CHENOMX

www.chenomx.com

Metabolite Discovery and Measurement

Software Licensing

EXTENSIVE REFERENCE LIBRARY
INTUITIVE USER INTERFACE
SUPPORTS MOST NMR DATA FORMATS
QUANTITATIVE RESULTS

REFERENCE LIBRARY

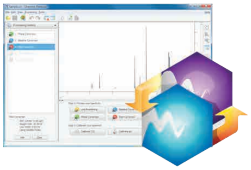
The Chenomx Reference Libraries contain hundreds of fully searchable pH-sensitive compound models. These models are automatically calibrated by adjusting compound line shapes, peak widths, and chemical shifts to better match sample conditions. The libraries have been developed using a combination of mathematical algorithms and actual NMR measurements for suitability for quantitative metabolite measurement.

A list of the reference compounds can be referenced from the Chenomx Web site. New entries can be added by Chenomx on request or by users of the software.

PROFILER - Identify metabolites and measure their concentration

Chenomx Profiler is used to identify compounds and quantify their concentrations based on data in an NMR spectrum. Key features include:

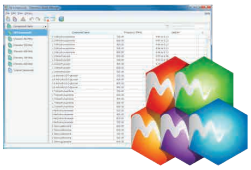
- Computer assisted metabolite assignment
- Spectral binning
- Spectral overlays
- Multiple file concentration exports
- Detailed reference resources for library compounds
- Automated fit of selected metabolites in batches of spectra



PROCESSOR - Process your NMR spectra

Chenomx Processor is used to calibrate a spectrum by specifying pH and CSI. This ensures the proper calibration of our spectral library when identifying and quantifying compounds with Profiler. Chenomx Processor converts various spectrum formats into the Chenomx file format, including Agilent, Bruker, JEOL, JCAMP-DX, Mestrelab, and NMRPipe. It also provides many tools to process your spectra including:

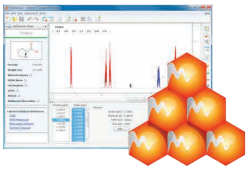
- Phase Correction
- Baseline Correction
- Shim Correction
- Region Deletion
- Automatically process multiple spectra in a batch



LIBRARY MANAGER - Organize and create compound sets

Chenomx Library Manager allows you to create and manage Compound Sets for use in Profiler. Compound Sets allow you to:

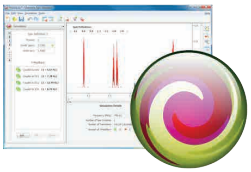
- Customize a list of compounds for a specific biofluid
- Filter and narrow your list of interesting compounds
- Manage your own custom compounds



COMPOUND BUILDER - Add your own compounds and metabolites

Chenomx Compound Builder lets you create your own powerful mathematical models of custom NMR compounds. It includes a number of tools to make this task easier, such as:

- Automatic cluster fit and optimization
- pH curve modeling
- For creating pH-sensitive compound signatures using equation based peak parameters



SPIN SIMULATOR - Generate theoretically accurate metabolite simulations

Chenomx Spin Simulator is a powerful tool for creating and manipulating simulations of compound spin systems. Use Chenomx Spin Simulator to:

- Determine the coupling relationships between nuclei
- Calculate j-coupling constants between nuclei
- See your simulation update in real time

Research Services

ROBUST ANALYTICAL PROCESS
SCALABLE FROM SMALL TO LARGE PROJECTS
COST-EFFECTIVE SOLUTIONS

CHENOMX RESEARCH SERVICES offers a cost-effective method for measuring concentrations of many small molecules found in different complex mixtures and biological matrices. Our research services keep repeatability and reproducibility as a priority, and can be used for both large and small studies. Results are fully quantitative, allowing data to be compared across long-term studies. We offer sample analysis, spectral profiling services and/or statistical support.

At the heart of Chenomx's technology platform is a Nuclear Magnetic Resonance (NMR) spectrometer. Chenomx's patented targeted profiling technique easily translates NMR spectra of complex mixtures and biofluids into compound information relevant to the underlying biology. Customers using our research services include some of the world's largest life sciences companies, as well as leading universities in the United States, Europe, and Asia.

Applications

Chenomx research services produces a metabolic profile, which can be used to monitor the effects of disease, diet, toxins or pharmaceuticals on an organism. Results from Chenomx research services is particularly valuable in understanding effects on metabolic pathways since it is an inherently quantitative method and provides a global view of the metabolites.

Applications include:

- **Drug metabolism studies** – metabolic pathway analysis, pharmacokinetics
- **Biomarker discovery** – metabolic marker patterns for monitoring or diagnosing disease
- **Cell Metabolism** – cancer, Bio-production and other applications
- **Food and Nutrition** – both food content and effect of nutrition on organisms

Chenomx MetaProfile Results

Chenomx produces a full MetaProfile report describing the mixture analysis results from the complete study. This report breaks down results for each sample, describing small molecules identified in the sample, and describing concentrations of the small molecule found in each sample.

Data is provided to the client as an Excel spreadsheet, suitable for further analysis or transfer to other statistical and analysis systems.

Biomarker Pattern Discovery

Discovery of biomarkers starts with a clear identification and quantification of the components in a mixture. This is offered by Chenomx's patented Targeted Profiling technique. Quantification using Targeted Profiling produces data that may be subjected to a variety of statistics and visualization methods. These methods are key to discovering useful biomarker information.

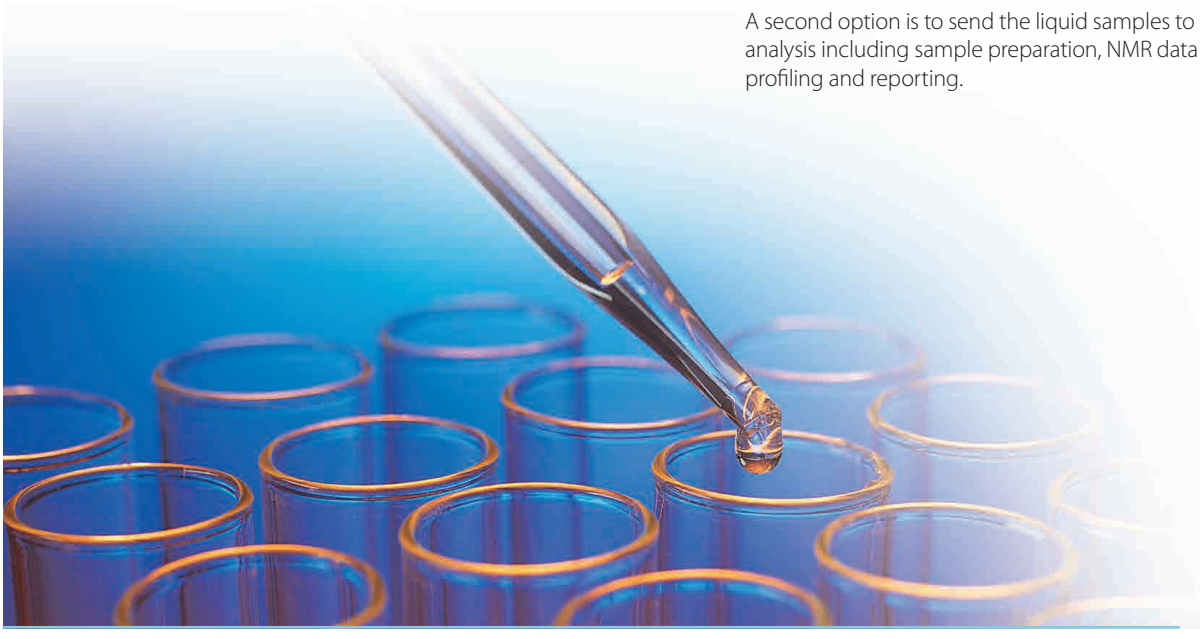
Cell Metabolism Studies

Chenomx services are suitable for measurement of cell growth media, both fresh and depleted during a cell culture. Compare performance of the fermentation process for different cell types and different media composition. The results can be used to monitor and optimize experiments for scale-up of the production process.

Project Options

Two options for project implementation are offered by Chenomx. One is for those with access to NMR instruments and the interest in measuring the samples before sending the electronic spectral results to Chenomx. In that case Chenomx would consult with the client on the format of the sample preparation and NMR data acquisition, perform metabolic profiling on the electronic version of the spectra, and produce a report on the results.

A second option is to send the liquid samples to Chenomx for turn-key analysis including sample preparation, NMR data acquisition, metabolic profiling and reporting.



CHENOMX

About Us

CHENOMX offers a unique and patented method of simplifying the measurement of the concentration of biological mixture components as measured by NMR instruments. The method is based on software and an extensive spectral signature library of relevant metabolites. The signature library consists of both theoretical and empirical data within a model which adjusts to the NMR field strength and sample conditions to closely match that of the experiment spectrum. Then the software, through a combination of automated and supervised operation, uses the models to de-convolute the spectral signatures of the various components in the mixture being measured. Overlapping spectral areas are simplified by the subtraction of the identified peaks of known components from the spectrum as they are fitted into the spectrum and thus are made visible to be compared to other compounds that were previously hidden.

The result is that 1D H NMR spectra can be turned into tables of identified compounds and their concentration in a convenient and straightforward way.

The Technology Platform

Chenomx's patented NMR-based metabolomics platform provides a powerful, global analysis of small molecule metabolites within complex biological mixtures. A compound list of over 300 metabolite models is used as a reference database for the analysis. Users are able to add their own compounds to the library as needed.

Metabolomics

Metabolic profiling, or metabolomics, is the study of patterns in the complement of low molecular weight compounds found in biological fluid samples. Small molecule byproducts of metabolic processes vary in concentration and relative proportion in response to disruptions in the metabolism of an organism, providing insight into the health status of the organism. Genetic abnormalities, enzyme inhibition or activation, pathological conditions, and drug actions can create metabolic disruptions detectable in the metabolite content of biofluids.

Nuclear Magnetic Resonance

Nuclear Magnetic Resonance (NMR) spectroscopy is a powerful tool with a wide range of applications in academia, industry, and medicine. NMR has proven to be a versatile and productive technology for metabolomics.

Unlike other analysis platforms, NMR does not rely on separating mixtures before analysis. NMR can simultaneously scan for hundreds of metabolites in biological samples, and has been referred to as a "universal detector". NMR's non-destructive, global detection make it a strong choice for any metabolomics study.

Targeted Profiling

Chenomx's patented Targeted Profiling technique addresses two of the more challenging aspects of NMR-based metabolomics: identifying and quantifying metabolites.

Targeted Profiling identifies compounds in a complex biofluid mixture rapidly and accurately. This direct analysis approach differs from previously published methods, which depend on binned spectral areas. Targeted profiling relies instead on libraries of compound signatures modeled to behave like the pure spectra of the individual compounds under comparable experimental conditions. The underlying spectral libraries are collected at a variety of pH conditions to account for variations among sets of samples. Analysis of samples using target profiling directly yields both the identity and concentration of individual compounds in a single operation.

What You'll Need for the Software

- **Chenomx runs on multiple platforms including:** Windows, Mac OS X, Linux
- **The Chenomx library supports** 400 through 800 NMR spectrometers manufactured by Agilent/Varian, Bruker, JEOL and others supporting the JCAMP spectral data format. Other field strengths are supported by the software with user-created libraries**.**
- **Libraries available utilizing HMDB.ca spectral data.**

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