Intellomx White Paper

Revealing Causal Biology to Transform Drug Discovery

Executive Summary

Intellomx (www.intellomx.com) is a privately funded, AI-driven drug discovery company established to address one of the most persistent causes of failure in pharmaceutical R&D: the selection of drug targets that lack true biological relevance in human disease. By analysing large-scale human molecular and clinical datasets directly, Intellomx identifies novel targets, identifies new drug assets and enables earlier, better-informed decisions about where to commit discovery effort and development capital.

In contrast to AI approaches that depend primarily on literature mining or opaque pattern recognition, Intellomx applies evidence-based modelling, swarm intelligence, and network inference to uncover the molecular drivers that actively govern disease biology. These insights are then translated into ranked targets and associated drug candidates, with safety considerations assessed at the earliest stages of discovery. We treat LLMs as *assistive interfaces* (for retrieval and synthesis) rather than "biology engines".

For Business Development teams, Intellomx provides access to a stream of novel, risk-mitigated drug assets as well as an independent, data-driven means of assessing internal targets, pathways, and mechanisms in support of partnering, licensing, and M&A decisions. For CSOs and Heads of Discovery, the platform offers a scalable and explainable discovery capability that complements existing R&D infrastructure and helps reduce late-stage attrition.

Intellomx works with its clients and partners in three ways:

1. **Fee for service**, revealing the causal biology of disease and using that knowledge to identify novel therapeutic targets. We identify and rank docking molecules to modulate these targets
2. **Co-development projects**, with shared IP and upside
3. **In-house Development projects**, originated and developed at our own risk, generating assets available for licensing, partnering and BD partnerships

The Structural Challenge in Drug Discovery

Despite major advances in biology, data generation, and computing power, overall productivity in drug discovery has continued to decline. Clinical attrition remains high, and post-hoc analyses consistently point to inadequate biological understanding, poor model translation, or unanticipated safety issues as root causes of failure.

Conventional discovery approaches are often hypothesis-driven and narrow. Targets are selected on the basis of limited datasets, non-human models, or prevailing scientific consensus, rather than comprehensive analysis of disease biology in human populations. As a result, important drivers of disease may be overlooked, while secondary or reactive signals are over-interpreted.

Although artificial intelligence has been widely adopted in early discovery, many platforms perpetuate existing biases by relying on literature-derived knowledge or correlation-based learning. Without a robust framework for causality, such approaches rarely deliver durable translational value.

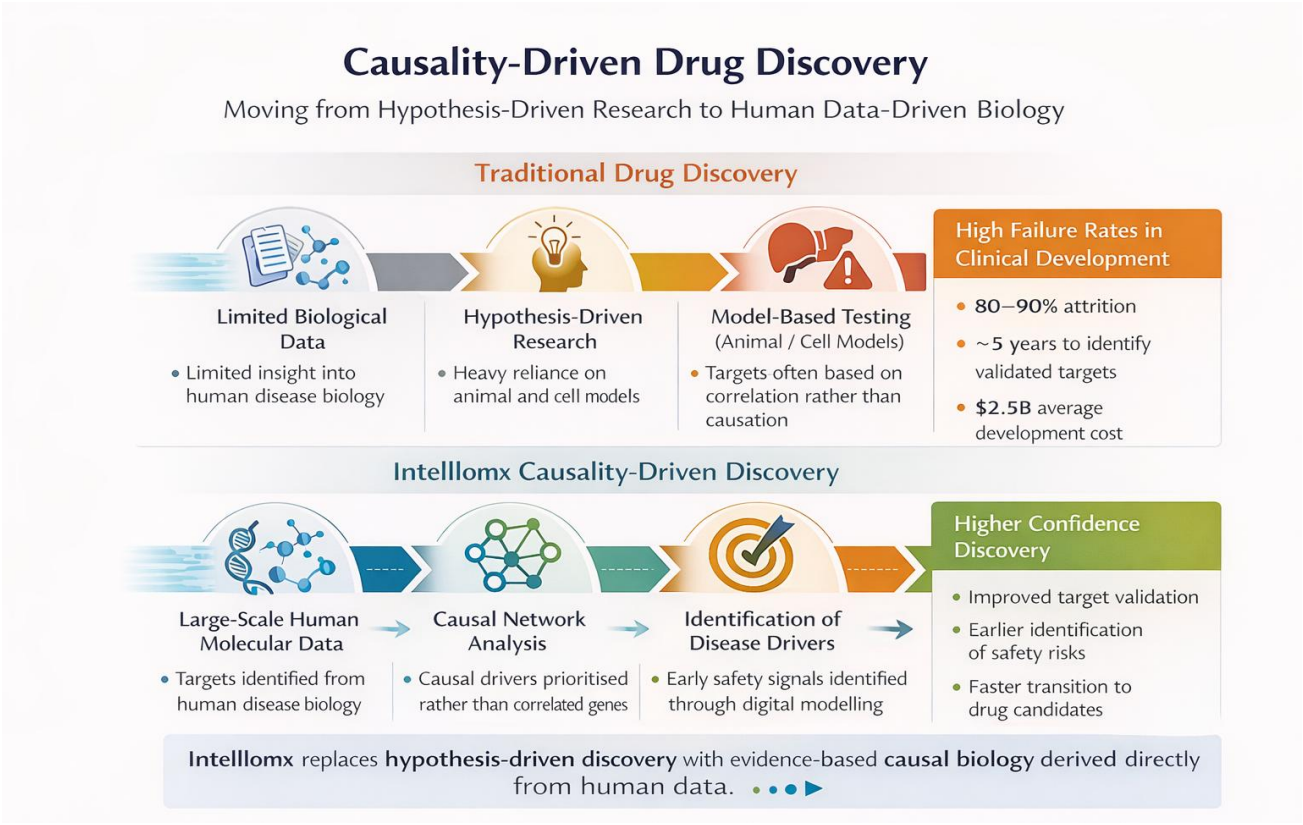

Figure 1. Traditional Drug Discovery vs Causality-Driven Discovery

Traditional discovery approaches often rely on limited datasets, hypothesis-driven research, and non-human models. Intellomx applies large-scale human molecular data and causal network analysis to identify disease drivers, enabling more confident target discovery and earlier drug candidate identification. Intellomx replaces hypothesis-driven discovery with evidence-based causal biology derived directly from human data.

Why Now?

Several developments have made causal biology analysis possible at a scale that was not achievable even a decade ago. Large human molecular datasets now exist across many disease areas, including transcriptomic, genomic, proteomic, and clinical outcome data derived directly from patient populations. At the same time, advances in computational architecture and machine learning now allow these datasets to be analysed simultaneously rather than in isolation.

The convergence of these developments means that disease can now be studied as a complex biological system operating within human populations rather than as a simplified model derived from cell lines or animal systems. Intellomx was established specifically to take advantage of this shift and to translate these emerging data resources into actionable biological insight for drug discovery.

What is Causal Biology?

Causal biology refers to the identification of the molecular drivers that actively control disease behaviour, rather than molecular changes that merely accompany or reflect disease state.

In many discovery programmes, targets are selected based on correlation - genes that are differentially expressed, statistically significant, or frequently cited in the literature - yet these signals are often downstream effects rather than true drivers of pathology. Causal biology focuses instead on understanding how disease systems are organised, which molecular features exert disproportionate influence within biological networks, and how perturbing those features alters disease progression.

Intellomx is purpose-built to uncover this causal layer of biology by analysing large-scale human molecular data using network inference, concordance across datasets, and evidence-based machine learning. By revealing the mechanisms that genuinely drive disease in human populations, Intellomx enables more confident target selection, clearer mechanistic hypotheses, and a materially higher probability that discoveries will translate into effective medicines and diagnostics.

Causal Biology as the Foundation

Intellomx was founded on the conviction that causality, rather than correlation, must underpin target discovery. Genes that exhibit the largest changes in expression are not necessarily those that control disease behaviour.

The Intellomx platform quantifies biological influence, stability, and network connectivity to identify molecular features that exert disproportionate control within disease systems. This enables the identification of targets that are mechanistically central to disease progression, rather than peripheral responders.

By focusing on causal drivers, Intellomx delivers targets with clearer mechanisms of action, stronger translational relevance, and a higher likelihood of clinical success as evidenced for example by our projects

in breast cancer (SPAG5) or analysis of the RAS cascade in lung cancer with targets validated by siRNA knockout, phosphorylation of RAS and small molecule efficacy in NSCLC cell lines.

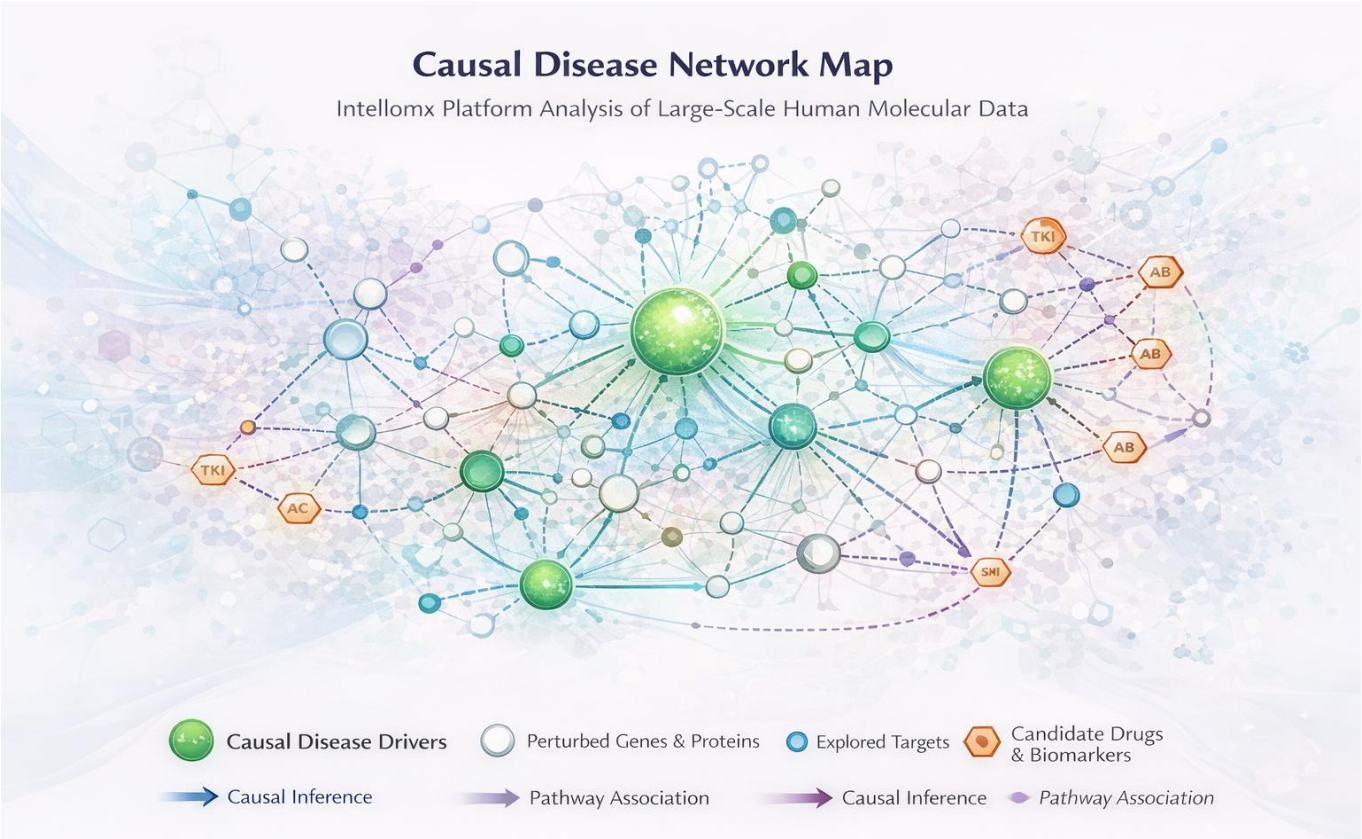

Figure 2. Causal Disease Network Analysis

Large-scale human molecular datasets can be modelled as biological networks in which genes, proteins, pathways, and therapeutic targets interact. Intellomx applies causal inference and concordance across datasets to identify the molecular drivers that exert the greatest influence within these networks, enabling more confident target identification and drug discovery.

Technology Platform Overview

Intellomx combines proprietary neural network architectures, machine learning, and graph-based network inference to model disease as an integrated biological system.

Large-scale transcriptomic, proteomic, genomic, epigenetic, and clinical datasets derived from human tissue are analysed in parallel. Rather than simplifying complexity, the platform preserves biological context and population heterogeneity, enabling robust interrogation of disease mechanisms at scale.

The resulting models are quantitative and explainable, supporting informed decisions across target selection, pathway reconstruction, biomarker identification, and drug discovery.

The Intellomx platform integrates causal biology discovery, target prioritisation, and drug candidate identification within a single computational workflow, illustrated below.

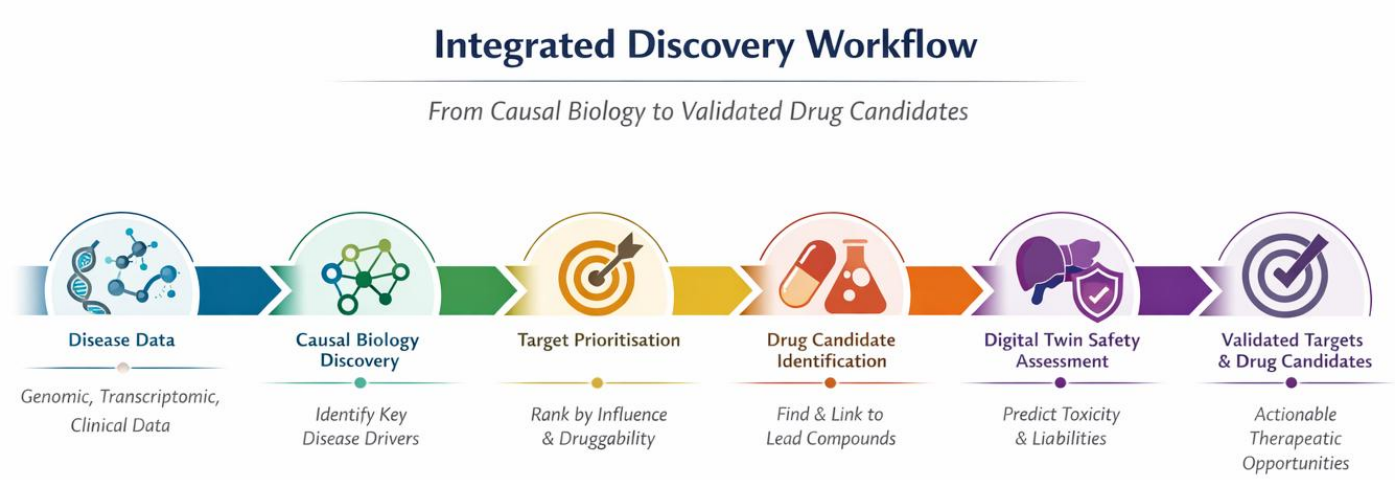

Figure 3. Intellomx Integrated Discovery Workflow

Large-scale human molecular data are analysed to reveal causal disease biology, enabling systematic target identification, drug candidate discovery, and early safety assessment within a single integrated discovery framework.

Swarm Intelligence and Concordance

A defining feature of the Intellomx platform is its use of swarm-based AI. Thousands of smaller neural networks are trained concurrently, each viewing the data from a distinct analytical perspective.

Findings are prioritised only when they recur consistently across multiple models and independent datasets. This requirement for concordance substantially reduces false discovery and limits over-fitting.

Compared with monolithic deep-learning approaches involving vast, impenetrable databases and ever-increasing electricity demands, swarm-based analysis offers improved transparency, faster and more energy efficient execution, and greater biological robustness.

The Intellomx I³ Platform

The Intellomx I³ platform provides an integrated discovery framework spanning the full early R&D continuum.

- I³-Distiller identifies disease-associated genes and biomarkers across large datasets.
- ³-Driver quantifies causal influence and network centrality.
- I³-Miner reconstructs disease pathways de novo.
- I³-Digital Twin anticipates organ-specific safety liabilities.

- I^3-Engage links targets to small molecules and biologics, while I^3-Precise supports optimisation of diagnostic and response panels.

Together, these modules create an integrated workflow that starts with understanding disease biology and carries that insight through to target selection and drug candidate identification, all grounded in human biology.

Digital Twins and Early Safety De-Risking

Late-stage toxicity remains a leading cause of failure and value destruction. Intellomx addresses this through Digital Twins that model disease and healthy tissue states across multiple organs. By mapping pathway perturbations onto organ-specific networks, Intellomx predicts off-target and safety risks early in discovery. This enables pharmaceutical teams to terminate unsafe programs before significant capital is deployed, dramatically improving portfolio efficiency.

Target-to-Drug Integration

A key differentiator of Intellomx is its ability to connect target discovery directly with drug discovery. Once causal targets are identified and validated, the platform supports in-silico docking, druggability assessment, and ADME and toxicity evaluation. The outcome is a ranked set of drug candidates that are mechanistically linked to disease drivers which we are then able to validate through third party wet lab work before coupling appropriate drug candidates. This integrated approach shortens discovery timelines and shifts experimental work toward targeted validation rather than open-ended exploration, enabling the capture of valuable IP.

Selected Case Study Summaries

NSCLC — Non-Small Cell Lung Cancer: Intellomx constructed the RAS/MEKK pathway from scratch through analysis of multiple RNASeq datasets using I^3 algorithms. Comparison of results with pathways characterised in literature enabled identification of novel causal drivers. These targets were validated experimentally and linked to potential drug candidates. Third party validation confirmed exceptional EC50 values for Intellomx-derived drug candidates.

Similar analyses have been undertaken across multiple disease areas. Examples:

IPF — Idiopathic Pulmonary Fibrosis: Analysis of human lung tissue revealed previously unrecognised drivers of fibrotic progression, enabling rational target ranking in a highly heterogeneous disease.

Autoimmune — Intellomx differentiated validated causal targets from biologically irrelevant alternatives, enabling portfolio reprioritisation and avoidance of misdirected investment.

TB: Tuberculosis Diagnostics: Biomarkers were identified that robustly differentiate latent from active TB across populations, supporting development of a clinically deployable diagnostic.

Obesity: Ongoing work demonstrates how Intellomx identifies stable causal drivers in metabolic disease, complementing incretin-based therapeutic strategies.

Why Intellomx vs Other AI Discovery Platforms

Many AI discovery platforms rely on literature mining, LLM-based hypothesis generation, or correlation-driven deep learning. While useful for summarisation, these approaches rarely reveal novel causal biology.

Intellomx operates directly on primary human data, applies evidence-based modelling, and enforces concordance across datasets. The result is explainable, biologically grounded outputs that support confident decision-making for both discovery and business development.

The table below summarises the fundamental differences between Intellomx and other commonly used AI discovery approaches.

Capability	**Intellomx**	**LLM / Literature-Based AI**	**Black-Box Deep Learning AI**	**Traditional Bioinformatics**
Primary data source	Primary human omics + clinical data	Published literature	Curated datasets	Single datasets
Discovery paradigm	De novo causal biology	Correlation / summarisation	Correlation-driven	Statistical association
False discovery control	Concordance across datasets	None	Limited	Multiple testing correction
Explainability	High (network-based)	Narrative only	Low	Moderate
Human relevance	Direct human tissue modelling	Indirect	Variable	Variable
Target-to-drug linkage	Integrated in silico docking	None	Partial	None
Toxicity prediction	Multi-organ Digital Twins	None	Limited	None
BD / diligence utility	High	Low	Moderate	Low

Key Differentiators

Several characteristics distinguish Intellomx from conventional AI discovery platforms:

- Discovery begins with human molecular data rather than literature-derived hypotheses
- Disease is analysed as a networked biological system rather than individual gene changes
- Swarm-based modelling and concordance analysis reduce false discovery
- Targets are ranked using causal influence rather than expression magnitude
- Digital Twins allow early prediction of off-target toxicity
- Target discovery is directly linked to drug candidate identification and prioritisation

Value for Business Development Teams

For BD teams, Intellomx provides access to a stream of validated targets and associated drug candidates or an independent, data-driven lens on internal assets, targets, and platforms.

Use cases include target validation prior to licensing, pathway assessment in M&A diligence, and competitive benchmarking of internal versus external programs.

This capability reduces deal risk and strengthens negotiation leverage.

Typical Engagement Model

Engagements with Intellomx are designed to be rapid and focused. Following an initial scientific discussion, the Intellomx team reviews available public and proprietary datasets relevant to the disease area of interest. A short proposal is then developed outlining the analytical approach, expected outputs, and potential discovery pathways.

Projects typically progress through three phases:

1. **Causal Biology Analysis** – reconstruction of disease pathways and identification of candidate drivers.

2. **Target Prioritisation** – ranking of targets based on influence, stability, druggability, and safety considerations.

3. **Target-to-Drug Discovery** – identification of candidate molecules and validation strategies.

This structured workflow allows discovery teams to generate actionable insights within weeks rather than years.

Value for CSOs and Heads of Discovery

For scientific leadership, Intellomx functions as a scalable discovery engine that integrates with existing R&D infrastructure.

Intellomx accelerates early discovery, improves target confidence, reduces reliance on non-translatable models, and enables more disciplined portfolio decision-making.

The platform supports both first-in-class innovation and best-in-class optimisation.

Conclusion

Innovation captured by Intellomx represents a paradigm shift in drug discovery: causal, human-relevant, explainable, and efficient. It is now leading to the discovery of new biological knowledge, new and enhanced disease pathways, new targets and novel drugs.

By revealing the true drivers of disease and linking them directly to ranked drug candidates, Intellomx enables pharmaceutical organisations to deliver better medicines, faster and with greater confidence.

Pharmaceutical organisations are increasingly recognising that improvements in target selection have the greatest impact on overall R&D productivity. Intellomx was built specifically to address this challenge by revealing the causal mechanisms underlying disease and translating those insights into actionable therapeutic opportunities.

We welcome discussions with pharmaceutical, biotechnology, diagnostics, and precision medicine organisations interested in applying causal biology to accelerate discovery programmes or evaluate new therapeutic opportunities.

Intellomx Contacts

www.intellomx.com

Dr. Bill Mason, Chairman
Bill.mason@intellomx.com
Tel: +44 7785 950134

Dr. Simon Haworth, CEO
Simon.haworth@intellomx.com
+1 236 989 9555

About Intellomx - Corporate Profile

Intellomx (www.intellomx.com) is a UK-based (Cambridge) AI-driven drug discovery company focused on revealing the causal biology of human disease. The company was founded to address one of the most persistent challenges in pharmaceutical R&D: the selection of drug targets that are biologically correct, translationally relevant, and capable of supporting successful clinical development. By operating directly on large-scale human molecular and clinical data, Intellomx provides pharmaceutical and biotechnology partners with a robust, evidence-based foundation for discovery and portfolio decision-making.

At the core of Intellomx is a proprietary AI and machine-learning platform designed to model disease as a dynamic biological system rather than a collection of isolated molecular signals. Using swarm-based neural networks, network inference, and concordance across multiple independent datasets, Intellomx identifies the molecular drivers that exert the greatest causal influence within disease networks. This approach moves beyond correlation-driven discovery and literature bias, enabling de novo identification of targets, pathways, and biomarkers grounded in human biology.

Intellomx offers clients an integrated, end-to-end discovery capability that spans target identification, target validation, pathway reconstruction, biomarker discovery, and target-to-drug linkage. Through its I^3 platform — incorporating Distiller, Driver, Miner, Digital Twin, Engage, and Precise modules — Intellomx connects causal disease biology directly to ranked drug candidates while anticipating safety and toxicity liabilities across multiple organs. This allows discovery teams to make earlier, higher-confidence decisions and transforms wet-lab experimentation from exploratory to confirmatory.

For new clients, Intellomx provides flexible engagement models tailored to scientific and commercial objectives. These include fee-for-service discovery and validation projects, strategic collaborations, and shared-IP partnerships. Typical engagements are rapid to initiate and designed to integrate seamlessly with existing R&D workflows, supporting internal programs, external asset evaluation, licensing diligence, and portfolio prioritisation. For Business Development teams, Intellomx offers an independent, data-driven lens on targets and assets; for CSOs and Heads of Discovery, it delivers a scalable, explainable discovery engine capable of materially improving R&D productivity.

Through its focus on causal biology, human relevance, and translational confidence, Intellomx enables its partners to reduce risk, accelerate discovery, and increase the probability of delivering meaningful new medicines to patients.

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