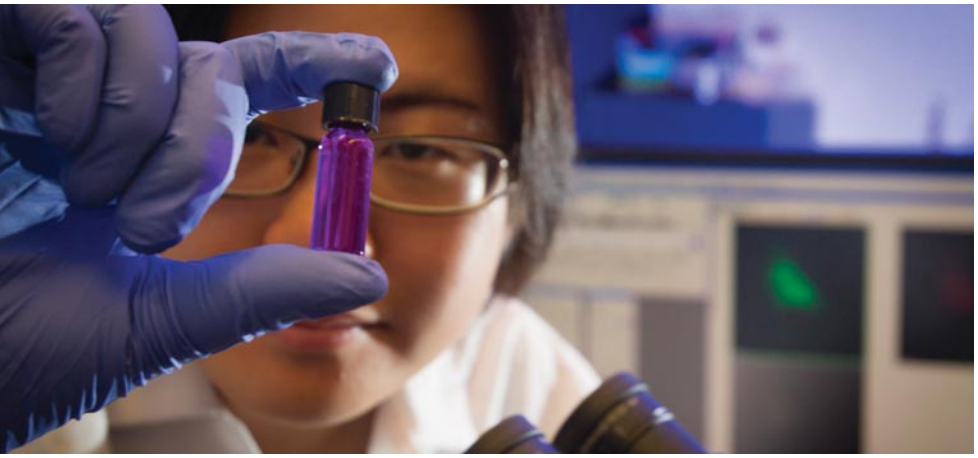
UNIVERSITY CANCER RESEARCH FUND
2016 LEGISLATIVE REPORT

Annual Financial Report to the Joint Legislative Education Oversight Committee and the Office of the State Budget and Management
Submitted November 1, 2016 in accordance with G.S. 116-29.1



UNC LINEBERGER

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Message from the Chair

Cancer is a global scourge to mankind. It is also North Carolina's leading cause of death and, coupled with this disease's heavy toll in terms of human lives, cancer has profound, negative associated human and economic consequences.

Thankfully, UNC Lineberger Comprehensive Cancer Center is working every day to make a life-saving difference. Our faculty are dedicated to discovering and implementing cutting-edge methodologies and treatments to help prevent, detect and treat a disease that will affect almost 40 percent of North Carolinians during their lifetimes.

This year, we celebrate the center's 40th year of designation as a National Cancer Institute-designated cancer center. An essential element of the center's successful past, and what will help propel future research and life-changing treatments, is the University Cancer Research Fund (UCRF).

The UCRF has played a leading role in our work to produce positive health outcomes for cancer patients across our state – from the 170,000 patient visits each year at the N.C. Cancer Hospital to the thousands of patients we reach in their home communities through telemedicine and partnerships with local doctors and hospitals across North Carolina.

As Chair of the Cancer Research Fund Committee, I am honored to present our annual legislative report. This report lays out in detail the many positive impacts the UCRF is making possible through ongoing work to combat cancer in our state and, through the center's research efforts, is producing results that are making a national and global difference as well.

For example, the UCRF has helped us this year recruit and retain 23 faculty members who are recognized as leaders in their fields. The dedicated work of these outstanding researchers and doctors is the key reason UNC has earned the highest possible ratings from the National Cancer Institute. The UCRF also supports the groundbreaking research in cancer genetics, treatments and outcomes that places UNC at the forefront of the fight against cancer and brings these treatments to our state first.

Together with providing cutting-edge care for patients in North Carolina, today we are leading global-scale collaborations that are already changing the way cancers are identified. This year – for the first time ever at UNC – we are successfully shrinking patients' tumors using their own T-cells as the vehicle for treatment. This innovative immunotherapy treatment is the direct result of UCRF resources.

The UCRF helps more than people. It also helps drive our economy. These wide-spread economic benefits continue to grow, and in 2016 they include:

- Generating more than $406 million in total economic impact in North Carolina – a return of nearly $9 for every dollar invested;
- Creating and supporting more than 2,546 jobs through both indirect and induced impacts of those direct jobs and the spending generated from the UCRF within North Carolina;
- Leveraging UCRF funds to attract more than $170 million in external research grants to improve health; and
- Providing nearly $14.3 million in local and state tax revenue.

On the behalf of all those in critical need of the treatments and services provided by UNC Lineberger Comprehensive Cancer Center, and on behalf of all of our scientists and clinicians involved in cancer research and care, I thank you for your continued and generous support.

Sincerely,

Carol L. Folt, PhD
Chair, Cancer Research Fund Committee

EXECUTIVE SUMMARY

UNIVERSITY CANCER RESEARCH FUND
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EXECUTIVE SUMMARY

The North Carolina General Assembly created the University Cancer Research Fund in 2007, the year that cancer overtook heart disease as the state's leading cause of death. The UCRF is used solely to support cancer research under UNC Hospitals, the Lineberger Comprehensive Cancer Center, or both in an effort to defeat a disease that affects nearly 40 percent of North Carolinians.

The UCRF supports the recruitment, retention and research of world-class faculty members who are leading our efforts to better understand, prevent, diagnose, and treat cancer. These faculty members – along with innovative technologies, infrastructure and other core resources – have helped UNC become a national leader in cancer research and earn its highest rating ever from the National Cancer Institute. This simply would not be possible without the UCRF.

Originally funded by a combination of state appropriations, tobacco settlement funds, and taxes on non-cigarette tobacco products such as snuff, the UCRF received $25 million in 2007 and $40 million in 2008 before reaching its fully authorized funding amount of $50 million in 2009. In 2013, the legislature consolidated all earmarked tobacco settlement funds into the General Fund, eliminating those monies as a source of UCRF support and thereby reducing its funding stream by about 16 percent. The portion of UCRF revenue from non-cigarette tobacco product sales has varied year by year. In FY 2016, the state's total allocation to the UCRF was $44.7 million.

When the UCRF was created, the General Assembly also established the Cancer Research Fund Committee to provide continued oversight and to ensure that UCRF funds are invested responsibly. In 2009, the Committee adopted a Strategic Plan to target UCRF resources in areas where they can have maximum impact. The plan, which continues to be re-evaluated in an ongoing effort to maintain accountability of UCRF investments, calls for funds to be invested in the following areas:

- Strategic research priorities in genetics, novel therapies, and outcomes;
- Selective opportunities that allow UNC scientists more nimbly to adapt to a rapidly changing field of research; and
- Clinical and scientific infrastructure such as technology, training, outreach and other core resources.

The Cancer Research Fund Committee has published regular reports on the Fund's activities since 2008. In 2011, the General Assembly mandated an annual financial report including UCRF's effects on the state's economy, details on expenditures of UCRF monies and outside funds leveraged by UCRF support, and other performance measures.

This is the sixth financial report submitted under the legislative requirement, and it demonstrates that the University Cancer Research Fund continues to have a significant economic benefits for the state of North Carolina. From 2008 to 2016, impact has increased yearly, including a greater than 10 percent increase in competitive grant funds from outside of North Carolina. The UCRF includes the following economic impact:

- Directly supported portions of more than 1,036 employees in FY 2015-2016.
- Created the equivalent of 1,510 new jobs, based on an independent economic evaluation.
- Had an overall economic impact that reached $406.7 million in FY 2015-2016 and totaled more than $2 billion over the years since UCRF inception.

- Has leveraged $170 million in extramural funding in FY 2015-2016 that is directly linked to faculty who were recruited or retained by UCRF funds, or attributable to innovation grants, technology and infrastructure investments from the UCRF.
- Has had an increased return on investment each year, exceeding a 9-to-1 return in FY 2015-2016.

In addition to these economic benefits for North Carolina, the human impact of the UCRF will persist through the continuing advancement of cancer research and care. This report details several research highlights according to the priorities adopted in the Strategic Plan.

Genetics in Cancer Causation and Treatment

This research priority focuses on the role of genetics in cancer. UNC faculty are uncovering proteins and genetic mutations that play a significant role in cancer causation and development, and are leading global collaborative efforts through The Cancer Genome Atlas project to transform the way cancers are classified, diagnosed and treated. UNC's leadership role in this project is made possible largely because of UCRF investments in sequencing technology and other key research tools.

Developing Novel Therapeutics

This research priority supports our work to improve treatment methods to better target tumor cells and minimize toxic side effects on non-cancerous tissues. As scientists gain more insights as to how cancer develops and grows, they can strive to find more effective methods of treatment. Reprogrammed cells, nanoparticles and other vehicles for more precise drug delivery are continually evolving. Enrollment in clinical trials gives more North Carolinians access to cutting-edge therapies as part of the drug testing process. A new cellular therapy program has brought the most advanced, personalized form of immunotherapy to North Carolina.

Optimizing NC Cancer Outcomes

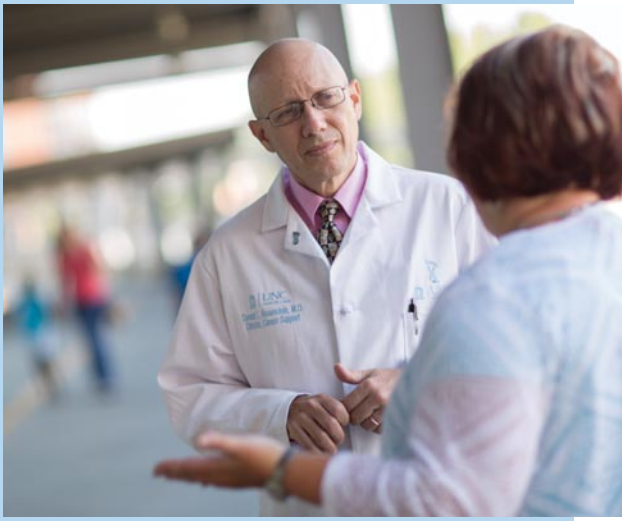
This research priority aims to use robust datasets; community-based research interventions; and strong partnerships with doctors, hospitals and patients to gain a more holistic understanding of cancer in North Carolina. The UCRF has been critical in building rich population-based data resources and funding community-based projects that test the most effective ways to improve prevention and early detection across our state.

Clinical Excellence and Infrastructure

The UCRF has enabled us to recruit and retain faculty with expertise and leadership in several key clinical areas, and to build research infrastructure that is widely used at UNC as well as by provider practices and research institutions across North Carolina. Virtual tumor boards and our telemedicine network connect community doctors, nurses, office staff and hospitals with oncology experts at UNC.

The UCRF's importance in ongoing research, infrastructure and public service is complemented by the state's two major capital investments in cancer care: The N.C. Cancer Hospital, which opened in 2009 and serves patients from all 100 counties, helping more than 10,000 patients each year; and Marsico Hall, a collaborative research facility that opened in 2014 and houses cutting-edge genomics and cancer immunology technology and equipment that further accelerates our research capabilities.

The University Cancer Research Fund has been a landmark initiative with significant benefits – not only the economic impacts, but also the enhanced research, public health intervention and care for patients and support for these families in North Carolina – that will only keep growing as UNC continues to be a national leader in the fight against cancer.



ECONOMIC IMPACTS

UNIVERSITY CANCER RESEARCH FUND
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ECONOMIC IMPACTS

To determine whether the UCRF is achieving its goal of stimulating North Carolina's economy, UNC again engaged Tripp Umbach, a nationally respected consulting firm, to estimate the UCRF's economic impact for Fiscal Year 2016. Tripp Umbach examined the UCRF's immediate impact on state income growth and employment. The Fund's overall economic impact was estimated as the sum of its direct and indirect and induced impacts (see the full report in the Appendix). Direct impact resulted from two major sources: expenditures from the UCRF itself, and the expenditure of UCRF-attributable research funds awarded to UNC by federal, foundation and other sources. The indirect and induced impact was calculated by applying standard multipliers to direct expenditures.

For Fiscal Year 2016, UCRF's total allocation was $44.7 million and the return increased for the eighth straight year. Using standard methodologies, Tripp Umbach estimated that in FY 2016 the UCRF:

- Had an overall economic impact of $406.7 million, including $214.9 million in direct spending and $191.8 million in indirect and induced impact attributable to external grant funding.
- Generated $9 in economic impact for every UCRF dollar expended.
- Supported more than 2,546 jobs, including the direct support of 1,036 jobs and an additional 1,510 jobs through the increased extramural funding and the indirect and induced impacts of those direct jobs and the spending generated within North Carolina.
- Resulted in nearly $14.3 million in local and state tax revenues to North Carolina.

UCRF's economic impact has been measured and reviewed by outside firms since the fund's establishment. SRA International and the UNC Center for Competitive Economies (Frank Hawkins Kenan Institute of Private Enterprise) produced the reports between FY 2008 and FY 2012. Tripp Umbach has generated the reports since FY 2013. Although the two external entities used slightly different methodologies, the reports and the calculations are based on industry standards. UCRF's economic impact was $406.7 million in FY 2016, and its cumulative economic impact is more than $2 billion since its establishment in 2007.

Faculty Job Creation and Retention

Faculty truly drive the UCRF. They lead the teams that conduct the groundbreaking research to push the boundaries of our knowledge and advance cancer treatment, prevention and early detection. They also hire staff, buy equipment, earn research funding from outside North Carolina, and train students and fellows. Since the UCRF was created in 2007, it has had a tremendous positive impact on cancer research faculty:

- **Recruitment:** The UCRF has supported the recruitment of 19 faculty this year, and 171 since its inception. These faculty are developing a wide range of research programs in nanomedicine, quantitative biology, cancer genomics, health outcomes, health communications, multiple cancer types, immunotherapy and other areas critical to improving cancer prevention, diagnosis and treatment in our state.
- **Retention:** UCRF support has led to the retention of 4 faculty this year and 39 total since 2007, allowing us to keep top talent at UNC where they can continue their research and clinical care.

Extramural Funding Growth Continues

Almost all extramural funds come to UNC from outside North Carolina, adding significantly to the state's economy. The UCRF's Strategic Plan establishes extramural research funding – particularly competitive federal funding – as a key measure for UCRF success. UCRF support is leveraging significant amounts of extramural research funds for North Carolina and keeping the state at the forefront of research nationally. Key trends include the following:

- FY 2016 funding from outside sources that is directly attributable to the UCRF totaled $170 million in annual total cost dollars.
  - This amount is based on a snapshot of active attributable extramural funding. A complete list of the awards is included in the Appendix.
  - The positive ef f ects of faculty recruitment and retention, technology enhancement, and developmental projects have accumulated. The UCRF-attributable extramural funding has risen dramatically since FY 2008, when it was directly linked to $5 million. By FY 2011, it was $69 million. This year, it is $170 million, an 18 percent increase over 2015 levels. Many of the currently active awards will continue for several more years, and we fully expect new awards to add to the total.

Intellectual Property, Innovation, and Entrepreneurship

Through its focus on innovation, the UCRF has promoted entrepreneurship and has created jobs and spinoff companies. The UCRF collaborates with UNC's North Carolina Translational and Clinical Sciences Institute to foster an entrepreneurial mindset at UNC, and supports specialized staff to maximize the development and licensing of university intellectual property. More than 33 startup companies have launched or expanded their scope with direct help from the UCRF; these companies are attracting external grant support, drawing venture capital investments, and creating private-sector jobs.

RESEARCH IMPACTS

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RESEARCH IMPACTS

The UNC Lineberger Comprehensive Cancer Center is in its 40th year as a National Cancer Institute-designated cancer center. NCI granted UNC Lineberger an "exceptional" rating in 2010 and again in 2015 – the highest that a cancer center can earn – and each review cited the University Cancer Research Fund as a significant reason UNC earned the National Cancer Institute's top rank.

When the UCRF reached its fully authorized funding amount of $50 million in 2009, the Cancer Research Fund Committee adopted a Strategic Plan to guide the most effective and responsible use of the state's investment. This section of our annual report highlights noteworthy successes in each of the Strategic Plan's three primary tiers: Research Priorities, the Opportunity Fund, and Critical Infrastructure.

1. **Research Priorities:** The Strategic Plan includes three targeted research priority areas where with focused investment in major scientific programs, disease-based initiatives, or cutting-edge research platforms, UNC could have substantial impact and become a world leader. The priority areas are as follows.
   - **Understanding the Role of Genetics in Cancer Causation and Treatment** – to discover the genes that predispose families to cancer and that predispose cancer patients to poor treatment outcomes – especially by looking for the various genetic mutations in specific cancer subtypes that lead to cancer therapy failure.
   - **Developing Novel Therapeutics** – to devise new therapies that are targeted to the specific vulnerabilities of treatment-resistant cancers, and to develop new ways of delivering treatments that reduce toxic side effects for patients. This research priority relates closely to the genetics initiative, and makes key observations that will be utilized in clinical applications as quickly as possible.
   - **Optimizing NC Cancer Outcomes** – to enhance the quality of oncology and survivor care, and to build population-based datasets that track the occurrence and treatment of cancer across North Carolina in order to support research designed to improve community prevention and early detection. The ultimate goal is to understand North Carolina's cancer problem at a level unprecedented in the nation and to design research interventions aimed at rectifying these problems at the practice, health system and community levels.
2. **Opportunity Fund:** The Opportunity Fund allows UCRF to remain nimble, seizing research or clinical opportunities as they arise and providing the top minds in the field with the resources they need. Examples include seed funds to recruit top researchers; support of leading-edge technology and equipment for use by multiple faculty members; competitive, innovative pilot projects; and the development of shared research resources.
3. **Critical Infrastructure Fund:** This Fund provides critical resources for cancer research that are not readily obtainable by outside funding, but upon which future progress relies. Investments in imaging, informatics and fundamental research techniques give our clinician scientists the tools they need to change patient outcomes. UCRF resources provide the opportunity to grow our multidisciplinary excellence in cancer care and to develop a statewide infrastructure that helps bring leading-edge clinical research and applications into community practices.

Research Priority 1: Understanding the Role of Genetics

One of the most dynamic fields of cancer research, cancer genetics is the study of how an individual's genetic makeup can influence the risk and development of cancer, and the study of how various types of enzymes, proteins and genetic mutations can affect tumor growth. The UCRF has funded much-needed investments in high-powered sequencing technologies, massive data resources, and other important tools that have helped UNC become a national leader in cancer genomics.

Genomic analysis finds new subtypes of breast cancer

Charles M. Perou, PhD

Researchers from UNC Lineberger and other academic centers have discovered that invasive lobular carcinoma, the second most commonly diagnosed invasive form of breast cancer, is actually at least three distinct diseases that could result in different outcomes for patients.

Patients with the "reactive-like" subtype had better overall survival than patients with the "proliferative" subtype, researchers found. There were no significant differences in survival for patients in the third "immune-related" group, patients in this group had higher levels of immune system-related functions and high expression of a number of oncology drug targets.

"Now that we have these important new subgroups of invasive lobular carcinoma, we can try to validate some of the findings about differences in outcome, and see if these new genomic classifications make a difference in terms of patient's responsiveness to drugs," said senior study author **Charles M. Perou, PhD**, a UNC Lineberger member and the May Goldman Shaw Distinguished Professor of Molecular Oncology. "This is how personalized medicine is developed."

The study in the journal Cell involved the analysis of genetic and molecular patterns in more than 800 breast cancer samples as part of The Cancer Genome Atlas (TCGA), a federally funded collaborative effort to map the genetic mutations in cancer. Investments in next-generation sequencing technology from the UCRF were crucial in enabling UNC to serve in several TCGA leadership roles.

The UNC Lineberger's major role in this nationwide NCI endeavor was just renewed for another five years, both as the site for RNA sequencing and as a central site for development of computational analysis.

Genetics probe immune system's role in fighting cancer

To better understand the immune system's role in the fight against cancer, UNC researchers searched thousands of tumors for genetic signatures that could indicate whether immune cells had invaded tumors to stage a defense.

For the study, funded in part by the UCRF, researchers analyzed more than 3,400 tumors across 11 types of cancer using data from The Cancer Genome Atlas. They reported in the Journal of the National Cancer Institute that higher levels of immune cell gene expression inside tumors – a sign of higher numbers of invading immune cells – were often linked to better survival for many cancers. However, for a few cancer types, higher immune signature levels were linked to a poor prognosis.

Based on these findings, the researchers believe it may be possible to use a patient's immune system's gene expression characteristics to identify patients who will respond to certain immunotherapy drugs. These data are being computationally "boiled down" to a signature that can be eventually used by community oncologists. **Benjamin Vincent, MD**, an assistant professor in the UNC School of Medicine Division of Hematology/Oncology who was recruited using UCRF funds, said future studies will analyze immune system cancer signature while patients are undergoing treatment with immunotherapy.

"We wanted to see if we could use our genomics approach to gauge differences in the immune system's response to tumors," Vincent said. "We will be working to develop biomarkers for responsiveness to immunotherapy drugs in the context of ongoing UNC clinical trials."

Colorectal cancer biomarker could lead to potential personalized treatment

UNC scientists have discovered that a key protein called NLRX1 may play a role in preventing the growth of colorectal cancer, the second largest cancer killer in the United States. Their findings were published in Cell Reports.

Jenny P. Ting, PhD

The study, led by UNC Lineberger member **Jenny P. Ting, PhD**, the William R. Kenan Jr. Professor of Microbiology and Immunology, found that a deficiency in NLRX1 could be a biomarker for colorectal cancer. Researchers found markedly low levels of this protein – which is involved in regulating immune system signals to prevent hyperactive inflammatory responses – in multiple laboratory models of colorectal cancer and in samples of human tissue.

"We're arguing that clinicians could analyze NLRX1 expression, and provide a more targeted treatment based on that finding," said **Alicia Koblansky, PhD**, the paper's first author and a postdoctoral research fellow at UNC Lineberger. "We want to help clinicians drive precision medicine for patients as much as possible."

Ting and Koblansky identified a treatment – an existing drug used to treat arthritis – that could be used as a new therapy for colorectal cancer in patients with low NLRX1. They found that the drug, which blocked a small signaling protein called IL-6, decreased tumor growth and activation of downstream cancer-causing signals. Based on these findings, they believe IL-6 blockers could be redirected against colorectal cancers with low NLRX1 expression.

Faulty genetic instructions drive a deadly blood cancer, study reveals

A study by UNC Lineberger researchers has uncovered the genetic mechanism that prevents acute myeloid leukemia (AML) cells with a specific DNA mutation from maturing into healthy blood cells – a finding that further explains how AML develops.

AML, one of the most common acute leukemia types in adults, involves over-production of immature blood cells that then crowd out normal, healthy cells. Previous studies have identified a series of genetic errors that typically occur inside cancerous blood cells. However, it has been unclear is exactly how those genetic malfunctions create immature blood cells that overpopulate and spread in patients with acute myeloid leukemia.

UNC researchers found a mutation in a particular gene gives normal cells faulty genetic instructions that contribute to the development of cancerous cells. This mutation, which is found in 20 to 30 percent of AML cases, leads to the creation of immature precursor cells that can become AML cells, the researchers report. They also found that the mutation is not sufficient to cause cancer alone, but cooperates with a defect in another gene.

"Our findings not only provide a deeper understanding of how this prevalent mutation contributes to the development of AML, but it also offers useful information on how to develop new strategies to treat AML patients," said **G. Greg Wang, PhD**, UCRF recruit and UNC Lineberger member and an assistant professor in the UNC School of Medicine Department of Biochemistry and Biophysics.

Wang and his colleagues reported in Cancer Cell that they also tested a potential treatment, finding that AML cells with this mutation were sensitive to specific drug inhibitors that are now under clinical evaluation, suggesting the possibility of personalized treatment strategies.

Researchers identify DNA repair enzyme as potential brain cancer drug target

Cells repeatedly copy their genetic material as they divide, sometimes making mistakes and causing DNA damage in the process. An enzyme called Dicer helps cells repair that damage – and now, UNC researchers are looking at Dicer's role to discover a new potential strategy to kill rapidly dividing cancerous cells in the brain.

Dicer's role in repairing DNA damage is relevant to cancer research because rapidly dividing cells such as cancer cells incur DNA damage as they divide, and because chemotherapy and radiation treatments often work by damaging the cells' DNA. When researchers removed Dicer from preclinical models of medulloblastoma, a common type of brain cancer in children, they found high levels of DNA damage in the cancer cells, leading to the cells' death. The tumor cells were smaller and more sensitive to chemotherapy.

Based on their findings published in Cell Reports, the researchers believe that Dicer could be investigated as a potential drug target for medulloblastoma and other types of brain cancer.

"This is the first time that the specific function of Dicer for DNA damage has been looked at in the context of the developing brain or even in brain tumors, despite that the fact that the protein has been extensively studied," said **Mohanish Deshmukh, PhD,** a UNC Lineberger member and professor in the UNC School of Medicine Department of Cell Biology and Physiology and also the Neuroscience Center. "Targeting Dicer could be an effective therapy to prevent cancer development or to sensitize tumors to chemotherapy."

Next-generation sequencing aims to help patients when traditional treatments fail

Five years ago, UNC Lineberger launched UNCSeq, an ambitious clinical research protocol funded by the University Cancer Research Fund to assess whether next-generation tumor sequencing could identify genetic changes that influence clinical outcomes or choice of therapy.

Nirali Patel, MD

This genetic sequencing protocol and clinical trial, which was designed to create customized cancer treatment plans based on an individual patient's tumor, enrolled more than 2,700 patients and has furthered researchers' understanding of the genetic underpinnings of cancer. Now that the accrual phase of this study is ending, UNC is transitioning its focus toward investigating other innovative methods of tumor profiling, such as RNAseq and immune-imaging.

The work done under UNCSeq has identified novel clinical approaches for patients for whom traditional therapies had failed – patients like Siler City native Roger Johnson. Diagnosed with bladder cancer, Roger entered the UNCSeq clinical program and had his cancer genetically sequenced. His doctor initially put him on a treatment widely used for kidney and breast cancers, but not used to treat bladder cancer, and Roger responded well to his new therapy. Roger than entered a new immunotherapy clinical trial that his doctor felt would be even more effective. Roger responded almost immediately to the new immunotherapy treatment, improving his overall quality of life and slowing the progression of his cancer.

Besides helping patients like Roger receive personalized medicine based on their tumor's genetic makeup, UNCSeq has had a significant research impact. The data has served as the basis for more than 30 presentations and papers, and the investment has returned millions of dollars in grant funding. It also opened the door for collaborations with IBM Watson Health, helping position UNC at the forefront of precision medicine. This deep dataset will continue to be used in exploratory settings for grants, clinical trial applications and scholarly papers.

UNC plans to build on the success of UNCSeq using multiple options for clinical sequencing of our patients' tumors. Doctors will leverage in-house tumor sequencing within the UNC Molecular Genetics Laboratory and work with research centers, clinical trial operators and commercial partners to ensure that patients have access to the most advanced therapies available.

Research Priority 2: Developing Novel Therapies

It can take more than 10 years for a new cancer drug to go through the testing process required for widespread patient use, and roughly one third of U.S. cancer patients will die with advanced disease that resists treatment. The University Cancer Research Fund has helped UNC researchers further the development and testing of new therapies and drug delivery methods that aim to treat cancer more effectively and with fewer toxic side effects.

UNC Lineberger researchers uncover promising direction for pancreatic cancer treatment

Channing Der, PhD,

More than 95 percent of pancreatic cancers have mutations in a gene called KRAS, and UNC researchers believe, based on the results of a preclinical study, that blocking the gene's function could be a very effective approach to treating pancreatic cancer.

Channing Der, PhD, a UNC Lineberger member and a Kenan Distinguished Professor in the Department of Pharmacology, and his colleagues tested an investigational drug that blocks a signaling protein called ERK. They report in Cancer Cell that a pathway that includes ERK, called the RAF-MEK-ERK pathway, is key for regulating cell growth and becomes abnormally activated in cancers with KRAS mutations. Although some drugs already target signals in this pathway, they do not effectively treat pancreatic ductal adenocarcinoma, the most common form of pancreatic cancer.

NC STATE UNIVERSITY

COLLABORATION WITH NC STATE WILL PROMOTE INNOVATION AMONG RESEARCHERS, ENTREPRENEURS

A UNC/NC State Department of Biomedical Engineering collaborative created with UCRF support recently was awarded one of two $85,000 RTP Catalysts for Innovation grants to encourage collaboration among university researchers and businesses in Research Triangle Park.

The Medical Innovators Collaborative (MEDIC) will promote early-stage biomedical innovation by bringing together innovators and entrepreneurs including academics, caregivers, industry professionals, students, and veterans. UNC Lineberger member **Jason Long, MD, MPH**, and **Andrew DiMeo**, a biomedical engineering professor at NC State University, came up with the concept last year after meeting at the UCRF Speed Dating Event hosted by their respective universities, where they won a $10,000 award funded by UCRF to launch their idea.

The purpose of MEDIC is to provide a space where surgeons could share device or technology ideas and work on them with engineering students and with entrepreneurs. MEDIC and its strategic partner, Bunker Labs RDU, will provide a high-tech prototyping lab and educational programming to help military veterans start and grow businesses.

In Der's study, nearly 50 percent of the human pancreatic cancer cell lines that they tested responded to the ERK inhibitor. And in animal models of Kras-mutant pancreatic ductal adenocarcinoma, they found that the drug had a significant effect on tumor growth, causing them to shrink or impairing their progress. Der and his collaborators believe ERK-specific inhibitors could be more effective – but caution that even cancer that is initially responsive to the treatment will eventually develop resistance.

"We don't think that an ERK inhibitor is just the miracle drug and we're done. We know that cancers often figure out a way to develop resistance," Der said. "And we believe that while these ERK inhibitors may be better than existing drugs targeting this pathway in this particular cancer, to really activate a successful long-term response in the patient, we're going to have to identify another inhibitor that will work in combination with the ERK inhibitor to overcome resistance."

Potential new drug targets melanoma, lymphoma driven by genetic mutation

In working toward targeted treatments that can block the genetic mutations influencing the growth of cancer, UNC researchers have shown how mutation can drive the most common type of lymphoma as well as melanoma, the deadliest form of skin cancer.

Norman Sharpless, MD

Led by **Norman Sharpless, MD**, director of UNC Lineberger and the Wellcome Distinguished Professor of Cancer Research, researchers devised new laboratory models of B-cell lymphoma and melanoma featuring a specific mutation of EZH2, a gene known to regulate cell fate.

The EZH2 mutation examined in this study occurs in about 20 percent of B-cell lymphomas, 5 percent of melanomas and less frequently in a variety of other cancers. The researchers found that the mutation alone can drive B-cell lymphoma, but in melanoma the EZH2 mutation occurs along with mutations of the BRAF gene, which occurs in about half of melanoma patients.

Researchers, who published their study in Nature Medicine, also demonstrated that a new investigational inhibitor, JQEZ5, blocked the function of the protein made by the EZH2 gene, and that it was highly effective in EZH2-driven cancer models. Their findings suggest that EZH2 inhibitors like JQEZ5 could be effective for some patients with melanoma or B-cell lymphoma, and that for melanoma in particular, they might work well in combination with inhibitors of BRAF that are already approved by the U.S. Food and Drug Administration as melanoma therapy.

"While there has been significant progress in recent years against cancers such as lymphoma and melanoma, many patients still fail these newer therapies and need further options for therapy," Sharpless said. "Given that EZH2 malfunction is a common event in many types of cancer beyond lymphoma and melanoma, we are hopeful that well-tolerated inhibitors of this enzyme will benefit a large group of patients with cancer."

New compound is effective against drug-resistant leukemia, preclinical study finds

Researchers at UNC and other institutions developed a new potential treatment for acute myeloid leukemia, reporting that a compound developed at UNC more than doubled the median days of survival in mouse models – even when applied to a drug-resistant form of the disease. Initial work on drug development for this target was supported by UCRF resulting in a large NCI award.

The drug, MRX-2843, blocked the growth of acute myeloid leukemia cells, led to a significant level of cancer cell death, and more than doubled the median days of survival in laboratory models with resistant forms of the leukemia. It was developed in the UNC Center for Integrative Chemical Biology and Drug Discovery, led by


Stephen Frye, PhD

UNC Lineberger member and UCRF recruit **Stephen Frye, PhD**, the Fred Eshelman Distinguished Professor in the UNC Eshelman School of Pharmacy.

MRX-2843 specifically targets two cell signaling proteins called tyrosine kinases that help drive abnormal cell growth in acute myeloid leukemia, non-small cell lung cancer, melanoma and glioblastoma. Frye's group made more than 1,500 compounds designed to target and block MERTK, a protein found to be overexpressed in acute myeloid leukemia cells. But they found that this particular compound could also block FLT3 – a protein that is mutated in 20 to 30 percent of adults and in 10 to15 percent of children with acute myeloid leukemia, and that is associated with worse outcomes in patients. They published their findings in the journal JCI Insight.


Shelton Earp, MD

"This could be a superior drug for certain resistant forms of acute myeloid leukemia, but it has to be tested in clinical trials," said study co-author **Shelton Earp, MD**, whose lab discovered MERTK. "We know that leukemia can develop resistance to other FLT3 drugs and that our drug overcomes this resistance. The question is: Would this new UNC inhibitor give patients with resistant acute myeloid leukemia longer survival? This is a particularly salient question for older AML patients who can't tolerate high doses of chemotherapy and bone marrow transplant."

Nanoparticle form of bone loss prevention drug effective against cancer, study finds

A preclinical study at UNC has found that a nanoparticle formulation of a drug typically used to prevent bone loss could be an effective treatment against small-cell lung cancer and prostate cancer.


Andrew Wang, MD

Andrew Wang, MD, UCRF recruit and UNC Lineberger member and associate professor in the UNC School of Medicine Department of Radiation Oncology and UNC Eshelman School of Pharmacy, and his collaborators tested a reformulation of zoledronate, a drug used to prevent bone loss.

Instead of directly fighting cancer cells, zoledronate slows down bone resorption and prevents bone metastasis progression. Previous research has shown that zoledronate and similar drugs have direct anti-tumor effects – but when they are in the body they are taken up by the bone, preventing their use as a chemotherapeutic treatment against cancer.

In their study, researchers reformulated zoledronate using nanotechnology. When they tested their new nanoparticle formulation in non-small cell lung cancer and prostate cancer cells, they found they were more efficient than the regular, small-molecule formation of the drug in stopping the cells from proliferating and causing their death.

"By making a nanoformulation, we allowed the agent to stay longer in circulation and reach tumor cells," Wang said. "Our work suggests that nanoformulation of zoledronate can be a new type of chemotherapy. More broadly, it suggests that nanoformulation may introduce new capabilities to existing drugs."

Research Priority 3: Outcomes

Improving outcomes for cancer patients is a public health priority. UCRF resources have helped build unprecedented data sources that give researchers a more comprehensive look at cancer incidences in North Carolina, including how patient outcomes vary by geographic, economic and other differences. The UCRF also supports different intervention strategies that reduce cancer risk factors and enhance a patient's ability to access screenings, treatments, and other information that could affect their decisions about cancer care.

UNC promotes better cancer screening to improve colorectal cancer outcomes in NC

Dan Reuland, MD, MPH

Northeastern North Carolina is one of three "hot spots" in the country with the highest colorectal cancer death rates – a designation that UNC researchers are working to change.

UNC Lineberger members **Dan Reuland, MD, MPH,** and **Stephanie Wheeler, PhD MPH**, are leading the Carolina Cancer Screening Initiative (CCSI), a multidisciplinary effort to improve cancer screening in North Carolina communities. CCSI's initial focus is on the 11-county hotspot, as well as 18 additional counties in the northeast that also have high colorectal cancer mortality rates.

Colorectal cancer screening is effective in early detection but underutilized, particularly in vulnerable populations including those with Medicaid, the uninsured, and Latinos. Reuland, Wheeler and colleagues are working to identify the most effective evidence-based approaches to increase screening rates in adults aged 50-75.

Stephanie Wheeler, PhD MPH

They are considering the effectiveness of four different interventions: a Medicaid mailed reminder and registry intervention; an endoscopy facility expansion initiative to increase access to colonoscopy; a mass media campaign encouraging African Americans to get screened; and an intervention offering vouchers to uninsured individuals.

Preliminary outcomes suggest that adults who receive an intervention are 40 percent more likely to complete a colorectal cancer screening test than those who do not. The CCSI will continue its work, as North Carolina is trying to reach the national

IMMUNOTHERAPY PATIENT SPOTLIGHT

Immunotherapy has been increasingly studied as an effective treatment for cancer. But recently, scientists discovered that cancer can essentially disguise itself and prevent the immune system's attack, preventing the body from healing. Thanks to a breakthrough in therapies called checkpoint inhibitors, doctors now have a way to remove the cancer's disguise so that healing can occur. For patients like **Janet Mazzurco** of Greensboro, that breakthrough was lifesaving. Janet came to UNC when her Stage IV metastatic melanoma continued to grow – and spread to her liver and lungs – after two surgeries and radiation. Fortunately, a new checkpoint inhibitor had just received FDA approval. Janet's doctor immediately prescribed it, and only 15 months later Janet was in remission.

goal of an 80 percent screening rate by 2018. Reuland also was awarded a UCRF grant to begin studies to increase screening in North Carolina Indian populations.

Risk of death for adults with blood cancer higher in three NC regions

The risk of death from the most common form of blood cancer in adults across North Carolina was significantly higher in three regions of the state, UNC researchers have found. They published their study findings in the journal Cancer.

While U.S. survival rates for AML generally have improved, incidence of this disease has been on the rise. Researchers have seen survival differences by race and insurance type, and the UNC researchers wanted to investigate whether survival could also vary based on where North Carolina patients were living when they were diagnosed diagnosis.

The study reported that adults treated with chemotherapy for acute myeloid leukemia (AML) from 2003 to 2009 had a statistically significant higher risk of death if they lived in a five-county region of northeastern North Carolina from Wilson to Roanoke Rapids, in a 23-county region of eastern North Carolina including Greenville, and a nine-county region around Wake County.

To study death rates from the cancer across North Carolina, researchers – led by **William A. Wood, MD**, a UNC Lineberger member and associate professor in the Division of Hematology and Oncology – analyzed data for 900 adults diagnosed with AML between 2003 and 2009. They used the Integrated Cancer Information and Surveillance System (ICISS), a powerful, data-rich research tool that gives researchers an unprecedented view of the cost and quality of cancer care and provides a pathway to improve cancer outcomes for patients. UCRF funds were used to build the database, which contains details on all North Carolina's cancer cases and links to health claims data for 5.5 million insured people – covering about 85 percent of North Carolina's cancer patient population. No similar integrated population-based cancer informatics system exists in the United States.

Wood and his colleagues determined that a region around Greensboro had the lowest risk of death for AML patients who received chemotherapy treatment in a hospital. Compared to the Greensboro region, they found the risk of death was four times higher in an area of northeastern North Carolina that included Roanoke Rapids, Rocky Mount and Wilson – the highest in the state. The risk was more than two times greater in the eastern region of the state around Greenville, and nearly twice as high in the region around Wake County.

But it is unclear why the disparities continued even after researchers controlled for regional factors like poverty or education. They believe other factors could be involved, such as the providers' experience with treating rare or complex diseases or how supportive care is delivered.

NORTH CAROLINA CENTRAL UNIVERSITY
FOUNDED 1910

UNC LINEBERGER, NC CENTRAL RESEARCH PARTNERSHIPS EARN $11 MILLION IN GRANTS

This year in a joint effort, N.C. Central University was awarded more than $6 million and UNC Lineberger more than $5 million to support an ongoing partnership between the two institutions to understand and address disparities in cancer incidence and death for African-Americans in North Carolina.

The five-year grants from the National Cancer Institute are the latest in a series of awards supporting a 14-year partnership between the two institutions. The funds will support molecular-and population-based cancer research and the research education of junior faculty and students.

The grants awarded this year will support three research projects and two pilot studies conducted by NCCU faculty in collaboration with UNC Lineberger members. The funding also supports undergraduate cancer research through the PARTNERS Program, a two-year research training and education program that provides NCCU students with research training in cancer biology and public health at both NCCU and UNC.

Studies find disparities in breast cancer risk, treatment, survivorship

Several separate UNC studies have found disparities in the risk, treatment and survivorship among breast cancer patients in North Carolina. Researchers are using population-based and claims data to pinpoint these trends in an effort to better understand why such differences exist, and how to overcome them to improve outcomes for all cancer patients.

One study, published in the Journal of Clinical Oncology, considered differences in therapy for a specific type of cancer called HER-2 positive, which be treated with trastuzumab (Herceptin), a proven yet expensive targeted drug that has dramatically improved survival rates. The study revealed low rates of use of this drug among women aged 66 and older with early-stage breast cancer of this type, and even lower rates for older black women.

Lisa Carey, MD

Researchers found that black women were 25 percent less likely to receive the drug within one year of diagnosis than whites, even after accounting for other factors that could influence access to the treatment such as poverty and the presence of other health conditions. Overall, they found that about half of women in the study did not receive any trastuzumab at all. Breaking their findings down further by race, the researchers found that 50 percent of white women and 40 percent of black women received some trastuzumab therapy.

"Fifty percent of white women and 60 percent of black women didn't get a drug that improves survival by nearly 40 percent. If confirmed, these are terrible numbers," said study co-author **Lisa Carey, MD,** a UNC Lineberger member, the physician-in-chief of the N.C. Cancer Hospital and the Richardson and Marilyn Jacobs Preyer Distinguished Professor in Breast Cancer Research at the UNC School of Medicine. "There was underutilization broadly of what is very effective therapy – we must find out why."

In a different study, researchers report in the Journal of Clinical Oncology that black women with advanced breast cancer were half as likely to receive supportive care medications, like antidepressants and sleep aids, than white patients. They also were less likely to enroll in hospice care, and more likely to get intensive treatment at the end of their lives.

DESIMONE RECEIVES NATIONAL MEDAL OF TECHNOLOGY AND INNOVATION

UNC Lineberger member **Joseph DeSimone, PhD**, the Chancellor's Eminent Professor of Chemistry and the William R. Kenan Jr. Distinguished Professor at NC State, received the National Medal of Technology and Innovation – the nation's highest honor for achievement and leadership in advancing the field of technology.

The honor was created by statute in 1980 and is administered for the White House by the U.S. Department of Commerce's Patent and Trademark Office. The award recognizes those who have made lasting contributions to America's competitiveness and quality of life and helped strengthen the nation's technological workforce. A distinguished independent committee representing the private and public sectors submits recommendations to the President, who awarded the Medal to DeSimone in a White House ceremony.

SHAWN HINGTGEN FACULTY SPOTLIGHT

UNC Lineberger member **Shawn Hingtgen, PhD**, assistant professor in the UNC Eshelman School of Pharmacy, has seen the benefits of many uses of the UCRF. Resources from the Fund helped recruit him to UNC from Harvard in 2010. Two years later, he won the UCRF Innovation Award to further his work in advancing effective treatments for glioblastoma, or brain cancer.

The survival rate beyond two years for a patient with a glioblastoma is 30 percent because it is so difficult to treat. Even if a surgeon removes most of the tumor, it is nearly impossible to get the invasive, cancerous tendrils that spread deeper into the brain, and inevitably the remnants grow back. Most patients die within a year and a half of their diagnosis.

This year, in a first for medical science, Hingtgen and his colleagues successfully turned skin cells into cancer-hunting neural stem cells that destroy brain tumors – a discovery that could offer a new and more effective treatment for the disease.

In their work, Hingtgen and his colleagues reprogram skin cells known as fibroblasts – which produce collagen and connective tissue – to become induced neural stem cells. Working with mice, Hingtgen's team showed that these neural stem cells have an innate ability to move throughout the brain and home in on and kill any remaining cancer cells. The researchers also demonstrated that these stem cells could be engineered to produce a tumor-killing protein, adding another blow to the cancer. Depending on the type of tumor, Hingtgen's team increased survival time of the mice 160 to 220 percent.

Hingtgen's groundbreaking research, published in the journal Neuro-Oncology, was informed by a related study he recently led, which found that removing a glioblastoma tumor from the brain causes any cancer left behind to grow 75 percent faster than the original tumor. The work gives researchers more insight into the effects of surgery on the brain and tumor, potentially leading to new therapeutic targets that will tailor postoperative treatment. His work engineering human skin cells into neural stem cells was just published in Nature Communications. This is an additional step towards application in human trials.

"A glioblastoma is fundamentally a different disease before and after surgery," he said. "The process of removing the tumor speeds up the cancer such that we have to rethink of how to treat the disease differently after the surgery."

The findings build on previous research that identified disparities in the use of palliative care, which focuses on relieving disease symptoms and treatment side effects, and hospice care. In the new study, researchers wanted to know if patients were more likely to receive palliative or hospice care at the end of life if they received supportive care early in their treatment.

They analyzed Medicare data to check for use of pain medications, antidepressants and other supportive care medications, for 883 women with stage IV breast cancer who died between 2007 and 2012 in the 90 days after diagnosis. While there were no disparities in use of opioids to reduce pain, black women were half as likely as white women to receive medications to relieve anxiety, depression and insomnia.

Another study, published this year in the journal Breast Cancer Research and Treatment, took a closer look at quality of life differences for cancer survivors, finding differences in how black and white women functioned and felt physically and spiritually during their cancer treatment and two years after diagnosis. Researchers used surveys to gauge the physical, functional, emotional and spiritual health-related quality of life of more than 2,100 women, ages 20 to 74 years.

White women reported higher physical and functional health-related quality of life scores during treatment, compared to black women. But the gap in physical quality of life scores narrowed two years after diagnosis, and in both physical and functional measures after researchers adjusted the data to account for socioeconomic differences. Yet black women had higher spiritual quality of life scores five months and two years after diagnosis than white women, and after adjusting for socioeconomic factors.

The analysis is part of the Carolina Breast Cancer Study, the largest population-based study of breast cancer ever in North Carolina and one of the largest in the world. Launched in 1993 and including participants from 44 of North Carolina's 100 counties, the CBCS is now in its third phase, which is funded by the University Cancer Research Fund.

UNC research leader earns $5.45M grant to study patient-reported outcomes

Ethan Basch, MD, MSc, associate professor of medicine and public health, has received a five-year, $5.45 million grant to support research into clinical benefits of having people with cancer self-report their symptoms while undergoing treatment.

The director of UNC Lineberger's Cancer Outcomes Research Program, Basch is a national leader in the study of patient-reported outcomes and technologies to measure the impact of interventions on patients' experiences. He will conduct the research in conjunction with the Alliance for Clinical Trials in Oncology Foundation.

Ethan Basch, MD, MSc

Nausea and other side effects that patients experience in cancer clinical trials are typically reported by doctors, not directly by patients. Prior research has shown that doctors under-report these symptoms, and a Basch has been a pioneer in establishing self-reporting measures that empower patients to report their own symptoms during cancer drug development.

The grant, from the Patient-Centered Outcomes Research Institute, will support Basch's national trial to investigate whether integrating patient-reported symptoms into care management can improve the patient's quality of care and quality of life as well as measure the impact of patient self-reporting on the healthcare delivery system.

Clinical excellence and opportunity

Cancer research is a continually changing field, and new opportunities for strategically important research regularly develop outside the three Tier 1 Research Priorities. Another important function of the Opportunity Fund is to support competitive and innovative pilot projects, and invest in cutting-edge technology and shared research resources.

Our outstanding faculty – who are the top experts in their fields and are on the cutting edge of new discoveries – are critical to our efforts to fight cancer, and the Opportunity Fund has successfully helped UNC recruit and retain researchers to build capacity in key areas of study. Since the UCRF was established, it has been used to help UNC recruit 171 and retain 39 outstanding experts in their fields.

FACULTY RECRUITMENT

CRITICAL INFRASTRUCTURE

Christopher Dittus DO, MPH
Assistant Professor
UNC School of Medicine
Division of Hematology/Oncology

Michael S. Lee, MD
Assistant Professor
UNC School of Medicine
Gastrointestinal Oncology

Kandace McGuire, MD
Associate Professor
UNC School of Medicine
Department of Surgery

Marco Patti, MD, FACS
Surgical Co-Director, Center for Esophageal Diseases and Swallowing
Professor
UNC School of Medicine
Department of Surgery

Brandi Reeves, MD
Assistant Professor
UNC School of Medicine
Division of Hematology/Oncology

Marcie Riches, MD, MS
Medical Director, Bone Marrow Transplant Clinic
Director of Clinical Research and Data Quality, Bone Marrow Transplant
Associate Professor
UNC School of Medicine
Division of Hematology/Oncology

Michelle Roughton, MD
Program Director
Director of Microsurgery
Division of Plastic and Reconstructive Surgery
Assistant Professor
UNC School of Medicine

Sara Wobker, MD, MPH
Assistant Professor
UNC School of Medicine
Department of Pathology and Laboratory Medicine

DEVELOPING NEW TREAMENTS

Robert McGinty, MD, PhD
Associate Director, Structural Biology, Center for Integrative Chemical Biology and Drug Discovery
Associate Professor
UNC Eshelman School of Pharmacy
Affiliate faculty
UNC School of Medicine
Department of Biochemistry and Biophysics

Kenneth Pearce, Jr, PhD
Director, Lead Discovery and Characterization
Center for Integrative Chemical Biology and Drug Discovery
Research Professor
UNC Eshelman School of Pharmacy

Tim Willson, PhD
Chief Scientist, SGC Center for Chemical Biology
Professor
UNC Eshelman School of Pharmacy

CANCER GENETICS

Jill Dowen, PhD
Assistant Professor of Biochemistry & Biophysics
Joint Appointment in Biology
Member, Integrative Program for
Biological & Genome Sciences

Katherine Hoadley, PhD
Assistant Professor
UNC School of Medicine
Department of Genetics

Benjamin Vincent, MD
Assistant Professor
UNC School of Medicine
Division of Hematology/Oncology
Bioinformatics, Computational Genomics,
Computational Systems Biology

OPPORTUNITY

Pengda Liu, PhD
Assistant Professor
UNC School of Medicine
Department of Biochemistry and Biophysics

Helen Lazear, PhD
Assistant Professor
UNC School of Medicine
Department of Microbiology & Immunology

OPTIMIZING NC OUTCOMES

Leah Frerichs, PhD
Assistant Professor in the Department of Health Policy
and Management
Center for Health Equity Research
UNC Gillings School of Global Public Health

Jennifer Lafata, PhD
Associate Director, UNC Institute for Healthcare Quality
Improvement
Co-leader, UNC Health Care System's Cancer Care
Quality Initiative
Professor
UNC Eshelman School of Pharmacy
Division of Pharmaceutical Outcomes and Policy

Keely Muscatell, PhD
Assistant Professor
UNC School of Medicine
Department of Psychology and Neuroscience

FACULTY RETENTION

CRITICAL RESEARCH

Nancy Thomas, MD, PhD
Irene and Robert Alan Briggaman Distinguished
Professor
UNC School of Medicine
Department of Dermatology

CANCER GENETICS

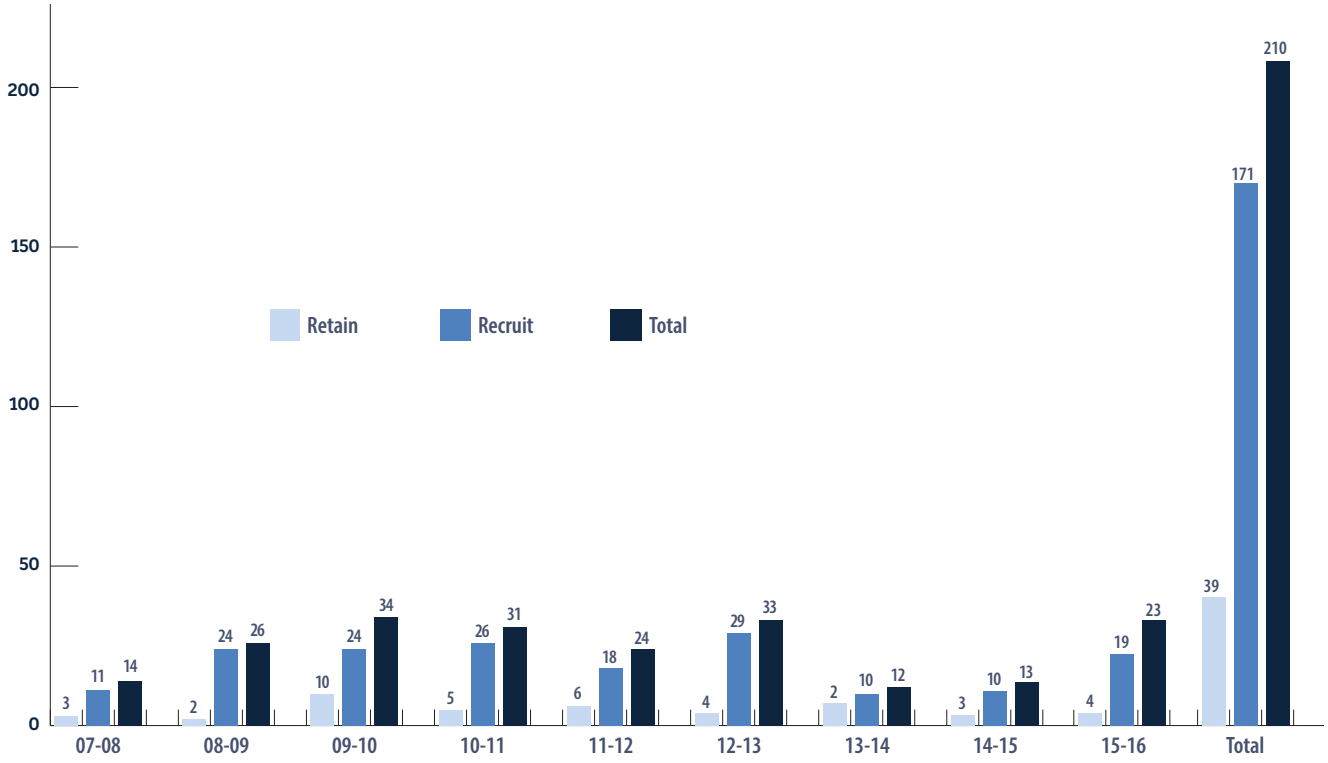
Joel Parker, PhD
Assistant Professor
UNC School of Medicine
Department of Genetics

OPTMIZING NC OUTCOMES

Dan Reuland, MD, MPH
Associate Professor
UNC School of Medicine
Division of General Internal Medicine and Clinical
Epidemiology

Stephanie Wheeler, PhD
Associate Professor Health Policy and Management
UNC Gillings School of Global Public Health

Recruitment and Retention by Year



Patient navigators make sure people don't face cancer alone

UNC Lineberger supported and participated in this summer's annual conference of the North Carolina Oncology Navigator Association (NCONA), which brought together more than 150 nurses, patient navigators and community health workers from North Carolina, South Carolina and Virginia.

Jean Sellers, RN, MSN

"There is a tremendous benefit when we provide patient navigators the opportunity to learn about their role in the evolving world of cancer care and how to support patients, both inside health care systems and out in the community," said **Jean Sellers, RN, MSN**, NCONA president and clinical administrative director of the UNC Cancer Network. "Today's healthcare system is growing increasingly complex, and patient navigators are critical to helping ensure patients receive high quality, coordinated care in a timely manner."

UCRF resources have helped UNC become a state and national leader in patient navigation for cancer, funding navigator education programs and supporting more than 100 volunteer navigators who work with oncology nurses to help patients all across the state. The UNC Cancer Network's unique navigation model has been rated one of three best practices in the country by the Oncology Advisory Board.

The conference focused on bridging all types of health systems and communities and featured a series of talks, including one on how patient navigation can promote colorectal cancer screening and smoking cessation. There was also a panel discussion about how to integrate community health workers into health care teams. Conference

attendees were invited to participate in a study led by UNC Lineberger member **Stephanie Wheeler, PhD**, that addresses the financial difficulty that some cancer patients experience.

UCRF telehealth services include scalp melanoma webinar to educate NC hairstylists

More than 150 hair care professionals and health care providers from across North Carolina came together virtually in May for a webinar on scalp melanoma. The webinar – led by UNC Lineberger melanoma program co-directors **David Ollila, MD**, and N**ancy Thomas, MD, PhD**, and hairstylist Andrea Saccone Snyder of Flow Beauty Project in Chapel Hill – explained why hairstylists play a vital role in the early detection of scalp melanoma.


David Ollila, MD

Snyder instructed stylists on the proper technique for using a blow dryer while visually inspecting the scalp to detect skin abnormalities. Thomas showed hairstylists what to look for by providing visual slides of various moles, comparing and contrasting the difference between the different types of skin cancer and melanoma. Ollila discussed the importance of early detection and why checking your scalp is so important. All presenters encouraged immediate follow up with a health care provider if hairstylists see a changing or suspicious lesion.

"We believe that having an educational program that targets hair care professionals has the potential to increase the early detection of skin cancer on areas that are difficult to check, such as the scalp and neck. Lives can be saved when melanoma is caught early," said Ollila.

The webinar is one example of how UCRF resources have significantly improved UNC's ability to connect with oncologists and cancer patients across North Carolina. Using the infrastructure supported by UCRF funds, UNC faculty regularly hold virtual "tumor boards" – in-depth review of a particular patient's case with a team of doctors – with doctors in hospitals across the state, and do consultations in specialties that are lacking in rural communities.


Nancy Thomas, MD, PhD

Through the telehealth network, UNC connects with health care providers in real time to discuss best practices for patient care and cutting-edge research, and holds community education events to raise patient awareness of issues related to cancer. This year, UNC hosted more than 30 sessions with more than 1,728 viewings of these broadcast events, recording each lecture and making it available online. Each lecture on average reaches more than 120 medical professionals – nurses, doctors, physician assistants, nurse practitioners, pharmacists, social workers, nutritionists and clinic managers in over 40 oncology practices across North Carolina.

New screening technique expedites identification of potential cancer treatments

UNC researchers discovered and applied a new screening technique capable of quickly testing thousands of potential drug compounds to determine which might be most effective in fighting a cancer common in teens and young adults.

In a first-of-its-kind preclinical study funded in part by the UCRF, researchers used this new screening technique to identify a group of drug compounds that were active in their cell model of Ewing sarcoma, a bone and soft tissue cancer that's most common in teens and young adults. Most Ewing sarcoma patients have a DNA

mutation that creates a new gene called EWSR1-FLI1, which in turn creates a protein that travels to unexpected spots along the genome and causes DNA to unwind abnormally.

Ian J. Davis, MD, PhD

Researchers created a lab test reflecting the unique signature of DNA packaging in Ewing sarcoma in order to examine sections of chromatin that are unwound in the cancer cells, but not in normal cells. Then, they tested hundreds of small-molecule compounds from a specialized library at UNC to see if they could reverse the abnormal DNA unwinding and restore normal chromatin structure in their cell model.

Through the screening technique, they found that a class of compounds called histone deactylase inhibitors, as well as other novel molecules, that were effective. The researchers believe they've shown proof of concept of a drug screening strategy that could be applied for an array of cancers. They published their findings in the journal Proceedings of the National Academy of Sciences

Ian J. Davis, MD, PhD, G. Denman Hammond Associate Professor in Childhood Cancer and associate professor in the UNC School of Medicine Departments of Pediatrics and Genetics, co-authored the study with **Stephen Frye PhD**, Professor and Director of the Center for Integrative Chemical Biology and Drug Discovery at UNC-Chapel Hill, who was recruited to UNC thanks in part to UCRF resources.

"We wanted to know if you can develop a screen that uses changes in chromatin as a way of identifying small molecule drugs for cancer. The answer is yes, you can," Davis said. "If we can get this to work in one disease that has a very distinct profile for how DNA is packaged, maybe we can get it to work to identify potential drugs in other cancers."

Sequencing RNA in tumors could help improve cancer care

After earlier findings that DNA sequencing of a patient's tumor could improve care by matching the mutations and genetic abnormalities with targeted treatments, UNC researchers now believe that RNA sequencing can further improve patient care.

Neil Hayes, MD, MPH

In an ongoing UNC study, researchers selected a subset of 300 patients for RNA sequencing from a group of 2,200 patients who had consented as part of a clinical trial for sequencing. In the preliminary study findings, researchers reported at the 2016 American Association for Cancer Research Annual Meeting that they identified changes in RNA based on DNA mutations, and that the additional information could be potentially helpful for better management of cancer patients.

"With next-generation sequencing and some other advances, we now have the ability to sequence RNA, which has some advantages over DNA sequencing," said **Neil Hayes, MD, MPH**, a UNC Lineberger member and an associate professor in the UNC School of Medicine Division of Hematology/Oncology. "Many of these are technical advances, but there is also a clinical benefit in that we can better characterize many of the mutations found in cancer, especially some of the difficult-to-detect changes in the structure of DNA."

Hayes said RNA also could be used to generate gene signatures while they are detecting mutations, providing additional information that could have "broad potential use" for many cancer patients.

Critical Infrastructure Fund

Geriatric breast cancer clinical trials seek to help older patients

The incidence of cancer rises after the age of 65 and with increased U.S. lifespans, the incidence of cancer in the elderly is becoming a much more significant issue. Cancer treatment in the older population is complicated by factors related to other diseases and conditions they may have, other medicines they take, and psychosocial issues related to aging.

To address these challenges, UNC used UCRF funds to recruit **Hy Muss, MD**, a nationally known leader in breast cancer research and geriatric oncology, in 2009 to establish a multidisciplinary program at UNC specializing in cancer among the aging.

Hy Muss, MD

The mission of UNC Lineberger's Geriatric Oncology Program is to educate medical professionals on issues concerning older patients with cancer, to optimize treatment of older cancer patients, and to conduct research focusing on improving cancer outcomes. Older patients can be seen by both an expert in their type of cancer as well as a geriatric oncologist to maximize the quality of care for each individual.

On the research side, since the Geriatric Oncology Program's inception, more than 2,000 patients have participated in Lineberger-UNC geriatric oncology research studies. There are 8 open studies now and 20 studies have been completed.

Muss' major research interest is in cancer in older patients with a focus on the treatment of breast cancer in older women. Muss is leading several ongoing clinical trials that study whether and how exercise during treatment may benefit breast cancer patients. These studies have resulted in additional funding from the Kay Yow Foundation. He is also collaborating with UNC Lineberger Director **Norman Sharpless, MD**, on a biomarker of health and aging that could help predict which older patients will do well with appropriate therapies, and for which patients those treatments may do more harm than good. And with UCRF support, he is developing one of the nation's largest databases of elderly cancer patients – with more than 1,500 enrolled so far – to monitor their treatment, outcomes, and quality of life to help inform senior cancer care in the future.

Continuing education helps medical professionals stay at the forefront of their fields

Part of UNC's function as a teaching hospital is to provide continuing education to health care providers across the state. A continuing medical education (CME) credit is a continuing education credit owned by the American Medical Association. Physicians earn CME credit by attending events sponsored by an accredited provider and use the credit toward re-licensure, re-certification, and renewal of hospital privileges.

The UNC Cancer Network is a robust source of continuing education for oncology professionals as it is convenient for practitioners and up to the moment in terms of content. The network is responsible for about 15 percent of all CME credit awarded by the School of Medicine.

The program's bi-monthly continuing education series reaches physicians, nurses and allied health professionals across North Carolina through live, interactive medical and nursing lectures delivered by UNC faculty. This lecture series allows practitioners to access timely, evidence-based oncology therapeutic updates from the convenience of their own practice – and earn continuing education credits. Medical professionals earned 980 CME credit hours this year for lecture participation via the telehealth infrastructure.

UNC's tumor boards are another important source for continuing education. This year, tumor boards provided more than 2,500 credit hours in the following specialty areas:

Breast	839
Gastro-Intestinal	618
Head and Neck	296
Melanoma	135
Hematology-Oncology (Parker)	256
Pediatrics	414
Total	**2,558**

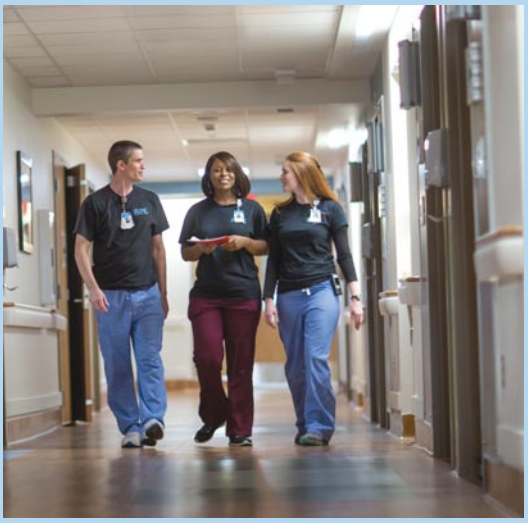
Uro-oncology sees growth, collaboration at UNC

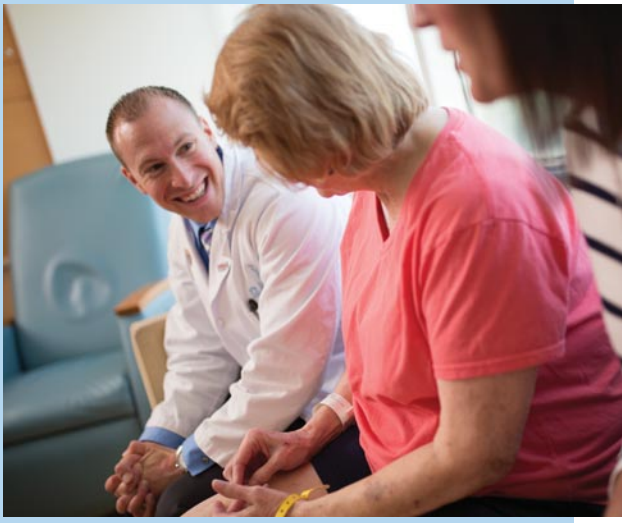
Urologic cancers – kidney, bladder, testicular and prostate – are relatively common, but UNC is taking a unique approach in research and patient care for these diseases.

Focusing on collaboration and partnership, UNC Lineberger's Urologic Oncology Program is a multidisciplinary team of recognized experts in urologic cancer care. The group includes urologists, medical oncologists, radiation oncologists, radiologists and pathologists with specific expertise in the management of genitourinary cancers.

Through the UNC Urologic Oncology Multidisciplinary Clinic, patients have the unique opportunity to be seen by multiple providers during a single visit. This is followed by a Patient Treatment Planning Conference where the team reviews all new patient visits to create a consensus recommendation on the diagnosis and treatment plan. Specialists from surgery, medicine, radiation therapy, radiology, pathology, and nursing form a dedicated patient care team and deliver individualized care in a coordinated manner.

The number of patients coming to UNC for care of these diseases continues to grow. UNC is a high-volume regional and national referral center for patients with all types of genitourinary cancers. The Urologic Oncology surgical service is clinically busy, with an average of over 80 cancer cases per month (about 75 percent of these involve robotic and minimally invasive techniques). In addition to surgical and chemotherapy treatments, UNC continually works to improve care through cancer genetics-based approaches to treatment, the introduction of novel therapies and innovative clinical trials.





BUDGET AND EXPENDITURES

UNIVERSITY CANCER RESEARCH FUND

2016 LEGISLATIVE REPORT

UNC LINEBERGER

BUDGET AND EXPENDITURES

The UCRF was initially funded by three sources of support: tobacco settlement funds, taxes on other (non-cigarette) tobacco products (OTP) such as snuff, and state appropriations. In the 2013-2014 budget, the General Assembly consolidated all tobacco settlement funds into the State's General Fund. That consolidation eliminated tobacco settlement funds as a source of UCRF support, which resulted in a roughly 16 percent reduction in UCRF revenues. The OTP tax proceeds, the amount of which varies by year based on product sales, and the $16 million state appropriation have remained intact as UCRF revenue sources.

The charts below reflect anticipated and actual revenue for this year, and the fund balance after considering carryover and expenditures.

Anticipated and Actual Revenue

FY 15-16 Anticipated and Actual Fund Revenue	Amount*
Anticipated	
State Appropriation	$16,020,000
Projected OTP Tax Receipts	$28,605,000
Total	$44,625,000
Actual	
State Appropriation	$16,020,000
Tobacco Settlement Fund Transfer	--
Actual OTP Tax Receipts	$28,695,258
Total	$44,715,258
Balance	$90,258

Fund Balance

FY 15-16 Budget and Expenditures	Amount*
Anticipated Budget	
Revenue	$44,625,000
Carryover from FY15	$(216,390)
Carryover from unrealized FY15 OTP tax receipts	--
Total	$44,408,610
Actual Budget	
Revenue	$44,715,258
Carryover from FY15	$(216,390)
Carryover from unrealized FY15 OTP tax	--
Total	$44,498,868
Expenditures	$44,724,056
Balance	$(225,188)

* Rounded to the nearest dollar

Restrictions on the Use of UCRF Monies

G.S. 116 29.1 established the Fund as a special revenue fund in the Office of the President of the University of North Carolina. The law also created the Cancer Research Fund Committee to provide accountability, and explicitly stated that allocations from the fund "shall be made in the discretion of the Cancer Research Fund Committee and shall be used only for the purpose of cancer research under UNC Hospitals, the Lineberger Comprehensive Cancer Center, or both."

As the Cancer Research Fund Committee, led by its Chairman, then-UNC President Erskine Bowles, developed the UCRF Strategic Plan in 2009, each potential use of UCRF resources was evaluated according to the following questions:

- Will it address North Carolina's needs in terms of the goal of reducing the cancer burden in the state?
- Can we be world class at it? (Does it build on existing strengths, and is there an opportunity to lead?)
- Is there a strong economic model/justification for UCRF investment?

Based on these questions, the Committee developed a clear set of rules to guide how UCRF funds would be best spent. The Committee determined that UCRF funds should focus major resources on a limited set of opportunities to have the greatest impact; fund initiatives where UNC has the opportunity to establish a leadership position; be self-sustaining and provide leverage for additional extramural funding; build fundamental cancer-related research capabilities that benefit UNC research programs; and enhance North Carolina's economy by creating jobs, intellectual property, and startup companies.

To maximize the effectiveness of the state's investment and to ensure wise and responsible use of the funding, the Strategic Plan imposed additional restrictions on the use of these funds, instructing that UCRF funds should not:

- Invest broadly in an effort to make incremental improvements everywhere;
- Provide funding that would limit future flexibility;
- Undermine faculty innovation and competitiveness by eliminating the need for extramural grant funding;
- Substitute for existing university or health system funding or new philanthropy;
- Make expenditures based upon institutional or other needs outside cancer research; or
- Negatively impact other research on campus, for example by appropriating shared research infrastructure or resources.

Expenditures of State Funds related to UCRF

Table below provides an accounting of expenditures of state funding related to the UCRF. Further details regarding these expenditures are included as appendices to this report.

More than half the funding from UCRF has been used to recruit world-class researchers to North Carolina. Only one percent of the total UCRF budget is used for ongoing administrative expenses.

Categories	YTD Actual
Strategic Plan Categories	
Tier 1: Research Priorities	
Understanding Genetics	6,331,353
Developing Novel Therapies	8,590,494
Optimizing Outcomes	6,450,527
Tier 2: Opportunity Fund	9,435,917
Tier 3: Critical Infrastructure	
Clinical Excellence – Research & Outreach	6,400,247
Research & Tech Development and Training	7,515,519
Total	**44,724,056**

Conclusion

We are sincerely grateful for the General Assembly's ongoing support of the University Cancer Research Fund, a vital tool in our ongoing efforts to defeat our state's deadliest disease. With oversight from the Cancer Research Fund Committee, we continue to invest these funds responsibly, strategically and effectively.

The University Cancer Research Fund powers innovative research that will enhance the prevention, diagnosis and treatment of cancer and improve outcomes for patients. It has enabled us to form important partnerships and share research resources with other universities, the private sector, and with communities all across our state. The UCRF leverages remarkable amounts of external funding, and has sparked jobs and commercialization opportunities for North Carolina. Its total economic impact demonstrates a 9-to-1 return on investment.

The economic effects of the University Cancer Research Fund have been – and will continue to be – significant for North Carolina, and our progress in cancer care and research will have a lasting impact both in and beyond our state.

APPENDIX

UNIVERSITY CANCER RESEARCH FUND
2016 LEGISLATIVE REPORT

UNC LINEBERGER

APPENDIX

ESTABLISHING LEGISLATION

UNC
LINEBERGER

ESTABLISHING LEGISLATION

§ 116-29.1. University Cancer Research Fund (as modified by SL 2013-360)

a. **Fund.** – The University Cancer Research Fund is established as a special revenue fund in the Office of the President of The University of North Carolina. Allocations from the fund shall be made in the discretion of the Cancer Research Fund Committee and shall be used only for the purpose of cancer research under UNC Hospitals, the Lineberger Comprehensive Cancer Center, or both.

b. Effective July 1 of each calendar year, the funds remitted to the University Cancer Research Fund by the Secretary of Revenue from the tax on tobacco products other than cigarettes pursuant to G.S. 105-113.40A is appropriated for this purpose are appropriated for this purpose.

c. **Cancer Research Fund Committee.** – The Cancer Research Fund Committee shall consist of five ex officio members and two appointed members. The five ex officio members shall consist of the following: (i) one member shall be the Chancellor of the University of North Carolina at Chapel Hill, (ii) one member shall be the Director of the Lineberger Comprehensive Cancer Center, (iii) one member shall be the Dean of the School of Medicine at The University of North Carolina, (iv) one member shall be the Dean of the School of Pharmacy at The University of North Carolina, and (v) one member shall be the Dean of the School of Public Health at The University of North Carolina. The remaining two members shall be appointed by a majority vote of the standing members of the Committee and shall be selected from persons holding a leadership position in a nationally prominent cancer program. If any of the specified positions cease to exist, then the successor position shall be deemed to be substituted in the place of the former one, and the person holding the successor position shall become an ex officio member of the Committee.

d. **Chair.** – The chair shall be the Chancellor of the University of North Carolina at Chapel Hill.

e. **Quorum.** – A majority of the members shall constitute a quorum for the transaction of business.

f. **Meetings.** – The Committee shall meet at least once in each quarter and may hold special meetings at any time and place at the call of the chair or upon the written request of at least a majority of its members. (2007-323, s. 6.23(b); 2009-451, s. 27A.5(e); 2010-31, s. 9.12.)

g. **Report.** – By November 1 of each year, the Cancer Research Fund Committee shall provide to the Joint Legislative Education Oversight Committee and to the Office of State Budget and Management an annual financial report which shall include the following components:

   1. Accounting of expenditures of State funds related to strategic initiatives, development of infrastructure, and ongoing administrative functions.
   2. Accounting of expenditures of extramural funds related to strategic initiatives, development of infrastructure, and ongoing administrative functions.
   3. Measures of impact to the State's economy in the creation of jobs, intellectual property, and start-up companies.
   4. Other performance measures directly related to the investment of State funds.
   5. Accounting of any fund balances retained by the Fund, along with information about any restrictions on the use of these funds.

APPENDIX

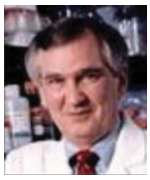
CANCER RESEARCH FUND COMMITTEE

UNC
LINEBERGER

CANCER RESEARCH FUND COMMITTEE

The legislatively established Cancer Research Fund Committee, chaired by Carol Folt, Chancellor of the University of North Carolina at Chapel Hill, oversees the University Cancer Research Fund. The seven-member committee includes five ex-officio members designated by the legislation who elect two at-large members. The at-large members are to be leaders at nationally prominent cancer programs. Currently, the two are Drs. Edward Benz (President and CEO Emeritus, Dana-Farber Cancer Institute) and John Mendelsohn (President Emeritus, the University of Texas M.D. Anderson Cancer Center).

Carol Folt, PhD, Chair
Chancellor
The University of North Carolina at Chapel Hill



Edward J. Benz, MD
President and Chief
Executive Officer, Emeritus
Dana-Farber Cancer Institute

Robert Blouin, PharmD
Dean
Eshelman School of Pharmacy
The University of North Carolina at Chapel Hill

John Mendelsohn, MD
President Emeritus
The University of Texas M. D.
Anderson Cancer Center

Barbara K. Rimer, DrPH
Dean
Gillings School of Global Public Health
The University of North Carolina at Chapel Hill

William L. Roper, MD, MPH
Dean, UNC School of Medicine
Vice Chancellor for Medical Af f airs
CEO, UNC Health Care
The University of North Carolina at Chapel Hill

Norman Sharpless, MD
Director
UNC Lineberger Comprehensive Cancer Center
The University of North Carolina at Chapel Hill

APPENDIX

FY 15-16 EXPENDITURES

UNC
LINEBERGER

UCRF Fiscal Year 2016

Strategy	Sum of Annual Budget	Sum of Year to Date Actual	Sum of Cash Balance
Theme 1: Optimizing NC Cancer Outcomes	$6,200,000	$6,331,353	-$131,353
Theme 2: Understanding Genetics in Cancer- Basic approaches & Clinical Applications	$8,090,000	$8,590,494	-$500,494
Theme 3: Develop New Cancer Treatments	$7,300,000	$6,450,527	$849,473
Tier 2: Opportunity Fund	$9,800,000	$9,435,917	$364,083
Tier 3: Infrastructure- Clinical Excellence and Outreach	$6,300,000	$6,400,247	-$100,247
Infrastructure	$7,025,000	$7,515,519	-$490,519
Grand Total	**$44,715,000**	**$44,724,056**	**-$9,056**

Expenditures for Fiscal Year 2016

Objective	Year To Date Actual	Expense to Expenditure
Faculty Salaries	$12,849,579	28.7%
EPA Student Salaries	$3,366,801	7.5%
Staff Salaries	$6,171,916	13.8%
Other Staff	$529,315	1.2%
Benefits	$5,490,392	12.3%
HCS Contracted Serv	$763,164	1.7%
Faculty/Non Faculty Benefits	$0	0.0%
Phy Benefits	$191,602	0.4%
Other Staff Benefits	$122,996	0.3%
Transit Tax	$68,331	0.2%
Consult/Contracted Services	$91,540	0.2%
Employee Education	$8,599	0.0%
Repairs and Maint	$662,968	1.5%
Other Current Services	$2,961,452	6.6%
Supplies, Other	$4,230,648	9.5%
Travel	$472,064	1.1%
Freight and Exp	$0	0.0%
Maintenance Contracts	$1,334,737	3.0%
Advertising	$12,816	0.0%
Meetings & Amenities	$47,788	0.1%
Transfer Computer Science	$0	0.0%
Printing and Binding	$22,139	0.0%
Communication	$85,980	0.2%
Contracted Serv	$0	0.0%
Computer Services	$193,198	0.4%
Rental/Lease Facilities	$649,919	1.5%
Other Fixed Charges	$0	0.0%
Rental Equipment	$0	0.0%
Equipment	$3,247,821	7.3%
Study Subjects & Exp	$95,859	0.2%
Employee on Loan	$0	0.0%
Insurance	$153	0.0%
Student Support	$969,346	2.2%
Utilities	$82,933	0.2%
Legal Fees	$0	0.0%
HIPAA Deduct	$0	0.0%
Grand Total	**$44,724,056**	**100.0%**

UCRF Funding by Strategy and Expense

Objective	Year to Date Actual
Theme 1: Optimizing NC Cancer Outcomes	
Faculty Salaries	$2,221,085
EPA Student Salaries	$240,850
Staff Salaries	$1,178,429
Other staff	$71,805
Benefits	$993,014
Phy Benefits	$5,287
Other Staff Benefits	$20,011
Transit Tax	$11,117
Consult/Contracted Services	$51,313
Employee Education	$0
Repairs and Maint	$24,855
Other Current Services	$120,764
Supplies, Other	$202,398
Travel	$138,265
Legal Fees	$0
Maintenance Contracts	$106,584
Advertising	$2,420
Meetings & Amenities	$2,374
Printing and Binding	$11,951
Communication	$34,403
Contracted Serv	$0
Computer Services	$144,113
Rental/Lease Facilities	$302,742
Other Fixed Charges	$0
Equipment	$296,217
Insurance	$34
Study Subjects & Exp	$14,200
Student Support	$136,324
Equip Rental	$0
HCS Residents	$800
Theme 1 Total	**$6,331,353**

Objective	Year to Date Actual
Theme 2: Understanding Genetics in Cancer - Basic Approaches & Clinical Applications	
Faculty Salaries	$1,633,094
EPA Student Salaries	$260,443
Staff Salaries	$1,351,261
Other staff	$61,053
Benefits	$867,401
HCS Contracted Serv	$0
Phy Benefits	$12,092
Other Staff Benefits	$17,620
Transit Tax	$9,789
Consult/Contracted Services	$58,168
Employee Education	$421
Repairs and Maint	$7,956
Other Current Services	$1,147,316
Supplies, Other	$1,132,703
Travel	$81,837
Maintenance Contracts	$466,705
Advertising	$0
Meetings & Amenities	$0
Printing and Binding	$2,043
Communication	$9,870
Computer Services	$16,434
Rental/Lease Facilities	$237,362
Other Fixed Charges	$0
Equipment	$1,090,209
Insurance	$0
Study Subjects & Exp	$0
Student Support	$59,748
Utilities	$66,967
Theme 2 Total	**$8,590,494**

Objective	Year to Date Actual
Theme 3: Developing New Cancer Treatments	
Faculty Salaries	$2,420,641
EPA Student Salaries	$506,537
Staff Salaries	$477,821
Other staff	$29,700
Benefits	$838,456
Faculty/Non Faculty Benefits	$0
Phy Benefits	$0
Other Staff Benefits	$19,759
Transit Tax	$10,977
Consult/Contracted Services	$18,178
Employee Education	$160
Repairs and Maint	$10,725
Other Current Services	$533,063
Supplies, Other	$690,575
Travel	$35,921
Maintenance Contracts	$137,323
Advertising	$0
Meetings & Amenities	$0
Transfer Computer Science	$0
Printing and Binding	$168
Communication	$6,364
Computer Services	$4,415
Rental/Lease Facilities	$9,319
Other Fixed Charges	$0
Rental Equipment	$0
Equipment	$654,425
Employee on Loan	$0
Insurance	$0
Student Support	$46,000
Legal Fees	$0
Theme 3 Total	**$6,450,527**

Objective	Year to Date Actual
Tier 2: Opportunity Fund	
Faculty Salaries	$1,317,358
EPA Student Salaries	$1,408,134
Staff Salaries	$501,920
Other staff	$134,554
Benefits	$691,888
Faculty/Non Faculty Benefits	$0
Phy Benefits	$18,702
Other Staff Benefits	$17,926
Transit Tax	$9,959
Consult/Contracted Services	$36,686
Employee Education	$224
Repairs and Maint	$605,627
Other Current Services	$943,863
Supplies, Other	$1,913,896
Travel	$141,336
Maintenance Contracts	$333,262
Advertising	$1,652
Meetings & Amenities	$2,929
Printing and Binding	$6,836
Communication	$18,209
Computer Services	$26,986
Other Fixed Charges	$0
Rental/Lease Facilities	$86,885
Equipment	$975,019
Legal Fees	$0
Insurance	$119
Study Subjects & Exp	$57,533
Student Support	$167,641
Utilities	$15,966
HCS Residents	$809
Tier 2 Total	**$9,435,917**

Objective	Year to Date Actual
Tier 3: Infrastructure - Clinical Excellence and Outreach	
Faculty Salaries	$3,630,228
EPA Student Salaries	$83,856
Staff Salaries	$528,143
Other Staff	$30,054
Benefits	$940,014
HCS Contracted Serv	$594,547
Phy Benefits	$155,175
Other Staff Benefits	$22,883
Transit Tax	$12,713
Consult/Contracted Services	$36,425
Employee Education	$6,294
Repairs and Maint	$539
Other Current Services	$47,678
Supplies, Other	$59,247
Travel	$20,743
Maintenance Contracts	$32,984
Advertising	$0
Meetings & Amenities	$169
Printing and Binding	$476
Communication	$9,826
Contracted Serv	$0
Computer Services	$700
Rental/Lease Facilities	$11,539
Other Fixed Charges	$0
Equipment	$0
Insurance	$0
Study Subjects & Exp	$100
Employee on Loan	$0
Student Support	$8,906
Rental Equipment	$0
HCS Residents	$167,008
Tier 3 Total	**$6,400,247**

Objective	Year to Date Actual
Infrastructure	
Faculty Salaries	$1,627,173
EPA Student Salaries	$866,982
Staff Salaries	$2,134,342
Other Staff	$202,149
Benefits	$1,159,619
HCS Contracted Serv	$0
Faculty/Non Faculty Benefits	$0
Phy Benefits	$346
Other Staff Benefits	$24,799
Transit Tax	$13,777
Consult/Contracted Services	-$109,230
Employee Education	$1,500
Repairs and Maint	$13,265
Other Current Services	$168,767
Supplies, Other	$231,829
Travel	$53,962
Freight and Exp	$0
Maintenance Contracts	$257,880
Advertising	$8,743
Meetings & Amentites	$42,316
Printing and Binding	$665
Communication	$7,308
Contracted Serv	$0
Computer Services	$550
Rental/Lease Facilities	$2,072
Other Fixed Charges	$0
Equipment	$231,951
Insurance	$0
Legal Fees	$0
Study Subjects & Exp	$24,026
Employee on Loan	$0
Student Support	$550,728
Infrastructure Total	**$7,515,519**
Grand Total	**$44,724,056**

APPENDIX

ECONOMIC IMPACT ANALYSIS

UNC LINEBERGER

The Economic Impact of University Cancer Research Fund

Current economic, employment, government revenue, and generated research funds which assist with the recruiting and retaining of local research talent due to the UCRF at University of North Carolina Lineberger Comprehensive Cancer Center


October 2016

Tripp Umbach

Tripp Umbach
2359 Railroad Street
#3701
Pittsburgh, PA 15222

(t) 412.281.2311
(f) 412.281.9143

www.trippumbach.com

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Executive Summary

In 2007, the state leaders of North Carolina developed a fund to invest in cancer research in the state. Cancer is one of the leading causes of death in North Carolina, and the fund was developed to demonstrate a commitment to the health of the state residents. Although cancer mortality rates have been decreasing, incident rates of cancer have been increasing over the past decade.[1] Additionally, lung cancer continues to be the leading cancer causing death in North Carolina.[2]The state is investing in this fund, ensuring that future generations of North Carolinians will develop cancer less often, and live longer and better when they do.

The initial investment in 2007 to the University Cancer Research Fund (UCRF) of $25 million has grown to $44 million for FY 2016. This year alone the FY 2016 $44 million investment produced an economic impact of over $406.7 million. This investment has translated into innovative research to detect, treat, and prevent cancer and has given an opportunity for UNC to become home to one of the nation's leading public comprehensive cancer centers. University of North Carolina Lineberger Comprehensive Cancer Center (UNC LCCC) is one of only 47 NCI-designated comprehensive cancer centers. The center brings together some of the most exceptional physicians and scientists in the country to investigate and improve the prevention, early detection, and treatment of cancer. With research that spans the spectrum from the laboratory to the bedside to the community, the faculty work to understand the causes of cancer at the genetic and environmental levels, to conduct groundbreaking laboratory research, and to translate findings into pioneering and innovative clinical trials. Investment in the UCRF allows the state an even greater ability to continue its tradition of care for all North Carolinians. It is an investment in making the best care in the world available in North Carolina; and it is difficult to think of a better investment than one for the future health of the state.

People and place are the keys to the UCRF's success. UCRF is about investing in people – promising researchers with the best ideas for cancer research and master clinicians who know how to bring those findings to patients and others. UNC Chapel Hill and its UNC Lineberger Comprehensive Cancer Center have a culture of collaboration – both across the University and with partners beyond the University's walls – that is essential to promote discovery and then turn those discoveries into new ways to treat, find, and prevent cancer. Outside of the obvious impacts this National Cancer Institute-designated Comprehensive Cancer Center provides to

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[1] Cancer in North Carolina 2013 Report. North Carolina State Center for Health Statistics.
[2] Cancer Profiles North Carolina October 2015
http://www.schs.state.nc.us/schs/CCR/cp2015/NorthCarolina_CP_2015.pdf

North Carolina, there are additional impacts that the UCRF provides to the state through the dollars that directly and indirectly impact the state economy and job numbers.

The aim of this report is to illustrate in detail the positive economic impact that UCRF dollars have on North Carolina's biomedical sector in 2016; it is important to note that these impacts have been annual since the Fund's inception. Through expanding the state economy, creating jobs, generating tax revenue, encouraging scientific collaboration, and leveraging federal research funds, these dollars have provided a significant benefit to the State of North Carolina.

University Cancer Research Fund

Key Findings

- **Expanding the state's economy.** UCRF generated nearly more than $406.7 million in total economic impact in North Carolina in 2016. This includes direct spending of more than $214.9 million within the state, much of which is a result of the generation of more than $130 million from national grants due to research activities which is just a portion of the $170 million in research funding received in 2016 alone. The ripple effect of in-state spending accounts for nearly $191.8 million additional dollars; representing downstream spending by employees, vendors, and contractors. This is just the impact of the current year (2016). Tripp Umbach estimates that through the commercialization of the discoveries made from this research, the impact by 2026 will be dramatically larger.

- **Creating jobs.** UCRF directly supported employment in 2016 of more than 1,036 jobs in North Carolina and an additional 1,510 jobs through both the indirect and induced impacts of those direct jobs and the spending generated from the UCRF within North Carolina. This means the total impact of this fund is more than 2,546 jobs.

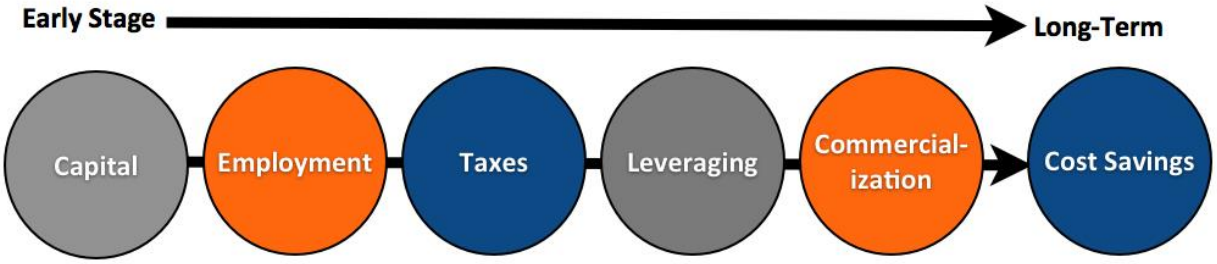
- **Generating tax revenue.** Tripp Umbach estimates that UCRF provided nearly $14.3 million in local and state tax revenue in 2016.

- **Encouraging scientific collaboration and leveraging federal research funds.** These funds have encouraged recipient institutions to collaborate, as well as to apply for and win, highly competitive federal grants. Recipients of these state research funds have leveraged federal research funds which have amounted to more than $130 million in federal research grants, bringing the total to over $170 million in external funding in 2016 alone. This would not have been possible without the UCRF funding, which lead to a North Carolina NCI Comprehensive Cancer Center.

Impacts of UCRF in 2016

Any discussion of the economic impact of these state funds must be predicated on an understanding that research investments, by their nature, have a multitude of impacts on a state's economy, both in the present and in the future. Short-term impacts include capital and non-capital investment and employment growth supported by the funds and new federal medical research funding leveraged by North Carolina's funds that expand the state's economy. Longer term impacts include a strengthened ability to compete nationally for funding and to attract world-class scientists; the economic and employment advances that will be achieved when medical research and innovation are translated into commercial products and services; and healthcare cost-savings to the state as a result of innovation (see Figure 1):

Figure 1: Research Return on Investment Timeline

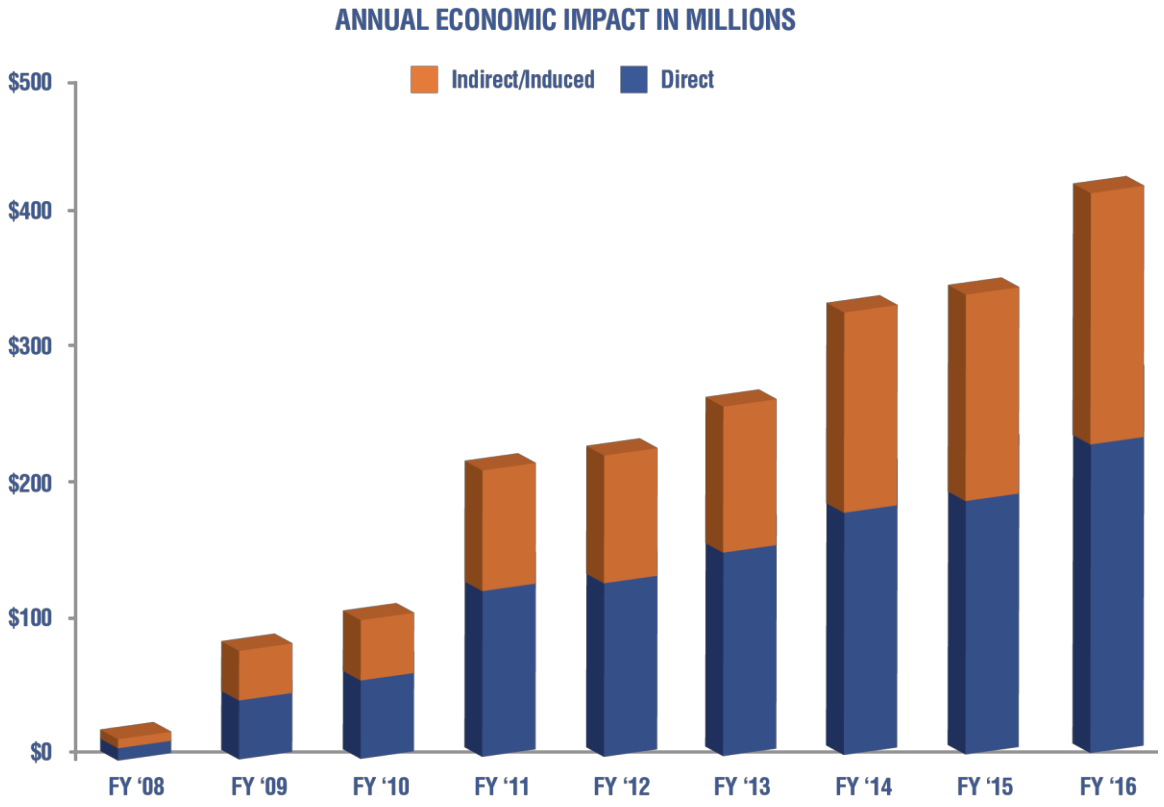


Early Stage Economic Impact of Funding

UCRF dollars invested in research in 2016 have resulted in an expansion of the state's economy by nearly $406.7 million. Tripp Umbach's economic impact analysis indicates that even in the early stage (2007-2011), program investments in capital and human resources have returned greater than three dollars to the state's economy for every one dollar invested. In 2016, this amount has risen to more than nine dollars for every dollar invested. Spending attributable to the fund can be divided into two parts: direct and indirect/ induced impacts.

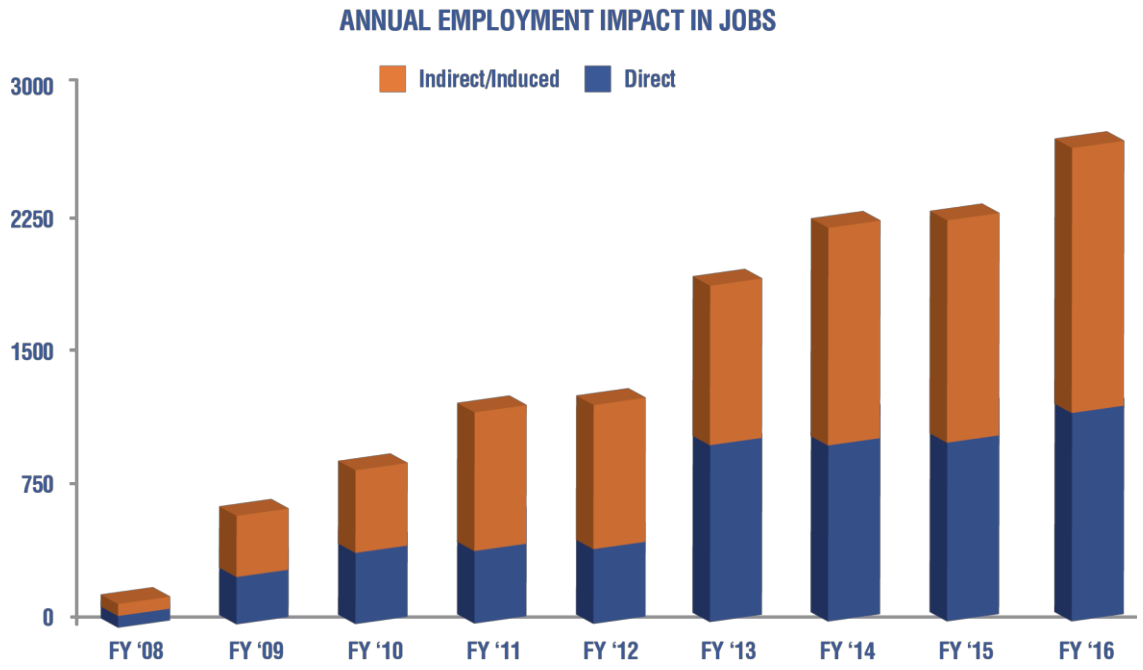
The direct impacts of program funding include institutional expenditures for capital improvements, goods and services, as well as the spending by researchers, research staff, subcontractors, and visitors who come to these institutions for conferences and meetings. The indirect impacts of tobacco funds result from these direct, first-round expenditures, which are received as income by businesses and individuals in the state and re-circulate through the economy in successive rounds of re-spending. The end result is a multiplied economic impact

that is a linear result of the state's investment in research. The impacts over the last decade are outlined below in the chart below.



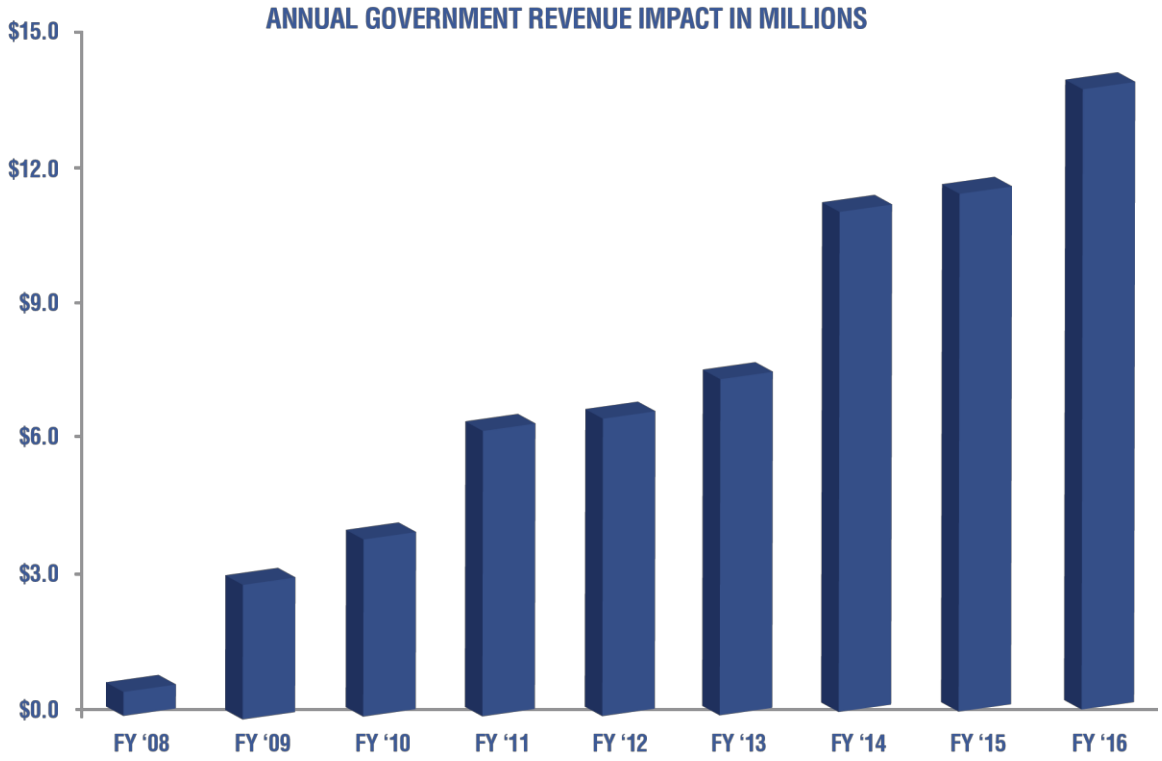
Early Stage Impact of UCRF Dollars on Employment

Tripp Umbach estimates that in 2016, UCRF dollars for healthcare research have created and sustained 2,546 high-paying research-related jobs throughout the state of North Carolina. This includes both the 1,036 high-paying research-related jobs directly attributed to UNC in addition to the 1,510 indirect and induced jobs supported throughout the state of North Carolina. The economic expansion created by the funds allocated to the UCRF have, in turn, brought about demand for additional employment in the state's economy. The employment impact has continued to grow and provide high paying jobs to the state of North Carolina.



Early and Later Stage State Tax Impacts

Tripp Umbach estimates that funds provided in 2016 have resulted in nearly $14.3 million in tax revenues to the state of North Carolina. In-state spending by the recipient organizations and spending in the state by out-of-state parties have a significant impact on state tax revenue. Taxes created as a result of spending in the state's economy, and generation of fresh dollars from outside of the state, are expected to grow as early-stage research is commercialized. The tax impacts have increased over the last decade as well providing a return to the state for the investment. In 2016 alone, the federal tax impact was greater than $31.1 million.



Impacts Associated with Leveraged Federal Medical Research Funds

The North Carolina academic medical industry and growing life sciences industry have been measurably enhanced by these state funds. This federal medical research funding helps fuel clinical enterprises. According to the Association of American Medical Colleges, North Carolina's academic medical industry is among the top 10 nationally in total annual economic impact[3].

[3] In 2012, North Carolina ranked 10th in Academic Medical Impact of AAMC members and COTH hospitals.

These funds from the state's UCRF have encouraged researchers at the recipient organization to collaborate to apply for and win highly competitive federal grants. These funds have enabled recipients of UCRF dollars to leverage federal research funds which have amounted to more than $130 million, bringing the total to over $170 million in external funding in 2016 alone.

Healthcare Cost-Savings

While this study does not include detailed economic impact models that calculate the potential cost-savings attributable to research activities, a growing body of literature provides some potential insights. Breakthrough research by Silverstein et al. (1995) documented $69 billion in annual economic savings resulted from NIH-supported research. The return on investment calculated by Silverstein was $7 in healthcare cost-savings for every dollar invested in NIH-sponsored research[4].

Commercialization

Additional impacts which will be realized due to the UCRF are the levels of commercialization that occur when clusters of research professionals collaborate on a specialty area of research. Tripp Umbach estimates that after ten years of funding and operations, the commercialization of the UCRF will produce discoveries and spinoff businesses which will generate additional economic activity in the State of North Carolina. Looking at projected commercialization impact in 2026, Tripp Umbach estimates this to be between $326.6 million at a conservative level of growth scenario and $719 million using the aggressive level of growth, in additional economic activity within North Carolina. These activities will also create between an additional 2,177 high paying jobs (conservative) and 4,794 jobs (aggressive). These additional economic and employment impacts will translate into additional state and local government revenue of between $11.3 million and $23.4 million.

It is important to note that these commercialization impacts are in addition to the annual operational impacts of the UCRF and that these impacts will continue to grow as the research fund continues to be successful. These are impacts that are realized after years of research once the breakthroughs or discoveries have been made and the discoveries begin to hit the marketplace. Examples of successful spinoff businesses supported by the UNC Lineberger include Meryx, G1 Therapeutics, Genecentric, Epicypher,Epizyme, Liquidia, and many others. Since 2009,

[4] Cost-Savings Resulting from NIH Research Support, NIH Publication No. 93. Silverstein, H.H. Garrison and S.J. Heinig, 1995.

Lineberger startup companies have raised more than $300 million in non-dilutive financing from the NIH, angel investors and venture capitalists.

Tripp Umbach's projections are based on 2016 funding, and the national experience of peer academic medical centers that have implemented similar academic, clinical, research, and economic development plans over the past 20 years. Since 1995, Tripp Umbach has measured the economic impact of every U.S. academic medical center on behalf of the Association of American Medical Colleges (AAMC) and used historical trending data from this experience in making projections.

Appendix A: Definition of Terms

Study Year

Fiscal Year 2016

Total Impact

The total impact of an organization is a compilation of the direct impact, the indirect impact, and the induced impact generated in the economy as a result of the organization.

Direct Impact

Direct impact includes all direct effects the organization has on the regional area due to the organizational operations. These items include direct employees, organizational spending, employee spending, as well as spending by patients and visitors to the organization.

Indirect Impact

The indirect impact includes the impact of local industries buying goods and services from other local industries. The cycle of spending works its way backward through the supply chain until all money leaks from the local economy, either through imports or by payments to value added. The impacts are calculated by applying direct effects to the Type I Multipliers.

Induced Impact

The response by an economy to an initial change (direct effect) that occurs through re-spending of income received by a component of value added. IMPLAN's default multiplier recognizes that labor income (employee compensation and proprietor income components of value added) is not leakage to the regional economy. This money is recirculated through the household spending patterns causing further local economic activity.

Multiplier Effect

The multiplier effect is the additional economic impact created as a result of the organization's direct economic impact. Local companies that provide goods and services to an organization increase their purchasing by creating a multiplier.

Appendix B: Methodology

In order to fully quantify the impact of the funding of UCRF to the operations of UNC Lineberger Comprehensive Cancer Center within the various geographical areas throughout this study, it was necessary for Tripp Umbach to establish a study methodology. It was critically important that the methodology used would deliver a comprehensive, yet conservative, estimate of the operations' impact, based on information compiled using uniform and consistent techniques. In addition, the study team sought to develop a reproducible methodology, ensuring that subsequent studies could build upon the information and knowledge gained through this effort.

Tripp Umbach determined that the use of the IMPLAN Pro economic impact model software was most appropriate for this analysis. The IMPLAN econometric model operates by estimating the direct impact, indirect impacts, and induced impacts of specific economic activity. Direct economic impacts are those attributable to the initial economic activity. For example, an operation with 10 full-time employees creates 10 direct jobs. Indirect economic impacts are those economic activities undertaken by vendors and suppliers within the supply chain of the direct activity because of the initial economic activity. For example, suppliers of goods, materials, and services used in the direct activities produce indirect economic impacts. Induced economic impacts result from the spending of wages paid to employees in local industries involved in direct and indirect activities. Tripp Umbach selected the IMPLAN model due to its frequent use in economic impact, in addition to its development independent of local influences.

Tripp Umbach collected employment information concerning the economic activity of UCRF's funding on operations themselves and followed up in-person to make certain the data was the most current available.

In this report, the impact was measured using IMPLAN datasets. The IMPLAN data files include information for 528 different industries (generally three- or four-digit SIC code breakdown) and 21 different economic variables. IMPLAN sources their employment data from ES202 employment security data supplemented by county business patterns and REIS data. Employment data utilized in the analysis includes full-time and part-time positions.

It should be noted that, at the time of performing the UCRF assessment, the most recent IMPLAN data files for the state of North Carolina were for 2013. While the data is not current, it is unlikely that the fundamental economic structure of North Carolina's economic fabric has changed to an extent that would invalidate the analysis. IMPLAN data and accounts closely follow the

accounting conventions used in the “Input/ Output Study of the U.S. Economy” by the U.S. Bureau of Economic Analysis and the rectangular format recommended by the United Nations.

By deriving the direct and actual employment numbers from IMPLAN for each county, Tripp Umbach was able to conduct input/output modeling to analyze the current impact of the industry in each county. Tripp Umbach supplied additional information as required to supplement the data supplied by UNC Lineberger Comprehensive Cancer Center.

Appendix C: Tripp Umbach Qualifications

Tripp Umbach is the national leader in providing economic impact analysis to leading healthcare organizations and academic health centers. The firm has completed more than 250 economic impact studies over the years for clients such as the Mayo Clinic Rochester, The Cleveland Clinic, University of Florida Shands HealthCare, and the Ohio State University Medical Center. In addition to work on multiple occasions for the six allopathic medical schools and academic medical centers in Pennsylvania, Tripp Umbach has completed statewide studies for multiple institutions in Ohio, Virginia, South Carolina, Wisconsin, and Minnesota.

Tripp Umbach recently completed its fifth national study of all U.S. medical schools and teaching hospital affiliates for the Association of American Medical Colleges.

Tripp Umbach has also completed economic impact studies for cancer centers such as the CURE Funding for PA Cancer Alliance, The Wistar Institute, University of North Carolina's Cancer Hospital, Ohio State University's James Cancer Center and Solove Research Center, Ohio State University's Comprehensive Cancer Center, Milton S. Hershey Medical Center's Cancer Institute, Mayo Clinic/Allegheny General Hospital Cancer Services planning, UPMC Hillman Cancer Center feasibility and economic impact projections study, University of Pennsylvania projected economic impact of the Cancer Center as a component of the Civic Center project, and University of Florida Shands Healthcare economic impact projections.

For more information on Tripp Umbach please go to www.trippumbach.com, for more information on this research please contact:

Carrie Kennedy
Principal
Tripp Umbach, Inc.
232 Shenley Drive
Erie, PA 16505
814.923.4375 (direct)
412.973.3835 (mobile)
412.774.1870 (personal fax)
Corporate Headquarters: 800.250.6724, ext. 12

Tripp Umbach

APPENDIX

LIST OF ACTIVE EXTRAMURAL AWARDS

UNC LINEBERGER

UCRF	PI First Name	PI Last Name	Sponsor	Number	Begin	End	Title	Total Cost $
Retention	Nancy	Allbritton	Duke University	2031849	1/15/15	12/31/16	Single cell analysis of intratumoral heterogeneity in parathyroid neoplasia	$29,899
Retention	Nancy	Allbritton	Cell Microsystems, Inc.	not assigned	2/1/16	1/31/18	STTR-The CellRaft AIR System: Workflow Automation for Stem Cell Isolation and Recovery	$499,934
Retention	Nancy	Allbritton	NIH National Cancer Institute	5-F31-CA192529-02	4/1/15	3/31/18	FELLOW:WOSS, GREG Development and Optimization of an Analytical Chemical Separations Technique to Analyze E3 Ligase Activity in Single Cells	$32,938
Retention	Nancy	Allbritton	NIH National Cancer Institute	1-F31-CA206233-01	6/1/16	5/31/19	FELLOW:M DISALVO High-Throughput Generation of Pancreatic Organoids with Controlled Stromal Milieus using Microraft-Based Cell Sorting	$34,398
Retention	Nancy	Allbritton	NIH National Cancer Institute	5-R01-CA177993-01-03	8/15/14	7/31/19	Single-Cell Measurement of Lipid Signaling in Colorectal Cancer	$590,158
Retention	Nancy	Allbritton	NIH National Eye Institute	5-R01-EY024556-01-03	9/1/14	8/31/19	Generation of a Gene-Targeted Human iPS Cell Library for Macular Degeneration	$575,997
Retention	Nancy	Allbritton	NIH National Institute of Diabetes, Digestive, and Kidney Diseases	5-R01-DK109559-01-02	9/25/15	7/31/20	Development of Human Intestinal Simulacra	$818,619
Recruit	Antonio	Amelio	NIH National Cancer Institute	5-R00-CA157954-03-05	9/22/14	8/31/17	Convergence of CREB and MYC Pathways in Oncogenesis	$249,000
Theme Investment (MP1U)	Carey	Anders	NIH National Cancer Institute	5-K23-CA157728-05	9/1/11	8/31/16	PARP Inhibition to Treat Triple-Negative Breast Cancer Brain Metastases	$173,598
Theme Investment (Protocol)	Carey	Anders	Novartis Pharmaceuticals Corporation	not assigned	8/1/11	12/31/16	LCCC 1025 A Phase II Study Evaluating The Efficacy And Tolerability Of Everolimus (RAD001) In Combination With Trastuzumab And Vinorelbine In The Treatment Of Progressive HER2-Positive Breast Cancer Brain Metastases	$84,060
Theme Investment (Protocol)	Carey	Anders	Eli Lilly and Company	not assigned	6/5/15	6/4/17	A Phase 2 Study of Abemaciclib in Women with Brain Metastases Secondary to Hormone Receptor Positive Breast Cancer	$25,636
Theme Investment (Protocol)	Carey	Anders	Angiochem	not assigned	6/6/14	6/5/17	A Phase II, Open-Label, Multi-Center Study of ANG1005 in HER2+ Breast Cancer Patients with Progressive/Recurrent Brain Metastases	$34,679
Theme Investment (Protocol)	Carey	Anders	Merck Sharp and Dohme Corp.	not assigned	12/21/15	12/20/17	A Phase II Clinical Trial of Pembrolizumab (MK-3475) as Monotherapy for Metastatic Triple-Negative Breast Cancer (mTNBC)	$18,000
Theme Investment (MP1U)	Carey	Anders	Conquer Cancer Foundation	not assigned	7/1/16	6/30/19	Molecular Dissection and Immune Characterization of Breast Cancer Brain Metastases to Predict Outcomes and Reveal Novel Therapeutic Strategies	$150,000
Innovation Award	Paul	Armistead	NIH National Cancer Institute	1-R01-CA201225-01	2/1/16	1/31/21	Leukemia Specific Splice Isoforms as Neo-Antigens for T-Cell Immunotherapy	$442,225
Recruitment	Aravind	Asokan	National Inst. of Health	5-P30-AI027767-27	12/1/14	11/30/17	Combating HIV Infection by Fusion Inhibitor Gene Therapy	$239,035
Recruitment	Aravind	Asokan	National Inst. of Health	1-PO1-HL112761-02	2/8/13	1/31/18	Neutralizing Antibody & AAV FIX Gene Therapy - Project 2	$291,026
Recruitment	Aravind	Asokan	National Inst. of Health	5-R01-HL089221-07	1/1/14	12/31/18	Determinants of AAV Tropism	$449,257

Retention	Kenneth	Ataga	NIH National Heart, Lung, and Blood Institute	4-R01-HL111659-05	1/1/12	12/31/16	Endothelial Dysfunction in the Pathogenesis of Sickle Cell Nephropathy	$474,581
Retention	Kenneth	Ataga	NCDHHS Division of Public Health	00033329	6/1/16	5/31/17	UNC Comprehensive Sickle Cell Program	$413,284
Retention	Kenneth	Ataga	NIH National Heart, Lung, and Blood Institute	4-U01-HL117659-04	8/15/13	5/31/18	Targeted anticoagulant therapy for sickle cell disease	$1,481,743
Retention	Kenneth	Ataga	Global Blood Therapeutics, Inc.	not assigned	2/20/13	2/19/20	Permeability and Metabolic Characteristics of Red Blood Cells from Patients with Hemolytic Anemias	$40,375
Recruit	Jeff	Aube	Scripps Research Institute	5-20859	7/1/15	1/31/17	NOVEL PROBES OF THE KAPPA OPIOID RECEPTOR: CHEMISTRY, PHARMACOLOGY, AND BIOLOGY	$226,216
Recruit	Jeff	Aube	University of Kansas Center for Research, Inc.	FY2016-006	7/1/15	3/31/17	HTS to identify small molecules to disrupt abnormal huntingtin interactions in hd	$219,466
Recruit	Jeff	Aube	University of Kansas Center for Research, Inc.	FY2016-020-M1	7/8/15	5/31/17	Molecular Cancer Therapy Targeting HuR-ARE Interaction	$80,817
Recruit	Jeffrey	Aube	Cornell University Medical Campus	16111865-04	7/1/15	6/30/17	TRI-INSTITUTIONAL TB RESEARCH UNIT: PERSISTENCE AND LATENCY 1U19AI111143 - Chemistry Core	$526,905
Recruit	Jeff	Aube	University of Kansas Center for Research, Inc.	FY2016-001	8/1/15	7/31/17	Legacy continuation of the KU CMLD Mission	$128,665
Recruit	Jeff	Aube	University of Kansas Center for Research, Inc.	FY2016-005	9/1/15	8/31/17	Small molecules modulating RNA-binding protein MSI1	$80,817
Theme Investment (CC)	David	Aylor	National Inst. of Health	5-ROO-ES021535-04	6/1/12	5/31/17	Epigenetics, environmental exposure, and reproduction in the Collaborative Cross	$238,469
Retention	Victoria	Bae-jump	North Carolina Biotechnology Center	2015-CFG-8004	8/14/15	8/13/17	Discovery of Novel, Efficacious and Safe Biguanides for the Treatment of Ovarian Cancer	$140,000
Retention	Victoria	Bae-jump	American Cancer Society	RSG-15-138-01-CCE	1/1/16	12/31/19	Obesity, Cation-Selective Transporters and Metformin in Endometrial Cancer	$200,000
Theme Investment (CC)	Ralph S.	Baric	National Inst. of Health	1-R56-AI106006-01A1	9/1/14	8/30/16	Mechanisms of Norovirus Protective Immunity	$162,193
Theme Investment (CC)	Ralph	Baric	Columbia University	5(GG008377-19)	3/1/16	2/28/17	Diagnostic and Prognostic Biomarkers for Viral Severe Lung Disease	$889,034
Theme Investment (CC)	Ralph	Baric	University of Minnesota	N005402801	6/7/16	5/31/17	Receptor recognition and cell entry of coronaviruses	$120,384
Theme Investment (CC)	Ralph	Baric	NIH National Institute on Aging	5-K99-AG049092-01-02	7/15/15	5/31/17	Systems Based Analysis of Host Factors that Contribute to Aging Pathogenesis	$101,494
Theme Investment (CC)	Ralph	Baric	NIH National Institute of Allergy and Infectious Diseases	3-U19-AI100625-04S1	8/1/15	7/31/17	Unlocking Zika Virus Immune Control and Pathogenesis with the Collaborative Cross	$135,110
Theme Investment (CC)	Ralph	Baric	Ohio State University	60045042	2/1/15	1/31/18	Molecular attenuation mechanisms of porcine epidemic diarrhea virus in pigs	$44,804
Theme Investment (CC)	Ralph	Baric	Takeda Vaccines Inc.	64807	6/23/16	6/22/18	Breadth of Blockade Antibody Responses Following Norovirus Vaccination	$1,066,500
Theme Investment (CC)	Ralph	Baric	Takeda Vaccines Inc.	4100131120	1/8/16	1/7/19	In Vitro and In Vivo Characterization of Bivalent DENV Live Virus Vaccines	$1,243,047
Theme Investment (CC)	Ralph	Baric	NIH National Institute of Allergy and Infectious Diseases	5-R01-AI110700-01-02	4/20/15	3/31/20	Mechanisms of MERS-CoV Entry, Cross-species Transmission and Pathogenesis	$739,162
Recruitment	John	Baron	NIH National Cancer Institute	5-U01-CA086400-15	7/1/11	6/30/16	Early Detection Research Network (EDRN)	$113,495
Recruitment	John	Baron	NIH National Cancer Institute	3-RO1-CA098286-11S1	8/1/13	7/31/16	A Pilot Metabolomic Study of the Effects of vitamin D and Calcium Supplementation - Supplement	$163,305

Recruitment	John	Baron	NIH National Cancer Institute	5-R01-CA098286-13	12/1/02	7/31/17	Colorectal Chemoprevention with Calcium and Vitamin D	$2,234,370
Recruitment	John	Baron	University of Michigan	3004034932	4/6/16	3/31/21	Great Lakes New England Clinical Validation Center	$36,508
Recruitment	Ethan	Basch	National Inst. of Health	5-U24-NR-014637-02	9/28/10	6/30/18	Refinement and Expansion of the Palliative Cooperative Group	$110,620
Recruitment	Ethan	Basch	NIH National Cancer Institute	1-UG1-CA189823-01	8/1/14	7/31/19	Alliance NCORP Research Base	$169,387
Recruitment	Ethan	Basch	NIH National Cancer Institute	4-R25-CA116339-09	7/1/05	8/31/18	Cancer Care Quality Research Training Program	$405,045
Retention	Ted	Bateman	University of Colorado Boulder	1554280	7/18/16	6/30/17	Combined Evaluation of Mouse Musculoskeletal Data from Space Shuttle and ISS Experiments to Support the CASIS Good Health Initiative	$118,125
Innovation Award	Victoria	Bautch	NIH National Heart, Lung, and Blood Institute	5-R01-HL117256-01-03	8/1/14	5/31/18	Mechanisms of neovascularization in response to ischemia	$375,662
Innovation Award	James	Bear	NIH National Institute of General Medical Sciences	5-R01-GM111557-01-03	9/1/14	8/31/18	The role of the Arp2/3 complex in cellular actin dynamics	$370,544
Recruitment/Theme Investment	Jonathan	Berg	National Inst. of Health	3-U01-HG007437-03S2	9/23/13	7/31/16	Clinically Relevant Genetic Variants Resource: Admin Supplement	$49,999
Recruitment/Theme Investment	Jonathan	Berg	National Inst. of Health	3-U01-HG007437-03S1	9/23/13	7/31/17	CRVR Administrative Supplement - Geisinger	$165,625
Recruitment/Theme Investment	Jonathan	Berg	NIH National Human Genome Research Institute	3-U01-HG007437-03S1	9/23/13	7/31/17	A Knowledge Base for Clinically Relevant Genes and Variants	$165,625
Recruitment/Theme Investment	Jonathan	Berg	NIH National Human Genome Research Institute	3-U01-HG007437-03S2	9/23/13	7/31/17	A Knowledge Base for Clinically Relevant Genes and Variants	$49,999
Recruitment/Theme Investment	Jonathan	Berg	NIH National Human Genome Research Institute	4-U01-HG007437-04	9/23/13	7/31/17	A Knowledge Base for Clinically Relevant Genes and Variants (CRVR/ClinGen)	$2,191,509
Recruitment/Theme Investment	Jonathan	Berg	NIH National Institute of Child Health and Human Development	4-U19-HD077632-04	9/5/13	8/31/18	NC NEXUS, North Carolina Newborn Exome Sequencing for Universal Screening	$1,177,646
Recruitment	Albert	Bowers	Arnold & Mabel Beckman Foundation	Not Assigned	9/1/14	8/31/17	Synthetic biology Approach to Scaffolding Pathways for Small Molecule Biosynthesis	$250,000
Recruitment	Rosa	Branca	NIH National Institute of Diabetes, Digestive, and Kidney Diseases	5-R01-DK108231-01-02	9/25/15	8/31/20	Sensitive and Specific Detection of BAT Tissue and Activity by Magnetic Resonance with Hyperpolarized Xe-129	$333,534
Recruitment	Maurice	Brookhart	Amgen, Inc.	7100166716	8/1/14	6/30/16	Persistence with Bone-targeting Agents in Patients with Bone Metastases from Solid Tumors	$237,863
Recruitment	Maurice	Brookhart	Amgen, Inc.	7100163382/2011561720	7/1/14	7/1/16	The Effect of Persistent Cinacalcet Use on Biochemical Control in Patients REceiving Hemodialysis	$249,720
Recruitment	M.	Brookhart	Amgen, Inc.	2011561720/ 7100211863	8/14/15	10/31/16	Trajectory of lab values following cinacalcet discontinuation	$66,170
Recruitment	M.	Brookhart	NIH National Institute of Diabetes, Digestive, and Kidney Diseases	1-F32-DK109561-01	9/8/16	9/7/17	FELLOW:M ASSIMON Investigating the longitudinal patterns of use and comparative effectiveness of beta blocker therapy in the hemodialysis population	$70,554
Innovation	Keith	Burridge	NIH National Institute of General Medical Sciences	5-R01-GM029860-33-34	4/1/81	3/31/19	Cell Adhesion and the Regulation of Rho GTPases	$451,850
Theme Investment (GeriOnc)	Jan	Busby-Whitehead	American Federation for Aging Research	Not Assigned	7/1/15	6/30/16	John A. Hartford Foundation's Center of Excellence in Geriatric Medicine and Training	$93,000
Theme Investment (GeriOnc)	Jan	Busby-Whitehead	NIH National Institute on Aging	5-T35-AG038047-07	5/1/10	5/31/20	UNC-CH Summer Research Training in Aging for Medical Students	$74,455

Geriatric Oncology	John	Buse	NIH National Center for Advancing Translational Sciences	4-UL1-TR001111-04	9/26/13	4/30/18	RPPR CTSA U 2016	$1,900,000
Recruitment	Joseph	Calabrese	March of Dimes	5-FY15-7	2/1/15	1/31/17	Selective Modulation of Noncoding RNA Function as a Novel Therapeutic Tool to Treat Childhood Disease	$136,363
Innovation	Sharon	Campbell	NIH National Institute of General Medical Sciences	4-R01-GM106227-04	6/1/13	5/31/17	Regulation of Ras by Monoubiquitination	$378,127
Theme Investment (Protocol)	Lisa	Carey	NIH National Cancer Institute	5-U10-CA180838-01-03	5/7/14	2/28/19	NCTN Lead Academic Participating Sites Application	$474,318
Innovation	Kathleen	Caron	NIH National Institute of Child Health and Human Development	5-R01-HD060860-06-07	4/1/09	7/31/20	Adrenomedullin Signaling at the Maternal-Fetal Interface	$307,738
Recruitment	Ronald	Chen	Accuray, Inc.	Not Assigned	6/1/12	5/31/16	Comparative Effectiveness of Management Options for Localized Prostate Cancer Parallel Study to Include Patients Treated with Cyberknife Radiation Therapy	$100,000
Recruitment	Xian	Chen	NIH National Cancer Institute	5-U24-CA160035-05	8/1/12	7/31/16	Cancer Proteome Center at Washington University, University of North Carolina & Boise State	$379,563
Theme Investment (Proteomics)	Xian	Chen	W. M. Keck Foundation	Not Assigned	1/1/13	12/31/16	New Tools for Characterization of the Protein Methylome and the Histone Code	$250,000
Recruitment	Ronald	Chen	Agency for Healthcare Research and Quality	1-RO1-HS022713-01A1	7/1/14	6/30/19	NC Process: A Stakeholder-Driven, Population-Based Prospective Cohort Study	$696,957
Recruitment	Ronald	Chen	Livestrong Foundation	not assigned	3/1/15	2/28/18	True NTH USA Projects of Self-Management Portal Intervention and The Care Plan & Navigation Intervention	$184,159
Recruitment	Ronald	Chen	Patient-Centered Outcomes Research Institute (PCORI)	CER-1310-06453	1/1/15	3/31/18	North Carolina Prostate Cancer Comparative Effectiveness & Survivorship Study (NCProCESS): A Stakeholder-Driven, Population-Based Prospective Cohort Study	$58,869
Recruitment	Ronald	Chen	Alliance for Clinical Trials in Oncology	CER-1503-29220	2/1/16	6/30/19	Optimizing the Effectiveness of Routine Post-Treatment Surveillance in Prostate Cancer Survivors	$1,158,413
Recruitment	James	Coghill	Leukemia & Lymphoma Society	6461-15	10/1/14	9/30/17	Targeting CCj-Chemokine Receptor 7 (CCR7) with Fully Human Anti-CCR7 Antibodies for the Prevention of Graft-versus-host disease	$199,541
Recruitment	Catherine	Coombs	Conquer Cancer Foundation	not assigned	9/1/16	8/31/17	Investigation of the impact of clonal hematopoiesis in patients with solid tumors without known hematologic disease	$50,000
Theme Investment (Training)	Adrienne	Cox	NIH National Cancer Institute	4-T32-CA071341-20	9/30/96	8/31/17	Cancer Cell Biology Training Program	$205,844
Theme Investment (HTS)	James	Crowley	Foundation of Hope for Research and Treatment of Mental Illness	not assigned	8/14/15	8/15/18	Identifying Susceptibility Loci for Tourette's Syndrome in a Densely Affected Pedigree	$40,000
Theme Investment (HTS)	James	Crowley	NIH National Institute of Mental Health	5-R01-MH105500-01-02	1/20/15	11/30/19	Genetic & Environmental Predictors of Tourette Syndrome & OCD in Denmark	$583,361
Theme Investment (HTS)	James	Crowley	NIH National Institute of Mental Health	1-R01-MH110427-01	8/1/16	4/30/21	OCD: Novel Comparative Genomic Approaches to Identify Disease and Treatment Mechanisms	$650,855
Retention	Blossom	Damania	NIH National Institute of Dental and Craniofacial Research	4-R01-DE018281-10	6/1/07	5/31/17	Innate Immunity and KSHV	$365,968
Retention	Blossom	Damania	NIH National Cancer Institute	4-R01-CA096500-14	7/1/02	5/31/18	Role of KSHV Viral Proteins in Signaling and Pathogenesis	$281,108

Retention	Blossom	Damania	NIH National Institute of Dental and Craniofacial Research	4-R01-DE023946-04	9/17/13	7/31/18	Targeting the Epigenome of Gammaherpesviruses in Oral Disease	$378,255
Retention	Blossom	Damania	NIH National Cancer Institute	2-P01-CA019014-37	5/1/97	6/30/21	Herpesviral, Oncogenesis, Latency and Reactivation	$1,811,800
Theme Investment (HTS)	Jeff	Dangl	Gordon and Berry Moore Foundation	3030	9/1/11	8/31/16	Understanding Plant Immune System Function in Complex Microbial Environments	$333,333
Theme Investment (HTS)	Jeff	Dangl	NIH National Institute of General Medical Sciences	4-R01-GM107444-04	9/1/13	8/31/17	The intersection of development and innate immune system function in arabidopsis	$256,993
Innovation Award	Ian	Davis	Vanderbilt University Medical Center	VUMC58792	9/30/15	11/30/16	Chromatin Maintenance in Cancer Progression	$100,661
Innovation Award	Ian	Davis	NIH National Cancer Institute	4-R01-CA166447-05	5/1/12	3/31/17	Chromatin Organization and Transcription Factor Targeting in Cancer	$304,426
Retention	Paul	Dayton	National Inst. of Health	5-R01-EB015508-04	8/1/12	5/31/16	Dual-Frequency Intravascular Arrays for Functional Imaging of Atherosclerosis - Subcontract with North Carolina State University	$107,708
Retention	Paul	Dayton	NIH National Cancer Institute	5-RO1-CA170665-04	7/1/12	6/30/16	Micro-Tumor Detection by Quantifying Tumor-Induced Vascular Abnormalities (PQ-13)	$456,058
Retention	Paul	Dayton	NIH National Cancer Institute	3-RO1-CA170665-04S1	9/1/12	6/30/16	Pilot Clinical Study of Acoustic Angiography for Improving Ultrasound Sensitivity - Supplement	$196,588
Retention	Paul	Dayton	Department of Defense	W81XWH-12-1-0303	8/1/12	7/31/16	Piezoelectric Composite Micromachined Multi-Frequency Transducers for High-Resolution, High-Contrast Ultrasound Imaging for Improved Prostate Cancer Assessment	$502,375
Retention	Paul	Dayton	Vanderbilt University Medical Center	VUMC 57291	12/1/15	3/31/17	Exploiting Notch inhibition as a mechanism to overcome resistance in ccRCC	$83,072
Retention	Paul	Dayton	NIH National Institute of Biomedical Imaging and Bioengineering	5-F32-EB018715-02	5/1/15	4/30/17	FELLOW:BROOKS, L Contrast-enhanced intravascular ultrasound imaging of vascular invasion	$59,970
Retention	Paul	Dayton	Kitware Inc.	K000646-00-S01	9/1/12	6/30/17	SBIR-Quantitative ultrasound analysis of vascular morphology for cancer assessment	$163,313
Retention	Paul	Dayton	NIH National Cancer Institute	5-U01-CA189281-01-02	7/17/15	6/30/18	Improving breast ultrasound specificity through SFRP2 targeted molecular imaging	$483,305
Retention	Paul	Dayton	NIH National Cancer Institute	5-F31-CA196216-02	8/1/15	7/31/18	FELLOW:ROJAS, J Novel Ultrasound Molecular Imaging for Assessment of Tumor Response to Therapy	$33,929
Retention	Paul	Dayton	NIH National Cancer Institute	5-R01-CA189479-01-03	9/4/14	8/31/18	Academic-Industrial Partnership for Translation of Acoustic Angiography	$514,371
Retention	Paul	Dayton	North Carolina State University (NCSU)	570253	4/13/15	3/31/19	Ultrasound Molecular Imaging to Assess Therapeutic Response	$117,828
Theme Investment (Protocol)	Elizabeth	Dees	Duke University	2035177	4/1/16	2/28/17	Duke-UNC-Wash U Partnership for Early Phase Clinical Trials in Cancer	$97,384
Theme Investment (Proteomics/HTS)	Channing	Der	NIH National Cancer Institute	5-R01-CA175747-01-03	2/5/14	1/31/19	Mechanisms of PAK1 activation, signaling and tumor resistance	$424,266
Theme Investment (Proteomics/HTS)	Channing	Der	NIH National Cancer Institute	5-U01-CA199235-01-02	9/1/15	6/30/19	Identification of synthetic lethal interactors in pancreatic cancer	$732,247
Theme Investment (Proteomics/HTS)	Channing	Der	NIH National Cancer Institute	5-R01-CA042978-29-30	7/1/86	7/31/20	Biological Activity of Ras Oncogenes	$369,223
Innovation	Channing	Der	NIH National Cancer Institute	1-P01-CA203657-01	6/1/16	5/31/21	Defining RAS isoform- and mutation-specific roles in oncogenesis	$1,609,721
Innovation Award	Mohanish	Deshmukh	NIH National Institute of General Medical Sciences	4-R01-GM105612-04	4/1/13	3/31/17	Mechanism by which Human ES Cells Prime Bax at the Golgi for Rapid Apoptosis	$324,900

Retention	Joseph M.	DeSimone	NIH National Cancer Institute	5-U54-CA151652-05	9/1/10	7/31/16	Carolina Center of Cancer Nanotechnology Excellence-Project 1	$421,528
Retention	Joseph M.	DeSimone	Liquidia Technologies	Not Assigned	9/1/05	8/31/16	Research Agreement between UNC and Liquidia in the area of PFPE, Lithography, Microfluidics, Nanostudies and Membrane Studies	$436,014
Retention	Joseph	DeSimone	Carbon3D, Inc.	not assigned	12/1/13	12/31/16	Research Agreement with Carbon3D, Inc.	$377,625
Retention	Dirk	Dittmer	NIH National Cancer Institute	5-R21-CA177315-02	8/1/13	7/31/16	Pathobiology and Clinical Profile of HIV-Associated Cancers in India and the West	$204,706
Retention	Dirk	Dittmer	NIH National Cancer Institute	Not Assigned	9/1/15	8/31/20	AIDS Malignancy Clinical Trials Consortium (AMC)	$76,000
Retention	Dirk	Dittmer	NIH National Cancer Institute	Not Assigned	9/1/15	8/31/20	AIDS Malignancy Laboratory Consortium (AMC)	$53,200
Retention	Dirk	Dittmer	Stellenbosch University	S004345	7/13/15	6/30/17	Origin of the Kaposi Sarcoma Tumor Cell	$75,673
Retention	Dirk	Dittmer	NIH National Institute of Dental and Craniofacial Research	4-R01-DE018304-09	5/15/07	8/31/18	ART Modulation of Viral Pathogenesis	$377,837
Retention	Dirk	Dittmer	NIH National Institute on Drug Abuse	5-R01-DA040394-01-02	7/1/15	6/30/20	HIV and substances of abuse influence exosomes and endothelial cell function	$368,240
Retention	Dirk	Dittmer	NIH National Cancer Institute	2-R01-CA163217-06	9/1/11	7/31/21	Targeted Therapies for HIV-Associated Kaposi Sarcoma and Lymphoma	$342,759
Recruitment	Claire	Doerschuk	National Inst. of Health	1-P50-HL120100-02S1	9/19/13	8/31/18	The Impact of Tobacco Exposure on the Lungs Innate Defense System - Supplement	$99,999
Recruitment	Claire	Doerschuk	National Inst. of Health	5-P50-HL120100-03	9/19/13	8/31/18	The Impact of Tobacco Exposure on the Lungs Innate Defense System: Project 3 - Mouse Models of Smoking-related Diseases: What is the Best Mimic of Human Disease	$805,503
Recruitment	Claire	Doerschuk	NIH National Heart, Lung, and Blood Institute	4-T32-HL007106-40	7/1/75	3/31/17	Multidisciplinary research training in pulmonary diseases	$442,058
Recruitment	Claire	Doerschuk	NIH National Heart, Lung, and Blood Institute	4-R01-HL114388-05	6/1/12	3/31/17	Rho-mediated signaling in lung endothelial cells induced by neutrophil adhesion	$619,559
Recruitment	Claire	Doerschuk	NIH National Heart, Lung, and Blood Institute	4-K12-HL119998-04	9/1/13	5/31/18	Application of Omics in Lung Disease	$349,342
Retention	Nikolay	Dokholyan	National Inst. of Health	5-R01-AI102732-04	7/1/12	6/30/16	Immunogen Design to Target Carbohydrate-Occluded Epitopes on the HIV Envelope	$497,332
Retention	Nikolay	Dokholyan	NIH National Institute of General Medical Sciences	1-R01-GM114015-01	8/15/16	5/31/20	Integrating cheminformatics and molecular simulations for virtual drug screening	$293,344
Recruitment	Gianpietro	Dotti	Leukemia & Lymphoma Society		3/1/15	9/30/18	Targeting CD138 in Myeloma	$153,214
Recruitment	Gianpietro	Dotti	Galera Therapeutics, Inc.	not assigned	1/21/16	1/20/17	Galera UNC Sponsored Research	$190,000
Recruitment	Gianpietro	Dotti	DOD DA Army Medical Research Acquisition Activity	W81XWH-16-1-0332	8/15/16	8/14/17	Exploiting Hypoxia for T-Cell Immunotherapy in Neuroblastoma	$114,000
Recruitment	Gianpietro	Dotti	Bluebird bio, Inc.	not assigned	5/16/16	5/15/18	Sponsored Research Bluebird Bio - UNC	$150,000
Recruitment	Gianpietro	Dotti	DOD DA Army Medical Research Acquisition Activity	W81XWH-16-1-0501	9/1/16	8/31/19	Strategies to Counteract Resistance Mechanisms in CAR + T Cell-based Immunotherapy for Triple Negative Breast Cancer	$607,500
Recruitment	Gianpietro	Dotti	NIH National Cancer Institute	1-R01-CA193140-01A1	2/1/16	1/31/21	Targeting the Ig-Light Chains with CAR-T Cells in Lymphoid Tumors	$569,255
Recruitment	Jill	Dowen	Sidney Kimmel Foundation	SKF-16-095	7/1/16	6/30/18	Role of long-range chromosomal interactions in cancer	$100,000
Innovation Award	Andrew	Dudley	NIH National Cancer Institute	5-R01-CA177875-01-03	9/1/14	8/31/19	Mechanisms of tumor escape from anti-angiogenic therapy	$312,777

Recruitment	Stacie	Dusetzina	American Cancer Society	RSGI-14-030-01-CPHPS	7/1/14	6/30/16	Impact of Parity Legislation on Use and Costs of Oral Cancer Medications	$239,947
Innovation Award	Stacie	Dusetzina	University of Chicago	FP064058-A	6/1/16	5/31/17	Access to and Value of Treatment Innovation Study	$202,995
Theme Investment (CBCS)	Shelton	Earp	NIH National Cancer Institute	4-P50-CA058223-23	8/5/97	8/31/17	SPORE in Breast Cancer	$1,725,265
Theme Investment (CBCS)	Shelton	Earp	Susan G. Komen Breast Cancer Foundation	OGUNC1202	5/1/12	4/30/18	Carolina Breast Cancer Study: PHASE III	$225,000
Theme Investment (CBCS)	Shelton	Earp	NIH National Cancer Institute	5-U54-CA156733-06-07	9/28/10	8/31/20	NCCU-LCCC Partnership in Cancer Research (2 of 2)	$997,277
Innovation	Timothy	Elston	DOD DA Army Research Office	W911NF-15-1-0631	9/28/15	9/27/17	Spatio-temporal control of Rho family signaling networks in motility	$260,000
Recruitment	Michael	Emanuele	Susan G. Komen Foundation	CCR14298820	10/24/14	10/23/17	Altered Ubiquintin Signaling Networks Regulating Breast Cancer Proliferation	$150,000
Recruitment	Michael	Emanuele	NIH National Institute of General Medical Sciences	1-R01-GM120309-01	9/1/16	8/31/21	SCF Ubiquitin Ligases in Cell Cycle Control and Chromosome Stability	$301,840
Recruitment	Lawrence	Engel	Henry M Jackson Foundation	PO 753538/2331	3/1/12	11/30/16	Effects of the Deepwater Horizon Disaster:the Coast Guard Responder Cohort	$52,225
Theme Investment (HTS)	James	Evans	NIH National Human Genome Research Institute	3-U01-HG006487-04S1	12/1/14	11/30/16	NC GENES: North Carolina Clinical Genomic Evaluation by NextGen Exome Sequencing Supplement to 5032286	$1,508,968
Theme Investment (HTS)	James	Evans	NIH National Human Genome Research Institute	3-U01-HG006487-04S1	12/1/14	11/30/16	NC GENES: North Carolina Clinical Genomic Evaluation by NextGen Exome Sequencing Supplement to 5032286	$301,794
Recruitment	Matthew	Foster	Celgene Corporation	LCCC 1111	5/31/12	5/30/16	An Open-Label Dose-Finding Study of Lenalidomide as Reinduction/Consolidation Followed by Lenalidomide Maintenance Therapy for Adults Over 60 Years of Age with AML in Partial or Complete Response Following Induction Therapy	$107,835
Recruitment	Matthew	Foster	ICON Clinical Research	B1931022	6/26/13	6/25/16	An Open-label Randomized Phase 3 Study of Inotuzumab Ozogamicin Compared to a Defined Investigator's Choice in Adult Patients with Relapsed or Refractory CD22-Positive Acute Lymphoblastic Leukemia (ALL)	$15,434
Recruitment	Matthew	Foster	Celator Pharmaceuticals, Inc	not assigned	10/8/13	10/7/16	PHASE III, MULTICENTER, RANDOMIZED, TRIAL OF CPX-351(CYTARABINE:DAUNORUBICIN) LIPOSOME INJECTION VERSUSCYTARABINE AND DAUNORUBICIN IN PATIENTS 60-75 YEARS OF AGEWITH UNTREATED HIGH RISK (SECONDARY) AML.	$21,969
Recruitment	Rebecca	Fry	National Inst. of Health	5-R01-ES019315-05	9/20/10	5/31/16	In Utero Exposure to Arsenic, Links to Epigenetic Alterations and Disease	$363,075
Recruitment	Rebecca	Fry	University of Georgia	RR715-234/S000725	2/5/15	11/30/16	Functional interaction between the gut microbiome and arsenic exposure	$18,466
Recruitment	Stephen	Frye	Initos Pharmaceuticals, LLC	1441TR001330-01	8/1/15	7/14/17	STTR: Development of Small Molecules that Enhance the Delivery and the Pharmacological Effects of Oligonucleotides	$94,764

Recruitment	Stephen	Frye	NIH National Institute of General Medical Sciences	2-R01-GM100919-05A1	5/1/12	7/31/20	Discovery of Chemical Probes for Chromatin Readers	$429,687
Recruitment	Terrence	Furey	National Inst. of Health	1-RO1-ES024983-02	12/1/14	11/30/16	Interpreting Molecular Role of DNA Variants Associated with Crohn's Disease Through Integrative Analysis of Open Chromatin, Epigenome and Transcriptome Data in Diverse and Relevant Tissues and Cells	$300,204
Recruitment	Terry	Furey	NIH National Institute of Environmental Health Sciences	4-R01-ES023195-04	8/26/13	5/31/17	Genes, genomes and genotoxicity; in vivo epigenetic toxicology of 1,3-butadiene	$546,211
Recruitment	J Victor	Garcia-Martinez	National Inst. of Health	5-RO1-AI097012-05	12/1/15	11/30/16	Mode of action of a new Tat HIV-1 inhibitor	$185,000
Recruitment	J Victor	Garcia-Martinez	NIH National Institute of Allergy and Infectious Diseases	5-R01-AI111899-01-03	3/1/14	2/28/19	Plug & Purge: In Vivo Targeting of Active HIV Reservoirs That Persist Despite ART	$521,436
Recruitment	J Victor	Garcia-Martinez	NIH National Institute of Mental Health	5-R01-MH108179-01-02	4/1/15	1/31/20	Role of Myeloid Cells in HIV latency in the Periphery and the CNS	$482,900
Recruitment	Timothy	Gershon	St. Baldrick's Foundation	Not Assigned	7/1/14	6/30/16	Exploiting Bcl-xl Dependence to Improve medulloblastoma Therapy	$75,000
Theme Invest (HTS)	Timothy	Gershon	Alex's Lemonade Stand Foundation	Not Assigned	7/1/15	6/30/17	Preclinical Development of Atr Inhibitor VE-822, Delivered Systemically in Nanoparticles, for Medulloblastoma Therapy	$125,000
Recruitment	Timothy	Gershon	NIH National Cancer Institute	5-F30-CA192832-02	3/25/15	12/24/19	FELLOW:YUN LONG LANG ATR: a novel therapeutic target for medulloblastoma identified by its role in cerebellar development	$33,814
Recruitment	Timothy	Gershon	NIH National Institute of Neurological Disorders and Stroke	5-R01-NS088219-01-02	2/15/15	1/31/20	Glycolytic regulation of cerebellar development and medulloblastoma tumorigenesis	$327,837
Theme Invest (HTS)	Paola	Giusti	NIH National Institute of Mental Health	1-K01-MH109772-01	4/1/16	3/31/20	Interpreting GWAS associations in schizophrenia using genome-wide chromatin mapping	$155,168
Innovation	Bob	Goldstein	NIH National Institute of General Medical Sciences	2-R01-GM083071-09	6/1/08	7/31/20	C. elegans Gastrulation: a Model for Understanding Apical Constriction Mechanisms	$334,215
Retention	Satish (Damania	Gopal	NIH National Cancer Institute	1-U54-CA190152-02	9/15/14	8/31/19	Addressing Herpesviruses-Associated Cancers Through the UNC-Malawi Cancer Consortium	$749,896
Retention	Satish	Gopal	NIH Fogarty International Center for Advanced Study in the Health Sciences	4-K01-TW009488-05	9/20/12	6/30/17	Developing a clinical cohort of histopathologically characterized lymphoma	$140,175
Theme Investment (HTS)	Penny	Gordon-Larsen	NIH National Institute of Child Health and Human Development	5-R01-HD057194-06-08	1/1/08	6/30/19	Exome Variants Underlying Weight Gain from Adolescence to Adulthood	$596,111
Recruitment	Juneko	Grilley-Olson	Morphotek, Inc	MORab-004-203-STS	7/26/13	9/18/16	A Study of the Safety and Efficacy of the Combination of Gemcitabine and Docetaxel with MORab-004 in Metastatic Soft Tissue Sarcoma	$8,850
Recruitment	Juneko	Grilley-Olson	GlaxoSmithKline	FGF117360	10/2/13	10/1/16	Multi-arm, Non-randomized, Open-label Phase IB Study to Evaluate GSK3052230 in Combination with Paclitaxel and Carboplatin, or Docetaxel or as Single Agent in Subjects with Solid Malignancies and Deregulated FGF Pathway Signaling	$16,208
Recruitment	Juneko	Grilley-Olson	Seattle Genetics, Inc	not assigned	4/9/15	4/8/17	SGNS40-001 - A phase 1, open-label, dose-escalation study of SEA-CD40 in adult patients with advanced malignancies	$54,714

Recruitment	Juneko	Grilley-Olson	Pharmaceutical Product Development (PPD), Inc.	not assigned	5/13/14	5/12/17	NC-6004-0043A: A Phase 1b/2 Dose Escalation and Expansion Trial of NC-6004 (Nanoparticle Cisplatin) plus Gemcitabine in Patients with Advanced Solid Tumors or Non-Small Cell Lung Cancer	$21,216
Recruitment	Juneko	Grilley-Olson	Novartis Pharmaceuticals	not assigned	1/7/14	12/31/17	Modular phase II study to link targeted therapy to patients with pathway activated tumors: Module 1 - BKM120 for patients with PI3K-activated tumors	$7,300
Recruitment	Juneko	Grilley-Olson	Novartis	not assigned	10/28/13	12/31/17	Modular phase II study to link targeted therapy to patients with pathway activated tumors: Module 3 - MEK162 for patients with RAS/RAF/MEK activated tumors	$58,861
Recruitment	Juneko	Grilley-Olson	Genentech, Inc.	not assigned	2/23/15	3/31/20	My Pathway: An Open-Label Phase IIA Study Evaluating Trastuzumab/Pertuzumab, Erlotinib, Vemurafenib, and Vismodegib in Patients who have Advanced Solid Tumors with Mutations or Gene Expression Abnormalities Predictive of Response to one of these Agents.	$18,393
Recruitment	Gaorav	Gupta	Burroughs Wellcome	1012285-01	1/1/15	12/31/19	DNA Damage Responses in Breast Cancer Pathogenesis	$140,000
Recruitment	Gaorav	Gupta	NIH National Cancer Institute	1-F32-CA206345-01	6/1/16	5/31/19	FELLOW:K FAGAN-SOLIS Identifying Drivers of Genomic Instability in Triple-Negative Breast Cancer	$58,002
Recruitment	Gaorav	Gupta	Susan G Komen for the Cure	CCR16377075	7/1/16	6/30/19	Identifying Drivers of Genomic Instability in Triple Negative Breast Cancer	$150,000
Recruitment	Stephanie	Gupton	NIH National Institute of Mental Health	1-R21-MH109653-01	5/15/16	4/30/18	Identification of ubiquitnated neural substrates of TRIM9 and TRIM67	$226,624
Recruitment	Stephanie	Gupton	NIH National Institute of General Medical Sciences	5-R01-GM108970-01-03	1/1/14	12/31/18	TRIM9 coordinates membrane trafficking and cytoskeletal dynamics	$349,992
Recruitment	Stephanie	Gupton	NIH National Institute of Neurological Disorders and Stroke	1-F31-NS096823-01	3/15/16	3/14/19	FELLOW:N BOYER TRIM67 regulates growth cone filopodia during netrin-dependent axon guidance	$33,935
Retention	Klaus	Hahn	National Inst. of Health	5-RO1-GM102924-04	8/1/12	5/31/16	A Toolkit for Imaging and Photo-Manipulation of Signaling in Zebrafish	$310,929
Retention	Klaus	Hahn	University of Wisconsin at Madison	647K662	12/8/15	11/20/16	Mechanisms of cell migration on aligned matrices	$104,122
Retention	Klaus	Hahn	NIH National Cancer Institute	5-F31-CA192739-02	7/1/15	6/30/18	FELLOW:STONE, O Cancer metastasis studied via optically controlled cofilin and LIM kinase analogs.	$33,935
Retention	Klaus	Hahn	American Cancer Society	129486-PF-16-118-01-CSM	7/1/16	7/1/18	Microtubule-Mediated RhoG Dynamics in Migration of Cancer Cells	$111,500
Retention	Klaus	Hahn	NIH National Institute of General Medical Sciences	4-P01-GM103723-04	9/30/13	7/31/18	Spatio-temporal dynamics of GEF-GTPase networks	$1,101,950
Retention	Klaus	Hahn	NIH National Institute of General Medical Sciences	1-F32-GM120958-01	8/1/16	7/31/19	FELLOW:N PINKIN Improving Environment Sensitive Dyes for Live Cell Single Molecule Imaging	$54,294
Retention	Zongchao	Han	NIH National Eye Institute	1-R01-EY026564-01	4/1/16	3/31/21	Targeting Retinitis Pigmentosa Using Nanoparticle-Mediated Delivery of Genomic DNA	$360,448
Innovation	Laura	Hanson	NIH National Institute on Aging	1-R21-AG052140-01	5/1/16	4/30/18	Triggered Palliative Care for Advanced Dementia: A Pilot Study	$228,000
Recruitment	Nate	Hathaway	American Association of Colleges of Pharmacy	not assigned	1/1/16	12/31/16	Development of novel inhibitors of mammalian heterochromatin gene repression	$10,000
Recruitment	Liza Makowski	Hayes	NIH National Cancer Institute	5-R21-CA180134-02	8/7/13	7/31/16	(PQA2) Reversing Carcinogenic Effect of Obesity on Basal-like Breast Cancer	$154,570

Recruitment	Liza Makowski	Hayes	Mary Kay Ash Charitable Foundation	062-13	7/1/13	7/31/16	Reversing Carcinogenic Effect of Obesity on Basal-like Breast Cancer	$154,540
Theme Investment (Protocol)	Neil	Hayes	Pharmaceutical Research Associates	not assigned	1/8/14	1/7/17	A Randomized, Double-Blind, Placebo-Controlled Study of Chemotherapy Plus Cetuximab in Combination with VTX-2337 in Patients with Recurrent or Metastatic SCCHN	$14,600
Theme Investment (HTS)	Neil	Hayes	NIH National Cancer Institute	5-U10-CA181009-01-03	4/22/14	2/28/19	Network Group Integrated Translational Science Centers Application	$700,000
Theme Investment (CC)	Mark	Heise	NIH National Institute of Allergy and Infectious Diseases	4-U19-AI100625-05	8/5/12	7/31/17	Systems Immunogenetics of Biodefense Pathogens in the Collaborative Cross	$4,403,040
Theme Investment (HTS)	Gail	Henderson	NIH National Human Genome Research Institute	1-K99-HG008819-01	9/18/15	8/31/17	Use of Genetic Information by Life, Long-term Care, and Disability Insurers: Exploring International Lessons, the Domestic Legal Landscape, and Options for U.S. Policy	$91,113
Theme Investment (HTS)	Gail	Henderson	NIH National Human Genome Research Institute	4-P50-HG004488-09	9/27/07	5/31/18	Center for Genomics and Society	$1,188,966
Recruitment	Shawn	Hingtgen	NIH National Institute of Neurological Disorders and Stroke	1-R01-NS097507-01	6/1/16	5/31/21	Nanofiber matrices to improve neural stem cell-mediated cancer therapy	$321,130
Theme Investment (HTS)	Katherine	Hoadley	NIH National Cancer Institute	1-U24-CA210988-01	9/1/16	8/31/21	RNA sequencing analysis of Cancer	$416,184
Theme Investment (Nanotech)	Leaf	Huang	NIH National Institute of Diabetes, Digestive, and Kidney Diseases	4-R01-DK100664-04	9/10/13	6/30/18	Hepatic Non-viral Gene Therapy	$330,600
Theme Investment (Nanotech)	Leaf	Huang	NIH National Cancer Institute	5-U54-CA198999-01-02	8/1/15	7/31/20	Nano Approaches to Modulate Host Cell Response for Cancer Therapy	$2,261,936
Recruitment	Stephen	Hursting	Breast Cancer Research Foundation	BCRF-16-075	10/1/16	9/30/17	Bariatric Surgery versus Dietary Interventions for Preventing Obesity-Related Breast Cancer: Roles of Epigenetic and Metabolic Reprogramming	$250,000
Recruitment	Stephen	Hursting	NIH National Cancer Institute	5-R35-CA197627-01-02	8/1/15	7/31/22	Breaking the Obesity-Cancer Link: New Targets and Strategies	$762,608
Retention	Joseph	Ibrahim	Merck & Co.	Not Assigned	7/1/09	2/28/17	Methods for Interim Analysis with Incomplete Adjudication of Events	$253,000
Retention	Joseph	Ibrahim	Amgen, Inc.	PO#7200856546	7/31/08	12/31/16	Supported Research Agreement	$276,500
Theme Investment (Bios/HTS)	Joseph	Ibrahim	NIH National Institute of General Medical Sciences	2-R01-GM070335-17	3/1/96	6/30/20	Bayesian Approaches to Model Selection for Survival Data	$425,722
Theme Investment (Bios/HTS)	Joseph	Ibrahim	NIH National Cancer Institute	2-T32-CA106209-11	5/1/04	7/31/21	Biostatistics for Research in Genomics and Cancer	$146,168
Recruitment	Federico	Innocenti	Alliance for Clinical Trials in Oncology Foundation	not assigned	3/1/15	2/28/17	Genentech Analysis of Biospecimens from the CALGB/SWOG C80405 Study	$141,637
Recruitment	Katarzyna	Jamieson	GlaxoSmithKline	Zoster-039	8/13/13	7/13/16	A Phase III, Randomized, Observer-blind, Placebo-controlled, Multicenter Study to Assess the Safety and Immunogenicity of GSK Biologicals' Herpes Zoster HZ/su Candidate Vaccine when Administered Intramuscularly on a Two Dose Schedule to Adults Aged 18 Yea	$17,933

Recruitment	Katarzyna	Jamieson	Astellas Pharma, Inc	0113-CL-1004	9/11/13	10/3/16	A Randomized, Double-Blind, Placebo-Controlled, Phase III Trial to Evaluate the Protective Efficacy and Safety of a Therapeutic Vaccine. ASP0113, in Cytomegalovirus (CMV)-Seropositive Recipients Undergoing Allogenic, Hematopoietic Cell Transplant (HCT)	$15,500
Theme Investment (CBCS, HTS, MP1U)/Innovation	Gary	Johnson	Susan G. Komen Foundation	IIR12225201	1/1/13	12/31/16	Whole Kinome Profiling and Remodeling in HER2+ Breast Cancer	$244,838
Theme Investment (Proteomics)	Gary	Johnson	Children's Tumor Foundation	Not Assigned	2/3/14	1/31/17	Applying Systems Biology to Create Tools and Treatment Paradigms for NF2-associated meningioma and Vestibular Schwannoma	$116,666
Theme Investment (Proteomics)	Gary	Johnson	NIH National Cancer Institute	1-U54-CA196519-01	7/1/15	6/30/20	Developmental and Hyperactive Ras Tumor SPORE (Omics Core)	$400,702
Theme Investment (Proteomics)	Gary	Johnson	NIH National Institute of Mental Health	5-U01-MH104999-01-03	8/1/14	4/30/17	Activation and Regulation of the Understudied Kinome Using MIB/MS Technology	$395,126
Theme Investment (Proteomics)	Gary	Johnson	Childrens Hospital of Philadelphia	961188-RSUB	7/1/14	5/31/17	Targeting Oncogenic ALK Signaling in Neuroblastoma	$50,744
Recruitment	Alexander	Kabanov	NIH National Cancer Institute	5-U01-CA151806-05	9/20/10	7/31/16	High Capacity Nanocarriers for Cancer Chemotherapeutics	$379,186
Recruitment	Alexander	Kabanov	NIH National Cancer Institute	1-RO1-CA184088-01A1	9/1/14	8/31/19	Liposomal Doxorubicin and Pluronic Combination for and Cancer Therapy	$344,549
Recruitment	Alexander	Kabanov	NIH National Cancer Institute	5-R01-CA184088-01-02	1/1/15	12/31/19	PEGylated Liposomal Doxorubicin and Pluronic Combination for and Cancer Therapy	$344,549
Recruitment	Alexander	Kabanov	NIH National Cancer Institute	5-T32-CA196589-02	7/1/15	6/30/20	CAROLINA CANCER NANOTECHNOLOGY TRAINING PROGRAM (C-CNTP)	$395,375
Recruitment	Alexander	Kabanov	NIH National Cancer Institute	5-U01-CA198910-01-02	8/14/15	7/31/20	Targeted Core Shell Nanogels for Triple Negative Breast Cancer	$562,542
Theme Investment (Viral Core)	Tal	Kafri	NIH National Heart, Lung, and Blood Institute	5-R01-HL128119-01-02	9/2/15	6/30/19	Lentiviral vector-based gene therapy and the host genetic background	$758,060
Recruitment	Kimberly	Kasow	National Marrow Donor Program	not assigned	10/5/15	10/31/19	Natural History and Biology of Long-Term Late Effects Following Hematopoietic Cell Transplant for Childhood Hematologic Malignancies	$2,500
Retention	Nigel	Key	University of Washington	UWSC8675 (BPO9467)	8/15/15	5/31/17	Trial Using Epsilon Aminocaproic Acid in Therapy in Thrombocytopenia (TREAT)	$297,013
Retention	Nigel	Key	NIH National Heart, Lung, and Blood Institute	4-T32-HL007149-40	7/1/75	6/30/17	Research Training in Hematology at UNC Chapel Hill	$124,743
Retention	Nigel	Key	Baxalta	H15-27944	10/27/15	10/26/17	An Observational Study of the Natural History of Outcomes in Hemophilics Undergoing Major Orthopedic Surgery	$125,000
Retention	Nigel	Key	Doris Duke Charitable Foundation	2015191	11/1/15	10/31/17	Microfluidic modeling of sickle cell disease	$54,000
Retention	William	Kim	Bladder Cancer Advocacy Network	Not Assigned	7/15/14	7/14/16	Immune Characterization of High-Grade Bladder Cancer	$150,000
Retention	William	Kim	American Cancer Society	RSG-14-219-01-TBG	1/1/15	12/31/18	Intrinsic Subtypes of Bladder Cancer	$197,774
Retention	William	Kim	Acerta Pharma BV	17-0214	6/1/16	5/31/17	Comprehensive tumor immune microenvironment profiling to discover determinants of response to pembroluzimab with or without BTK inhibition	$199,867
Retention	William	Kim	NIH National Cancer Institute	1-1R01CA202053-01A1	9/2/16	7/31/21	Kinase Inhibition in Kidney Cancer	$432,423

Recruitment	Christine	Kistler	Beth Israel Deaconess Medical Center	01027406	6/12/14	5/31/17	Randomized Trial of a Mammography Decision Aid for Women Aged 75 and Older	$159,820
Recruitment	Christine	Kistler	Agency for Healthcare Research and Quality	1-R01-HS024519-01	4/1/16	3/31/19	Nurse and Physician Decision-making for Suspected Urinary Tract Infections in Nursing Homes: Potential Targets to Reduce Antibiotic Overuse	$497,425
Theme Investment (HTS)	Michael R.	Knowles	Natl Heart, Lung, & Blood Inst	5-R01-HL68890-13	9/1/06	6/30/16	Gene Modifiers in CF Lung Disease	$735,600
Theme Investment (HTS)	Michael	Knowles	NIH National Heart, Lung, and Blood Institute	5-U54-HL096458-11-13	8/6/04	7/31/19	Genetic Disorders of Mucociliary Clearance	$1,242,974
Theme Investment (Bios)	Michael	Kosorok	National Science Foundation	DMS-1407732	7/1/14	6/30/17	Support Vector Machines for Censored Data	$139,000
Theme Investment (Bios)	Michael	Kosorok	NIH National Cancer Institute	5-P01-CA142538-06-07	4/1/10	3/31/20	Statistical Methods for Cancer Clinical Trials	$1,977,577
Theme Investment (Bios)	Michael	Kosorok	NIH National Cancer Institute	3-T32-LM012420-02S1	5/1/15	4/30/20	Big Data Visualization Methods and Software for Population Health Research	$97,956
Theme Investment (Bios)	Michael	Kosorok	NIH National Cancer Institute	8-T32-LM012420-02	5/1/15	4/30/20	Big Data Visualization Methods and Software for Population Health Research	$297,372
Innovation	Cherie	Kuzmiak	OptoSonics, Inc	not assigned	6/1/12	3/31/17	3D Photoacoustic and US Breast Imaging	$106,400
Recruitment	Alain	Laederach	NIH National Heart, Lung, and Blood Institute	4-R01-HL111527-05	1/1/12	12/31/16	Non-coding RNA structure change in Chronic Obstructive Pulmonary Disease	$360,062
Recruitment	Alain	Laederach	NIH National Human Genome Research Institute	5-R01-HG008133-01-02	9/1/15	6/30/18	Predicting the causative SNPs in LD blocks by allele-specific structural analysis of the transcriptome	$736,100
Recruitment	Samuel K.	Lai	National Inst. of Health	1-R21-EB017938-02	9/30/14	6/30/16	Prevalence and Characteristics of Anti-PEG Antibodies in Humans	$224,429
Recruitment	Samuel K.	Lai	National Science Foundation	DMR-1151477	4/15/12	3/31/17	Synthetic Nanoprobes Reveal Novel Biophysical Immune Protective Mechanism of Mucus	$79,999
Recruitment	Samuel K.	Lai	David and Lucile Packard Foundation	2013-39274	10/15/13	10/14/18	Harnessing Antibody-mucin Interactions	$174,999
Recruitment	Ethan	Lange	NIH National Heart, Lung, and Blood Institute	5-R21-HL126045-01-02	12/1/14	11/30/17	The interplay between genes and environment on cardiovascular disease phenotypes	$150,915
Innovation	David	Lawrence	NIH National Cancer Institute	1-R01-CA203032-01	2/2/16	1/31/21	Single Cell Sampling of Signaling Activity in Triple Negative Breast Cancer	$466,217
Recruitment	Yueh	Lee	National Inst. of Health	1-R41-NS086295-01A1	6/1/15	5/31/16	STTR: Automated Assessment of Leptomeningeal Collaterals on CT Angiograms	$75,000
Recruitment	Carrie	Lee	Millennium Pharmaceuticals, Inc.	C15010	6/20/13	6/19/16	A Phase 1b, Open-Label, Dose Escalation, Multi-arm Study of MLN4924 Plus Docetaxel, Gemcitabine, or Combination of Carboplatin and Paclitaxel in Patients with Solid Tumors	$121,692
Recruitment	Michael	Lee	American Society of Clinical Oncology	2015YIA LEE	8/1/15	1/31/17	Combination CDK4/6 inhibitor and MEK inhibitor in KRAS mutant metastatic colorectal cancer	$50,000
Recruitment	Yueh	Lee	Kitware, Inc.	K001085-00-S01	6/1/15	5/31/17	STTR: Automated Assessment of Leptomeningeal Collaterals on CT Angiograms	$75,000
Recruitment	Carrie	Lee	Quintiles, Inc	not assigned	12/9/13	12/8/17	A Phase Ib Study of the Safety and Pharmacology of MPDL3280A Administered with Cobimetinib in Patients with Locally Advanced or Metastatic Solid Tumors	$163,093
Recruitment	Stanley	Lemon	NIH National Cancer Institute	4-R01-CA164029-05	5/1/12	3/31/17	Murine Model of HCV-Associated Human Liver Cancer	$470,695

Recruitment	Stanley	Lemon	NIH National Institute of Allergy and Infectious Diseases	4-R01-AI103083-05	9/24/12	8/31/17	Membrane Hijacking: Biogenesis and Fate of Enveloped Hepatovirus	$380,000
Recruitment	Stanley	Lemon	Gilead Sciences, Inc.	16-4945	9/1/16	8/31/18	MOA of Direct-Acting Antivirals Targeting HCV NS5A Protein	$328,010
Recruitment	Stanley	Lemon	NIH National Institute of Allergy and Infectious Diseases	2-R01-AI095690-06	4/15/11	3/31/21	Micro-RNA 122 and Chronic Hepatitis C	$380,000
Recruitment	Zibo	Li	American Cancer Society	MRSG-12-034-01-CCE	6/1/14	12/31/16	Integrin alpha2beta1 Targeted Multimodality Molecular Imaging Probes Integrin alpha2beta1 Targeted Multimodality Molecular Imaging Probes	$73,803
Recruitment	Zibo	Li	NIH National Institute of Biomedical Imaging and Bioengineering	5-R01-EB014354-02-04	9/23/13	6/30/17	The Tetrazine Ligation for Efficient 18F Labeling and Pretargeted Imaging/Radiotherapy of Cancer	$330,463
Retention/Theme Investment	Weili	Lin	NIH National Institute of Mental Health	1-U01-MH110274-01	9/1/16	5/31/20	UNC/UMN Baby Connectome Project	$1,060,130
Theme Investment/Retention	Laura A.	Linnan	Centers for Disease Control	2-R49-CE002479-01	8/1/14	7/31/19	UNC Injury Prevention Research Center	$408,961
Retention	Laura A.	Linnan	Centers for Disease Control	3-U48-DP005017-01S1	9/30/14	9/29/19	SIP 14-030 UNC Coordinating Center of the Worksite Health Research Network - Supplement	$66,177
Retention	Laura A.	Linnan	Centers for Disease Control	Not Assigned	9/30/14	9/29/19	SIP 14-031 UNC Collaborating Center of the Worksite Health Research Network	$149,926
Recruitment	Pengda	Liu	NIH National Cancer Institute	4-R00-CA181342-03	7/1/14	2/28/19	Elucidating a Novel Akt Activation Mechanism for Targeted Prostate Cancer Therapy	$217,518
Retention	P. Kay	Lund	National Inst. of Health	5-RO1-DK40247-22	5/1/89	6/30/16	Intestinal Adaptation: Role of Hormones and Growth Factors	$335,352
Retention	P. Kay	Lund	National Inst. of Health	5-R01-AG041198-04	8/1/12	6/30/17	Aging Intestinal Stem Cells and Insulin/IGF System	$300,013
Theme Investment (CC)	Terry	Magnuson	NIH Office of the Director	5-U42-OD010924-16-17	9/30/99	2/28/20	A Carolina Center to Characterize and Maintain Mutant Mice	$1,339,761
Theme Investment (CC)	Terry	Magnuson	NIH National Institute of General Medical Sciences	2-R01-GM101974-28	12/1/89	3/31/20	Albino Deletion Complex and Early Mouse Development	$409,640
Recruitment/Theme Investment	Benjamin	Major	V Foundation	Not Assigned	12/1/14	11/30/17	Team Science Approach for Defining the Activation State and Dynamic Reprogramming of the Kinome in Aerodigestive Cancer	$200,000
Recruitment	Benjamin	Major	Gabrielle's Angel Foundation for Cancer research	85	6/1/15	5/31/18	Molecular Rationale for WNT Inhibitor Therapy in B-Cell Lymphoma	$75,000
Recruitment	Benjamin	Major	American Cancer Society	RSG-14-068-01-TBE	7/1/14	6/30/18	Mechanisms Controlling KEAP1 Function in Cancer	$178,572
Recruitment	Ben	Major	NIH National Cancer Institute	5-R21-CA178760-01-02	9/1/14	3/31/17	Mass Spectrometry-coupled Hypermorphic Functional Genomics	$164,360
Recruitment	Ben	Major	NIH National Cancer Institute	5-R01-CA187799-01-02	7/1/15	6/30/20	Role of FOXP1 and WNT signaling in B-cell Lymphoma	$307,500
Innovation	Greg	Matera	NIH National Institute of General Medical Sciences	1-R01-GM118636-01	4/1/16	3/31/20	In vivo models of small RNP biogenesis and Spinal Muscular Atrophy	$296,629
Theme Investment (ICISS)	Anne Marie	Meyer	University of Colorado Denver	FY16.804.001	1/5/16	12/31/17	Improving Targeted Colorectal Cancer Screening in the Elderly	$123,503
Recruitment	Edward	Miao	NIH National Institute of Allergy and Infectious Diseases	4-R01-AI097518-05	2/1/12	1/31/17	Inflammasome Response to Bacterial Infection	$401,923
Recruitment	Edward	Miao	NIH National Institute of Allergy and Infectious Diseases	5-R01-AI119073-01-02	5/1/15	4/30/20	Role of caspase-11 in innate immunity	$341,839

Recruitment	Matt	Milowsky	Sloan-Kettering Institute for Cancer Research	C11-092	05/20/13	05/19/16	A Phase 2, Randomized, 3-Arm Study of Abiraterone Acetate Alone, Abiratreone Acetate Plus Degarelix, a GnRH Antagonist, and Degarelix Alone for Patients with Prostate Cancer with a Rising PSA or Rising PSA and Nodal Disease Following Definitive Radical	$12,380
Recruitment	Matt	Milowsky	BIND Biosciences, Inc	BIND-014-004	6/6/13	6/5/16	An Open Label, Multicenter, Phase 2 Study to Determine the Safety and Efficacy of BIND-014- (Docetaxel nanoparticles for Injectable Suspension), Administered to Patients with Metastatic Castration-Resistant Prostate Cancer	$32,764
Recruitment	Matt	Milowsky	Sloan-Kettering Institute for Cancer Research	MSK13-074	11/11/13	10/31/16	Randomized Phase II Trial of Paclitaxel, Ifosfamide, and Cisplatin (TIP) vs. Bleomycin, Etooposide and Cisplatin (BEP) for Patients with Previously Untreated Intermediate - and Poor - Risk Germ Cell Tumors.	$13,500
Recruitment	Matt	Milowsky	Janssen Pharmaceuticals, Inc	Not Assigned	6/26/15	6/26/18	A Phase II Open-label, Parallel Group Study of Abiraterone Acetate Plus Prednisone in African American and Caucasian Men and Metastatic Castrate-resistant Prostate Cancer	$38,051
Recruitment	Matthew	Milowsky	Prostate Cancer Clinical Trials Consortium	not assigned	5/11/15	5/10/17	Phase II open, non-randomized trial assessing pain efficacy with Radium-223 in symptomatic metastatic castration-resistant prostate cancer	$12,225
Recruitment	Matthew	Milowsky	MethylGene, Inc.	not assigned	10/10/14	10/9/17	An Open-Label, Single-Arm, Phase 2 Study of Mocetinostat in Selected Patients with Inactivating Alterations of Acetyltransferase Genes in Previously Treated Locally Advanced or Metastatic Urothelial Carcinoma.	$29,323
Recruitment	Matthew	Milowsky	Merck Sharp and Dohme Corp.	not assigned	12/2/15	12/1/18	Phase II Single Arm Study of Gemcitabine and Cisplatin plus Pembrolizumab as Neoadjuvant Therapy Prior to Radical Cystectomy in Patients with Muscle-Invasive Bladder Cancer	$157,981
Theme Investment (HTS)	Karen	Mohlke	National Inst. of Health	5-R01-DK093757-04	9/5/11	7/31/16	Genetic Epidemiology of Rare and Regulatory Variants for Metabolic Traits	$586,255
Theme Investment (HTS)	Karen	Mohlke	NIH National Institute of Diabetes, Digestive, and Kidney Diseases	5-R01-DK072193-10-11	9/1/05	5/31/19	Targeted Genetic Analysis of T2D and Quantitative Traits	$610,825
Theme Investment (HTS)	Karen	Mohlke	NIH National Institute of Diabetes, Digestive, and Kidney Diseases	5-U01-DK105561-01-02	5/1/15	4/30/20	Functional genetic variants for type 2 diabetes	$426,659
Recruitment	Cary	Moody	American Cancer Society	RSG-13-229-01-MPC	7/1/13	6/30/17	The Role of ATM Signaling in the Life Cycle of Human Papillomaviruses	$167,651
Recruitment	Cary	Moody	NIH National Cancer Institute	5-R01-CA181581-01-03	9/11/14	8/31/19	Regulation of Human Papillomavirus Replication by the DNA Damage Response	$315,400
Recruitment	Nathaniel	Moorman	NIH National Institute of Allergy and Infectious Diseases	4-R01-AI103311-04	12/1/12	11/30/17	The role of host and viral translation factors during HCMV infection	$444,704
Recruitment	Nathaniel	Moorman	NIH National Institute of Allergy and Infectious Diseases	1-R21-AI123811-01	2/1/16	1/31/18	Hybrid Sequencing to Define the Full-Length Transcriptome of Double Stranded DNA Viruses	$225,672
Recruitment	Stergios	Moschos	NIH National Cancer Institute	3-P30-CA016086-38S3	9/1/14	8/31/16	Cancer Center Core Support Grant - Team Leadership Award (CCITLA) - Supplement	$76,000

Recruitment	Stergios	Moschos	Merck Sharp and Dohme	not assigned	2/15/13	2/14/17	MK-3475-002-29 Randomized, Phase II Study of MK-3475 versus Chemotherapy in Patients with Advanced Melanoma	$12,539
Recruitment	Stergios	Moschos	GlaxoSmithKline (GSK), Inc.	not assigned	4/28/14	4/27/17	A Phase II, Open-Label, Multicentre Study of Dabrafenib plus Trametinib in Subjects with BRAF Mutation-Positive Melanoma that has Metastasized to the Brain	$21,160
Recruitment	Stergios	Moschos	Bristol-Myers Squibb Company	not assigned	4/17/15	4/16/18	Multi-Center Phase 2 Open-Label Study to Evaluate Safety and Efficacy in Subjects with Melanoma Metastatic to the Brain treated with Nivolumab in Combination with Ipilimumab followed by Nivolumab Monotherapy	$25,358
Recruitment	Stergios	Moschos	Amgen Pharmaceuticals	not assigned	4/21/15	4/20/18	A Phase 1b/2 Study Evaluation of the Safety, Tolerability, Pharmacokinetics, Pharmacodynamics and Efficacy of AMG 232 Combined with Trametinib and Dabrafenib or Trametinib in Adult Subjects with Metastatic Cutaneous Melanoma	$140,000
Recruitment	Hy	Muss	Mayo Clinic	not assigned	4/8/15	4/7/17	Adjuvant Ado-Trastuzumab Emtansine (TDM-1) for Older Patients with Human Epidermal Growth Factor Receptor 2 (HER2)-Positive Breast Cancer	$7,500
Recruitment	Hyman	Muss	City of Hope National Medical Center	23030.1914940.669304	8/15/11	4/30/17	Clinical and Biological Predictors of Chemotherapy Toxicity in Older Adults with Cancer	$30,075
Recruitment	Hyman	Muss	Kay Yow Cancer Foundation	Not Assigned	5/1/14	2/28/18	Impact of Physical Activity on Biomarkers of Aging and Body Composition Among Breast Cancer Survivors Age 65 and Older	$249,978
Recruitment	Hazel (June)	Nichols	The Avon Breast Health Access Fund	02-2014-080	1/1/15	12/31/16	MicroRNA & Breast Cancer: Functional Characterization in a Population-Based Study	$200,000
Recruitment	Wanda	Nicholson	Agency for Healthcare Research and Quality	1-P50-HS023418-01	9/1/14	8/31/19	Comparing Options for Management: Patient-Centered Results in Uterine Fibroids (COMPARE-UF)	$336,419
Recruitment	Wanda	Nicholson	Johns Hopkins University	2605	3/1/16	8/31/17	Defining a patient-centered research and health agenda for women with diabetes using the DSNet	$50,119
Recruitment	Matthew	Nielsen	Kaiser Foundation Research Institute	OOS030047-UNC	1/1/15	12/31/16	Optimizing Risk Stratification To Manage Early Stage Bladder Cancer	$34,311
Recruitment	Seth	Noar	NIH National Institute on Drug Abuse	1-R03-DA041869-01	4/1/16	3/31/18	Systematic Review of Perceived Message Effectiveness Measures for Anti-Tobacco Communication	$111,300
Theme Investment (HTS)	Andrew	Nobel	North Carolina State University	2014-0236-01	8/15/13	6/30/17	Systems Approaches to link tissue-specific expression to disease	$151,031
Innovation	Amy	Oldenburg	NIH National Heart, Lung, and Blood Institute	5-R01-HL123557-01-02	9/1/15	8/31/18	Anatomic optical coherence tomography for quantitative bronchoscopy	$662,948
Theme Investment (HTS)	Andrew	Olshan	National Inst. of Health	5-RO1-DE023414-02	8/1/14	7/31/19	Exome Sequencing for Head and Neck Cancer Susceptibility Genes	$12,308
Theme Investment (CBCS)	Andrew	Olshan	Vanderbilt University Medical Center	VUMC 58928	1/1/16	6/30/17	Breast Cancer Genetic Study in African-Ancestry Populations	$14,518
Theme Investment (CBCS)	Andrew	Olshan	SUNY Buffalo Roswell Park Cancer Institute	76-01	8/1/15	7/31/17	Epidemiology of Breast Cancer Subtypes in African-American Women: a Consortium	$656,534
Theme Investment (CC)	Fernando	Pardo Manuel de Villena	NIH National Institute of Mental Health	5-F30-MH103925-03	9/8/14	9/7/18	FELLOW:MORGAN, ANDREW Effects of advanced paternal age on germline genome stability	$41,981

Theme Investment (CC)	Fernando	Pardo-Manuel de	National Inst. of Health	1-F30-MH103925-01A1	9/8/14	9/7/18	Effects of Advanced Paternal Age on Germine Genome Stability	$33,035
Recruitment	Steven	Park	American Cancer Society	MRSG-14-215-01-TBG	1/1/15	12/31/19	Combined Targeting of Myc-associated Pathways for Treatment of Lymphoma	$145,500
Recruitment	Steven	Park	Seattle Genetics, Inc	not assigned	4/26/12	4/25/17	LCCC 1115 A pilot feasibility tiral of induction chemotherapy with ABVD followed by brentuximab vedotin (SGN-35) consolidation in patients with previously untreated non-bulky stage I or II hodgkin lymphoma (HL)	$75,000
Recruitment	Steven	Park	Quintiles, Inc	not assigned	11/17/14	5/15/17	A Phase Ib Study of the Safety and Pharmacology of MPDL3280A Administered with Obinutuzumab in Patients with Relapsed/Refractory Follicular Lymphoma and Diffuse Large B-Cell Lymphoma	$40,363
Recruitment	Steven	Park	Molecular Templates, Inc.	not assigned	11/23/15	11/22/18	Pharmacokinetics, Pharmacodynamics, Safety and Tolerability of Multiple Dose Regimens of MT-3724 for the Treatment of Patients with Relapsed non-Hodgkin's B-Cell Lymphoma	$18,920
Recruitment	Kenneth	Pearce	NIH National Institute of Diabetes, Digestive, and Kidney Diseases	5-R01-DK101645-01-02	7/1/15	4/30/18	High Throughput Screening Assay for IP7K inositol pyrophosphate kinases	$342,000
Recruitment	Chad	Pecot	V Foundation	Not Assigned	11/1/14	10/31/16	Tumor Angiogenesis Regulation by the miR-200 Family	$99,786
Recruitment	Chad	Pecot	American Cancer Society	MRSG-14-222-01-RMC	1/1/15	12/31/19	Tumor Angiogenesis Regulation by the miR-200 Family	$145,774
Recruitment	Chad	Pecot	Lung Cancer Initiative of North Carolina	not assigned	5/1/16	4/30/17	FELLOW:SANGGYU BAE Carolina Lung Cancer Network	$25,000
Recruitment	Chad	Pecot	Lung Cancer Research Foundation	not assigned	11/1/16	10/31/18	Targeting Lung Squamous Metastasis with CCR2 Inhibitors	$150,000
Theme Invest (HTS)	Mark	Peifer	National Inst. of Health	5-R01-GM067236-11	9/1/08	7/31/16	A Model System to Study the Tumor Suppressor APC	$255,910
Theme Investment (HTS, CBCS)	Charles	Perou	Breast Cancer Research Foundation	BCRF-16-122	10/1/16	9/30/17	Molecular Therapeutics for Luminal Tumor Subtypes	$250,000
Theme Investment (HTS, CBCS)	Charles	Perou	V Foundation for Cancer Research	D2016-008	5/15/16	5/15/18	Sequencing the RNA genome for clinical use	$250,000
Theme Investment (HTS, CBCS, MP1U)	Charles	Perou	NIH National Cancer Institute	5-R01-CA195740-01-02	6/1/15	5/31/18	Credentialing Mouse Models for Immune System Therapy Research	$581,304
Theme Investment (HTS, CBCS, MP1U)	Charles	Perou	NIH National Cancer Institute	5-R01-CA195754-01-02	8/1/15	7/31/18	Mouse Models of Metastatic Triple-Negative Breast Cancer for Therapeutic Testing	$572,521
Theme Investment (HTS, CBCS)	Charles	Perou	Susan G Komen for the Cure	SAC160074	7/15/16	7/14/19	Identification of the Genetic Drivers of HER2-Enriched Subtype Breast Cancers	$600,000
Theme Investment (HTS, CBCS, MP1U)	Charles	Perou	NIH National Cancer Institute	5-R01-CA148761-06-07	3/17/10	8/31/20	Therapeutic Targeting of Breast Cancer Tumor Initiating Cells	$393,933
Retention	Ben	Philpot	NIH National Institute of Mental Health	4-R01-MH093372-05	12/9/11	11/30/16	Epigenetic Regulation of Ube3a as a Treatment for Angelman Syndrome	$591,194
Retention	Ben	Philpot	NIH National Institute of Neurological Disorders and Stroke	5-R01-NS085093-01-03	2/1/14	1/31/18	Role of UBE3A in the Central Nervous System	$321,269
Recruitment	Gianmarco	Pinton	NIH National Institute of Neurological Disorders and Stroke	5-R01-NS091195-01-02	4/1/15	3/31/20	Shear shock wave propagation in the brain: high frame-rate ultrasound imaging, characterization, and simulations	$313,623
Recruitment	Cynthia	Powell	NIH National Institute of Child Health and Human Development	3-U19-HD077632-03S1	9/5/13	8/31/18	NC NEXUS, North Carolina Newborn Exome Sequencing for Universal Screening	$78,748

Recruitment	Wizdom	Powell	Robert Wood Johnson Foundation	73921	9/1/16	8/31/21	2016 Health Policy Research Scholars	$120,000
Theme Invest (HTS)	Jan	Prins	National Inst. of Health	1-R01-HG006272-03	7/1/12	6/30/16	Unlocking Transcript Diversity via Differential Analyses of Splice Graphs	$403,681
Recruitment	Jeremy	Purvis	National Inst. of Health	3-ROO-GM120372-04	9/1/12	8/31/16	Dynamics of Cellular Senescence in Single Human Cells	$279,873
Recruitment	Jeremy	Purvis	NIH National Heart, Lung, and Blood Institute	1-F31-HL134336-01A1	9/1/16	8/31/19	FELLOW:R HAGGERTY Single-cell dynamics of the OCT4-GATA6 axis in human lung progenitors	$31,643
Recruitment	Jeremy	Purvis	NIH National Institute of Child Health and Human Development	1-DP2-HD091800-01	9/30/16	6/30/21	Controlling Stem Cell Fate through Computational Modeling	$350,000
Recruitment	Yuliya	Pylayeva-Gupta	American Association for Cancer Research	13-70-25-PYLA	1/1/15	6/30/18	Immunomodulatory mechanisms in Kras-driven pancreatic cancer and metastasis	$11,926
Retention	John	Ramsey	US Defense Advanced Research Project Agency	HR0011-12-2-0001	11/7/11	11/5/16	Reconfigurable Multi element Diagnostic ReMeDx	$5,342,757
Retention	J	Ramsey	908 Devices, Inc	UNC-0014	4/7/15	4/6/17	Ultracompact GC - High Pressure MuMS System	$1,532,824
Retention	J	Ramsey	NIH National Human Genome Research Institute	4-R01-HG007407-04	8/1/16	7/31/17	Nanofluidic Platforms for High Resolution Mapping of Genomic DNA	$509,472
Theme Invest (HTS)	Scott H.	Randell	National Inst. of Health	5-UO1-HL111018-03	1/1/12	12/31/16	An Integrated Approach to Airway Epithelial Repair and Regeneration	$214,600
Innovation Award	Matthew	Redinbo	NIH National Cancer Institute	1-R01-CA207416-01	8/1/16	7/31/19	Microbiome-Targeted Probes to Eliminate Chemotherapy-Induced GI Toxicity	$552,404
Innovation Award	Matthew	Redinbo	NIH National Cancer Institute	5-R01-CA098468-11-13	9/23/14	8/31/19	Improving CPT-11 Efficacy Using Structural and Chemical Biology	$263,899
Recruitment	Katie	Reeder-Hayes	American Society of Clinical Oncology	not assigned	7/1/15	6/30/18	Effects of Breast Cancer Gene Expression Profiling on Treatment Disparities, Chemotherapy Utilization And Disease Outcomes	$50,000
Recruitment	Katie	Reeder-Hayes	Susan G Komen for the Cure	CCR15333140	11/3/15	11/2/18	Molecular, Treatment and Behavioral Factors in Breast Cancer Race Disparities	$150,000
Recruitment	Bryce	Reeve	NIH National Cancer Institute	5-RO1-CA174453-04	9/1/12	7/31/16	PROMIS Validation in Prospective Population-Based Prostate Cancer Research Study	$280,122
Recruitment	Bryce	Reeve	NIH National Cancer Institute	5-RO1-CA174453-03	8/1/14	7/31/16	PROMIS Validation in Prospective Population-based Prostate Cancer Research Study - Supplement	$150,000
Recruitment	Bryce	Reeve	Patient-Centered Outcomes Research Institute	ME-1303-5838	10/1/13	11/30/16	Measuring Patient-Centered Communication for Colorectal Cancer Care and Research	$125,055
Recruitment	Bryce	Reeve	NIH National Cancer Institute	3-R01-CA174453-04S1	9/21/12	7/31/17	Using PROMIS as part of routine clinical care for racially diverse prostate and bladder cancer patients	$150,000
Recruitment	Bryce	Reeve	NIH National Cancer Institute	4-R01-CA175759-04	4/1/13	3/31/19	Creating and Validating Child Adverse Event Reporting in Oncology Trials	$64,858
Recruitment	Bryce	Reeve	NIH National Institute of Arthritis and Musculoskeletal and Skin Diseases	1-U19-AR069522-01	9/30/15	9/29/19	Enhancing Clinical Meaningfulness And Usefulness Of PROMIS Pediatric Measures Via Validation In Children And Adolescents With Rheumatic Disease, Cancer, Or Inflammatory Bowel Disease	$2,936,800
Recruitment	Kurt	Ribisl	NIH National Cancer Institute	5-P50-CA180907-01-03	9/19/13	8/31/18	Effective Communication on Tobacco Product Risk and FDA Authority	$3,971,060
Recruitment	Christine	Rini	National Inst. of Health	5-P60-AR064166-03	7/19/13	6/30/18	NIAMS Multidisciplinary Clinical Research Center	$214,263
Recruitment	Whitney	Robinson	NIH National Cancer Institute	4-K01-CA172717-05	9/11/12	8/31/17	Racial disparities in cancer outcomes: quantifying modifiable mechanisms	$128,245
Innovation	Julian	Rosenman	NIH National Cancer Institute	4-R01-CA158925-04	4/1/13	3/31/18	Integration of Endoscopic and CT data for Radiation Therapy Treatment Planning	$306,421

Recruitment	Donald	Rosenstein	Susan G. Komen Foundation	CGA-2014-NC101-UNCL69-000	4/1/14	6/30/16	TLC-UNC: Transforming Lymphedema Care for Underserved North Carolinians	$50,000
Recruitment	Donald	Rosenstein	Duke Endowment Foundation	6513-SP	1/1/15	12/31/17	Improving Cancer Survivorship Care Across North Carolina: Training Group Intervention Leaders	$193,009
Recruitment	Hanna	Sanoff	Bayer	LCCC 1029	12/6/10	8/31/16	Randomized Phase II Study of Regorafenib in Combination with FOLFIRI (Irinotecan, r-Fluoracil, and Leucovorin) versus Placebo in Combination with FOLFIRI as Second Line Therapy in Patients with KRAS or BRAF Mutant Metastatic Colorectal Cancer	$300,000
Recruitment	Hanna	Sanoff	NIH National Cancer Institute	5-KO7-CA160722-05	9/1/12	8/31/16	Use and Comparative Effectiveness of Innovative Therapies for Hepatoellular Carcinoma	$170,100
Recruitment	Hanna	Sanoff	H. Lee Moffitt Cancer Center and Research Institute	MCC 17651	6/1/15	6/1/18	Multi Institutional Phase II Trial of Single Agent Regorafenib in Refractory Advanced Biliary Cancers	$200,000
Recruitment	Hanna	Sanoff	Merck Sharp and Dohme	not assigned	6/1/15	5/31/18	A Phase II Clinical Trial of Pembrolizumab as Monotherapy and in Combination with Cisplatin+5-Fluorouracil in Subjects with Recurrent or Metastatic Gastric or Gastroesophageal Junction Adenocarcinoma	$46,081
Recruitment	Barbara	Savoldo	NIH National Heart, Lung, and Blood Institute	5-R01-HL114564-03-04	9/1/13	6/30/18	Enhancement of stem cell transplants using CAR.CD30-redirected T lymphocytes	$447,090
Recruitment	Barbara	Savoldo	Hyundai Hope on Wheels	not assigned	9/26/16	12/31/18	New generation Chimeric Antigen Receptor (CAR)-based cell therapy for Neuroblastoma	$250,000
Retention	Mark	Schoenfisch	NIH National Institute of Allergy and Infectious Diseases	5-R21-AI112029-01-02	12/1/14	11/30/16	Nitric oxide-releasing cystic fibrosis therapeutics	$185,401
Retention	Mark	Schoenfisch	KNOW Bio, LLC	not assigned	5/1/16	4/30/17	IN VIVO ASSESSMENT OF BIODEGRADABLE NITRIC OXIDE-RELEASE SCAFFOLDS AS MONOTHERAPEUTICS FOR CYSTIC FIBROSIS	$515,977
Retention	Mark	Schoenfisch	Clinical Sensors, Inc	1R41AI112064-01	8/18/14	6/30/17	STTR: Nitric oxide microfluidic sensor	$61,631
Retention	Mark	Schoenfisch	NIH National Institute of Diabetes, Digestive, and Kidney Diseases	1-R01-DK108318-01	12/1/15	11/30/19	Role of diabetes and nitric oxide release duration on analytical performance of in vivo glucose biosensors	$476,433
Retention	Mark	Schoenfisch	NIH National Institute of Dental and Craniofacial Research	5-R01-DE025207-01-02	7/2/15	4/30/20	Nitric oxide-releasing dendrimers for the treatment of periodontal disease	$301,256
Innovation	Jeff	Sekelsky	NIH National Institute of General Medical Sciences	1-R35-GM118127-01	6/1/16	5/31/21	Mechanisms of meiotic and mitotic recombination	$494,831
Retention	Jonathan S.	Serody	National Inst. of Health	5-R01-HL115761-04	6/1/12	5/31/16	Targeting CCR7 for the Prevention/Treatment of GvHD	$364,450
Retention	Jonathan	Serody	NIH National Cancer Institute	4-R01-CA166794-05	5/9/12	3/31/17	Th1/Th17 Macrophage Interactions in Cutaneous GVHD	$309,342
Retention	Jonathan	Serody	GlaxoSmithKline Biologicals S.A.	456153	12/1/15	12/31/17	GSK Task Order 9	$83,866
Retention	Jonathan	Serody	GlaxoSmithKline Biologicals S.A.	456005	12/1/15	12/31/22	GSK Task Order 8	$64,996
Recruitment	Praveen	Sethupathy	Fibrolamellar Cancer Foundation	not assigned	9/8/15	9/7/17	Discovery of RNA biomarkers of fibrolamellar carcinoma	$100,000
Recruitment	Praveen	Sethupathy	NIH National Institute of Diabetes, Digestive, and Kidney Diseases	5-F31-DK105747-02	7/1/15	6/30/18	FELLOW:BAILEY PECK Whole transcriptome analysis of distinct populations of the intestinal epithelium and its response to microbial presence	$31,321
Recruitment	Praveen	Sethupathy	NIH National Institute of Diabetes, Digestive, and Kidney Diseases	1-R01-DK105965-01A1	12/1/15	11/30/19	Molecular and biological functions of miR-29 in lipid homeostasis	$342,000
Recruitment	Praveen	Sethupathy	American Diabetes Association	1-16-ACE-47	1/1/16	12/31/20	Systems approach to defining genetic regulation of intestinal physiology and gut microbiota in diet-induced obesity	$324,991

Retention	Nicholas	Shaheen	BARRX	Not Assigned	3/3/06	7/1/16	Ablation of Intestinal Metaplasia Containing Dysplasia (AIM Dysplasia Trial) Multi-Center, Randomized, Sham-Controlled Trial	$41,109
Retention	Nicholas	Shaheen	CSA Medical, Inc	Not Assigned	8/1/13	7/31/16	Database Maintenance for the US Spray Cryotherapy Patient Registry	$91,235
Retention	Nicholas	Shaheen	NIH National Cancer Institute	RS506502	9/1/11	8/31/16	Barrett's Esophagus Translational Research Network (BETRNet)	$38,162
Retention	Nicholas	Shaheen	RedPath Integrated Pathology	RG 0004 BE 19	12/15/14	12/14/17	RedPath Effort Agreement	$54,005
Retention	Nicholas	Shaheen	CSA Medical, Inc	Not Assigned	3/21/13	3/31/19	A #003 truFreeze Spray Cryotherapy Patient Registry	$76,160
Retention	Nicholas	Shaheen	CSA Medical, Inc.	not assigned	3/15/13	3/14/17	A Dose-Optimization Study for the Initial Treatment of Dysplastic Barrett's Esophagus with TruFreeze Spray Cryotherapy ("Dose" Trial)	$73,659
Retention	Nicholas	Shaheen	Takeda Pharmaceutical Company, Ltd.	not assigned	5/28/14	5/27/17	A Randomized, Double-Blind, Phase 4 Study to Evaluate the Effect of Dexlansoprazole 60 mg QD and 60 mg BID on Recurrence of Intestinal Metaplasia in Subjects who have achieved Complete Eradication of Barrett's Esophagus with Radiofrequency Ablation	$25,955
Retention	Nicholas	Shaheen	Covidien	not assigned	8/17/09	6/30/17	B500 HALO Patient Registry Ablation of Barrett's Esophagus	$84,842
Retention	Nicholas	Shaheen	CDx Diagnostics	not assigned	3/21/14	8/31/17	Wide Area Transepithelial Sample Esophageal Biopsy combined with computer assisted 3-dimensional analysis (WATS) For the Detection of Esophageal Dysplasia: A Prospective, Randomized, Tandem Study	$20,884
Retention	Nicholas	Shaheen	NIH National Institute of Diabetes, Digestive, and Kidney Diseases	4-K24-DK100548-04	9/17/13	8/31/18	Non-Endoscopic Surveillance for Barrett's Esophagus Following Ablative Therapy	$180,183
Retention	Nicholas	Shaheen	C2 Therapeutics	C2T1	8/25/16	6/30/19	C2 Services Agreement	$79,677
Retention	Nicholas	Shaheen	Covidien	not assigned	7/23/15	7/22/19	Assessment of a Minimally Invasive Esophageal Cytology Collection System inPatients with Barrett's Esophagus or GERD Symptoms (B-271/CASE-II)	$86,847
Retention	Nicholas	Shaheen	National Institute of Diabetes, Digestive and Kidney Diseases	2-T35-DK007386-36	5/1/80	2/28/21	Short Term Research Training	$140,727
Retention	Nicholas	Shaheen	Covidien	not assigned	12/5/15	12/4/21	Medtronic ISR for Non-Endoscopic Surveillance for Barrett's Esophagus Following Ablative Therapy	$46,449
Retention	Ned	Sharpless	NIH National Cancer Institute	4-R01-CA163896-05	4/16/12	3/31/17	In vivo murine models of metastasis for therapeutic testing	$400,209
Retention	Ned	Sharpless	NIH National Cancer Institute	4-K12-CA120780-10	7/1/06	8/31/17	UNC Oncology Clinical Translational Research Training Program	$494,054
Retention	Norman	Sharpless	NIH National Institute on Aging	5-F32-AG050399-02	4/1/15	3/31/18	FELLOW:B DIEKMAN Defining the role of cellular senescence in osteoarthritis	$58,002
Retention	Norman	Sharpless	NIH National Cancer Institute	5-R01-CA185353-01-03	6/1/14	5/31/18	(PQD5) Predicting Anti-Cancer Efficacy through Tumor Profiling	$405,890
Retention	Norman	Sharpless	NIH National Institute on Aging	5-R01-AG024379-11-12	8/15/04	3/31/20	The Role of p16INK4a in Mammalian Aging	$335,160
Retention	Norman	Sharpless	NIH National Cancer Institute	1-R01-CA203023-01	1/12/16	12/31/20	Biomarkers of Molecular Age to Predict the Toxicity of Cancer Chemotherapy	$572,222

Theme Investment (Protocol)	Thomas	Shea	GlaxoSmithKline (GSK), Inc.	not assigned	1/28/13	6/30/18	115523 (ZOSTER-2) A phase III, randomized, observer-blind, placebo-controlled, multicenter, clinical trial to assess the prophylactic efficacy, safety, and immunogenicity of GSK Biologicals? herpes zoster gE/AS01B candidate vaccine when administered intramuscularly on a two-dose schedule to adult autologous haematopoietic stem cell transplant (HCT) recipients	$38,846
Recruitment	Dinggang	Shen	National Inst. of Health	5-R01-EB009634-04	9/1/11	8/31/16	Fast, Robust Analysis of Large Population Data	$323,010
Recruitment	Dinggang	Shen	The Methodist Hospital Research Institute	22000007-133	2/1/16	1/31/17	Novel CBCT analysis tools to improve the care of patients with CMF deformities	$243,619
Recruitment	Dinggang	Shen	NIH National Institute of Mental Health	4-R01-MH100217-04	8/26/13	5/31/17	Infant Brain Measurement and Super-Resolution Atlas Construction	$506,315
Recruitment	Dinggang	Shen	NIH National Institute of Biomedical Imaging and Bioengineering	5-R01-EB006733-04-07	12/1/06	8/31/17	Development and Dissemination of Robust Brain MRI Measurement Tools	$497,189
Recruitment	Dinggang	Shen	NIH National Institute of Biomedical Imaging and Bioengineering	5-R01-EB008374-05-06	4/1/08	1/31/19	4D Software Tools for Longitudinal Prediction of Brain Disease	$451,650
Recruitment	Dinggang	Shen	NIH National Institute of Biomedical Imaging and Bioengineering	1-R01-EB022880-01	9/30/16	6/30/19	Diagnosis of Alzheimer's Disease Using Dynamic High-Order Brain Networks	$380,000
Recruitment	Dinggang	Shen	NIH National Institute on Aging	5-R01-AG041721-04-05	4/1/12	3/31/20	Quantifying Brain Abnormality by Multimodality Neuroimage Analysis	$350,863
Recruitment	Dinggang	Shen	NIH National Cancer Institute	1-R01-CA206100-01A1	9/1/16	7/31/21	Automatic Pelvic Organ Delineation in Prostate Cancer Treatment	$347,254
Recruitment	Yen-Yu	Shih	American Heart Association	15SDG23260025	1/1/15	12/31/18	Dynamic MRI of tPA-induced peri-infract spreading depolarizations: outcome correlates and potential therapy	$77,000
Recruitment	Yen-Yu	Shih	NIH National Institute of Neurological Disorders and Stroke	5-R01-NS091236-01-02	5/15/15	4/30/20	Functional dissection of therapeutic deep brain stimulation circuitry	$389,880
Recruitment	Yen-yu	Shih	NIH National Institute of Mental Health	1-R01-MH111429-01	9/13/16	6/30/21	Chemogenetic Dissection of Neuronal and Astrocytic Compartment of the BOLD Signal	$528,745
Recruitment	Angie	Smith	Agency for Healthcare Research and Quality (AHRQ)	1-K08-HS024134-01A1	4/1/16	3/31/19	Developing an Interactive, Patient-Centered mHealth Tool to Enhance Post-Cystectomy Care	$155,064
Recruitment	Jennifer	Smith	NIH National Cancer Institute	5-R01-CA183891-01-02	4/9/15	3/31/20	Effect of HPV Self-Collection on Cervical Cancer Screening in High Risk Women	$614,804
Innovation	John	Sondek	NIH National Institute of General Medical Sciences	1-R01-GM120291-01	9/15/16	7/31/20	Inhibition of GTPases and G proteins to treat human disease	$358,307
Retention	Thomas	Stinchcombe	Ariad Pharmaceuticals, Inc.	not assigned	7/22/14	7/21/17	A Randomized Phase 2, Study of AP26113 in Patients with ALK-positive Non-Small Cell Lung Cancer (NSCLC) Previously Treated with Crizotinib	$16,763
Retention	Thomas	Stinchcombe	Bristol-Myers Squibb Company	not assigned	8/7/14	8/6/17	An Open-Label, Randomized Phase 3 Trial of Nivolumab versus Investigator's Choice Chemotherapy as First-Line Therapy for Stage IIIB/IV or Recurrent Non-Small Cell Lung Cancer (NSLC)	$89,019
Retention	Thomas	Stinchcombe	Threshold Pharmaceuticals	not assigned	11/4/15	11/3/17	A Phase 2 Study of TH-4000 in Patients with EGFR-Mutant, T790M-Negative, Advanced Non-Small Cell Lung Cancer Progressing on an EGFR Tyrosine Kinase Inhibitor	$70,000

Retention	Thomas	Stinchcombe	EMD Serono, Inc.	not assigned	3/7/14	3/6/18	A Phase I, open-label, multiple-ascending dose trial to investigate the safety, tolerability, pharmacokinetics, biological and clinical activity of MSB0010718C in subjects with metastatic or locally advanced solid tumors and expansion to selected indications.	$63,690
Retention	Thomas	Stinchcombe	Alliance Foundation Trials, LLC (AFT)	not assigned	4/14/15	4/13/18	A Phase I Dose Escalation and Phase 2 Randomized, Placebo-Controlled Study of the Efficacy and tolerability of Veliparib in Combination with Paclitaxel/Carboplatin-Based Chemoradiotherapy Followed by Veliparib and Paclitaxel/Carboplatin Consolidation in Subjects with Stage III Non-Small Cell Lung Cancer (NSCLC)	$21,816
Innovation	Brian	Strahl	NIH National Institute of General Medical Sciences	5-R01-GM110058-01-03	6/1/14	2/28/18	Factors that regulate chromatin organization and gene transcription	$286,204
Innovation	Til	Stürmer	NIH National Institute on Aging	2-R56-AG023178-11A1	12/1/03	2/28/17	Propensity Scores and Preventive Drug Use in the Elderly (R01 AG023178)	$411,862
Innovation	Til	Stürmer	NIH National Institute of Mental Health	1-F31-MH107085-01A1	1/1/16	12/31/17	FELLOW:BUSHNELL, G Pediatric anxiety: Pharmacotherapy and psychotherapy utilization and serious adverse outcomes	$34,281
Retention	Lishan	Su	National Inst. of Health	5-R01-DK098079-03	9/1/13	8/31/16	HIV-Hepatitis C Virus Interactions and Pathogenesis	$92,282
Innovation Award	Lishan	Su	National Inst. of Health	5-R01-AI095097-04	12/1/11	11/30/16	HIV Co-Infection and HCV-induced Liver Fibrosis in vivo	$370,000
Recruitment	Maureen	Su	National Inst. of Health	3-RO1-NS079683-02S1	6/1/14	5/31/17	Autoimmune Mechanism in a Novel Aire-Deficient Model of Peripheral Neuropathy - Supplement	$61,292
Retention	Lishan	Su	NIH National Institute of Diabetes, Digestive, and Kidney Diseases	4-R01-DK095962-04	7/15/13	4/30/17	Novel Therapeutic Approaches to Treating Chronic Hepatitis B Virus Infection	$486,852
Recruitment	Maureen	Su	NIH National Institute of Neurological Disorders and Stroke	4-R01-NS079683-04	6/1/13	5/31/18	Autoimmune Mechanisms in a Novel Aire-deficient Model of Peripheral Neuropathy	$333,561
Recruitment	Maureen	Su	DOD DA Army Medical Research Acquisition Activity	W81XWH-15-1-0411	8/15/15	8/14/18	Central Tolerance Blockade to Augment Checkpoint Immunotherapy in Melanoma	$200,000
Theme Investment (HTS)	Patrick	Sullivan	National Inst. of Health	2-R21-MH102814-02	7/1/14	6/30/16	The Schizophrenia Candidate Gene MIR137: functional Studies in Mouse	$190,000
Theme Investment (HTS)	Patrick	Sullivan	NIH National Institute of Mental Health	5-R01-MH077139-07-08	4/1/06	4/30/19	1/2 A Large-Scale Schizophrenia Association Study in Sweden	$985,429
Theme Investment (HTS)	Patrick	Sullivan	NIH National Institute of Mental Health	1-U01-MH109528-01	4/1/16	3/31/21	1/7 Psychiatric Genomics Consortium: Finding actionable variation	$478,788
Theme Investment (HTS)	Patrick	Sullivan	Karolinska Institute	ZZC8ANALMQ	11/1/15	12/31/24	An International Effort to Advance Knowledge of Schizophrenia	$1,240,214
Theme Investment (HTS)	Ronald	Swanstrom	NIH National Institute of Allergy and Infectious Diseases	2-R56-AI044667-15A1	9/1/16	8/31/17	Biological Properties of HIV-1 V3 Evolutionary Variants	$396,000
Theme Investment (CC)	Lisa	Tarantino	National Inst. of Health	5-RO1-MH100241-03	4/19/13	3/31/18	Role of Maternal diet and Allelic Imbalance in Behavior	$536,322
Innovation	Nancy	Thomas	NIH National Cancer Institute	5-R03-CA199487-01-02	7/1/15	6/30/17	TERT Promoter Mutation as a Melanoma Biomarker	$76,000
Retention	Jenny P.-Y.	Ting	Multiple Sclerosis Society	CA10068	4/1/14	3/31/19	Preclinical Therapeutic Development for Multiple Sclerosis	$181,500
Retention	Jenny P.-Y.	Ting	National Inst. of Health	2-U19-AI067798-11	8/1/15	7/31/20	Innate Immune Pathways that Mitigate Delayed Radiation-Induced Damage	$346,900
Retention	Jenny	Ting	Duke University Medical Center	2034588	8/1/10	7/31/17	Inflammation and Radiation-Induced Lung Injury	$346,900

Retention	Jenny	Ting	Duke University	2035707	8/17/16	7/31/17	Testing of TLR Radiomitigator in Nonhuman Primates - Administrative Supplements to Existing NIH Grants	$273,256
Retention	Jenny	Ting	NIH National Institute of Allergy and Infectious Diseases	4-R37-AI029564-24	7/1/91	3/31/18	Plexin-A1: Regulation by CIITA and Immunologic Function	$409,284
Retention	Jenny	Ting	NIH National Institute of Allergy and Infectious Diseases	5-U19-AI109965-01-03	3/1/14	2/28/19	Discovery of New Innate Immune Pathways in Viral Recognition	$2,863,677
Retention	Jenny	Ting	NIH National Institute of Allergy and Infectious Diseases	5-U19-AI109784-01-03	7/1/14	6/30/19	Novel Nanoparticle Platform for the Delivery of Vaccines and Adjuvants	$4,178,026
Retention	Jenny	Ting	NIH National Institute of Allergy and Infectious Diseases	2-T32-AI007273-31	7/1/84	8/31/21	Basic Immune Mechanisms	$370,388
Recruitment	Melissa	Troester	NIH National Cancer Institute	5-R21-CA175783-02	9/1/13	8/31/16	HGF Signaling in African-American and Basal-like Breast Cancer	$151,040
Recruitment	Melissa	Troester	NIH National Cancer Institute	5-F31-CA200336-02	9/15/15	9/14/17	FELLOW:E BUTLER Smoking as a Proxy for Nicotine Exposure and Risk of EGFR Positive Breast Cancer	$34,449
Recruitment	Melissa	Troester	NIH National Cancer Institute	5-U01-CA179715-01-03	6/1/14	5/31/19	Biology of Race and Progression Associated Breast Tumor Gene Expression	$313,159
Recruitment	Melissa	Troester	Susan G Komen for the Cure	GTDR16381071	8/5/16	8/4/19	Breast Cancer Mortality Disparities: Integrating Biology and Access	$405,000
Recruitment	Justin	Trogdon	Centers for Disease Control	15IPA1504755	7/1/15	6/30/16	Justin Trogdon IPA to CDC 070115 through 063016	$35,180
Recruitment	Justin	Trogdon	Centers for Disease Control (Subcontract with Research Triangle Institute)		6/9/15	9/30/16	The Medical Costs Attributable to Breast Cancer for Younger Women	$24,311
Recruitment	Justin	Trogdon	Merck Co., Inc.	PO#8101627613	12/14/15	11/30/16	Impact of Introduction of 9-valent HPV Vaccine on HPV Vaccination Initiation and Series Completion in US Adolescents	$81,718
Recruitment	Justin	Trogdon	NIH National Institute on Aging	1-R01-AG050733-01A1	9/1/16	5/31/19	Cancer, Care Coordination, and Medication Use for Multiple Chronic Conditions	$218,120
Recruitment	Justin	Trogdon	Robert Wood Johnson Foundation	73923	9/1/16	8/31/21	RWJF Health Policy Research Scholar	$120,000
Recruitment	William	Valdar	National Inst. of Health	5-RO1-DK088975-05	7/1/10	6/30/16	Genome-wide Fine-mapping of Metabolic Traits in Heterogeneous Stock Rats	$29,483
Recruitment	William	Valdar	NIH National Institute of General Medical Sciences	4-R01-GM104125-05	9/30/12	8/31/17	Statistical Modeling of Complex Traits in Genetic Reference Super-Populations	$241,086
Recruitment	William	Valdar	Pharmaceutical Research and Manufacturers of America Foundation	not assigned	1/1/16	12/31/17	DANIEL OREPER Methods to identify parent-of-origin effects on behavior via reciprocal mouse crosses	$40,000
Recruitment	William	Valdar	NIH National Institute of Mental Health	1-F30-MH108265-01A1	8/1/16	7/31/19	Statistical modeling of genetic effects on behavior and its variability	$34,217
Recruitment	David	van Duin	Natl Inst Allergies & Infectious Diseases	203 9893	12/1/13	5/31/16	Antibacterial Resistance Leadership Group (ARLG)	$160,189
Recruitment	David	Van Duin	Duke University	2038121	12/1/15	11/30/16	Antibacterial Resistance Leadership Group (ARLG)	$44,805
Recruitment	David	Van Duin	Duke University	2038136	12/1/15	11/30/16	ARLG-CRaCKleII	$171,441

Recruitment	David	Van Duin	Scynexis, Inc.	not assigned	1/13/15	1/12/17	A Prospective, Multicenter, Open-Label, Randomized, Comparative Study to Estimate the Safety, Tolerability, Pharmacokinetics, and Efficacy of Oral SCY-078 vs. Standard of-Care Following Initial Intravenous Micafungin Therapy in the Treatment of Invasive Candidiasis (Including Candidemia) in Hospitalized Nonneutropenic Adults	$14,697
Recruitment	David	Van Duin	Case Western Reserve University	RES510308	6/25/15	5/31/17	Molecular Epidemiology of Carbapenem Resistant Klebsiella pneumoniae	$75,816
Recruitment	Cyrus	Vaziri	Department of Defense	W81XWH-14-1-0428	6/1/14	5/31/16	Exploiting Tumor-Activated Testes Proteins to Enhance Efficacy of First-Line Chemotherapeutics in NSCLC - Subcontract with University of Texas Southwetern Medical Center	$87,499
Recruitment	Cyrus	Vaziri	National Inst. of Health	1-R21-ES023895-02	9/19/14	8/31/16	Novel Rad18 functions in Histone Modification and Regulation of Gene Expression	$157,500
Recruitment	Cyrus	Vaziri	NIH National Institute of Environmental Health Sciences	4-R01-ES009558-20	8/1/98	4/30/17	A Novel Carcinogen-Induced Cell Cycle Checkpoint	$333,000
Recruitment	Cyrus	Vaziri	NIH National Institute of General Medical Sciences	5-R01-GM105883-01-03	1/1/14	11/30/17	Targeting the TLS DNA Damage Tolerance Pathway for Cancer Therapy	$286,392
Recruitment	Benjamin	Vincent	Pharmacyclics, Inc.	not assigned	6/1/16	5/31/18	Prediction of Response and Rapid Development of Ibrutinib-based Combination in Genetically Engineered Mouse Models of Bladder, Breast and Melanoma	$169,858
Theme Investment (Protocol)	Peter	Voorhees	GlaxoSmithKline (GSK), Inc.	not assigned	10/15/14	10/14/18	A Phase I Open-Label, Dose Escalation Study to Investigate the Safety, Pharmacokinetics, Pharmacodynamics, Immunogenicity and Clinical Activity of the Antibody Drug Conjugate GSK2857916 in Subjects with Relapsed/Refractory Multiple Myeloma and Other Advanced Hematologic malignancies Expressing BCMA	$70,065
Retention	Eric	Wallen	EDAP Technomed	G050103 EDAP TMS SA	10/16/08	12/31/17	ADAP Ablatherm Integrated Imaging High Intensity Focused Untrasound (HIFU) Indicated for Treatment of Low Risk, Localized Prostate Cancer	$177,281
Recruitment	Yisong	Wan	NIH National Institute of Allergy and Infectious Diseases	4-R01-AI097392-05	5/1/12	4/30/17	The Roles of Gata3 in Controlling Treg Function	$368,389
Recruitment	Gang (Greg)	Wang	Kimmel Foundation	SKF-14-053	7/1/14	6/30/16	Deciphering the Role of Histone Demethylation Among Hematopoietic Malignancies	$100,009
Recruitment	Gang (Greg)	Wang	Amer Society of Hematology	Not Assigned	7/1/14	6/30/16	Epigenetic Therapy of Hematopoietic Malignancies: Novel Approaches for Global and Tissue-Specific Inhibition of EZH2 and Related EZH1 Enzymes	$75,000
Recruitment	Gang (Greg)	Wang	Department of Defense	W81XWH-14-1-0232	7/15/14	6/30/16	Epigenetic Therapy of Hematopoietic Malignancies: Novel Approaches for Tissue-Specific and Global Inhibition of EZH2 Enzymatic Activities	$271,056
Recruitment	Z. Andrew	Wang	NIH National Cancer Institute	5-R21-CA182322-03	9/19/13	8/31/16	Development of 3D Organ-Specific Models of Colorectal Cancer Metastasis	$260,571
Recruitment	Gang (Greg)	Wang	Gabrielle's Angel Foundation for Cancer research	84	5/1/14	4/30/17	Novel Approaches to Target prc2 Enzymatic Complexes for the Treatment of Hematopoietic Malignancies	$75,000

Recruitment	Andrew	Wang	Cerulean	not assigned	12/6/13	12/5/17	Phase Ib/II study of neoadjuvant chemoradiotherapy with CRLX-101 and capecitabine for locally advanced rectal cancer	$100,000
Recruitment	Andrew	Wang	NIH National Cancer Institute	4-R01-CA178748-04	8/15/13	5/31/18	Nanoparticle formulations of DNA repair inhibitors to improve chemoradiotherapy	$312,079
Recruitment	Andrew	Wang	DOD DA Army Medical Research Acquisition Activity	W81XWH-16-1-0530	9/1/16	8/31/18	Tissue Engineered Cancer Metastasis to Improve the Abscopal Effect and Cancer Immunotherapy in Melanoma.	$150,000
Recruitment	Greg	Wang	American Cancer Society	RSG-16-039-01-DMC	7/1/16	6/30/20	Decipher PRC2 Dysregulation Mechanisms in Multiple Myeloma	$190,000
Recruitment	Jared	Weiss	Synta Pharmaceuticals	9090-14	5/29/13	5/26/16	A Randomized, Phase 3 Study of Ganetespib in Combination with Docetaxel Versus Docetaxel Alone in Patients with Advanced Non-Small-Cell Lung Adenocarcinoma	$30,027
Recruitment	Jared	Weiss	GlaxoSmithKline	LCCC 1125	6/26/12	6/25/16	Multimodality Risk Adapted Therapy Including Carboplatin/Paclitaxel/Lapatinib as Induction for Squamous Cell Carcinoma of the Head and Neck Amenable to Transoral Surgical Approaches	$165,290
Recruitment	Jared	Weiss	Celgene Corporation	LCCC 1210	8/29/12	8/29/16	AX-NSCL-PI-0069 Second Line Treatment with Nab-Paclitaxel for the Elderly Patient with Advanced Lung Cancer which has Progressed on at least 1 Prior RegimenA	$119,993
Recruitment	Jared	Weiss	Celgene Corporation	LCCC 1407	10/22/14	10/31/17	Multicenter Phase II Trial of Neoadjuvant Cisplatin and Nab-paclitaxel for (N2) Defined Stage IIIA Non-Small Cell Lung Cancer (NSCLC)	$100,000
Recruitment	Jared	Weiss	OSI Pharmaceuticals, Inc.	not assigned	5/15/12	11/30/16	Phase II Study Of Stereotactic Radiosurgery or Other Local Ablation Followed by Erlotinib for Patients with EGFR Mutation Who Have Previously Progressed on an EGFR-TKI	$76,682
Recruitment	Jared	Weiss	Pharmaceutical Research Associates	MEDI4736-1108	3/17/14	3/16/17	A Phase 1 Study to Evaluate the Safety, Tolerability, and Pharmacokinetics of MEDI4736 in Subjects with Advanced Solid Tumors	$50,000
Recruitment	Jared	Weiss	Novartis Pharmaceuticals	not assigned	9/1/13	4/30/17	BKM120H2201 - Phase II multicenter randomized, double blind, placebo controlled study assessing the efficacy of buparlisib (BKM120) plus paclitaxel vs. placebo plus paclitaxel in patients with platinum pre-treated recurrent or metastatic head and neck squamous cell carcinoma	$30,992
Recruitment	Jared	Weiss	Astellas Pharma Global Development, Inc.	not assigned	6/19/14	6/18/17	An Open-label, Phase 1 Dose Escalation Study of Oral ASP8273 in Subjects with Non-Small-Cell Lung Cancer (NSCLC) Who Have Epidermal Growth Factor Receptor (EGFR) Mutations	$50,000
Recruitment	Jared	Weiss	GlaxoSmithKline (GSK), Inc.	not assigned	6/26/12	6/25/17	LCCC 1125 Multimodality Risk Adapted Therapy including Carboplatin/Paclitaxel/Lapatinib as Induction for Squamous Cell Carcinoma of the Head and Neck Amenable to Transoral Surgical Approaches	$50,000

Recruitment	Jared	Weiss	Celgene Corporation	not assigned	8/29/12	8/28/17	LCCC 1210 Second line treatment with nab-paclitaxel for the elderly patient with advanced lung cancer which has progressed on at least 1 prior regimenA	$68,062
Recruitment	Jared	Weiss	Celgene Corporation	not assigned	9/15/14	9/14/17	Safety and efficacy of nab-paclitaxel (Abraxane) in combination with carboplatin as first line treatment in elderly subjects with advanced non-small cell lung cancer (NSCLC): A Phase IV, randomized, open-label, multicenter study (ABOUND.70+)	$35,085
Recruitment	Jared	Weiss	Celgene Corporation	not assigned	12/4/14	12/3/17	Phase II Multi-Center Trial of Neoadjuvant Cisplatin and Nab-paclitaxel for (N2) Defined Stage IIIA Non-Small Cell Lung Cancer (NSCLC)	$85,931
Recruitment	Jared	Weiss	Merck Sharp and Dohme	not assigned	3/23/15	3/22/18	A Phase II Clinical Trial of Single Agent Pembrolizumab (MK-3475) in Subjects withRecurrent or Metastatic Head and Neck Squamous Cell Carcinoma (HNSCC) Who HaveFailed Platinum and Cetuximab	$14,787
Recruitment	Jared	Weiss	AstraZeneca Pharmaceuticals LP	not assigned	1/14/16	1/13/19	A Phase III Randomized, Open-label, Multi-center, Global Study of MEDI4736 in Combination with Tremelimumab versus Standard of Care in the Treatment of First-line Recurrent or Metastatic Squamous Cell Head and Neck Cancer Patients	$69,379
Recruitment	Jared	Weiss	Merck Sharp and Dohme Corp.	not assigned	12/7/15	12/7/19	Pembrolizumab and Radiation for Locally Advanced Squamous Cell Carcinoma of the Head and Neck (SCCHN) not Eligible for Cisplatin Therapy	$102,315
Recruitment	Stephanie	Wheeler	American Cancer Society	MRSG-13-157-01-CPPB	1/1/14	12/31/18	Improving Endocrine Therapy Utilization in Racially Diverse Populations	$145,722
Recruitment	Stephanie	Wheeler	Pfizer, Inc.	not assigned	1/1/16	12/31/17	Developing a Medication Assistance Program for Uninsured and Underinsured Metastatic Breast Cancer Patients	$295,485
Theme Investment (CC)	Jason	Whitmire	National Inst. of Health	1-R21-AI117575-01	7/1/15	6/30/17	Genetic & Mechanistic Dissection of a Lethal Systemic Virus Infection	$190,000
Theme Invest (HTS)	Kirk C.	Wilhelmsen	National Inst. of Health	3-R01-DA030976-05S1	9/30/10	5/31/16	Deep Sequencing Studies for Cannabis and Stimulant Dependence	$675,976
Recruitment	David	Williams	NIH National Institute of General Medical Sciences	5-R01-GM098264-03-06	5/1/12	4/30/17	Structural and functional diversity of the methyl-binding domain protein family	$284,726
Recruitment	Scott	Williams	NIH National Institute of Dental and Craniofacial Research	1-R21-DE025725-01A1	9/5/16	8/31/18	Illuminating the Role of Oral Stem Cells in the Development of Oral Squamous Cell Carcinomas	$190,000
Recruitment	Scott	Williams	NIH National Institute of Dental and Craniofacial Research	1-K08-DE026537-01	9/12/16	8/31/21	Mechanisms of Oral Epithelial Differentiation	$89,580
Recruitment	William	Wood	NIH National Cancer Institute	5-R21-CA192127-01-02	7/1/15	6/30/17	Exercise in Cancer Survivors Before Allogeneic Stem Cell Transplanation	$177,650
Recruitment	William	Wood	Mayo Clinic	NOR-194321	8/1/14	7/31/17	Assessing Physical Fitness in Cancer Patients with Cardiopulmonary Exercise Testing and Wearable Data Generation: An Alliance Pilot Study Proposal	$50,000
Recruitment	William	Wood	Genentech, Inc.	not assigned	6/15/16	6/14/18	Prospective Observational Study for Assessing Performance Status in Cancer Patients using Cardiopulmonary Exercise Testing and Wearable Data Generation.	$50,000

Recruitment	Michael	Woods	Ockham Development Group	RAD-IFN-CS-002	1/18/13	1/17/17	A Phase II, Randomized, Open Label, Parallel Arm Study to Evaluate the Safety and Efficacy of rAd-IFN/Syn3 Following Intravesical Administration in Subjects with High Grade, BCG Refractory or Relapsed Non-Muscle Invasive Bladder Cancer (NMI	$35,603
Recruitment	Michael	Woods	Photocure	not assigned	8/30/15	11/30/16	A prospective, open, comparative, within patient controlled multi-center phase 3 study of blue light cystoscopy with Cysview and white light cystoscopy using KARL STORZ D-Light C PDD Flexible Videoscope System in detection of bladder cancer in patients with bladder cancer	$30,000
Recruitment	Michael	Woods	Heat Biologics	not assigned	3/27/14	3/26/17	A Phase 1/2, Placebo-Controlled, Randomized Study to Evaluate the Safety Immune Response and Clinical Activity of HS-410 in Patients with High-Risk Non-Muscle Invasive Bladder Cancer who have Undergone Transurethral Resection of Bladder Tumor (TURBT) and Received Prior Treatment with Induction Bacillus Calmette-Guerin (BCG)	$50,000
Innovation	Yue	Xiong	NIH National Cancer Institute	4-R01-CA163834-05	3/1/12	2/28/17	Mechanisms of Metabolic Gene Mutations in Cancer	$307,100
Recruitment	Yang	Yang	National Inst. of Health	5-K01-AG036745-05	8/1/10	7/31/16	Sex Differences in Health and Longevity: A Social and Biodemographic Approach	$120,339
Retention	Jen Jen	Yeh	NIH National Cancer Institute	5-R01-CA193650-01-02	5/1/15	7/31/20	The adaptive kinome in pancreatic cancer	$570,696
Retention	Jen Jen	Yeh	NIH National Cancer Institute	1-R01-CA199064-01A1	9/1/16	7/30/21	Tumor subtypes and therapy response in pancreatic cancer	$600,010
Recruitment	William	Zamboni	NexImmune	not assigned	9/1/15	12/31/16	Assay Development and Validation for Quantitation of Kb-SIY-dimer and anti-CD28 ligands in Solution for CMC Studies by High Resolution Mass Spectrometry (HRAM)	$61,672
Recruitment	William C.	Zamboni	Onyx Pharmaceuticals, Inc	Not Assigned	8/14/14	8/13/16	Pharmacodynamic and Efficacy Studies of PEGylated Liposomal Carfilzomib and Non-liposomal Carfilzomib in Female nu/nu Mice Bearing A549 NSCLC Orthotopic Tumor Models (Task 2)	$65,304
Recruitment	William C.	Zamboni	SciDose LLC	Not Assigned	9/15/10	9/14/16	Pharmacology Studies of Curcumin-Succinate-PEG400 Conjugate compared with Curcumin in In Vivo Systems and in the Pa03C Human Pancreatic Cancer Orthotopic	$247,299
Recruitment	William C.	Zamboni	Merrimack Pharmaceuticals	Not Assigned	4/23/14	4/22/17	Non-GLP Development of Analytical Methods for MM-310-Encapsulated and Released Drug	$69,371
Recruitment	Joshua	Zeidner	Leukemia & Lymphoma Society	4311-15	7/1/14	6/30/17	Targeting Regulatory T Cells During Lymphocyte Recovery in Newly Diagnosed AML	$65,000
Recruitment	Joshua	Zeidner	Millennium Pharmaceuticals, Inc.	not assigned	3/24/15	3/16/17	A Phase 1b, Open-Label, Dose-Escalation Study of MLN4924 Plus Azacitidine in Treatment-Naïve Patients With Acute Myelogenous Leukemia Who Are 60 Years or Older	$66,651
Recruitment	Joshua	Zeidner	Tolero Pharmaceuticals, Inc.	not assigned	11/30/15	11/29/17	A Phase 2, Randomized, Biomarker-driven, Clinical Study in Patients with Relapsed or Refractory Acute Myeloid Leukemia (AML)	$20,948

Recruitment	Jose	Zevallos	Amer. Head and Neck Society	352690	7/1/15	6/30/16	Targeted DNA Sequencing of HPV-Positive Oropharyngeal Cancer Treatment Failures	$31,446
Recruitment	Qing	Zhang	Sidney Kimmel Fdn. for Cancer Research	SKF-14-094	7/1/14	6/30/16	Determining the Regulation of Progesterone Receptor (PR) by EgIN2 in Tamoxifen Resistant Breast Cancer	$100,000
Recruitment	Qing	Zhang	NIH National Cancer Institute	5-ROO-CA160351-05	2/1/13	6/30/16	Role of the EgIN2 Target FOXO3a in Breast Cancer	$241,530
Retention	Yanping	Zhang	NIH National Cancer Institute	5-R01-CA167637-04	9/1/12	6/30/17	The Role of the Mdm2-MdmX Interaction in p53 Regulation	$305,832
Retention	Yanping	Zhang	NIH National Cancer Institute	4-R01-CA155235-05	7/1/12	4/30/17	Mitochondrial p32 regulation of the Mdm2-p53 tumor suppression signaling and apoptotic cell death	$307,100
Retention	Yanping	Zhang	NIH National Cancer Institute	4-R01-CA167637-05	9/1/12	6/30/17	The in vivo role of the Mdm2-MdmX interaction in p53 regulation	$305,832
Retention	Qisheng	Zhang	National Institute of General Medical Sciences	5-R01-GM086558-01-05	9/1/11	8/31/17	Development of Small Molecule ARFGAP Regulators to Dissect Cell Signaling	$277,866
Recruitment	Yanping	Zhang	DOD DA Army Medical Research Acquisition Activity	W81XWH-16-1-0402	9/15/16	9/14/17	Characterizing the Role of Hep27 in Liver and Colorectal Cancer Stress Tolerance	$109,480
Recruitment	Qing	Zhang	V Foundation for Cancer Research	V2015-028	11/1/15	11/1/17	Validation of EglN2 As a Novel Therapeutic Target in Triple Negative Breast Cancer	$100,000
Recruitment	Qi	Zhang	American Heart Association	16GRNT31320013	7/1/16	6/30/18	Structural and Molecular Basis for the Regulation of Cardiovascular Essential microRNA-1 Biogenesis	$77,000
Recruitment	Qing	Zhang	DOD DA Army Medical Research Acquisition Activity	W81XWH-15-1-0599	9/30/15	9/29/18	Validation of ZHX2 as a Novel pVHL E3 Ligase Substrate and Its Role in Kidney Cancer	$150,000
Recruitment	Qing	Zhang	Susan G Komen for the Cure	CCR15331322	10/3/15	10/2/18	Control of Mitochondrial Function by EglN2 in Breast Cancer	$150,000
Recruitment	Qi	Zhang	NIH National Institute of General Medical Sciences	5-R01-GM114432-01-02	5/1/15	4/30/20	Riboswitch and Ribozyme Dynamics at Atomic Resolution	$285,918
Theme Investment (CC)	Fei	Zou	National Inst. of Health	5-R01-GM074175-08	7/1/11	8/31/16	Robust Methods for Complex Trait Association Mapping with Collaborative Cross	$222,740
								$170,511,238