



# Pharmacogenetics (PGx)

## For Oncologists

Recommended by Guidelines, pharmacotherapeutic genotyping is one of multiple pieces of information that oncologists should consider when making their therapeutic choice for each patient. Preemptive use of testing could significantly optimise drug outcomes and be particularly useful for patients undergoing multiple treatments or experiencing poor drug responses. See below a selection of pharmacogenetic (PGx) tests that may be useful for your practice. *To view our full pharmacogenetics offering, scan the QR code below.*

### Clinical Labs' Comprehensive PGx Gene Panel

Clinical Labs' **Comprehensive PGx Gene Panel** includes a family of enzymes that catalyse the metabolism of many drugs and xenobiotics, particularly in areas such as oncology, mental health, cardiology and pain management. With our Comprehensive PGx Gene Panel, you will receive a comprehensive report that will indicate the genotype and the predicted phenotypes, such as the metaboliser status, along with potential drug-gene interactions and Guidelines' recommendations. Please specify any medications of interest if you want them to be included in the report. The genes can be ordered separately or together - for individual genes, only genotyping/phenotyping will be reported. *See reverse for a list of genes tested and examples of drugs metabolised.*

#### Genes included in our Comprehensive PGx Panel

CYP2D6
CYP2C19
CYP2C9
CYP3A4
CYP3A5
CYP1A2
VKORC1
SLCO1B1

### Single Gene Tests for Oncology

- **CYP2D6 (Tamoxifen PGx):** is the primary enzyme responsible for the metabolism of many commonly used medications, especially oncology (tamoxifen and 5-HT3 receptor antagonists) (Goetz et al., 2018). *CYP2D6* is highly polymorphic, with over 130 identified allelic variants and sub-variants identified ([www.PharmVar.org](http://www.PharmVar.org); *CYP2D6* Allele Definition). *CYP2D6* alleles have been extensively studied in multiple geographically, racially, and ethnically diverse groups, and significant differences in allele frequencies have been observed.
- **TPMT:** Thiopurine methyltransferase (*TPMT*) is the primary enzyme responsible for the metabolism of thiopurine drugs (azathioprine, 6-mercaptopurine, and 6-thioguanine). It is recommended that physicians order *TPMT* genotyping before prescribing thiopurines to avoid bone marrow toxicity and subsequent neutropenia. *Medicare rebate available.*
- **DPYD:** Mutations in the dihydropyrimidine dehydrogenase gene (*DPYD*) interfere with the breakdown of chemotherapeutic cancer drugs with structures similar to pyrimidines, such as 5-fluorouracil and capecitabine. As a result, these drugs can accumulate in the body, leading to severe reactions and neurological manifestations due to *DPYD* deficiency.
- **UGT1A1:** *UGT1A1* gene polymorphism is associated with toxicity and clinical efficacy of irinotecan-based chemotherapy, which is used in patients with advanced solid tumours, including colorectal and lung cancers.

### Ordering Pharmacogenetic Testing at Clinical Labs

- **When to order:** At the time of drug prescribing and dispensing for patients with genotypes that require action, such as dose reductions.
- **What to put on the request form:** Fill out our routine Clinical Labs request form, list the gene required or group of genes and prescribed medications if available.
- **Turnaround time:** Results within 7-10 business days from the sample receipt date.
- **Specimen details:** 2x EDTA blood samples.
- **Test cost:** Apart from the *TPMT* gene, an out-of-pocket fee applies. Scan QR or visit [clinicallabs.com.au/pharmacogeneticstesting](http://clinicallabs.com.au/pharmacogeneticstesting) for current pricing.



Medication	Gene(s)
<b>Cardiology</b>	
Carvedilol	CYP2D6
Clopidogrel	CYP2C19
Flecainide	CYP2D6
Metoprolol	CYP2D6
Warfarin	VKORC1, CYP2C9
<b>Lipid Lowering Medication</b>	
Atorvastatin	SLCO1B1, CYP3A4
Fluvastatin	SLCO1B1, CYP2C9
Lovastatin	SLCO1B1
Pitavastatin	SLCO1B1
Pravastatin	SLCO1B1
Rosuvastatin	SLCO1B1
Simvastatin	SLCO1B1
<b>Gastroenterology</b>	
<b>Anti-Emetic</b>	
Metoclopramide	CYP2D6
Ondansetron	CYP2D6
Tropisetron	CYP2D6
<b>Proton Pump Inhibitors</b>	
Esomeprazole	CYP2C19
Lansoprazole	CYP2C19
Omeprazole (Losec)	CYP2C19
Pantoprazole	CYP2C19
Rabeprazole	CYP2C19
<b>Mental Health</b>	
<b>Anti-ADHD</b>	
Atomoxetine	CYP2D6
<b>Anti-Depressants (MOAs)</b>	
Moclobemide	CYP2C19
<b>Anti-Depressants (SNRIs)</b>	
Venlafaxine	CYP2D6
<b>Anti-Depressants (SSRIs)</b>	
Citalopram	CYP2C19
Escitalopram	CYP2C19
Fluvoxamine	CYP2D6
Paroxetine	CYP2D6
Sertraline (Zoloft)	CYP2C19

Please note that this is a guide for gene selection. The test is not intended to cover possible allergies to certain drugs. Due to a lack of evidence, some specific medications may not be reported even if they are part of the same drug class that is metabolised by the relevant gene.

\*The following genes are not included in our Comprehensive PGx Gene Panel and need to be ordered individually: UGT1A1, TPMT and DPYD.

Medication	Gene(s)
<b>Mental Health</b>	
<b>Anti-Depressants (TCAs)</b>	
Amitriptyline	CYP2D6, CYP2C19
Clomipramine	CYP2D6, CYP2C19
Desipramine	CYP2D6, CYP2C19
Doxepin	CYP2D6, CYP2C19
Imipramine	CYP2D6, CYP2C19
Nortriptyline	CYP2D6
Trimipramine	CYP2D6, CYP2C19
<b>Anti-Depressants (Other)</b>	
Vortioxetine	CYP2D6
<b>Anti-Psychotics</b>	
Aripiprazole	CYP2D6
Brexpiprazole	CYP2D6
Haloperidol	CYP2D6
Quetiapine	CYP3A4
Risperidone	CYP2D6
Zuclopenthixol	CYP2D6
<b>Benzodiazepines (Anxiolytics)</b>	
Clobazam	CYP2C19
Diazepam (Valium)	CYP2C19
<b>Neurology</b>	
<b>Anti-Dementia</b>	
Donepezil	CYP2D6
Galantamine	CYP2D6
<b>Anti-Epileptics</b>	
Phenytoin/ Fosphenytoin	CYP2C9
<b>Multiple Sclerosis</b>	
Siponimod	CYP2C9

Medication	Gene(s)
<b>Oncology</b>	
Atazanavir	UGT1A1*
Azathioprine	TPMT*
Belinostat	UGT1A1*
Binimetinib	UGT1A1*
Capecitabine	DPYD*
Cisplatin	TPMT*
Gefitinib	CYP2D6
Irinotecan	UGT1A1*
Mercaptopurine	TPMT*
Nilotinib	UGT1A1
Pazopanib	UGT1A1*
Tamoxifen	CYP2D6
Tegafur	DPYD*
Thioguanine	TPMT*
5-Fluorouracil	DPYD*
<b>Organ Transplant</b>	
Tacrolimus	CYP3A5
<b>Pain Management</b>	
<b>NSAIDs</b>	
Celecoxib	CYP2C9
Flurbiprofen	CYP2C9
Ibuprofen	CYP2C9
Piroxicam	CYP2C9
Meloxicam	CYP2C9
<b>Opioids</b>	
Codeine (prodrug)	CYP2D6
Dihydrocodeine	CYP2D6
Tramadol	CYP2D6
<b>Urology</b>	
Darifenacin	CYP2D6
Mirabegron	CYP2D6
Tamsulosin	CYP2D6
Tolterodine	CYP2D6
<b>Anti-Fungal</b>	
Voriconazol	CYP2C19

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