest in future cancer breakthroughs.

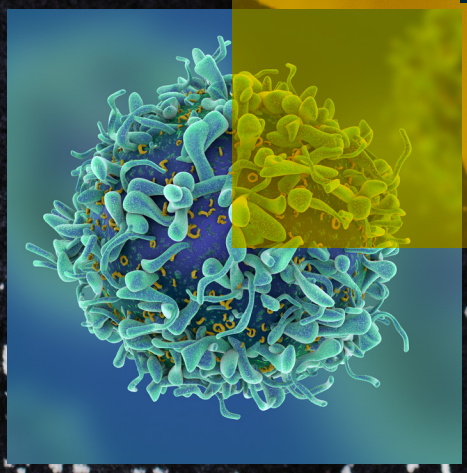
I am very proud to report that NFCR has launched a dozen AIM-HI translational research programs, providing critically needed seed funding. These are measurable outcomes in cancer research made possible by your generous support and philanthropic partnership.

With gratitude,

Sujuan

Sujuan Ba, Ph.D.
Chief Executive Officer
National Foundation for Cancer Research

ON THE FOREFRONT OF CANCER RESEARCH



PAUL SCHIMMEL, PH.D. &
XIANG-LEI YANG, PH.D.
SCRIPPS RESEARCH,
LA JOLLA, CA

RESEARCH FOCUS:
AMINOACYL-TRNA SYNTHETASE IN CANCER

In spite of recent advances in treating triple negative breast cancer (TNBC), patients diagnosed with TNBC still face the highest rates of mortality for all types of breast cancer. More importantly, 90% of deaths of women with breast cancer are not from the primary tumor growth, but rather from the spread or metastasis of primary breast cancer cells to other parts of the body. There is a tremendous unmet need to identify new therapeutic strategies to strengthen the body's immune system to prevent metastatic cancer.

Enter Drs. Paul Schimmel and Xiang-Lei Yang, NFCR-funded scientists at Scripps Research, who are developing novel approaches to stimulate the immune system and thwart cancer's ability to metastasize. Dr. Schimmel, a world-renowned biophysical chemist and pioneer in translational medicine, developed the concept of expressed sequence tags in 1983, an approach employed for the Human Genome Project. During his career-long study of essential enzymes, he worked on an enzyme-directed genetic code, known as aminoacyl-tRNA synthetase (aaRS). Humans express 20 different aaRS enzymes, each playing a pivotal role in gene expression. With NFCR funding since 1994, Dr. Schimmel has advanced our understanding of the important role these essential enzymes play in defining the genetic code. Strong associations of some of these enzymes to human diseases has been revealed as well. These associations are now believed to be related to new functions of these proteins studied by Schimmel-Yang. It now appears that, with these proteins, treatable diseases include chronic and acute inflammation, neuropathy, and cancer progression and metastasis.

With NFCR funding since 2005, Dr. Yang joined forces with Dr. Schimmel and began a multidisciplinary approach using biophysics, biochemistry, cell biology and structural analysis to identify roles of aaRS in cancer formation and progression and how the enzymes work as anti-cancer agents. She determined that one aaRS, SerRS, possesses both anti-tumor and anti-metastasis properties. She showed that SerRS inhibits formation of new blood vessels, preventing tumor growth. Specifically, Drs. Yang and Schimmel showed that SerRS inhibits a pro-cancer gene that triggers release of VEGF, a blood vessel formation factor. Without their own blood supply, tumors are deprived of oxygen and nutrients required for growth. In addition, they discovered that SerRS regulates many immune system-related molecules, implicating a role of SerRS in cancer metastasis.

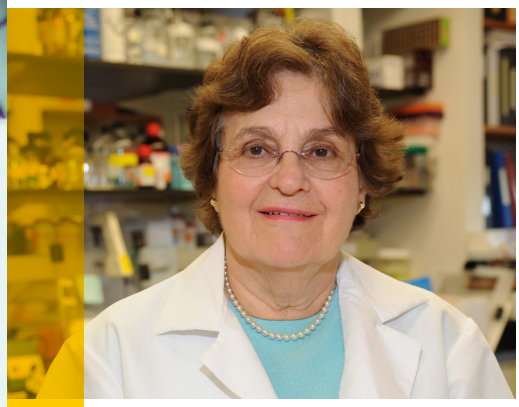
"Since 1994, NFCR has provided me with resources that can be used to pursue my 'blue sky' dream projects. Much good came from this freedom of research pursuit, which keeps on giving and fulfilling the hope that comes from science." — ***Dr. Paul Schimmel***

"The NFCR funding allows us to explore novel tumor and metastasis suppressors that are unexpected and overlooked by the cancer field at large." — ***Dr. Xiang-Lei Yang***

Their findings suggest that SerRS functions as a suppressor of metastasis, as SerRS levels are significantly decreased in breast tumor tissue during metastasis.

NFCR is proud to support the research of Dr. Schimmel and Dr. Yang, as they are on the forefront of cancer research. Their steadfast efforts to understand the mechanisms and pathways of aaRS enzymes' role in enhancing immune system function against cancer and prevention of cancer metastasis will result in better ways to treat cancer patients.

RESEARCHER HIGHLIGHTS



DEVELOPMENT OF NON-RESISTANT CANCER THERAPEUTICS

Susan B. Horwitz, Ph.D.
Albert Einstein College of Medicine, New York, NY

Dr. Horwitz is a pioneer in cancer research, having significantly contributed to development of the anti-cancer drug Taxol®, a natural compound in the Pacific yew tree bark. She discovered how Taxol works to be an effective anti-cancer agent because it binds to a cell's internal machinery, known as tubulin, and blocks the cancer cell's ability to replicate. Taxol, one of the most widely prescribed chemotherapy agents, has treated over 1.5 million patients with breast, lung, ovarian, cervical and pancreatic cancers. While Taxol therapy is effective for many patients, resistance to the drug is a clinical problem.

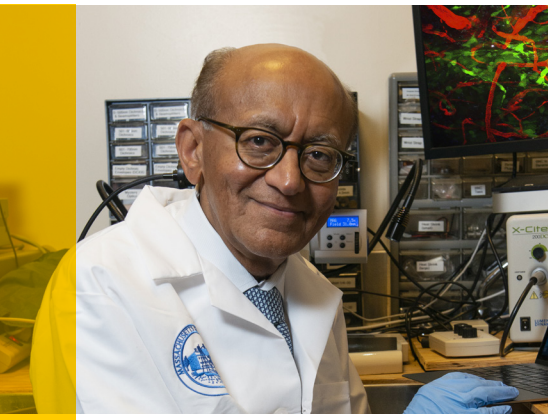
With NFCR support since 2000, Dr. Horwitz discovered that cells express different forms of tubulin, and Taxol's ability to effectively arrest cancer cell growth depends upon the tubulin type present in a patient's cancer. Her team is investigating how Taxol interacts with all forms of tubulin which could become the basis to predict whether a patient's tumor will be sensitive or resistant to the drug. Dr. Horwitz's research efforts to use natural products for developing cancer therapeutics with minimal toxicity led the research community to discover an additional chemotherapy agent, discodermolide, isolated from a Caribbean Sea sponge. Discodermolide, while effective in killing cancer, is not used in patients due to lung toxicity. Dr. Horwitz and fellow NFCR scientist and chemist, Dr. Amos Smith III, are together leading the charge to create discodermolide variations which can effectively kill cancer without damaging the lungs and inducing an aggressive and drug-resistant property of cancer known as senescence. Development of a clinically adopted version of discodermolide may be effective in treating patients with triple negative breast cancer and other cancers.

NATURAL PRODUCT CANCER THERAPY DEVELOPMENT

Amos B. Smith III, Ph.D.
University of Pennsylvania, Philadelphia, PA

Dr. Smith combines his expertise in bioorganic chemistry, materials science, and natural products to synthesize complex anti-cancer drugs based upon naturally occurring products. Dr. Smith was the first to synthesize large-scale production of discodermolide, a compound found in a sea sponge. As an NFCR-funded scientist since 2016, his collaborative efforts with fellow NFCR scientist, Dr. Susan Horwitz, focus on synthesis of analogs similar to discodermolide but without its toxicity. Discodermolide acts similar to Taxol® but causes cancer cells to become senescent - a dormant cell state that can cause drug resistance and drive tumors to be more aggressive. Using multiple cutting-edge chemical and scientific techniques, Dr. Smith discovered the structural differences between discodermolide and an analog. Testing in Dr. Horwitz's lab suggests the differences underlie the pro-cancer senescent effect. The discodermolide analogs developed by Drs. Smith and Horwitz have the potential to improve outcomes for patients with breast, ovarian and lung cancer.

Dr. Smith has recently developed viable synthesis of two additional natural anti-cancer products: 1) pterocidin - derived from bacteria and shown to lower progression of colon cancer and 2) neaumycin B - derived from a marine sponge and shown to be a potent anti-tumor agent for the difficult-to-treat brain cancer, glioblastoma or GBM. Dr. Smith's synthesis of new anti-cancer agents with high potency to kill cancer and low propensity to induce senescence has the potential to greatly impact the outcomes for cancer patients.



REPROGRAMMING GLIOBLASTOMA MICROENVIRONMENT TO IMPROVE IMMUNOTHERAPY

Rakesh K. Jain, Ph.D.
Massachusetts General Hospital, Boston, MA

Dr. Jain has received NFCR funding since 1998. He is a renowned world expert in understanding how changes in the microenvironment surrounding tumors effect the immune system, drug delivery, treatment efficacy and patient survival. Our immune system produces cytotoxic T cells to kill tumor cells. But tumors create molecules called immune checkpoints that weaken T cells' ability to kill tumors, allowing the tumor cells to escape the T cell attack. The new immunotherapy called immune checkpoint inhibitors — a class of drugs that block the checkpoints — has revolutionized cancer therapy for some tumors but are not effective in the most aggressive brain tumor, glioblastoma or GBM. Dr. Jain's current work has determined that the resistance to immune checkpoint inhibitor therapy in GBM is due, in part, by the tumor environment.

Dr. Jain discovered the theory that an imbalance of vessel growth in tumors resulted in leaky blood vessels that caused edema, lack of oxygen and immunosuppression. In GBM models, his team discovered the abnormal vessels severely limit the immune system's cytotoxic T cells to enter and kill tumors. Most importantly, treating GBM models with a factor previously discovered by Dr. Jain to inhibit blood vessel growth, led to a more normalized tumor vasculature and improved outcomes when combined with immune checkpoint blockers. Dr. Jain's research has tremendous potential to improve treatment outcomes and increase survival in patients diagnosed with glioblastoma.

GENETIC BASIS OF CANCER METASTASIS

Danny R. Welch, Ph.D.
University of Kansas Cancer Center, Kansas City, KS

Dr. Welch is a leader in the field of cancer metastasis. With support from NFCR since 1996, his team is identifying the mechanisms underlying how cancer spreads (metastasis) throughout the body from a primary tumor. Metastasized cancer leads to pain, weight loss, bleeding and impairment of organ function. More importantly, nearly 90% of cancer related deaths are due to metastasized cancer. Dr. Welch is leading a novel charge to prevent the spread of cancer by predicting how and what triggers the initiation of metastasis. He and his team are using state-of-the-art molecular biology techniques to explore the expression of biomarkers produced by metastatic and non-metastatic cancer cells in order to predict which cancer will metastasize. In addition, Dr. Welch and his laboratory discovered eight genes that get turned off when cancer cells become metastatic cells and can lead to therapeutics that arrest metastasis.

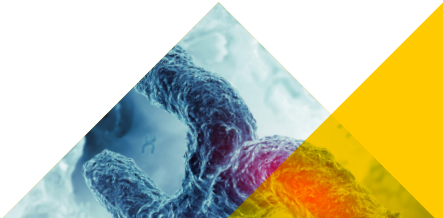
This two-pronged approach will permit Dr. Welch to not only develop novel metastatic cancer markers to assess a patient's likelihood of developing metastasis, but also to develop unique anti-metastasis therapies. His current research regarding cancer metastasis has high impact for patients with breast, lung, ovarian, pancreatic, prostate, kidney and skin cancer.

IMMUNO-THERANOSTIC TREATMENT OF CANCER

Paul B. Fisher, M.Ph., Ph.D.
Virginia Commonwealth University, Richmond, VA

Dr. Fisher's cancer research focuses on the daunting challenge facing clinicians and cancer patients, namely identifying, treating and monitoring cancers once they have metastasized from the primary tumor. His efforts have led to development of novel technologies that simultaneously detect and diagnose tumors as well as effectively treat them – or a theranostic approach. With NFCR funding since 2008, Dr. Fisher is now developing an immuno-theranostic by genetically engineering a tumor suppressor previously discovered by him to produce a fluorescent (light) signal, allowing for diagnosis, treatment and monitoring of tumors. The fluorescent signal can be imaged using current non-invasive imaging techniques to detect the precise location of metastatic cells and monitor the tumor size after treatment.

NFCR funding has allowed Dr. Fisher to successfully incorporate the tumor suppressing immuno-theranostic into an 'adoptive cell therapy' to reduce prostate tumors in mice. In the laboratory, his adoptive therapy first collects the immune T cells from mice to genetically modify the cells with anti-cancer genes he discovered. After reinjection, the supercharged T cells seek out and deliver an immune enhancer gene that kills any prostate cancer cells. His therapy also provides an imaging tool to identify all metastases and monitor destruction of the tumor using non-invasive imaging. Dr. Fisher's immuno-theranostic therapy could effectively treat not only metastatic prostate cancer but has the potential to treat virtually any solid tumor, and with modifications, blood cancers.



PRECISION TRANSLATIONAL DRUG DISCOVERY

Daniel D. Von Hoff, M.D., FACP
Translational Genomics Research Institute, Phoenix, AZ

Dr. Von Hoff is a pioneer and world leader in translational medicine, accelerating novel drug discoveries from the laboratory to cancer treatments in clinical trials. He has personally been involved in over 200 clinical trials. In 1985, when his NFCR grant support began, his research led to the first approved treatment for pancreatic cancer, the chemotherapy gemcitabine. Resistance to pancreatic cancer therapies results in poor survival. His current research involves developing precision therapies for pancreatic cancer patients, by identifying the role of different pancreatic cancer cell populations in resistance to therapy.

Recently, he discovered that pancreatic tumors express scar-forming cells called fibroblasts that protect cancer cells from immune system attack. This has furthered our understanding of signaling pathways in the tumor microenvironment to exploit and make tumors more susceptible to attack and cell death. Dr. Von Hoff's team identified one such pathway, known as the EMT pathway, that makes tumor cells more aggressive and resistant to many chemotherapeutics. He also discovered that pancreatic cancer cells expressing the EMT pathway respond better to a sequential regimen of chemotherapy and an EMT inhibitor. Dr. Von Hoff demonstrated that first treating patients with chemotherapy resulted in killing most pancreatic cancer cells and subsequent treatment with EMT inhibitors killed the remaining drug resistant EMT-positive pancreatic cancer cells. His laboratory is currently developing this regimen for a clinical trial to provide precision oncology therapy for pancreatic cancer patients.

OVERCOMING CANCER TREATMENT RESISTANCE

Alice T. Shaw, M.D., Ph.D.
Massachusetts General Hospital, Boston, MA

Dr. Shaw's research aims to provide viable treatments for lung cancer patients whose tumors have become resistant to their current drug therapy. With NFCR support since 2014, she seeks to develop new treatments for patients with anaplastic lymphoma kinase (ALK) mutations in non-small cell lung cancer. While only 5% of lung cancer patients are diagnosed with ALK-positive lung cancer (or ALK$^+$ lung cancer), the ALK mutation leads to a high rate of cancer growth and spread to other parts of the body. Dr. Shaw was the lead investigator in the global registration studies for two drugs, which led to their FDA approval for advanced ALK$^+$ lung cancer. These therapies have dramatically improved the outlook for patients, but, eventually, almost all patients will develop resistance.

By using multiple research models, Dr. Shaw and her team quickly identified new drug combinations for lung cancer patients who have developed resistance to their current therapy. Dr. Shaw demonstrated a marked regression of ALK$^+$ lung cancer tumors in mice when treated with a combination of FDA-approved ALK$^+$ lung cancer agents and inhibitors of SHP2 — a cancer gene that regulates cancer cell survival and growth and suppresses an immune system protein. In 2019, a first-in-human clinical trial led by Dr. Shaw began with this combination therapy. Hope is on the horizon with this new combination therapy for ALK$^+$ lung cancer patients who have become resistant to standard targeted therapies.

ENGINEERING EFFECTIVE CANCER ANTIBODIES

Wayne A. Marasco, M.D., Ph.D.
Dana Farber Cancer Institute, Harvard Medical School, Boston, MA

Dr. Marasco is developing immunotherapy for cancer. He is a pioneer in engineering a patient's immune system T cells to express new targeting receptors - liken to antennas on cells - that can seek out and kill cancer. As a type of adoptive cell therapy using a patient's own immune cells, this specific modification of the patient's T cells is referred to as Chimeric Antigen Receptor (CAR) T cell therapy. CAR-T therapy not only initiates the killing of a patient's cancer, but also stimulates the patient's immune system to activate more T cells within the body to seek and kill cancer. While CAR-T therapy has been approved for types of blood cancers, lymphoma and leukemia, it has not been successful in treating solid tumors.

With NFCR support since 1994, Dr. Marasco has advanced his immunotherapy for clear cell renal cell carcinoma, a type of kidney cancer among the ten most common cancers in men and women. His approach combines CAR-T therapy with checkpoint blockade inhibitors or antibodies that stimulate the immune system. This combination approach is designed to change the tumor environment and enhance the ability of CAR-T treatment to kill cancer cells. Dr. Marasco has proven that restoring the tumor environment towards effective T cell anti-tumor immunity leads to significant renal cell carcinoma cell death in complex tumor models. His technology may be a breakthrough for patients with renal cell carcinoma and may serve as a platform therapy to treat all solid tumors.

IDENTIFYING OPTIMAL TREATMENTS FOR METASTATIC CANCER

Daniel A. Haber, M.D., Ph.D.
Massachusetts General Hospital, Boston, MA

Dr. Haber discovered cancer cells that are shed from a primary tumor and traverse through the bloodstream, known as circulating tumor cells (CTCs), hold the key to predicting cancer treatment response, resistance and cancer relapse. NFCR funding since 2004 has allowed Dr. Haber to further understand the importance of CTCs. He has developed a non-invasive fluorescent light analysis which permits characterization of unique genetic sequences of liver, breast, prostate and melanoma CTCs in the bloodstream. As a platform technology, a CTC-derived signal can be applied to virtually any cancer. The CTC-derived signal in patients is an excellent metric of early and reliable positive outcomes for patients with: 1) metastatic melanoma treated with immune checkpoint inhibitor therapy; 2) advanced localized prostate cancer identified as high-risk with poor survival in response to hormone therapy; 3) localized breast cancer prior to and during presurgical chemotherapy; and 4) metastatic breast cancer.

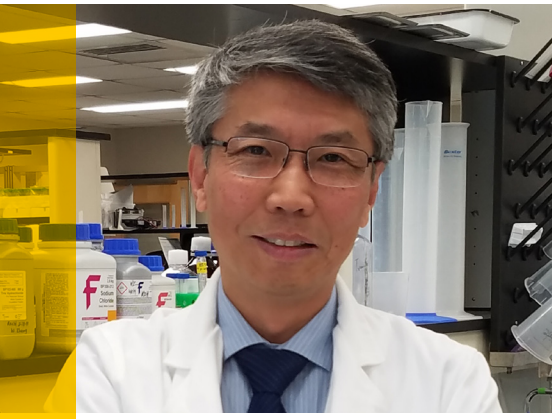
Analyses of patients with localized breast cancer showed that a high CTC signal was a significant predictor of higher residual disease at the time of surgery. The results for women with metastatic breast cancer indicated that patients with a low pre-treatment CTC signal that further decreases with treatment have improved overall survival. Dr. Haber's technology of monitoring a patient's CTC signals prior to and during treatment will better guide clinicians towards more effective, personalized cancer treatments and have a profound impact on the outcome for many cancer patients.

THERANOSTIC TREATMENT OF PROSTATE CANCER

James P. Basilion, Ph.D.
Case Western Reserve University, Cleveland, OH

Diagnostics and therapy together in one agent is called theranostics. Dr. Basilion's theranostic approach to treating cancer utilizes a novel compound or probe developed in his lab. With the probe, clinicians first visualize the precise location of prostate cancer cells, followed by light-activation of the probe to kill only prostate cancer cells. Current prostate cancer treatments include surgical removal or radiation of the prostate, however these treatments lead to unwanted side effects of erectile dysfunction, incontinence and bowel urgency. Dr. Basilion sought to create a therapy which would effectively treat prostate cancer without causing these debilitating side effects.

With NFCR funding beginning in 2005, Dr. Basilion created the novel probe to bind prostate specific membrane antigen (PSMA) — a protein found on prostate cancer cells, allowing clinicians to identify the precise location of cancer. When light is shown on the probe bound to PMSA, the probe becomes activated and causes cellular stress, killing only prostate cancer cells. PSMA is also found in new blood vessels of all solid tumors, allowing Dr. Basilion's theranostic approach to potentially enhance outcomes of image-guided surgery and light treatment for patients with breast, prostate, colorectal, pancreas, brain and liver tumors.



CANCER GENOMICS AND PERSONALIZED MEDICINE

Wei Zhang, Ph.D.
Wake Forest Baptist Medical Center, Winston-Salem, NC

Dr. Zhang is a leader of precision oncology, using NFCR support since 2006 to characterize underlying genetic mechanisms responsible for cancer growth and progression. His research addresses the variability in cellular properties, within and across cancer types, which often leads to treatment resistance and poor survival in patients. For example, African-Americans diagnosed with lung cancer have higher incidences and lower survival rates than Caucasian Americans. Utilizing leading-edge genomic techniques, Dr. Zhang discovered that lung cancer in African-Americans expressed higher immunosuppressive components, permitting the lung cancer to escape attack by their immune system.

Dr. Zhang's research has advanced our understanding of the role of genetic mutations in cancer progression and treatment: 1) lung cancer in African-Americans expresses a mutation in the TP53 tumor suppressor gene, leading to shorter survival times; 2) daily alcohol consumption causes DNA damage and changes in over 600 genes shown to be involved in cancer development; and 3) development of new computational methods utilizing artificial intelligence can predict the origin of cancers that have metastasized to the brain. Dr. Zhang's precision oncology approach has the potential to improve outcomes for patients with non-Hodgkin's lymphoma and leukemia, melanoma, and cancers of the lung, gastrointestinal tract, pancreas, ovary, uterus, brain and liver.

AIM-HI TRANSLATIONAL RESEARCH INITIATIVE

With your long term support, we have propelled many discoveries in basic research that are made in the laboratories—increasing our understanding of the fundamental nature of cancer and how it spreads, and how to stop it. After decades of discoveries and breakthroughs, we have reached the fruition stage, but many of these discoveries have not yet been translated to benefits for patients.

At this critical juncture, we must speed up the translation of the discoveries from the laboratories to the bedside in order to save patients' lives. Translational research is the crucial step to identify and prove the best of cancer therapies for patients.

This is why we launched the AIM–HI Translational Research Initiative in 2019. We are more determined than ever to accelerate the discoveries born in our laboratories into tomorrow's better cancer therapies, diagnostics and prevention strategies.

We are proud to highlight eight translational research programs that are entering the clinical trial stages, after decades of steadfast support from NFCR made possible by your generous donations. These programs have great potential to change the future of cancer care, giving patients renewed hope.

Working together, we are committed to *Research for a Cure*, bringing life-saving diagnostics and treatments to patients who deserve nothing less.

For more information on NFCR's translational cancer research, please visit: www.nfcr.org/research-programs/scientists/

Antibody pipeline: strategic therapies for colorectal and pancreatic cancer

Novel antibodies to strategically target cells surrounding tumors that cause resistance to current drugs are being developed by renowned pancreatic cancer scientist, Dr. Daniel Von Hoff. The antibodies will move into clinical trials following final preclinical studies.

Repurposing of malaria drug to treat most difficult form of leukemia

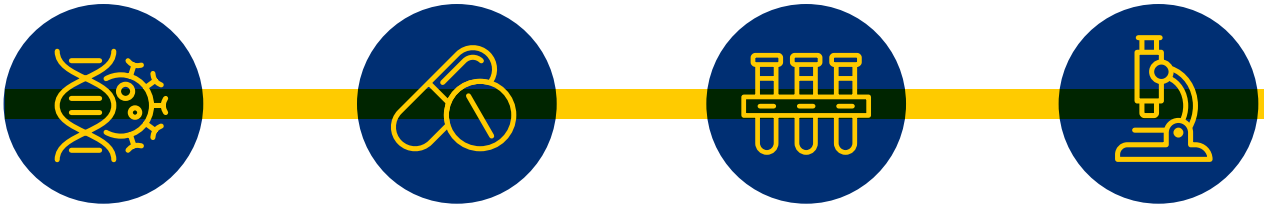
NFCR-supported leukemia expert, Dr. Curt Civin, discovered that malaria drug Artemisinin, arrests growth of Acute Myeloid Leukemia. Next generation drug modeling software is creating the best chemical structure to improve treatment options.

Molecular probe guides improved surgical removal of cancer

Dr. Jim Basilion developed a "smart" probe that when topically applied during surgery greatly improves surgeon's ability to detect tumor margins. In a Phase I trial, the probe will be used in lumpectomies to further enhance cure rates for early stage breast cancer.

Targeted therapy designed to stop cancer spread

Dr. Paul Fisher genetically constructed Cancer Terminator Viruses (CTVs) that carry an immune system gene (IL/24). CTV with IL/24 seeks out and destroys only cancer cells, leaving healthy cells untouched. With Dr. Web Cavenee, CTV-IL/24 will first treat the brain cancer, GBM, in a Phase I clinical trial.



Phase II clinical trials with botanical drug approved for liver cancer

Dr. Yung-Chi Cheng developed YIV-906, a botanical drug that enhances anti-tumor activity in immunotherapy, chemotherapy and radiotherapy while reducing gastro-intestinal discomfort. YIV-906 will be paired with liver cancer drug, sorafenib, to improve patient outcomes.

A novel drug and delivery method approved for Phase I clinical trial to treat relapsed lymphoma

NFCR-funded scientist Dr. Michael Sporn, conducted research on ferentinide, a drug with similar structure to Vitamin A. He proved its safety for use in humans. A novel delivery system designed for optimal treatment gained approval for clinical trials.

Innovative drug to inhibit a cancer-spreading gene

Dr. Paul Fisher discovered MDA-9/ Syntenin gene that promotes the deadly spread of many cancers. With Dr. Web Cavenee, they created an innovative drug that blocks the gene's signals for cancer spread (metastasis). This new drug may be effective in treating metastatic cancers.

Pipeline for childhood cancer treatments

Lack of therapies for young patients forces pediatric oncologists to use adult cancer drugs. Dr. Cesare Spadoni is identifying treatments for the most common pediatric cancers with poorest prognoses. A combined therapy with a potent inhibitor, volasertib, shows enhanced anti-cancer effects for Rhabdosarcoma. Clinical trials are planned for this difficult-to-treat childhood cancer.

GBM AGILE

THE WORLD'S FIRST ADAPTIVE CLINICAL TRIAL FOR BRAIN CANCER PATIENTS

Unlike other cancers, treatment options for patients with the rare, aggressive brain cancer—glioblastoma or GBM—have improved little in recent decades. Currently, the five-year average survival rate is only 5% or less. We critically need an innovative clinical trial system in order to save patients, fast.

GBM AGILE clinical trial—different from traditional clinical trials—can evaluate multiple therapies simultaneously, ultimately creating an adaptable trial approach. This new approach allows researchers to identify drugs that are showing promising results and seamlessly transition them to a confirmatory stage designed to support fast drug approval.

In this **adaptive** trial, researchers are able to pinpoint and cull the use of underperforming drugs with minimal time and resources being wasted. Simply put, GBM AGILE is patient-centric and provides a streamlined method for researchers to utilize data connectivity within the trial to answer many questions concurrently.

The National Foundation for Cancer Research has been a pioneer and founding supporter of GBM AGILE from the very beginning! We are also a proud strategic partner of the Global Coalition for Adaptive Research (GCAR), the official sponsor of GBM AGILE. GCAR is a nonprofit organization uniting physicians, clinical researchers, advocacy and philanthropic organizations, biopharma, health authorities and other key stakeholders in healthcare to expedite the discovery and development of treatments for patients with rare and deadly diseases.

With your generous support, tremendous progress has been made for GBM AGILE. Eleven GBM AGILE trial sites opened in the US in 2019 and is rapidly expanding to be available at nearly 40 sites in the US and Canada. Global expansion is underway to open this innovative trial in Europe, China and Australia.

We are very hopeful that the knowledge and trial design platform established by GBM AGILE will serve as a model that can be applied to other cancers—giving patients hope for treatments that are best suited for their care.

MAJOR MILESTONES ACHIEVED

Patient screenings were accomplished at a much swifter pace than expected, with over 150 patients screened for the study.

Partnership with the first pharmaceutical partner, Bayer, was incredibly successful. Negotiations began with several other pharmaceutical partners to bring exciting new drugs into the study.

Plans to launch the study in Canada, Europe, China and Australia continued, with trial sites expected to open in at least five European countries in 2020.

GBM AGILE
Adaptive Global Innovative Learning Environment

DWAYNE'S STORY

In the spring of 2019, Dwayne Osgood, a United States Marine Corps veteran and U.S. Naval Academy graduate was feeling sick and experiencing painful headaches. A CT scan revealed a brain mass, which was identified as a glioblastoma (GBM) tumor, the most common type of brain cancer. Days later, Dwayne had surgery, and after recuperation, underwent radiation and chemotherapy.

This did not diminish Dwayne's enthusiasm for life. He had a sudden urge to run the annual Marine Corps Marathon (MCM) in October with NFCR's *Play4TheCure* program, which encourages athletes to leverage their passion for sports to raise funds for cancer research.

Ten of Dwayne's Naval Academy friends also signed up to run the marathon with him. He named his unexpected team 'Team Invictus', after the famous poem by William Ernest Henley. The funds raised by Team Invictus were designated to GBM AGILE, NFCR's new collaborative initiative to develop effective treatment for GBM.

With overwhelming support from teammates, family, friends and community members, Team Invictus raised over $38,000 for GBM AGILE.

"Brain cancer is my condition, not my position. I am not going to let a condition define who I am or alter my position. I am going to keep a positive attitude, continue to love my life and those in it, and have faith that there is a plan for me."

— DWAYNE OSGOOD

Dwayne and his wife Elizabeth

"GBM AGILE allows us to get more researchers involved and allows there to be enough patients enrolled in trials to get statistically significant results," Dwayne said.

"This sharing of data and information could allow the research to move faster, and ultimately bring lifesaving and life extending treatments to patients faster."

Dwayne is no stranger to looking a challenge in the eye and tackling it head on. After graduating from the Naval Academy and meeting his wife, Elizabeth, he served two tours in Iraq. Since then, the couple has continued to navigate the various challenges of parenthood as they raise three young children. However, earlier this year, the family was faced with a new, difficult and frightening challenge.

The mass.

Dwayne and Elizabeth have proudly turned this unexpected challenge into a remarkable opportunity to make a significant impact in cancer research.

NFCR is extremely grateful to Dwayne, a true warrior, Team Invictus and all of its donors who are helping to support a revolutionary clinical trial platform and give new hope for survival to brain cancer patients around the globe.

SZENT-GYÖRGYI PRIZE
FOR PROGRESS IN CANCER RESEARCH

On April 27, 2019, the National Press Club in Washington, DC was filled to capacity to celebrate the milestone achievements of a renowned physician-scientist. Donors, prior prize winners and fellow scientists gathered at the award dinner to honor the 2019 Szent-Györgyi Prize winner, Steven A. Rosenberg, M.D., Ph.D.

The 2019 Szent-Györgyi Prize Selection Committee voted unanimously to recognize Dr. Rosenberg, Chief of the National Cancer Institute Center for Cancer Research Surgery Branch, for revolutionizing the field of cancer immunotherapy.

"Steve Rosenberg really changed the future of cancer care and redefined how we take care of cancer patients, and he did this through decades of painstaking research and elegant biology with clinical translation to figure out how to harness and use the immune system for new kinds of cancer treatment."

— ***DR. NED SHARPLESS***
ACTING COMMISSIONER OF THE FOOD AND DRUG ADMINISTRATION (FDA)

2019 Szent-Györgyi Prize for Progress in Cancer Research Winner, Steven A. Rosenberg, M.D., Ph.D.

Dr. Ned Sharpless delivers the keynote address in honor of Szent-Györgyi Prize winner, Dr. Rosenberg.

Dr. Rosenberg gave a wonderful award presentation on his research that began in the early 1970's. His efforts in basic, translational and clinical research contributed immeasurably to groundbreaking advances and the development of several FDA-approved immunotherapy drugs.

A highlight of the evening was a heartfelt testimony by Melinda Bacchini, a young mother of six and terminally-ill cancer patient, who was treated by Dr. Rosenberg after exhausting all other options. "With the combination of a novel approach and my body's own defenses, the cancer has been kept at bay. Here I stand today, 10 years later", Melinda proudly proclaimed.

This coveted prize was established in honor of our co-founder and Nobel Laureate, Dr. Albert Szent-Györgyi. It honors scientists who have made seminal discoveries that have had a long lasting impact and saved lives. The award highlights the essential role basic research plays in understanding cancer, and symbolizes NFCR's enduring commitment to uphold Dr. Szent-Györgyi's vision of curing cancer through innovation and collaboration.

SALISBURY AWARD
FOR ENTREPRENEURIAL TRANSLATIONAL RESEARCH

The National Foundation for Cancer Research proudly introduced the "Salisbury Award for Entrepreneurial Translational Research" in 2019 to honor the founding family—whose vision and combined 80 plus years of service to the cancer research community— shaped NFCR into one of the leading cancer charities in the world.

The Salisbury Award was established to encourage entrepreneurial translational research efforts by scientists and business leaders and catalyze their promising laboratory discoveries onto a pathway toward clinical trials that will save the lives of cancer patients.

The 2019 Salisbury Award Competition was held in Rockville, Maryland in November. Several dozen investigators from major cancer research institutions and scientists from promising early-stage oncology companies applied to compete in front of an esteemed judging panel, comprised of cancer research key opinion leaders and business leaders from the life sciences and venture investment sectors.

The contestants were given a valuable opportunity to present their entrepreneurial projects and receive productive and insightful critique and suggestions from the judges. Another unique benefit of participating in this event is the chance to interact with fellow contestants, judging panelists, and other key opinion leaders during the evening networking receptionand award dinner.

(l to r) Dr. Raju Kucherlapati, with awardees Dr. Goldberg, Ms. Douglass, Dr. Hsiue, and Dr. Garkavstev, and NFCR CEO and President, Dr. Sujuan Ba.

At the award ceremony, Franklin C. Salisbury, Jr., together with Dr. Raju Kucherlapati, the Chair of Selection Committee, presented the grand prize award to colleagues Dr. Emily Han-Chung Hsiue and Ms. Jacqueline Douglass of the Sidney Kimmel Comprehensive Cancer Center, Johns Hopkins University.

First runner-up honor was awarded to Dr. Manijeh Goldberg of Privo Technologies; and the second runner-up honor was presented to Dr. Rakesh Jain and Dr. Igor Garkavstev of Harvard Medical School and Massachusetts General Hospital.

The Salisbury Award platform avails each of its competitors access to NFCR's extensive network of key opinion leaders, insightful feedback from life sciences industry figures, increased visibility and credibility.

THE SALISBURY FAMILY

Together with Nobel Prize winning scientist Albert Szent-Györgyi, the late Franklin C. Salisbury, Sr. and his wife Tamara launched NFCR in 1973 to fund innovative basic-science cancer research. Franklin Sr. served as President and CEO until 1997; Tamara, a research chemist, served as Chief Operating Officer from 1973-2003; and their son, Franklin C. Salisbury, Jr., served as Chief Executive Officer from 1997-2018.

CANCER PATIENT NAVIGATION HOTLINE

NFCR understands a cancer diagnosis comes with panic, confusion and uncertainty. We are here to help.

Connecting patients and their families with our navigators – certified oncology nurses – can provide the necessary education and support to help patients manage their cancer journey and ensure the best outcomes.

Navigators and our medical team will ensure patients have the necessary education, support and resources needed to deal with the complex course of the disease.

The information provided is an additional resource for patients to consult and discuss with their doctors.

NFCR knows patient navigation is an essential part of every patient's cancer journey. We thank our partners for helping to bring this free service to patients.

HERE'S WHAT CANCER PATIENTS ARE SAYING:

"Someone with cancer experience talked with me...a real person Helped ease my pain. The mere fact that I was able to connect with a real oncology nurse made me less anxious and more confident in this whole process."

The NFCR Cancer Patient Navigation Hotline is open Monday through Friday, 9 am to 9 pm, EST, via email or toll-free number.
To get started, please visit:
nfcr.org/cancer-information/cancer-hotline

KEY PATIENT BENEFITS

NFCR collaborates with HonorHealth Research Institute in Phoenix, AZ, to provide the NFCR Cancer Patient Navigation Hotline. Our navigators and elite medical team can help patients:

Understand the diagnosis and treatment options, and know the ways and relevant terminology to communicate comfortably with doctors, family and friends

Access important information to deal with issues associated with diagnostic tests and treatment

Recommend top oncologists to meet specific needs and coordinate the referral process

Identify clinical trials of the newest therapies for advanced cancer or rare tumors for which no standard care or effective therapy is available

Provide specific resources for community care and support organizations nearest to patients' homes

SCIENTIFIC SYMPOSIUM
ON STATE OF CANCER RESEARCH AND GLOBAL COLLABORATION

In October 2019, NFCR held its bi-annual scientific symposium, The Scientific Symposium on State of Cancer Research and Global Collaboration. Scientists from the US and around the world attended this event in Bethesda, Maryland to showcase their new research discoveries.

The three-day event was a wonderful opportunity for the presenting scientists to have an interactive dialogue and discussion with peers and supporters on the latest results and vital next steps in their research programs.

Scientists presented new progresses on a broad spectrum of tumor types such as pancreatic, breast, ovarian, liver and skin cancer. Numerous advances were showcased including: immunotherapy, precision medicine, natural product cancer drugs, novel tools for image-guided surgery and therapeutic interventions among other leading-edge cancer themes.

Several collaborations between scientists are being forged to explore new areas, resulting from the exchanging of ideas. The members of the Scientific Advisory Board were pleased to see many breakthroughs shared by our scientists which could dramatically improve patient outcomes.

This is a great opportunity for many of NFCR's donors and supporters to meet individually with the scientists and learn first-hand how their support impacts cancer research progress and ultimately benefits cancer patients.

We look forward to presenting the next Scientific Symposium in 2021.

The symposium brought together esteemed research scientists from around the world, NFCR's Scientific Advisory Board, Board of Directors, and donors to learn about the impact of NFCR's cancer research programs.

MEET SOME OF OUR DONORS

Jonathan Marmelzat with his sisters, Jill and Jina.

THE WILLARD MARMELZAT FOUNDATION

"My father was fascinated with the connection between medicine and music...a significant number of physicians throughout history who were also accomplished musicians and composers."

The Willard Marmelzat Foundation was established by Willard and Ruth Marmelzat in Los Angeles in the 1960s. As a medical historian and a renowned dermatologist specializing in melanoma (skin cancer), Dr. Willard Marmelzat was keenly aware of the need for cancer research. The charitable gift-giving vehicle was initially created as a way to fund his two main areas of interest: cancer research and medical history library development.

Though the Marmelzat name is easily recognized in the medical field, the family is also greatly involved in music. And though it may seem that musical talent and medical knowledge are two unrelated gifts, Jonathan Marmelzat, CEO of the Foundation, shared that his father discovered there is a unique connection. In fact, in the 1940s, Dr. Marmelzat wrote the book *Musical Sons of Aesculapius*, exploring that very idea.

"My father was fascinated with the connection between medicine and music," Jonathan recalls. "He became aware of a significant number of physicians throughout history who were also accomplished musicians and composers. His book, for which he was awarded the William Osler Medal, is a seminal work on this subject."

Growing up, Jonathan and his sisters, Jill and Jina, always admired their parents' commitment to supporting medical research, education, music and social justice causes. Since its founding and with the passing of Willard and Ruth, the Marmelzat family foundation has continued to donate to leading organizations in cancer research, including NFCR.

NFCR is thankful to The Willard Marmelzat Foundation and all of the foundations that support our critical cancer research initiatives.

NFCR scientist Danny R. Welch, Ph.D., alongside donor Tony Pratt

TONY AND MARJORIE PRATT

"NFCR investigates all aspects of different types of cancer—genetics, new treatments, immunology. They take a broad approach to research."

Anthony (Tony) Pratt and his wife, Marjorie, a retired couple living in Brooklyn, New York, have been loyal NFCR supporters for over 45 years. When asked why, Tony emphatically stated, "NFCR is making a lot of progress in cancer research. It is very important work."

A very personal connection to NFCR occurred in 1985, when a Long Island newspaper article detailing the life story of Albert Szent-Györgyi (NFCR's co-founder and Nobel Prize recipient) happened to catch Tony's eye. He wrote to Dr. Szent-Györgyi, and was thrilled to receive a return letter containing a detailed explanation of NFCR's mission in the words of one of its famous co-founders. The letter also motivated Tony to make a memorial gift in honor of his beloved mother, who passed away after a lengthy battle with metastatic breast cancer.

Throughout the years, both Tony and Marjorie, as well as other family members, have survived brushes with various types of cancer, including skin cancer (melanoma) and colon cancer. Their financial support of NFCR has been unwavering because they believe "NFCR investigates all aspects of different types of cancer—genetics, new treatments, immunology. They take a broad approach to research."

The Pratt's attend the annual Szent-Györgyi Prize for Progress in Cancer Research when their schedule permits, and are honored to have met several NFCR-funded scientists in person. They enjoy receiving updates on the latest research discoveries and feel confident that their contributions will impact the health of future generations.

Dr. Lisa Miller

LISA MILLER

"Donating by way of Fly to Find a Cure is a bonus for me. I can support cancer research and use my points to travel to some really great places with family and friends, and even to attend NFCR events to further show my support of their great work!"

Lisa A. Miller, Ph.D., a clinical psychologist and long-term *Fly to Find a Cure* donor, learned the importance of supporting cancer research from her beloved father. Dr. Leonard R. Miller, who passed away in 2003, was a highly respected pathologist with a distinguished medical career that included serving on the faculty of Yale, University of Arizona and University of Oklahoma Medical Schools as both a professor and researcher.

Lisa explained, "Giving to NFCR is all about the legacy of my father, who dedicated his life to education and cancer research. He was my inspiration to become a child clinical psychologist. Early in my career I worked with many children battling cancer and, boy, cancer stinks!

"Today, I am especially thankful that I am now fortunate enough to be able to help support an organization that believes in scientists, like my dad was. I get to help provide scientists in the lab the funding they need to let them keep trying until they can make a real difference in the battle against cancer."

PLAY4THECURE

Play4TheCure is a signature fundraising program of NFCR. This unique platform inspires athletes to combine their passion for sports and fitness with the fight against cancer. Individuals and teams who participate in the program create their own unique fundraising events, with **100% of proceeds supporting NFCR-funded scientists.**

To learn more or sign-up with *Play4TheCure*, please visit Play4TheCure.org

$70K A charity partner of the 44th Marine Corps Marathon, an annual event bringing together over 30,000 runners in Washington, D.C., *Play4TheCure's* team of 50 runners from around the world raised nearly $70,000.

$30K *Play4TheCure* partnered with the National Field Hockey Coaches Association (NFHCA) to promote Cancer Awareness Month in October. NFHCA-associated teams raised an unprecedented $30,000.

$5K+ Chelsea Field Hockey of Michigan raised a record-breaking $5,686 to support breast cancer research. Chelsea Field Hockey joined *Play4TheCure* in 2015, and since then has raised over $18,000 in total.

$5K+ Through the annual *Summer Series* initiative, *Play4TheCure* partnered with various Minor and Major League Baseball teams, including the Brooklyn Cyclones, Potomac Nationals, Frederick Keys, Bowie Baysox and the Baltimore Orioles. In total, fans contributed over $5,000.

$273K+

In 2019, over 270 individuals and teams across 13 different sports, "Played for The Cure" raising more than $273,000.

PLAY 4 THE CURE
NATIONAL FOUNDATION FOR CANCER RESEARCH

Chelsea Field Hockey during their Play4TheCure breast cancer awareness game

ARTS4THECURE

Arts4TheCure is a unique fundraising platform of NFCR. The program encourages musicians, singers, artists, performers and other creative individuals to utilize their talents and skills to raise awareness and funds for cancer research.

Among the program's highlights is the incredible fundraising efforts of high school student Tina Zhang and middle school student Sahaana Padayathi.

Ms. Zhang, a fine arts high school student from Virginia, organized the Youth Art Bridge—an initiative to bring together student artists for fundraising activities to support cancer research. **The Youth Art Bridge organized a community art auction, selling 50 original art pieces and raising over $16,000 to help bring new treatments and a cure to cancer patients.**

Ms. Padayathi, a California middle school student, used her passion for Indian classical music to show her support in the fight against cancer. Sahaana gathered her fellow vocalists and musicians and organized an Indian music concert for her local community. **Through ticket sales and donations, this effort raised over $5,000 to support cancer research.**

To learn more about Arts4TheCure, please visit NFCR.org.

Tina Zhang, pictured with fellow Youth Art Bridge student

Sahaana Padayathi, (second from right) pictured with her fellow performers

IN 2019, *ARTS4THECURE* PARTICIPANTS RAISED NEARLY $50,000 TO SUPPORT CANCER RESEARCH THROUGH NFCR.

DAFFODILS & DIAMONDS

The 38th Annual Daffodils & Diamonds Luncheon and Fashion Show was held in March 2019 at the Columbia Country Club in Chevy Chase, Maryland, in memory of long-time committee member, Anne Muir. The luncheon is a meaningful spring tradition organized by a committee of strong and accomplished women who have resolved to move forward together in the fight against cancer.

This year's event was attended by more than 300 dedicated women. **Their generosity raised more than $115,000 to support NFCR-funded scientist, Dr. James Basilion, and his work developing "smart probes"** to assist surgeons with rapidly identifying incomplete surgical resections of breast cancer to prevent recurrence or repeated surgeries.

Hosted by Emmy award-winning journalist Laura Evans, the event included a fashion show presented by Lord & Taylor. The program also included a luncheon, raffle and a silent auction featuring clothing and jewelry, gift certificates for dining, paintings by local artists and more.

Attendees enjoying a traditional Cajun-style meal during this year's New Orleans themed event

Event founder Alice-Anne Birch welcomes attendees

THE 2019 LUNCHEON RAISED MORE THAN $115,000.

IN MEMORIAM
ROBERT RINGDAHL

Robert Ringdahl was taken to the emergency room in early 2019 for stroke-like symptoms. Doctors found that he had metastatic lesions in his brain and lungs. In February, he underwent brain surgery and was diagnosed with Stage IV Melanoma. He continued with single agent immunotherapy infusion once a month and received CyberKnife radiation therapy to the brain. By spring, the tumors in his brain were found to be shrinking, which gave him a rare opportunity for him to enjoy life and travel with his wife (Rose Wang) and family.

By summer, a new scan showed that the cancer had spread to his gastrointestinal tract. He switched to targeted therapy drugs that were supposed to keep the disease at bay for 8 to 9 months, on average. Soon after, drug resistance kicked in, and running out of options, Robert decided to give dual agent immunotherapy a try. He experienced strong side effects which resulted in frequent visits to the ER. He became extremely weak from chronic gastrointestinal bleeding. With dual-agent immunotherapy not working, he was again put on target therapy drugs.

Rose learned about a new treatment option while attending NFCR's 2019 Scientific Symposium in October where she spoke with NFCR scientists from Harvard University. Unfortunately, with Robert's health rapidly declining, he did not have the opportunity or time to qualify for the trial. He passed away peacefully in November 2019, after spending his wedding anniversary weekend with Rose and being surrounded by his children and grandchildren.

Determined to continue Robert's vision and dedication to those affected by cancer, Rose created a memorial fund in her husband's name to support cancer research. The Robert Ringdahl Memorial Rose Fund has raised nearly $16,000 to support cancer research in his memory.

WAYS TO GET INVOLVED

HOW YOU CAN HELP!

- "Cash" gifts can be made by check, credit card, online at nfcr.org, by phone at 1-800-321-CURE (2873) or via a donor advised fund.
- Stock gifts (long-term securities, including stocks and bonds) can be a source of significant tax benefit by eliminating capital gains taxes, as well as receiving an applicable tax deduction.
- Charitable IRA Rollovers are gifts made directly from a traditional IRA to NFCR. Donors must be at least 70 ½ years old. While not income tax-deductible, these types of gifts may help a donor to meet his/her annual IRA required minimum distribution and provide other tax benefits. Simply contact your IRA custodian and ask them to direct your distribution to NFCR.
- Charitable Gift Annuities are gifts that provide guaranteed income to a donor for life (and/or life of a spouse) with a portion eligible for tax deduction.
- Wills or Living Trusts are popular because they are easy to arrange and may be changed at any time you choose. A provision or amendment prepared by your attorney is all that is necessary.

For more information on NFCR programs and ways to give and get involved, visit our website at NFCR.org

OTHER WAYS TO SUPPORT CANCER RESEARCH

Avid sports player? Consider creating a *Play4theCure* event with your team and leverage your shared passion for your sport to "Play4" loved ones affected by cancer. This is a fun way to unite your team and rally behind a cause!
Visit play4thecure.org

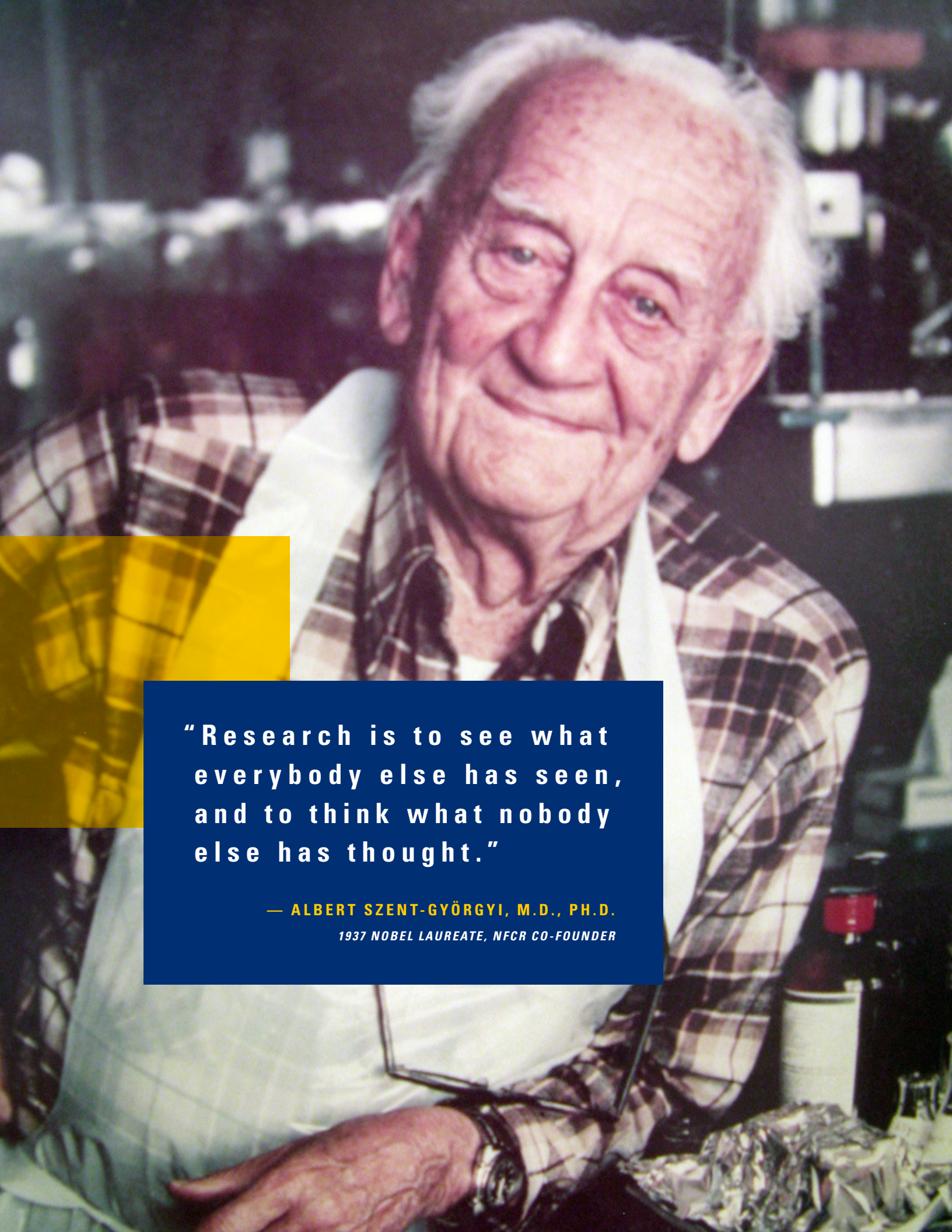
Art enthusiast? Consider creating an *Arts4theCure* event to leverage your passion for music and the arts among your network and support cancer research!
Visit nfcr.org/get-involved/arts4thecure

Frequent flyer? *Fly to Find a Cure* is a fundraising program that allows donors to support the fight against cancer, with the added benefit of receiving airline miles in return. Our airline partners include: Alaska Mileage Plan, American Airlines AAdvantage, Delta Sky Miles and United Mileage Plus.
Visit nfcr.org/airline2020

Establishing a Rose Fund is a great way to memorialize your loved one while continually supporting cancer research in their name.
To establish a Rose Fund, contact Deena Faruki at DFaruki@NFCR.org or 301-654-1250.

As a result of the current health crisis, and with our offices closed during the time of this publication, our official audit for 2019 will be made available online this summer in the electronic version of NFCR's 2019 Annual Report.

We appreciate your understanding.



"Research is to see what everybody else has seen, and to think what nobody else has thought."

— ALBERT SZENT-GYÖRGYI, M.D., PH.D.

1937 NOBEL LAUREATE, NFCR CO-FOUNDER

National Foundation for Cancer Research

Research for a Cure

5515 Security Lane, Suite 1105
Rockville, MD 20852
1-800-321-CURE (2873)
info@nfcr.org
EIN# 04-2531031

NFCR.ORG/GIVE2020

BBB ACCREDITED CHARITY · CFC Combined Federal Campaign #11267 Cancer Research America - NFCR · Community Health Charities PARTNER · GuideStar Exchange GOLD PARTICIPANT · UICC global cancer control