Cancer Imaging Informatics Workshop
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Imaging is Key to Cancer Research

◆ The ability to detect, through imaging, the molecular changes associated with a tumor cell will improve our ability to detect and stage tumors, select appropriate treatments, monitor the effectiveness of a treatment, and determine prognosis.

Spectrum of Imaging in Cancer

◆ Anatomic - see clearer and more detailed pictures of
   organs and tissues

◆ Functional - see physiological, cellular, or molecular
processes in living tissue, as they take place

◆ Move imaging into early role of:
   ● identifying paths of disease pathogenesis,
   ● discovering and developing new drugs

◆ Expand and improve clinical studies of imaging technologies and image-guided interventions

Imaging – what's its potential value to the clinician?

- Detect cancer earlier, when treatments may be more effective
  - Screen at risk individuals

- Allow a non-invasive or image-guided needle biopsy approach to diagnose cancer and avoid an open surgical procedure

- More accurately assess the extent of cancer to guide the treatment options
  - At time of diagnosis, and during treatment

- Distinguish viable cancer from necrotic cells or swelling or other benign causes of persistent radiographic abnormalities

Imaging – what's its potential value to the clinician?

- ◆ Distinguish indolent from aggressive cancer at time of diagnosis, allowing more appropriate treatment strategies e.g., prostate cancer
  - ● Does the imaging correlate with biomarkers?
  - ● Does it predict response to treatment?
  - ● Does it predict clinical outcome?

- ◆ During treatment of the patient with cancer
  - ● Will imaging allow the physician to make an informed decision earlier than anatomic changes or clinical outcomes about treatment management?
    - ● If predicts ineffectiveness - change treatment strategy earlier to lessen risks of adverse events, and offer more promising options
    - ● If predicts effectiveness – provides confirmation that patient is more likely to benefit from current treatment strategy and tips the balance of risk/benefit

Imaging – what's its potential value to the clinician?

- ◆ Non-invasively detect, diagnose, and deliver or guide treatment
- ◆ Done in real time

Imaging – what's its potential value to the academic or company developer?

- Facilitate Development of More Effective Therapies
  - Molecularly Targeted Therapies
    - Does the drug reach its target?
    - Does it modulate its target and affect the downstream pathways?
    - Is there a correlation with the effects on the tumor and the effects on the target and pathway?
    - Possibly lead to more precisely determined doses and therapies less toxic to normal tissues

Imaging – what's its potential value to the academic or company developer?
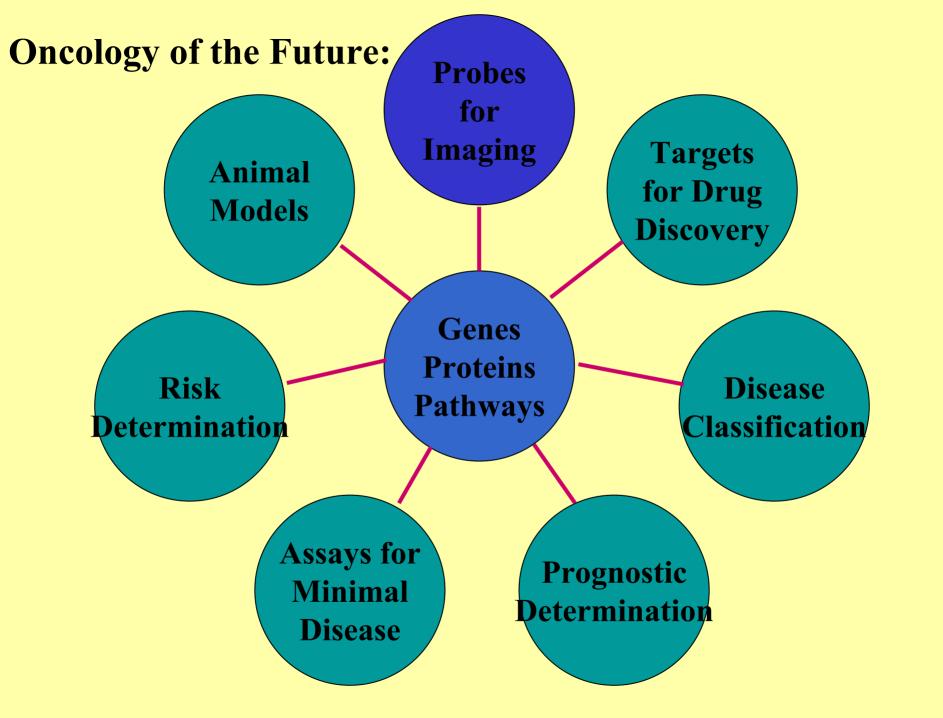
- Facilitate Development of More Effective Therapies
  - Non-invasively and non-destructively evaluate parameters of interest
    - Pharmacodynamics
    - Pharmacokinetics
    - Success of treatment delivery
    - Determine biodistribution
  - Predict tumor response to treatment
  - Measure tumor response to treatment

Expanding Knowledge through Integration and Synthesis

- ◆ Resources/Research for Imaging
  - ● In Vivo Cellular and Molecular Imaging Centers
    - ● Foster multidisciplinary research on cellular and molecular imaging
    - ● Act to narrow the gap between the discovery of new cancer genes and intracellular pathways and the translation of these discoveries into clinically useful, minimally invasive imaging approaches to expand our understanding of cancer
  - ● Small Animal Imaging Resource Program
    - ● Develops and applies a wide variety of functional, quantitative imaging modalities, and working with the Mouse Models of Human Cancer consortium researchers will help in developing and validating new preclinical models and in designing and testing imaging techniques to detect human cancer
  - ● Mouse Models of Human Cancer Consortium

Expanding Knowledge through Integration and Synthesis

- Resources/Research for Imaging
  - Development of Clinical Imaging Drugs and Enhancers
    - Foster and speed the development of promising imaging enhancers and molecular probes and their translation from laboratory synthesis to investigational new drug application
  - Early clinical trials of novel imaging probes
  - Phased innovation award for diagnostic imaging and guided therapy
  - Innovative technologies for the molecular analysis of cancer
  - Applications of innovative technologies for the molecular analysis of cancer
  - Interdisciplinary Research Teams for Molecular Target Assessment
  - American College of Radiology Imaging Network (ACRIN) and Clinical Trials Cooperative Groups
  - National Forum and an Interagency Council to facilitate partnering of academic, commercial and government resources to promote cancer drug discovery and development into the clinic and marketplace

Oncology of the Future:

- Probes for Imaging
- Animal Models
- Targets for Drug Discovery
- Genes Proteins Pathways
- Risk Determination
- Disease Classification
- Assays for Minimal Disease
- Prognostic Determination

Center for Bioinformatics

building common architecture, common tools, and common standards

access portals

participating group nodes

Clinical Trials

Molecular Signatures

NCI Core

Mouse Models

Cancer Genomics

TGI

GAI

CCAP

molecular
pathology

pre-clinical
models

basic
science

clinical
trials

authoring

execution

management

monitoring