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# OPENSPECIMEN USE AT UNIVERSITY OF UTAH

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**UTAH CTSI**  
CLINICAL & TRANSLATIONAL  
SCIENCE INSTITUTE

# CTSI BIOMEDICAL INFORMATICS CORE



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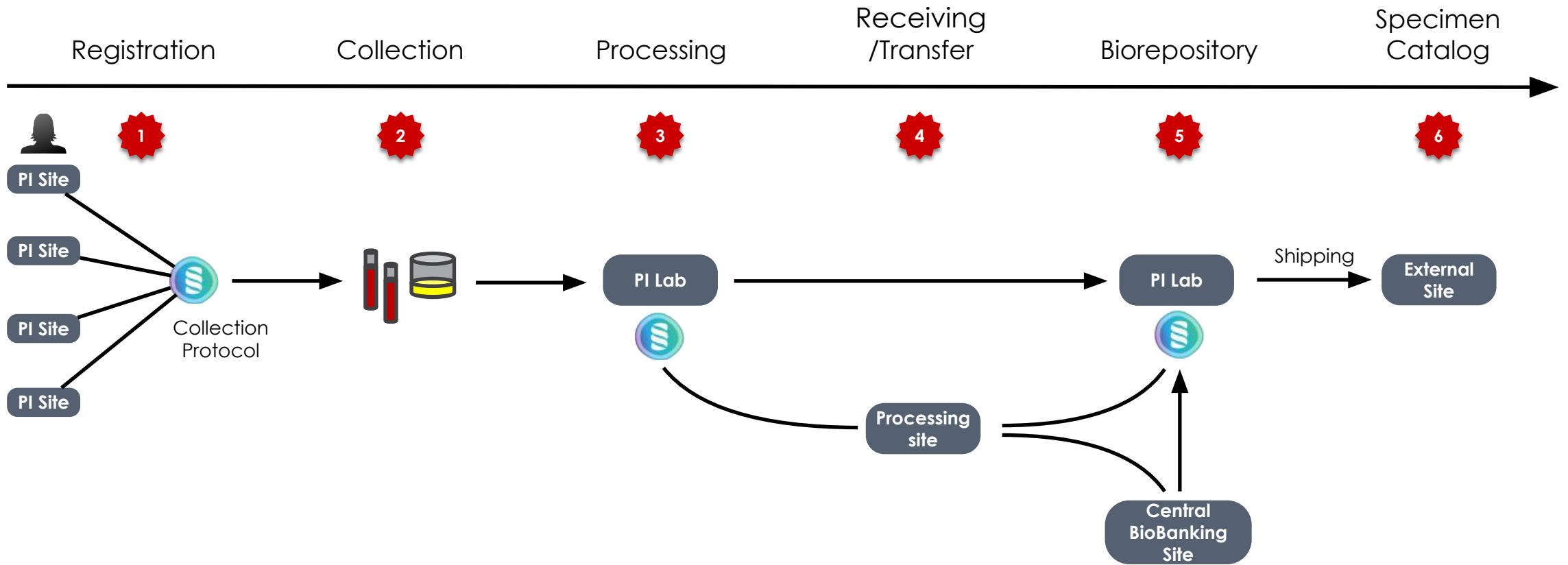
# CTSI GOAL

- Catalog all specimens owned by the University
- Build collaborations
  - within the University
  - nationwide/worldwide
- Usefulness:
  - Link specimens to clinical data: standard vocabulary
  - Link to consent statements

# 3 TYPES OF SUPPORTED IMPLEMENTATIONS

- **Individual collections and storage**
- **Biorepositories**
  - **Departments**
  - **Research groups**
- **Core Laboratory processing and storage**
  - **Current**
    - Specimen-centric protocols managed by the Core staff
      - Accession, processing, and storage
      - Legacy storage projects
    - PI managed protocols
      - Submit samples for processing to CTCR
      - Specimens stored at CTCR or returned to PI lab for storage/use
    - Special processing workflows: iPSC, CRISPR: Protocol groups
  - **Future**
    - All protocols to be designed and managed by PI lab

# LABORATORY WORKFLOW



# TYPES OF INDIVIDUAL WORKFLOWS

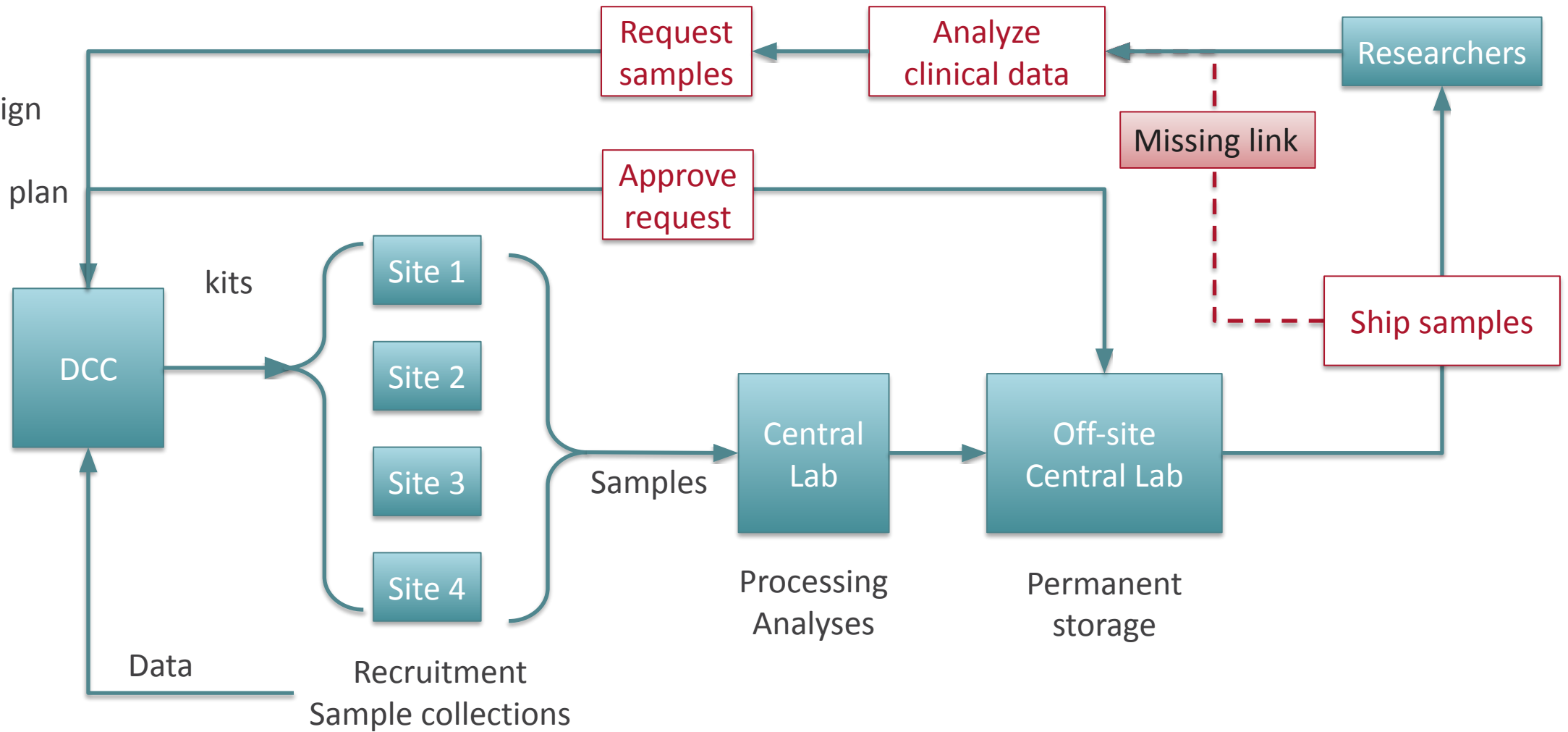
- Single local site managing participant registration and sample storage
  - Can follow standard OS workflows
- Local lab is a Site in a multi-site study
  - Processes defined and set by external source
  - Limits flexibility
  - Must design workflow to fit predesigned, NIH-defined, process
  - Participant registration is in external LIMS (or REDCap)

# MULTI-SITE STUDIES: WORKFLOW TYPES

- Central Biorepository (external)
  - Samples collected here, shipped to central lab at intervals
    - Extra samples collected and stored for use locally
    - Need to link participants to Study ID for eventual linkage to clinical data
  - Samples shipped directly
  - Samples are processed and then shipped off-site
- Local Biorepository
  - Participants registered and samples collected according to established DCC protocol, pass through central lab.
  - Samples shipped to local BR for permanent management
    - Kit or Requisition ID
    - Link barcoded samples with minimal metadata (type, qty)

# WORKFLOW FOR MULTI-SITE STUDIES

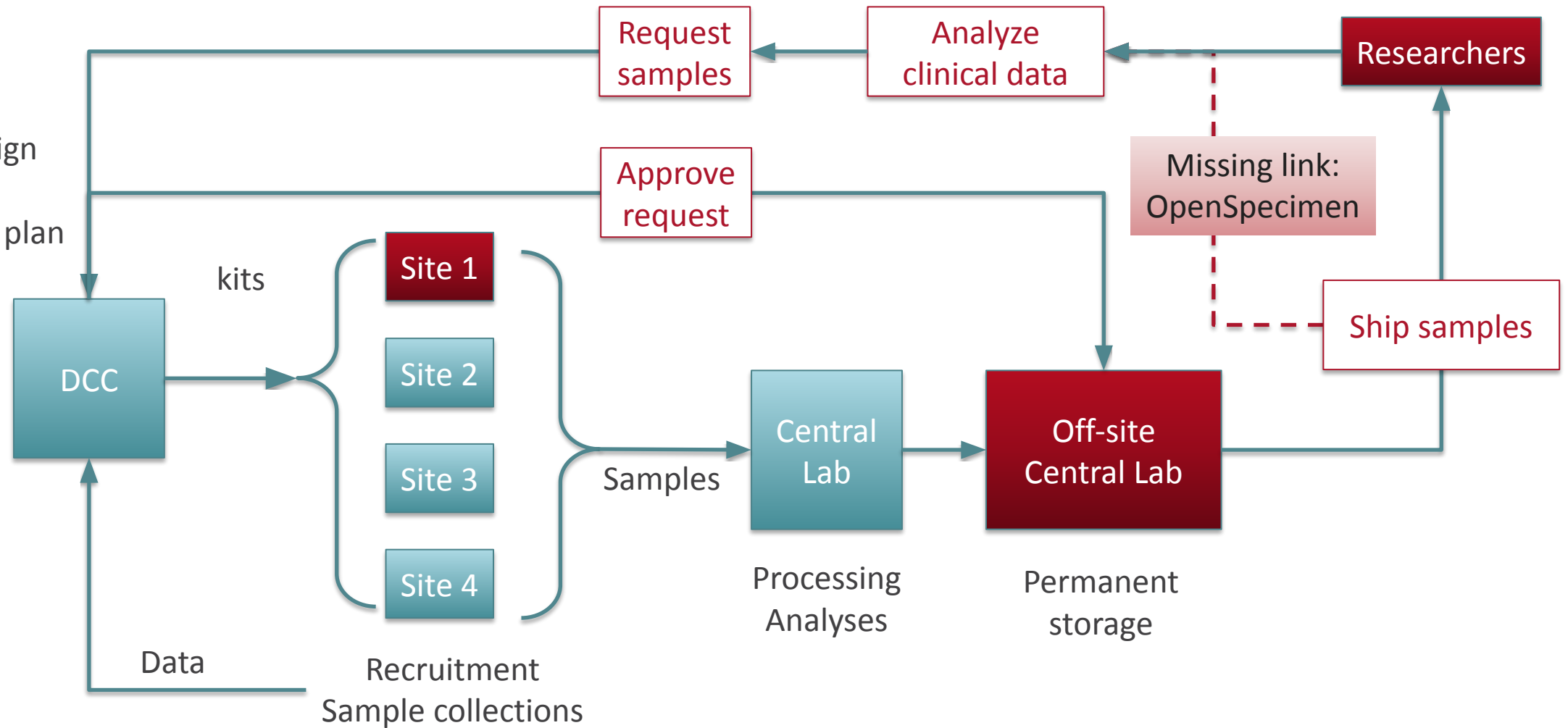
- Study design
- Data plan
- Specimen plan



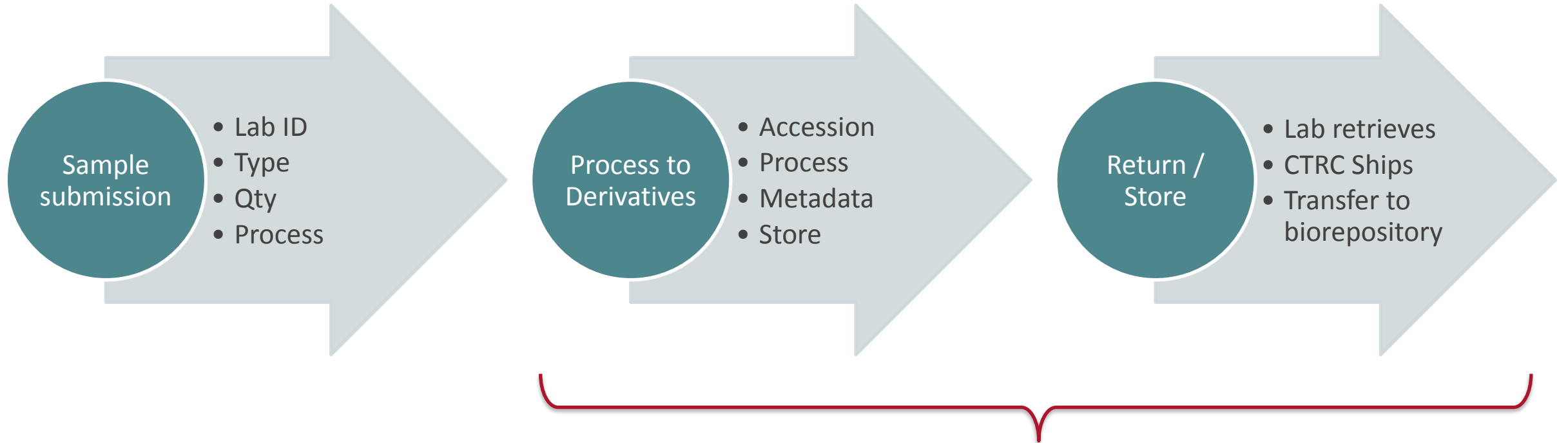


# WORKFLOW FOR MULTI-SITE STUDIES

- Study design
- Data plan
- Specimen plan



# INTERIM PROCESS FLOW FOR CTTC



**REDCap Project**

**OpenSpecimen: Specimen-centric protocol**

# INITIAL GOAL: BILL FOR CONTAINER STORAGE

- Count containers per project for billing
  - Create CP for all projects being billed
  - Map all existing boxes in freezers
  - Assign each box to CP
  - Query: count boxes per project per freezer type (-80 vs LN2)
  - Invoice: \$\$ \* #\_containers per freezer type

# QUERY OUTPUT

## Filters

> Project Title

> Freezer

> PI Name

CTSI ID	Billing Code	Investigator	Department	Project Title	Container Name Count
1017	01-00237-200...	Adhish Agarwal	Nephrology	ERES-HFpEF (18-26) 1071	14
1313	01-00196-250...	Tanya Halliday	Health and Kinesiology	CTSI CTRC Protocol 18-...	5
1403		James Beck	Orthopaedics	Microbiome and Innate I...	4
2051	01-01549-600...	Deborah Neklason	Neklason Lab	Utah Genome Project Bi...	2
2254	01-00269-500...	Dustin Williams	Microbiology & Immunol...	Heterotopic Ossification ...	37
2718		Ken R Smith	Family and Consumer St...	CTSI CTRC Protocol 05-...	1
297	01-00976-200...	Patrice Mimche Nsangou	Microbiology & Immunol...	Role of EphB/EphrinB si...	37
354		Brett Burton	Scientific Computing an...	OrthodontiCell:Signal O...	14
3561		Adam Spivak	Infectious Diseases	UHCQ Biorepository (Pa...	117
364	01-01486-500...	Joseph Stanford	Public Health	Utah Children's Project ...	1

# PROBLEMS

- Legacy protocols with no samples mapped
  - Containers are invisible to the query if no samples are in the box
  - Created 'ghost' samples in the CP and assigned one per box: type recorded as 'Fluid' if not known
- Samples from 2 CPs mixed in one box
  - Boxes are counted more than once. Had to create a specific query for those affected CPs.
- Oversized boxes / bags:
  - organized to one shelf.
  - New query: count containers on shelf
  - Add surcharge to invoice per project

# CUSTOMIZED CP EXAMPLE: SCRNs

<input type="checkbox"/> Pregnancy ID	Study ID	Cohort	Type of gestation	Enrollment
<input type="checkbox"/> Y4926	242135U	all live birth outcome	singleton	enrolled once
<input type="checkbox"/> Y8385	242134W	all live birth outcome	singleton	enrolled once

- Events
- Maternal Blood Draw (MAT)**
- Delivery (DLV)
- Placental Pathology (PLAC)
- Fetal Postmortem (FETAL)
- Fetal Neuropathology (NEURO)

## Filters

Pregnancy ID

Study ID

Cohort  
any stillbirth outcome

Type of gestation  
multiple

Enrollment

# REQUIREMENTS SET BY DESCRIPTIONS

Events	
Maternal Blood Draw (MAT)	⋮
Delivery (DLV)	⋮
Placental Pathology (PLAC)	⋮
Fetal Postmortem (FETAL)	⋮
Fetal Neuropathology (NEURO)	⋮
Add Event...	

● Frozen Tissue from Placenta (Placental Disc Section 4)	Frozen Tissue
● Frozen Tissue from Placenta (Placental Disc Section 4)	Frozen Tissue
● Swab collected in Cryovial (4mL) (Placental membrane swab - DNA)	Swab
▶ ● Fixed Tissue Block from Umbilical Cord (Umbilical cord - proximal)	Fixed Tissue Block
▶ ● Fixed Tissue Block from Umbilical Cord (Umbilical cord - distal)	Fixed Tissue Block
▶ ● Fixed Tissue Block from Placental Membrane (Membrane Roll)	Fixed Tissue Block
● Fixed Tissue Block from Placenta (Parenchyma at UC insertion site)	Fixed Tissue Block
▼ ● Fixed Tissue Block from Placenta (Standard disc)	Fixed Tissue Block
● Derived Fixed Tissue Slide (Standard disc)	Fixed Tissue Slide
● Derived Fixed Tissue Curl (Standard disc)	Fixed Tissue Curl
▶ ● Fixed Tissue Block from Placenta (Focal lesions)	Fixed Tissue Block
● Fixed Tissue Block from Placenta (Diffuse lesions)	Fixed Tissue Block
▶ ● Fixed Tissue Block from Dividing membrane (Dividing membrane)	Fixed Tissue Block

# EXAMPLE OF TISSUES COLLECTED

## ☑ Occurred Visits

Event Name	Visit Name	Visit Date	Sample Origin	Placental Disc ID	Collection Stats	Utilization Stats	
Maternal Blood Draw	Y6825_MAT	Apr 24, 2008	0 - Mother	Not Specified	<div style="width: 100%; background-color: #4CAF50; text-align: center;">3</div>	<div style="width: 100%; background-color: #4CAF50; text-align: center;">19</div> <div style="width: 100%; background-color: #9C27B0; text-align: center;">6</div>	⋮
Delivery	Y6825_DLV1	Apr 24, 2008	1 - Live birth	Not Specified	<div style="width: 100%; background-color: #4CAF50; text-align: center;">1</div> <div style="width: 100%; background-color: #FF9800; text-align: center;">3</div>	<div style="width: 100%; background-color: #4CAF50; text-align: center;">1</div>	⋮
Delivery	Y6825_DLV2	Apr 24, 2008	2 - Stillborn	Not Specified	<div style="width: 100%; background-color: #4CAF50; text-align: center;">2</div> <div style="width: 100%; background-color: #FF9800; text-align: center;">2</div>	<div style="width: 100%; background-color: #4CAF50; text-align: center;">2</div>	⋮
Placental Pathology	Y6825_PLAC2	Apr 24, 2008	2 - Stillborn	AB	<div style="width: 100%; background-color: #4CAF50; text-align: center;">17</div> <div style="width: 100%; background-color: #FF9800; text-align: center;">9</div>	<div style="width: 100%; background-color: #4CAF50; text-align: center;">17</div>	⋮
Placental Pathology	Y6825_PLAC1	Apr 24, 2008	1 - Live birth	AB	<div style="width: 100%; background-color: #4CAF50; text-align: center;">19</div> <div style="width: 100%; background-color: #FF9800; text-align: center;">7</div>	<div style="width: 100%; background-color: #4CAF50; text-align: center;">19</div>	⋮
Fetal Postmortem	Y6825_FETAL1	Apr 24, 2008	2 - Stillborn	Not Specified	<div style="width: 100%; background-color: #4CAF50; text-align: center;">22</div> <div style="width: 100%; background-color: #FF9800; text-align: center;">4</div>	<div style="width: 100%; background-color: #4CAF50; text-align: center;">22</div>	⋮
Fetal Neuropathology	Y6825_NEURO1	Apr 24, 2008	2 - Stillborn	Not Specified	<div style="width: 100%; background-color: #4CAF50; text-align: center;">7</div> <div style="width: 100%; background-color: #FF9800; text-align: center;">11</div>	<div style="width: 100%; background-color: #4CAF50; text-align: center;">7</div>	⋮



# QUERY EXAMPLE; FETAL SPECIMENS FROM NEUROPATH

## Filters

> Total number of stillbirth babies

> Type

> Sample Description

> Anatomic Site

> Pregnancy ID

> Sample Origin

Pregnancy ID	Specimen Label	Specimen Type	Sample Description	Anatomic Site	Visit name	Sample origin
Y0005	4029617H-000	Fixed Tissue Block	Cerebellum and brai...	Not Specified	Y0005_NEURO1	1 - Stillborn
Y0005	4029614N-000	Fixed Tissue Block	Cortical tissue	Cortical tissue (grey ...	Y0005_NEURO1	1 - Stillborn
Y0005	4029615L-000	Fixed Tissue Block	White matter	Subcortical tissue (...	Y0005_NEURO1	1 - Stillborn
Y0005	4029616J-000	Fixed Tissue Block	Choroid plexus and ...	Not Specified	Y0005_NEURO1	1 - Stillborn
Y0110	2007747.I-000	Fixed Tissue Block	Cortical tissue	Cortical tissue (grey ...	Y0110_NEURO1	1 - Stillborn

# UTAH CTSI

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VA Salt Lake City  
Health Care System

# PROSPECTIVE STUDY

- Determine workflow
- Design Events
- Set participant, visit, specimen labels
- Standard workflow
- Design physical labels

# LEGACY STUDIES

- Data organization
- How to represent specimens in logical manner
- Is there a need to customize the interface?