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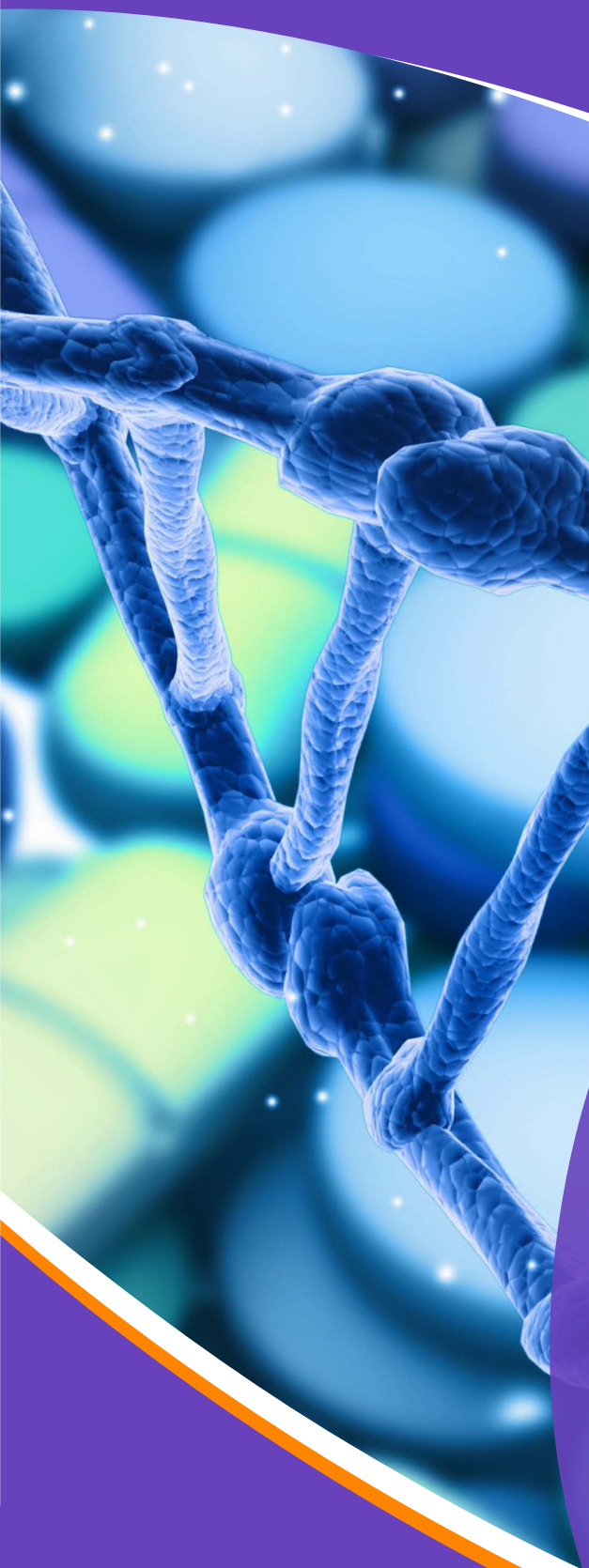


Pharmacogenetic (PGx) Testing

Advanced insights for optimised drug treatment outcomes

Pharmacogenetic Testing

Pharmacogenetics (PGx), an important part of precision medicine, is the study of how genetic variability influences drug treatment outcomes. Recommended by Guidelines, many medications currently prescribed have pharmacogenetic data to support appropriate dosing or selection. Like all diagnostic tests, pharmacotherapeutic genotyping is one of multiple pieces of information that clinicians should consider when making their therapeutic choice for each patient.

Clinical Labs offers a comprehensive range of pharmacogenetic testing in order to provide clinicians and healthcare providers with important information to help decide on the most appropriate treatment for each individual, particularly in areas such as mental health, pain management, cardiology and oncology.

PGx test utility

Implementation of clinical pharmacogenetics, allele function and inferred phenotypes is a crucial step toward optimal patient health. Identifying responders and non-responders to medications can reduce morbidity, avoid adverse events and optimise drug dosing.

Literature has shown that a large number of people are injured or die in hospitals each year due to adverse drug events (ADEs), resulting in millions of dollars in healthcare costs. The field of genomic medicine presents one potential solution to reduce healthcare costs associated with ADEs and poor response to pharmacotherapy.

PGx guidelines

Evidence-based guidelines with pharmacotherapeutic recommendations for combinations of specific drugs and genotypes or predicted phenotypes are essential for implementing acquired pharmacogenetics knowledge in daily clinical practice.

The Dutch Pharmacogenetics Working Group (DPWG) and the Clinical Pharmacogenetics Implementation Consortium (CPIC) have been developing guidelines for more than a decade (Swen *et al.* 2011a; Caudle *et al.* 2017).

Recommendations are preferably made available at the time of drug prescribing and dispensing for a patient with a genotype that requires an action, such as a dose reduction (Swen *et al.* 2011a; Deneer and van Schaik, 2013).

When to order the test

Physicians may order the pharmacogenetic testing per drug at the point of care, or an alternative approach is the use of pre-emptive testing, perhaps as part of an annual exam in young adults or even children who require multiple treatments. As a result of the increasing number of drugs with pharmacogenetic data, the pre-emptive use of testing could significantly optimise drug outcomes (Schildcrout *et al.* 2012).

Regardless of when ordered (at time of treatment or prior), due to the continuing decline in the costs of genomic testing technologies, a broad-based pharmacogenetic screen may yield the greatest cost savings.

Identifying responders and non-responders to medications can reduce morbidity, avoid adverse events and optimise drug dosing.

The *cytochrome P450 (CYP450)* and differences in drug metabolism

A family of enzymes (Figure 1), catalyses the metabolism of many drugs and xenobiotics. The genes that code for *cytochrome P450* enzymes are highly polymorphic, which can significantly affect drug metabolism in certain individuals. Differences in drug metabolism due to *CYP450* gene variants influence plasma levels of both the active drug and its metabolites.

For example, *CYP2D6, CYP2C19* and *CYP2C9* are responsible for the metabolism of a large number of commonly prescribed drugs, including warfarin, analgesics, clopidogrel, codeine, tamoxifen, some antidepressants, statins, proton pump inhibitors (PPIs) and anti-emetics (See Table 1). *CYP3A5* genotype results can be used to guide dosing of tacrolimus in organ transplant patients (Birdwell *et al*. 2015).

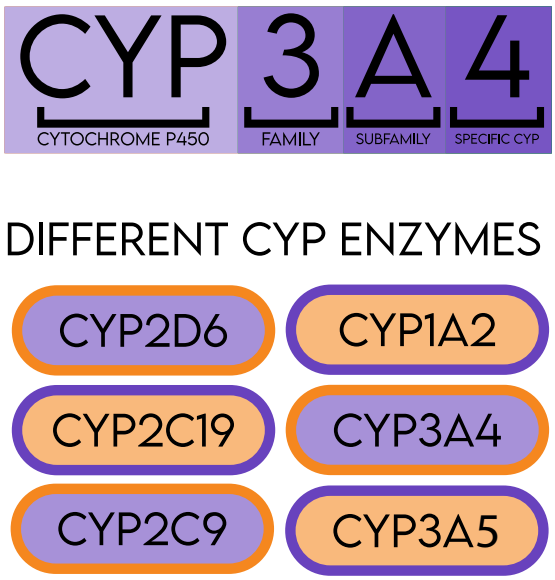


Figure 1. CYP Cytochrome P450 enzyme nomenclature and examples chart.

CYP2D6

CYP2D6 is the primary enzyme responsible for the metabolism of many commonly-used medications especially in mental health, oncology (tamoxifen and 5-HT3 receptor antagonists) (Goetz *et al*. 2018) and pain management (Crews *et al*. 2021) (Table 1). *CYP2D6* is highly polymorphic with over 130 identified allelic variants and sub-variants identified (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. It is important to note that variation in *CYP2D6* may have implications for many therapies that may not be listed in this report (Gaedigk *et al*. 2017).

CYP2C19

The hepatic *CYP2C19* enzyme contributes to the metabolism of a large number of clinically relevant drugs, such as antidepressants, benzodiazepines, some proton pump inhibitors (Lima *et al*. 2021), clopidogrel (Scott *et al*. 2013) and the anti-fungal medication voriconazole (Moriyama *et al*. 2017) (Table 1). Like many other *CYP450* superfamily members, the *CYP2C19* gene is highly polymorphic, with >25 known variant alleles.

CYP2C9

Variants in the *CYP2C9* gene modify the rate at which some medications are metabolised. When considering antidepressant therapy, such as tricyclic anti-depressants (TCAs), *CYP2C9* testing is often combined with analysis of the *CYP2C19* and *CYP2D6* genes (Attia *et al*. 2014 and Hicks *et al*. 2017). When considering warfarin therapy, this test is often combined with analysis of *VKORC1*.

VKORC1, CYP2C9 and warfarin

Warfarin is one of the most commonly prescribed medications worldwide, used for many indications, including prophylaxis and treatment of thromboembolic disorders, atrial fibrillation, cardiac valve replacement and prevention of systemic embolism after myocardial infarction (MI). Approved in the US in 1954, the high efficacy of warfarin is challenged by the high risk of ADEs due to its narrow therapeutic window, requiring careful monitoring and strict compliance.

While *CYP2C9* is predominantly involved in the metabolism of warfarin subtypes, *VKORC1* is the molecular target of the drug. In 2017, an international collaboration published an updated landmark paper defining appropriate warfarin doses based on a validated dosing algorithm of clinical biomarkers and *VKORC1/CYP2C9* genotypes (Johnson *et al*. 2017).

SLCO1B1 and statins

SLCO1B1 gene testing is clinically important in clearance of statins, especially simvastatin. Myopathy is reported in poor metabolisers of this gene. Alternative lipid-lowering statins can be prescribed in lower doses such as atorvastatin, pravastatin and rosuvastatin (Ramsey *et al*. 2014).

Pharmacogenetic markers in oncology

In addition to *RAS, BRAF, EGFR, ERBB2 (HER2), PK3CA* and *KIT* mutation and *PD-1, ROS, ALK* and *BCR-ABL* fusion genes, other genetic pharmacogenetic biomarkers play a role in patients' responses to oncology therapy.

UDP-glucuronosyltransferase gene (UGT1A1)

UGT1A1 is involved in the metabolism of *irinotecan*, a topoisomerase I inhibitor. *UGT1A1* gene polymorphisms are associated with toxicity and clinical efficacy of irinotecan-based chemotherapy in patients with advanced solid tumours, including colorectal, rectal and lung cancer (Fujii *et al.* 2019).

Thiopurine methyltransferase (TPMT)

TPMT is the primary enzyme responsible for thiopurine drugs (azathioprine, 6-mercaptopurine and 6-thioguanine) metabolism. These drugs are converted in the body to thioguanine nucleotides (TGNs).

Thiopurine therapy targets the replicating cells without overly harming normal cells. Several studies have established Single Nucleotide Polymorphisms (SNPs) in the *TPMT* gene that may lead to enzyme inactivity, and therefore, haematopoietic toxicity due to thiopurine therapy. It is recommended that physicians order *TPMT* genotyping before prescribing thiopurines to avoid bone marrow toxicity and consequent neutropenia (Relling *et al*. 2018).

Dihydropyrimidine dehydrogenase gene (DPYD)

DPD stands for dihydropyrimidine dehydrogenase, an enzyme made by the liver that breaks down uracil and thymine. The molecules created when pyrimidines are broken down (5,6-dihydrouracil and 5,6-dihydrothymine) are excreted by the body or used in other cellular processes. *DPYD* gene mutations result in excess quantities of the breakdown molecules in the blood, urine and cerebrospinal fluid.

Mutations in the *DPYD* gene also interfere with the breakdown of drugs with structures similar to the pyrimidines, such as the cancer drugs 5-fluorouracil and capecitabine (two common chemotherapy drugs used as treatments for a number of different cancers). As a result, these drugs accumulate in the body and cause the severe reactions and neurological manifestations as a result of DPD deficiency (Amstutz *et al*. 2017).

Genetic variations can render some medications ineffective or toxic

Pharmacogenetic variants result in four distinct phenotypes: normal metabolisers (NMs), intermediate metabolisers (IMs), poor metabolisers (PMs), and ultrarapid metabolisers (UMs), which provide guidance for drug dosing and selection.

Overall, wild-type alleles are usually associated with functional enzyme-mediated metabolism. *Ultrarapid metabolisers* may not achieve therapeutic plasma levels due to decreased trough drug concentrations, whereas *poor metabolisers* treated with drugs that are metabolised by these enzymes are at increased risk of prolonged therapeutic effect or toxicity due to increased trough levels of therapeutic drugs.

Some anti-psychotic and SSRI medications can be contraindicated in intermediate *CYP2D6* metabolisers due to increased risk of adverse effects and so alternative agents must be prescribed.

CYP2D6 ultrarapid metabolisers treated with codeine may exhibit symptoms such as extreme sleepiness, confusion or shallow breathing; the lowest possible dose should be prescribed to these patients. Meanwhile, patients who are *CYP2D6 poor metabolisers* may not achieve sufficient pain control due to their inability to convert the drug to its active form, morphine (Crews *et al.* 2021).

CYP2C19 ultrarapid metabolisers should be prescribed alternative therapeutic agents other than benzodiazepines, such as citalopram (Celexa), escitalopram (Lexapro), and TCAs such as imipramine (Tofranil) and clomipramine (Anafranil), due to possible decreases in the efficacy of these medications.

Conclusion

The incorporation of genetic information obtained from pharmacogenetic testing holds substantial promise for improving therapeutic decision-making through enhanced efficacy and reduced adverse events. Considerations for clinical implementation, such as optimal laboratory workflows, electronic health record integration, and stakeholder engagement, as well as provider education, are crucial to patient health.

CNSDose® *(Comprehensive+)* for Mental Health Treatment

- **174 medications** across **19 genes** and multiple therapeutic areas
- Enhanced guidance for **antidepressants, antipsychotics, anxiolytics, ADHD and dementia** medications, and other psychotropics
- **User-friendly report** developed by psychiatrists
- Actionable insights for a lifetime

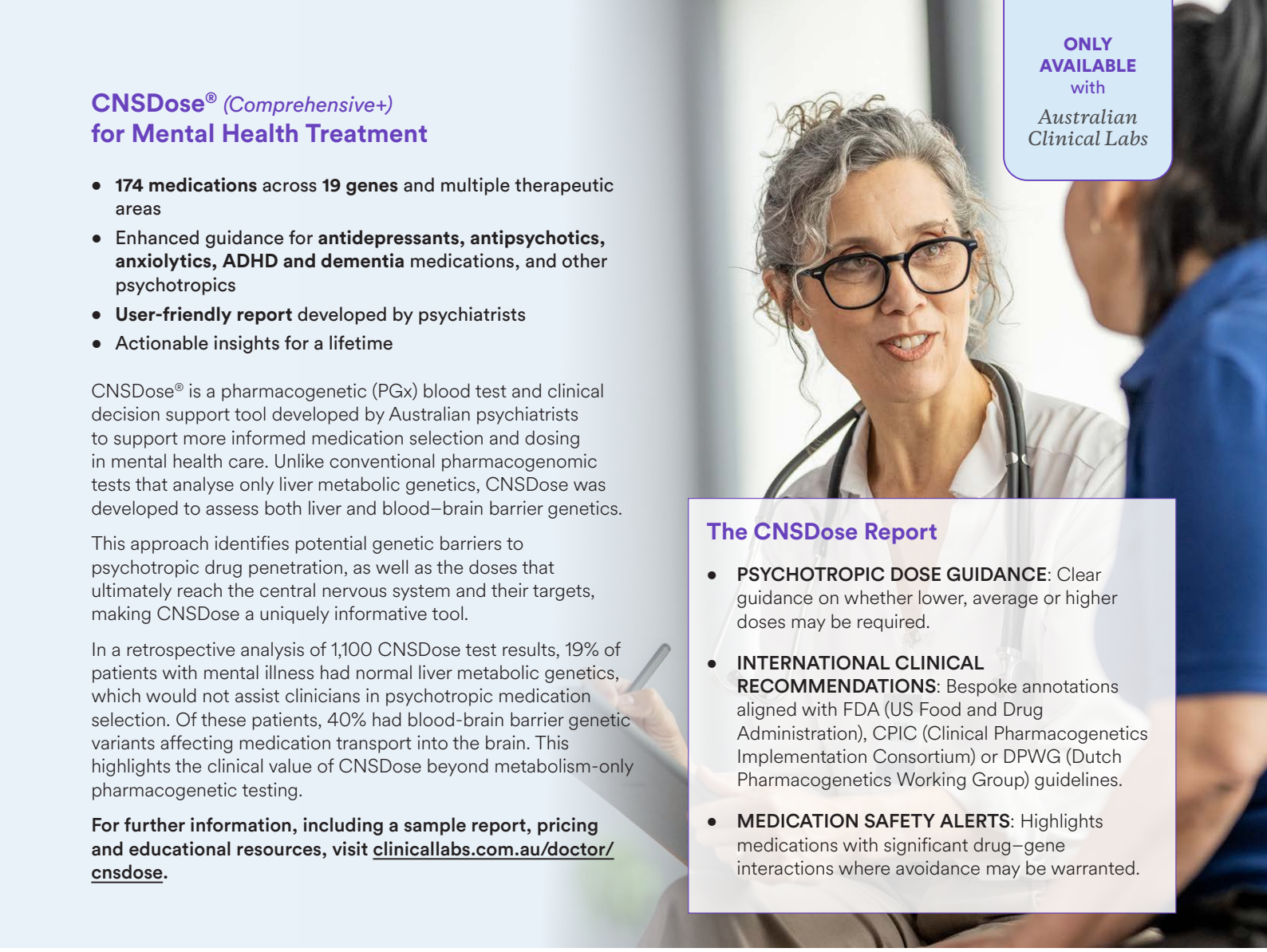
CNSDose® is a pharmacogenetic (PGx) blood test and clinical decision support tool developed by Australian psychiatrists to support more informed medication selection and dosing in mental health care. Unlike conventional pharmacogenomic tests that analyse only liver metabolic genetics, CNSDose was developed to assess both liver and blood–brain barrier genetics.

This approach identifies potential genetic barriers to psychotropic drug penetration, as well as the doses that ultimately reach the central nervous system and their targets, making CNSDose a uniquely informative tool.

In a retrospective analysis of 1,100 CNSDose test results, 19% of patients with mental illness had normal liver metabolic genetics, which would not assist clinicians in psychotropic medication selection. Of these patients, 40% had blood-brain barrier genetic variants affecting medication transport into the brain. This highlights the clinical value of CNSDose beyond metabolism-only pharmacogenetic testing.

For further information, including a sample report, pricing and educational resources, visit clinicallabs.com.au/doctor/cnsdose.

ONLY AVAILABLE with *Australian Clinical Labs*



The CNSDose Report

- **PSYCHOTROPIC DOSE GUIDANCE**: Clear guidance on whether lower, average or higher doses may be required.
- **INTERNATIONAL CLINICAL RECOMMENDATIONS**: Bespoke annotations aligned with FDA (US Food and Drug Administration), CPIC (Clinical Pharmacogenetics Implementation Consortium) or DPWG (Dutch Pharmacogenetics Working Group) guidelines.
- **MEDICATION SAFETY ALERTS**: Highlights medications with significant drug–gene interactions where avoidance may be warranted.

PGx Testing at Clinical Labs

Comprehensive PGx	CNSDose (Comprehensive+) PGx
• 8 genes analysed • 97 medications covered • Avoidance and cautionary recommendations in line with FDA, CPIC or DPWG guidelines • Prescribing guidance across mental health, cardiology, oncology, pain management, gastroenterology and other clinical areas using liver metabolism genetics	• 19 genes analysed • 174 medications covered • Avoidance and cautionary recommendations in line with FDA, CPIC or DPWG guidelines • Prescribing guidance across mental health, cardiology, oncology, pain management, gastroenterology and other clinical areas using liver metabolism and blood-brain barrier genetics • **Dose predictions (low, average, high) for psychotropic medications**
Smaller Individual PGx Panels*	**Single Gene PGx Tests***
• Statins Predictor: *SLCO1B1* • Warfarin Panel: *CYP2C9* and *VKORC1* • Organ Transplant (Tacrolimus Immunosuppressant) PGx: *CYP3A5* • PPIs PGx: *CYP2C19* • Tamoxifen Predictor: *CYP2D6* • Clopidogrel Predictor: *CYP2C19* • Voriconazole Predictor: *CYP2C19* • Anti-Psychotics Predictor: *CYP2D6* • Anti-Depressants Predictor: *CYP2D6* and *CYP2C19*	• *TPMT (Medicare rebate available for eligible patients)* • *DPYD (Medicare rebate available for eligible patients)* • *UGT1A1*

** Report for smaller and single PGx gene panels: You will receive an individual report indicating the genotype and predicted phenotypes for the ordered smaller gene panel or single gene(s), including metaboliser status and guideline recommendations where applicable.*

Table 1. Clinical Labs Pharmacogenetic (PGx) Testing Medication List

COMPREHENSIVE

COMPREHENSIVE+ (CNSDOSE)

MEDICATION	GENE(S) INVOLVED		
PSYCHOTROPICS			
ANTI-ADHD			
Atomoxetine	*CYP2D6*	✓	✓
Clonidine	Multi-gene algorithm		✓
Dextroamphetamine	Multi-gene algorithm		✓
Guanfacine	Multi-gene algorithm		✓
Lisdexamfetamine	Multi-gene algorithm		✓
Methylphenidate	Multi-gene algorithm		✓
Modafinil	Multi-gene algorithm		✓
Viloxazine	*CYP2D6*	✓	✓
ANTI-DEMENTIA			
Donepezil	*CYP2D6*	✓	✓
ANTIDEPRESSANTS			
Agomelatine	Multi-gene algorithm		✓
Amitriptyline	*CYP2C19, CYP2D6*	✓	✓
Bupropion	Multi-gene algorithm		✓
Citalopram	*CYP2C19*	✓	✓
Clomipramine	*CYP2C19, CYP2D6*	✓	✓
Desipramine	*CYP2C19, CYP2D6*	✓	✓
Desvenlafaxine	Multi-gene algorithm		✓
Dothiepin	Multi-gene algorithm		✓
Doxepin	*CYP2D6*	✓	✓
Duloxetine	Multi-gene algorithm		✓
Escitalopram	CYP2C19	✓	✓
Fluoxetine	Multi-gene algorithm		✓
Fluvoxamine	*CYP2D6*	✓	✓
Imipramine	*CYP2C19, CYP2D6*	✓	✓
Levomilnacipran	Multi-gene algorithm		✓
Mianserin	Multi-gene algorithm		✓
Milnacipran	Multi-gene algorithm		✓
Mirtazapine	Multi-gene algorithm		✓
Moclobemide	Multi-gene algorithm		✓
Nortriptyline	*CYP2D6*	✓	✓
Paroxetine	*CYP2D6*	✓	✓
Protriptyline	*CYP2D6*	✓	✓
Reboxetine	Multi-gene algorithm		✓
Sertraline	*CYP2C19, CYP2B6*	✓	✓
Trazodone	Multi-gene algorithm		✓
Trimipramine	*CYP2C19, CYP2D6*	✓	✓
Venlafaxine	*CYP2D6*	✓	✓
Vilazodone	Multi-gene algorithm		✓
Vortioxetine	*CYP2D6*	✓	✓
ANTIPSYCHOTICS			
Amisulpride	Multi-gene algorithm		✓
Aripiprazole	*CYP2D6*	✓	✓
Asenapine	Multi-gene algorithm		✓
Brexpiprazole	*CYP2D6*	✓	✓
Cariprazine	Multi-gene algorithm		✓

MEDICATION	GENE(S) INVOLVED		
Chlorpromazine	Multi-gene algorithm		✓
Clozapine	Multi-gene algorithm		✓
Haloperidol	*CYP2D6*	✓	✓
Iloperidone	*CYP2D6*	✓	✓
Lurasidone	Multi-gene algorithm		✓
Olanzapine	Multi-gene algorithm		✓
Paliperidone	Multi-gene algorithm		✓
Perphenazine	*CYP2D6*	✓	✓
Pimozide	*CYP2D6*	✓	✓
Quetiapine	*CYP3A4*	✓	✓
Risperidone	*CYP2D6*	✓	✓
Thioridazine	*CYP2C9*	✓	✓
Ziprasidone	Multi-gene algorithm		✓
Zuclopenthixol	*CYP2D6*	✓	✓
ANXIOLYTICS & HYPNOTICS			
Alprazolam	Multi-gene algorithm		✓
Bromazepam	Multi-gene algorithm		✓
Buspirone	Multi-gene algorithm		✓
Clobazam	*CYP2C19*	✓	✓
Clonazepam	Multi-gene algorithm		✓
Diazepam	*CYP2C19*	✓	✓
Diphenhydramine	Multi-gene algorithm		✓
Flunitrazepam	Multi-gene algorithm		✓
Melatonin	Multi-gene algorithm		✓
Midazolam	Multi-gene algorithm		✓
Nitrazepam	Multi-gene algorithm		✓
Propranolol	*CYP2D6*	✓	✓
Suvorexant	Multi-gene algorithm		✓
Temazepam	Multi-gene algorithm		✓
Zolpidem	Multi-gene algorithm		✓
Zopiclone	Multi-gene algorithm		✓
MOOD STABILISERS/ANTICONVULSANTS			
Brivaracetam	*CYP2C19*	✓	✓
Carbamazepine	Multi-gene algorithm		✓
Lamotrigine	Multi-gene algorithm		✓
Oxcarbazepine	Multi-gene algorithm		✓
Perampanel	Multi-gene algorithm		✓
Phenytoin	*CYP2C9*	✓	✓
Rufinamide	Multi-gene algorithm		✓
Topiramate	Multi-gene algorithm		✓
Valproic Acid	Multi-gene algorithm		✓
OTHER PSYCHOTROPICS			
Amphetamine	*CYP2D6*	✓	✓
Bromocriptine	Multi-gene algorithm		✓
Cabergoline	Multi-gene algorithm		✓
Dapoxetine	Multi-gene algorithm		✓
Deutetrabenazine	*CYP2D6*	✓	✓
Disulfiram	Multi-gene algorithm		✓

MEDICATION	GENE(S) INVOLVED		
Galantamine	*CYP2D6*	✓	✓
Naloxone	Multi-gene algorithm		✓
Naltrexone	Multi-gene algorithm		✓
Nicotine	Multi-gene algorithm		✓
Rasagiline	Multi-gene algorithm		✓
Ropinirole	Multi-gene algorithm		✓
Rotigotine	Multi-gene algorithm		✓
Selegiline	Multi-gene algorithm		✓
NON-PSYCHOTROPICS			
ANTIARRHYTHMICS			
Flecainide	*CYP2D6*	✓	✓
Propafenone	*CYP2D6*	✓	✓
ANTICOAGULANTS			
Acenocoumarol	*CYP2C9, VKORC1*	✓	✓
Warfarin	*CYP2C9, VKORC1*	✓	✓
ANTIDIABETIC			
Nateglinide	*CYP2C9*	✓	✓
ANTIFUNGALS			
Flucytosine	*DPYD*		✓
Voriconazole	*CYP2C19*	✓	✓
ANTI-NAUSEA			
Dronabinol	*CYP2C9*	✓	✓
Metoclopramide	*CYP2D6*	✓	✓
Ondansetron	*CYP2D6*	✓	✓
Tropisetron	*CYP2D6*	✓	✓
ANTIPLATELET			
Clopidogrel	*CYP2C19*	✓	✓
ANTIVIRALS			
Atazanavir	*UGT1A1*		✓
Dolutegravir	*UGT1A1*		✓
Efavirenz	*CYP2B6*		✓
Raltegravir	*UGT1A1*		✓
BETA BLOCKERS			
Carvedilol	*CYP2D6*	✓	✓
Metoprolol	*CYP2D6*	✓	✓
Nebivolol	*CYP2D6*	✓	✓
IMMUNOSUPPRESSANTS			
Azathioprine	*TPMT, NUDT15*		✓
Tacrolimus	*CYP3A5*	✓	✓
NSAIDS			
Celecoxib	*CYP2C9*	✓	✓
Flurbiprofen	*CYP2C9*	✓	✓
Ibuprofen	*CYP2C9*	✓	✓
Lornoxicam	*CYP2C9*	✓	✓
Meloxicam	*CYP2C9*	✓	✓
Piroxicam	*CYP2C9*	✓	✓
Tenoxicam	*CYP2C9*	✓	✓
ONCOLOGY/ANTINEOPLASTIC			
Belinostat	*UGT1A1*		✓
Belzutifan	*CYP2C19*	✓	✓
Capecitabine	*DPYD*		✓
Erdafitinib	*CYP2C9*	✓	✓

MEDICATION	GENE(S) INVOLVED		
Fluorouracil	*DPYD*		✓
Gefitinib	*CYP2D6*	✓	✓
Irinotecan	*UGT1A1*		✓
Mercaptopurine	*TPMT, NUDT15*		✓
Nilotinib	*UGT1A1*		✓
Sacituzumab Govitecan	*UGT1A1*		✓
Tamoxifen	*CYP2D6*	✓	✓
Tegafur	*DPYD*		✓
Thioguanine	*TPMT, NUDT15*		✓
OPIOID ANALGESIC			
Codeine	*CYP2D6*	✓	✓
Hydrocodone	*CYP2D6*	✓	✓
Oliceridine	*CYP2D6*	✓	✓
Tramadol	*CYP2D6*	✓	✓
PROTON PUMP INHIBITORS			
Dexlansoprazole	*CYP2C19*	✓	✓
Esomeprazole	*CYP2C19*	✓	✓
Lansoprazole	*CYP2C19*	✓	✓
Omeprazole	*CYP2C19*	✓	✓
Pantoprazole	*CYP2C19*	✓	✓
Rabeprazole	*CYP2C19*	✓	✓
STATINS			
Atorvastatin	*SLCO1B1*	✓	✓
Fluvastatin	*CYP2C9, SLCO1B1*	✓	✓
Lovastatin	*SLCO1B1*	✓	✓
Pitavastatin	*SLCO1B1*	✓	✓
Pravastatin	*SLCO1B1*	✓	✓
Rosuvastatin	*SLCO1B1, ABCG2*	✓	✓
Simvastatin	*SLCO1B1*	✓	✓
OTHERS			
Abrocitinib	*CYP2C19*	✓	✓
Allopurinol	*ABCG2*		✓
Avatrombopag	*CYP2C9*	✓	✓
Carisoprodol	*CYP2C19*	✓	✓
Cevimeline	*CYP2D6*	✓	✓
Elagolix	*SLCO1B1*	✓	✓
Eliglustat	*CYP2D6*	✓	✓
Fesoterodine	*CYP2D6*	✓	✓
Flibanserin	*CYP2C19*	✓	✓
Lofexidine	*CYP2D6*	✓	✓
Mavacamten	*CYP2C19*	✓	✓
Meclizine	*CYP2D6*	✓	✓
Mirabegron	*CYP2D6*	✓	✓
Pazopanib	*UGT1A1*		✓
Pitolisant	*CYP2D6*	✓	✓
Siponimod	*CYP2C9*	✓	✓
Tamsulosin	*CYP2D6*	✓	✓
Tetrabenazine	*CYP2D6*	✓	✓
Tolterodine	*CYP2D6*	✓	✓
Valbenazine	*CYP2D6*	✓	✓

How to Order Pharmacogenetic (PGx) Testing at Clinical Labs

Request Form Instructions: Before commencing therapy, or in cases of adverse reaction or resistance.

How to order: Fill out our routine Clinical Labs testing request form. List the gene(s) or group of genes required, and prescribed medications if available. ***Please note: CNSDose is only available through Australian Clinical Labs***.

Collection locations: Patients can visit any of our convenient locations for their blood test. For locations, please visit clinicallabs.com.au/location.

Turnaround time: Please see our website for current turnaround times for each PGx panel.

Specimen required: 2x EDTA blood samples.

Report for smaller and single PGx gene panels:* You will receive an individual report indicating the genotype and predicted phenotypes for the ordered smaller gene panel or single gene(s), including metaboliser status and guideline recommendations where applicable.

Test cost: Apart from the *TPMT and DPYD genes*, Clinical Labs' PGx gene panels are non-Medicare rebatable (an out-of-pocket fee applies). For more information, including pricing, visit clinicallabs.com.au/pharmacogenetictesting.

Please note: depending on the PGx panel(s) ordered, testing may be performed and reported in collaboration with an external provider.

For more information about PGx testing options available at Clinical Labs, scan the QR code or visit clinicallabs.com.au/pharmacogenetictesting.

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Associate Professor Mirette Saad is a Consultant Chemical Pathologist and the National Director of Molecular Genetics at Australian Clinical Labs. At Clinical Labs, A/Prof Mirette Saad leads the Molecular Genetic testing for non-invasive prenatal testing (NIPT), antenatal screening, personalised drug therapy and cancer. She is a Chair of the RCPA Chemical Pathology Advisory Committee, Member of the RCPA Genetic Advisory Committee, AACB and a Chair of the Precision Medicine Services at Australian Clinical Labs.

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