



Accelerating Scientific Research with Signals Research Suite

A comprehensive platform for the entire R&D lifecycle

The pharmaceutical research landscape has undergone a profound transformation over the past two decades. Yet, remarkably, many researchers remain tethered to outdated tools and practices for documentation, analysis, and reporting. Isn't it time for your research software to support the entire R&D workflow instead of you stitching together siloed applications?

Signals Research Suite addresses the challenge of siloed applications by providing a comprehensive platform for the entire R&D lifecycle. It expedites informed decision-making within the intricate Make-Test-Decide research lifecycle. This complete, unified SaaS software for scientific research was developed by Revvity Signals, an organization with extensive experience drawn from scientifically intelligent applications like ChemDraw® and Signals™ Notebook.

The Signals Research Suite is a transformative force that expedites informed decision-making within the Make-Test-Decide research lifecycle.

The Signals Research Suite includes a trio of scientifically intelligent and integrated software applications:

- Signals™ Notebook
- Signals™ VitroVivo
- Signals™ Inventa

Together, they support the entire drug development process from initial research and *in vitro* testing to safety evaluations and early development. The Signals Research Suite is an innovative solution tailored to address the evolving demands of contemporary research so that you never miss a Signal.

A Peek into Signals Research Suite: A Day in the Life of a Research Scientist

Visualize a research landscape where agility and accessibility intersect. Enter the Signals Research Suite – a comprehensive SaaS platform designed for scientific research, poised to revolutionize how you document, analyze, manage, report your research endeavors, and collaborate with others. The era of cumbersome downloads and installations is gone.

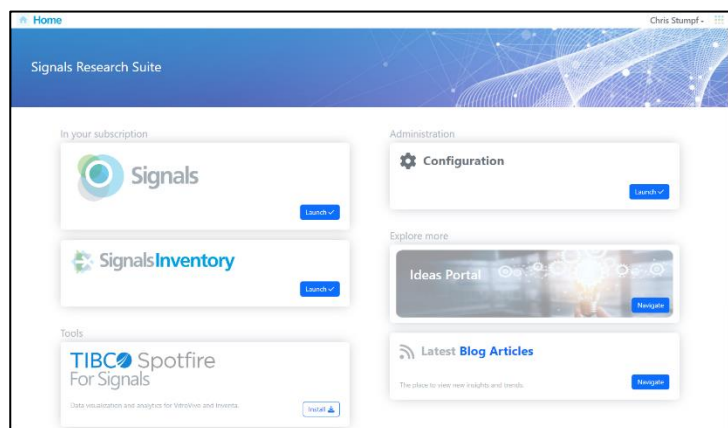


Figure 1. Signals Research Suite home screen.

Upon entering the Signals Research Suite, possibilities unfold as you encounter the user-friendly dashboard. It serves as a panoramic window into your research environment, offering panels that provide snapshots of vital information tailored to your needs. Whether checking the status of experiments under review or accessing a collection of experiments linked to a specific project, the dashboard furnishes a holistic, customized view

Empowering Research Organizations with Data Management

Research organizations of all sizes face the pervasive challenge of burgeoning data. As experiments yield ever-expanding volumes of data, the resultant information deluge can seem insurmountable.

The Signals Research Suite confronts this challenge head-on. It provides an intelligent ecosystem that captures your data and equips you to extract actionable insights. You no longer need to grapple with data overload. The Signals Research Suite streamlines data management, allowing researchers to concentrate on what truly matters: groundbreaking discoveries.

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The Signals Research Suite provides a software environment where innovation intersects with user-centric design and research converges with cutting-edge technology. This centralized capability is reshaping how researchers capture, analyze, and harness data. Welcome to the dawn of a new era in research documentation, planning, analysis, and reporting – a future propelled by the prowess of the Signals Research Suite.

Make Phase: Facilitating Efficient Experiment Management and Collaboration

Navigating the Sea of Data

In today's research landscape, data accumulates exponentially. Researchers face the challenge of sifting through numerous experiments to find the relevant information they need. Imagine an organic chemist aiming to access specific reactions from a thousand experiments. How can they efficiently extract the experiments that matter most amidst this sea of data?

This dilemma presents a choice: invest hours in searching for information, possibly with uncertain outcomes, or proceed with the experiment, hoping for timely results. More often than not, researchers choose the latter due to its defined endpoint. However, both scenarios are a drain

on research budgets, time, and resources so a better route is adopting a smarter informatics solution.

Resolving This Issue with Signals Research Suite

The Signals Notebook within the Signals Research Suite is uniquely equipped to address these data challenges due to its powerful capabilities. Researchers can efficiently filter and select experiments that align with their objectives. For instance, let's consider the scenario of identifying data related to a project. By applying filters, such as project association and experiment type, the pool of a thousand results is rapidly reduced to management number, significantly simplifying the search process.

Tailoring Results with Precision

Researchers, particularly chemists, often require even more refined results. Through additional filters, they can zero in on specific experiments of interest. This tailored approach allows them to focus solely on the relevant chemical reactions, narrowing the selection to under ten experiments. Further personalizing the search, researchers can identify experiments they have not yet conducted themselves, streamlining their decision-making process.

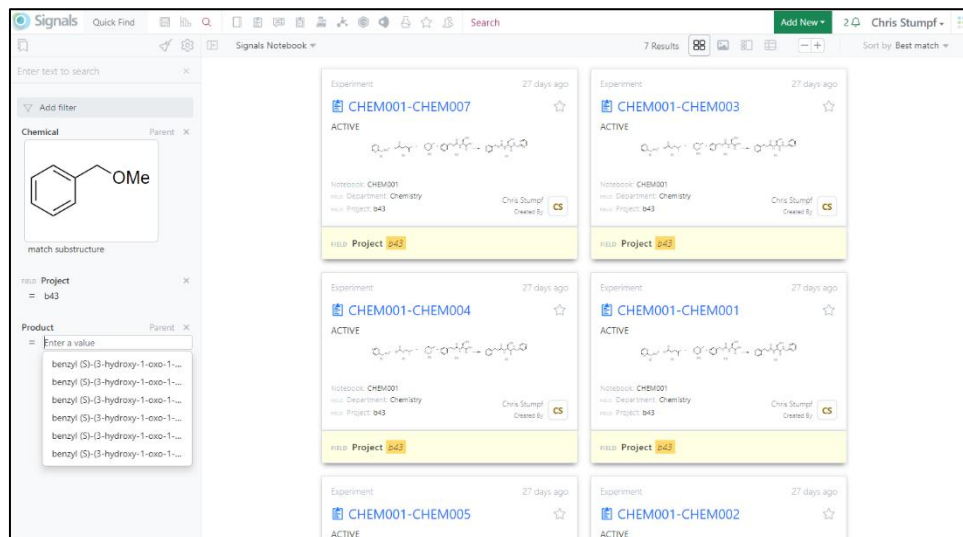


Figure 2. A powerful and quick search engine within Signals Notebook of Signals Research Suite helps users readily find the information they need when they need it.

Addressing Individual Researcher's Needs

Beyond organizational benefits, Signals Notebook caters to individual researchers' requirements. Juggling diverse media types, from written procedures to chemical diagrams, can be daunting. However, the platform excels in handling versatile media, seamlessly integrating text, images, and interactive elements. For instance, the integration of ChemDraw, the industry-standard chemistry communication solution, empowers chemists to swiftly map out reactions, utilizing its chemical intelligence to streamline the process.

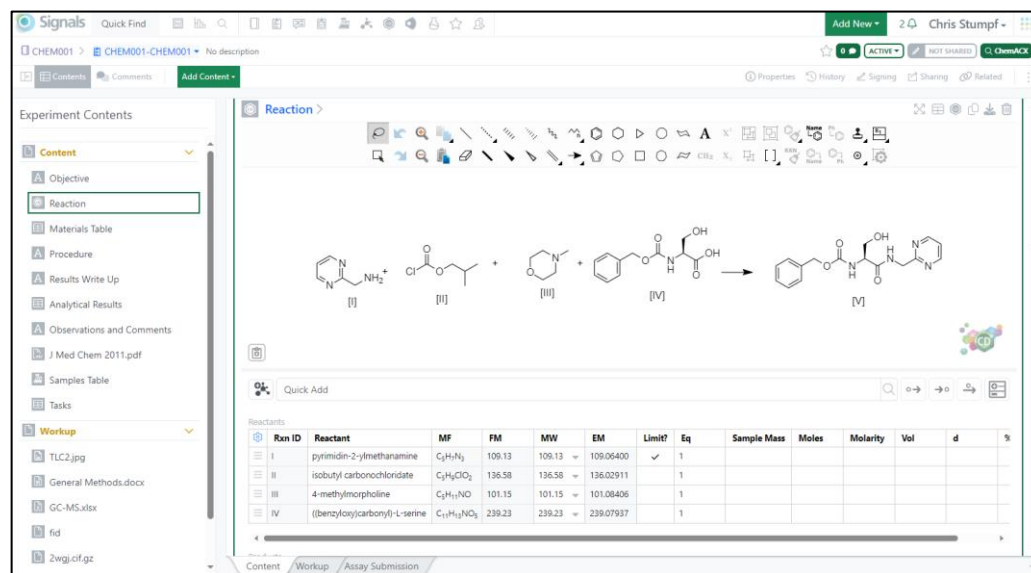


Figure 3. Native ChemDraw integration directly within Signals Notebook enables chemists to design and plan out their chemical reactions.

Enhancing Collaboration and Document Management

Signals Notebook's prowess extends to collaboration and document management. Its ability to index text-based documents, including spreadsheets and Word files, facilitates quick searches even within complex files. Moreover, the platform's compatibility with various data types, such as microscope slide images and electronic outputs, ensures a cohesive data package.

Test Phase: Optimizing Analysis and Insights

Navigating the Test Phase

Consider the high throughput screening (HTS) lab in the Test phase of the Make-Test-Decide cycle. The Signals Notebook interface seamlessly connects researchers to the shared experiments. Notably, the Chemist in the Make phase shared an experiment with an Assay

Biologist in the Test phase involving a screening protocol, prompting cytotoxicity analysis in Signals VitroVivo.

Introducing Signals VitroVivo

A pivotal aspect of this phase is the integration of Signals VitroVivo, powered by Spotfire, an advanced data visualization and analytics platform. Signals VitroVivo combines Spotfire's functionality with workflow enhancements, packaged as apps designed to streamline specific tasks within the screening workflow. This modular approach fosters standardization across diverse analyses within an organization.

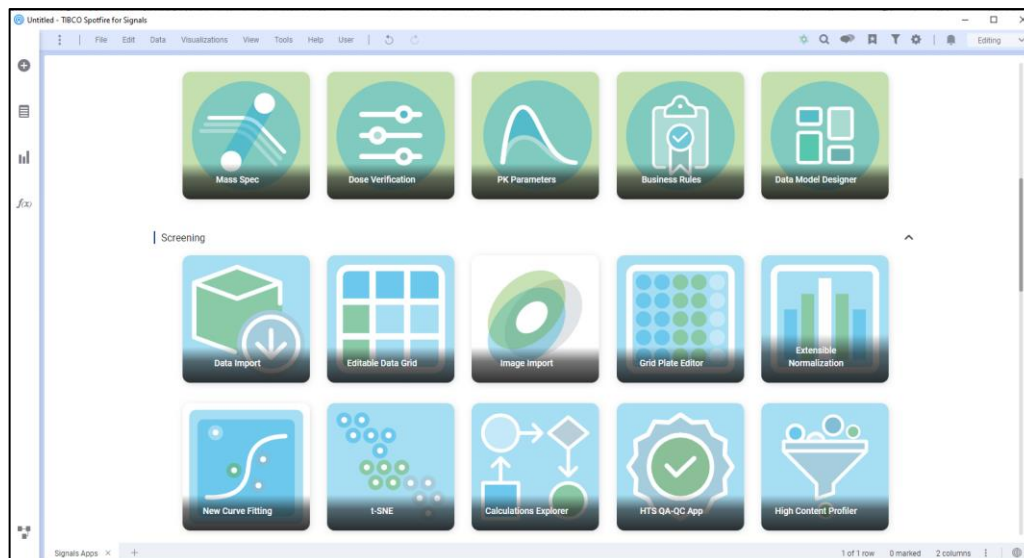


Figure 4. Example of screening apps available with Signals VitroVivo to streamline and standardize data processing within Signals Research Suite.

Customizable Analysis Workflows

Each app within Signals VitroVivo corresponds to a distinct step in the analysis workflow. Researchers can combine these apps to analyze data of any modality. The software's flexibility allows a customized approach to data analysis and enables simple onboarding of new methods. Once the analysis is defined, it can then be delivered as a standardized workflow. This ensures data uniformity and seamless collaboration, with the added advantage of easy data access through the integrated data lake.

Enhanced Data Handling and Integration

Gone are the days of scouring multiple sources for data inputs, Signals VitroVivo offers specialized apps for direct data import from various sources, such as files from instruments. These apps enable the swift inclusion of metadata and facilitate specific normalization procedures.

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Calculation Precision and Data Enrichment

The Calculation Explorer empowers researchers to apply predefined calculations to their data tables, optimizing consistency and minimizing human error. This dynamic calculation framework enables advanced data analysis, including dimensionality reduction and complex curve fitting. This becomes particularly pertinent in situations like a cytotoxicity assay example, where data-driven insights determine compound behavior.

Visualizing and Interpreting Data

The combination of calculated results and raw data unveils a comprehensive analysis overview. Heat maps, variance distribution charts, and plate quality controls illuminate trends and anomalies, rendering the data tangible and accessible. Such visualizations support informed decision-making and ensure data quality.

Interactive Analysis and Collaboration

Signals VitroVivo's interactive functionalities extend to multi-layer analysis, empowering researchers to drill down into specific plate or compound data. These analyses guide subsequent steps, including metadata addition, data structure definition, and more.

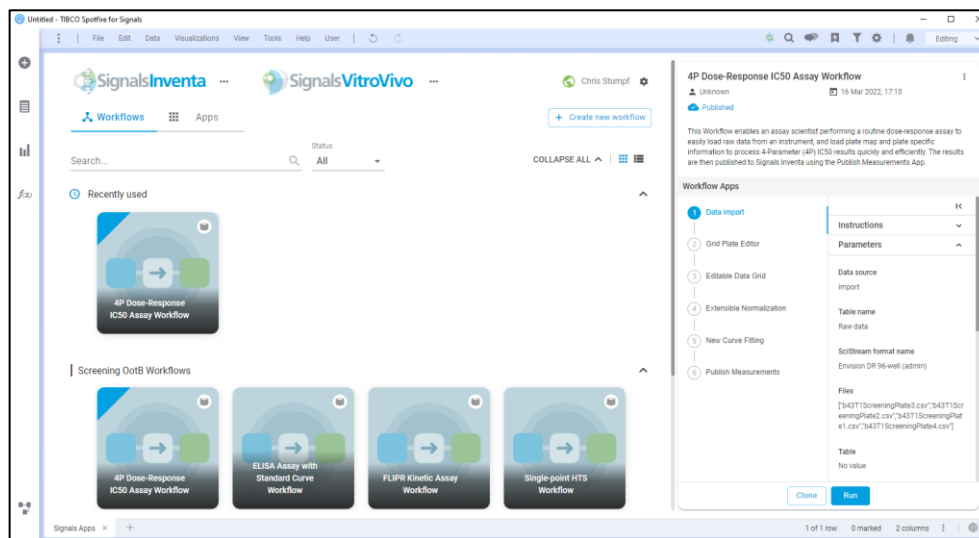


Figure 5. Signals VitroVivo provides guided workflows to simplify data import, analysis, and visualization within Signals Research Suite.

Efficient Data Management and Publishing

The data integration process is further facilitated by the inclusion of plate-specific metadata, creating a holistic dataset enriched with contextual information. This orchestrated data fusion guarantees broad insights and supports informed analysis.

Publication and Knowledge Sharing

The culmination of the analysis journey is the data publication step. Biologists can select specific data tables, measurement types, and attributes to be published to the integrated data lake, called Signals™ Data Factory, that is subsequently accessible by Signals Inventa. By standardizing and cataloging results, researchers enable effective collaboration and information exchange within their organization.

The Decide Phase: Empowering Decision-Making with Signals Inventa

In the Decide phase, the program manager’s foremost objective is identifying optimal drug candidates for advancement in the discovery pipeline. A panoramic view of data within the project and tools enable them to focus on scientific insights rather than data compilation.

Instant Access and Insight

Signals Inventa offers immediate feedback on assay data availability, leveraging a guided workflow to navigate Structure Activity Relationships (SAR). This integration with Spotfire, backed by advanced scientific visual analytics, aids in uncovering patterns, trends, and outliers within the data.

Harnessing Global Search

The Global Search interface equips the program manager with the ability to build queries using diverse criteria, receiving real-time data summaries based on these criteria. The query structure guides the process, offering a streamlined approach to data inclusion in analysis.

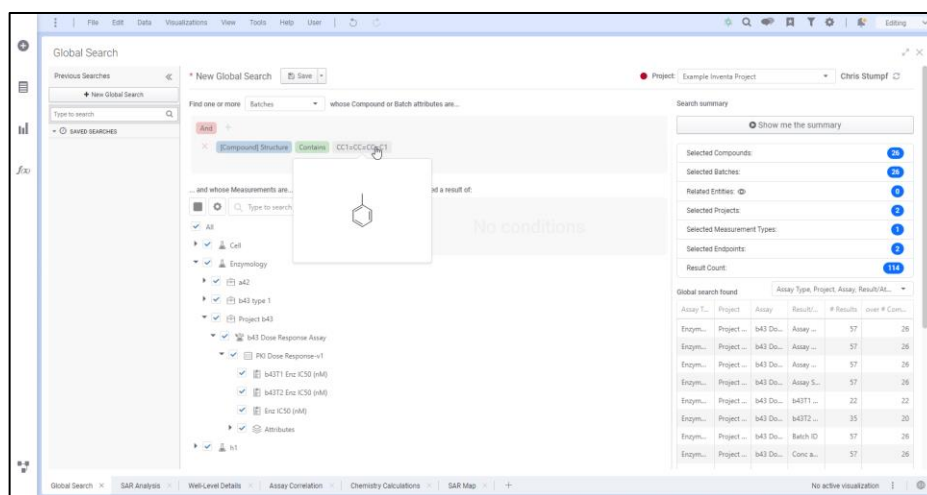


Figure 6. Illustration of the using search criteria available within Signal Inventa's Global Search including chemical structure substructures via the native integration of ChemDraw.

Refining Data Retrieval

Researchers can fine-tune queries by specifying assay-associated parameters such as cell type, organism, tissue, or activity conditions. The system allows the incorporation of chemical structure and substructure searches, bolstering the precision of data retrieval.

Guided Analysis and Exploration

Saved queries enable seamless execution, ensuring consistent analysis across projects. Downloading results into an analysis dashboard facilitates a guided workflow to explore data from different facets, including compound physicochemical properties and structural activity relationships (SAR).

Group	Compound ID	Compound Batch ID	Structure	Molecular Weight	h4371 Efficacy (µM) Avg	h4372 Efficacy (µM) Avg	h4373 Efficacy (µM) Calculated
1	REG00473579	REG00473579-01	<chem>O=C1C=CC(=O)N1</chem>	386.36	10000.00	2226.62	242.12, 317.26, 293.68, 290.88, 18000.00
2	REG00476080	REG00476080-01	<chem>CC1=CC=C(C=C1)C(=O)N</chem>	412.29	2777.72	2853.40	2853.40
3	REG00476247	REG00476247-01	<chem>CC1=CC=C(C=C1)C(=O)N</chem>	208.63	3647.20	7809.40	7809.40
4	REG00474339	REG00474339-01 REG00474339-02	<chem>NC1=CC=C(C=C1)N</chem>	259.05	854.39	7019.54	10000.00, 271.89, 1795.33, 10000.00, 10000.00
5	REG00473094	REG00473094-01	<chem>NC1=CC=C(C=C1)N</chem>	277.28	905.16	7809.54	10000.00, 10000.00, 10000.00, 1239.36
6	REG00476812	REG00476812-01	<chem>CC1=CC=C(C=C1)C(=O)N</chem>	208.63	8610.28	5265.63	1252.04, 2152.59, 1621.52, 1491.98, 100

Figure 8. Example of Signal Inventa's SAR table, from the Signals Inventa SAR analysis, that enables easy analysis of compound relationships.

Visualizing and Comparing Data

Signals Inventa's SAR template offers configurable tables, enabling easy analysis of compound relationships. Features like Venn diagrams permit graphical comparison of compound groups, enhancing data exploration. Interactive visualizations reveal functional group correlations within chemical structures.

Optimizing Lead Optimization

R-group decomposition dissects functional groups attached to specific chemical scaffolds. Structure-activity relationship (SAR) maps reveal insights into how different functional groups influence activity. Advanced visualizations like heat maps and hierarchical clustering offer insights into selectivity and clustering patterns.

Streamlined Annotation and Action

Annotations and tagging categorize compounds based on their activity levels and viability. This streamlined approach ensures relevant compounds are identified and considered for future analysis or synthesis, driving lead optimization.

Signals Inventa's capabilities empower decision-makers to seamlessly navigate vast datasets, extract insights, and refine compound choices, ushering in a new era of efficient, data-driven drug discovery. At this stage, researchers can publish their results back to Signals Notebook to close the loop and initiate a new cycle of the Make stage to decide the next steps in the project.

Conclusion: The Signals Research Suite Elevates the Horizon of Research Possibilities

The Signals Research Suite is the first fully integrated SaaS platform for both discovery chemistry and biology. It is ideally suited for research use cases including early to late-stage in vitro assays, cell line optimization, biologics process optimization, in vitro DMPK assays, animal pharmacokinetic studies, and animal efficacy and safety studies. This whitepaper described a comprehensive drug discovery workflow that encapsulates the Make-Test-Decide lifecycle.

In this age of new drug modalities and biologics research, the Signals Research Suite offers researchers a unified SaaS platform for the R&D lifecycle to accelerate innovation and facilitate collaboration between biologists and chemists.

To increase your chance for market success, learn more about the Revvity Signals Research Suite for drug discovery at <https://revvitysignals.com/products/research/signals-research-suite>




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