

i2b2 Clinical Research Chart

Shawn Murphy MD, Ph.D.

Griffin Weber MD, Ph.D.

Michael Mendis

Andrew McMurry

Vivian Gainer MS

Lori Phillips MS

Rajesh Kuttan

Wensong Pan MS

Henry Chueh MD

Susanne Churchill Ph.D.

John Glaser Ph.D.

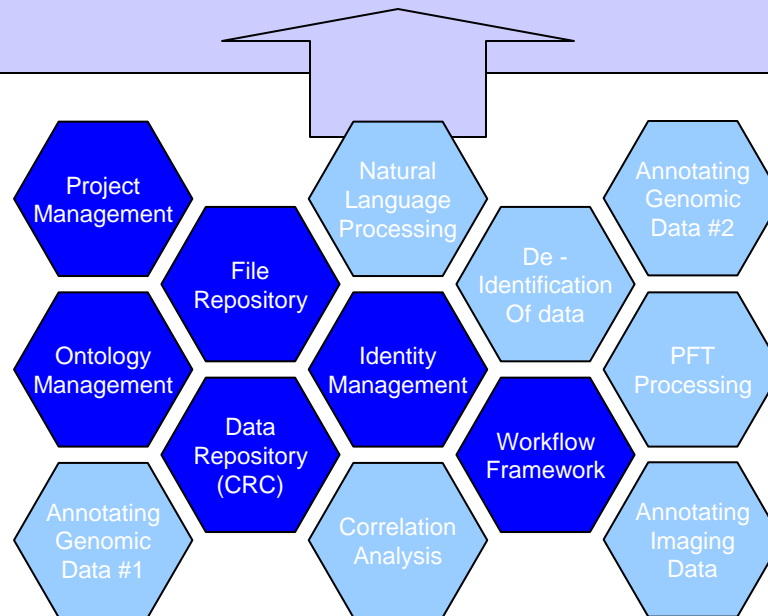
Isaac Kohane MD, Ph.D.

Use Case Development of i2b2 technology

Enterprise-wide repurposing and distribution of medical record data for research

- Hospital-wide availability of clinician-driven queries to find research cohorts
- Suggestion of novel relationships between genes and disease through mutual information theory methods
- Display of large collections of odds ratios as calculated following environmental exposures (Pharmacovigilance)
- IDENTITY MANAGEMENT
- CRC ANALYSIS PLUG-IN

Enterprise-wide repurposing and distribution of medical record data for research



- Enable high performance collection of medical record data for querying and distribution
 - Enterprise web client
 - Create patient cohorts for further investigation
- Enable discovery within data on enterprise wide scale
 - Relevance networks
 - Pharmacovigilance

Enterprise web client

<http://services.i2b2.org/webclient/>

The screenshot shows the i2b2 Query & Analysis Tool web client interface. The browser window title is "i2b2 Web Client - Microsoft Internet Explorer". The address bar shows "http://services.i2b2.org/webclient/#". The interface includes a navigation menu with "Find Patients", "Analysis Tools", "Message Log", "Help", and "Logout".

The main interface is divided into several sections:

- Navigate Terms / Find Terms:** Search by Names (contains) and Search by Codes (multiple sclerosis). A "Find" button is present. Below the search results, "Multiple sclerosis" is listed.
- Workplace:** A file explorer showing a tree structure with "SHARED" and "demo" folders.
- Query Tool:** Query Name: "Moderat-Multipl@02:14:47". It displays a query structure with three groups:

Group 1	Group 2	Group 3
Moderate Alzheimers dise...	Multiple sclerosis	

Below the groups are buttons for "none of these", "AND", "one or more of these", "AND", and "drop a term on here".
- Previous Queries:** A list of recent queries including "Moderat-Multipl@02:14:47 [2-24-2009] [demo]", "Moderat-Multipl@02:14:24 [2-24-2009] [demo]", "BetaBlockerStudy [2-24-2009] [demo]", "Coronal@21:39:04 [2-24-2009] [demo]", "Age-Circu-WBC (@21:36:01 [2-24-2009] [demo]", and "Age-Circu-WBC (@21:32:35 [2-24-2009] [demo]".
- Query Status:** "Executing query...", "Elapsed time (seconds): 2.8", "Query Finished...", "Matching patients: 2".

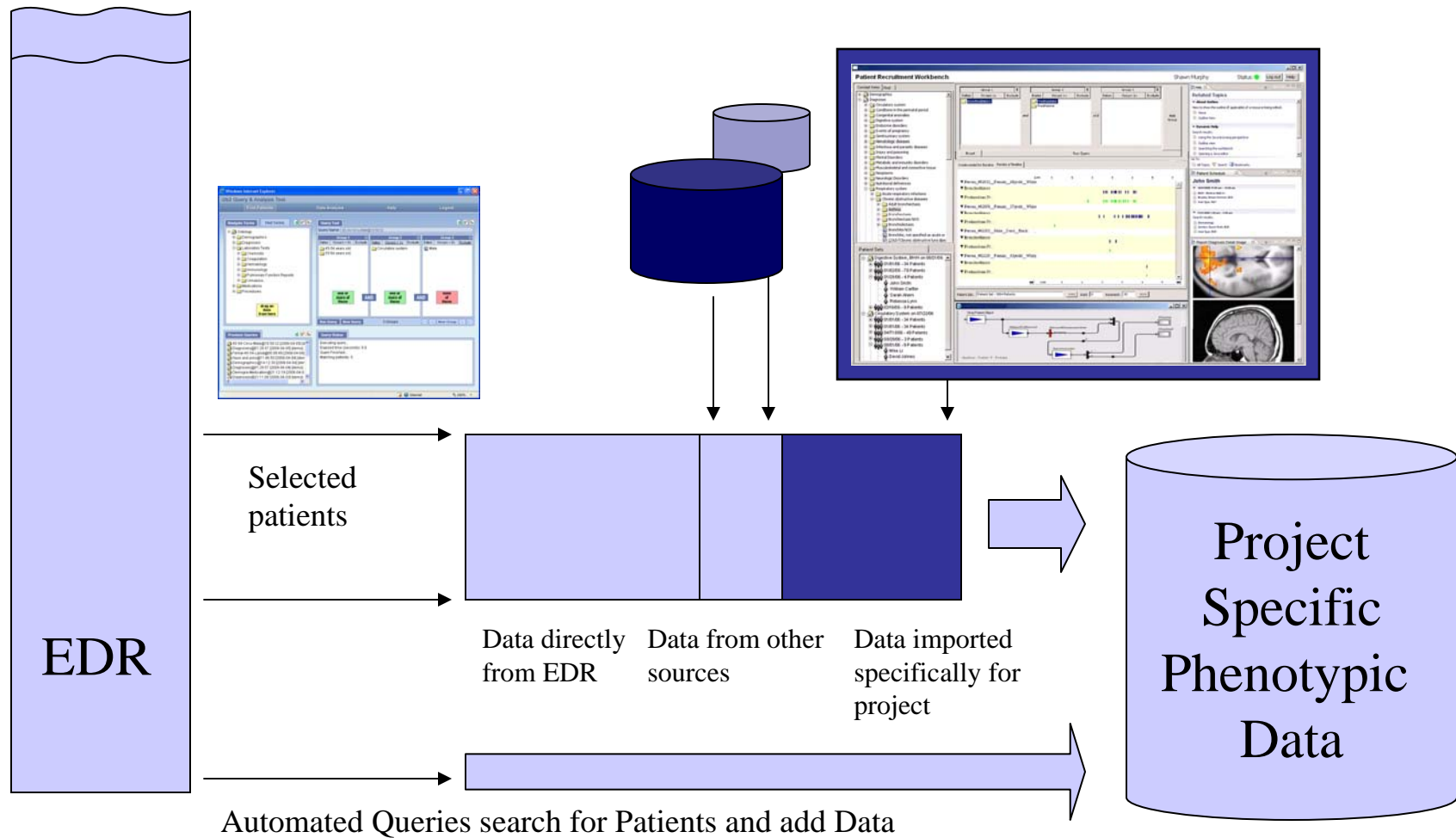
Use Case Development of i2b2 technology

Provide distribution of medical records and tools for their manipulation in supporting specific research projects.

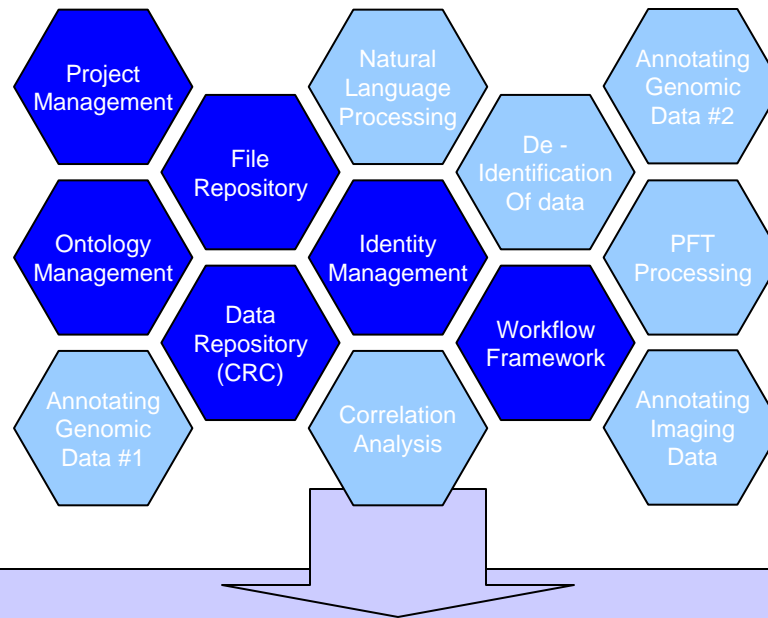
- Select patients for clinical trials
- Working out details for calculating odds ratios of pharmacovigilance
- Annotating images in clinical studies

- NLP WORKFLOW SUPPORT
- CRC ANALYSIS PLUG-IN

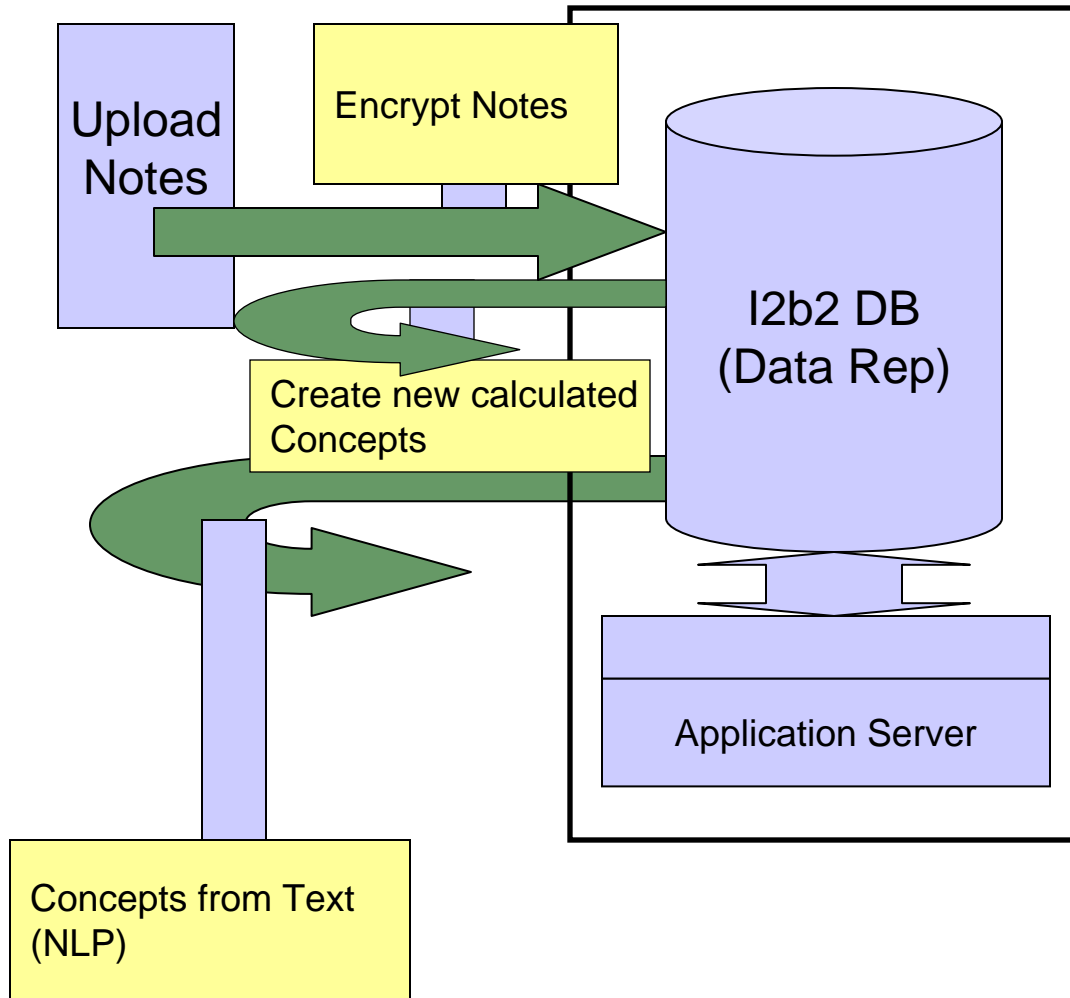
Set of patients is selected through Enterprise Repository and data is gathered into a data mart



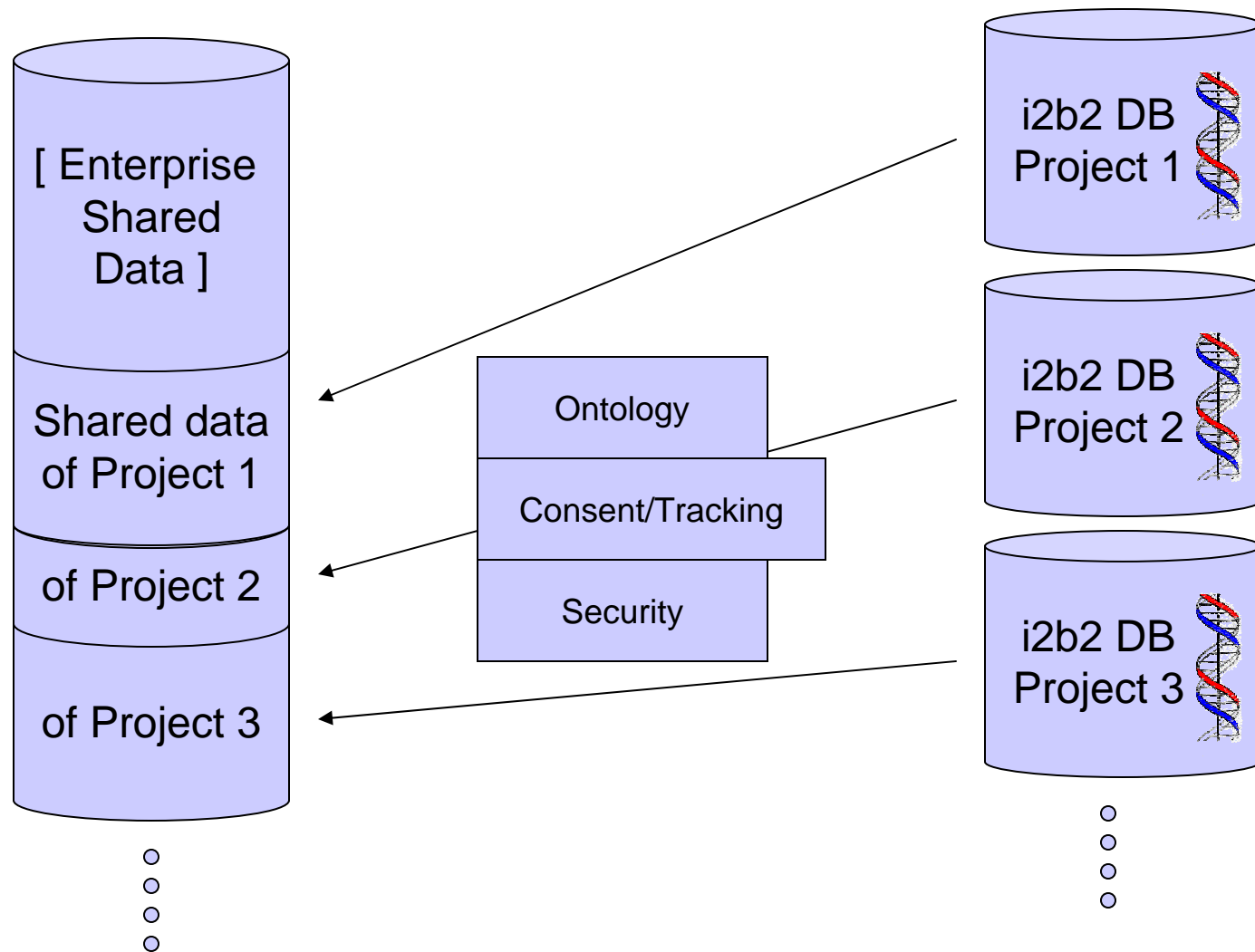
- Repurpose medical record information for research studies
 - I2b2 Workbench
 - Natural language processing
- Enable genomic studies
 - Tissue/blood selection
 - Genetic data integration



Use of medical record data in clinical studies
focused upon genomics and pharmacology



Project data can be added back to Enterprise Repository





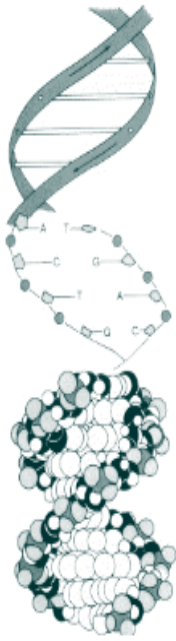
Enterprise Querytool allows:

- Selection of patient populations through complex queries
- Specifically targeted population analysis
- Privacy Management



Project Workbench allows:

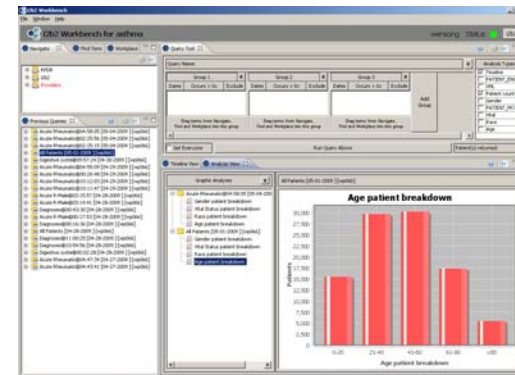
- Patient population medical record review and exploration of data in a targeted population
- Use of Natural Language Processing
- Import of batch data sets
- Workflow support to simulate sequences of operations
- Export of batch outputs for specific applications
- Privacy management



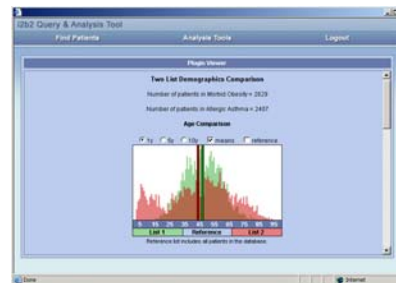
CRC Analysis Plug-in

Use of CRC Analysis Plug-ins

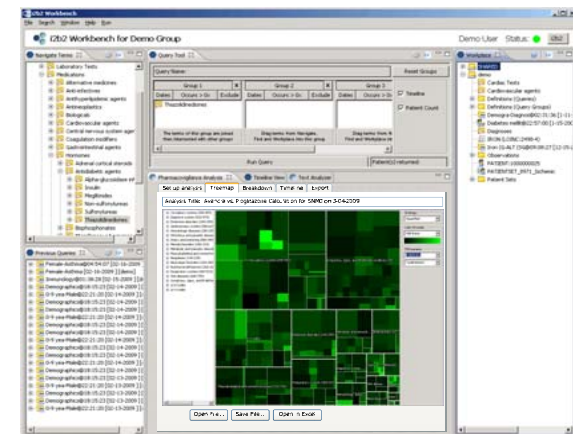
- Breakdowns of patient attributes



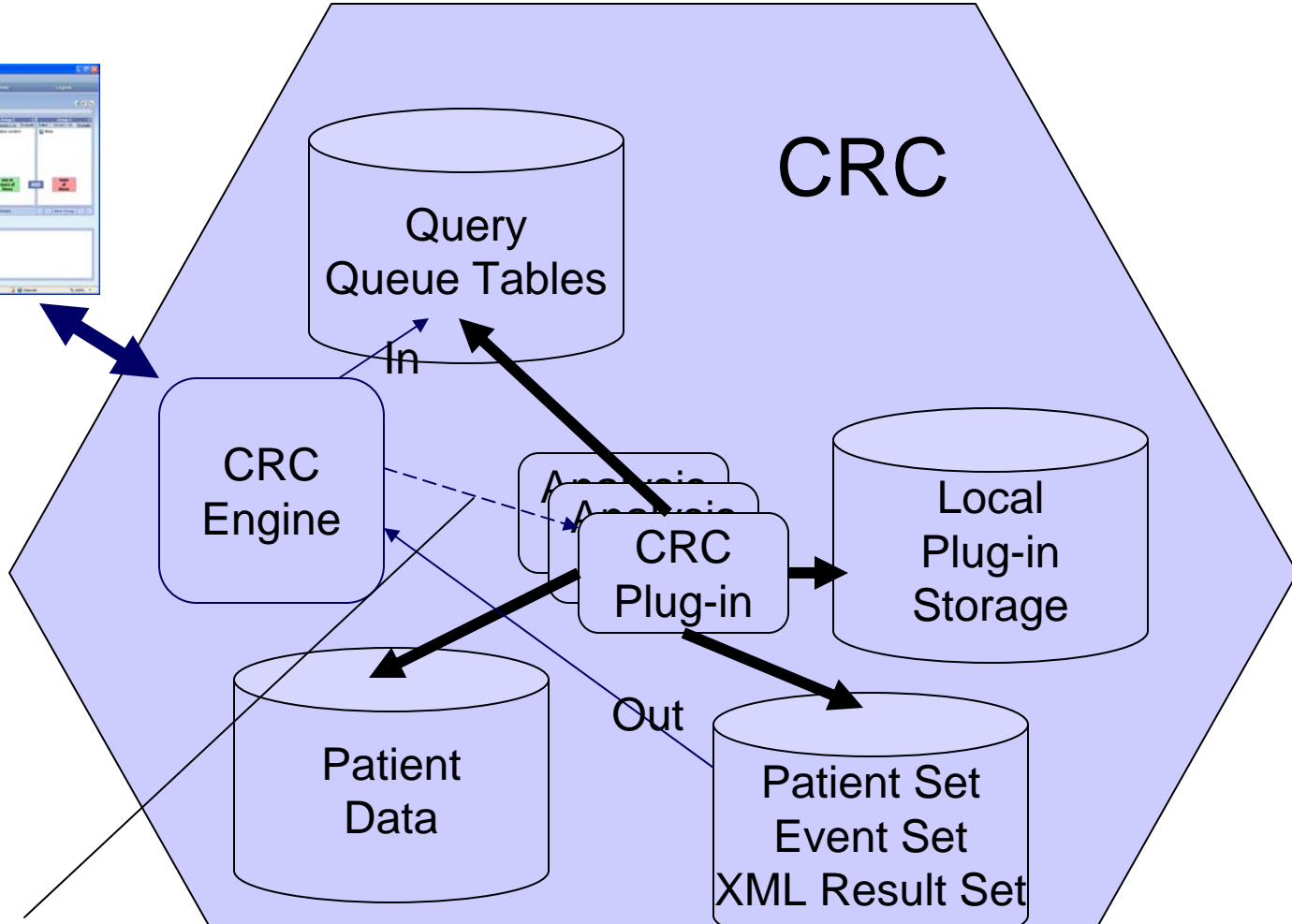
- Two group comparisons



- Increasingly complex types of analyses



Client



Analysis wrapped as a command-line or remotely executed program
Can be started by trigger from client
Can be started as scheduled event
Input parameters are XML in Query Queue tables
Output goes to Result tables, may have pointer to Local Plug-in Storage

Process for Adding New Plug-ins

- Register CRC Plug-in with:
 - Unique ID
 - Name
 - Start up process (local vs. remote)
 - Algorithm API Call to establish run time (for Queue management)
 - Any new XML Result Types and Icons

CRC Plug-in Program – Starting-up

- Client delivers input through web service
- Input from reading block of XML from CRC Query Queue tables, placed there by CRC Engine
- Execution controlled by CRC Engine
- Run from command line (or)
- Run as remote service
- Queue mechanism encourages short running processes to have higher priority

CRC Plug-in Program - Execution

- Access to Patient Data tables through direct SQL
- Local Plug-in Storage database can be persistent storage if desired
- Plug-in manages Local storage

CRC Plug-in Program – Finishing-up

- Output goes to one of three tables
 - Patient Set Table
 - Encounter Set Table
 - XML Results Table
- XML Results Table can have a pointer to a Local Plug-in Database table



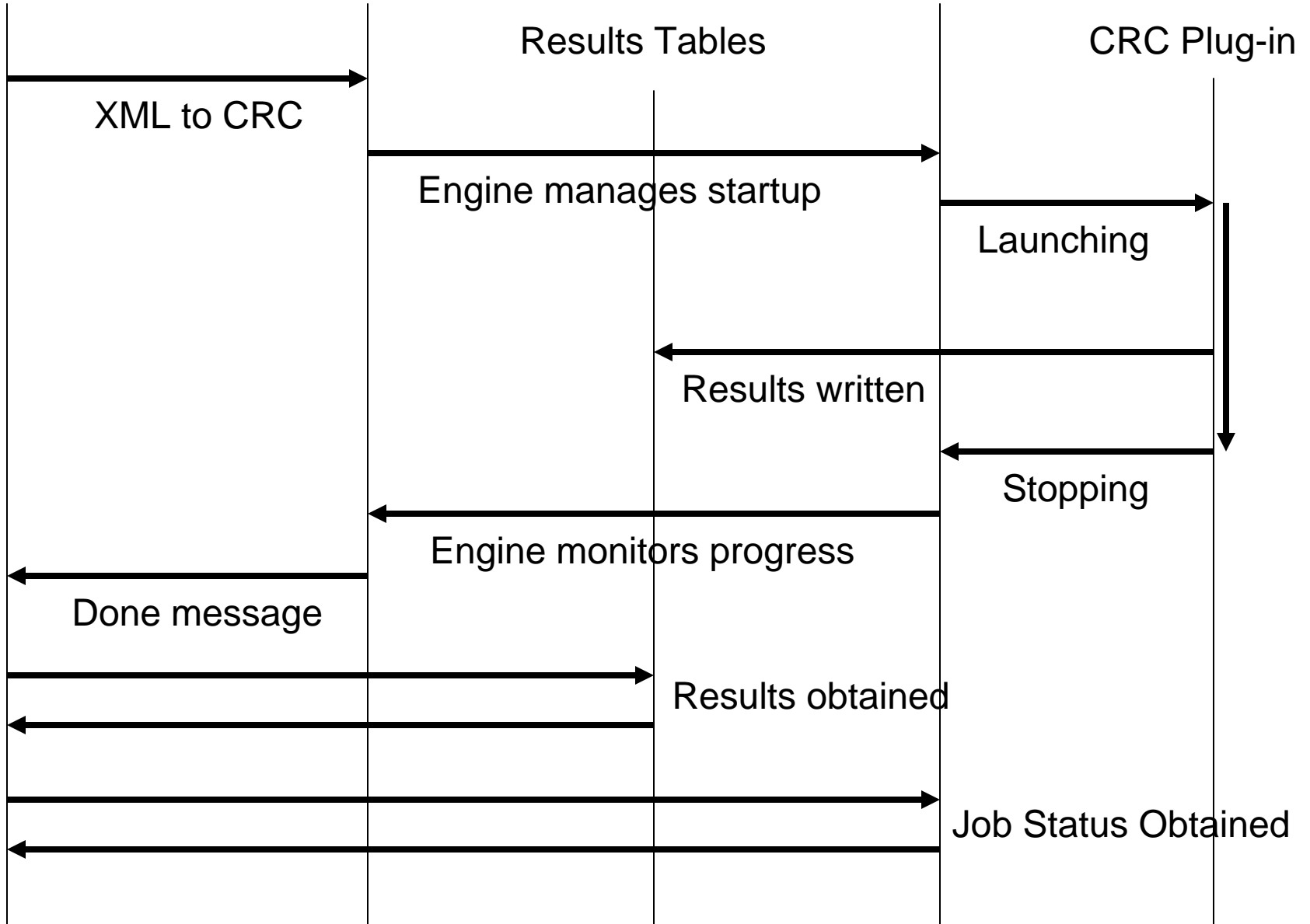
Client

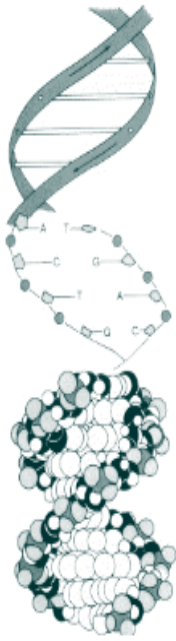
CRC Engine

Queue Processing

Results Tables

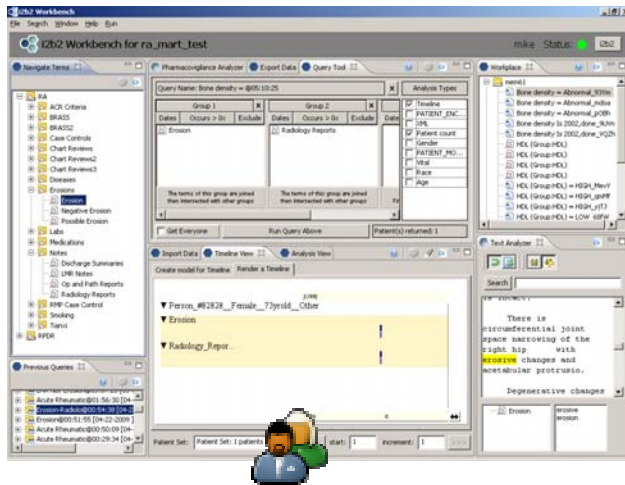
CRC Plug-in





NLP Workflow Support

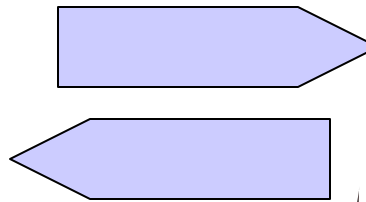
NLP Workflow Requirements



I2b2 Project Investigators

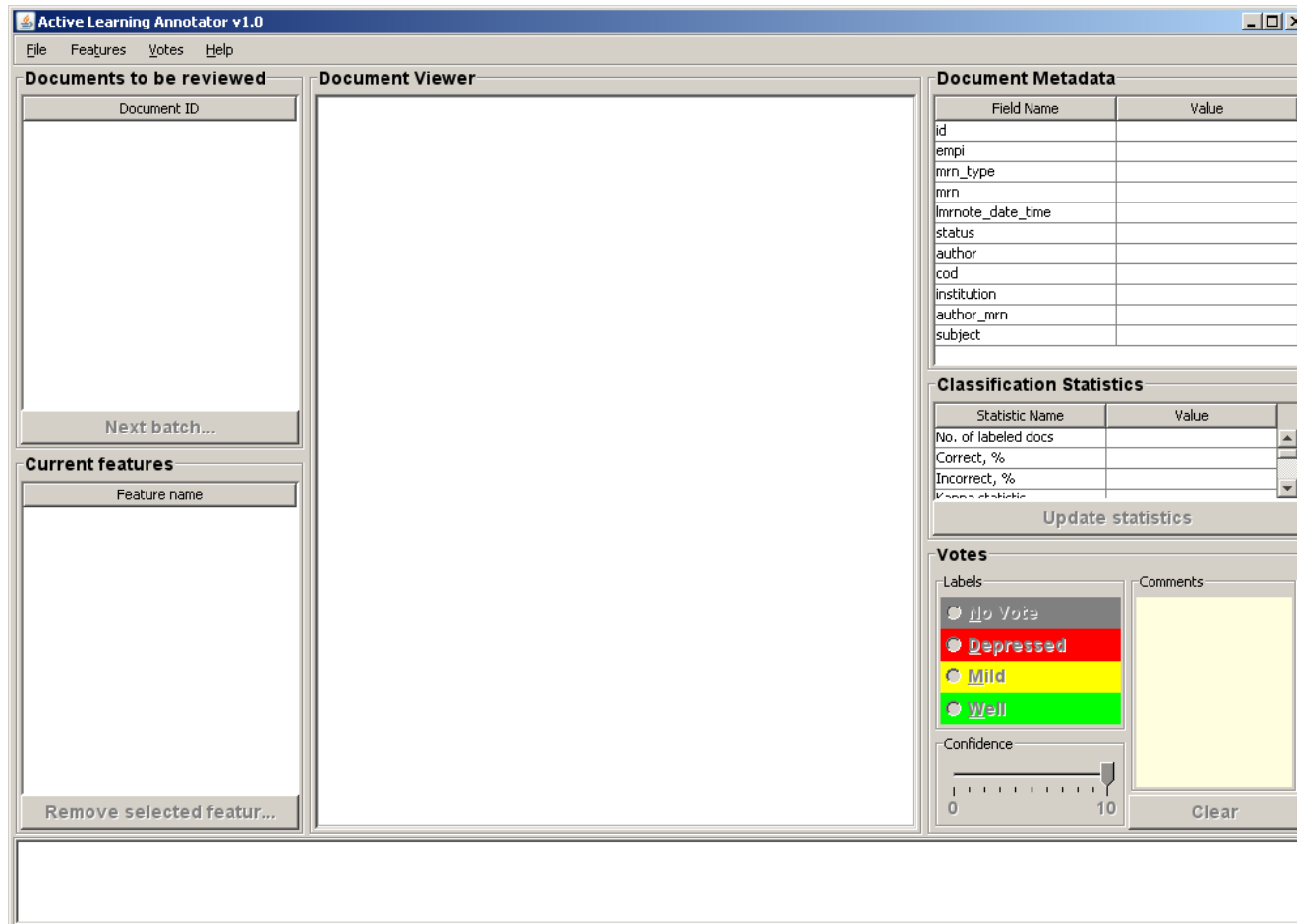
Results Delivery

Communication

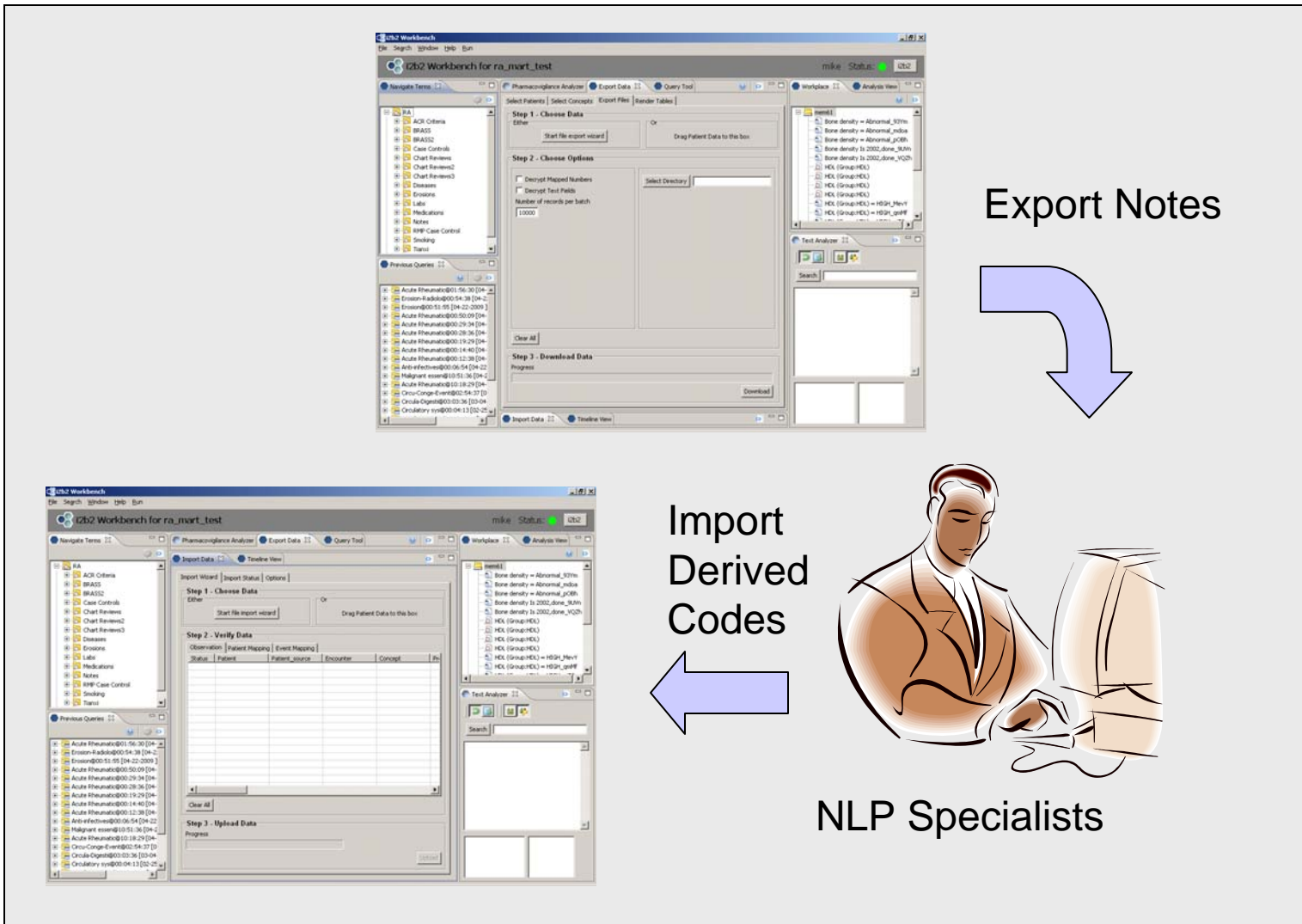


NLP Specialists

Investigator Annotation



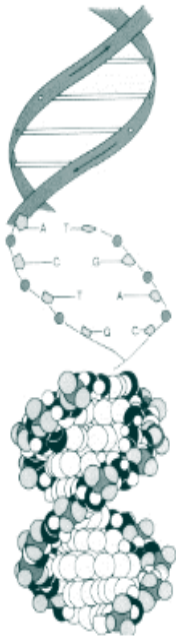
NLP Specialists Workstation



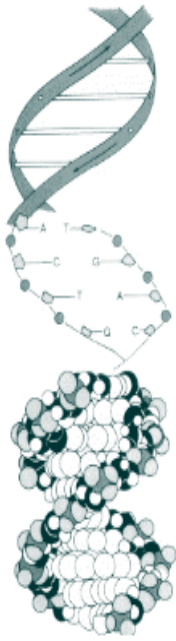
Investigator Review

The screenshot displays the i2b2 Workbench interface for a user named 'mike'. The main window is titled 'i2b2 Workbench for ra_mart_test'. The interface is divided into several panes:

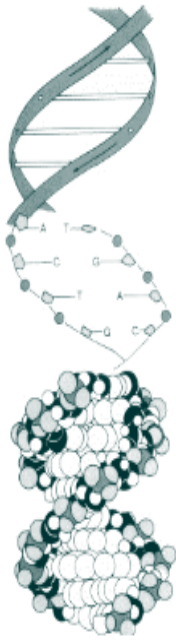
- Navigate Terms:** A tree view on the left showing a hierarchy of terms under 'RA', including 'ACR Criteria', 'BRASS', 'Erosions', and 'Radiology Reports'. 'Erosion' is currently selected.
- Pharmacovigilance Analyzer:** The central pane shows a query named 'Bone density = @05:10:25'. It features two groups: 'Group 1' containing 'Erosion' and 'Group 2' containing 'Radiology Reports'. Analysis types on the right include 'Timeline' (checked), 'Patient count', 'Gender', 'Vital', 'Race', and 'Age'. The status indicates 'Patient(s) returned: 1'.
- Workplace:** A list of search results on the right, including 'Bone density = Abnormal_93Ym', 'Bone density = Abnormal_mdoa', and several 'HDL (Group:HDL)' entries with values like 'HIGH_MevY' and 'LOW_68FW'.
- Timeline View:** The bottom pane shows a timeline for 'Person_#82828_Female_73yrold_Other'. It highlights 'Erosion' and 'Radiology_Report...' events. A search bar at the bottom shows 'Patient Set: Patient Set: 1 patients' with 'start: 1' and 'increment: 1'.
- Text Analyzer:** The bottom right pane displays a text snippet: 'There is circumferential joint space narrowing of the right hip with erosive changes and acetabular protrusio. Degenerative changes'. The word 'erosive' is highlighted in yellow.



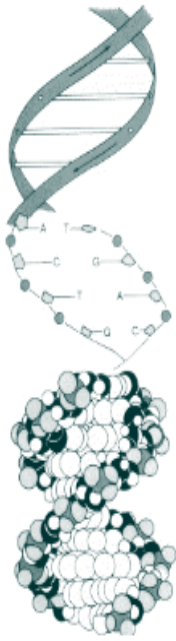
IDENTITY MANAGEMENT PRESENTATION



WEB CLIENT PRESENTATION



JIRA PRESENTATION

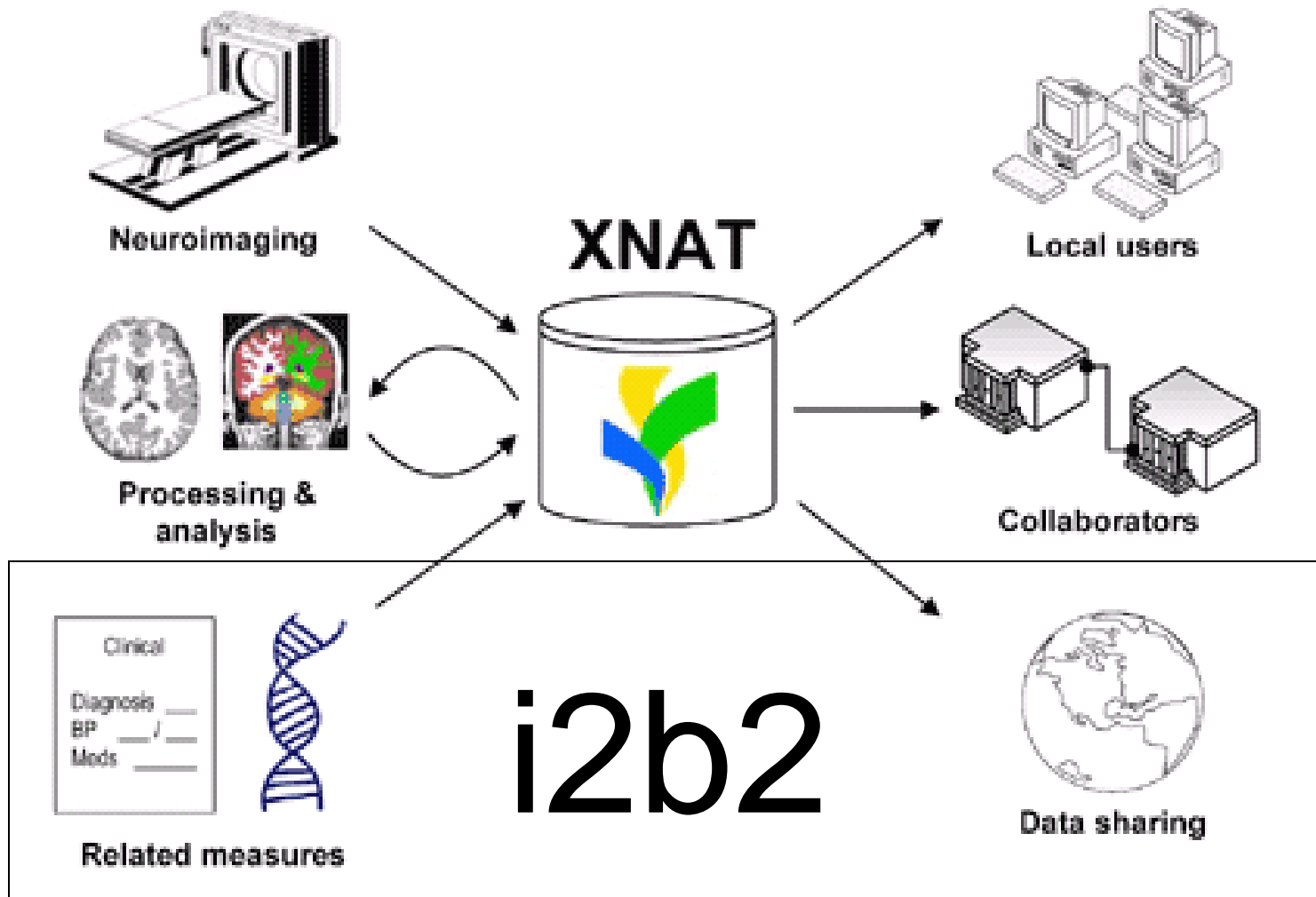


IMPORTANT ACTIVITIES

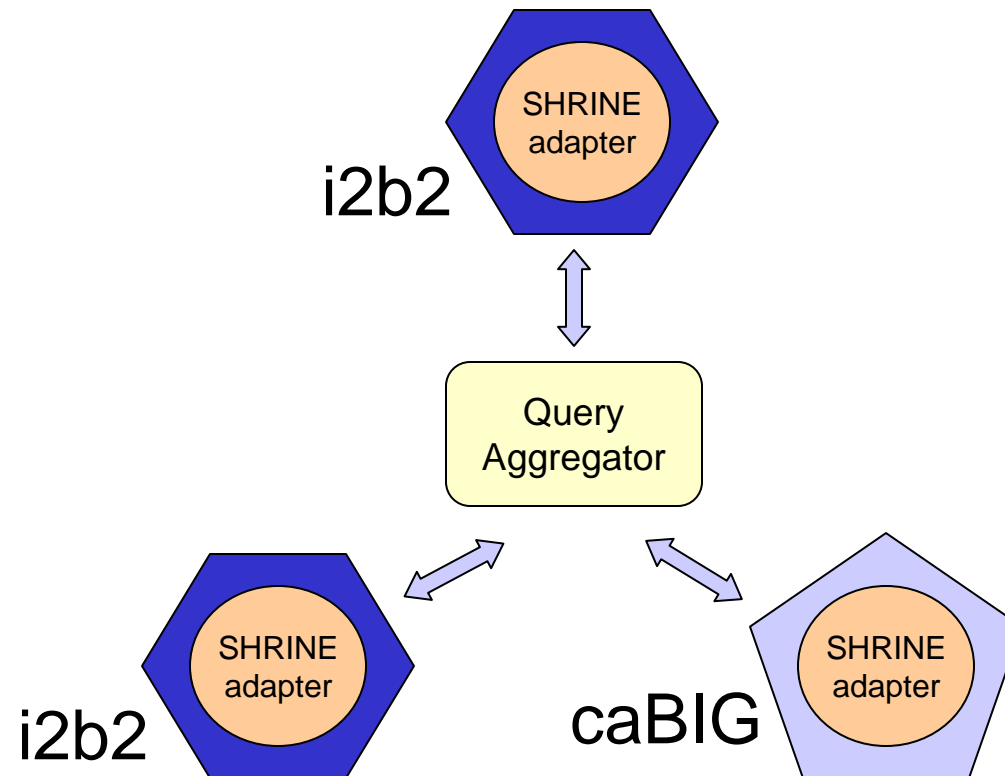
Help outside of i2b2

- Ontology management
 - NCBO
- Imaging Research
 - BIRN / XNAT
- Cross Site and Platform Integration
 - SHRINE / caBIG

Extensible Neuroimaging Archive Toolkit (XNAT) used to integrate image management into i2b2



SHRINE (Shared Research Informatics Network) = Distributed Queries



Central “aggregator” broadcasts query to local hospital “adaptors”, which return aggregate counts only

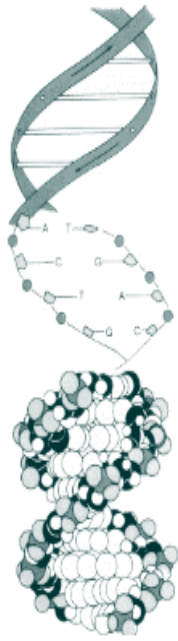
Community

United States

- Beth Israel Deaconess Hospital, Boston, MA
- Boston University School of Medicine, Boston, MA
- Brigham and Women's Hospital, Boston, MA
- Children's Hospital, Boston, MA
- Denver Children's Hospital, Denver, CO
- Cincinnati Children's Hospital, Cincinnati, OH
- Cleveland Clinic, Cleveland, OH
- Weil Medical College of Cornell, NYC, NY
- Group Health Cooperative
- Harvard Medical School, Boston, MA
- Massachusetts General Hospital, Boston, MA
- Maine Medical Center, Portland, ME
- Marshfield Clinic, Wisconsin
- Morehouse School of Medicine, Atlanta, GA
- Oregon Health & Science University, Portland, OR
- Ohio State University Medical Center, Columbus, OH
- Philadelphia Children's Hospital, Philadelphia, PA
- Renaissance Computing Institute, Chapel Hill, NC
- Tufts New England Medical Center, Boston, MA
- University of California Davis, Davis, CA
- University of California San Francisco, SF, CA
- University of Massachusetts Medical School, Worcester, MA
- University of Michigan Medical Center, Ann Arbor, MI
- University of Pennsylvania School of Medicine, Philadelphia, PA
- University of Rochester Medical Center, Rochester, NY
- University of Texas Health Sciences Center Houston, Houston, TX
- University of Texas Health Sciences Center San Antonio, SA, TX
- University of Texas Health Sciences Center Southwestern,
- Utah Health Science Center, Salt Lake City, UT
- University of Washington, Seattle, WA

International

- Georges Pompidou Hospital, Paris, France
- University of Goettingen, Goettingen, Germany
- University of Pavia, Pavia, Italy
- University of Seoul, Seoul, Korea



i2b2 Clinical Research Chart

Shawn Murphy MD, Ph.D.

Griffin Weber MD, Ph.D.

Michael Mendis

Andrew McMurry

Vivian Gainer MS

Lori Phillips MS

Rajesh Kuttan

Wensong Pan MS

Henry Chueh MD

Susanne Churchill Ph.D.

John Glaser Ph.D.

Isaac Kohane MD, Ph.D.