Accelerating Biomarker Discovery and Validation

IDBS is working with leading pharmaceutical, biotechnology and research organizations such as Celera, Dana-Farber Cancer Institute and Children’s Hospital of Philadelphia to improve the speed and accuracy of biomarker discovery and validation. IDBS’ solutions enable scientists to systematically analyze, compare and confirm that a set of biological findings is a putative biomarker without being dependent on informatics support.
Accelerating Biomarker Discovery and Validation

Utilizing clinical data in combination with experimental and laboratory data holds many promises for the identification of biomarkers for disease presence and progression, drug effectiveness and improved disease understanding. However, the analytics and informatics requirements involved in bringing together the necessary data and technologies are varied and challenging. Perhaps the greatest challenge is that best practices are guaranteed to evolve and change, meaning that inherent flexibility to respond to new requirements is essential.

The IDBS Biomarker Data Mining Solution (BDMS) provides a powerful and flexible IT framework to search, analyze, view, and compare clinical, LIMS and experimental data for biomarker research. This unified system supports any experimental technique including, Genome Wide Association studies, gene expression, microarrays, proteomics and image analysis. Being able to integrate these techniques means that they can be used to compare results and assess comparative cohorts across multiple studies, enabling better understanding of side effects and treatment responses.

Proven Capability

Biomarker research groups are able to accelerate their research and reduce the risk of implementing translational approaches by relying on the experience of IDBS because:

We have developed Biomarker and Translational Research systems for eight leading drug companies and medical institutions including Celera, Dana-Farber Cancer Institute, Children’s Hospital of Philadelphia, King’s College London and Erasmus Medical Center.

We have extensive experience of analyzing biological data, which is used in many pharmaceutical companies and research institutes.

We have established relationships with leading vendors in the field including: Affymetrix, Illumina, Microsoft, Oracle, SAS, GeneGo, Ingenuity, Thermo Fisher Scientific and LabVantage Systems.

Comparing Multiple Experimental Techniques

BDMS works with any molecular technique and allows the results of experiments from different modalities to be mapped to a common genome and compared. In this way, genome wide association studies (GWAS), gene expression, micro-arrays and proteomics data can be compared to identify the most common regions of interest. Trellis views and overlay views are used to visualize different techniques and data points can be interactively selected to see how techniques compare.
Defining Patient Cohorts

IDBS’ ClinicalSense enables researchers to slice and dice clinical data sets to identify suitable cohorts of, for example, responders and non-responders to treatment. The system allows clinicians to select from hundreds of patient attributes as the basis of a cohort such as disease and treatment history, environment factors and sample status. In this way, researchers can explore their data and define cohorts in minutes rather than being reliant on IT to run queries. ClinicalSense also provides a longitudinal view of patient data, allowing groups to be compared and synchronized to ensure the most appropriate cohorts are defined.

Comparing Cohorts

An important aspect of working with patient sets is comparing different cohorts to look for differential molecular markers. For example, scientists may want to compare the differences between cohorts in separate study arms based on baseline laboratory measurements such as C-reactive protein. We enable the cohorts to be quickly selected and then their intersections and differences displayed to identify regions of interest. Cohorts can also be compared based on clinical endpoints such as FEV1, biomarker values such as IL4 or differences in endpoints or values.

Viewing and Searching for Project Data

IDBS enables scientists to quickly show all relevant data about their active and previous projects, plus any other projects they have permissions for, in one simple interface. Users can drill down into particular projects to view all current information for any experiment technique, analysis results and putative biomarkers. Data from clinical and pre-clinical studies are both included in this view. Standard scatter plots of best fit curves showing, for example, serum concentration vs tumor volume are provided including interactive outlier removal. Results can be assessed using a variety of analysis tools such as PCA and T-test, connection to external sources NetAffx. Data sources can include internal experimental results and external data provided by CROs. Users can upload their results into a central data store, which can then be shared across multiple groups to improve data reuse.

Users can interactively remove outliers and recalculate curves
The output of many of the technologies in biomarker discovery is a series of genes or proteins that have a putative connection with a disease or side effect and need to be investigated further. IDBS’ Solution allows genes and proteins to be automatically annotated using public domain sources such as GenBank, UNI-PROT, GO and OMIM.

Annotating and Validating Findings

IDBS supports seamless integration with GeneGo and Ingenuity

Putting biological results in context is critical and metabolic pathways provide a valuable resource for this. Our solution provides seamless integration to GeneGo and Ingenuity at the touch of a button. This enables any user to retrieve pathway data without needing to be familiar with individual products.

Publications network for a particular disease area shown in CytoScape™
Another way of assessing the significance of putative biomarkers is to review the literature around the topic and see what diseases have been associated. TextSense integrates any form of text or literature, for example PubMed or internal document store into BDMS, enabling users to quickly see any papers which associate their gene list with their diseases of interest. TextSense integrates any web-based or internal text source and can use ontologies to enhance querying; once results have been returned they can be analyzed for patterns and viewed as interconnected networks.

**Automating Business Processes**

Many data analysis and manipulation operations are manual, repetitive and prone to errors and leave scientists dependent on specialists. IDBS’ solutions allow data analysis and manipulation applications to be rapidly constructed in a visual drag and drop environment enabling manual processes to be automated and made available to all scientists. For example, PK/PD commonly requires the retrieval of clinical data from SDD or Oracle Clinical, extensive re-formatting of the data to make it compatible with NonMem input formats, running NonMem and retrieving results, and presenting formatted charts. This manual task has been automated by IDBS to provide easy access to data and a significant reduction in manual effort.

**Bringing Together Different User Groups to Support Scientific Decision Making**

The IDBS BDMS has been developed with input from the world’s leading research institutes and drug discovery companies. Researchers, clinicians, statisticians and developers have all been involved in the design of their respective interfaces ensuring they are intuitive and deliver the required functionality.

- Biomedical Research Scientists access data and analysis workflows via easy to use web pages built by bio-statisticians and IT personnel
- Bio-statisticians can rapidly develop analysis workflows using TRS integration with R and SAS tools, plus extensive predictive modelling, clustering and classification algorithms
- Clinicians interact with data and patient records via simple web pages designed by clinicians to support data-driven clinical decision making
- IT personnel use a standards-based platform with strong database and web services support, as well as powerful workflow and web deployment tools

BDMS provides pre-built interfaces for each user group, but has the flexibility to allow IT personnel to modify workflows and user interfaces to support new requirements and technologies. By integrating all data and workflows into a single system all users and developers have access to the best available data with which to make decisions.

**IDBS’ Technology**

IDBS’ solution is a framework that enables the rapid development and delivery of scientific applications, providing major enhancements in developers’ and scientists’ productivity. It is used to integrate seamlessly all types of data resources, analytical tools, applications and services to enable decision makers to analyze data interactively and gain new insights. The VisualSense interactive web interface provides the same integration flexibility and delivery to end users. This industry-proven, scalable and flexible architecture enables companies to quickly integrate and
Advanced analytical capabilities are essential to tackle the large and complex data volumes available in translational research. IDBS’ solution is specifically designed to support advanced data mining and modelling in a workflow environment. Originally spun out of the Data Mining group at Imperial College, London in 1999, IDBS has an extensive track record in data analysis in all fields. BDMS includes a full complement of advanced analytics tools to support:

- Classification and Predictive Modelling
- Clustering and Segmentation Analysis
- Association Analysis
- Multi-Variant and Regression Analysis
- Advanced data preparation methodologies

R and SAS are fully integrated into IDBS and there is also a comprehensive integration with Oracle, and other databases, enabling all analysis to be carried out in the database environment without needing to transfer data.

This powerful analysis toolset enables bio-statisticians and developers to extract data from any data source or technology and analyze and display it within both the workflow builder and web-based interfaces.

**Data Analytics - Identify Patterns and Establishing Relationships**

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**Flexibility**

As an evolving field that can use many techniques to differentiate case and control populations, Translational Research requires a flexible infrastructure that can easily be modified to reflect evolving requirements. The IDBS workflow builder is an industry proven tool to develop enterprise scale applications. This form of Rapid Application Development ensures that programming and analytical groups can quickly develop and deliver tools that meet user needs. Once deployed applications can easily be modified to reflect new requirements and quickly re-deployed, significantly reducing turn-around time.

**Advanced Data Representation**

Representing the complex data types in translational research and biomarker research requires sophisticated data models because disease progression and the analysis of patient records is dependent on events and treatments occurring over time. A further complication is that proteomics, metabolomics, gene expressions and Genome Wide Association study data all have different formats and analysis techniques but need to be unified with clinical data and presented back to the user. Unlike some applications, the IDBS models have been designed to be non-disease specific ensuring that the solutions which are delivered represent all the available data.
Professional Services

IDBS has an experienced team of scientific analysts and developers who are able to quickly configure workflows and user interfaces and integrate data sources into BDMS to meet customer needs. With extensive experience in delivering translational research systems the IDBS Professional Services team can help customers avoid pitfalls and get their systems up and running as quickly as possible.

Key Benefits

- Enables companies to deal with the explosion in ‘omics data to accelerate biomarker discovery
- Breaks down the bottlenecks between scientists and their data via 24/7 interactive web interface, enabling them to run their own QC, normalization and analysis
- Enables consistent data analysis across the company, which is captured visually and provides documented evidence of each approach
- Provides integrated access to any preclinical, clinical and experimental data
- Allows rapid selection of study cohorts based on any clinical factor without IT support
- Supports integrated views of results from multiple ‘omics techniques to quickly see commonalities
- Automates assessment of function and clinical relevance of biomarkers based on scientific literature, third party metabolic pathway data and public sources
- Improves search capabilities for legacy data to enable re-use of past study information

ClinicalSense allows users to slice and dice data to quickly build patient cohorts
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