

Fully automated diagnostic test for kidney graft rejection

AIM

Develop **personalized predictive diagnostic test** to predict patient & organ response using **high-throughput RNA profiling** from liquid biopsies.

CURRENT SITUATION

Personalized predictive diagnostic tests have immense potential to improve post-transplant care for kidney recipients, who still face high rejection rates. **Liquid biopsies**, using high-throughput RNA profiling, offer a **quick, cost-effective way to enhance care** by providing detailed molecular insights. **Scalable calculation of personalized risk scores** will be required for use in a **clinical setting**.

STRATEGY & PROCESS

- Validated 2 academic publications on client's data
- Developed a **custom bioinformatics pipeline** optimized for **high-volume processing & analysis**, for the client's proprietary technology
- Leveraged data to discover **two new biomarker panels** for acute & chronic rejection with improved predictive accuracy, & which are suitable for clinical use
- Created **two AI algorithms to calculate personalized risk scores** for acute & long-term kidney graft rejection using our IDx/MDx platform

RESULTS

AI-based development of biomarkers to predict adverse effects and personalized risk scoring is highly complex. BioLizard supported the client in **discovering new biomarker panels** alongside developing an **end-to-end analysis solution** with automated bioinformatics, QC & reporting. Altogether, we provided **highly reliable ML-driven personalized risk scoring**, with high test risk scores correlating with 83% of early biopsies indicating acute rejection. **CLIA validation & data-driven algorithm refinement** for **broader population applicability** through intelligent experimental design are ongoing.

ADDED VALUE

5-DAYS SAMPLE TO RESULTS PIPELINE:

BioLizard enhanced cost-efficiency of sequencing depth via in-silico simulation, & streamlined processing time with automated technical & biological QC.

BEST IN CLASS DIAGNOSTIC TEST:

Implemented a fully automated, scalable cloud-based solution with algorithms designed for full transparency using explainable AI.



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Enhancing drug development through AI & data management

AIM

Institute a **scalable data strategy** that allows high quality **data governance** & enables application of **advanced analytics (ML & AI)** to improve overall R&D performance.

CURRENT SITUATION

A mid-sized biotech company, having heavily invested in data management, found the value derived from their efforts lacking. They sought an assessment of their existing data management strategy, focusing on **enhancing their "AI-readiness"** and identifying future AI opportunities.

STRATEGY & PROCESS

- Conducted a **comprehensive FAIR assessment** of data management strategies, highlighting strengths & areas for improvement
- **Evaluated infrastructure** against domain-specific requirements, noting limitations of generic tools like Spotfire
- Identified **8 low-hanging fruit AI-driven proof of concept (PoC)** implementations
- Identified compound purification as a **crucial step 1-2 years after lead selection with a high drop-out rate**, presenting an opportunity for AI to enhance drug development success
- **Integrated PoC into the client's infrastructure**, making it part of standard procedure for candidate prioritization
- Created a **sandbox environment** for engineers for in silico experimentation under different conditions (**digital twin**)

RESULTS

We delivered a **3 year step-wise implementation strategy for improved data strategy**, focusing on the unique requirements of the client & on identifying areas in which AI implementation could underlie **quick wins for R&D**. Selected AI-driven PoCs were identified & implemented, including **development of custom machine learning models to accurately predict binding** necessary for compound purification, based on peptide sequences. To **empower researchers** to run predictions themselves, we developed **interactive software with a graphical user interface** that does not require data science expertise.

ADDED VALUE

COMPREHENSIVE & STRATEGIC PLAN:
BioLizard delivered a 3 year step-wise implementation strategy for infrastructure spanning the entire drug development pipeline & stakeholders across 5 departments.

SEAMLESS INTEGRATION OF AI:
Successfully implemented two PoCs, with the first now seamlessly integrated into the client's environment as a standard procedure for improved lead candidate selection.



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Omics-driven CKD diagnostics in companion animals

AIM

Develop a **scalable multi-omics bioinformatic solution** for processing & integrating **thousands of proteomic, genomic, & transcriptomic datasets**

CURRENT SITUATION

A global animal health pharmaceutical company has amassed significant molecular data & continues to acquire new data assets rapidly. This has escalated its bioinformatics demands and introduced both **data management challenges & opportunities**, which they require **expert guidance** to navigate.

STRATEGY & PROCESS

- Developed a strategy to **enhance data FAIRness & streamline bioinformatics processes**, & catalogued all existing -omic datasets
- Delivered a **3-year step-wise data management strategy** for integrating & unifying their bioinformatic teams
- Developed a **custom-made, scalable multi-omics bioinformatic solution** for processing & integrating diverse & plentiful omics datasets
- Leveraged the data-driven bioinformatics pipeline and state-of-the-art bioinformatics approaches to **discover a novel biomarker panel** for chronic kidney disease (CKD) in cats & dogs
- Implemented Bio|Mx, our AI-powered multi-omics engine, to deliver cross-species & cross-omics insights

RESULTS

Bio|Mx merged omics data sets into a **single, consolidated gene feature matrix** suitable for downstream analytics. Scientists were enabled to leverage AI for **discovery of associations between disease condition & genes, proteins, & pathways**, including assessments of strength, confidence level, & causality relationships of associations.

Custom implementation of Bio|Mx for multi-omics data ingestion, analysis, & exploration additionally permitted **enhanced data integration** by translating human CKD -omics to cats & dogs, & identification of **novel & breakthrough veterinary medicine biomarkers** for CKD.

ADDED VALUE

EARLY DIAGNOSIS, BETTER PROGNOSIS:
Previously, CKD was often diagnosed only when animals reach stage 3-4, at which point prognosis is poor. The novel biomarker panel discovered herein allows early diagnosis at CKD stage 1-2, paving the way for improved treatment, design of better therapies, & higher quality of life for animals.

DATA-DRIVEN ADVANTAGE:
Bio|Mx will drive long-term out-competition in development of CKD diagnostic tools & identification of therapeutic targets.



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Defining therapeutic compound potential: Calypso Biotech

AIM

Access independent **confirmation of lead compound potential** & improved understanding of **mechanisms of action** underlying disease state & treatment efficacy.

CURRENT SITUATION

Calypso Biotech specializes in **therapeutic antibodies**, and have developed a promising lead compound. They would like to use a **data mining** strategy to assess its suitability in a **novel disease venue**. BioLizard supported in evaluating evidence within **public datasets** to assess the potential of the compound.

STRATEGY & PROCESS

- Conducted a literature search for **disease-specific single-cell RNA sequencing datasets**
- **Reanalyzed & integrated** public datasets derived from a variety of tissues
- Delivered a **comprehensive overview of target gene expression** across cell types in healthy & disease states
- Identified **specific cell types & states affecting target signaling** under pathological conditions that persist after conventional therapy
- Performed differential gene analysis to further **characterize disease-associated cell types & states**
- Used tissue-wise dataset integration to increase analytical power in the context of a disease that impacts multiple tissues

RESULTS

Integrated analysis (1) provided a **broad view of target gene activity across cell types & conditions** (2) pinpointed **specific hallmarks** that persist after conventional therapy, highlighting potential mechanisms underlying relapse & recurrence, & (3) **confirmed lead compound potential**.

“BioLizard produces **meaningful & actionable results that can be easily explained & presented**. They have been very reactive to our remarks & clearly understand very well the biological questions underlying these analyses.

Dr. Alain Vicari, CEO 

ADDED VALUE

DE-RISKING DRUG DEVELOPMENT:

Independent data supports the viability of the lead compound. The provided comprehensive transcriptomic overview at cellular resolution will guide toxicology studies & pinpoint potential follow up experiments early on.

COST- EFFICIENT APPROACH:

Key information was extracted from public data, saving the cost of in-house data generation. Converging evidence from independent sources & sampling techniques provided a more robust result for the client.



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ML-based antimicrobial activity & toxicity prediction: Madam Therapeutics

AIM

Leverage AI/machine learning (ML) to predict antimicrobial activity & toxicity of synthetic antimicrobial & anti-biofilm peptides (SAAPs).

CURRENT SITUATION

Madam Therapeutics developed targeted antimicrobial peptides (AMPs) to combat antimicrobial resistance (AMR) & its consequences in acute hospital settings. AMPs are proven to exhibit antimicrobial behaviour, but **mechanisms of action** are largely unknown, complicating **selection of clinically viable peptides**.

STRATEGY & PROCESS

- Used natural language processing (NLP) & text mining to **scope known AMPs' toxicity & antimicrobial activity**
- Assembled a **large & curated database** of AMPs
- Built a ML model for **sequence-based prediction of AMP activity & toxicity**
- **Validated** previously developed models by using the models on new sequences
- Identified correlations between different types of toxicity & physicochemical properties of AMPs

“We are very happy with the time & dedication put into the project by an experienced & knowledgeable bioinformatician.

Leonie de Best,
Chief Business Officer



RESULTS

We assembled the **largest annotated AMP database to date**, providing the client with a comprehensive & up-to-date overview.

Predictive ML models were validated on a variety of bacterial species & evaluated across different metrics. **High precision & recall** were achieved: F1 scores were as high as 0.74 and recall values as high as 0.96 for activity.

Multiple promising compounds are now in clinical development. Madam Therapeutics has since been acquired by Aurobac Therapeutics.

ADDED VALUE

FUTURE- PROOF APPROACH:

BioLizard provided validation that the ML models work and perform well, but also suggested options for further iterative improvements.

DE-RISKING CLINICAL DEVELOPMENT:

Madam Therapeutics not only gained new biological insight into sequence-based toxicity & activity, but could also transform this knowledge into data-driven design of highly promising compounds now in clinical development.



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Custom single-cell analytic pipeline & visualization toolkit

AIM

Scoping of client's existing data infrastructure & licensing requirements, and thereafter **custom design of analytical pipeline & visualization tool** to suit their unique needs & goals.

CURRENT SITUATION

The client works with large single cell RNA seq datasets that require highly advanced analytical processing, and are difficult to scale. Their IT, analytics, & bioinformatics department would like to develop a system for centralized processing, analysis & visualization of these datasets.

STRATEGY & PROCESS

- Detailed assessment of existing infrastructure & unbiased vendor assessment of analytical tools
- Develop custom Nextflow pipeline supporting & centralising all single-cell analysis tools & protocols
- Design a cloud environment for scalable pipeline execution
- Design a customized visualization platform for intuitive & easy-to-use data visualization & exploration
- Expansion of pipeline & toolkit to support additional omics data, new plot types, and download functionality
- Ongoing support for maintenance & continuous improvement of the toolkit as the client company rapidly evolves



RESULTS

Single cell analytics are now **standardized** & run on a **scalable, centralized analytics platform** in a cloud environment.

To empower scientists to interpret and explore their own data, BioLizard also built a **hosted data visualization platform** with an **intuitive & easy-to-use interface**.

After the first phase of the project, the **pipeline & visualisation toolkit were expanded** for processing & visualization of single cell 10x multiome data, and to include **new plot types & download functionality** for every chart.

ADDED VALUE

COST-EFFICIENT APPROACH:

BioLizard developed & validated the analytical pipeline & visualization tool using publicly available single cell sequencing datasets, & later verified & further optimized with in-house datasets.

LONG-TERM PARTNERSHIP:

BioLizard provides recurrent support for adaptation of the pipelines & visualization tools to meet the client's evolving needs as projects progress.



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Inferring causality of microbiome in gastric ulceration: Ghent University

AIM

Understand the role of feed size & different gastric **microbiota** in ulcer development in **pigs**, using **advanced biostatistics & computational approaches** to make **accurate causal inferences**.

CURRENT SITUATION

The client has acquired qPCR & sequencing data from biopsies across different treatment groups of pigs. Feed size & presence of specific microbial species, including *Helicobacter suis* & *Fusobacterium gastrosuis*, may contribute to gastric ulceration in pigs - but their relative contribution is unclear.

STRATEGY & PROCESS

- Set up a causal DAG based on client's hypotheses to represent underlying assumptions
- QC to de-noise & de-contaminate samples
- Annotated species & abundances
- Analysed relationships: feed size & microbial diversity; feed size & microbial abundance; microbial abundance & ulceration score
- Performed causal inference, assessing possible mechanisms of causality & relative contribution

“BioLizard was able to understand our needs & come up with customized solutions. Working with BioLizard has resulted in an extended academic collaboration & conclusive results.

Emily Taillieu, PhD

*Lab for Veterinary Bacteriology & Mycology,
Ghent Univ. Veterinary Medicine Faculty*



RESULTS

Advanced QC & preprocessing identified limitations of data & **removed contamination & species not of interest**. BioLizard delivered **processed datasets, in-depth reporting with a thorough explanation of all methods utilized, & publication-ready visualizations**. Analyses **corroborated** existing literature, revealed **novel insights** into underlying modes of action, and provided **actionable insights to investigate in follow-up studies**.

This study is now published in *Veterinary Research* (2024): doi: 10.1186/s13567-024-01274-1

ADDED VALUE

CUSTOMIZED SOLUTIONS: BioLizard developed bespoke analysis pipelines to permit causal inference with high confidence

SUPPORTING DATA-DRIVEN RESEARCH: Results uncovered biological insights that suggest novel, data-driven hypotheses for investigation in future studies

CUSTOMER-CENTRIC COMMUNICATION: Client received continuous, end-to-end support and a detailed final report clearly explaining data analysis and containing publication-ready figures



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