CIRP Program: Status Update

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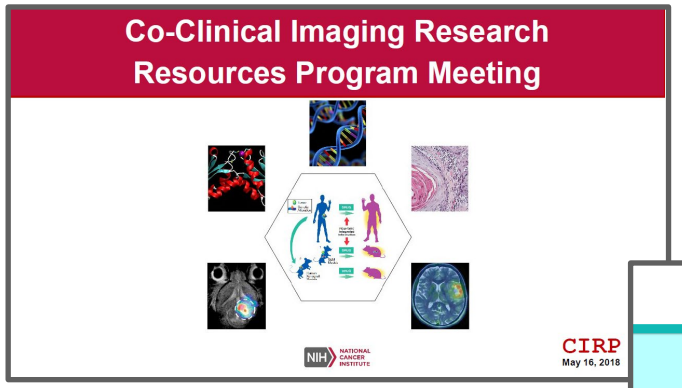
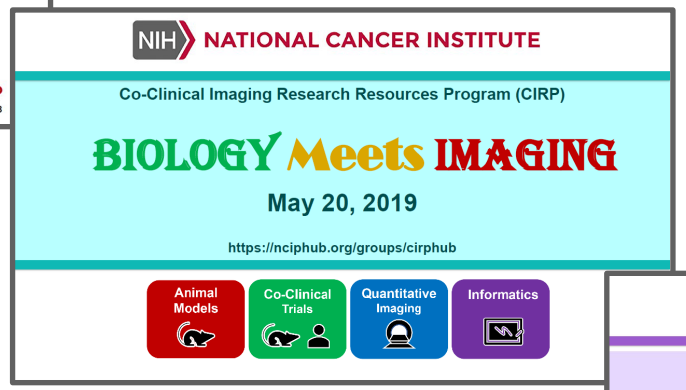
NIH NATIONAL CANCER INSTITUTE

June 16, 2021

CIRP Meeting In The 4th Year



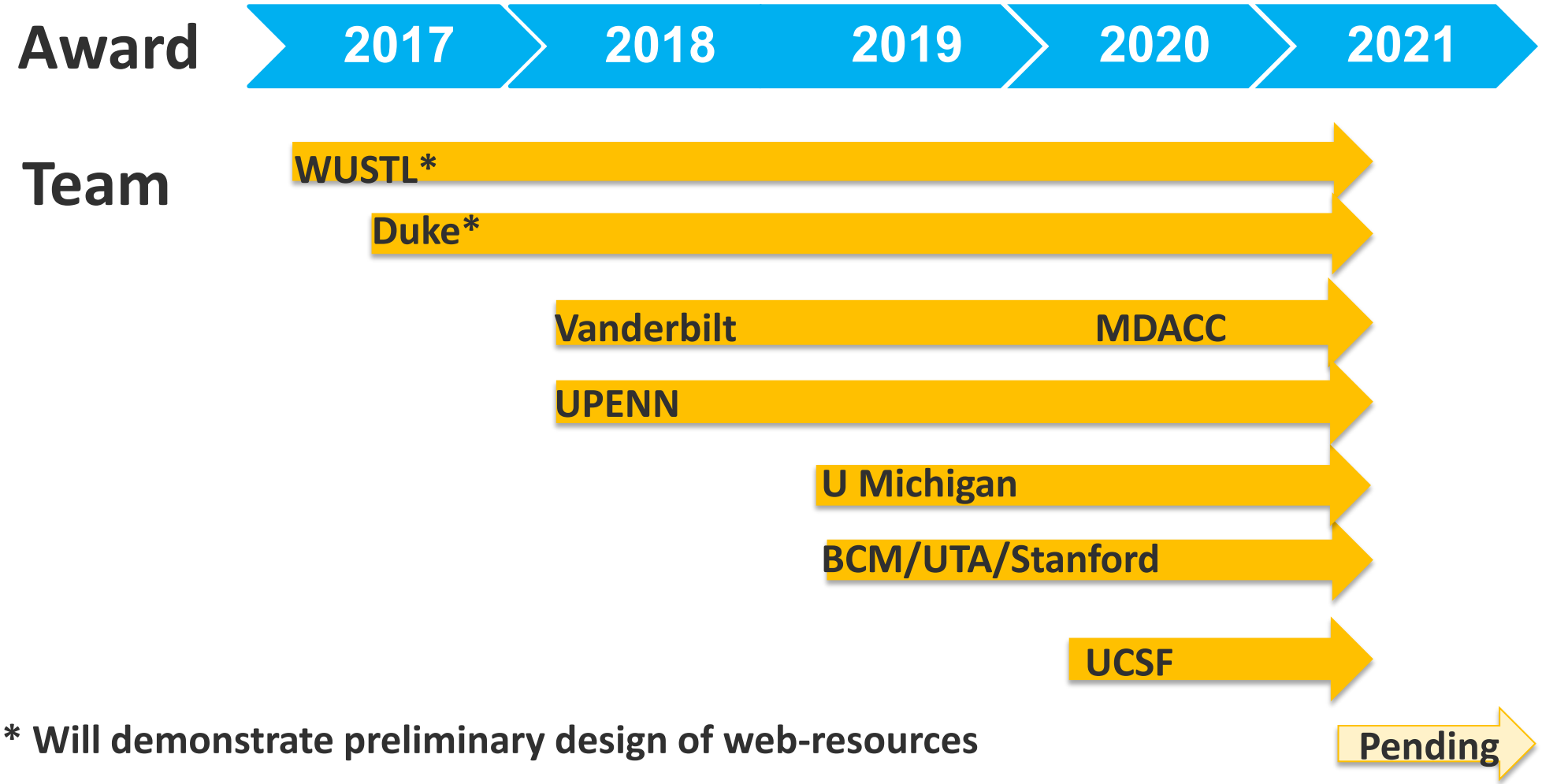


CIRP Is Expanding

- **New Awards**
  - UCSF
  - MD Anderson (Transferred from Vanderbilt)

- **New Associate Members**
  - WUSTL: ITCR project
  - Vanderbilt: Humanized Animal Models
  - MD Anderson: CEST MRI

CIRP Web-Resources Are On The Way

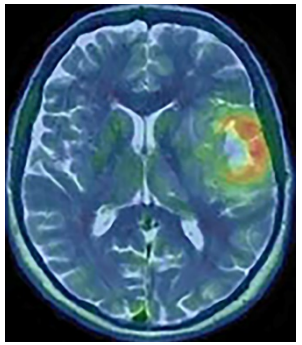


* Will demonstrate preliminary design of web-resources

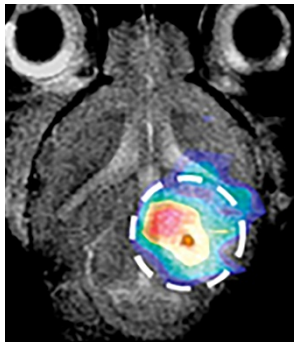
CIRP Deliverable: *Each site will develop a web-accessible resource with information and functionality by the 3rd quarter of Year 5.*

Data Examples:

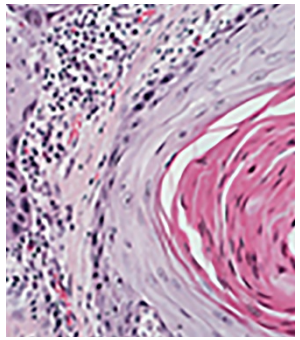
Clinical imaging



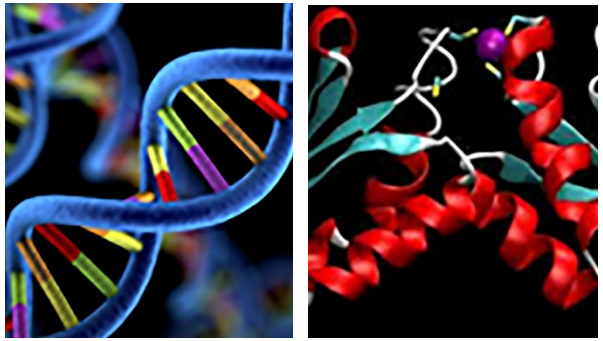
Preclinical imaging



Pathology



RNA-Seq & WES (PDXs)



Anatomic

Correlated data sets

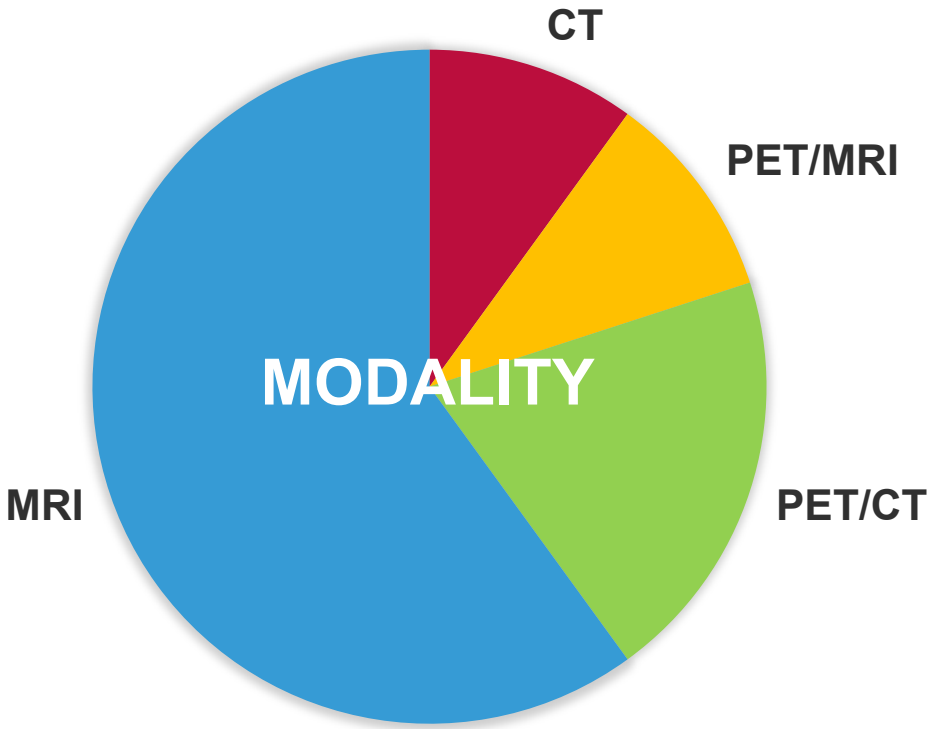
Molecular

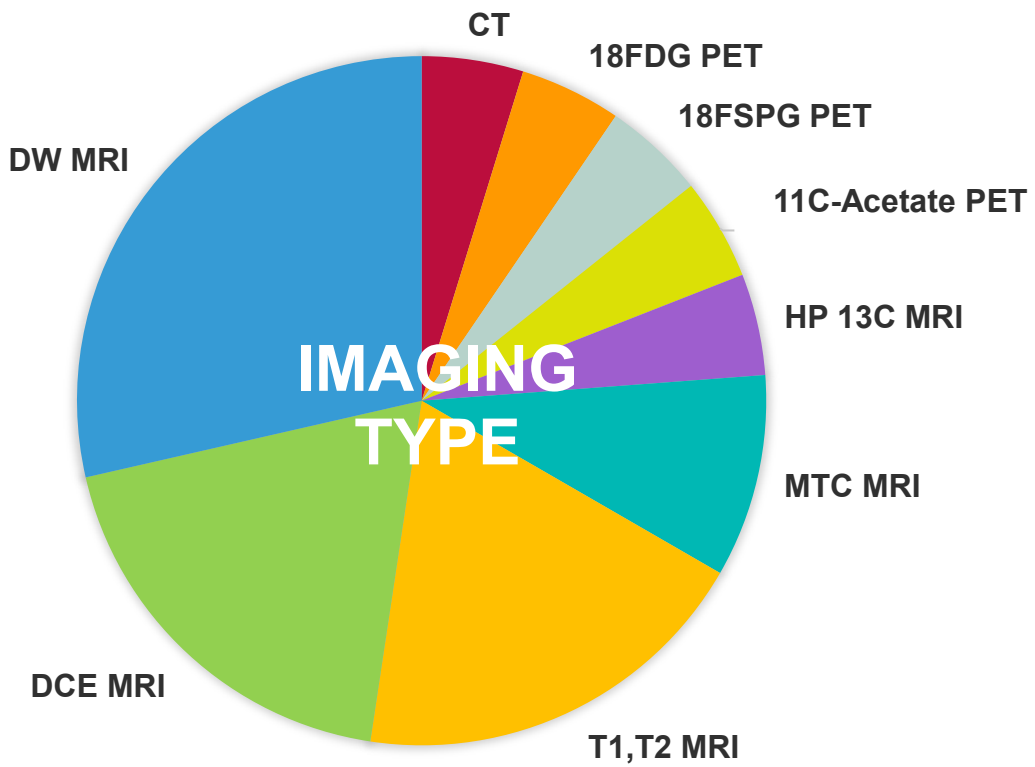
Protocols
Software
Workflow
Tools, etc.

CIRP Projects

Institute	Animal Models	Therapy	Imaging	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
MD Anderson (transferred from Vanderbilt)	RAS CRC, Subcutaneous, Orthotopic PDXs, Immuno-competent	Immunotherapy 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
UCSF	Prostate Metastatic PDXs	Chemotherapy	Hyperpolarized 13C MRI,T2, DW, DCE MRI	NIH P41 HP 13C MRI Center,

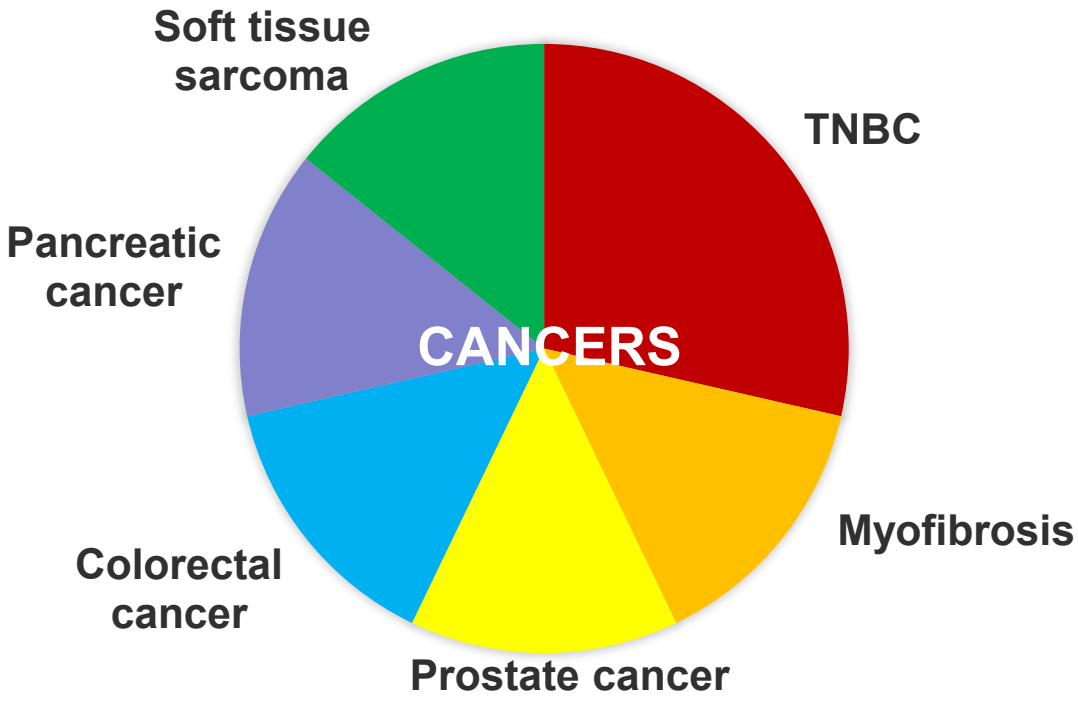
CIRP: Imaging Methods

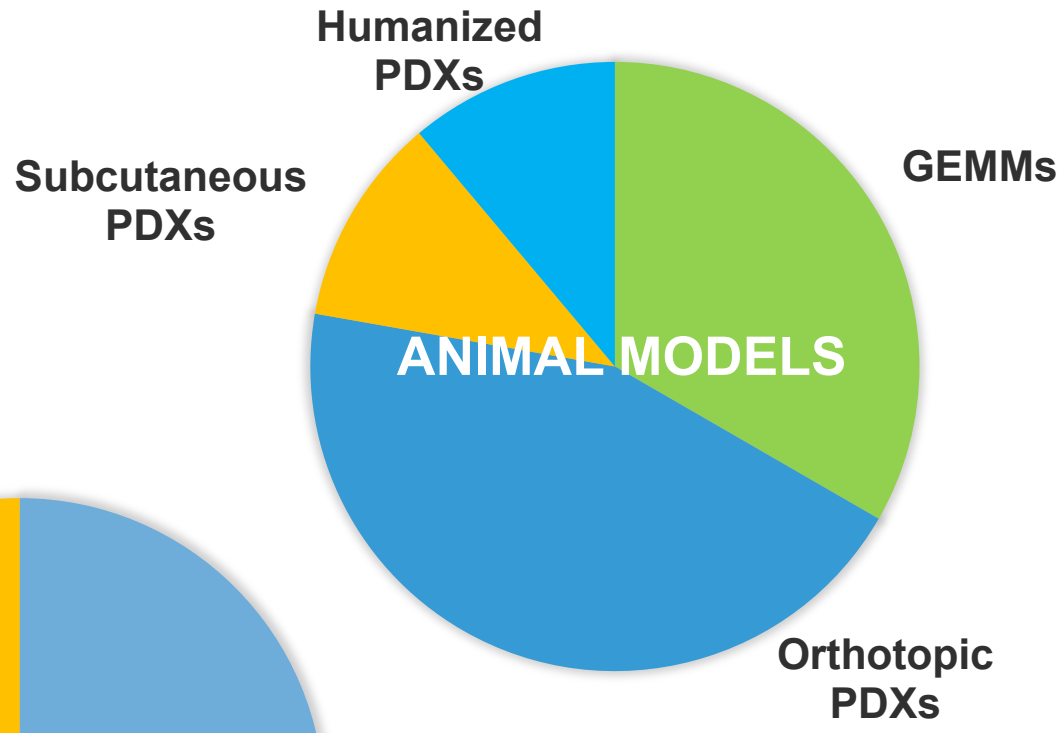


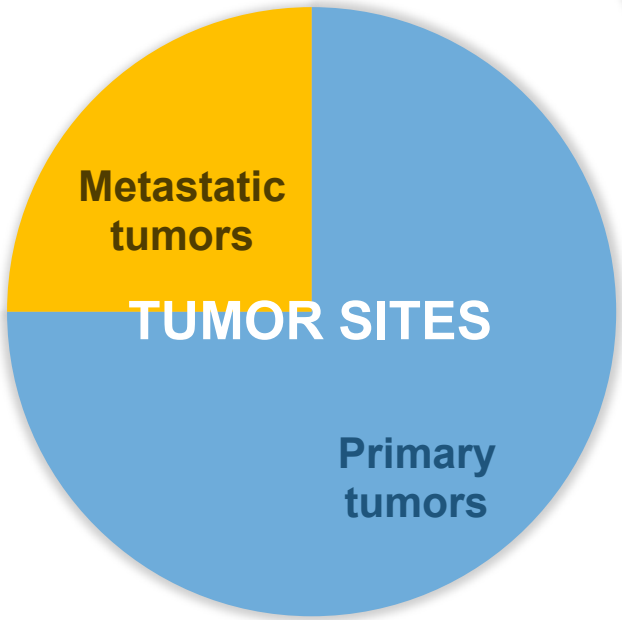


In vivo **imaging anatomy, function, metabolism, vascularity, cellularity**

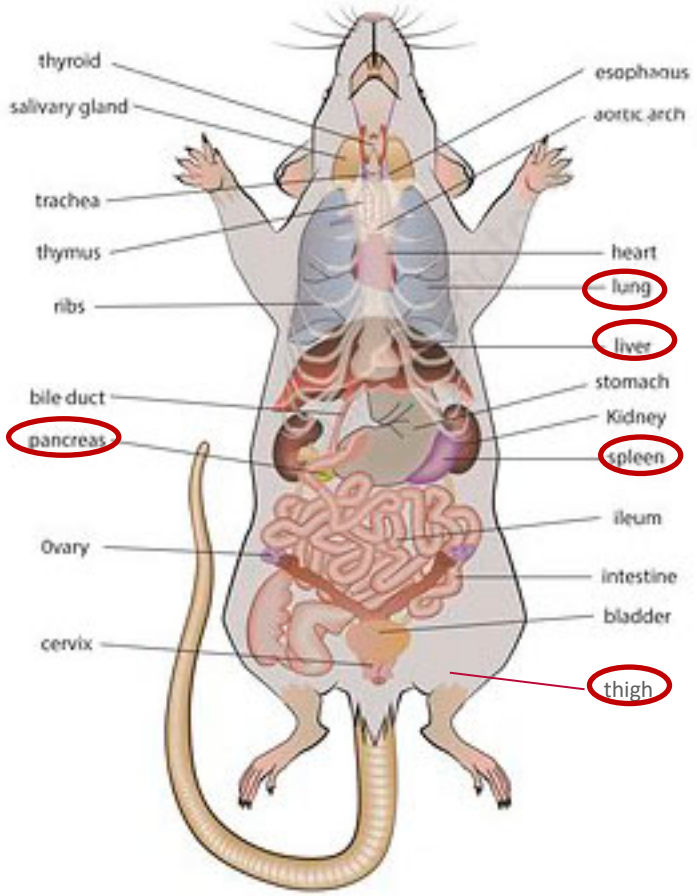
CIRP: Cancer Models

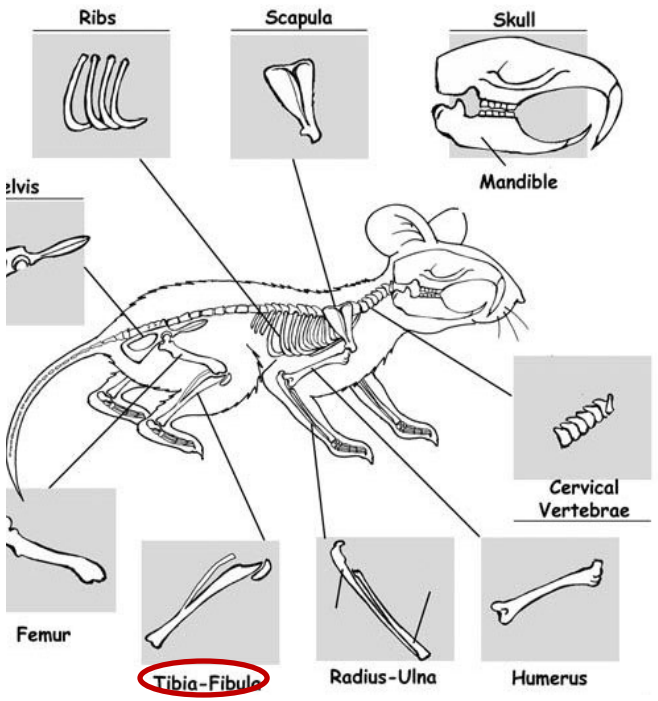






Imaging Orthotopic Cancer Models





(*) Studies by CIRP projects

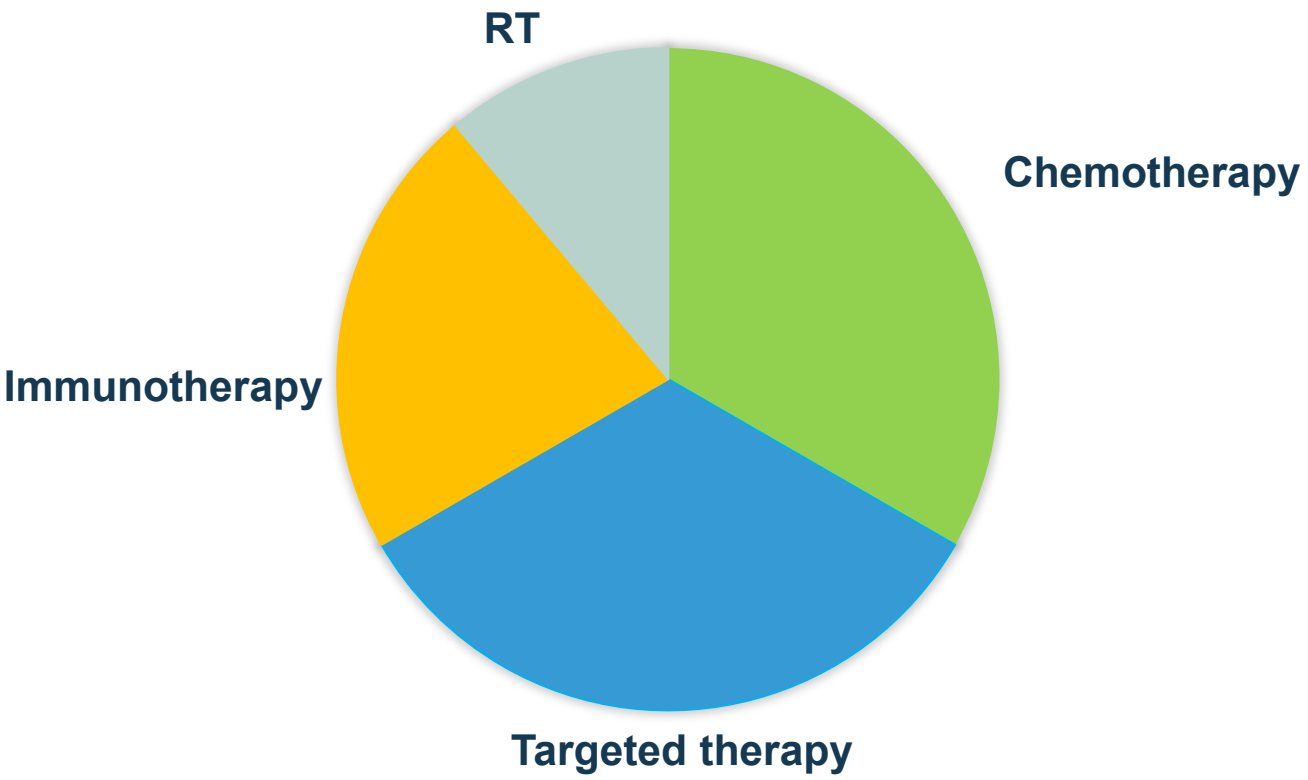
Advantage:

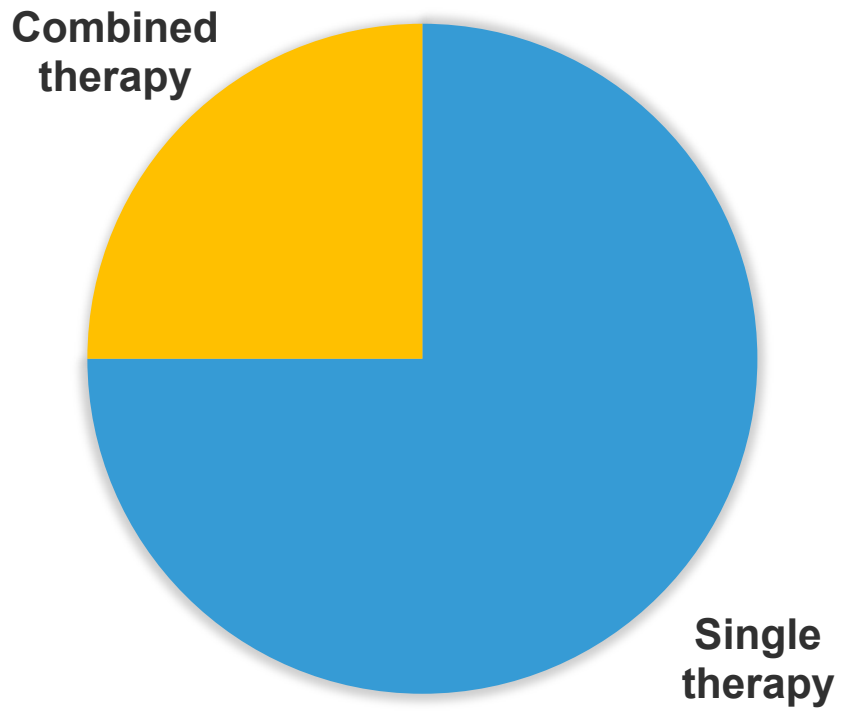
- Mimics human tumors

Challenges:

- Location-dependent
- Disease-dependent
- Small voxel sizes
- Heterogeneity
- Respiration
- Organ Motion

CIRP: Therapies





Imaging Therapy Response

Therapy:

- Chemotherapy*
- Radiation Therapy*
- Targeted Therapy*
- Immunotherapy*
- Combination Therapy*
- Hormone Therapy

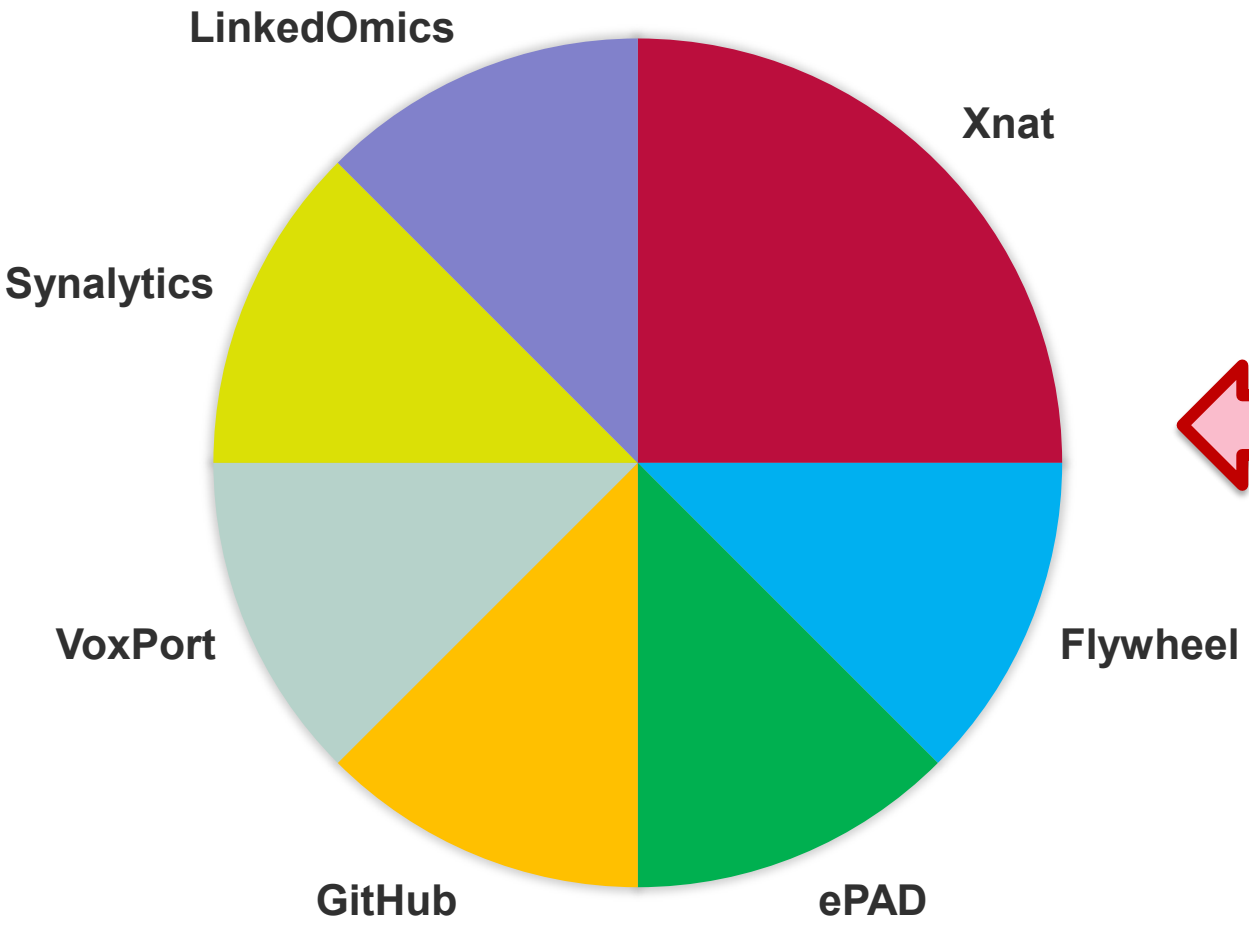
Imaging approach?
Specificity?
Sensitivity?

Imaging Methods

- Anatomy*
- Metabolism*
- Cellularity*
- Perfusion*
- Diffusion*
- Molecular imaging*
- pH
- Hypoxia

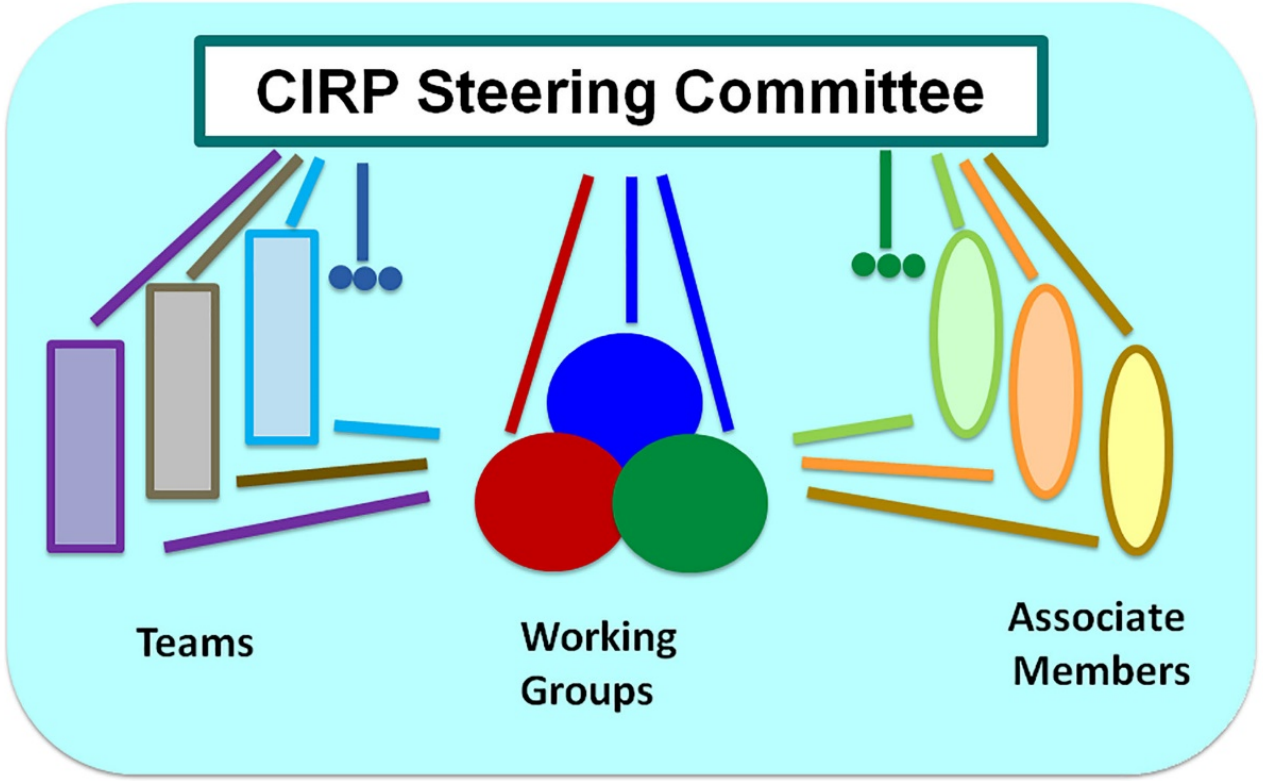
* Studies by CIRP projects

CIRP: Informatics Platforms



Preclinical XNAT (NCI ITCR U24)

CIRP Steering Committee



Promotes Consensus:

- ❑ Harmonization
- ❑ Standardization
- ❑ Consensus
- ❑ Integration
- ❑ Dissemination

CIRP Network Activities

PERSPECTIVES TOMOGRAPHY®

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, Flippase; 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.

BACKGROUND

Co-clinical trials are an emerging area of investigation in which a clinical trial is coupled with a preclinical study to inform the corresponding clinical trial (1–7). The preclinical arm of the co-clinical trial generally uses genetically engineered mouse models (GEMMs), cell transplant models (CTMs) of human cancers or patient-derived tumor xenografts (PDXs) to aid in therapeutic efficacy assessment, patient stratification, and optimal treatment strategies designing (8, 9). The emergence of GEMMs, CTMs, and PDXs as co-clinical platforms is largely motivated by the realization that established cell lines do not recapitulate the heterogeneity of human tumors and the diversity of tumor phenotypes

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Member-Initiated Symposium

MRI Advances Within the Co-Clinical Cancer Trials Network: Informing Cancer Clinical Trials Through Preclinical Imaging

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MRI Advances Within the Co-Clinical Cancer Trials Network: Informing Cancer Clinical Trials Through Preclinical Imaging

Member-Initiated Symposium

Monday, 17 May 2021

Concurrent 8 17:00 - 17:30 Moderators: Joseph Ackerman & Rong Zhou
Session Number: MIS-16
Parent Session: MRI Advances Within the Co-Clinical Cancer Trials Network: Informing Cancer Clinical Trials Through Preclinical Imaging

Session Number:MIS-16

Organizers
Joseph Ackerman, Rong Zhou

Overview
This symposium was organized with the assistance of teams from the NCI Co-Clinical Imaging Research Program (CIRP) Network. The session will: (1) describe the unique technical challenges to achieving quantitative MRI (qMRI) biomarkers with small-animal models of cancer; (2) provide innovative solutions to address these challenges; and (3) show how preclinical qMRI findings can inform clinical cancer imaging trials. The initial presentation (20 min) will define challenges and potential solutions unique to preclinical qMRI. This will be followed by theme-specific presentations regarding six new qMRI advances (4 @ 1x15-minute, single-speaker; 2 @ 2x8-minute, dual-speaker): (1) achieving ultrahigh spatial resolution for murine tibia bone marrow imaging; (2) mitigating respiratory motion artifacts in DWI of mouse abdomen; (3) increasing rigor and reproducibility in hyperpolarized 13C metabolic MR; (4) leveraging complementary PET/MRI findings; (5) validating biomarkers using multimodal imaging; (6) predicting tumor growth and response by imaging-driven

2021 ANNUAL MEETING
March 30-31
April 8

ONCOLOGY MODELS FORUM

Oncology Models Forum Annual Meeting

The National Cancer Institute's Division of Cancer Biology will hold the **Annual Meeting of the Oncology Models Forum** on **March 30, March 31** and **April 8, 2021**. Due to COVID-19 regulations, the meeting will be held virtually via WebEx.

Mammalian models and their derivatives are integral components of basic cancer research. The Oncology Models Forum supports mammalian models that overcome translational deficiencies of mammalian oncology models and define new uses of mammalian models or their genetics for unexplored translational challenges. Members of the Oncology Models Forum spur the development of mammalian models that advance standard practices for translational use, test approaches to validate and credential models, or challenge current practices for how models are used translationally. The demonstration of these models as robust representations of human biology that are appropriate to test questions of clinical importance will provide reliable information for patient benefit.

The purpose of the meeting is to stimulate information sharing and collaborations between Oncology Models Forum Members. This year, the OMF Annual Meeting will also include participation from members of the National Cancer Institute's Co-Clinical Imaging Research Program (CIRP) and the Pre-medical Cancer Immunotherapy Network for Canine Trials (PRECINCT) in an effort to share research strategies.

CIRP Working Groups

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

  Cancer issues and Unmet Needs

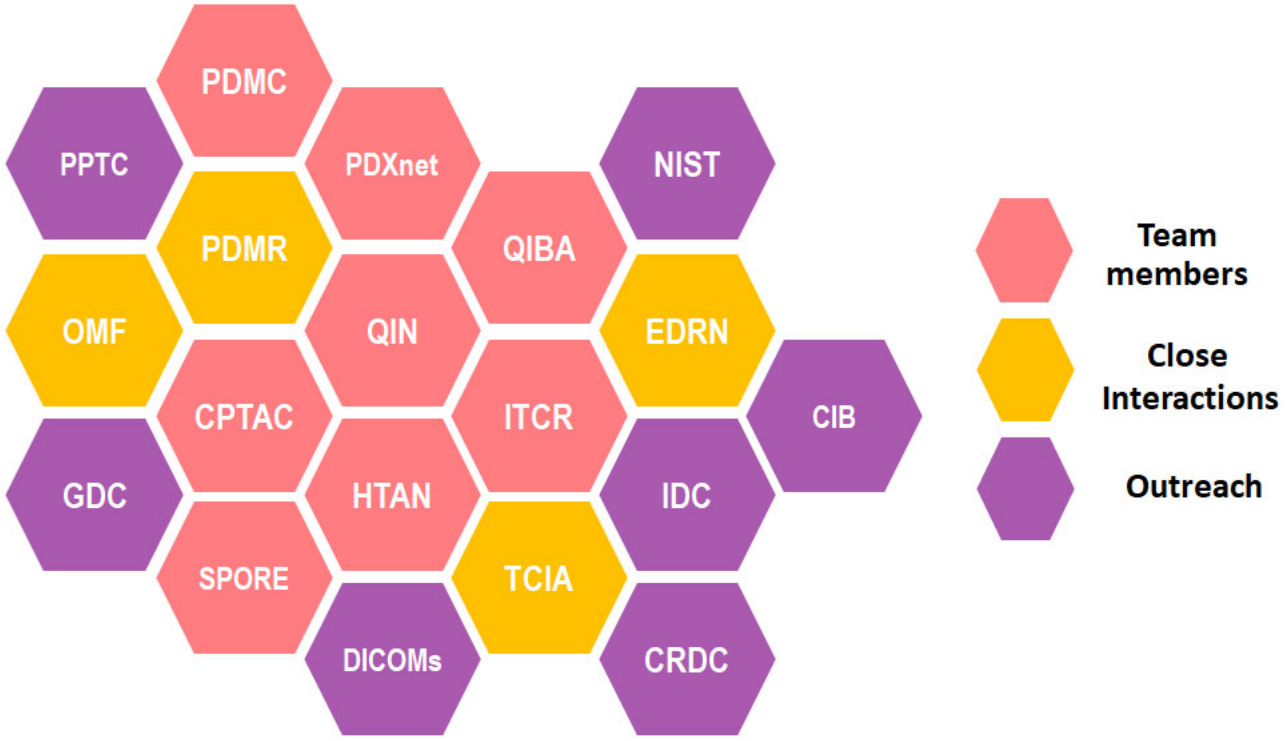
- **Imaging Acquisition & Data Process (IADP) WG:**

  Standardization & Metrology

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

  Metadata & Interoperability

CIRP Outreach & Data Dissemination



- ❑ CIRP annual meeting
- ❑ Outside Speaker Presentations at WGs
- ❑ CIRP sessions at scientific meetings/conferences
- ❑ Scientific meetings
- ❑ CIRP Web-resources

Questions?

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

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www.cancer.gov

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