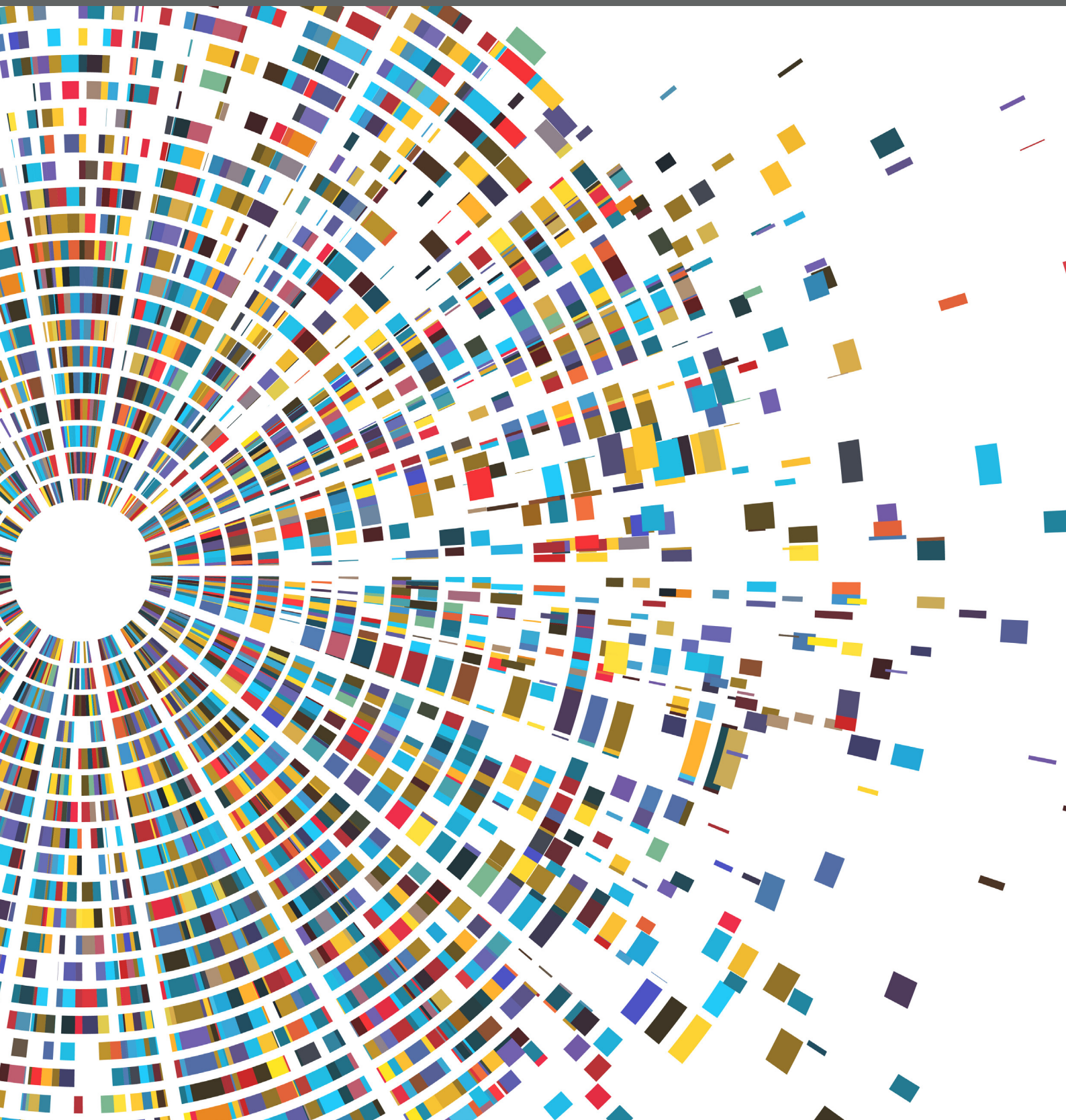
Enabling Precision Medicine

Phenomics Australia
Enabling precision medicine

NCRIS
National Research Infrastructure for Australia
An Australian Government Initiative

Data Analytics



Enabling discovery and driving translational medicine with high throughput technologies

VCFG Victorian Centre For Functional Genomics

Peter Mac Peter MacCallum Cancer Centre Victoria Australia

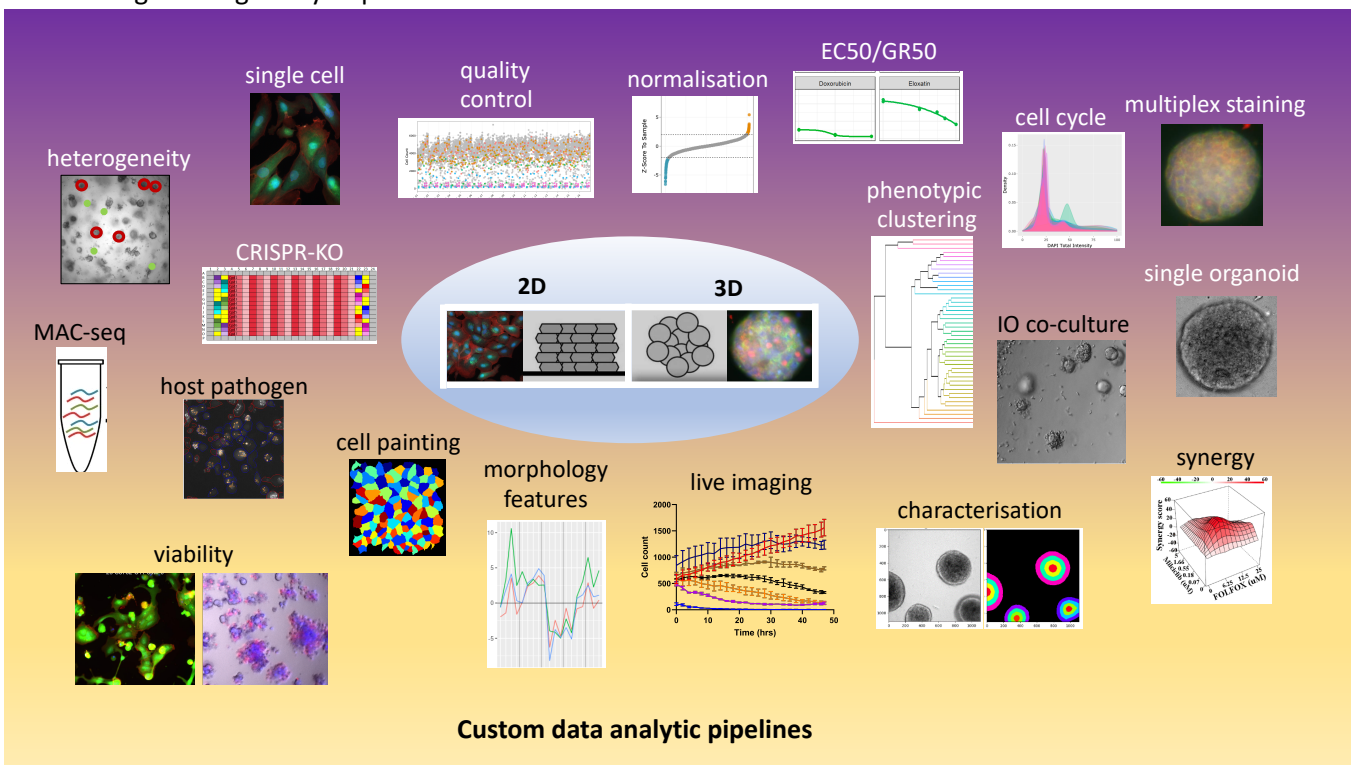
Data Analytics at VCFG

Overview

The VCFG provides an end-to-end service, starting with supporting grants, through assay development, screening and data analysis. It is the data analysis that can be the most challenging part of any project, particularly from complex high content imaging-based screens. This is an area that we are constantly evolving, creating new and innovative methods to interpret outcomes. Coupled with our PRIME management portal the code and all data files are available, and all data outputs are represented in a fully interactive html format.

Analysis pipelines

Our pipelines are frequently being refined and expanded and are always customised to each project. Many of the protocols are applied to cells cultured in both 2D and 3D settings and can be used in small or large scale screen campaigns. Fundamental to screen success is a robust experimental design with strong positive and negative controls. Our analytics begins at the QC level, applying different statistical methods to verify controls and normalisation of entire data sets. For every screen, the first measure is cell viability and beyond that, sophisticated multiplex staining can lead to application of cell painting, derivation of morphology features and clustering of phenotypic profiles to identify targets of similar cellular action. More specialised applications include drug synergy interactions, live cell imaging, immuno-oncology and host-pathogen co-cultures and determining heterogeneity of patient derived cells in 3D scaffolds.

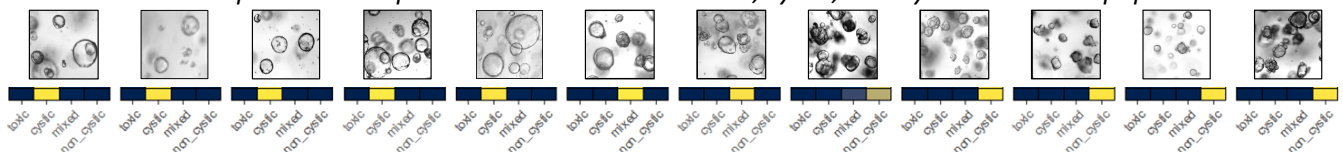


Custom data analytic pipelines

Advanced analytics – applying machine learning strategies

The VCFG has enabled large scale drug screens using patient derived organoids (PDOs) and patient derived xenograft (PDX) models of cancer and it is clear that intra tumour heterogeneity plays a major role in disease response and that each patient 'looks' phenotypically different. We have developed advanced machine learning pipelines to characterise complex phenotypes and assess the relative effectiveness of drugs across patients.

Pancreatic PDOs response to compound treatment reveals toxic, cystic, non-cystic and mixed populations



With Support from NCRIS through Phenomics Australia and The University of Melbourne

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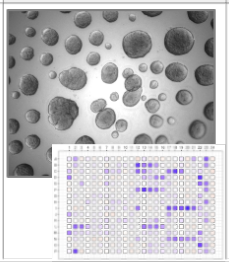
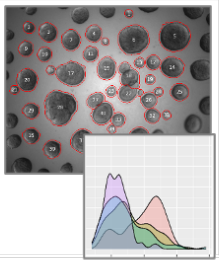
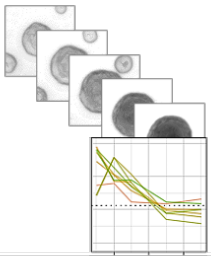
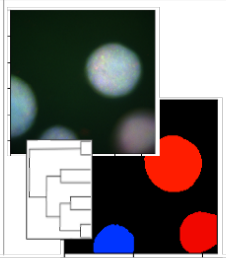
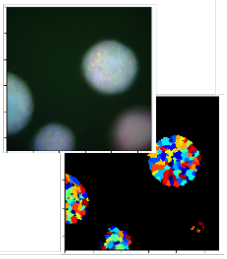
Summary of VCFG 3D applications and relative scalability

	Basic screening	Population heterogeneity	Time course tracking	Multiplexed staining	Single cell
Magnification	4x	4x	4x	20x	20x
# fields	1	1	1	min of 4	min of 4
# z-slices	1	1	1	1	1
# channels	1 (BF)	1 (BF)	1 (BF)	5	5
# time points	1	1	1 to 10	1	1
Single organoids	No	Yes	Yes	Yes	Yes
Single cells	No	No	No	No	Yes
Use for	- label-free screening - well-level BF imaging	- label-free screening - population-level data - heterogeneity	- label-free screening - time-course tracking - many populations	- multiplex fixed cell staining - phenotypic clustering	- multiplex fixed single-cell analysis - intra-organoid heterogeneity
					

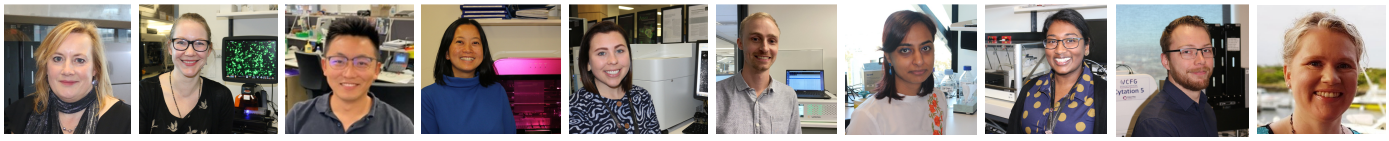
throughput → complexity

Who will help me?

VCFG staff are with you every step of the way. We will collaborate to build your custom image analysis pipelines and we're often looking for new types of applications to advance novel analysis capabilities. All information and analysis related to your project will be stored on PRIME, our Project Information and Management Enterprise.

The VCFG team – a collaborative and innovative partnership

Highly experienced, driving innovative technology and method development, housing large reagent and resource collections, enabling complete end to end service, researcher focused, open access to everyone.



A/Prof Kaylene Simpson - Head, project management, grant support
Dr Susanne Ramm - 2iC, 3D organoid characterisation, screening, analysis
Dr Mark Li - 3D screen support and fee for service, analysis
Jennii Luu - Lab manager, automation specialist, 2D and 3D platforms
Karla Cowley - High content imaging and analysis, 2D platform
Dr Henry Beetham - MRFF stem cell project, 2D screens and analysis, CRISPR
Dr Twishi Gulati - CRISPR screening, iLAB management, Business Development
Arthi Macpherson - Equipment training, new instrumentation, PRIME management
Robert Vary - Equipment training, screen support, fee for service projects
Louise Scerri - Administrative support

You can find us on Level 11, Cluster 6, VCCC building - Come and chat any time!

https://www.petermac.org/research/core-facilities-and-services/victorian-centre-functional-genomics

https://research.unimelb.edu.au/facilities-and-resources/research-infrastructure/victorian-centre-for-functional-genomics

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