Pediatric Cancer Research Group Supported by the Nebraska Legislature (LB 417) in collaboration with The Fred and Pamela Buffet Cancer Center & Children's Hospital and Medical Center

This year, the Pediatric Cancer Research Group (PCRG) hosted the fifth annual Pediatric Cancer Research Group Symposium on August 31, 2022. The Symposium, co-sponsored by the Child Health Research Institute, was attended by 120 participants in a hybrid fashion. The event started with a generous check presentation of $180,000 from Kiewit Corporation from their annual pediatric cancer fundraiser, JakeFest. The donation will go to support research conducted by the PCRG. The morning featured PCRG member presentations, including highlights from research on using virtual reality to decrease the need for sedation and improve patient experiences and updates and future directions for epidemiological initiatives, which work to discover the underlying causes of pediatric cancers in Nebraska.

Keynote speaker Dr. Joseph Neglia, Professor and Department Head of Pediatrics from the University of Minnesota, provided an invigorating Grand Rounds presentation on his decades-long research in survivorship for childhood cancer. Participants were able to browse the nearly 40 scientific posters from trainees, junior and senior faculty from various disclipines. The event concluded with updates from the PCRG affinity research groups: Hematological Malignancies and the Medulloblastoma Collaborative.

A report of the current composition of the Pediatric Cancer Research Group and an accounting of the utilization of the 1.8 million dollars transferred from the General Fund for pediatric cancer research infrastructure at the University of Nebraska follows:

Current Program Personnel:

Program Director
Don Coulter, M.D., Proferssor, Pediatric Hematology/Oncology, University Tower 5117, Lab: 11th floor Lied Tower

Research Team Members
Aaron Mohs, Ph.D., Associate Professor, Pharmaceutical Sciences, BCC 5.12.315
Afshin Salehi, M.D., M.S., Assistant Professor, Pediatric Neurosurgery, CDS 81010
Alan Kolok Ph.D., Director Center for Environmental Health and Toxicology (University of Idaho)
Amarnath Natarajan, Ph.D., Professor, Eppley Cancer Institute
Angie Rizzino, Ph.D., Professor, Eppley Cancer Institute (Tumor Biology)
Anthony Podany, Pharm.D., Ph.D., Associate Professor, Pharmacy Practice & Science, PDD 3019
Anum Akbar, Graduate Assistant
Arnett Klugh, M.D., Associate Professor, Pediatric Neurosurgery
Balkissa Ouattara, Graduate Assistant, Environmental, Agricultural and Occupational Health
Bharti Sethi, Graduate Research Assistant, Pharmaceutical Sciences
Breanna Hetland, Ph.D, R.N., Assistant Professor, Nursing

Channabasavaiah Gurumurthy, M.V.S.C., Ph.D., M.B.A., Professor, Pharmacology & Experimental Neuroscience
Chittalsinh Raulji, M.B.B.S., Assistant Professor, Pediatric Hematology/Oncology
Christopher Christopher Shaffer, Pharm.D., Ph.D., Assistant Professor, Pharmacy Practice and Science, Lab: COP 4050 (Pharmacology)
Corey Hopkins, Ph.D., Professor, Pharmaceutical Sciences, COP3015 (Drug synthesis/Discovery)
Dalia Elgamal, Ph.D., Assistant Professor & Research Scientist, Eppley Cancer Institute
Daryl Murry, Pharm.D., Professor, College of Pharmacy (Drug Development/Analysis)
Dong Wang, Ph.D., Professor, Pharmaceutical Sciences
Eleanor Rogan, Ph.D., Professor, College of Public Health
Erin McIntyre, M.S., Lab Manager, PCRG Lab: Wittson 4057, 4059
Gargi Ghosal Ph.D., Assistant Professor, Genetics, Cell Biology and Anatomy (Tumor Biology)
Grace Murray, M.D., Pediatric Hematology/Oncology Fellow
Gracey Alexander, M.S., Research Technologist, PCRG Lab: Wittson 4057, 4059
Guangshun Wang, PhD, Professor, Pathology & Microbiology, DRC2 5034
Gurudutt Pendyala, Ph.D., Professor, Anesthesiology
Hamid Band Ph.D., Professor, Eppley Cancer Institute (Tumor Biology)
Heidi Reelfs, M.P.T., Physical Therapy
Jagadeesh Puvvula, Graduate Assistant, Environmental, Agricultural and Occupational Health
James Ford, M.D., Associate Professor, Pediatric Oncology, CHMC (Clinical Oncology)
Janina Baranowska-Kortylewicz, Ph.D., Research Professor, Radiation Oncology, Lab: Epp. Science 10025 (Radiation Biology)
Javeed Iqbal, Ph.D., Professor, Pathology & Microbiology, FPBCC 4.12.391
Jenna Allison, M.D., Assistant Professor, Pediatric Hematology/Oncology
Jessica Goeller, D.O., Associate Professor, Anesthesiology
Jill C Beck, MD, Associate Professor, Division Chief, Pediatric Oncology, CHMC (Clinical Oncology)
Joseph Vetro, Ph.D., Associate Professor, Pharmaceutical Sciences, COP 3033 (Drug delivery)
John Davis, Ph.D., Professor, Obstetrics and Gynecology
John Graham Sharp, Ph.D., Professor, Genetics, Cell Biology & Anatomy
Jonathan Vennerstrom, Ph.D., Professor, Pharmaceutical Sciences
Jorge Zuniga, Ph.D., Biomechanics (University of Nebraska at Omaha)
Joyce Solheim, Ph.D., Professor & Research Scientist, Eppley Institute, Lab: Eppley Science Hall 8006 (Immunology)
Kate Hyde Ph.D., Assistant Professor, Eppley Cancer Institute, BCC 6.12321 (Leukemia)
Kendra Ratnapradipa, Ph.D., Assistant Professor, Epidemiology
Kerrie Weber, Ph.D., Associate Professor, Biological Sciences and Earth & Atmospheric Sciences
Kishor Bhakat, Ph.D., Associate Professor & Research Scientist, GCBA, BCC.1012392 (DNA Repair)
Kishore Challagundla, Ph.D., Assistant Professor, Biochemistry and Molecular Biology, DRC 1 7032 (Tumor biology/Experimental Therapeutics)
Kumar Virender, Ph.D., Research Assistant Professor, Pharmaceutical Sciences

Kyle Hewitt, Ph.D., Assistant Professor & Research Scientist, Genetics, Cell Biology & Anatomy
Larisa Poluetktova, M.D., Ph.D., Professor, Pharmacology
Ling Li, M.D., Ph.D., Assistant Professor, Pediatric Cardiology
Mariah Jackson, M.M.N., R.D.N., Assistant Professor, Medical Nutrition
Matthew Kling, Ph.D., Assistant Professor, Oral Biology (Creighton University)
Melissa Acquazzino, Associate Professor, Pediatric Hematology/Oncology; Clinical Director, Survivorship Program, CHMC (Pediatric Cancer Survivorship)
Michael Rowley, Ph.D., Assistant Professor, Genetics, Cell Biology & Anatomy
Minnie Abromowitch, M.D., Professor, Pediatric Hematology/Oncology
Molly Schlegel, APRN-NP, Nebraska Medicine
Nagendra Chaturvedi, Ph.D., Assistant Professor & Research Scientist, Lab: Wittson 2010A
Oluwaseun Adetayo, M.D., Professor, Surgery
Paul Trippier, Ph.D., Associate Professor, Pharmaceutical Sciences
Pauline Xu, Graduate Research Assistant, Ob/Gyn Research
Ram Mahato Ph.D., Professor and Chair, Department of Pharmaceutical Sciences (Drug Development)
Rebecca Swanson, D.N.P., Clinical Assistant Professor, College of Nursing
Rizwan Ahmad, Ph.D., Assistant Professor, Biochemistry & Molecular Biology
Sachit Patel, M.D., Associate Professor, Pediatric Hematology/Oncology; Clinical Director, Stem Cell Transplantation, UNMC (Stem Cell Transplant)
Samiksha Jain, M.D., Assistant Professor, Ophthalmology
Santhi Gorantla, Ph.D., Professor, Pharmacology
Sarah Holstein, M.D., Ph.D., Professor, Onocology / Hematology
Shannon Bartelt-Hunt, Ph.D., Professor, Civil & Environmental Engineering (University of Nebraska Lincoln)
Shannon Buckley, Ph.D., Assistant Professor, Hematology (University of Utah)
Shantaram Joshi, Ph.D., Professor & Research Scientist, Genetics, Cell Biology and Anatomy, Lab: Wittson Hall 2010A (Tumor biology/Immunology)
Shatil Shahriar, Graduate Research Assistant
Shinobu Watanabe-Galloway Ph.D., Associate Professor, College of Public Health (Epidemiology)
Sidharth Mahapatra, M.D., Ph.D. Assistant Professor, Pediatric Critical Care (Brain tumors)
Siddappa Byrareddy, Ph.D. Professor, Pharmacology and Experimental Neuroscience
So-Youn Kim, Ph.D., Assistant Professor, Department of OB/GYN (Fertility Preservation)
Surinder Batra, Ph.D., Professor & Chair, Biochemistry & Molecular Biology
Sutapa Ray, Ph.D. Assistant Professor, Lab: Wittson Hall 4027
Taylor Losole, M.D., Pediatric Hematology/Oncology Fellow
Wafaa Aldhafiri, Graduate Research Assistant
Yuxiang Dong, Ph.D., Research Assistant Professor, Pharmacy

New Projects:

Translational Science Research:

1. *SAP30, A Novel Drug Response Specific Transcription Factor in Neuroblastoma*
   Neuroblastoma is the most common devastating extracranial solid malignancy in children. Despite an intense treatment regimen, the prognosis for high-risk neuroblastoma patients remains poor, with less than 40% survival. This project by Dr. Challagundla seeks to better understand the role of Sap30 in neuroblastoma progression and treatment resistance. Dr. Challagundla's lab has shown that higher Sap30 expression is found in high-risk neuroblastoma patients and is a marker of resistance to Cisplatin. Methods to silence Sap30 signalling could result in improved survival for patients with neuroblastoma.

2. *Cancer Progression Driven by Transient Hypermutation*
   It is well established that mutations are in part responsible for a number of human cancers. This project will examine how cancer-causing mutations occur. The multi-investigator team of Dr. Shcherbakova, Preston and Pavlov will evaluate the process of hypermethylation as a cause of mutations and evenutual transformation of normal cells into malignancy. Studying this process will help us better understand why, where and when cancers occur and hopefully develop better strategies for therapy.

3. *The Role of RUNX1 in Early T cell Precursor Acute Lymphoblastic Leukemia*
   The transcription factor RUNX1 is capable of causing changes in gene expression, differentiation defects, and leukemia development. While Dr. Hyde has identified it as an important transcription factor and prognostic indicator in AML, its role in T cell Precursor Acute Lymphoblastic Leukemia is unknown. This project will further evaluate the role of RUNX1 as both a promoter of disease and a prognostic indicator for patients with T cell leukemia, perhaps identifying a target for future drug development.

4. *Therapeutic Potential of Neurolysin Inhibition in Pediatric Leukemias*
   Overexpression of Neurolysin has been identified in over 50 % of Acute Myeloid Leukemia patients, and represents a novel target for drug development. Modifications of known neurolysin inhibitors may lead to a novel target for leukemia treatment. This proposal leverages expertise in medicinal chemistry from Dr. Trippier and Dr. Murry to design an inhibitor of neurolysin with focus on efficacy while minimizing central nervous system toxicity to add a new strategy for treatment of AML.

5. *Role of FBXO21 as an Oncogene in AML*
   Acute myeloid leukemia has a poor prognosis in pediatric patients, and a better understanding of the transformation of normal myeloid cells to leukemia cells could lead to new treatment modalities. Drs. Hyde, Natarajan and Buckley are investigating FBXO21, a potential oncogene thought to play a role in the

transformation and progression of these cells. Their early studies could further promote FBXO21 as a potential therapeutic target in this disease.

6. *Targeting NK Cell Tolerance to Enhance GD2-targeted Immunotherapy in Neuroblastoma*

   While inclusion of dinutuximab in neuroblastoma care has improved outcomes, <50% 5-year survival rates in high-risk patients support the need to enhance its effectiveness. Notably, neuroblastomas exhibit an immunosuppressive tumor microenvironment that specifies poor outcomes. The CBL-family of ubiquitin ligases (CBL, CBL-B and CBL-C) are key negative regulators of immune cell activation. This immunosuppression can impact the ability of therapeutic antibodies, such as GD2 targeted antibodies in neuroblastoma, to have a positive impact for patiennts. This proposal from Dr. Band aims to complete genetic deletion or chemical inhibition of CBL-B in NK cells and relieve them of immune suppression in the tumor microenvironment to enhance ADCC-mediated neuroblastoma tumor killing by anti-GD2 antibody therapy.

Neuro-Oncology Research:

1. *Development of Tumor-targeted Peripherally Cross-linked Polymer Micelles to Improve the Systemic Treatment of Solid Pediatric and Adult Tumors with PROTACs drugs*

   PROteolysis Targeting Chimeras (PROTACs) are a novel class of "event-driven" small molecule drugs that exploit the ubiquitin-proteasome system to catalytically target cellular proteins for degradation, including those that cannot be inhibited by conventional "occupancy-driven" antagonist drugs. Physically encapsulating PROTACs in core-shell polymer micelles is a broadly applicable formulation approach to increase water solubility, decrease toxicity, and increase potency in solid pediatric and adult tumors after i.v. administration but may prematurely release drug into the bloodstream. This project from Dr. Vetro seeks to further understand the impact of encapsulation of PROTACs in tumor-targeted micelles that will allow for more efficient and effective drug release and improve the systemic treatment of pediatric and adult solid tumor.

2. *Novel Benzimidazole Carbamate theranostics as a replacement for vincristine in the treatment of medulloblatoma*

   Treatment of medulloblastoma involves surgery, radiation and chemotherapy. These modalities all ghave unique toxicities that can lead to long term complications of therapy. Novel therapeutics should decrease the side effects of our current treatment options. This study led by Dr. Baranowska – Kortylewicz seeks to contine the development of cpd 1, a benzimidazole carbamate theranostic designed in her laboratory that has the potential to be both a low toxicity agent and radiation sensitizer in patients with Medulloblastoma. Cpd 1 will be tested in medulloblastoma cell lines and normal cell lines and measures of impact on the cell cycle will be evaluated.

3. *Targeting Chemoresistance in Medulloblastoma using a Hedgehog Signaling Pathway Inhibitor*

   Cisplatin is a potent chemotherapeutic agent, but its use to treat medulloblastoma is limited by severe systemic toxicity and inefficient penetration of the blood-brain barrier.This proposal seeks to combine Hedgehog signaling inhibtion with a Cisplatin analoug as therapy for patients with medulloblastoma. The two agents will be encapsulated by Dr. Mahato and his team into a nanoparticle in an attempt to decrease the toxicity of Cisplatin. The combination will be tested in mice with medulloblastoma in hopes of continuing the development of these drugs.

Clinical Research:

1. *Implementation of Screening and Virtual Reality-Based Exposure Therapy for Claustrophobia that Interferes with Radiology Care*

   Children undergoing MRI and radiotherapy frequently experience fear/anxiety related to these procedures. VR can efficaciously treat claustrophobia and can reduce pain and anxiety for pediatric patients. Dr. Justin Weeks, psychologist, designed this project to improve identification of patients who experience medically-relevant claustrophia nad examine whether treatment via VR exposures to MRI and radiotherapy results in significant reductions in indices of claustrophobia (measured with BE CALMeD scores). Ultimately, the project hopes to help pediatric patients reduce anxiety and improve quality of life.

2. *Robot Rehab: Animal assisted interactions with a robotic baby harp seal during inpatient pediatric rehabilitation*

   Animal assisted interactions are interventions that intentionally incorporate animals as part of a therapeutic process to promote human health, learning, and well-being in patients. The highly technical, fast-paced hospital environment and the immunocompromised health statuses of many acutely ill hospitalized patients greatly limit the exploration of AAI in inpatient settings. This project led by Dr. Hetland continues the innovative use of a robotic seal to engage pediatric patients in a robotic animal assisted interaction during physical and occupational therapy. While previously this project was only available at Nebraska Medicine, these resources will allow Dr. Hetland to expand the use of the robotic seal to five specific patient units in Children's Hospital and Medical Center.

Population Research:

1. *Impact of Symptom Clusters on Health-related Quality of Life in Pediatric Cancer Survivors after Treatment Completion*

   Traditional cancer survivorship research often focus on a single symptom. However, cancer patients rarely exhibit an isolated symptom, but rather experience multiple interrelated symptoms known as symptom clusters. Compared with a single symptom, symptom clusters have a synergistic effect greater than an additive effect of individual symptoms on health outcomes, such as health-related quality of life (HRQoL) among cancer patients. However, there is a knowledge gap on symptom clusters prevalent among pediatric cancer

survivors after treatment completion and the association between symptom clusters and HRQoL. This study by PhD candidate Kristee Napt seeks to increase knowledge of the underlying causes of symptom clusters. Understanding symptom clusters will provide the evidence for symptom assessment and to develop symptom management interventions by targeting the set of symptoms with a single treatment approach and ultimately improving HRQoL.

Continued Projects:

Translational Science Research:

1. *Improving Cytotoxic Chemotherapy in High Risk Neuroblastoma*
   Neuroblastoma is the most common extra-cranial solid tumor in children and requires multimodal therapy with surgery, chemotherapy, radiation therapy and immunotherapy. Still overall survival for patients with High Risk Disease approaches 60 %, and that survival comes with a number of long-term impacts. Dr. Vetro is testing the packaging of tumor killing compounds in nano-particles which will hopefully beavidly absorbed by neuroblastoma cells. This method of drug delivery could prove to be more toxic to cancer cells while sparing the normal cells in the body.

2. *Targeting Epigenetic Alterations in Pediatric Cancer – Proof of Principle using FLT3 – ITD Driven AML*
   Dr. Hamid Band and his team of investigators are developing an integrated experimental and bioinformatics platform that will be available to all investigators within the PCRG. They will use FLT3 driven AML, a specific type of myeloid leukemia with a very low survival rate, as a proof of principle to show that a epigenetics-targeted inhibitor library of compounds can be evaluated for potential therapeutic use. The information provided by testing this library may lead to a number of potential targets for future investigation in leukemia and other pediatric malignancies.

Neuro-Oncology Research:

1. *Imaging Agents for Surgery in Medulloblastoma*
   The resection of pediatric brain tumors is a critical step in therapy in that it not only provides tissue for diagnosis but provides the first step in treatment with the removal of the tumor. Unfortunately, often times the pediatric neurosurgeon is confronted with the difficult task of identifying the barrier between tumor tissue and normal brain. Dr. Aaron Mohs has developed a fluorescing agent used in the resection of pancreatic tumors, and has adapted his work for evaluation in medulloblastoma.

2. *SOX2: MYC Axis and Drug Tolerant Medulloblastoma Cells*
   Dr. Angie Rizzino and his team have identified SOX2 as a major regulator of quiescence in human brain tumor cells, which can allow them to develop

resistance to chemotherapy. To allow for that quiescence, SOX2 may be inhibiting the function of MYC, an oncogenic protein responsible for rapid growth in a number of pediatric tumors. This work will further investigate the interplay between MYC and SOX2 and help to augment our understanding of quiescence in human cancer cells.

3. *The Creation of the Regional Pediatric Brain Tumor Tissue Bank*
   One of the great needs for investigative teams within the PCRG are functioning tumor banks which can provide samples of pediatric tumors for evaluation and research. Dr. Sid Mahapatra is leading a multi-disciplinary team of oncologists, neurosurgeons, pathologists and clinical researchers to develop the necessary infrastructure and protocols to launch the first pediatric brain tumor biobank in Nebraska.

Clinical Research:

1. *Salivary Cortisol Levels in Pediatric Cancer Patients*
   The diagnosis and treatment of pediatric cancer can stress the body of young children, which in turn can determine their response to certain medications. Dr. Shinobu Watanabe-Galloway is evaluating the amount of cortisol, a hormone released in stressful conditions, in pediatric oncology patients at various time points in their cancer treatment. The results could help to refine treatment regimens and allow for less toxicity for children.

2. *Water Quality in the Upper Big Blue NRD*
   Various evaluations of the epidemiology of pediatric cancer in Nebraska have focused on the contaminants in ground water as a potential etiology. Drs Rogan and Bartelt–Hunt and their teams at the College of Public Health and the University of Nebraska in Lincoln have utilized citizen science to obtain water samples for evaluation to identify levels of nitrate and agrichemicals at various timepoints in the year. It is hoped that these investigations will lead to a better understanding of the components of water in our rural communities, and potential further investigations into possible links with cancer.

3. *Metabolic Bone Health in Childhood Cancer Survivors*
   While 80 % of children will survive their pediatric cancer, 75 % of survivors go on to have chronic medical conditions. Among the most common of these are impacts on the health of bones. Dr. Acquazzino, the Director of the Survivorship clinic at Children's Hospital and Medical Center, has assembled a research team to investigate the impact of exercise on the overall bone health of survivors of pediatric tumors.

Population Research:

1. *Continued Evaluation of the Epidemiology of Pediatric Cancer in Nebraska*
   The University of Nebraska College of Public Health has previously evaluated the incidence of pediatric cancer within the State, and identified a number of counties where the incidence of pediatric cancer exceeds our state-wide average. Dr. Watanabe – Galloway and her team will now use that data set to investigate the electronic health record at both Children's Hospital Medical Center and Nebraska Medicine to evaluate demographic data about pediatric cancer patients from specific areas. This information will be key in the development of future care models for children with cancer and other chronic diseases in rural Nebraska. This project also represents the work of a current fellow in pediatric oncology, providing an opportunity to train the next generation of researchers in Nebraska.

Successful Extramural Funding:

1. NIH R01 (1R01CA263504-01A1): Mechanisms underlying USP1-mediated bypass of EWS-FLI1 oncogene-induced replication stress in Ewing sarcoma. Principal Investigator: Gargi Ghosal, Ph.D.

2. NIH R01 (1R01NS128336-01) Lipid nanomedicine targeting multiple signaling pathways of medulloblastoma. Principal Investigator: Ram Mahato, Ph.D.

Published Manuscripts:

1. Baranowska-Kortylewicz J, Kortylewicz ZP, McIntyre EM, Sharp JG, Coulter DW. Multifarious Functions of Butyrylcholinesterase in Neuroblastoma: Impact of BCHE Deletion on the Neuroblastoma Growth In Vitro and In Vivo. Journal of Pediatric Hematology/Oncology. 2022;44(6):293-304.

2. Bhakat KK, Ray S. The FAcilitates Chromatin Transcription (FACT) complex: Its roles in DNA repair and implications for cancer therapy. DNA Repair. 2022;109:103246.

3. Caplan M, Wittorf KJ, Weber KK, Swenson SA, Gilbreath TJ, Willow Hynes-Smith R, Amador C, Hyde RK, Buckley SM. Multi-omics reveals mitochondrial metabolism proteins susceptible for drug discovery in AML. Leukemia. 2022;36(5):1296-305.

4. Cross KA, Salehi A, Abdelbaki MS, Gutmann DH, Limbrick DD, Jr. MRI-guided laser interstitial thermal therapy for deep-seated gliomas in children with neurofibromatosis type 1: report of two cases. Child's Nervous System. 2022 Sep 15. Online ahead of print.

5. Gupta SC, Challagundla KB, editors. Clinical Applications of Noncoding RNAs in Cancer, 1st ed. Academic Press, 2022.

6. Joseph N, Kolok AS. Assessment of Pediatric Cancer and Its Relationship to Environmental Contaminants: An Ecological Study in Idaho. GeoHealth. 2022;6(3):e2021GH000548.

7. Joseph N, Propper CR, Goebel M, Henry S, Roy I, Kolok AS. Investigation of Relationships Between the Geospatial Distribution of Cancer Incidence and Estimated Pesticide Use in the U.S. West. GeoHealth. 2022;6(5):e2021GH000544.

8. Kanchan RK, Doss D, Khan P, Nasser MW, Mahapatra S. To kill a cancer: Targeting the immune inhibitory checkpoint molecule, B7-H3. Biochimica et Biophysica Acta - Reviews on Cancer. 2022;1877(5):188783.

9. Kling MJ, Kesherwani V, Mishra NK, Alexander G, McIntyre EM, Ray S, Challagundla KB, Joshi SS, Coulter DW, Chaturvedi NK. A novel dual epigenetic approach targeting BET proteins and HDACs in Group 3 (MYC-driven) Medulloblastoma. Journal of Experimental and Clinical Cancer Research. 2022;41(1):321.

10. Metz EP, Wilder PJ, Popay TM, Wang J, Liu Q, Kalluchi A, Rowley MJ, Tansey WP, Rizzino A. Elevating SOX2 Downregulates MYC through a SOX2:MYC Signaling Axis and Induces a Slowly Cycling Proliferative State in Human Tumor Cells. Cancers. 2022;14(8):1946.

11. Moberg L, Fritch J, Westmark D, Mina DS, Krause C, Bilek L, Acquazzino M. Effect of physical activity on fatigue in childhood cancer survivors: a systematic review. Supportive Care in Cancer. 2022;30(8):6441-9.

12. Ouattara BS, Puvvula J, Abadi A, Munde S, Kolok AS, Bartelt-Hunt S, Bell JE, Wichman CS, Rogan E. Geospatial Distribution of Age-Adjusted Incidence of the Three Major Types of Pediatric Cancers and Waterborne Agrichemicals in Nebraska. GeoHealth. 2022;6(2):e2021GH000419.

13. Ouattara BS, Zahid M, Rahman FI, Weber KA, Bartelt-Hunt SL, Rogan EG. Investigation of a Possible Relationship between Anthropogenic and Geogenic Water Contaminants and Birth Defects Occurrence in Rural Nebraska. Water (Switzerland). 2022;14(15):2289.

14. Pathania AS, Prathipati P, Murakonda SP, Murakonda AB, Srivastava A, Avadhesh, Byrareddy SN, Coulter DW, Gupta SC, Challagundla KB. Immune checkpoint molecules in neuroblastoma: A clinical perspective. Seminars in Cancer Biology. 2022;86:247-58.

15. Pathania AS, Prathipati P, Olwenyi OA, Chava S, Smith OV, Gupta SC, Chaturvedi NK, Byrareddy SN, Coulter DW, Challagundla KB. miR-15a and miR-15b modulate natural killer and CD8+T-cell activation and anti-tumor immune response by targeting PD-L1 in neuroblastoma. Molecular Therapy - Oncolytics. 2022;25:308-29.

16. Pathania AS, Prathipati P, Pandey MK, Byrareddy SN, Coulter DW, Gupta SC, Challagundla KB. The emerging role of non-coding RNAs in the epigenetic regulation of pediatric cancers. Seminars in Cancer Biology. 2022;83:227-41.

17. Pathania AS, Smith OV, Prathipati P, Gupta SC, Challagundla KB. Clinical implications of noncoding RNAs in neuroblastoma patients. Clinical Applications of Noncoding RNAs in Cancer. 2022. Elsevier, p. 409-31.

18. Ray S, Chaturvedi NK, Bhakat KK, Rizzino A, Mahapatra S. Subgroup-Specific Diagnostic, Prognostic, and Predictive Markers Influencing Pediatric Medulloblastoma Treatment. Diagnostics. 2022;12(1):61.

19. Sethi B, Kumar V, Mahato K, Coulter DW, Mahato RI. Recent advances in drug delivery and targeting to the brain. Journal of Controlled Release. 2022;350:668-87.

PCRG FY2022 Expenditures

Current Research Personnel

Don Coulter, MD (PCRG Director, COG LI UNMC)	83,742
Minnie Abromowitch, MD (COG PI CHMC)	24,837
Sutapa Ray, PhD (Research Scientist)	82,359
Nagendra Chaturvedi, PhD (Research Scientist)	80,372
Erin McIntyre (Lab Manager)	63,045
Grace Alexander (Research Technologist)	48,368
Hillary Stevenson (Research Nurse Coordinator)	45,063
Benefits	115,334
Current Personnel Subtotal	543,120

Core Lab Operational Costs

Supplies, Scientific Services, Publication Costs, etc.	139,592
Travel	20
Capital	267,797
Operational Costs Subtotal	407,410
TOTAL RESEARCH PERSONNEL AND CORE LAB FY2022	**$950,529**

Awarded Projects FY2022

Overcoming Immunosuppression	Solheim	50,000
Role of FBXO21 as an Oncogene in AML	Buckley	50,000
Targeting Epigenetic Alterations	Band	100,000
Imaging Agents for Surgery Medulloblastoma	Mohs	50,000
Development of BRD4 and P13K	Mahato	50,000
SOX2: MYC Axis & Drug Tolerant	Rizzino	50,000
Developing Regional Medulloblastoma Core	Mahapatra	100,000
Targeting NK Cell Tolerance	Band	50,000
The Role of RUNX1 in Early T-cell	Hyde/Woods	50,000
Novel Benzimidazole Carbamate Theranostics	Baranowska	15,000
Robot Rehab: Animal Assisted Interactions	Hetland	49,978
Impact of Symptom Clusters on Survivors	Napit	10,000
Data-driven Identification of Regulatory Networks	Challagundla	75,000
Therapeutic Potential of Neurolysin Inhibition	Trippier/Murry	50,000
Cancer Progression Driven by Transient	Scherbakova/Preston/Pavlov	100,000
TOTAL AWARDED FY2022		**$849,978**

Planned Funding FY2023

Targeting Epigenetic Alterations	Band	100,000
Developing Regional Medulloblastoma Core	Mahapatra	100,000
Data-driven Identification of Regulatory Networks	Challagundla	75,000
Role of FBXO21 as an Oncogene in AML	Hyde/Natarajan/Buckley	150,000
Development of Tumor-Targeted Peripherally	Vetro	100,000
Targeting Chemoresistance in Medulloblastoma	Mahato	75,000
Implementation of Screening and VR	Weeks	50,000
Hematological Malginancies Affinity Group	Hyde	100,000
TOTAL PLANNED FUNDING TO DATE FY2023		**$750,000**
TOTAL PLANNED FUTURE FUNDING FY2023 (Includes Fred & Pamela Buffett Cancer Center Projects)		150,000
TOTAL PROJECTS FUNDED FY2022 – FY2023		**$1,710,440**