

The NCI CIRP Program

Quantitative Imaging Research Resources At Preclinical and Clinical Setting

Huiming Zhang, Ph.D., Cancer Imaging Program, DCTD, NCI

CIRP Objectives

- ❑ Establish co-clinical quantitative imaging protocols via reverse-translation from clinical imaging setting to pre-clinical imaging setting, with emphasis on optimization of preclinical imaging,
- ❑ Use available, credential GEMMs or PDXs to re-capitulate disease biological features and to address important cancer issues for adult or pediatric diseases,
- ❑ Use known therapeutic or prevention interventions as testing bed,
- ❑ Implement optimized imaging protocols to co-clinical interventions to collect co-clinical images,
- ❑ Deliver a Web-Resource populated with all methods, protocols, tools and results by the 3rd quarter of yr-5.

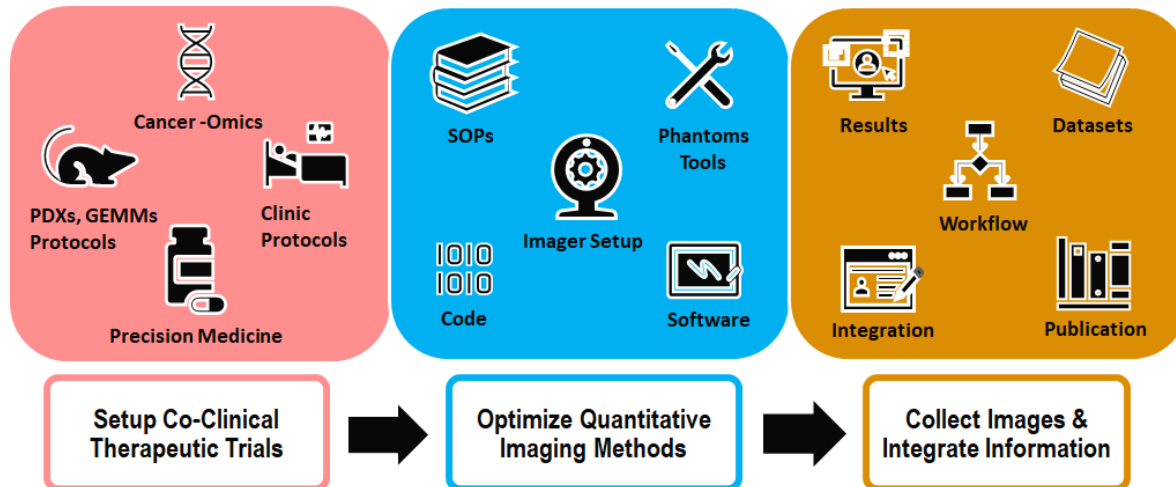


<https://ncihub.org/groups/cirphub>

CIRP Web-Resource

Basic Required Content

Workflow



Protocols

- Animal protocols
- Biology/Pathology/histopathology protocols
- Imaging protocols: QA/QC, PET, CT, MRI, etc.

Methods

Software

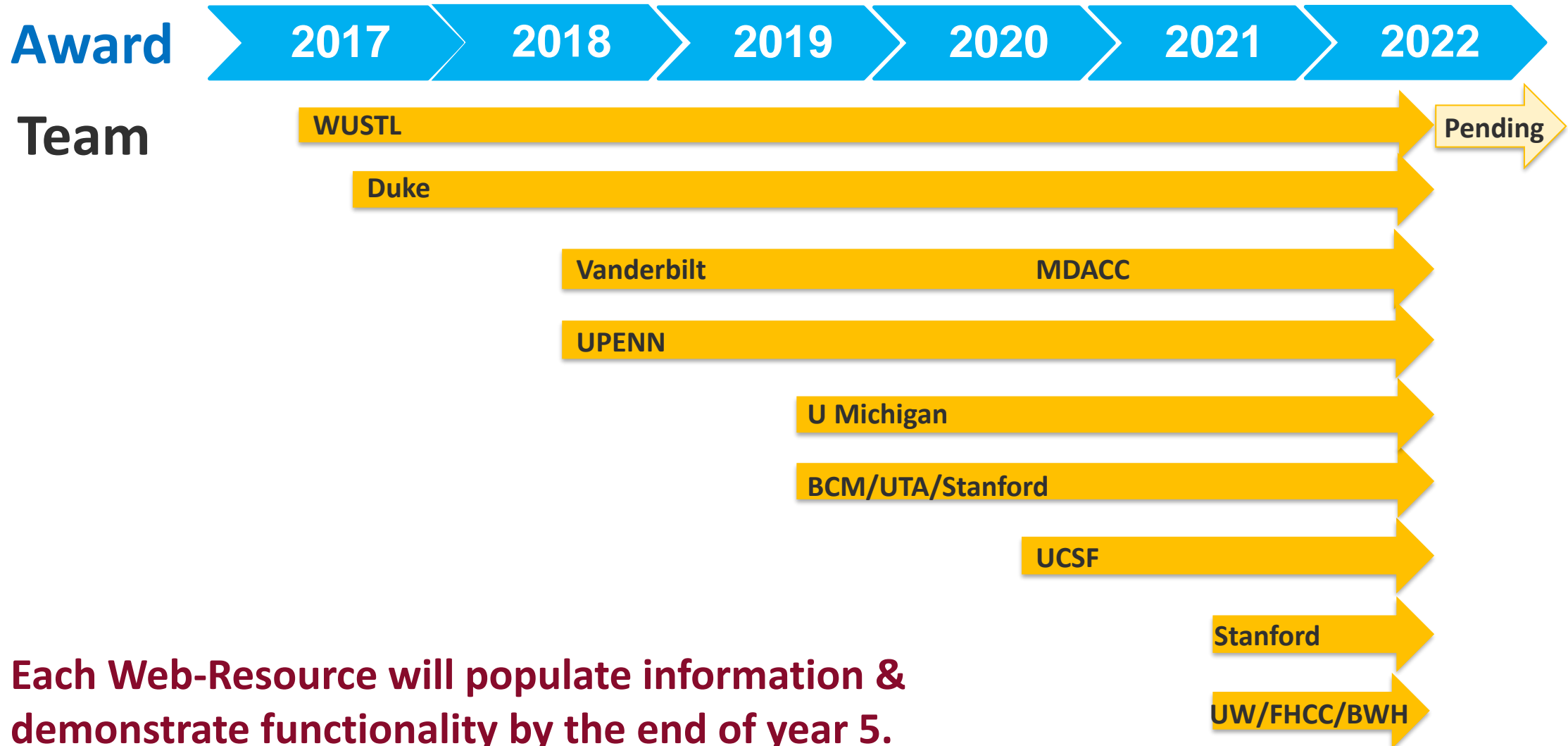
- Imaging process
- Image reconstruction
- Data analysis

Representative Data that are correlated to each other (preclinical & clinical)

- Biology data
- Pathology Data
- Imaging data

Results

CIRP Web-Resources Are on the Way



Each Web-Resource will populate information & demonstrate functionality by the end of year 5.

CIRP Teams: Project Overview

Cancer Type	Diseases	Team	Patient Group		Tumor Stage		Mouse Model		Therapy		Quantitative Imaging				
			Adult	Pediatric	Primary	Metastatic	PDXs	GEMMs	Therapy	Combined	Anatomic	Metabolic	Cellular	Perfusion	Molecular
Hematology	Myelofibrosis	U Michigan	Y		Y			Y	Target		Y		Y		Y
Bone	Osteosarcoma	Stanford		Y	Y		Y		Immuno-therapy			Y			Y
Breast	Breast Cancer, TNBC	WUSTL	Y		Y		Y		Chemo-therapy		Y	Y	Y	Y	
	Breast Cancer, TNBC	BCM/UT/Stanford	Y		Y		Y		Chemo-therapy				Y	Y	
Colon	Colorectal Cancer	MDACC	Y		Y		Y		Target	Immuno-therapy		Y			Y
Lung	Lung Cancer, NSCLC	UW/FHCRC/BWH	Y		Y			Y	Immuno-therapy	Target		Y			
Muscle	Soft Tissue Sarcoma	Duke	Y		Y	Lung		Y	Immuno-therapy	Radiation	Y		Y		
Pancreas	Pancreatic Cancer, PDA	UPENN	Y		Y			Y	Target				Y	Y	
Prostate	Prostate Metastatic cancer, SCNC	UCSF	Y		Y	Bone Liver	Y		Chemo-therapy		Y		Y	Y	Y

Cancer Issue: Therapeutic response, efficacy, failure and prediction, personalized treatment,

Disease: 8 cancer types (6 primary, 2 metastasis), 7 Adult diseases, 1 pediatric diseases,

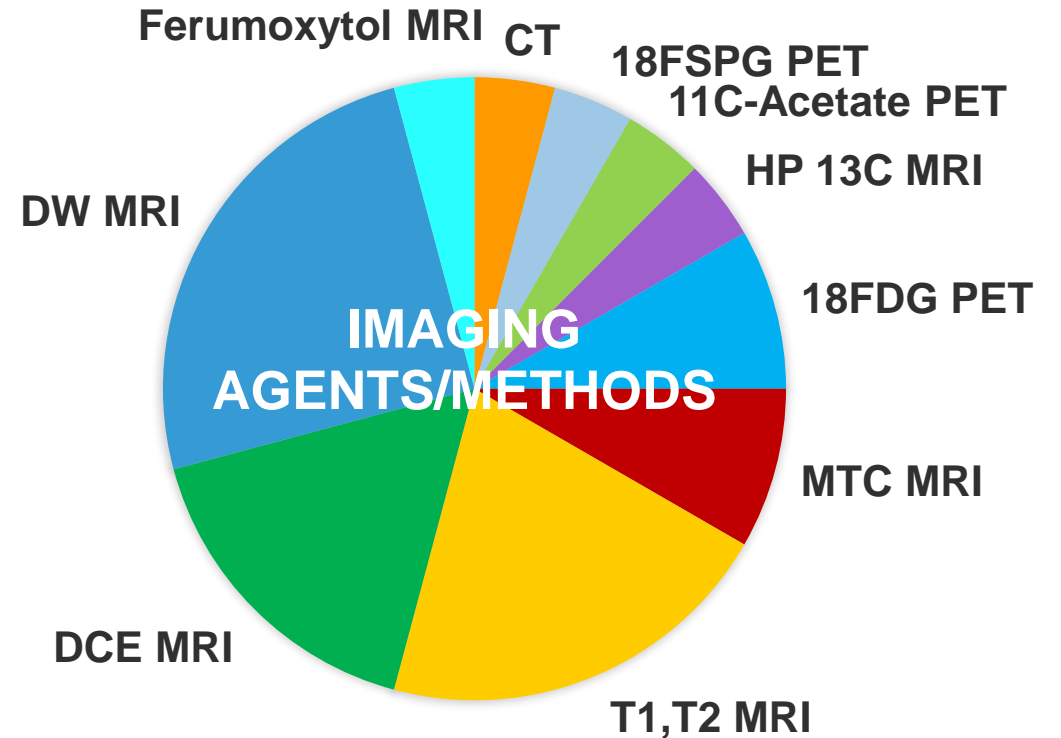
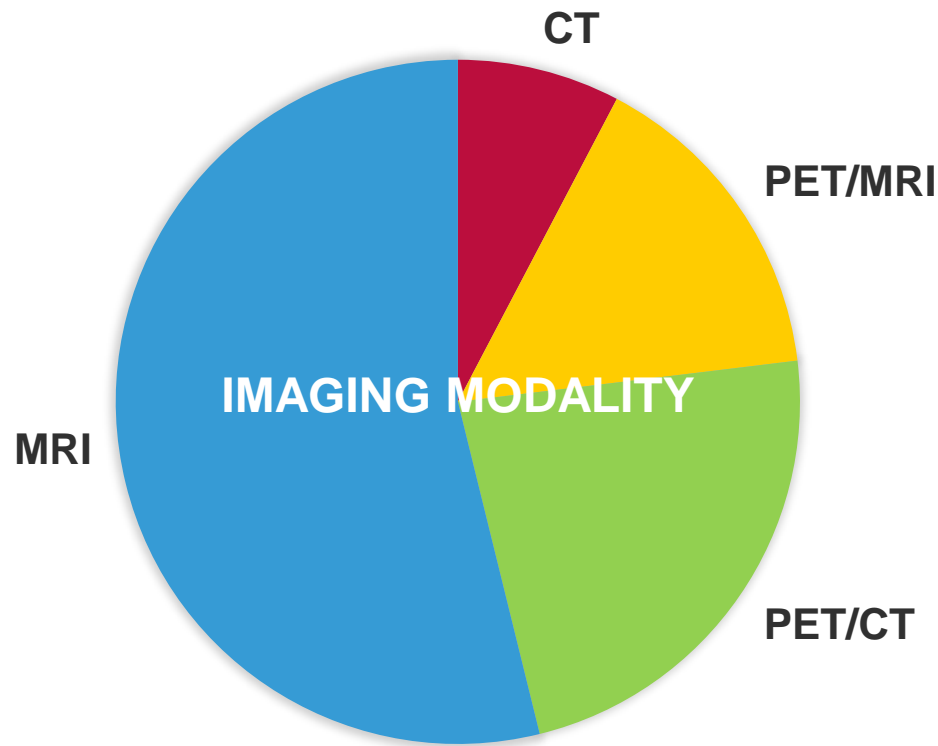
Animal Model: 5 sites use PDXs, 4 sites use GEMMs,

Clinical Trial: 4 institutes on-going, 2 SPOREs, 1 CTEP, 1 R01, 1 Consortium; 8 Co-Clinical prospective, 1 matched pre-clinical prospective,

Therapy: 3 Chemotherapy, 2 target therapy, 2 target/immunotherapy, 1 immunotherapy, 1 immunotherapy/radiation therapy,

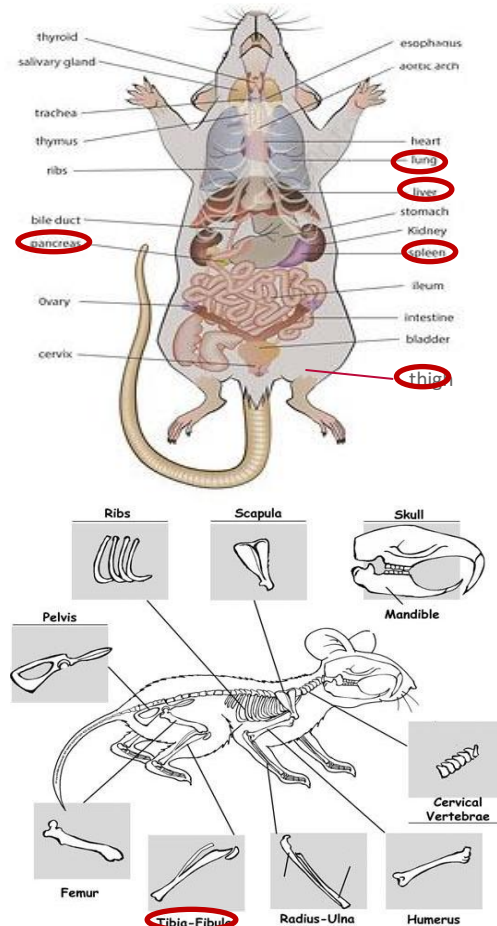
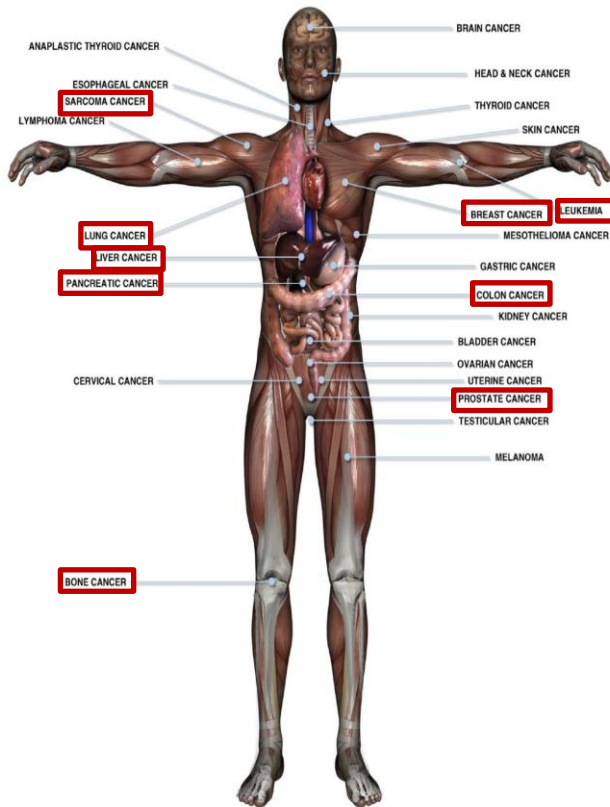
Imaging Methods: 1 CT, 2 PET, 5 MRI, 2 PET/MRI, anatomic, molecular, metabolic, cellular, perfusion, extendable to other diseases & therapies.

CIRP: Imaging Methods



In vivo quantitative imaging of anatomy, function, metabolism, molecules, vascularity, cellularity.

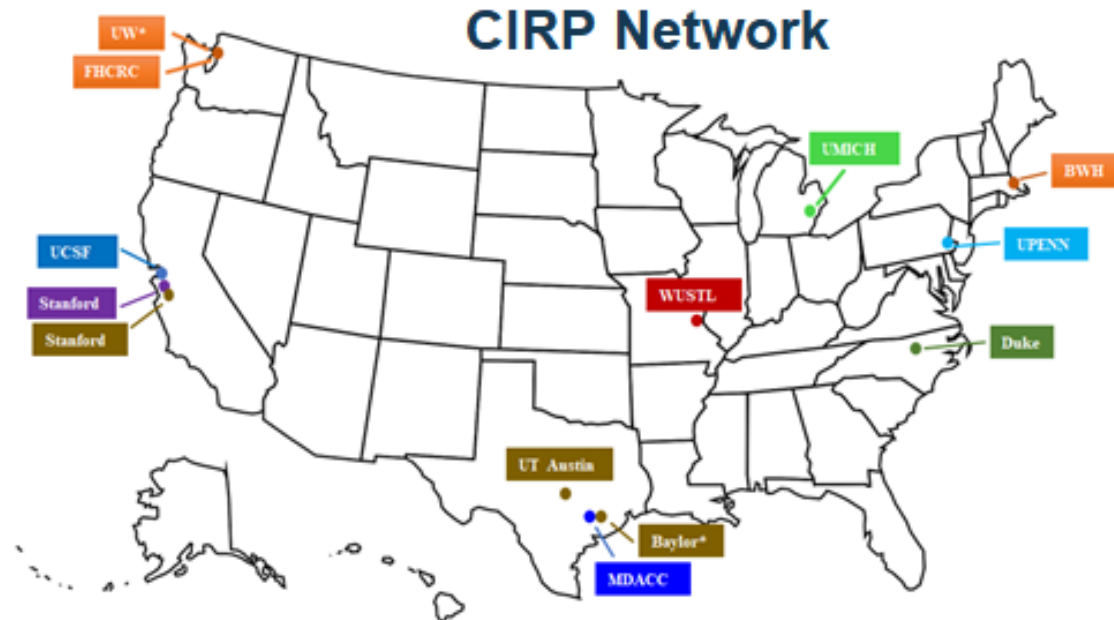
Cancers and Orthotopic Mouse Models Studied by CIRP



Potential of CIRP as Publicly Available Web-Resources

- ❑ Methodology to use animal models (PDXs or GEMMs) to recapitulate biological features of diseases,
- ❑ Protocols to detect dynamic spatio-temporal changes in tumor burdens at molecular, cellular, functional, physiological, anatomic level,
- ❑ Tools to generate quantitative, non-invasive, real time, longitudinal assessment for large cohort study,
- ❑ Strategies to inform clinical trials with pre-clinical study non-invasively and to bridge preclinical-clinical translational divide efficiently.

Web-resources Demonstrations: 7 teams



Washington University in St. Louis

Co-Clinical Imaging Research Resource (C2IR2)

Welcome to the Washington University Co-Clinical Imaging Research Resource

Multi-scale PET/MR & Optical imaging, Clinical, Pathology, Radiomics, Feature Extraction, Machine Learning

UCSF Co-Clinical Imaging Research Resource Program (CIRP)

UCSF CIRP: A portal for protocols & tools for PET-CT quantitative image acquisition and processing

University of Michigan

Quantitative Co-Clinical Imaging Research Resource

Research, Publications, Project Team, Contact Us

Percelman

Penn Quantitative Imaging Resource for Pancreatic Cancer

Collaborative, Biomechanical, RBC

The Duke Preclinical Research Resources for Quantitative Imaging Biomarkers

Duke Radiology

HOME, SIGNIFICANCE, SPECIFIC AMS, TEAM, MRI, MICRO-CT, PROTOCOLS, CODE, DATA, PUBLICATIONS, FUNDING

National Cancer Institute

PREDICT

Quantitative PET imaging resource for pancreatic cancer

UT TEXAS

MIRACCL

Microfluidic and Imaging Resource for Cancer Clinical Trials

Team, Awarded Time

WUSTL	May 2017
Duke	Sept 2017
MDACC	Sept 2018
UPENN	Sept 2018
UMich	Sept 2019
Baylor	Sept 2019
UCSF	Sept 2020

CIRP Resource Example: WUSTL

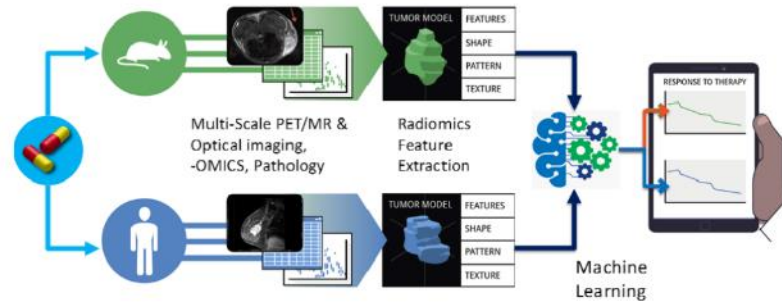
<https://c2ir2.wustl.edu/>

Washington University School of Medicine in St. Louis

Co-Clinical Imaging Research Resource (C2IR2)

HOME ABOUT RESEARCH PUBLICATIONS RESOURCES CO-CLINICAL DATABASE (CCDB) CONTACT

Welcome to the Washington University
Co-Clinical Imaging Research Resource



Resources

- [Animal Models](#)
- [Preclinical Phantoms for QA/QC](#)
- [SOPs for Animal Modeling](#)
- [SOPs for Scanner QA/QC](#)
- [Software/Code](#)
- [Datasets](#)
- [CIRP Resource Sharing Policy](#)

Disease: TNBC Breast Cancer

Selected publications

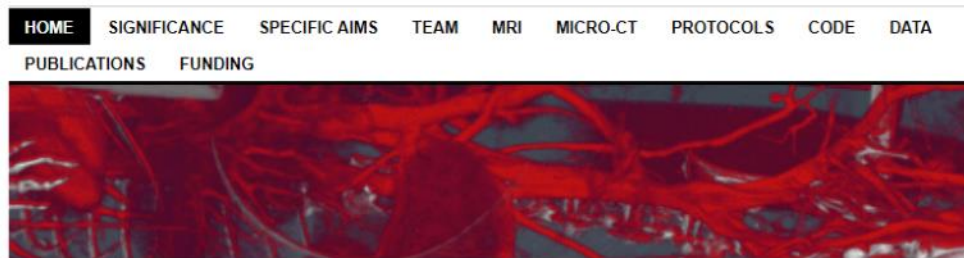
- X. Ge, et al., *Test–Retest Performance of a 1-Hour Multiparametric MR Image Acquisition Pipeline with Orthotopic Triple-Negative Breast Cancer Patient-Derived Tumor Xenografts*, *Tomography*, 2019, 5, 320-331,
- S. Roy, et al., *Optimal co-clinical radiomics: Sensitivity of radiomic features to tumour volume, image noise and resolution in co-clinical T1-weighted and T2-weighted magnetic resonance imaging*, *EBioMedicine* 59 (2020) 102963,
- M. A. Savaikar, et al., *Preclinical PERCIST and 25% of SUVmax Threshold: Precision Imaging of Response to Therapy in Co-clinical 18F-FDG PET Imaging of Triple-Negative Breast Cancer Patient-Derived Tumor Xenografts*, *J Nucl Med* 2020; 61:842–849,
- K. I. Shoghi, et al., *Co-Clinical Imaging Resource Program (CIRP): Bridging the Translational Divide to Advance Precision Medicine*, *Tomography*, 2020, 6, 273-287,
- K. Dutta, et al., *Deep Learning Segmentation of Triple-Negative Breast Cancer (TNBC) Patient Derived Tumor Xenograft (PDX) and Sensitivity of Radiomic Pipeline to Tumor Probability Boundary*, *Cancers* 2021, 13, 3795.
- S. Roy, et al., *Co-clinical FDG-PET radiomic signature in predicting response to neoadjuvant chemotherapy in triple-negative breast cancer*, *European Journal of Nuclear Medicine and Molecular Imaging*, 2021, <https://doi.org/10.1007/s00259-021-05489-8>.

CIRP Resource Example: Duke

<https://sites.duke.edu/pcqiba/>

The Duke Preclinical Research Resources for Quantitative Imaging Biomarkers

Duke Radiology



Resources

- [MRI](#)
- [Micro-CT](#)
- [Protocols](#)
- [Code](#)
- [Data](#)

Disease: Soft Tissue Sarcoma with Lung Metastasis

Selected publications

- S. J. Blocker, et al., *Bridging the translational gap: Implementation of multimodal small animal imaging strategies for tumor burden assessment in a co-clinical trial*, PLoS ONE 14(4): e0207555, 2019
- S. J. Blocker, et al., *The impact of respiratory gating on improving volume measurement of murine lung tumors in micro-CT imaging*, PLoS ONE 15(2): e0225019, 2020
- M. D. Holbrook, et al., *MRI-Based Deep Learning Segmentation and Radiomics of Sarcoma in Mice*, Tomography, 2020, 6, 23–33,
- A. J. Wisdom, et al., *Single cell analysis reveals distinct immune landscapes in transplant and primary sarcomas that determine response or resistance to immunotherapy*, NATURE COMMUNICATIONS, 6410 (2020),
- M. D. Holbrook, et al., *Detection of Lung Nodules in Micro-CT Imaging Using Deep Learning*, Tomography 2021, 7, 358–372.
- Blocker, S. et al., *Ex Vivo MR Histology and Cytometric Feature Mapping Connect Three-dimensional in Vivo MR Images to Two dimensional Histopathologic Images of Murine Sarcomas*, Radiology: Imaging Cancer 2021; 3(3): e200103.

CIRPHub: Central Hub links to Individual Resources

<https://nciphub.org/groups/cirphub>

The screenshot shows the CIRPHub website interface. At the top, there is a navigation bar with 'powered by NCIP Hub' on the left and 'Login', 'Register', and 'Request Membership' on the right. Below this is a header for 'Co-Clinical Imaging Research Resources Program Network (CIRP) [cirphub]'. A teal navigation menu contains links for 'Overview', 'Members', 'Resources', 'Forum', 'Projects', 'Calendar', 'Announcements', 'Collections', and 'Activity'. The main content area is titled 'About CIRP' and contains a paragraph of text describing the program. Below the text, it lists 'Four essential elements' with corresponding icons: 'Animal Models' (red box with a mouse icon), 'Co-Clinical Trials' (green box with a mouse and person icon), 'Quantitative Imaging' (blue box with a microscope icon), and 'Informatics' (purple box with a computer monitor icon).

- ❑ **Teams:** abstracts of CIRP projects
- ❑ **Team Websites:** links to individual CIRP web-resource
- ❑ **Activities:** meeting agenda and program slides
- ❑ **Selected publications:** CIRP papers

CIRP Working Groups

❑ **Animal Model & Co-Clinical Trial (AMCT) WG:**

Cancer issues and Unmet Needs

❑ **Imaging Acquisition & Data Process (IADP) WG:**

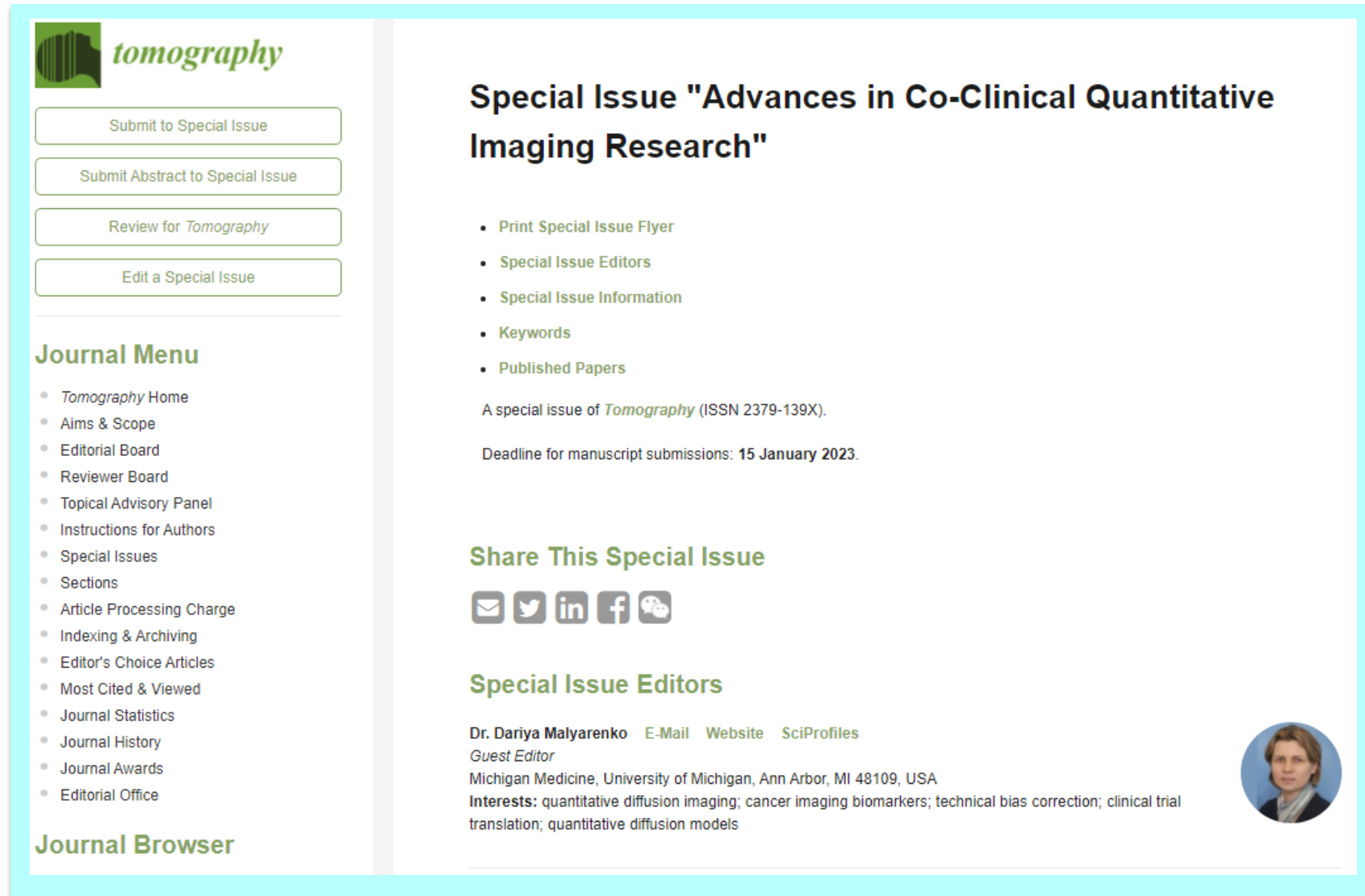
Standardization & Metrology

❑ **Informatics & Outreach (IMOR) WG:**

Metadata & Interoperability

CIRP Network: A special issue is coming

https://www.mdpi.com/journal/tomography/special_issues/AQCCIR



The screenshot displays the Tomography journal website. On the left, there is a sidebar with the journal logo and navigation buttons: "Submit to Special Issue", "Submit Abstract to Special Issue", "Review for Tomography", and "Edit a Special Issue". Below these is a "Journal Menu" with links to various journal sections. The main content area features a large heading for the special issue, a list of links for more information, a description of the issue, a submission deadline, and a section for the special issue editor with a profile picture.

tomography

Submit to Special Issue

Submit Abstract to Special Issue

Review for *Tomography*

Edit a Special Issue

Journal Menu

- [Tomography Home](#)
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Journal Browser

Special Issue "Advances in Co-Clinical Quantitative Imaging Research"

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- [Special Issue Editors](#)
- [Special Issue Information](#)
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A special issue of *Tomography* (ISSN 2379-139X).


Deadline for manuscript submissions: **15 January 2023**.

Share This Special Issue

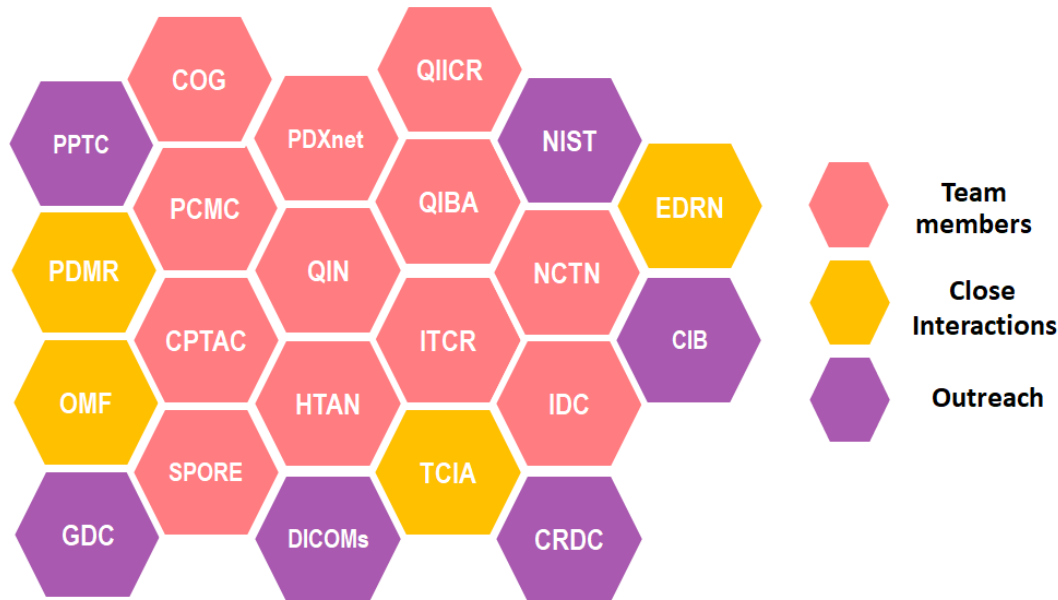
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Special Issue Editors

Dr. Dariya Malyarenko [E-Mail](#) [Website](#) [SciProfiles](#)
Guest Editor
Michigan Medicine, University of Michigan, Ann Arbor, MI 48109, USA
Interests: quantitative diffusion imaging; cancer imaging biomarkers; technical bias correction; clinical trial translation; quantitative diffusion models



CIRP Outreach & Dissemination



- CIRP Annual Meeting: Open to public,
- Outside speakers invited by the CIRP working groups,
- CIRP organizes sessions at scientific meetings or conferences,
- CIRP investigators present at scientific meetings,
- CIRP invites outside investigators as associate members,
- CIRP Hub as central hub**
(<https://nciphub.org/groups/cirphub>),
- Individual CIRP Web-resources.**

Questions?

This set of slides will be available at
<https://ncihub.org/groups/cirphub>



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