ICR The Institute of Cancer Research

Poetic Trial of Perioperative Endocrine Therapy - Individualising Care

NIHR | Biomedical Research Centre at The Royal Marsden and the ICR
The ROYAL MARSDEN NHS Foundation Trust

FPN: 222P

Developing an Integrated Multimodal Platform for the POETIC Breast Cancer Trial

Ferran Cardoso Rodriguez*, Xixuan Zhu*, Lucy Kilburn, Manuel Salto-Tellez†, Maggie Chon U Cheang †

*,†: These authors contributed equally

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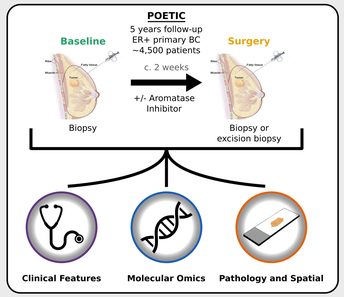
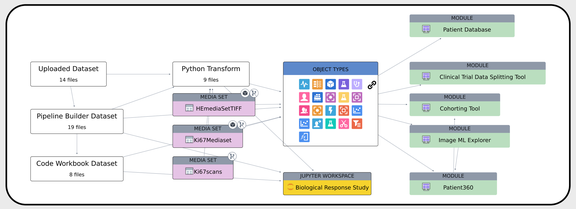
The POETIC trial (NCT02338310) evaluated peri-operative endocrine therapy in hormone receptor–positive early breast cancer. POETIC represents a unique translational resource in the UK, covering ~ 4,500 patients and combining detailed clinicopathological annotations with extensive multi-omics profiling.

Here we present POETIC-AI, a data integration study* where we have used clinical, molecular (including transcriptomics, genomics, and spatially resolved omics), and digitised histopathology data from the POETIC trial.



To demonstrate the capabilities of POETIC-AI we present a cross-modality study that, using orthogonal measurements of the proliferative marker Ki67, recapitulates proliferative changes as a biological response to intervention.

Building the Graph-based POETIC-AI Interoperable Ecosystem

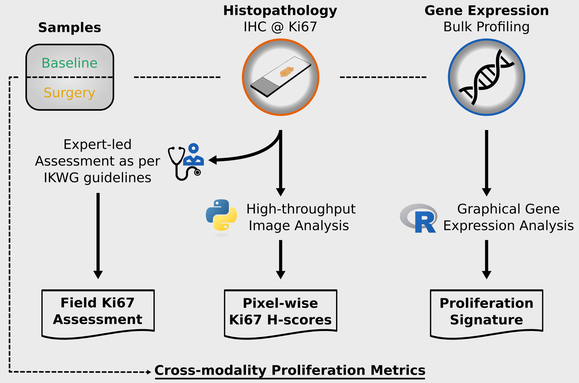


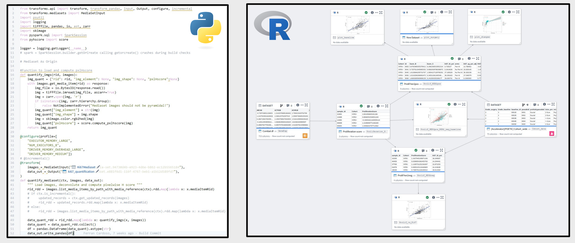
Leveraging the commercial solution Foundry, in POETIC-AI we have developed and implemented analysis, visualisation, and exploration tools across the multiple data modalities. We have built this interconnected platform around a graph-based ontology that unifies clinical records, molecular profiles, and pathology scans within a single interoperable ecosystem with built-in versioning and access control.

Within this environment we can map relationships among entities such as patient, sample, assays, and derived molecular features. In addition to uploaded datasets and data transform operations, our custom built applications and analyses (e.g. Biological Response Study) are also integrated within the broader ontology. This architecture supports dynamic data linkage, hierarchical querying, and real-time visualisation of multimodal relationships.

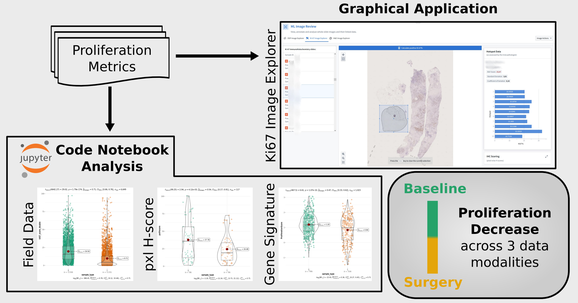
Recapitulating the Early Biological Response to Endocrine Therapy [1/2]

Within POETIC-AI, we have implemented analytical pipelines in two complementary forms: interactive graphical workflows and server-executed code-based pipelines. The graphical R-based workflows offer an accessible interface for data exploration and reproducible analysis directly linked to ontology-defined entities, while the Python-based pipelines operate on dedicated compute infrastructure for scalable, distributed processing of large datasets such as whole-slide images. To demonstrate the need for both these forms we have aimed to quantify proliferative changes across modalities to recapitulate an early biological response to intervention. A graphical workflow was used to compute proliferation signatures based on gene expression data from bulk profiling, while a code-based image analysis pipeline is used to quantify IHC targeting the proliferation marker Ki67.



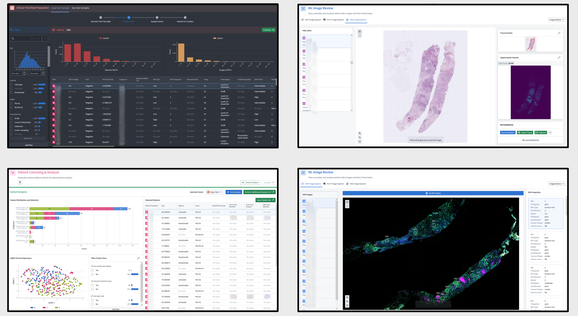


Recapitulating the Early Biological Response to Endocrine Therapy [2/2]



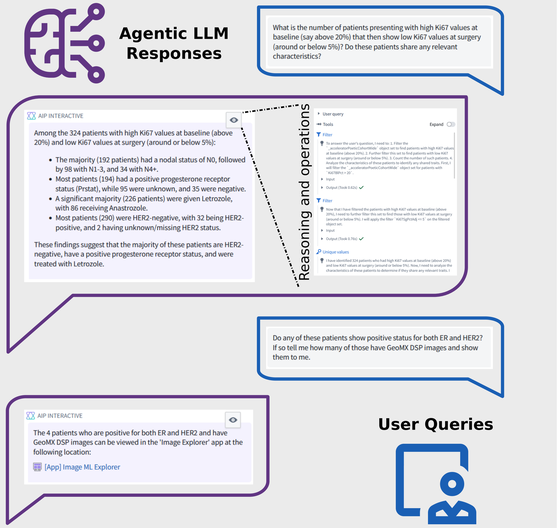
Incorporating field-spot assessments by expert trial pathologists following IKWG guidelines, this multimodal framework enables consistent evaluation of early biological response across molecular and histopathological modalities; recapitulating a decrease in proliferative index between baseline and surgical samples and surfacing the results as a graphical application.

Building Graphical Applications for Accessible Analysis and Exploration

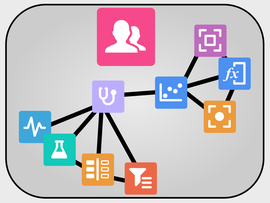


To facilitate accessibility, we have developed a series of graphical applications to support zero-code visualisation, exploration and analysis. These can be used to create cohorts and design splits (for downstream machine learning tasks), perform compositional analysis of the transcriptomic profiles of patients, and visualise histological and spatial modalities; linking digitised images with relevant metadata within POETIC-AI.

Demonstrating the Natural Language Interface Via an Agentic LLM



Conclusion



POETIC-AI unifies disparate data modalities within a governed, interoperable ecosystem where researchers build and deploy analytical tools. By combining multimodal integration with flexible interfaces, POETIC-AI 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.

References

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Disclosure Statement

FCR confirms no conflicts of interest to declare.

Acknowledgments

*: This study has been carried out with the oversight of the appropriate governance and consent teams.
POETIC is co-sponsored by The Institute of Cancer Research and The Royal Marsden NHS Foundation Trust. POETIC is funded by Cancer Research UK (CRUK/07/015) and coordinated by the ICR-CTSU. ICR-CTSU also receives programme grant funding from Cancer Research UK, grant number C1491/A15955. We acknowledge NHS funding to the NIHR Biomedical Research Centre at The Royal Marsden and The Institute of Cancer Research. The views expressed are those of the authors and not necessarily those of the NIHR or the Department of Health and Social Care. We thank all the POETIC participants and staff for their help and assistance. We thank also Breast Cancer Now and CRUK for additional funding. Finally, we thank the past and present colleagues on the POETIC Trial Management Group, and the POETIC Independent Data Monitoring Committee and Trial Steering Committee. Maggie C. U. Cheang has a patent for Breast Cancer Classifier: US Patent No. 9,631,239 with royalties paid and received research funding from NanoString Technologies and Veracyte advisory role.

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Contact

Ferran Cardoso Rodriguez, PhD
Computational Senior Scientific Officer at the **Integrated Pathology Unit**
The Institute of Cancer Research & Royal Marsden Trust
T +442034376070 | **E** Ferran.Cardoso@icr.ac.uk