

CIRP Program: Status Update

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CIRP Annual Meeting

- ❑ CIRP Program
- ❑ CIRP Network
- ❑ CIRP Teams

CIRP Program

Scientific Goals of CIRP

Develop Co-Clinical imaging research resources that will encourage a consensus on how quantitative imaging (QI) methods are optimized to improve the quality of imaging results for co-clinical trials of adult and/or pediatric cancers:

- Perform optimization of pre-clinical quantitative imaging methods
- Implement optimized methods in co-clinical trials
- Populate a web-accessible research resource with all data, methods, workflow documentation, and results collected from co-clinical investigations.

Structure of Individual CIRP Site

❑ Co-clinical interventions:

Known intervention
Therapeutic or prevention
Prospective or retrospective

❑ GEMMs or PDXs models:

Mice, available, credentialed, validated

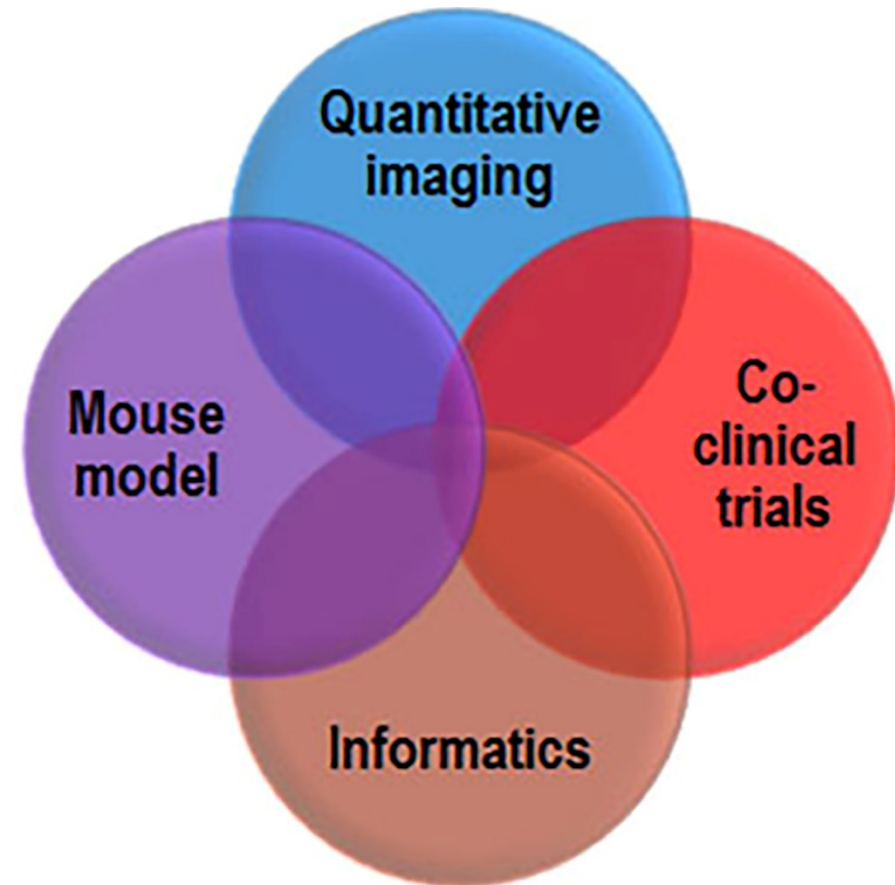
❑ Quantitative imaging:

Preclinical identical to clinic one
New methods require IND or IDE
User developed software tools allowed

❑ State-of-art informatics:

Encourage data integration
Encourage to use TCIA, NCIP hub
Encourage to contribute to OMF, QIN, EDRN, etc.

Four Elements



Adult & Pediatric Cancers: Differences

Adults

Bladder Cancer
Breast Cancer*
Colorectal Cancer*
Endometrial Cancer
Kidney Cancer
Leukemia
Liver Cancer
Lung Cancer
Melanoma*
Non-Hodgkin Lymphoma
Pancreatic Cancer*
Prostate Cancer
Thyroid Cancer

*CIRP projects

Children

Leukemia
Brain and spinal cord
Neuroblastoma
Wilms
Lymphoma
Rhabdomyosarcoma
Retinoblastoma
Bone cancer

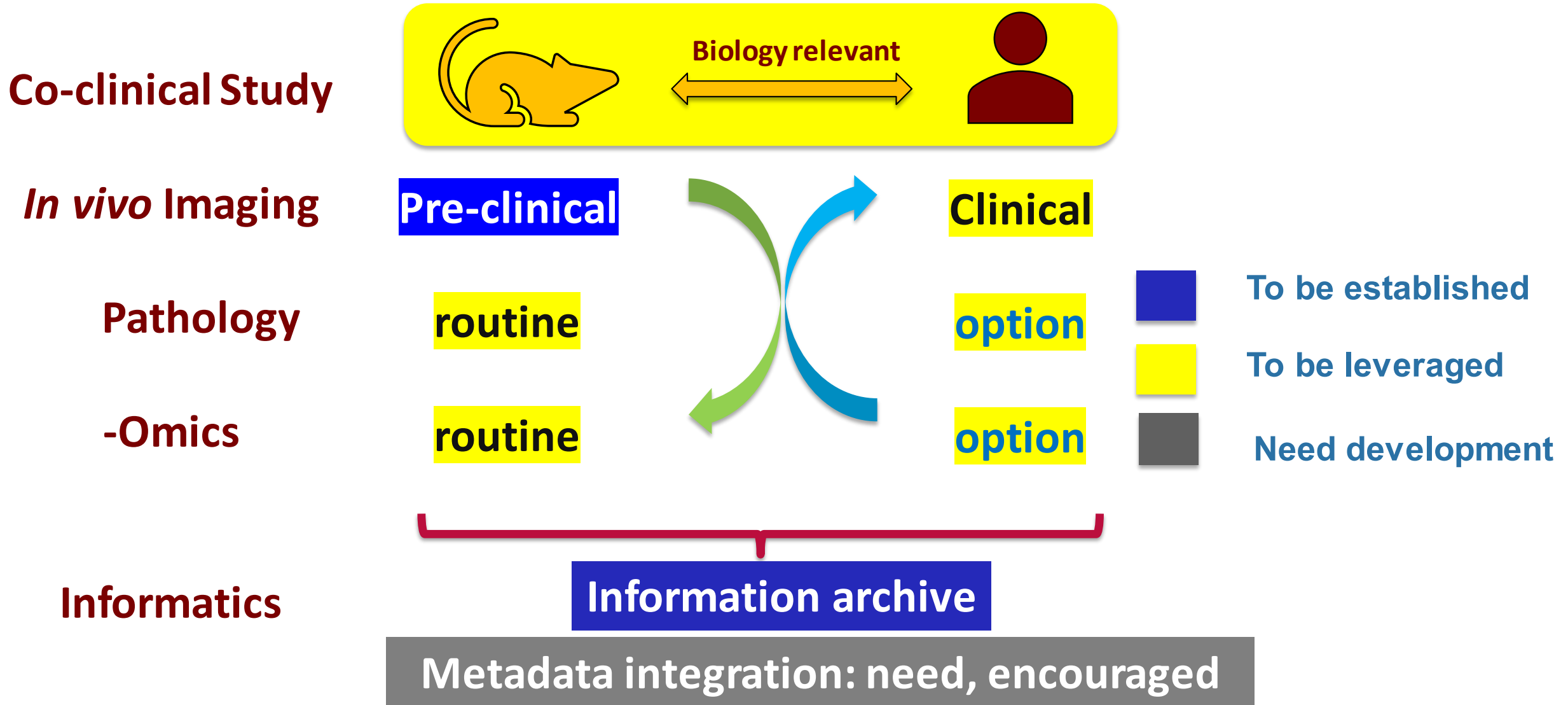
Differences

Patient groups
Types
Organ sites
Treatment
Long term side effect



**Need different
imaging protocols**

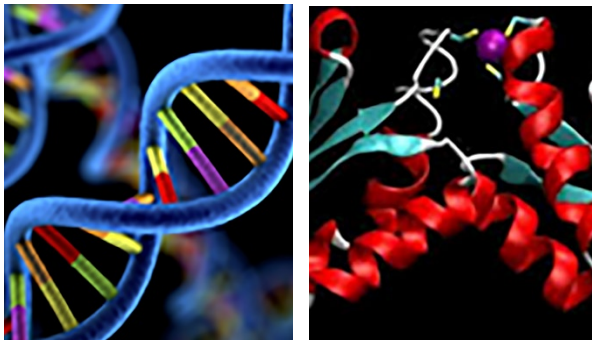
CIRP Expectation: To Deliver Standards & SOPs



CIRP Deliverables: *A web-accessible resource with functional information and functionality.*

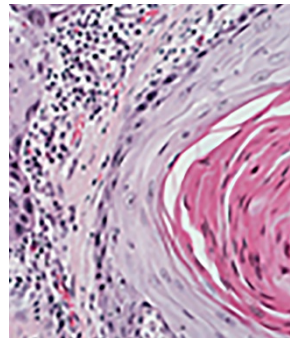
Data Examples:

RNA-Seq & WES (PDXs)

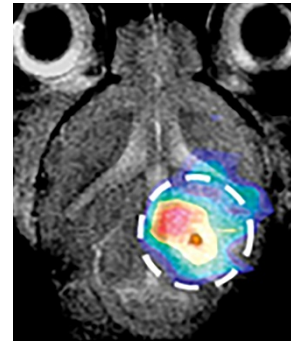


Molecular

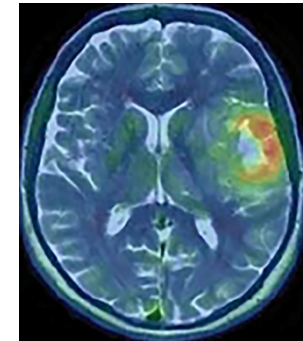
Pathology



Preclinical imaging



Clinical imaging



Anatomical

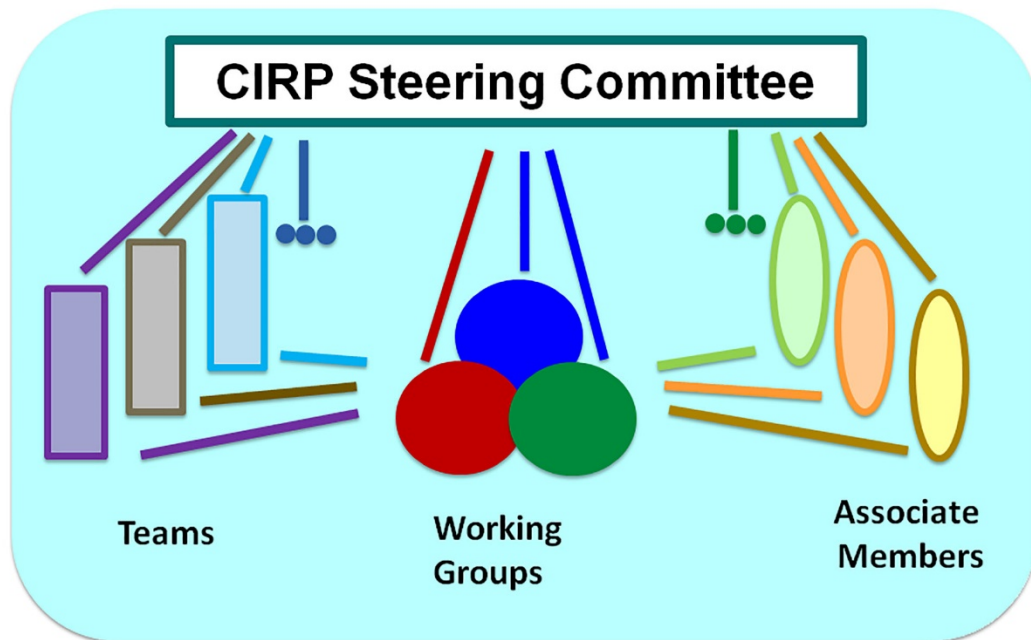
Protocols
Software
Workflow
Tools, etc.

Correlated data sets

CIRP Network

CIRP Network

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



- ❑ **Steering Committee (SC)**
- ❑ **Three Working Groups (WGs):**
 - **Animal models and co-clinical trials (AMCT)**
 - **Imaging acquisition and data process (IADP)**
 - **Informatics and outreach (IMOR)**
- ❑ **Associate Members:**
 - **Join WGs T-cons**
 - **Contribute to consensus development**
 - **Participate annual meetings**

CIRP Network Effort

PERSPECTIVES TOMOGRAPHY®

WMIC 2019
WORLD MOLECULAR IMAGING CONGRESS

MONTRÉAL SEPTEMBER 4-7, 2019





LATE BREAKING ABSTRACT
SUBMISSION PERIOD:
JUNE 3— JULY 1, 2019

THE DYNAMICS OF LIFE:
INTEGRATING MOLECULAR IMAGING

wmis.org

Program

Speakers

Print

Spotlight 5: Co-clinical Imaging in Precision Medicine

Thu, September 05	8:00 - 9:30	520a
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Description

The National Cancer Institute (NCI) has recently launched the Co-Clinical Imaging Research Resources

Co-Clinical Imaging Resource Program (CIRP): Bridging the Translational Divide to Advance Precision Medicine

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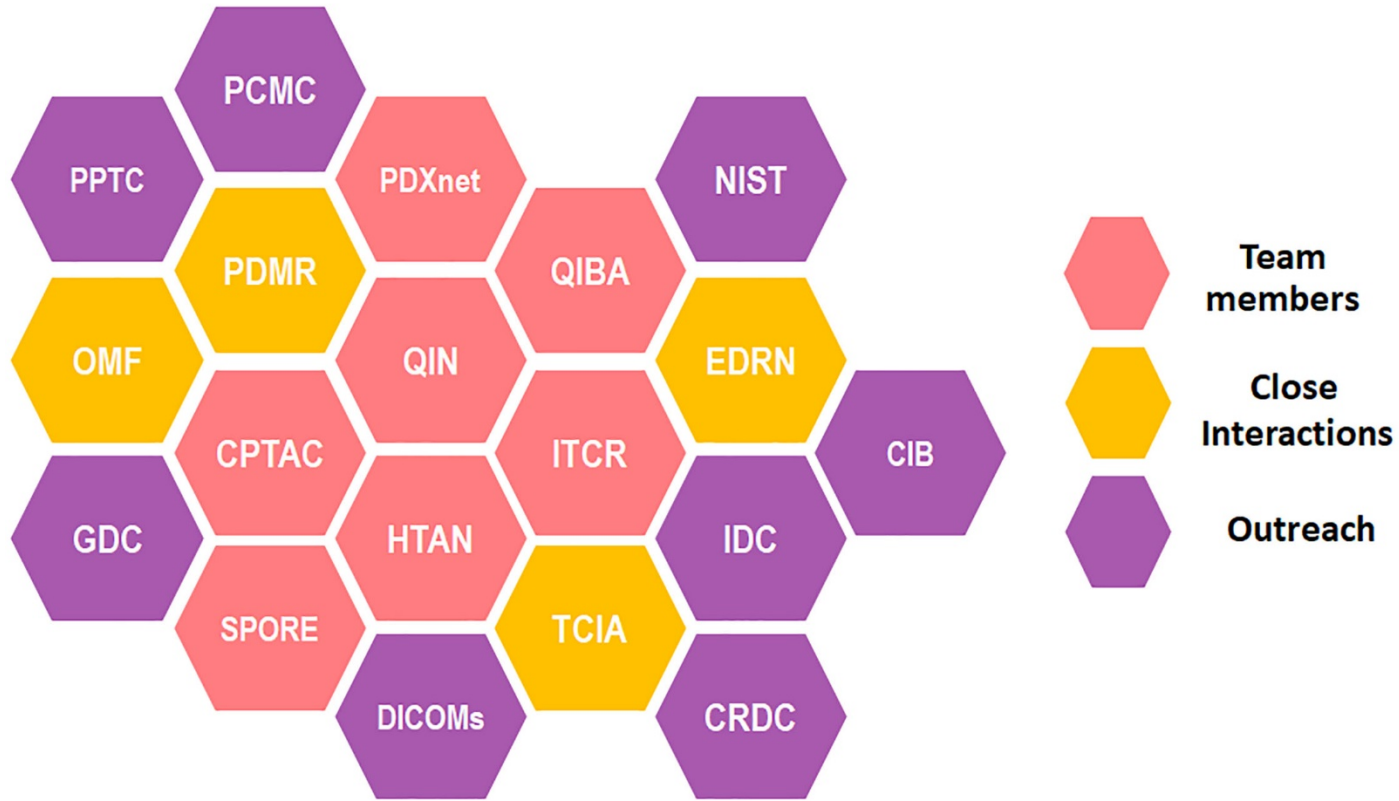
Key Words: Co-clinical trial, preclinical PET, MR, CT, quantitative imaging, informatics, precision medicine, patient-derived tumor xenograft (PDX), genetically engineered mouse model (GEMM), cell transplant model (CTM)

Abbreviations: Co-Clinical Imaging Research Resource Program (CIRP), genetically engineered mouse models (GEMM), cell transplant models (CTM), patient-derived tumor xenograft (PDX), quality assurance (FLP, flipase; QA), steering committee (SC), working group (WG), hematopoietic stem cells (HSCs), quantitative imaging (QI), National Cancer Institute (NCI), magnetic resonance imaging (MRI), computed tomography (CT), positron emission tomography (PET), American College of Radiology (ACR), field of view (FOV), Bland-Altman analysis (BA)

ABSTRACT

The National Institutes of Health's (National Cancer Institute) precision medicine initiative emphasizes the biological and molecular bases for cancer prevention and treatment. Importantly, it addresses the need for consistency in preclinical and clinical research. To overcome the translational gap in cancer treatment and prevention, the cancer research community has been transitioning toward using animal models that more faithfully recapitulate human tumor biology. There is a growing need to develop best practices in translational research, including imaging research, to better inform therapeutic choices and decision-making. Therefore, the National Cancer Institute has recently launched the Co-Clinical Imaging Research Resource Program (CIRP). Its overarching mission is to advance the practice of precision medicine by establishing consensus-based best practices for co-clinical imaging research by developing optimized state-of-the-art translational quantitative imaging methodologies to enable disease detection, risk stratification, and assessment/prediction of response to therapy. In this communication, we discuss our involvement in the CIRP, detailing key considerations including animal model selection, co-clinical study design, need for standardization of co-clinical instruments, and harmonization of preclinical and clinical quantitative imaging pipelines. An underlying emphasis in the program is to develop best practices toward reproducible, repeatable, and precise quantitative imaging biomarkers for use in translational cancer imaging and therapy. We will conclude with our thoughts on informatics needs to enable collaborative and open science research to advance precision medicine.

CIRP Outreach



- Leverage existing resources & expertise
- Ensure best practices for every CIRP element
- Address unmet needs in cancer community
- Provide better support to cancer research

CIRP Teams

CIRP Teams

Institute	Animal Models	Therapy	Imaging	Leveraged Resources
WUSTL	Breast TNBC orthotopic PDXs	Chemotherapy	PET/MRI, FDG PET T1, T2, DW, DCE MRI	PDXnet, ITCR, QIN, QIBA, SAIR, HTAN, XNAT
Duke	Soft Tissue Sarcoma GEMMs	Immunotherapy Radiation therapy	T1, T2, DW micro-MRI Micro-CT	CIVM, QIBA
Vanderbilt	RAS CRC, Subcutaneous, Orthotopic PDXs, Immuno-competent	Targeted therapy	Dual tracer dynamic PET 18F-FSPG, 11C-Acetate	SPORE, PET probe lab
UPENN	PDA KPC GEMMs	Targeted therapy	Radial sampling MRI DCE, DW, MTC MRI	SAIR, Mouse hospital,
U Michigan	Myelofibrosis, bone marrow transplant GEMMs	Targeted therapy	Cryoprobe MRI DFPP, DW, MTC, Spleen MRI	SAIR, QIN
Baylor/UT Austin/Stanford	Breast TNBC orthotopic PDX	Chemotherapy	DW, DCE MRI	PDXnet, CPTAC, QIN, ITCR, ePAD, LinkedOmics

Animal Models & Imaging Methods in CIRP

GEMMs:

- ❑ Soft tissue sarcoma with lung metastasis:
micro-MRI for primary tumor; micro-CT for lung metastasis
- ❑ Pancreatic cancers:
MRI for stromal status
- ❑ Myelofibrosis, a hematological disease:
MRI for bone marrow status

PDXs:

- ❑ TNBC orthotopic grafted:
PET/MRI, MRI for multiple models
- ❑ Colorectal Cancer, subcutaneous, orthotopic grafted
PET, dual tracers,

Humanized PDXs:

- ❑ Colorectal Cancer:
PET, dual tracers,

Challenges in Imaging Murine Cancer Models

- Beyond Subcutaneous Grafts

Disease-specific models:

GEMMs, Orthotopic PDXs, Metastatic diseases

Therapy-specific models:

Immunocompromised: PDXs

Immunocompetent : GEMMs, Humanized PDXs

Issues:

- ❑ **Body Motion:** Gating? Compensating? Removing? Reducing?
- ❑ **Sensitivity & Specificity:** Enhancing S/N? Better hardware? Better software? Better protocols? Impact of Animal Management?
- ❑ **Imaging protocols:** Single methods? Multiple methods? QA/QC?
- ❑ **Data extraction:** Automatic segmentation? Robust extraction?
- ❑ **Disease Models:** Biological Validations?

CIRP accomplishments

Publications by CIRP teams

- ❑ Preclinical PERCIST (μ PERCIST) paradigm -WUSTL
- ❑ 1-Hour Multiparametric MRI Acquisition Pipeline for orthotopic tumors -WUSTL
- ❑ Micro-CT protocols for lung metastases -Duke
- ❑ Multi-contrast micro-MRI Protocols for subcutaneous tumors -Duke
- ❑ Automated micro-MRI segmentation pipeline for subcutaneous tumors -Duke
- ❑ DCE MRI protocols for in situ pancreatic cancers -UPENN

CIRP Network Publications

- ❑ Consensus document on bridging the translational divide to advance precision medicine via co-clinical imaging

Questions?

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



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