Developing an Integrated Multimodal Platform for the POETIC Breast Cancer Trial

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September 2, 2025

Abstract

Clinical trials generate increasingly complex datasets spanning clinical, molecular and imaging modalities. Extracting biological signals requires not only statistical rigour but also platforms to integrate these modalities under robust governance.

We present POETIC-Foundry, a multimodal integration and analysis platform built on Foundry for the POETIC trial of perioperative endocrine therapy in breast cancer. With over 4,000 patients, POETIC was chosen as an exemplar owing to its multiple data modalities: from molecular assays, to digital pathology scans and spatial transcriptomics in select patient cohorts. Built on top of Foundry, a commercial data platform, we modelled Foundry's graph-based ontology to represent POETIC; unifying clinical records, molecular profiles and pathology scans within a single interoperable ecosystem with built-in versioning and access control.

We designed incremental R and Python pipelines deployed to update analyses as new data is ingested into the system. These pipelines computed proliferation scores from gene expression and immunohistochemistry scans, supporting custom graphical applications hosted on the platform for patient cohorting and exploration of molecular, spatial and image-based data modalities. Interoperability across these layers enabled us to capture the early endocrine therapy response readout in POETIC. To broaden accessibility we deployed secure large language model instances that enable natural-language navigation of the ontology; supporting exploratory analyses and hypothesis generation in an accessible manner.

POETIC-Foundry unifies disparate data modalities within a governed, interoperable ecosystem where researchers build and deploy analytical tools. By combining multimodal integration with flexible interfaces (e.g. computational pipelines, visual dashboards and natural-language querying), POETIC-Foundry demonstrates how advanced platforms can transform clinical trial data management and analysis. This approach accelerates hypothesis generation, supports AI-driven biomarker discovery, and provides a model for future data-rich trial ecosystems.

Keywords— Multimodal Data, Pathomics, Computational Framework, Breast Cancer, Clinical Trial

References

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