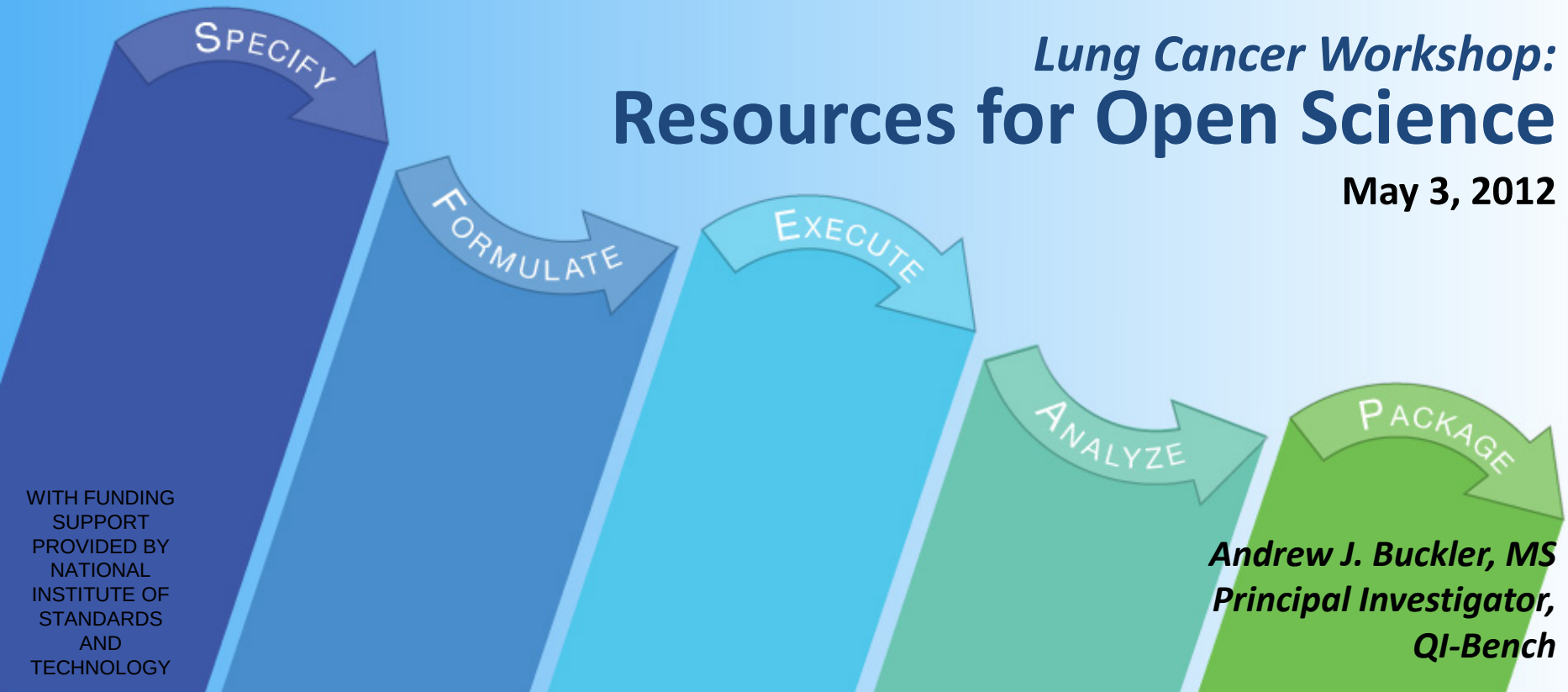
QI-Bench

Optimizing Performance Through Characterization



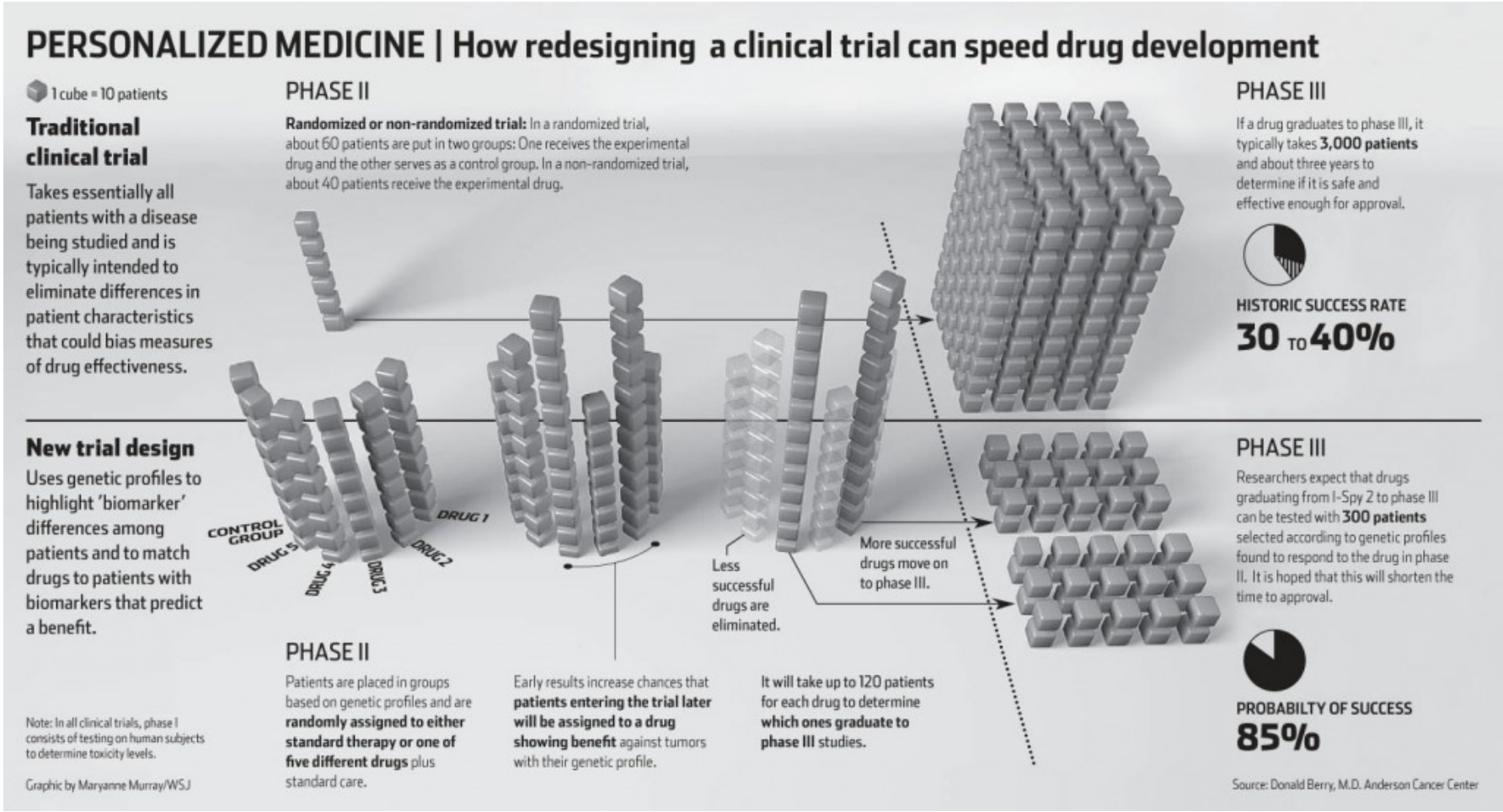
Lung Cancer Workshop:
Resources for Open Science

May 3, 2012

WITH FUNDING SUPPORT PROVIDED BY NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Andrew J. Buckler, MS
Principal Investigator,
QI-Bench

Resources are needed to address widening gap in imaging capability as practiced vs. capability of modern medicine



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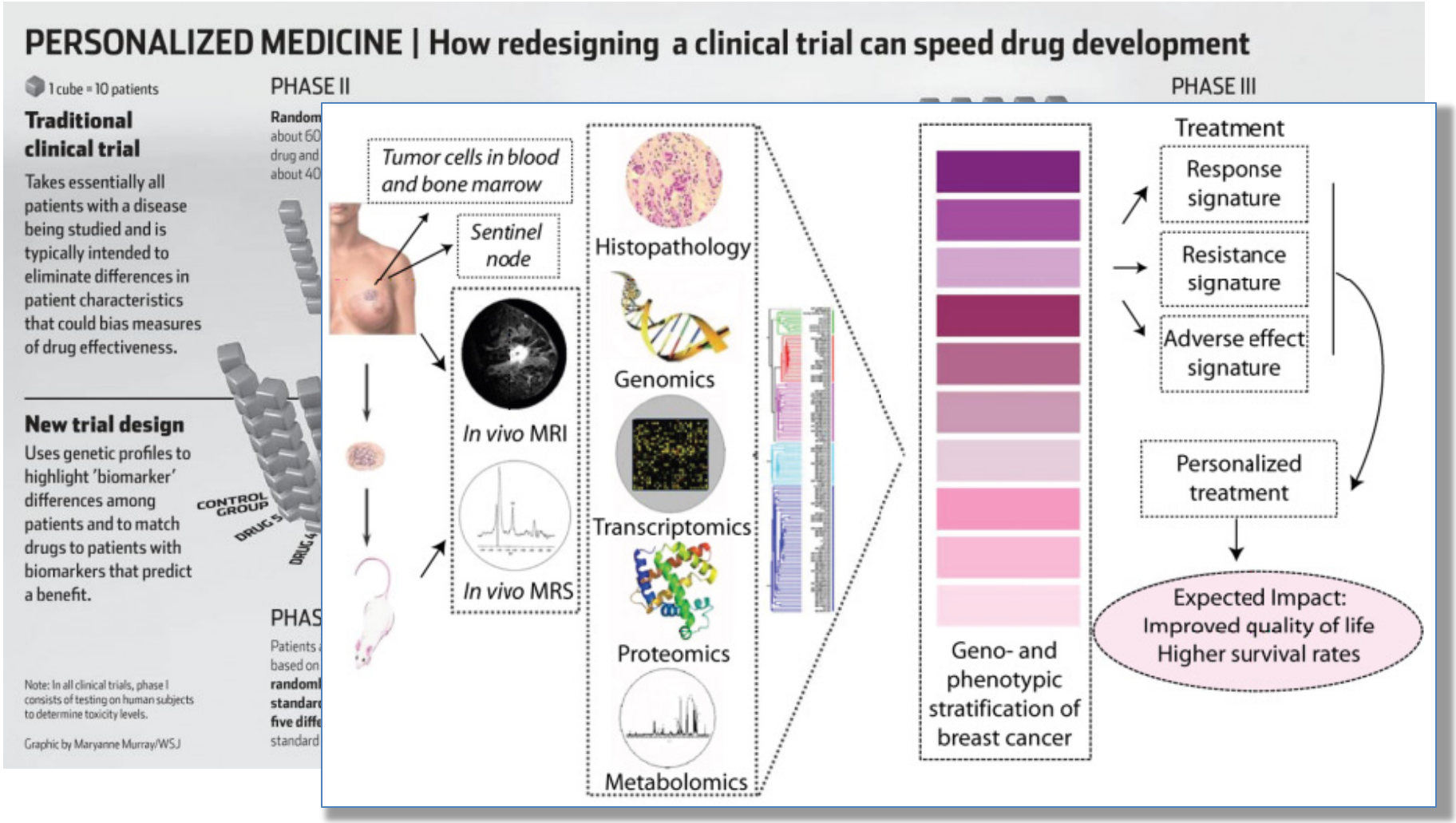
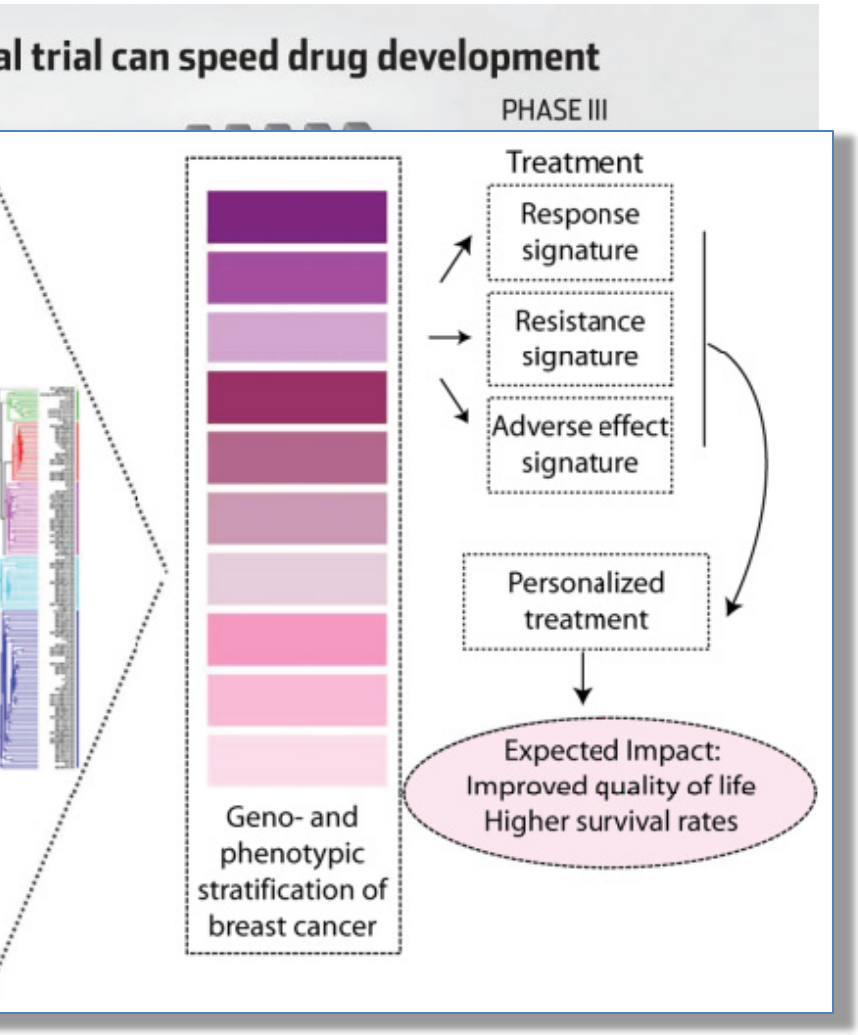
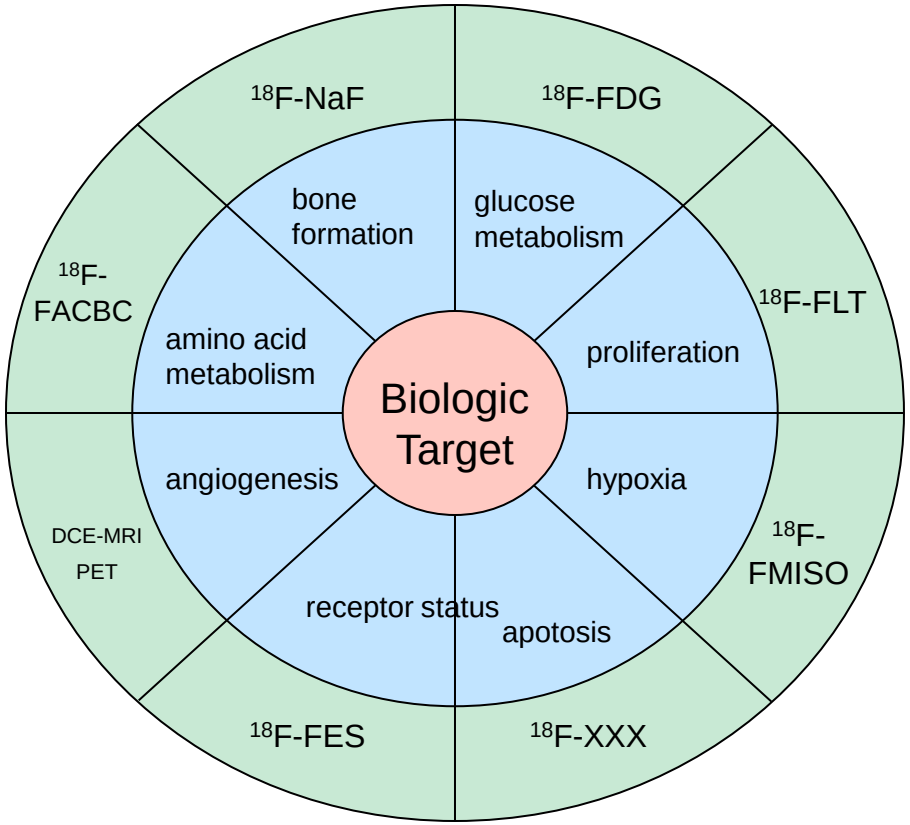
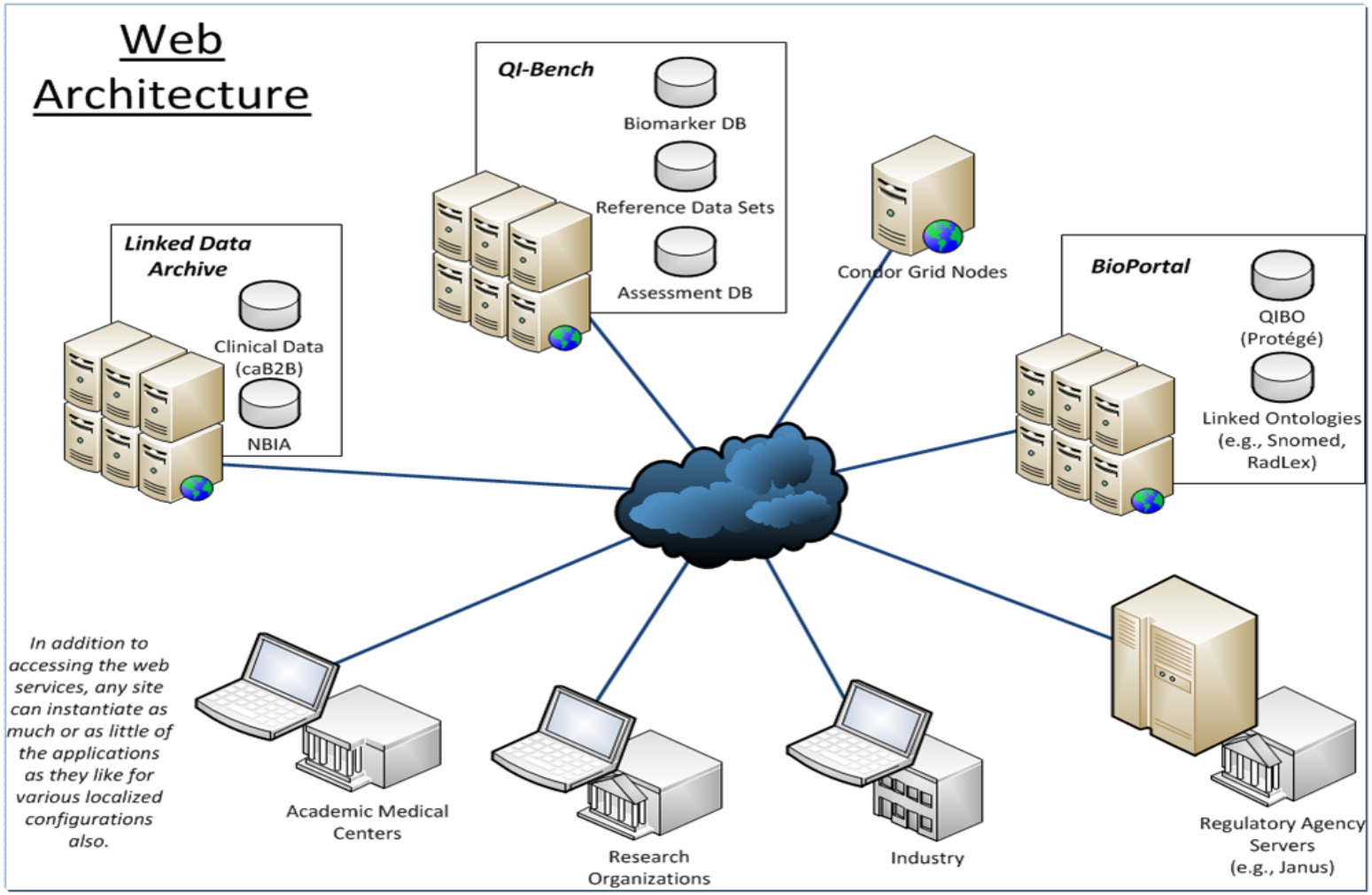


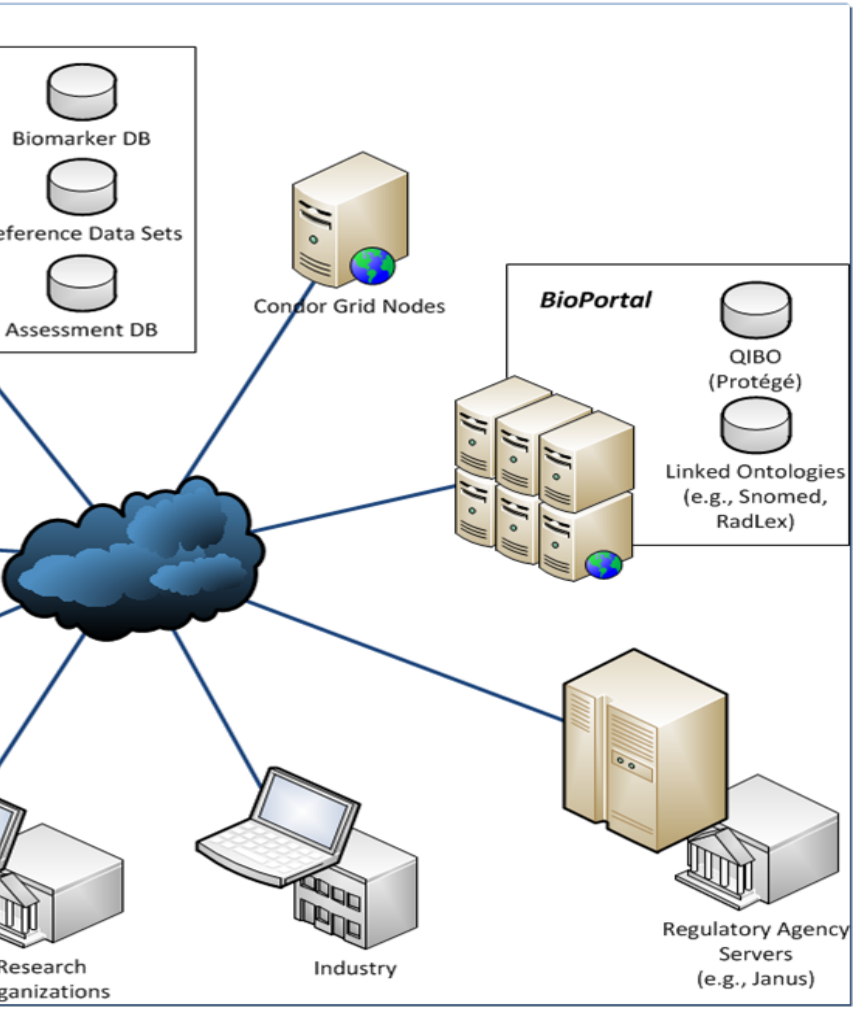


Example: Beyond Anatomy to Palette of Functional Measures

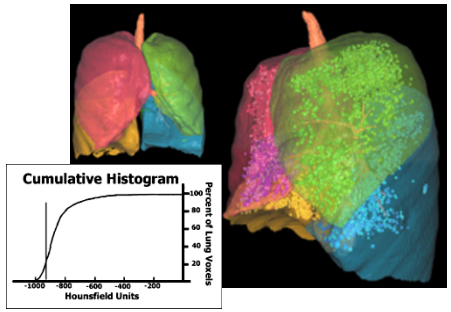


QI-Bench is a resource that may be used by single sponsors, defined-entity consortia, or true open science programs





Example: COPD



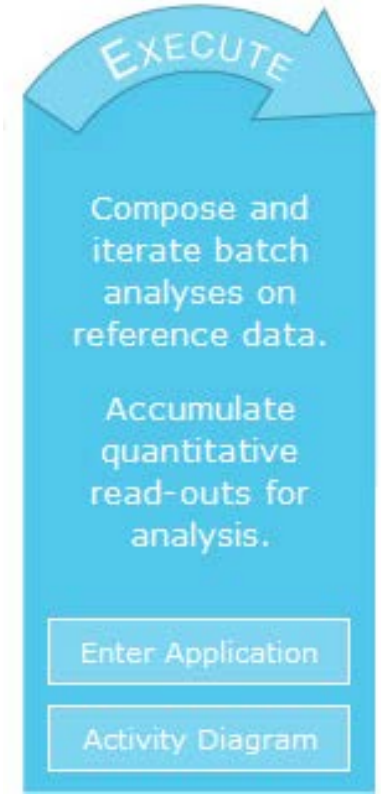
Either:

- To assist individual suppliers in optimizing their offerings
- To assist groups like COPDgene consortia
- To enable open development such as by QIBA

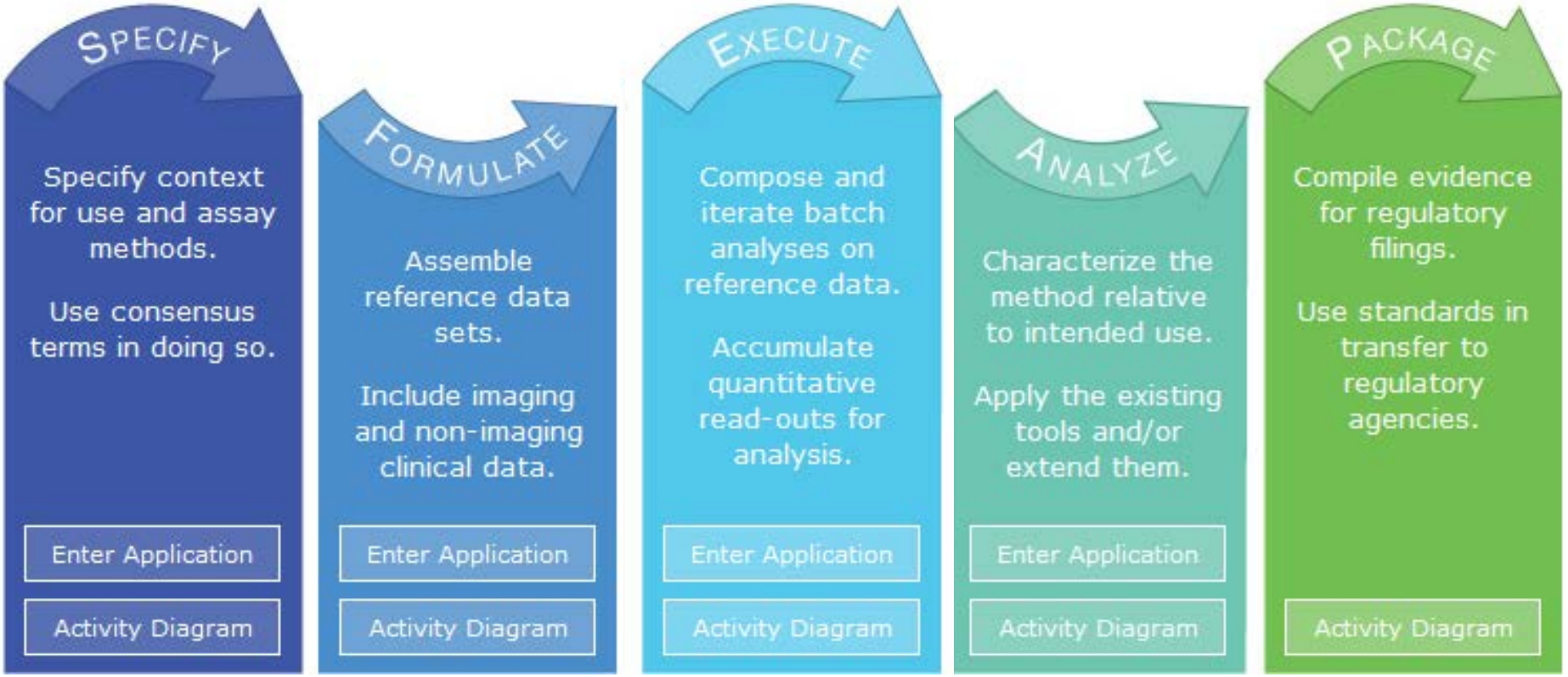
or flexible mix of these.

QI-Bench is composed of building blocks: central feature is capable data warehouse

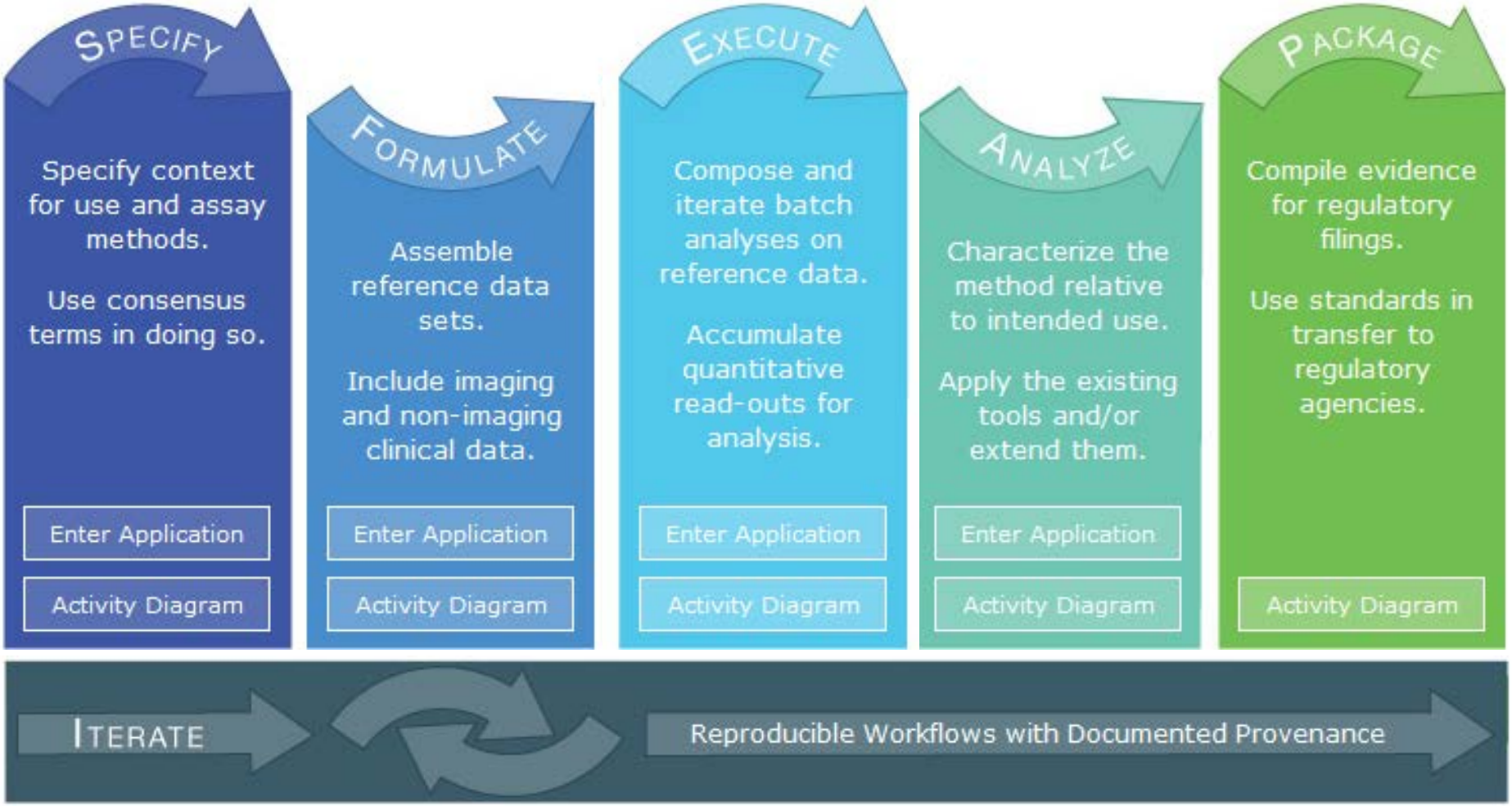
Add to that ability to conduct experiments with grid computing for automated algorithms and interactive RIS worklist generator for reader studies



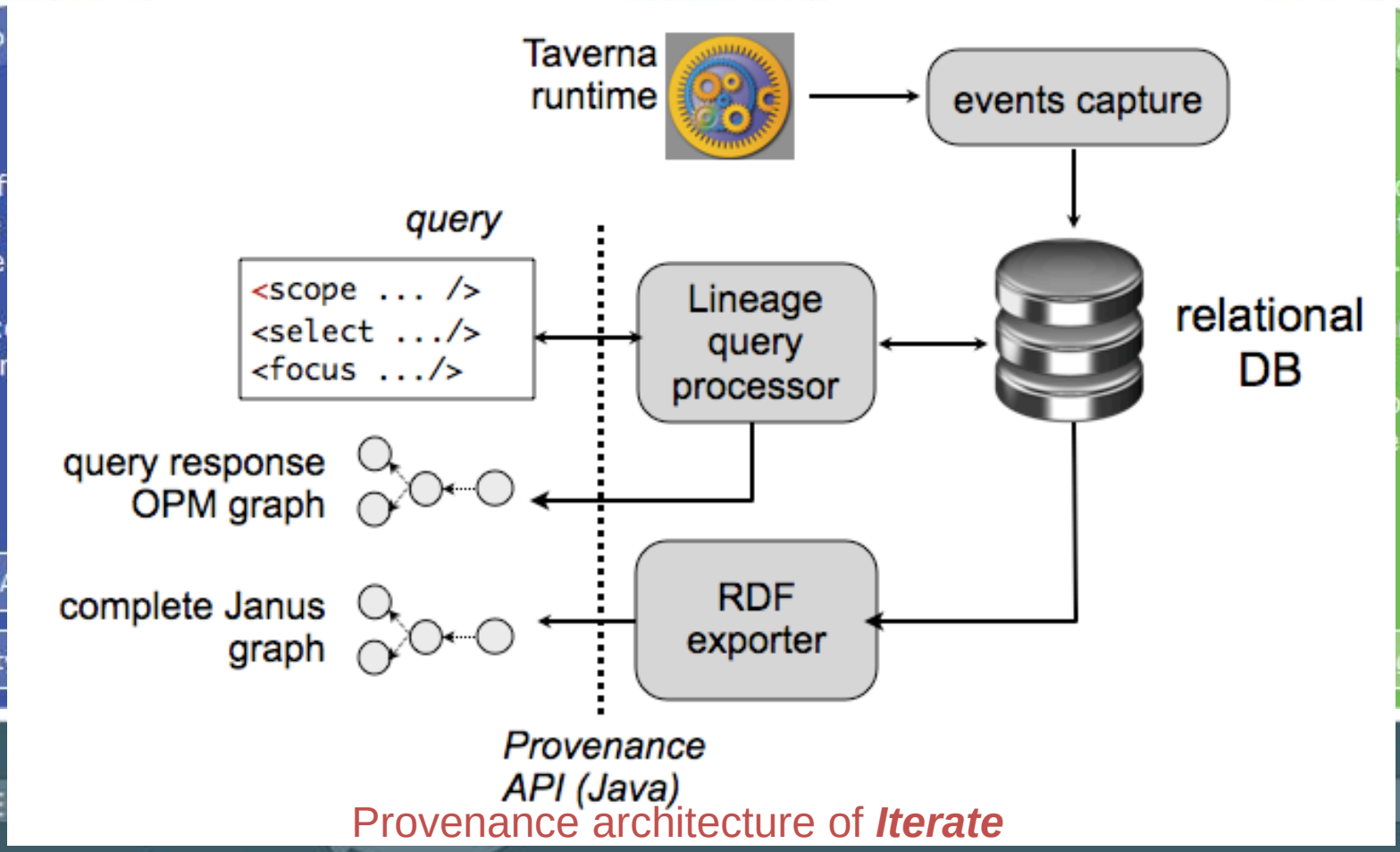
Next, layer context at front, and statistical analysis and results interpretation at back



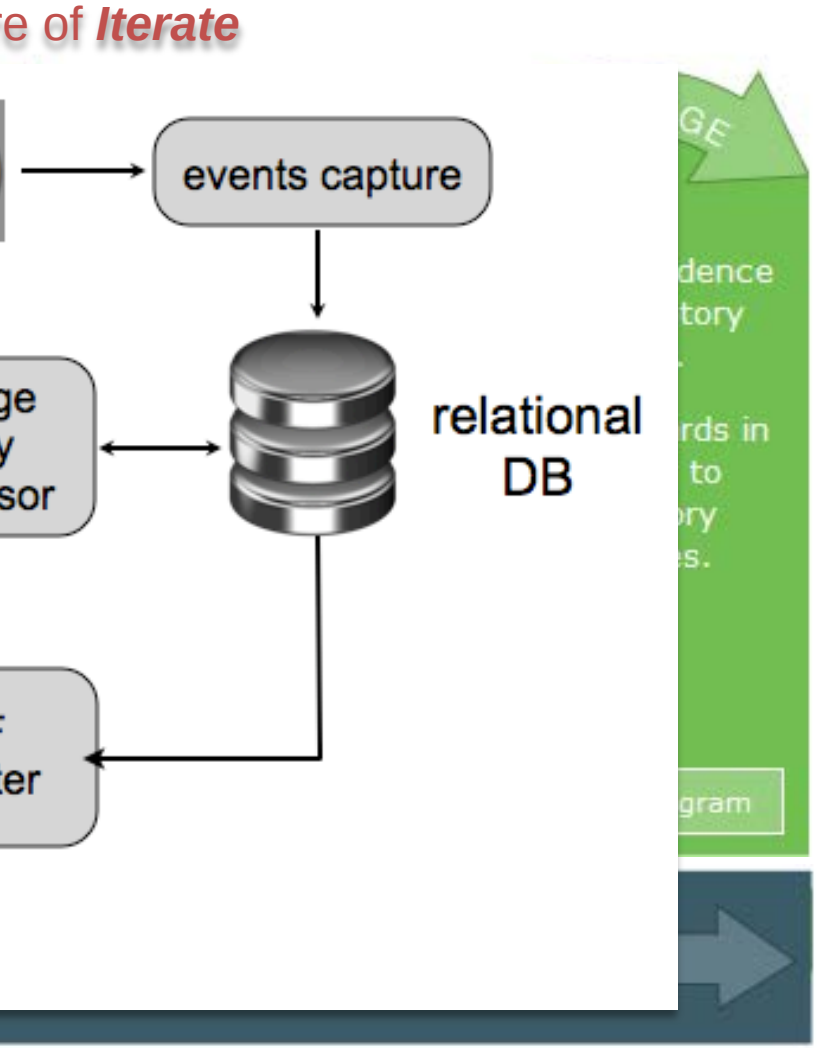
Last but not least, add workflow engine to allow composition and reproducible workflows with provenance documentation



The workflow engine utilizes a best-in-calss capability from sister fields of ‘omics assay development and optimization

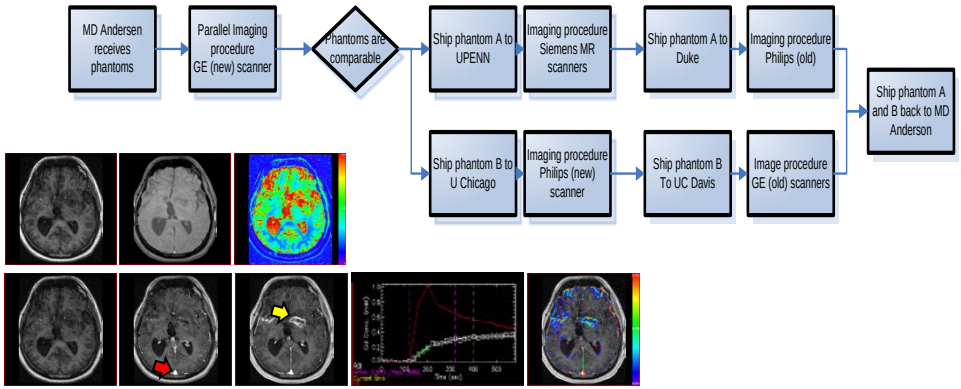


Provenance architecture of ***Iterate***

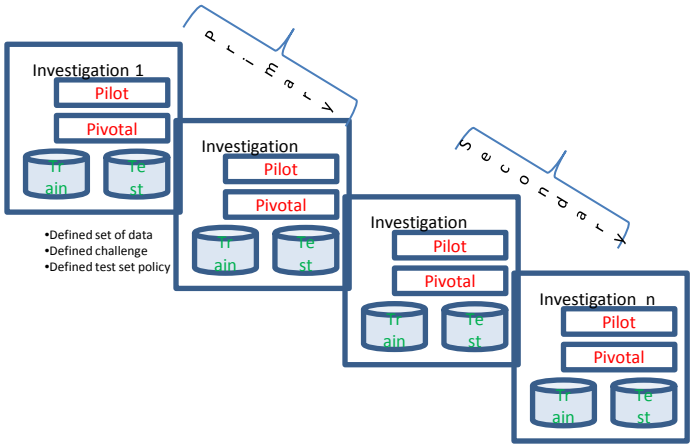


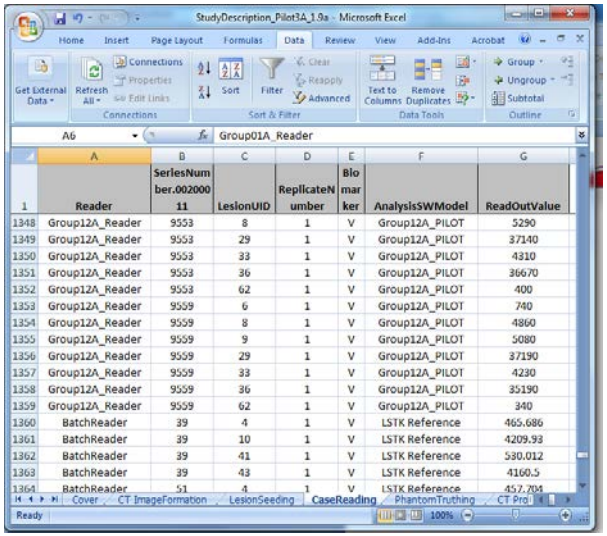
Example: DCE-MRI using Patient, Synthetic, and Phantom Data

- Curate, maintain and serve reference data sets
- Execute batch runs over multi-parameter synthetic data
- Characterize performance



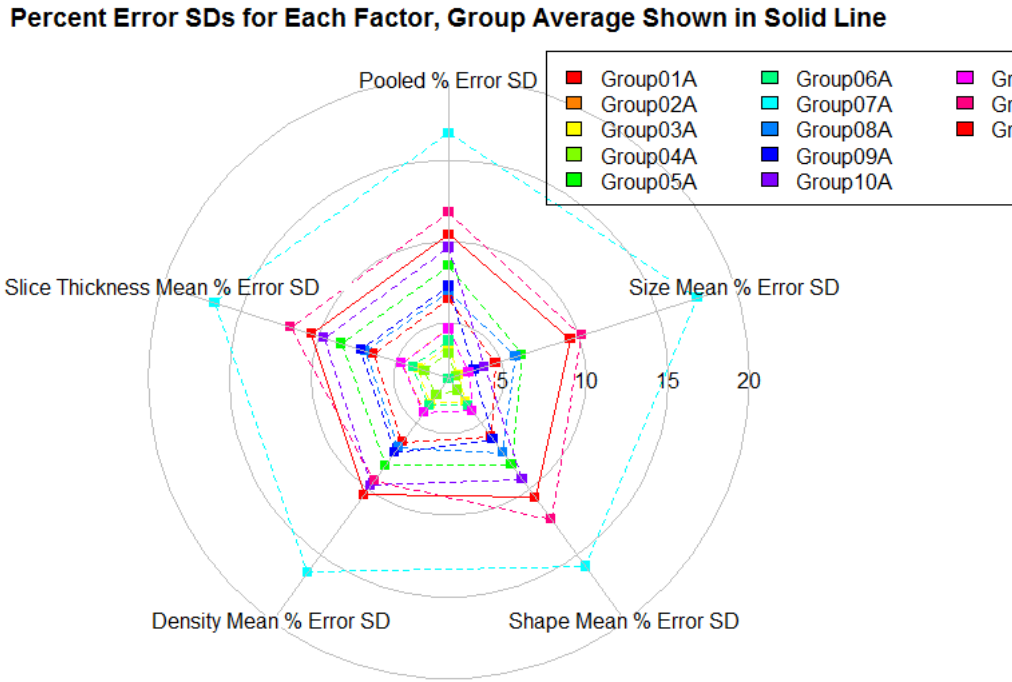
Test bed: CT volumetry method challenge ("3A")





Some of the Participants

1. Median Technologies
2. Vital Images, Inc.
3. Fraunhofer Mevis
4. Siemens
5. Moffitt Cancer Center
6. Toshiba
7. GE Healthcare
8. Icon Medical Imaging
9. Columbia University
10. INTIO, Inc.
11. Vital Images, Inc.



f the Participants

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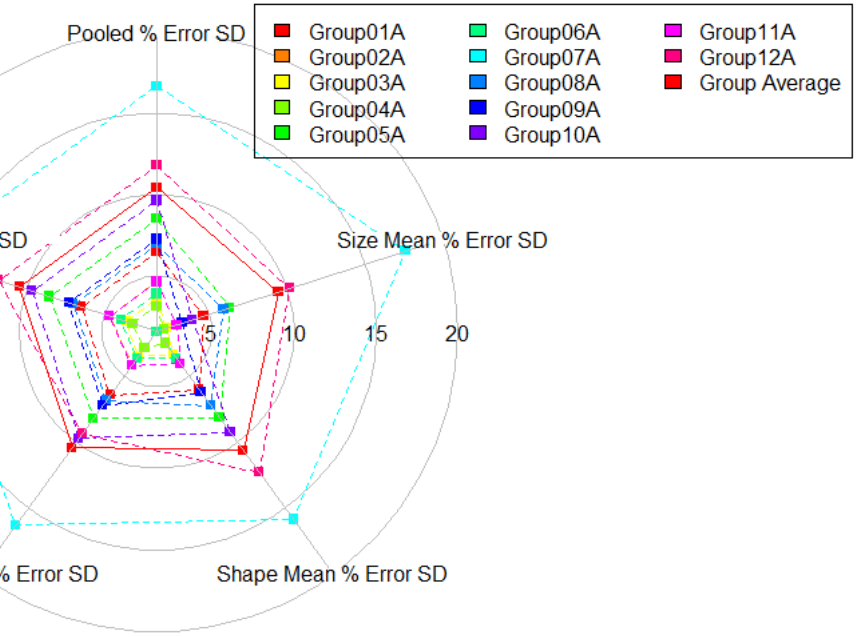
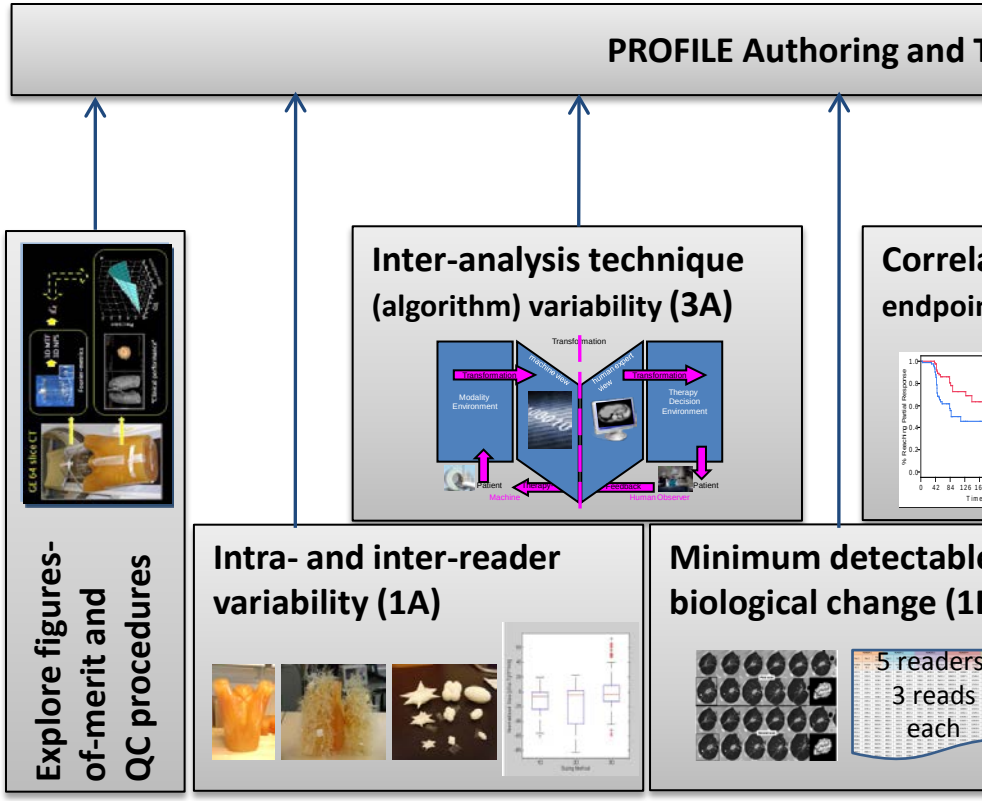
Cancer Center	11.	Vital Images, Inc.

Each Factor, Group Average Shown in Solid Line



Broader capability: Systematic qualification of CT volumetry



QI-BENCH

Up and running now for you to use

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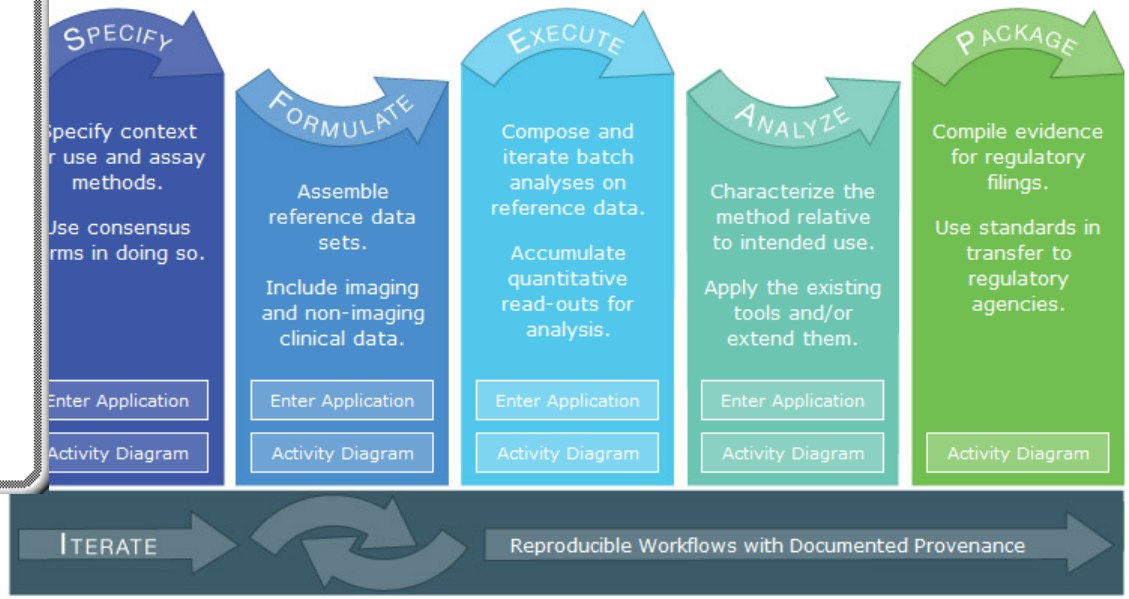
Quantitative imaging applications such as imaging biomarkers advance the utility of medical imaging. They may detect and characterize disease, before, during or after a course of therapy. They may also predict the course of disease, with or without therapy.

A precondition for use is the demonstration of performance according to recognized descriptive statistics:

- In a defined patient population,
- For a specific biological phenomenon associated with a known disease state,
- With evidence in large patient populations,
- Externally validated.



Open-source informatics tooling used to characterize the performance of quantitative medical imaging as needed to advance the field. These tools may be deployed internal to an organization or used for collaborative work across organizations. The data on which they work may be accessible only to identified individuals, or more broadly in an open archive, to suit the specific project purpose.

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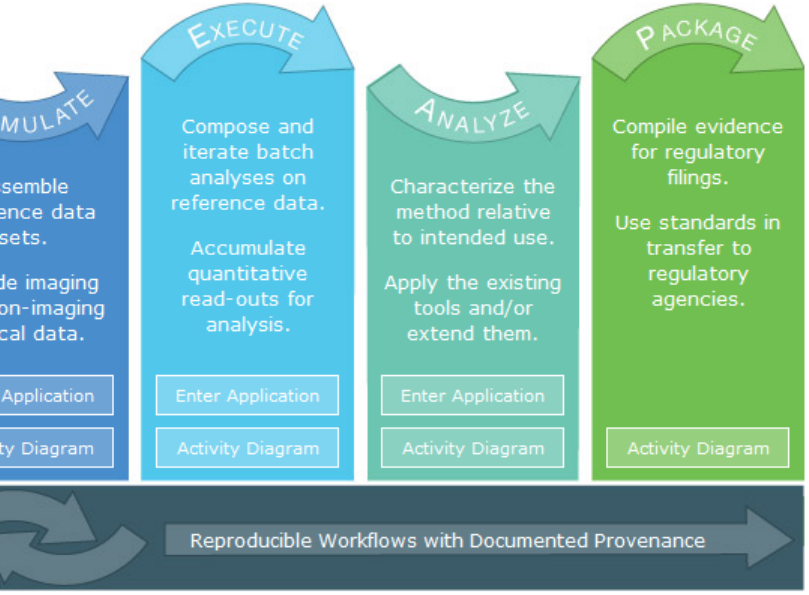

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Fill in your example here

- *Lung cancer screening?*

(join us at www.qi-bench.org)

(and/or our monthly meetings)


QI-BENCH
OPTIMIZING PERFORMANCE THROUGH
CHARACTERIZATION

Value proposition of QI-Bench

- Efficiently collect and exploit evidence establishing standards for optimized quantitative imaging:
  - Users want confidence in the read-outs
  - Pharma wants to use them as endpoints
  - Device/SW companies want to market products that produce them without huge costs
  - Public wants to trust the decisions that they contribute to
- By providing a verification framework to develop precompetitive specifications and support test harnesses to curate and utilize reference data
- Doing so as an accessible and open resource facilitates collaboration among diverse stakeholders

Summary: QI-Bench Contributions

- We make it practical to increase the magnitude of data for increased statistical significance.
- We provide practical means to grapple with massive data sets.
- We address the problem of efficient use of resources to assess limits of generalizability.
- We make formal specification accessible to diverse groups of experts that are not skilled or interested in knowledge engineering.
- We map both medical as well as technical domain expertise into representations well suited to emerging capabilities of the semantic web.
- We enable a mechanism to assess compliance with standards or requirements within specific contexts for use.
- We take a “toolbox” approach to statistical analysis.
- We provide the capability in a manner which is accessible to varying levels of collaborative models, from individual companies or institutions to larger consortia or public-private partnerships to fully open public access.

QI-Bench
Structure / Acknowledgements

- Prime: BBMSC (Andrew Buckler, Gary Wernsing, Mike Sperling, Matt Ouellette)
- Co-Investigators
  - Kitware (Rick Avila, Patrick Reynolds, Julien Jomier, Mike Grauer)
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- Collaborators / Colleagues / Idea Contributors
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  - Northwestern (Pat Mongkolwat)
  - UCLA (Grace Kim)
  - VUmc (Otto Hoekstra)
- Industry
  - Pharma: Novartis (Stefan Baumann), Merck (Richard Baumgartner)
  - Device/Software: Definiens, Median, Intio, GE, Siemens, Mevis, Claron Technologies, …
- Coordinating Programs
  - RSNA QIBA (e.g., Dan Sullivan, Binsheng Zhao)
  - Under consideration: CTMM TraIT (Andre Dekker, Jeroen Belien)