NCI Best Practices Forum
The Importance of Biospecimens in Cancer Research:
It Begins with Patients and Ends with Patients!

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Today’s Agenda

Introduction

The Current System

Challenges of the Current System

Solutions/Moving Forward
**Biospecimen:** Tissue, blood, urine, or other human-derived material. A single specimen may generate several samples. (Also called aliquots)

**Biospecimen Resource:** A collection of specimens and related data, the storage facility, and all relevant policies. (Also called: biorepository, biobank, tissue bank)

**Best Practices:** Standard operating procedures that are considered up-to-date and scientifically based and address all relevant ethical, legal, and policy regulations.

**Biomarker:** A substance (eg, a protein) sometimes found in the blood, other body fluids, or tissues that may indicate the presence of, susceptibility to, or extent of a disease.
Today’s Medicine Challenge: One Size Doesn’t Fit All

Patients are different

Medicines are not differentiated

~ 30% of patients do not benefit from medicines¹
(100,000 deaths and 2.2 million nonfatal events from ADR in the US in 1994)

¹JAMA 1998, 279: 1200

Source: Bayer HealthCare Diagnostics and Burrill & Company
Improved Effectiveness with Individualized Oncology

- Biologic Effect of Therapy
  - Waste
  - Empiric Therapy
  - Targeted Therapy

Waste due to Insufficient Rx
Waste due to Excessive Rx

Optimal Effect on Tumor

Insufficient Effect on Tumor

Excessive Effect on Patient
**Key Definitions**

**Molecular Medicine:** A branch of medicine that develops ways to diagnose, treat and prevent disease by understanding the way genes, proteins, and other cellular molecules work.

**Personalized Medicine:** Medical practices that are tailored to an individual patient and individual patient’s specific disease based on the molecular characteristics of each.

Image courtesy of *Science*, May 26, 2006
Finding the targets for detection, therapy, prevention

Genomics  Proteomics  Metabolomics

All Depend On High-Quality Human Biospecimens
Specimens are needed to:

- Identify biomarkers (unique targets) in cancers
- Develop biomarker-targeted diagnostics and therapeutics
- Accelerate molecular medicine
  - Herceptin targets Her2-neu; Iressa targets EGFR
- Identify new uses for existing targeted drugs
  - Gleevec → CML / Gleevec → GIST
The Current System
• Biospecimen Resource = Collections or “libraries” of diseased and/or normal human biospecimens

• Have existed for 100+ years

• Originated in pathology departments to confirm diagnosis and guide treatment pre/post surgery

• No national standards exist for biospecimen resources that collect and store specimens for use in research

• No regulatory body oversees biospecimen resources
After collection, there are two paths a biospecimen may follow:

- **Clinical Pathway:** This path includes diagnosis and treatment. The clinical pathway benefits the individual patient.

- **Research Pathway:** This path involves scientists doing research to enhance knowledge and advance cancer treatments. The research pathway benefits the broader population.
Clinical Pathway
What Happens to the Information from Your Biospecimen?

STANDARDIZED PROCESS
DIRECTED BY CLINICIANS

CONSSENT

COLLECTION

PATHOLOGY DEPARTMENT

CLINICAL PATH

DIAGNOSIS

RESEARCH PATH

BIOSTIMEN RESOURCE

RESEARCHERS

GENETIC DATA

SCIENTIFIC PUBLICATION
Challenges of the Current System
• 300+ million specimens, but tissue is of unknown quality
• Many biospecimen resources exist, but no “network”
• Collection methods vary, no commonly agreed standards
• Approaches to patient consent & privacy protections vary
  ➔ Not all specimens are consented appropriately for today’s cancer research
• Documentation of clinical data is limited and variable
• No common IT structure links resources together
  ➔ Difficult to exchange information
• Limited access to specimens exists between institutions
Low quality biospecimens impact multiple research efforts.
The lack of standardization of human biospecimens compromises the quality and utility of research and the advances in cancer research that depend on them.
Herceptin is a drug used for the treatment of some breast cancers.

Herceptin targets tumor cells that overexpress, or make too much of, a protein named HER2.

Herceptin should only be given to patients whose breast tumors overexpress HER2.

About 20% of breast cancers overexpress HER2.

The amount of HER2 protein in a tumor can be visualized by special techniques and scored from 0-3+. A higher score means that the patient is more likely to benefit from Herceptin therapy.
A 2006 study estimated ~20% inaccuracy rate in HER2 testing.

- Some patients not receiving potentially beneficial treatment.
- Some patients risking dangerous side effects when Herceptin is unlikely to help them.

- Lack of standard practices in specimen preparation and testing have contributed to inaccurate HER2 results.

- American Society of Clinical Oncology and the College of American Pathologists have addressed this with new standards.
Solutions/
Moving Forward
Prepare for changes in biospecimen requirements that are needed to:

- Conduct and advance molecular medicine
- Drive personalized cancer medicine

Prepare for an increased need for biospecimens

Remove a key barrier to cancer research: The limited availability of high-quality human specimens
Background Research: Key Barriers Identified

- Lack of common biospecimen resource SOPs, standards, and management principles across NCI-supported programs
  - May limit impact of research programs
- Lack of access to information on specimens available from the portfolio of biospecimen resources supported by the NCI
- No common database nor a defined mechanism to access biospecimens in NCI-supported programs
Objectives:

• Unify policies and procedures for biospecimen resources supported by the NCI or used by NCI-supported investigators

• Based on State of the Science as defined by 3 years of due diligence
Includes recommendations and guidelines for:

- Operational best practices for research biorepositories
- Quality assurance and quality control programs
- Establishing reporting mechanisms
- Providing administration and management structure
- Ethical, legal, and policy issues
- Informed consent
- Access to specimens and data
- Privacy protection – HIPAA
- Ownership of specimens
- Intellectual property
**What Do the Best Practices Mean for Patients?**

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<th>Improved Biospecimen Process:</th>
<th>Best practices will help standardize processes for collecting and managing specimens.</th>
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<td><strong>Increased Access:</strong></td>
<td>Best practices propose a set of mutual principles for how biospecimen resources are accessed and managed, hopefully allowing broad access among researchers.</td>
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<td><strong>Privacy Protection:</strong></td>
<td>Best practices recommend measures to protect patient privacy and recommend that patients be told how their information will be protected during the informed consent process.</td>
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How Will the Best Practices Benefit Cancer Research?

Improving the quality of biospecimens ➔
- More reliable research results

Standardized practices ➔
- Results will be more comparable across studies and researchers will be able to use multiple biospecimen resources within a single study

Standardizing access policies and encouraging sharing of resources ➔
- Greater research access to specimens
Large research initiatives (i.e., The Cancer Genome Atlas, TCGA) are underway

- Each will require large numbers of high-quality cancer and healthy biospecimens with clinical documentation

Cancer research is becoming tied to biomarkers found in biospecimens, and the accuracy/reliability will drive the next generation of diagnostics and therapeutics

The progress being made towards reducing the burden of cancer depends on the efficiency and accuracy of these and other translational research initiatives