



# Spotfire® Drives Microarray Analysis at the University of Washington

DecisionSite™ for Functional Genomics®' data integration capabilities have opened up new analytic opportunities for UW's biomedical researchers.

## Business Profile

The University of Washington is a global leader in biomedical and genomics research based in Seattle.

## Application Profile

UW's Center for Expression Arrays uses Spotfire DecisionSite for Functional Genomics to integrate data analysis of gene expression microarray data using multiple data sources.

## Challenges

- Disparate sources and formats of gene expression data were difficult to analyze in a single environment.
- Researchers needed a capable analytical environment to evaluate a variety of microarray and other genomics data.

## Solutions

- DecisionSite's data integration features can easily handle multiple data sources.
- Powerful, easy-to-use analytical tools and dynamic visualizations facilitate efficient analysis.
- Developer environment provides easy customization for adding features such as secure access control.
- Two-way integration helps researchers to get more from linked Resolver systems.

## Results

- Researchers' learning curve for microarray analysis reduced by having to learn only one easy-to-use interface.
- Repetitive tasks automated with Guides, saving time.
- DecisionSite bridges the gaps between incompatible formats in bioinformatics, thus improving research depth.

“Spotfire DecisionSite can integrate experimental gene data as well as our own databases for expression analysis with very little work. This considerably broadens the scope of our research.”

– Dr. Roger Bumgarner  
Director of the Center for  
Expression Arrays  
University of Washington

The University of Washington (UW) is one of the top biomedical research centers in the world. Known for its excellence in both teaching and research, the UW faculty boasts 42 National Academy of Sciences members and five Nobel laureates. Over the past decade, UW has dedicated itself to groundbreaking work in genome sciences and has taken a leadership role in the global genome sequencing projects. UW researchers are now taking the next step, exploring the roles that individual genes play within biological systems.

#### **Challenges**

Researchers at UW make extensive use of DNA microarrays to help decipher gene functions. With the latest microarray technologies, researchers can monitor the global changes in gene expression levels within a living system on the order of 10,000 to 30,000 genes at once. Applications range from the examination of the basic principles of yeast metabolism to pinpointing molecular mechanisms of complex human diseases such as HIV and hepatitis.

In late 2001, the university established the Center for Expression Arrays (CEA) to assist UW scientists in applying DNA microarrays to research into gene expression in yeasts, humans, and mice. The CEA offers a variety of services associated with processing Affymetrix® GeneChip® and cDNA microarrays and collecting the huge amount of data generated from these systems into a central Expression Array Manager (EAM) database.

The CEA was so popular with researchers, however, that it initially struggled to keep up with the management and analysis of large quantities of disparate genomics data. The challenge was to find a way to provide flexible, easy-to-use, cost-effective analysis software to over 100 researchers that would provide secure access from any computer on campus. In addition, the software would need to offer a complete set of analytical tools for statistical operations such as data preprocessing and normalization, cluster analysis, t-tests/ANOVA, and principal component analysis. Lastly, the software needed to be able to integrate well with existing commercial and in-house software systems.

## Solutions

Bumgarner and others at the CEA looked to Spotfire, Inc.'s DecisionSite for Functional Genomics to help address their bioinformatics requirements. This specially designed version of DecisionSite is customized for handling microarray data thanks to guided analytic applications and links to popular bioinformatics systems such as Rosetta Resolver® from Rosetta Biosoftware.® DecisionSite provides an interactive visualization environment for interpreting, capturing and sharing analyses of large amounts of data from disparate and often incompatible sources.

The data integration capabilities were of particular interest to the CEA researchers. "We needed a tool that would integrate effectively with our preexisting database and other databases that we have in-house," says Dr. Roger Bumgarner, the Director of the CEA and a UW professor of microbiology. "Spotfire's DecisionSite nicely fills that need."

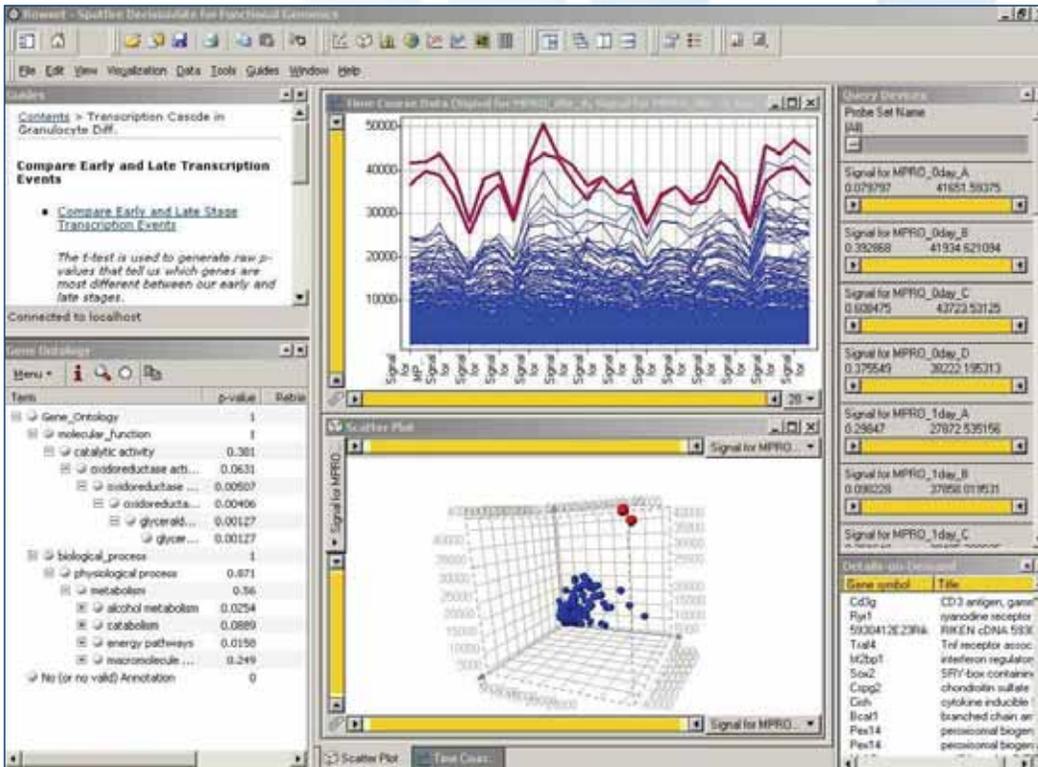
Using DecisionSite, researchers now have simple button-click access to information from the Expression Array Manager database. With the DecisionSite Developer application development environment, CEA personnel were also able to create a "scientist-friendly" representation of the array database and customize their applications with security features.

"We required an additional level of security for the array data, and using DecisionSite Developer, I was able to easily include a custom filter into the query interface," notes Jeff Furlong, senior bioinformatics software engineer at UW.

Furlong is also using Developer to create custom Guides comprised of directed taskflows within DecisionSite. For example, a typical Guide directs the user to the right data in the database, retrieves the data and displays the most appropriate visualizations of quality parameters together with raw scanned spot images for selected data points.

Furlong and his colleagues are developing a library of such Guides, ranging from simple tasks like normalizing and clustering data to more complex steps that include computations using research-specific algorithms developed at the CEA. Researchers are taking advantage of the two-way integration between DecisionSite for Functional Genomics and Resolver, layering DecisionSite's interactive visualizations and flexible analysis environment on top of Resolver's ability to efficiently manage massive volumes of microarray data and apply powerful error modeling and statistical capabilities.

"DecisionSite and Resolver are a powerful combination," says Bart Kwieciszewski, bioinformatics scientist in the Department of Microbiology, who uses the two programs in his research on the hepatitis C virus. "I am now able to retrieve publicly available gene expression data of any format, open it in DecisionSite, hone it down to genes of interest, and then compare those genes to my own data stored in Resolver. Spotfire DecisionSite makes this a relatively easy process."



Over 100 biomedical researchers at the University of Washington use Spotfire DecisionSite for Functional Genomics to analyze microarray and other genomics data. Due to the large number of occasional users, the UW researchers make good use of DecisionSite's Guides (upper left), which lead researchers through common analytic tasks related to microarray data.

## Results

Since its initial deployment several years ago, Spotfire DecisionSite for Functional Genomics has emerged as the standard analytical tool for UW's biomedical researchers investigating microarray data. Its scalability, extensive visualization options and data integration capabilities have helped to improve the understanding of genomics data, and the Guides have helped to speed both the learning curve and the ability to perform routine tasks.

According to Furlong, the Guides have also helped to establish standards of use and best practices, making researchers more confident about the quality of their analyses.

Until the scientific community adopts firm standards for the formatting and storage of both primary expression data and supplemental information, says Bumgarner, flexible data integration capabilities such as those exemplified by Spotfire DecisionSite, will be essential.

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UW Professor of Microbiology

Otherwise, researchers run the risk of arriving at false results when comparing experiments from different institutions, labs or individuals.

“Science is a collaborative enterprise, but sharing large datasets is difficult because of a lack of standards,” says Bumgarner. “The problem isn’t just that there is too much data, but that so much of it is in incompatible formats. Spotfire DecisionSite can integrate experimental gene

data as well as our own databases for expression analysis with very little work. This considerably broadens the scope of our research.”

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**About Spotfire, Inc.**

Spotfire, Inc. provides interactive, visual data analytics applications and services that empower enterprises and their end-users to improve operational performance and gain an information advantage over the competition. Over 25,000 users in close to 1,000 organizations around the world use Spotfire DecisionSite to drive confident decision making by quickly and easily spotting trends, outliers and unanticipated relationships in critical business data. The company maintains U.S. headquarters in Somerville, Mass., and European headquarters in Göteborg, Sweden. Additional information can be found at [www.spotfire.com](http://www.spotfire.com).