tetrascience

Solution Brief

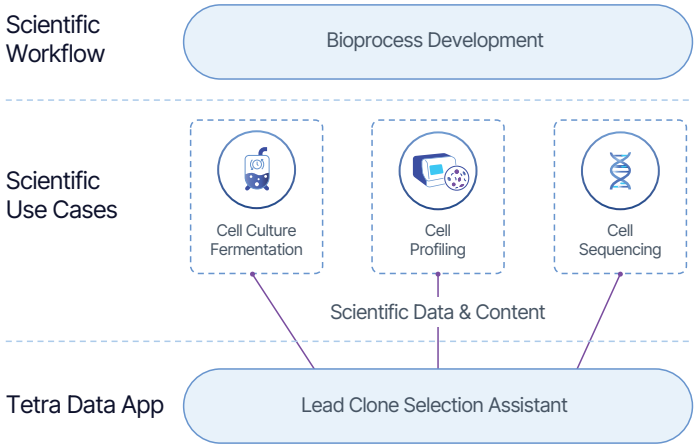
TetraScience's Unique Science-led Approach: Scientific Use Cases

Software deployments in the life sciences often fall short of delivering the expected impact on scientific outcomes because they prioritize point-to-point integrations over end-to-end workflows. To maximize value for customers, scientific data and workflow solutions must focus on **scientific use cases** instead of individual instrument or application integrations and data schemas. It is also critical to contextualize data, incorporating sophisticated scientific taxonomies and ontologies that align with desired scientific outcomes. With this science-led approach, customers achieve tangible and impactful outcomes through streamlined processes and purpose-built data for Scientific AI.

Scientific use cases

Scientific workflows, such as bioprocess development or lead identification, are composed of individual scientific use cases that are needed to achieve a scientific goal. In this context, a scientific use case is a complete end-to-end experiment that delivers specific scientific or operational outcomes (e.g., water content determination or impurity analysis).

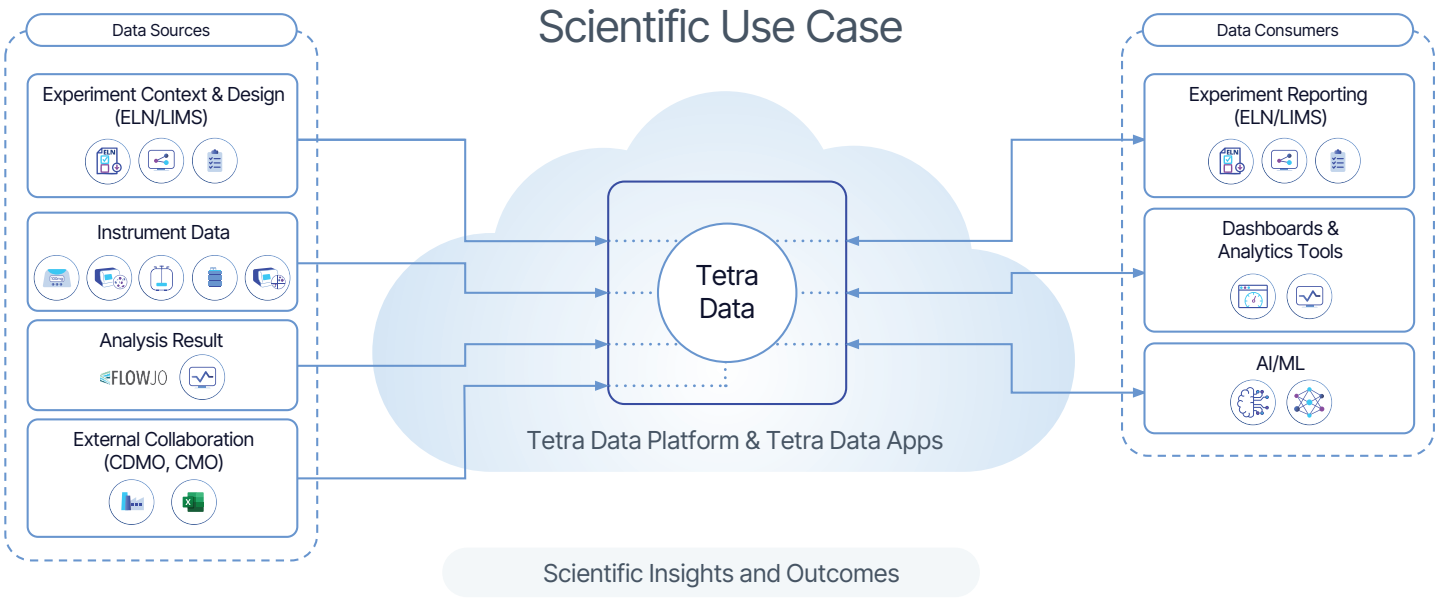
TetraScience supports scientific use cases through the lab data automation capabilities of the Tetra Data Platform (TDP) and the advanced analytics and AI capabilities of Tetra Data Apps. With the largest library of supported scientific use cases, TetraScience continually updates its offerings to address customer needs across discovery and research, process and method development (including CMC), and quality control and manufacturing. These solutions enable biopharma organizations to implement highly repeatable, streamlined processes supported by data-centric apps.



Example of an overarching scientific workflow (bioprocess development) composed of scientific use cases (cell culture fermentation, cell profiling, and cell sequencing). These use cases are supported by a Tetra Data App (Lead Clone Selection Assistant). Tetra Data Apps are powered by scientific data and context from various scientific use cases to deliver analytics, ML, and generative AI outcomes.

Our "Tetra Sciborgs"—experts in science, data, and AI with a strong focus on business outcomes—work with customers to identify use cases with the highest impact for scientists and design solutions. They also advise customers in the selection of scientifically relevant metadata to append to raw and processed data, ensuring it is properly contextualized, easily retrievable, and usable for analytics and AI. This process includes defining scientifically relevant taxonomies and ontologies. Examples of typical metadata are compound name, experiment ID, scientist name, instrument type, cell line, and location.

Our focus on scientific use cases enhances lab productivity, uncovers new insights through visualizations and analytics, and creates the data foundation needed for AI/ML.



Tetra Data Apps

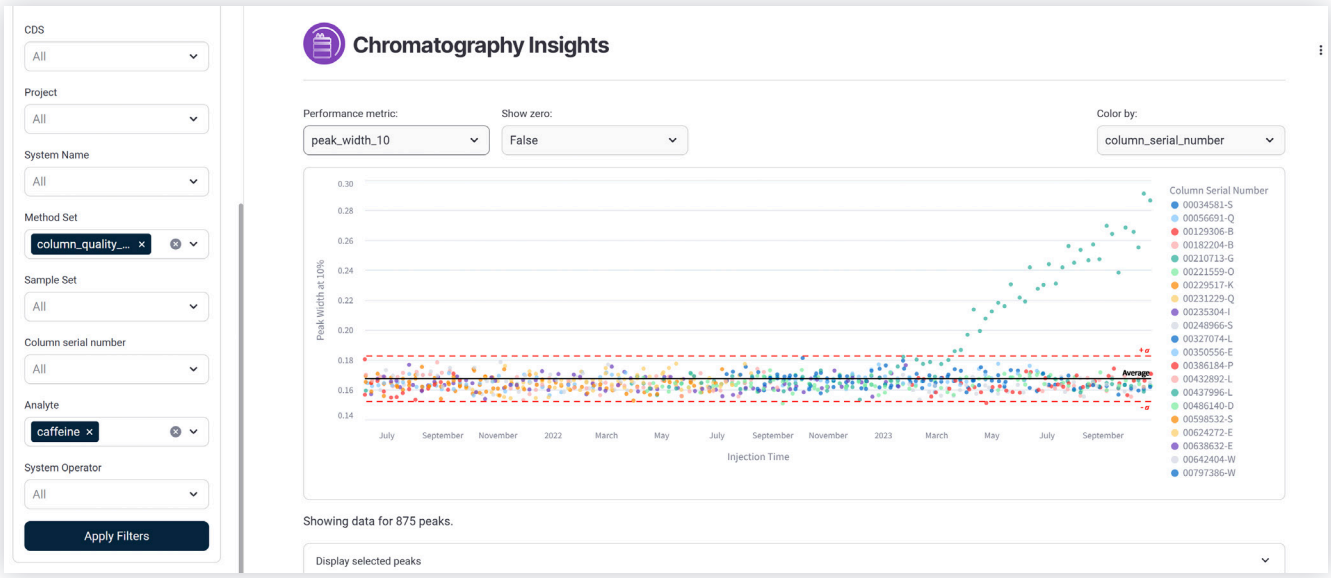
Tetra Data Apps are analytics- or AI-based applications offering features such as interactive dashboards and AI assistants. While the core capabilities of TDP support data automation for scientific use cases, Tetra Data Apps significantly add value by delivering actionable insights.

TetraScience focuses on the user experience for scientists and data scientists by thoughtfully considering the typical experiments, instruments, applications, and data interactions specific to each workflow. Purpose-built data pipelines contextualize data with relevant metadata, including rich taxonomies and robust ontologies, to ensure scientific accuracy and facilitate data retrieval. They also harmonize the plethora of vendor-proprietary scientific data into an open standard format that can be leveraged by analytics and AI.

Tetra Data Apps are powered by scientific data and context from various scientific use cases to generate analytics, machine learning, and generative AI outcomes. These apps are built on best practices shaped by extensive customer feedback.

One standout example is **Chromatography Insights**, the industry's first universal chromatography dashboard compatible with all major chromatography data systems (CDSs). This analytics-driven app consolidates method, column, and instrument performance data into an interactive dashboard within the Tetra Scientific Data and AI Cloud™. Engineered for enterprise scale, Chromatography Insights visualizes tens of millions of recent and historical injections with minutes-level latency. This supports robust process control and proactive monitoring that helps scientists to detect deviations, including out-of-specification (OOS) events, before they occur.

Additional examples include **Cell Culture Insights** for upstream bioprocessing, **Purification Insights** for bioprocessing purification, and the AI-based **Lead Clone Selection Assistant** for cell line development, which helps identify high-performing clones and predict their performance and stability.



Chromatography Insights helps development teams quickly diagnose assay issues by visualizing key metrics like peak width. Here, historical data is out-of-specification for a specific column, indicating the need for a replacement to avoid potential failures.

Currently supported scientific use cases

TetraScience supports a broad range of scientific use cases across the biopharmaceutical value chain. Core TDP capabilities typically yield 50–60% time savings and improve data quality and reliability by automating manual data processes such as transcription, aggregation, migration, and processing.

The platform also delivers centralized and harmonized Tetra Data which is ready for analytics, AI, and *in silico* modeling. These capabilities are further enhanced by the Tetra Data Apps, which amplify the value customers can derive from their scientific data.

Outlined below are the key supporting capabilities of TetraScience, including Tetra Data Apps where applicable (indicated in italics), along with the expected outcomes for scientific use cases in each phase of the value chain.

Research and discovery

Scientific Use Case	Key Supporting Capabilities	Value
High-Throughput Screening	Automatic collection of data from plate readers and/or scheduling software Contextualization with compound information Automatic push to ELN	2-4x increase in screening throughput Faster identification of higher-quality leads
High-Throughput Imaging	Automatic ingestion of native raw files from imaging systems Association with relevant metadata Parsing of raw CZI files to smaller PNG tiles	35% higher screening throughput 2x faster data processing Tracking samples in plates and correlating the resulting images to well positions Faster quantitative insights into therapeutic response and effects

Research and discovery (continued)

Scientific Use Case	Key Supporting Capabilities	Value
Lead Clone Selection in Cell Line Development	Automatic collection and harmonization of raw process- and assay-related data Integration of cell clone metadata and experimental conditions from ELN/LIMS Automation of data processing workflows, including normalization, outlier detection, and statistical analysis Publication of processed data and results to ELN/LIMS for centralized management and review. *Use of AI/ML algorithms to identify high-performing clones and predict their performance and stability (Lead Clone Selection Assistant)*	80% time reduction for clone selection Tracking clone performance and correlating with experimental conditions Streamlined troubleshooting with clear data lineage and contextual information Lower risk of late-stage failures predicting long-term stability and productivity Continuous improvement of clone selection process through iterative learning Accelerating cell line development by rapidly identifying and prioritizing high-potential clones
Cloning and Protein Expression	Automatic collection of log files from liquid handlers and automatic pipetting systems as well as raw data from analytical instruments Harmonization of raw data and automation of downstream calculations and data processing Retrieve plate maps from ELN/LIMS and publish measurement data to ELN/LIMS	Comprehensive data information including variables Deeper understanding of protein expression processes and smoother troubleshooting
Plasma Protein Binding by Mass Spectrometry	Automatic generation of plate map and liquid handler command files Automatic generation of batch sample files for mass spectrometers Automatic ingestion of XIC data from each well Harmonization of raw data and automation of basic data processing functions Publishing of processed data to ELN/LIMS	Removal of single points of failure in analysis script upkeep system and non-standardized analysis procedures Standardization of analysis scripts across multiple MS assays Quantitative understanding of protein bound to blood plasma for DMPK considerations Faster turnaround time for ADME results on potential drug candidates
mRNA Synthesis and QC	Automated ingestion of method, raw, and processed data from sample preparation systems, liquid handlers, and QC instruments Harmonization of raw data and automation of downstream calculations and data processing	Up to 80% time savings by eliminating bottlenecks and manual processing Automated mRNA method development workflows for mRNA production and QC processes Improved DNA amplification conditions Enhanced purification parameters for yield and quality
Cell Profiling / Sorting (Flow Cytometry)	Automatic ingestion of FCS data from flow cytometry instrumentation or robotic scheduling software Ingesting gated flow cytometry data in preparation for visualization *Dashboard for QC visualizations (Purification Insights)*	Automated flow cytometry experimentation for biologics lead identification/optimization Increased number of drug candidates identified Less time spent on data QC visualization and analysis
Asset Utilization	Automatic collection of data and metadata such as user, date/time, method, and run duration Automatic data preparation for analytics *Dashboard for visualizing instrument usage, instrument & method performance trending, and consumable usage (Chromatography Insights)*	Optimized productivity of laboratory instruments Visibility into enterprise-wide instrument utilization and consumable usage Improved CapEx deployment based on instrument utilization and performance Predictive maintenance to minimize unplanned downtime and mitigate potential compliance issues Enhanced lab operations with data insights

Process and method development

Scientific Use Case	Key Supporting Capabilities	Value
Bioprocess Purification Development	Automatic collection and engineering of data from Cytiva ÄKTA FPLC Automatic publication of results to ELN/LIMS Automatic publication of results to chromatogram inspection tool *Dashboarding tool supplemented with additional analyses (Purification Insights)*	Higher-quality biomolecules in less time by correlating critical quality attributes (CQAs) with critical process parameters (CPPs) Faster process development Comparison of chromatography runs across instances of Cytiva UNICORN Correlation of purification parameters with downstream analytical results (aggregation, charge variants, glycosylation, etc.)
mRNA Synthesis and QC	Automatic ingestion of method, raw, and processed data from sample preparation systems, liquid handlers, and QC instruments Harmonization of raw data and automation of downstream calculations and data processing	Up to 80% time savings by eliminating bottlenecks and manual processing Automated mRNA method development workflows for mRNA production and QC processes Improved DNA amplification conditions Enhanced purification parameters for yield and quality
Preformulation / Formulation Screening	Automatic collection of data from instruments Automatic push to ELN/LIMS and/or statistical analysis software Data collation to support systematic analysis of characterization data for the candidate drug and its formulation across the experimental design *Automatic visualization of data in analytics dashboard (Chromatography Insights)*	Characterization of candidate drug required for IND application Development of formulation design for optimal bioavailability Identification of attributes of the candidate drug and its formulation required to meet the target product profile
Lead Clone Selection in Cell Line Development	Automatic collection and harmonization of raw process- and assay-related data Integration of cell clone metadata and experimental conditions from ELN/LIMS Automation of data processing workflows, including normalization, outlier detection, and statistical analysis Publication of processed data and results to ELN/LIMS for centralized management and review. *Use of AI/ML algorithms to identify high-performing clones and predict their performance and stability (Lead Clone Selection Assistant)*	80% time reduction for clone selection Tracking clone performance and correlating with experimental conditions Streamlined troubleshooting with clear data lineage and contextual information Lower risk of late-stage failures by predicting long-term stability and productivity Continuous improvement of clone selection process through iterative learning Accelerating cell line development by rapidly identifying and prioritizing high-potential clones
Cell Culture Fermentation / Media Formulation	Automatic collection of raw data from bioreactor, in-line measurements, and off-line analytical measurements Harmonization of raw data Automation of downstream calculations and data processing *Automatic visualization of data in analytics dashboard (Cell Culture Insights)*	Automated correlation of in-line data with off-line analytical data from multiple instruments Data visualization in a single dashboard for downstream analysis Quick adaptation to changes in fermentation process conditions to optimize titer, productivity, and yield while balancing media formulation
Analytical Method Development	Automatic collection of method scouting, optimization, and robustness data from chromatography systems Automatic publication to ELN/LIMS *Automatic visualization of data in analytics dashboard (Chromatography Insights)*	Comparison of results from multiple chromatography methods in one place Association between method conditions and instrument/method/product robustness Compilation of data from design of experiment (DoE) runs in a single location Optimization of method conditions and robustness

Process and method development (continued)

Scientific Use Case	Key Supporting Capabilities	Value
Asset Utilization	Automatic collection of data and metadata such as user, date/time, method, and run duration Automatic data preparation for analytics *Dashboard for visualizing instrument usage, instrument & method performance trending, and consumable usage (Chromatography Insights)*	Optimized productivity of laboratory instruments Visibility into enterprise-wide instrument utilization and consumable usage Improved CapEx deployment based on instrument utilization and performance Predictive maintenance to minimize unplanned downtime and mitigate potential compliance issues Enhanced lab operations with data insights

Quality control and manufacturing

Scientific Use Case	Key Supporting Capabilities	Value
QC for Batch Release and Stability	Automatic collection of data from instruments and automatic push to ELN/LIMS Data prepared for critical quality attribute (CQA) trending and control charts *Automatic visualization of data in analytics dashboard (Chromatography Insights)*	Increased QC lab productivity by up to 40% Increased compliance and elimination of second scientist review Ability to trend batches and stability time points to proactively identify OOS (out of spec), OOT (out of trend), and OOE (out of expectation) events before they happen
Biologics Characterization and CQA Monitoring	Automatic collection of data from instruments and automatic push to ELN/LIMS Data prepared for CQA trending, comparison with process development/optimization parameters, and AI/ML modeling of the relationship between CQAs and critical process parameters (CPPs) *Automatic visualization of data in analytics dashboard (Chromatography Insights)*	Correlation of CQAs with CPPs Early detection of deviations from expected sequence or purity levels, avoiding further testing and wasted instrument time Faster identification and easier monitoring of CQAs for biologics characterization
mRNA Synthesis and QC	Automatic ingestion of method, raw, and processed data from sample preparation systems, liquid handlers, and QC instruments Harmonization of raw data and automation of downstream calculations and data processing	Up to 80% time savings by eliminating bottlenecks and manual processing Automated mRNA method development workflows for mRNA production and QC processes Improved DNA amplification conditions Enhanced purification parameters for yield and quality
Asset Utilization	Automatic collection of data and metadata such as user, date/time, method, and run duration Automatic data preparation for analytics *Dashboard for visualizing instrument usage, instrument & method performance trending, and consumable usage (Chromatography Insights)*	Optimized productivity of laboratory instruments Visibility into enterprise-wide instrument utilization and consumable usage Improved CapEx deployment based on instrument utilization and performance Predictive maintenance to minimize unplanned downtime and mitigate potential compliance issues Enhanced lab operations with data insights

Summary

Our science-led approach focuses on supporting scientific use cases through lab data automation, Tetra Data Apps, streamlined lab processes, and actionable insights. By leveraging industry best practices and the expertise of Tetra Sciborgs, customers can accelerate the implementation of the Tetra Scientific Data and AI Cloud. This approach enables faster, more informed decision-making and increases the impact on scientific outcomes across the biopharma value chain.