The Importance of High-Quality Biospecimens to the Research Enterprise: The Road to Molecular Medicine

Cancer Health Disparities Summit 2008

Carolyn Compton, M.D., Ph.D.
Director, Office of Biorepositories and Biospecimen Research
Today’s Medicine Challenge: One Size Doesn’t Fit All

Patients are different

Medicines are not differentiated

~ 30% of patients do not benefit from medicines\(^1\)
(100,000 deaths and 2.2 million nonfatal events from ADR in the US in 1994)

\(^1\)JAMA 1998, 279: 1200

Source: Bayer HealthCare Diagnostics and Burrill & Company
A New Era: Molecular Technology Promises to Transform Oncology

Beating cancer
The new frontier of molecular medicine

The war on cancer is entering a new phase

“CANCER” is one of those words that send shivers down the spine. The phrase “battle with cancer” is a headline writer’s cliché. And the military metaphor was widespread in 1971, when Richard Nixon, then president of the United States, announced an initiative that later became known as the “war on cancer.” Cancer treatment has not been banned. Indeed, by some measures the problem is worse than it was three decades ago. It is true that treatments have improved somewhat, and some patients with cancer have survived longer than their predecessors. But the greatest success has come in one area: early detection and prevention. And despite that success, the likelihood that a person will get cancer at some point in his or her lifetime has actually risen since Nixon’s speech.

The past three decades of effort have secured a disappointment, the next decade could guarantee some rapid progress. The battle against cancer is at a turning point. Because of recent advances, it is becoming possible to imagine a time when the disease will be curable, and when new medical treatments will be able to cure the disease, transforming it from a potent killer into something akin to a chronic disease. The disease will be more like diabetes, a chronic condition that is hard to cure but manageable.

Researchers have connected much of the basic molecular biology of cancer cells to the discovery that the human genome project has been completed over the past ten years. They have come to understand how genes and proteins interact to cause cancer. They know that some genes are mutated in cancer, and that these mutations can be used to develop new treatments. They also know that cancer cells can become resistant to treatments, and that this resistance can be overcome by targeting specific mutations.

But there is still much work to be done. The war on cancer is not over yet.
The Promise of Molecular Oncology/Medicine

Advances in Molecular Technologies and Research

Generic

Morphologic diagnosis and phenotypic tumor classification

Generic therapeutic regimens with unpredictable effectiveness

Treatments with unpredictable adverse effects on patients

Personalized

Molecular characterization of tumor pathways and processes

Targeted therapies tailored to the molecular profile of the disease

Drug regimens planned around host genetics that portend toxicity

Understanding Molecular Biology of Host and Disease
Improved Effectiveness with Individualized Oncology Treatments

- Generic Therapy
- Targeted Therapy

Waste due to Excessive Rx
Waste due to Insufficient Rx

Optimal Effect on Tumor

Insufficient Effect on Tumor

Excessive Effect on Patient

Biologic Effect of Therapy
Translational Research Promises to Realize the Vision of Personalized Medicine

- Molecular Data
- Diagnosis / Therapy
- Biospecimen Analysis
- PERSONALIZED CANCER CARE
- Biospecimen Collection
- Biospecimen Processing and Banking
Finding the targets for detection, therapy, prevention

Genomics  Proteomics  Metabolomics

All Depend On High-Quality Human Biospecimens

Biospecimen: Tissue, blood, urine, or other human-derived material
Challenge for the NCI: Lack of standardization of human biospecimens compromises the quality and utility of molecular research dependent on them.

Consensus of the Broad Scientific Community: The lack of high-quality human specimens has become the limiting factor for post-genomic biomedical science.

- **The #1 roadblock to translational research in cancer!!**
Garbage In ⇔ Garbage Out
Effects on Clinical Outcomes

- Potential for incorrect diagnosis
  - Morphological/immunostaining artifact
  - Skewed clinical chemistry results
- Potential for incorrect treatment
  - Therapy linked to a diagnostic test on a biospecimen (e.g., HER2 in breast cancer)

Effects on Research Outcomes

- Irreproducible results
  - Variations in gene expression data
  - Variations in post-translational modification data
- Misinterpretation of artifacts as biomarkers
Clinical Research Disparities May Perpetuate Skewed Research

Personalized Cancer Care

Not effective for all populations

Molecular Data

Diagnosis / Therapy

Translational Research

PERSONALIZED CANCER CARE

Biospecimen Analysis

Biospecimen Collection

Unrepresentative biospecimen collections

Biospecimen Processing and Banking

Unequal participation in clinical research
**Issue:**

- Some cultures believe the body is sacred and an individual must leave the world whole in order to be at peace
- These beliefs are common in Native American and other Native communities, and communities such as Orthodox Jews hold similar beliefs

**Impact:**

- For communities where such beliefs are common, it may be necessary to make arrangements for return of biospecimens if requested by the family or individual
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
NCI Best Practices for Biospecimen Resources

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
NCI Best Practices Recommendation C.2.2.9.

- If participation is discontinued, biospecimen resource managers should be sensitive to cultural issues and work with affected groups to develop mechanisms for the proper destruction of biospecimens or, if needed, returning biospecimens to the individual or affected group, as appropriate.
During the consent process, investigators should consider whether to ask research participants about cultural issues regarding the biospecimen, including the following:

- Any religious, cultural, or personal restrictions
- Wishes for family to have any rights or access
- Instructions for disposal or return of the biospecimen
Overall Approach: Transparency & Respect

Researchers and clinicians need to:

- Respect the beliefs of communities
- Be transparent about their processes and what services they can (and cannot) provide
- Educate about the importance of biospecimens to clinical care and research
- Consult with the community about what they would find acceptable
- Ensure that any promised benefits are accurately communicated and delivered
Without YOU This Can’t Happen

Molecular Data ➔ Translation Research ➔ PERSONALIZED CANCER CARE ➔ Diagnosis / Therapy

Biospecimen Analysis ➔ Biospecimen Collection ➔ Biospecimen Processing and Banking

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http://biospecimens.cancer.gov
biospecimens@mail.nih.gov