

Bioinformatics-Guided Biomarker Discovery Program

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The Tumor Bank and Genomics Program

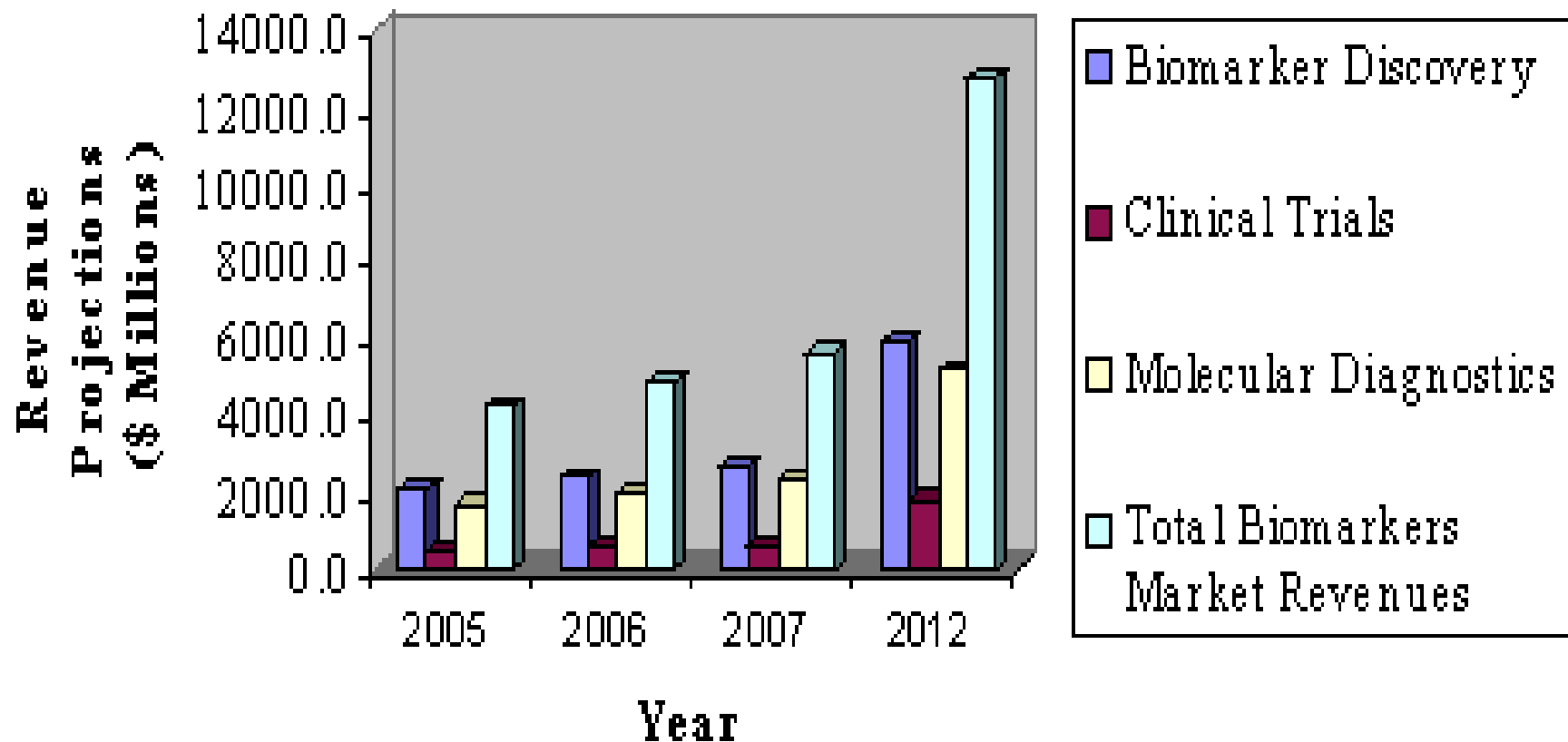
The Cancer Center

Hackensack University Medical Center

March 18, 2008

* We did not receive anything with monetary values from BioFortis and BioMax

Demands for basic, translational and clinical sciences relevant to biomarker market will dramatically increase in future



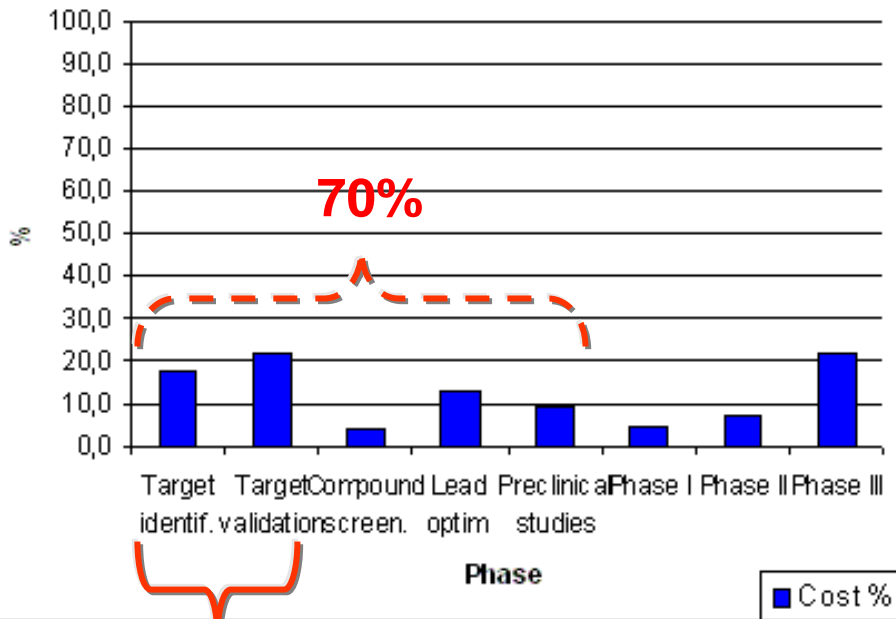
Source: BCC Research, 2007

Biomarkers: The Expanding Global Market (BIO61A)

Biomarker discovery (target identification and validation) is associated with high cost and time

Cost

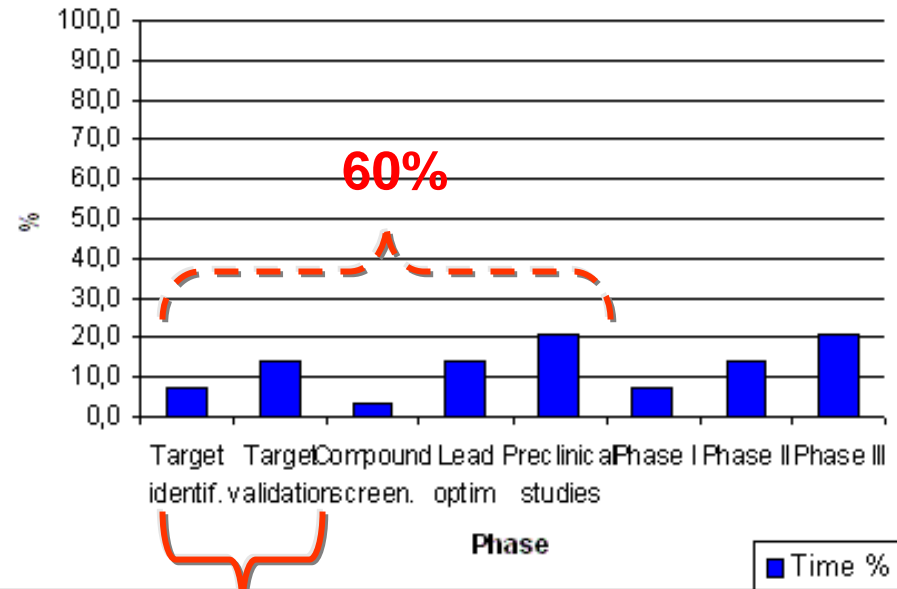
Percentage of total R&D cost spent in each phase



40%

Time

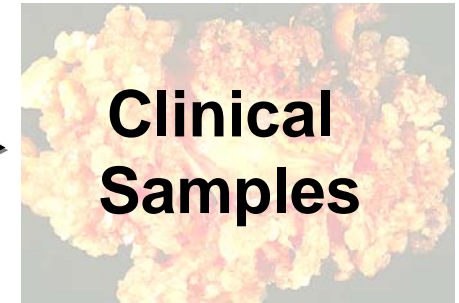
Percentage of total R&D time spent in each phase



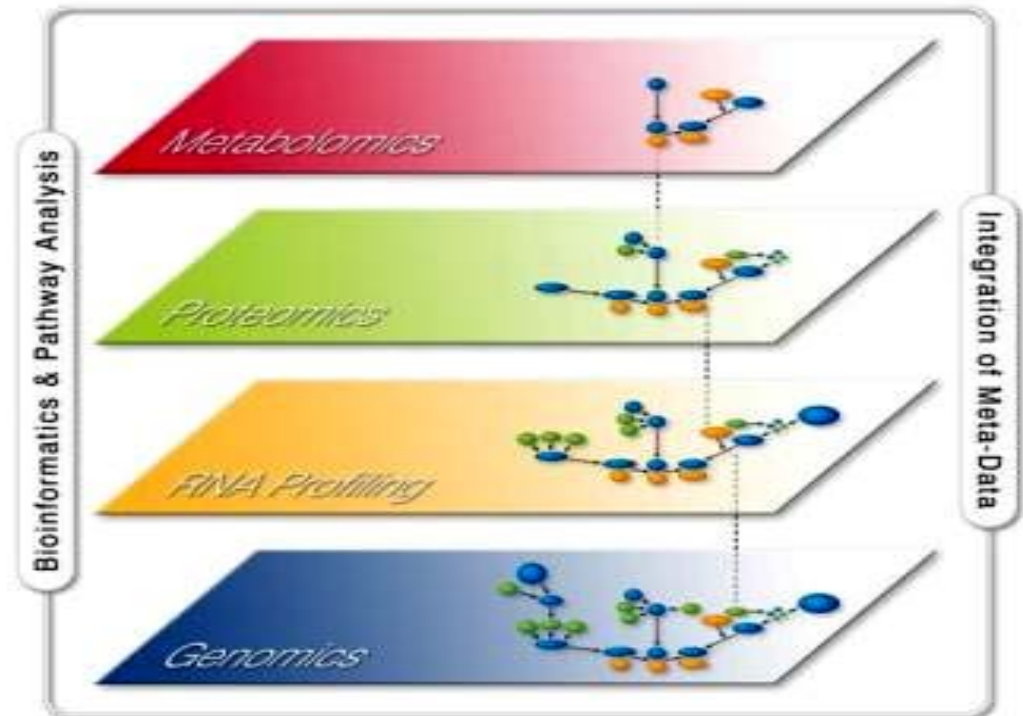
20%

Two phases of biomarker discovery involve procurement of clinical samples and –omics research

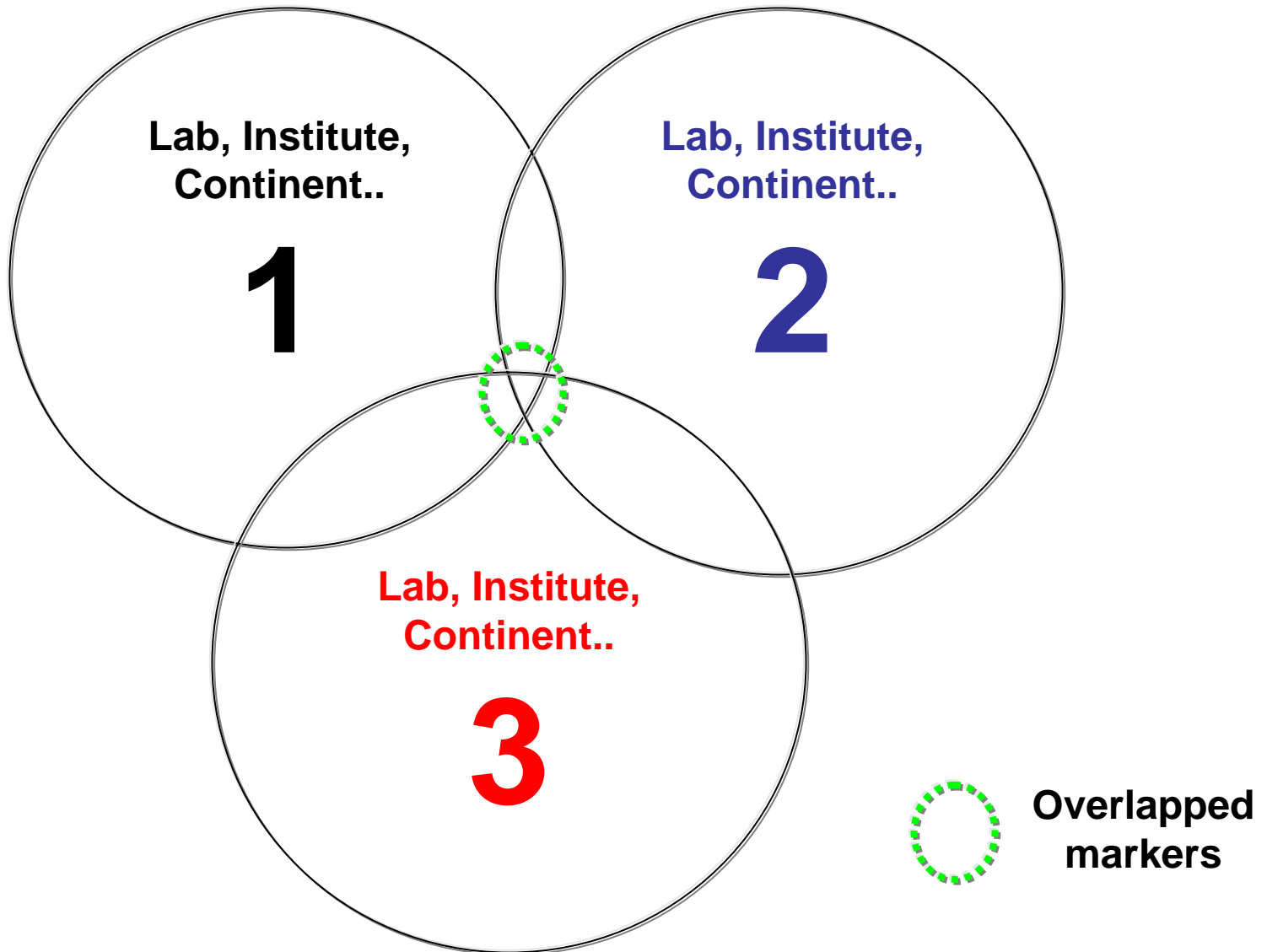
(1) “Procurement”



(2) “-omics Research”



A small number of tumor biomarkers overlap between laboratories, institutes and continents



Multiple departments are involved in the Tumor Bank tissue procurement workflow

DEPARTMENTS

- A. Outpatient clinic
- B. Outpatient laboratory
- C. Couriers
- D. Surgical procedure room
- E. Department of pathology
- F. Information technology
- G. Tissue repository and Research

PEOPLE

- Research, Education and Charge Nurses
- Schedule, Research and Data Coordinators
- Receptionist and Assistants ..etc

PROBLEMS

- 1. Sample loss (-\$300 to -\$500) due to lack of communication & information**
- 2. Structural integrity and quality of biomaterials compromised due to lack of coordination**
- 3. Disruption of routine workflows in Operating Rooms, Special Procedures and Pathology due to unexpected arrival of patients or samples without consent forms**
- 4. IT- and Tele-communication not frequently accessible due to high patient volume and short staff**

Solution

Translational bioinformatics is used to help the workflow associated with procurement of clinical samples

A combination of patient education and consent procedures are accomplished in digitized formats

New TMBK_Consent Data Workspace

Custom Data - TMBK_Consent

Consent

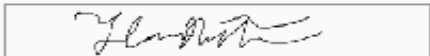

-I have read, or it has been explained to me, and I understand the information in this consent form. All my questions have been answered to my satisfaction. I consent to participate in this study.

-I understand that I will receive a signed and dated copy of this consent form for my records.

-By signing this consent form, I have not waived any of the legal rights, which I otherwise would have as a participant in a research study.

Florence Nightingale

Person obtaining consent

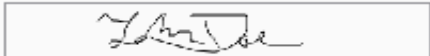

 9/21/2007 

Signature of person obtaining consent Date

Drop Subject here

Demo.1 Doe, John ()

Subject

 9/21/2007 

Signature of Subject or Signature of Legally Authorized Representative Date

A witness is someone who has no connection with the clinical trial. A witness is only required in cases where the subject cannot read or is not able to understand the consent document. By signing the consent form, the witness attests that the information in the consent form and any other written information was accurately explained to and apparently understood by the subject or the subjects legally acceptable representative and that the informed consent was freely given by the subject or the subjects acceptable representative. In cases where this does not apply N/A should be placed in the witness section.

Research nurses and coordinators initiate bioinformatics-guided tissue procurement process (*Lymphoma Division)

Labmatrix - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Sub... Con... Communica... Biomat... Genot... Sto... Custom ... Wor... Q... Log Off Imports Admin Help

TMBK_Workflow Data Workspace

Custom Data - TMBK_Workflow

Subject:

Consent_Nurse_Name:	<input type="text" value="Florence Nightingale"/>	Consent_Date:	<input type="text" value="9/12/2007"/>		
Diagnosis:	<input type="text" value="Leukemia"/>	Leukemic_Phase:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		
WBC:	<input type="text" value="100"/>	ANC:	<input type="text" value="200"/>	ALC:	<input type="text" value="300"/>
RBC:	<input type="text" value="400"/>	Hemoglobin:	<input type="text" value="500"/>	PLT:	<input type="text" value="600"/>
Consented_Peripheral_Blood:	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Blood_Drawn_Today:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Scheduled_Blood_Draw_Date:	<input type="text" value="9/20/2007"/>
Consented_Tissue:	<input type="text" value="Excisional Biopsy"/>	Consented_Tissue_Other:	<input type="text"/>		
Scheduled_Surgery_Date:	<input type="text" value="9/28/2007"/>	Surgeon_Name:	<input type="text"/>		
IgG:	<input type="text" value="700"/>	IgA:	<input type="text" value="800"/>	IgM:	<input type="text" value="900"/>
LD:	<input type="text" value="1000"/>	Hep_B_Core_Antibody:	<input type="text" value="Negative"/>	Hep_B_Surface_Antigen:	<input type="text" value="Negative"/>
Hep_B_Surface_Antibody:	<input type="text" value="Negative"/>	Hep_C:	<input type="text" value="TBD"/>	Beta2:	<input type="text" value="1100"/>
HIV:	<input type="text" value="TBD"/>	CMV_Serology:	<input type="text" value="Positive"/>	CMV_DNA:	<input type="text" value="1200"/>
EBV_Serology:	<input type="text" value="Negative"/>	EBV_DNA:	<input type="text"/>	Immunofixation:	<input type="text"/>

Automated emails and paging procedures alert members of the tissue procurement “TEAM” in real-time

it_Documents	Subject	This Custom Data form d...	+ ...	...	...	...
_Blood_Status	Subject	-	+ ...	...	...	...
_Consent	Subject	-	+ ...	...	...	...
_Special_Proc_B...	Subject	Only fill out this form whe...	+ ...	...	...	...
_Workflow	Subject	-	+ ...	...	...	...

und

Print Refresh

BK_Workflow

	PHI	Req'd	Datatype
	<input type="checkbox"/>	<input type="checkbox"/>	Decimal
ral_Bloo	<input type="checkbox"/>	<input type="checkbox"/>	Yes/No
	<input type="checkbox"/>	<input type="checkbox"/>	List
.Other	<input type="checkbox"/>	<input type="checkbox"/>	Small Text
_Date	<input type="checkbox"/>	<input type="checkbox"/>	Date
y	<input type="checkbox"/>	<input type="checkbox"/>	Yes/No
raw_Dal	<input type="checkbox"/>	<input type="checkbox"/>	Date
	<input type="checkbox"/>	<input type="checkbox"/>	Decimal
	<input type="checkbox"/>	<input type="checkbox"/>	Decimal
	<input type="checkbox"/>	<input type="checkbox"/>	Decimal
	<input type="checkbox"/>	<input type="checkbox"/>	Decimal
ody	<input type="checkbox"/>	<input type="checkbox"/>	List
tion	<input type="checkbox"/>	<input type="checkbox"/>	...

https://labmatrix.net - Notification - Mozilla Firefox

Operator: Match

Value: ,+

Email Title: Notification from Labmatrix

Email Message: The patient %subject% has been scheduled for surgery on this date %newValue%.
The patient's consent form has been electronically recorded in Labmatrix, under the %subject%'s patient record.
Please be sure to note this date on your schedule. Thank you.

Recipients: pathology@humed.com,
operating_room@humed.com,
tissue_bank@humed.com

Done labmatrix.net

All digitized data associated with clinical samples are stored and documented (Biospecimen management and tracking)

Tissue Sample - 2 DCIS biopsy

Name: DCIS biopsy
Type: breast
Access Group(s): BC
Source Subject(s): [BC.1 Roosevelt, Ms. Eleanor \(NIH1\)](#)
Source Biomaterial(s):
Suggested Discard Date:
Created By:
Received From: [Jeffreys, Patrick Dr.](#) 10/3/2005
Sample Quality: Apparent Quality-Acceptable
Anatomy/Cell Type:
Current Status: In inventory - stored
Storage Location: [rack/clinical specimens 1/1-A](#)
Current Status Date: 11/10/2006
Barcode: 000021231545-00-3-329277
System Generated Barcode: AA7289E7-CC74-43E8-B572-A72D7C2EA0C

Storage Browser

Location: rack/clinical specimens 1

Container	Contents
clinical...imens 1	
Row 1	
1-A	2 DCIS biopsy
1-B	4 IBC biopsy
1-C	17 DCIS biopsy
1-D	24 IBC biopsy
1-E	25 IBC biopsy
1-F	26 IBC biopsy
1-G	27 IBC biopsy
1-H	28 IBC biopsy
1-I	29 IBC biopsy
Row 2	
Row 3	
Row 4	
Row 5	
Row 6	
Row 7	
Row 8	
Row 9	

rack/clinical specimens 1
(Mouse over slots to see contents)

	A	B	C	D	E	F	G	H	I
1	🌐	🌐	🌐	🌐	🌐	🌐	🌐	🌐	🌐
2	🌐	🌐	🌐	🌐	🌐	🌐	🌐	🌐	🌐
3	🌐	🌐	🌐	🌐	🌐	🌐	🌐	🌐	🌐
4	🌐	🌐	🌐	🌐	🌐	🌐	🌐	🌐	🌐
5	🌐	🌐	🌐	🌐	🌐	🌐	🌐	🌐	🌐
6									
7									
8									
9									



Tissue Sample - 2 DCIS biopsy

General | Tissue Sample | Lineage | Custom Data | Workflows | Genotypes | Usage History | References | **Attachments** | Comments

Digitized histology images showing tissue morphology.

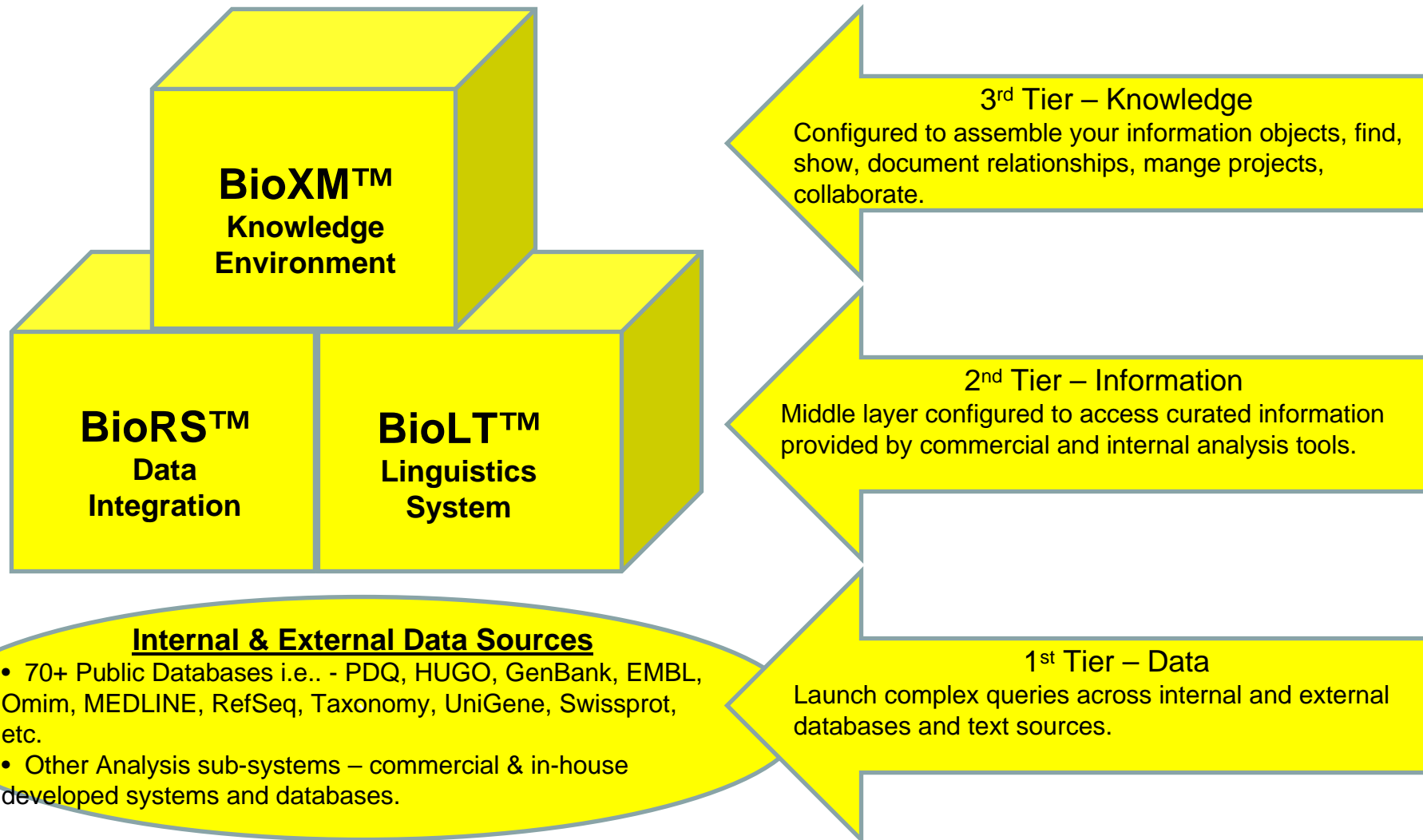
Summary

- **Translational Bioinformatics to guide the procurement process for clinical samples**

- 1) Real time and Web-based information management system**

- 2) Integrating clinical and molecular data for:**
 - a) Translational Clinical Research
 - b) Collaborative Research Studies
 - c) Biospecimen Management
 - d) Biomarker Discovery
 - e) Personalized Medicine

Knowledge Management Environment



Scientists and clinicians must create a knowledge management system to control explosions of data and information

- (1) Compilation of databases from both public and private sectors in one knowledge management system will be the most powerful tool for scientists and clinicians in the future.**
 - (i) DNA, Protein, Metabolite, Mutations, Toxicology, Compounds, References, Clinical Trials, Patents ..etc**
 - (ii) –omics Experimental databases (e.g. microarray)**
 - (iii) Institutional databases (e.g. Tumor Registry- patient outcome)**
 - (iv) Laboratory database (e.g. LabMatrix)**

- (2) Thus, institutions that construct informatics infrastructure that is based on knowledge-management in the form of a neural network will become future leaders in health care.**

Visualize Knowledge

BioXM Knowledge Management Environment

File Edit View Settings Modeling Administration Search Tools Help

Public

rwzhang (Public)

Public

BioLT

Lung Cancer

Lung Cancer 2a

QA

Tutorial AK

Biomax Oncology Base

Lung Cancer

Metabolic Pathways

DoD biospecimen project

HomoloGene

Clinical Study 'Smoking'

Affymetrix experiment re

Hypotheses

Literature

Patients

Patients of Interest

Patient1 03

Patient1 14

Patient1 50

Patient1 55

Patient1 69

Patient22

contexts

relations

Patient5

Patient78

Patient Tissue Sam

All Patients

Current Smokers

Former Smokers

Never Smokers

Others

Chip Platforms

KEGG Pathways

Repositories

Analyses

Patient 'Patient169' - Element View

Report Relations Contexts Graph Annotations

Layout: GraphViz Apply Configure...

Export...

Genistein (C09362)

EFEXOR

LEXEPIN

DEPECO

ALBUTEROL

EGFR (Homo sapiens)

TTF1 (Homo sapiens)

Adenocarcinoma Adenocarcinoma

ASTHMA

PANCREATIC CANCER

PNEUMONIA

P00_C0833048571V

medication for

medication for

medication for

medication for

medication for

has disease

has disease

has disease

has disease

participates in

participates in

Current project: Public

- Integrates information from various sources to find and show complex relationships.

- Supports iterative process of developing a hypothesis, integrating elements, viewing results, understanding how and why parts fit together and documenting findings.

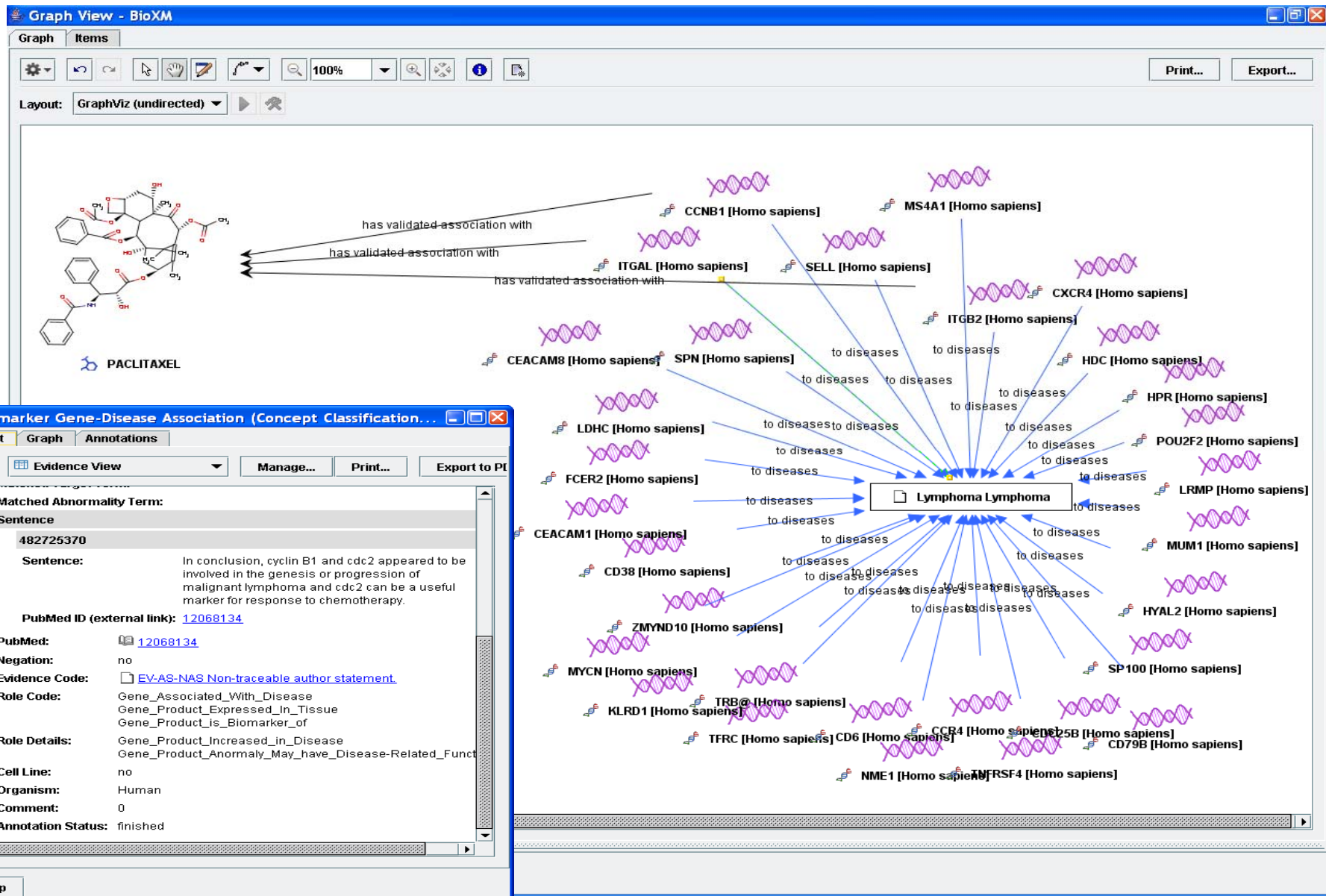
- Capture, preserve, share and institutionalize information to build knowledge across organizations.

- Software developed for non-technical researchers and MDs. No technical skills required.

- Flexible, configurable to support new research as biomedical science evolves.

- Scalable across organizations to support collaboration.

30 lymphoma biomarker-genes



1. Spheroid- 3D cell culture technology

- Construction of tumor spheroids by mixing with primary normal human fibroblasts to mimic human tumors *in vitro* (e.g. library of tumor cell lines)
- High throughput *in vitro* preclinical testing of drugs currently used in clinics (e.g. HUMC)
- Generation of xenografts by embedding spheroids for *in vivo* model

2. Impedance technology

- Signature database for cell culture (e.g. MCL, Ovarian, Prostate and etc.), clinical samples (serum, bodily fluids and tissue lysates)

3. Paramagnetic particle technology

- Rapid Magneto-Immunoassay for PSA/ prostate cancer project

All data will be integrated to knowledge management system