PERSONAL DETAILS	
PATIENT	Caroline Smith
DOB	
GENDER	Female
SPECIMEN TYPE	Saliva
ORDERING PHYSICIAN	

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LABORATORY INFORMATION	
ACCESSION NUMBER	1500123456
COLLECTION DATE	
RECEIVED DATE	February 7, 2022
REPORT GENERATED	
LABORATORY DIRECTOR	Dr Ahmed El-Sohemy

Current Patient Medication

This patient is either not receiving any medication or may be receiving medications that are outside the scope of this report.

Examples of different levels of evidence for PGx SNPs

Gene	Marker	Level of Evidence	Drugs
TPMT	rs1142345	1A	Azathioprine, Mercaptopurine, Thioguanine
DPYD	rs3918290	1A	Fluorouracil, Capecitabine, Tegafur, Pyrimidine analogues
CYP2D6	rs16947	1A	Amitriptyline, Codeine, Nortriptyline, Paroxetine
VKORC1	rs9923231	1A	Warfarin
SLCO1B1	rs4149056	1A	Simvastatin
CYP2D6	rs16947	1B	Tramadol
VKORC1	rs9923231	1B	Acenocoumarol
NAT2	rs1801280	2A	Isoniazid
CYP2D6	rs16947	2A	Flecainide, Doxepin, Desipramine, Atomoxetine, Risperidone, Clomipramine, Imipramine, Venlafaxine
SLCO1B1	rs4149056	2A	Cerivastatin, Pravastatin, Rosuvastatin
ABCB1	rs1045642	2A	Digoxin, Nevirapine, Methotrexate
UGT1A8	rs1042597	3	Cyclosporine, Mycophenolate mofetil, Sirolimus, Tacrolimus
ADH1B	rs1229984	3	Ethanol
CYP2D6	rs16947	3	Timolol, Carvedilol, Haloperidol, Aripiprazole, Metoprolol, Citalopram, Escitalopram, Tamoxifen
VKORC1	rs9923231	3	Phenprocoumon
SLCO1B1	rs4149056	3	Repaglinide, Irinotecan, Mycophenolate mofetil, Atorvastatin, Methotrexate, Olmesartan
ABCB1	rs1045642	3	Paclitaxel, Phenytoin, Fluorouracil, Dicloxacillin, Capecitabine, Nortriptyline, Oxaliplatin, Verapamil, Fexofenadine, Atorvastatin, Simvastatin, Sirolimus, Talinolol, Tamoxifen, Morphine, Efavirenz, Vincristine, Imatinib, Olanzapine, Risperidone, Cyclosporine, Tacrolimus, Atazanavir, Phenobarbital, Codeine, Clopidogrel, Etoposide, Oxaliplatin
CYP2D6	rs16947	4	Methylphenidate, Bufuralol
SLCO1B1	rs4149056	4	Lopinavir, Atrasentan
ABCB1	rs1045642	4	Carbamazepine

Level 1A Annotation for a variant-drug combination in a CPIC or medical society-endorsed PGx guideline, or implemented at a PGRN site or in another major health system.

Level 1B Annotation for a variant-drug combination where the preponderance of evidence shows an association. The association must be replicated in more than one cohort with significant p-values, and preferably will have a strong effect size.

Level 2A Annotation for a variant-drug combination that qualifies for level 2A where the variant is within a VIP (Very Important Pharmacogene) as defined by PharmGKB. The variants in level 2A are in known pharmacogenes, so functional significance is more likely.

Level 2B Annotation for a variant-drug combination with moderate evidence of an association. The association must be replicated but there may be some studies that do not show statistical significance, and/or the effect size may be small.

Level 3 Annotation for a variant-drug combination based on a single significant (not yet replicated) or annotation for a variant-drug combination evaluated in multiple studies but lacking clear evidence of an association.

Level 4 Annotation based on a case report, non-significant study or in vitro, molecular or functional assay evidence only.

MEDICATION HISTORY

MEDICATIONS THAT HAVE BEEN PROBLEMATIC
N/A

DRUG ALLERGIES
NKDA

BRIEF MEDICAL HISTORY
None

GENOTYPE/HAPLOTYPE/PHENOTYPE DETAIL

Gene	Genotype-Haplotype	Phenotype
CYP1A1	*1/*1	Extensive metabolizer
CYP1A2	*1F/*1B	Extensive metabolizer
CYP2A6	*1A/*1A	Extensive metabolizer
CYP2B6	*9/*9 or *9/*6 or *6/*6	Intermediate metabolizer
CYP2C8	*1/*1	Extensive metabolizer
CYP2C9	*1/*1	Extensive metabolizer
CYP2C19	*1/*1	Extensive metabolizer
CYP2D6	*1/*1	Extensive metabolizer
CYP2E1	*1/*1	Extensive metabolizer
CYP3A4	*1A/*1A	Extensive metabolizer
CYP3A5	***3A/*3A**	**Poor metabolizer**
CYP4F2	*1/*1	Extensive metabolizer
VKORC1	**H2/H7**	**Warfarin resistance**
SLC15A2	*409S/*409S	Low function
SLC22A1	***408V/*408V**	**Low function**
SLC22A2	*270A/*270A	Extensive function
SLC22A6	*1/*1	Extensive function
SLCO1B1	*1A/*1A	Extensive function
SLCO1B3	*233I/*233I	Low function
SLCO2B1	*1/*1	Extensive function
ABCB1	*1/*2	Intermediate function
ABCC2	*1/*1324I	Intermediate function
ABCG2	*1/*1	Extensive function
ADH1B	***2/*2**	**Ultrarapid metabolizer**
SULT1A1	*1/*1	Extensive metabolizer
EPHX1	***113His/*139Arg**	**Ultrarapid metabolizer**
NAT1	*1/*1	Extensive acetylator
NAT2	***6A/*6A**	**Poor acetylator**
TPMT	*1/*1	Extensive metabolizer
GSTP1	*1A/*1B	Intermediate metabolizer
BCHE	*1/*1	Extensive function
UGT1A1	***80/*60**	**Poor metabolizer**
UGT1A4	*1/*1	Extensive metabolizer
UGT1A6	*1/*1	Extensive metabolizer
UGT1A8	*1/*1	Extensive metabolizer
UGT2B7	*2b/*2b	Intermediate metabolizer
DPYD	*12/*12	Extensive metabolizer
OPRM1	*1/*2	Intermediate sensitivity to Opioids
NUDT15	*1/*1	Thiopurines resistance

Disclaimer: No patient should evaluate or use the information contained herein without the advice, consultation and supervision of a licensed healthcare professional such as a pharmacist or physician. Laboratory-developed testing characteristics and protocols. Results have not been reviewed or approved by the U.S. Food & Drug Administration (FDA).

Methodology: Array based assays detect listed alleles, including all common and most rare variants with known clinical significance at analytical sensitivity and specificity >99%. Array based assays detect listed alleles, including all common and most rare variants with known clinical significance at analytical sensitivity and specificity >99%.

Limitations: Testing cannot detect all genetic mutations, inactive or altered genes. The absence of a finding of a detectable gene, polymorphism or mutation does not necessarily indicate patient possesses intermediate or high sensitivity phenotypes or that patient has an undetected polymorphism. Absence of finding may be due to drug-drug interaction.

PHARMACOGENOMICS

Genetic Markers Tested for Pharmacogenomics:

Results are arranged by drug response. Each individual report contains six sections, including: Patient's current medication (if any), Medication history, genotype/haplotype/phenotype detail, PGx report, Genomic Test Results, and Patient Information Card. Inclusion of the PGx Report indicates that the tested individual: displays decreased efficacy to the drug (light green dots), should use the drug as directed (green dots), or exhibits increased toxicity to the drug (red dots). Inclusion of Genomic Test Results indicates genotype, haplotype, phenotype, or presence of mutation.

Organization of Table:

1. Gene/Locus refers to gene or intergenic region of genetic marker location.

2. Marker refers to the tested marker's unique identifier.

3. Genotype/Haplotype refers to the particular marker's combination of nucleotides. The letter(s) on either side of the slash refer(s) to the two (2) copies of the patient DNA. Del and dashes denotes nucleotide indels in patient DNA. Empty cells indicate an absence of genotyping results.

4. Phenotype refers to the CYP specific drug metabolizing capabilities of an individual.

See RISKS AND LIMITATIONS on the last pages of this Report.

PGx Report - Pain Management

Type: Anti-inflammatory Agent, Analgesic, Antipyretic

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
The Nonsteroidal Antiinflammatory Drugs (NSAIDs)						
Acetic acid derivatives	Diclofenac	UGT2B7	CYP2C9, UGT1A3, UGT1A9, CYP2E1, CYP3A4		✓	
	Nabumetone	CYP1A2	CYP2C19, CYP3A4		✓	
	Indomethacin	CYP2C9	CYP2C19		✓	
Enolic acid (Oxicam) derivatives	Meloxicam	CYP2C9	CYP1A2, CYP3A4, CYP3A5		✓	
	Piroxicam	CYP2C9	CYP3A4, CYP3A5		✓	
	Tenoxicam	CYP2C9			✓	
	Lornoxicam	CYP2C9			✓	
Selective COX-2 inhibitors (Coxibs)	Etoricoxib	CYP3A4	CYP3A5, CYP2C9, CYP2D6, CYP1A2		✓	
	Parecoxib	CYP2C9	CYP3A4, CYP3A5		✓	
	Celecoxib	CYP2C9	CYP2C19		✓	
Propionic acid derivatives	Ibuprofen	CYP2C9	CYP2C19, CYP2C8, UGT1A3, UGT1A9, UGT2B7		✓	
	Flurbiprofen	CYP2C9			✓	
	Ketoprofen	CYP3A4	CYP2C9, CYP3A5, UGT1A6, UGT1A9, UGT2B7		✓	
	Fenoprofen	CYP2C9	UGT2B7		✓	
	Vicoprofen	CYP2D6	CYP3A4		✓	
	Naproxen	CYP2C9	CYP1A2, CYP2C8, UGT2B7, SULT1A1, UGT1A3, UGT1A6, UGT1A9		✓	
Anthranilic acid derivatives (Fenamates)	Mefenamic acid	CYP2C9			✓	
The Non-NSAIDs Analgesic	Acetaminophen	UGT1A1, UGT1A6, UGT1A9, SULT1A1, GSHs	CYP2E1, CYP3A4, CYP3A5, CYP2D6, CYP1A2, ABCG2			✓

PGx Report - Pain Management

Type: Opioid

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Opioid Analgesics						
Opium alkaloids	Morphine	UGT2B7	ABCB1, ABCC3, UGT1A1, UGT1A8, OPRM1, COMT			●
	Codeine	CYP2D6	CYP3A4, UGT2B7, UGT2B4, FMO3, CYP3A5, OPRM1		●	
Esters of morphine	Diacetylmorphine (Heroin)	CES1	CES2, BCHE, OPRM1		●	
Ethers of morphine	Dihydrocodeine	CYP3A4	CYP2D6, CYP3A5		●	
	Ethylmorphine	CYP2D6	CYP3A4, CYP3A5		●	
Semi-synthetic alkaloid derivatives	Hydrocodone	CYP2D6	CYP3A4, CYP3A5, OPRM1		●	
	Hydromorphone	UGT2B7				●
	Oxycodone	CYP3A4	CYP3A5, CYP2D6, ABCB1, UGT2B7, COMT			●
	Oxymorphone	UGT2B7				●
Synthetic opioids						
Anilidopiperidine derivatives	Alfentanyl	CYP3A4	CYP3A5, ABCB1, OPRM1			●
	Fentanyl	CYP3A4	CYP3A5, ABCB1, OPRM1		●	
	Sufentanil	CYP3A4	CYP3A5, OPRM1			●
Phenylpiperidine derivatives	Meperidine	CYP2B6	CYP3A4, CYP2C19, CYP3A5, UGT1A4			●
	Ketobemidone	CYP2C9	CYP3A4, CYP3A5		●	
Diphenylpropylamine derivatives	Dextropropoxyphene	CYP3A4	CYP3A5, Renal Excretion		●	
	Levacetylmethadol	CYP3A4	CYP3A5		●	
	Loperamide	CYP3A4	CYP2C8, CYP3A5		●	
	Methadone	CYP3A4	CYP2B6, CYP2D6, CYP3A5, ABCB1, UGT2B7, COMT		●	
Oripavine derivatives	Buprenorphine	CYP3A4	CYP3A5, CYP2C8, UGT1A1, UGT1A3, UGT2B7			●
Morphinan derivatives	Dextromethorphan	CYP2D6	CYP3A4, CYP3A5		●	
Others	Tramadol	CYP2D6	CYP3A4, CYP2B6, CYP3A5, OPRM1, SLC22A1, COMT			●
	Tapentadol	CYP2C9	CYP2C19, CYP2D6		●	
	Tilidine	CYP3A4	CYP2C19, CYP3A5		●	
Anti-opioid	Methylnaltrexone	CYP2D6	CYP3A4, CYP3A5		●	
	Naloxone	UGT2B7	UGT1A3			●
	Naltrexone	UGT2B7	UGT1A1, UGT1A3, OPRM1			●

PGx Report - Pain Management

Type: Drugs Prescribed for the Treatment of Gout, Antirheumatic

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Drugs Prescribed for Gout						
Uricosurics	Sulfinpyrazone	CYP2C9	CYP3A4, CYP3A5		●	
Mitotic inhibitors	Colchicine	CYP3A4	CYP3A5		●	
Xanthine oxidase inhibitors	Febuxostat	CYP1A2, CYP2C8	CYP2C9, UGT1A1, UGT1A3, UGT1A9, UGT2B7		●	
	Allopurinol	AOX1	Renal Excretion, HLA-B*5801		●	
	Oxypurinol	Renal Excretion			●	
Recombinant urate oxidase	Rasburicase		G6PD, CYB5R1, CYB5R2, CYB5R3, CYB5R4		●	
DMARDs	Leflunomide	CYP1A2			●	
Anti-inflammatory	Tofacitinib	CYP3A4	CYP2C19, CYP3A5		●	

Abbreviations: DMARDs, Disease-modifying antirheumatic drugs; RE, renal excretion (unchanged drug).

Additional SNPs of Importance for Pain Management

Gene	Marker	Genotype	Drug	Level of Evidence	Results
OPRM1	rs1799971	AG	Naloxone	2B	Patients may have increased peak cortisol response
OPRM1	rs1799971	AG	Morphine	2B	Pain patients may experience increased efficacy of opioids and may be less susceptible to opioid addiction, and may require a decreased dose of opioids
OPRM1	rs1799971	AG	Alfentanil	2B	Pain patients may experience increased efficacy of opioids and may be less susceptible to opioid addiction, and may require a decreased dose of opioids
OPRM1	rs1799971	AG	Fentanyl	2B	Pain patients may experience increased efficacy of opioids and may be less susceptible to opioid addiction, and may require a decreased dose of opioids
OPRM1	rs1799971	AG	Tramadol	2B	Pain patients may experience increased efficacy of opioids and may be less susceptible to opioid addiction, and may require a decreased dose of opioids
OPRM1	rs1799971	AG	Hydrocodone	3	Patients may have an increased risk for experiencing side effects, including constipation, dry mouth or respiratory depression
COMT	rs4680	GG	Paroxetine	3	Patients may require a higher dose

PGx Report - Modulation of Cardiovascular Function

Type: Antiarrhythmic

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antiarrhythmic class Ia	Quinidine	CYP3A4, CYP2D6	CYP2E1, CYP3A5, CYP2C9, CYP2C8		✓	
	Procainamide	CYP2D6	NAT2		✓	
	Sparteine	CYP2D6			✓	
	Disopyramide	CYP3A4	CYP3A5, CYP1A2, CYP2C19		✓	
Antiarrhythmic class Ib	Phenytoin	CYP2C19	CYP2C9, CYP3A4, CYP3A5, CYP2D6, ABCB1, EPHX1, HLA-B*1502		✓	
	Tocainide	UGTs			✓	
	Lidocaine	CYP1A2	CYP3A4, CYP3A5		✓	
	Mexiletine	CYP2D6	CYP1A2		✓	
Antiarrhythmic class Ic	Propafenone	CYP2D6	CYP3A4, CYP1A2, CYP3A5		✓	
	Flecainide	CYP2D6			✓	
	Encainide	CYP2D6			✓	
Antiarrhythmic class II	Carvedilol	CYP2D6	UGT1A1, UGT2B4, CYP2C9		✓	
	Bisoprolol	CYP2D6	CYP3A4, CYP3A5		✓	
	Metoprolol	CYP2D6	CYP3A4, CYP3A5		✓	
	Propranolol	CYP2D6	CYP1A2, CYP2C19, CYP3A4, CYP3A5, UGT1A9		✓	
Antiarrhythmic class III	Amiodarone	CYP3A4	CYP2C8, CYP3A5		✓	
	Dronedarone	CYP3A4	CYP3A5		✓	
	Dofetilide	Renal Excretion	CYP3A4, CYP3A5		✓	
Antiarrhythmic class IV	Diltiazem	CYP3A4	CYP2C19, CYP3A5		✓	
	Verapamil	CYP3A4	CYP2C8, CYP3A5, ABCB1		✓	

PGx Report - Modulation of Cardiovascular Function

Type: Antihypertensive I

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antihypertensives						
Angiotensin II receptor antagonist	Losartan	CYP2C9	CYP3A4, CYP3A5, UGT1A1, UGT1A3		✓	
	Azilsartan	CYP2C9			✓	
	Irbesartan	CYP2C9			✓	
	Telmisartan	Biliary Excretion	UGT1A1		✓	
	Olmesartan	Hydrolysis	Renal Excretion, SLCO1B1		✓	
	Valsartan	CYP2C9			✓	
Angiotensin-Converting Enzyme Inhibitors	Captopril	Renal Excretion	CYP2D6		✓	
	Enalapril	CES1, Renal Excretion	CYP3A4, CYP3A5		✓	
	Trandolapril	CES1	CYP2D6, CYP2C9, Renal Excretion		✓	
Renin inhibitors	Aliskiren	CYP3A4	CYP3A5, ABCB1			◔
Aldosterone Antagonists	Eplerenone	CYP3A4	CYP3A5		✓	
Loop diuretic	Torasemide	CYP2C9	CYP2C8, Renal Excretion		✓	
Potassium-sparing diuretic	Triamterene	CYP1A2			✓	
Vasopressin receptor antagonists	Tolvaptan	CYP3A4	CYP3A5		✓	
Adrenergic release inhibitors	Debrisoquine	CYP2D6			✓	
Peripheral Adrenergic Inhibitors	Reserpine	CYP2D6			✓	
Beta-1 cardioselective beta-blockers	Metoprolol	CYP2D6	CYP3A4, CYP3A5		✓	
	Bisoprolol	CYP2D6	CYP3A4, CYP3A5		✓	
	Nebivolol	CYP2D6			✓	

PGx Report - Modulation of Cardiovascular Function

Type: Antihypertensive II

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antihypertensives						
Nonselective beta-blockers	Timolol	CYP2D6			✓	
	Propranolol	CYP2D6	CYP1A2, CYP2C19, CYP3A4, CYP3A5, UGT1A9		✓	
Beta-blockers with alpha activity	Carvedilol	CYP2D6	UGT1A1, UGT2B4, CYP2C9		✓	
	Labetalol	CYP2D6	CYP2C19, ABCB1, UGT1A1, UGT1A9, UGT2B7		✓	
Alpha blockers	Terazosin	CYP3A4	CYP3A5		✓	
	Doxazosin	CYP2D6	CYP2C19, CYP3A4, CYP3A5		✓	
α-2 adrenergic agonist	Clonidine	CYP2D6	CYP1A2, CYP3A4, CYP3A5		✓	
	Tizanidine	CYP1A2			✓	
Antihypertensives Calcium channel blockers						
Dihydropyridine	Amlodipine	CYP3A4	CYP3A5		✓	
	Nifedipine	CYP3A4	CYP1A2, CYP2A6, CYP3A5		✓	
	Nimodipine	CYP3A4	CYP3A5		✓	
	Nicardipine	CYP2C8	CYP2D6, CYP3A4, CYP3A5		✓	
Benzothiazepine	Diltiazem	CYP3A4	CYP2C19, CYP3A5		✓	
Phenylalkylamine	Verapamil	CYP3A4	CYP2C8, CYP3A5, ABCB1		✓	
Nonselective	Bepridil	CYP3A4	CYP3A5		✓	
Anti-pulmonary arterial hypertension						
ERA-Dual antagonists	Bosentan	CYP2C9	CYP3A4, CYP3A5, SLCO1B3		✓	
	Macitentan	CYP3A4	CYP2C19, CYP3A5		✓	
Phosphodiesterase inhibitors	Sildenafil	CYP3A4	CYP2C9, CYP3A5		✓	
	Tadalafil	CYP3A4	CYP3A5		✓	
Abbreviations: ERA, endothelin receptor antagonist.						

PGx Report - Modulation of Cardiovascular Function

Type: Cardiac stimulant, Vasodilator, Drugs Prescribed for the Treatment of Angina

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Cardiac stimulants						
Digitalis glycosides	Digoxin	Renal Excretion	ABCB1, SLCO1B3, ABCB4		✓	
Adrenergic and dopaminergic agents	Epinephrine	MAO	COMT		✓	
	Phenylephrine	MAO	SULTs, UGTs		✓	
	Dopamine	ALDH1A1, ALDH2	DBH, MAOA, MAOB, SULT1A3, SULT1A4, COMT		✓	
	Synephrine	MAO			✓	
Vasodilators used in cardiac diseases						
Organic nitrates	**Isosorbide dinitrate**	**NAT2**	NAT1			✓
Other Vasodilators	**Hydralazine**	**NAT2**	NAT1, CYP1A2, CYP3A4, CYP3A5			✓
Other Drugs Used in Angina						
Other cardiac preparations	Ranolazine	CYP3A4	CYP2D6, CYP3A5		✓	
	Ivabradine	CYP3A4	CYP3A5		✓	

PGx Report - Modulation of Cardiovascular Function

Type: Dyslipidemia

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Drug Therapy for Hypercholesterolemia and Dyslipidemia (Liver)						
HMG CoA reductase inhibitors Statins	Atorvastatin	CYP3A4, HMGCR	HMGCR, ABCG2, CYP3A5, ABCB1, ABCG8, UGT1A1, UGT1A3, UGT2B7, KIF6		✓	
	Fluvastatin	CYP2C9, SLCO1B1	HMGCR, ABCG2, CYP3A4, CYP2C8, UGT1A1, UGT1A3, UGT2B7		✓	
	Lovastatin	CYP3A4, SLCO1B1	CYP3A5, HMGCR, UGT1A1, UGT1A3			✓
	Cerivastatin	CYP3A4, SLCO1B1	HMGCR, CYP2C8, CYP3A5		✓	
	Pitavastatin	UGT1A3, UGT2B7	CYP2C9, CYP2C8, ABCB1, HMGCR		✓	
	Pravastatin	SLCO1B1, HMGCR	KIF6, APOE, ABCA1		✓	
	Simvastatin	CYP3A4, SLCO1B1	ABCG2, HMGCR, CYP3A5, ABCB1, SLCO2B1, UGT1A1, UGT1A3, UGT2B7, KIF6		✓	
	Rosuvastatin	**UGT1A1**	UGT1A3, ABCG2, HMGCR		✓	
MTTP inhibitors	Lomitapide	CYP3A4	CYP3A5, LDLR		✓	
Drug Therapy for Hypercholesterolemia and Dyslipidemia (GI)						
Cholesterol absorption inhibitors	**Ezetimibe**	**UGT1A1**	UGT1A3, UGT2B15			✓
Drug Therapy for Hypercholesterolemia and Dyslipidemia (Blood vessels)						
Fibrates	Gemfibrozil	CYP3A4	CYP3A5, UGT2B7, UGT1A1, UGT1A3, UGT1A9, UGT2B15			✓
	Clofibrate	UGT2B7				✓
Drug Therapy for familial hypercholesterolemia						
Cholesterol-reducing drug (antisense oligonucleotide)	Mipomersen	Nuclease, Renal Excretion	LDLR		✓	

Abbreviations: MTTP, microsomal triglyceride transfer protein; GI, gastrointestinal tract. Rosuvastatin and Pravastatin are considered alternative Statins since are not extensively metabolized by the CYPs.

Additional SNPs of Importance for Treatment Using Statins

Gene	Marker	Genotype	Drug	Level of Evidence	Results
HMGCR	rs17244841	AA	Fluvastatin	2A	Adequate response to Statin treatment
HMGCR	rs17244841	AA	Pravastatin	2A	Adequate response to Statin treatment
HMGCR	rs17244841	AA	Simvastatin	2A	Adequate response to Statin treatment
HMGCR	rs3846662	CC	Simvastatin	4	Less responsive to Statin treatment
APOE	rs7412	CC	Atorvastatin	2A	Less responsive to Statin treatment
APOE	rs7412	CC	Pravastatin	3	Less responsive to Statin treatment
APOE	rs7412	CC	Simvastatin	3	Less responsive to Statin treatment
LEPR	rs1137101	AG	Simvastatin	3	Patients with coronary heart disease may have an intermediate response to treatment
CETP	rs5882	AA	Simvastatin	3	Adequate response to Statin treatment
ITGB3	rs5918	TT	Clopiodgrel	3	Patients may have an increased antiplatelet effect to a 300 or 600 mg loading dose of Clopiodgrel

PGx Report - Modulation of Cardiovascular Function

Type: Anticoagulant, Antiplatelet

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Blood Coagulation and Anticoagulant, and Antiplatelet Drugs						
Vitamin K antagonist	Warfarin	CYP2C9, VKORC1	CYP4F2, CYP2C19, CYP1A2, CYP3A4, EPHX1, PROC, PROS1	◔		
	Acenocoumarol	CYP2C9, VKORC1	CYP4F2, CYP2C19, CYP1A2	◔		
	Phenprocoumon	CYP2C9, VKORC1	CYP4F2, CYP3A4, CYP2C8, EPHX1	◔		
Direct factor Xa inhibitors	Rivaroxaban	CYP3A4	CYP2J2, CYP3A5		◔	
	Apixaban	CYP3A4	CYP3A5		◔	
Antiplatelet Drugs						
ADP receptor (P2Y12) inhibitors Nucleotide/nucleoside analogs	Ticagrelor	CYP3A4	CYP3A5		◔	
ADP receptor (P2Y12) inhibitors Thienopyridines	Clopidogrel	CYP2C19	ABCB1, ABCC3		◔	
	Prasugrel	BCHE, CYP3A4	CYP2B6, CYP2C9, CYP2C19, CYP3A5, CYP2D6			◔
Irreversible cyclooxygenase inhibitors	Aspirin	GLYAT, UGTs, Renal Excretion	CYP2C9, CYP3A4, CYP3A5		◔	
Phosphodiesterase inhibitors	Cilostazol	CYP3A4	CYP2C19, CYP3A5		◔	
Protease-activated receptor-1 (PAR-1) antagonists	Vorapaxar	CYP3A4	CYP2J2, CYP3A5		◔	
Abbreviations: P2Y12, purinergic receptor P2Y12.						

Additional SNPs of Importance for Cardiovascular Treatment I

Gene	Marker	Genotype	Drug	Level of Evidence	Results
ADRB1	rs1801252	AA	Atenolol, Bisoprolol, Metoprolol, Verapamil	3	Patients may 1) experience more benefit from beta blocking agents (such as atenolol) than verapamil 2) require additional heart failure medications (such as diuretics)
ADRB1	rs1801252	AA	Timolol	3	Patients may have increased systolic (SAP) and diastolic (DAP) arterial pressure responses
ADRB1	rs1801253	CC	Metoprolol	3	Patients may have a stronger diastolic blood pressure (DBP) response with a significantly greater reduction in 24-hour and daytime DBP
ADRB1	rs1801253	CC	Verapamil	3	Patients with Atrial Fibrillation may have a decreased response to treatment
ADRB1	rs1801253	CC	Dobutamine	3	Healthy males may have a greater increase in fractional shortening and systolic blood pressure when given Dobutamine
ADRB2	rs1042713	AG	Benazepril	3	Patients with hypertension may have a greater decrease in diastolic blood pressure
ADRB2	rs1042714	AG	Isoproterenol	3	Patients may have increased isoproterenol-mediated desensitization in the vasculature

Additional SNPs of Importance for Cardiovascular Treatment II

Gene	Marker	Genotype	Drug	Level of Evidence	Results
GRK4	rs1024323	AG	Metoprolol	3	In male patients with hypertensive nephrosclerosis may have a reduced response
GRK4	rs1024323	AG	Atenolol or Verapamil	3	Patients with hypertension and coronory artery disease may have decreased, but not absent, risk for adverse cardiovascular outcomes when treated with Atenolol or Verapamil

PGx Report - Internal Medicine

Type: Drugs Prescribed for the Modulation of Respiratory Function

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Respiratory						
Anticholinergic	Umeclidinium	CYP2D6			✓	
	Aclidinium	CYP2D6	CYP3A4, CYP3A5		✓	
Beta2-adrenergic agonist	Arformoterol	CYP2D6, UGT1A1	CYP2C19		✓	
	Indacaterol	UGT1A1, CYP3A4	CYP3A5, CYP1A2, CYP2D6			✗
	Formoterol	CYP2D6	CYP2C19, CYP2C9, CYP2A6		✓	
	Salmeterol	CYP3A4	CYP3A5		✓	
	Vilanterol	CYP3A4	CYP3A5		✓	
Corticosteroid	Budesonide	CYP3A4	CYP3A5		✓	
	Fluticasone	CYP3A4	CYP3A5		✓	
	Mometasone	CYP3A4	CYP3A5		✓	
Phosphodiesterase inhibitor	Roflumilast	CYP3A4	CYP1A2, CYP3A5		✓	
	Theophylline	CYP1A2	CYP2E1		✓	
5-lipoxygenase inhibitor	Zileuton	CYP1A2	CYP2C9, CYP3A4, CYP3A5		✓	
Leukotriene receptor-1 antagonist	Montelukast	CYP3A4	CYP2C9, CYP3A5, SLCO2B1, ABCC1		✓	
	Pranlukast	CYP3A4	CYP3A5		✓	
	Zafirlukast	CYP2C9	CYP3A4, CYP3A5		✓	
Treatment of cystic fibrosis (specifics mutations in the CFTR gene)	Ivacaftor	CYP3A4	CYP3A5, CFTR		✓	

Abbreviations: CFTR, Cystic fibrosis transmembrane conductance regulator.

PGx Report - Internal Medicine

Type: Antiemetic

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antiemetic						
Antiemetic, 5-HT3 receptor antagonist Indole derivative	Dolasetron	CYP3A4	CYP2D6, CYP3A5		✓	
	Tropisetron	CYP3A4	CYP2D6, CYP3A5		✓	
Antiemetic, 5-HT3 receptor antagonist Isoquinoline derivative	Palonosetron	CYP1A2	CYP2D6, CYP3A4, CYP3A5		✓	
Antiemetic, 5-HT3 receptor antagonist Indazole derivative	Granisetron	CYP3A4	CYP3A5		✓	
Antiemetic, 5-HT3 receptor antagonist	Ondansetron	CYP2B6	CYP1A2, CYP2D6, CYP3A4, ABCB1		✓	
Antiemetic, dopamine-receptor antagonist	Domperidone	CYP3A4	CYP3A5		✓	
	Prochlorperazine	CYP2D6	CYP3A4, CYP3A5		✓	
	Metoclopramide	CYP2D6	CYP1A2, CYB5R1, CYB5R2, CYB5R3, CYB5R4		✓	
Antiemetic, NK1 receptor antagonist	Aprepitant	CYP3A4	CYP3A5, CYP1A2, CYP2C19		✓	
Antiemetic, H1 histamine receptor antagonist	Diphenhydramine	CYP2D6	CYP3A4, CYP3A5, UGT1A3, UGT1A4		✓	
	Hydroxyzine	ADHs	CYP3A4, CYP3A5		✓	
	Promethazine	CYP2D6	UGT1A3, UGT1A4, SULTs		✓	
Cannabinoids	Dronabinol	CYP2C9	CYP2C19, CYP3A4, CYP3A5		✓	
Benzodiazepines	Midazolam	CYP3A4	CYP3A5		✓	
Anticholinergics	Scopolamine	CYP3A4	CYP3A5		✓	
Steroids	Dexamethasone	CYP3A4	CYP17A1, CYP3A5		✓	

Abbreviations: 5-HT, Serotonin; NK1, neurokinin 1.

PGx Report - Internal Medicine

Type: Drugs Prescribed for the Treatment of Peptic Ulcers and/or Gastro-Esophageal Reflux Disease

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Histamine H2-receptor antagonists	Ranitidine	Renal Excretion	CYP1A2, CYP2C19, FMO3, CYP3A4, CYP3A5		✓	
Proton-pump inhibitor	Omeprazole	CYP2C19	CYP3A4, CYP2C9, CYP3A5		✓	
	Dexlansoprazole	CYP2C19	CYP3A4, CYP3A5		✓	
	Esomeprazole	CYP2C19	CYP3A4, CYP3A5		✓	
	Lansoprazole	CYP3A4	CYP2C19, CYP3A5		✓	
	Rabeprazole	Non Enz	CYP2C19, CYP3A4, CYP3A5		✓	
	Ilaprazole	CYP3A4	CYP3A5		✓	
	Pantoprazole	CYP2C19	CYP3A4, CYP2D6, CYP2C9, CYP3A5		✓	
Abbreviations: Non Enz, non-enzymatic metabolism.						

PGx Report - Internal Medicine

Type: Drugs Prescribed for the Treatment of Functional Gastrointestinal Disorders, Obesity

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Drugs for functional gastrointestinal disorders						
Acting on serotonin receptors 5-HT3 antagonists	Alosetron	CYP2C9	CYP3A4, CYP1A2		✓	
	Cilansetron	CYP3A4	CYP2D6, CYP1A2, CYP2C19, CYP3A5		✓	
Acting on serotonin receptors 5-HT4 agonists	Mosapride	CYP3A4	CYP3A5		✓	
	Prucalopride	Renal Excretion	CYP3A4, CYP3A5		✓	
Gastroprokinetic						
Serotonin 5-HT$_4$ receptor agonist	Cisapride	CYP3A4	CYP3A5		✓	
	Cinitapride	CYP3A4	CYP2C8, CYP3A5		✓	
Parasympatho mimetic	Itropride	FMO3			✓	
Dopamine antagonists	Metoclopramide	CYP2D6	CYP1A2, CYB5R1, CYB5R2, CYB5R3, CYB5R4		✓	
	Clebopride	CYP3A4	CYP3A5		✓	
	Domperidone	CYP3A4	CYP3A5		✓	
Antipropulsives						
Opioids	Loperamide	CYP3A4	CYP2C8, CYP3A5		✓	
	Morphine	UGT2B7	ABCB1, ABCC3, UGT1A1, UGT1A8, OPRM1, COMT			●
Centrally acting anti-obesity drugs						
Stimulant/ Amphetamine/ Appetite suppressant agent	Sibutramine	CYP3A4	CYP3A5		✓	
	Phentermine	Renal Excretion	CYP3A4, CYP3A5		✓	
Anorectic	Lorcaserin	CYP2D6	CYP3A4, CYP3A5		✓	

PGx Report - Internal Medicine

Type: Diabetes

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antidiabetic Secretagogues						
Meglitinides	Repaglinide	CYP2C8	SLCO1B1, CYP3A4, CYP3A5, ABCC8		✓	
	Nateglinide	CYP2C9	CYP3A4, CYP3A5		✓	
Sulfonylurea 1st generation	Chlorpropamide	Renal Excretion	CYP2D6, G6PD		✓	
	Tolazamide	CYP2C9			✓	
	Tolbutamide	CYP2C9	CYP2C19, CYP2C8		✓	
Sulfonylurea 2nd generation	Glipizide	CYP2C9	G6PD		✓	
	Glyburide	CYP3A4	CYP2C9, CYP2C19, CYP3A5, G6PD		✓	
	Gliquidone	CYP2C9			✓	
	Gliclazide	CYP2C9	CYP2C19		✓	
	Glimepiride	CYP2C9	G6PD		✓	
DPP-IV inhibitor	Saxagliptin	CYP3A4	CYP3A5		✓	
	Alogliptin	Renal Excretion	CYP2D6, CYP3A4, CYP3A5		✓	
	Linagliptin	Renal Excretion	CYP3A4, CYP3A5		✓	
	Sitagliptin	CYP3A4	CYP2C8, CYP3A5		✓	
Antidiabetic Sensitizers						
Biguanides	Metformin	Renal Excretion			✓	
Thiazolidinediones	Pioglitazone	CYP2C8	CYP3A4, CYP3A5		✓	
	Rosiglitazone	CYP2C8	CYP2C9		✓	
Antidiabetic Other						
SGLT2 inhibitors	Canagliflozin	UGT1A9, UGT2B4	CYP3A4, CYP3A5		✓	

Abbreviations: DPP-IV, Dipeptidyl peptidase-4; SGLT2, sodium/glucose cotransporter 2 or gliflozins.

PGx Report - Internal Medicine

Type: Migraine, Antihistamine, Abortifacient, Drugs Prescribed for the Treatment of Hyperparathyroidism, Dermatology

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Anti-migraine						
Selective serotonin (5-HT1) agonists	Almotriptan	CYP3A4	CYP2D6, CYP3A5		✓	
	Eletriptan	CYP3A4	CYP3A5		✓	
	Frovatriptan	CYP1A2			✓	
	Naratriptan	CYP1A2	CYP2C8, CYP2C9, CYP2D6		✓	
	Sumatriptan	MAO	UGTs, HTR2A		✓	
	Zolmitriptan	CYP1A2			✓	
Ergot alkaloids	Dihydroergotamine	CYP3A4	CYP3A5		✓	
	Ergotamine	CYP3A4	CYP3A5		✓	
Antihistamines						
Aminoalkyl ethers	Diphenhydramine	CYP2D6	CYP3A4, CYP3A5, UGT1A3, UGT1A4		✓	
Substituted alkylamines	Chlorpheniramine	CYP3A4	CYP3A5		✓	
Phenothiazine derivatives	Promethazine	CYP2D6	UGT1A3, UGT1A4, SULTs		✓	
Piperazine derivatives	Hydroxyzine	ADHs	CYP3A4, CYP3A5		✓	
	Cyclizine	CYP2D6			✓	
	Cetirizine	Renal Excretion			✓	
Other antihistamines	Terfenadine	CYP3A4	CYP3A5		✓	
	Loratadine	CYP3A4, CYP2D6	CYP3A5, CYP2C8, CYP2C9		✓	
	Fexofenadine	Biliary Excretion	Renal Excretion, CYP3A4, CYP3A5, SLCO2B1		✓	
	Desloratadine	CYP2C8	UGT2B10		✓	
	Astemizole	CYP3A4	CYP3A5		✓	
Treatment of secondary hyperparathyroidism						
Calcimimetic	Cinacalcet	CYP3A4	CYP2D6, CYP3A5, CYP1A2		✓	
Abortifacient						
Progestin Antagonist	Mifepristone	CYP3A4	CYP3A5		✓	
Dermatology Antipsoriatics						
Retinoids	Etretinate	CYP26A1			✓	
	Acitretin	CYP26A1			✓	
Dermatology Anti-acne						
Retinoid	Isotretinoin	CYP2C8	CYP2C9, CYP3A4, CYP2B6, CYP3A5		✓	

Abbreviations: BE, biliary excretion.

PGx Report - Psychiatry

Type: Antidepressant I

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antidepressants						
SSRIs	Citalopram	CYP2C19, CYP2D6	CYP3A4, CYP3A5, SLC6A4, HTR2A		✓	
	Escitalopram	CYP3A4, CYP2C19	CYP2D6, CYP3A5, SLC6A4, HTR2C		✓	
	Dapoxetine	CYP2D6	CYP3A4, CYP3A5, FMO1		✓	
	Fluoxetine	CYP2D6	CYP3A4, CYP2C9, CYP3A5, CYP2C19, SLC6A4, HTR2A		✓	
	Paroxetine	CYP2D6	CYP3A4, CYP1A2, CYP3A5, CYP2C9, SLC6A4, HTR2A, DRD3		✓	
	Sertraline	CYP2B6	CYP2C19, CYP2C9, CYP3A4, CYP2D6, SLC6A4		✓	
	Fluvoxamine	CYP2D6	CYP1A2, SLC6A4, HTR2A		✓	
SMSs	Vilazodone	CYP3A4	CYP3A5, CYP2C19, CYP2D6		✓	
SNRIs	Levomilnacipran	CYP3A4	CYP2C8, CYP3A5, CYP2C19, CYP2D6		✓	
	Milnacipran	UGTs	Renal Excretion		✓	
	Venlafaxine	CYP2D6	CYP2C19, CYP3A4, CYP2C9, CYP3A5, SLC6A3, SLC6A4, HTR2A		✓	
	Duloxetine	CYP2D6	CYP1A2, HTR2A		✓	
NRIs	Atomoxetine	CYP2D6	CYP2C19, CYP3A4, CYP3A5, SLC6A2		✓	
	Reboxetine	CYP3A4	CYP3A5		✓	
	Maprotiline	CYP2D6	CYP1A2		✓	
TCAs that preferentially inhibit the reuptake of serotonin	Clomipramine	CYP2D6	CYP3A4, CYP2C19, CYP1A2, CYP2C9, SLC6A4, HTR2A		✓	
	Imipramine	CYP1A2, CYP2D6	CYP2C19, CYP3A4, CYP3A5, UGT1A3, UGT1A4		✓	
TCAs that preferentially inhibit the reuptake of norepinephrine	Desipramine	CYP2D6	CYP1A2, CYP2C19		✓	
	Nortriptyline	CYP2D6	CYP1A2, CYP2C19, ABCB1, SLC6A4		✓	
	Protriptyline	CYP2D6			✓	

PGx Report - Psychiatry

Type: Antidepressant II

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antidepressants						
TCAs that fairly balanced serotonin-norepinephrine reuptake inhibitors	Amitriptyline	CYP2D6	CYP3A4, CYP2C19, CYP2C9, CYP1A2, CYP2B6, UGT1A3, UGT1A4		✓	
	Doxepin	CYP2D6, CYP2C19	CYP1A2, CYP3A4, CYP3A5, UGT1A3, UGT1A4		✓	
	Dosulepin	CYP2D6, CYP2C9	CYP3A4, CYP1A2, CYP3A5, CYP2C19		✓	
TeCAs	Mianserin	CYP2D6	CYP3A4, CYP1A2, CYP2B6, CYP3A5		✓	
	Amoxapine	CYP2D6	CYP3A4, CYP3A5		✓	
TCA with antipsychotic and sedative properties	Trimipramine	CYP2D6	CYP2C19, CYP2C9		✓	
MAOI	Tranylcypromine	MAO	CYP3A4, CYP2A6, CYP3A5, CYP2C19, CYP2D6		✓	
	Moclobemide	CYP2C19	CYP2D6, CYP1A2, HTR2A		✓	
Atypical antidepressants						
SMSs	Vortioxetine	CYP2D6	CYP2C9, CYP3A4, CYP3A5, UGTs, CYP2A6, CYP2C8, CYP2C19, CYP2B6		✓	
NaSSAs	Mirtazapine	CYP1A2	CYP2D6, CYP3A4, CYP3A5, SLC6A4, HTR2A		✓	
SARIs	Trazodone	CYP3A4	CYP2D6, CYP3A5		✓	
	Nefazodone	CYP2D6, CYP3A4	CYP3A5, UGT1A6		✓	
Antidepressant and smoking cessation aid	Bupropion	CYP2B6	CYP2E1, CYP3A4, CYP2C9, CYP2D6, CYP1A2, CYP3A5		✓	
Antidepressant and anti-anxiety	Buspirone	CYP3A4	CYP3A5		✓	

Abbreviations: SSRI, serotonin selective reuptake inhibitor; SMS, Serotonin modulator and stimulator; SNRI, serotonin-norepinephrine reuptake inhibitor; NRI, norepinephrine reuptake inhibitor; TCA, tricyclic antidepressant; TeCA, tetracyclic antidepressant; MAOI, monoamine oxidase inhibitor; NaSSA, noradrenergic and specific serotonergic antidepressant; SARI, serotonin antagonist and reuptake inhibitor.

Additional SNPs of Importance for Treatment Using Antidepressants

Gene	Marker	Genotype	Drug	Level of Evidence	Results
GRIK4	rs1954787	CC	Citalopram	1B	Patients may have an increased chance of response to Citalopram treatment
GRIK4	rs1954787	CC	Antidepressants	2B	Patients with Depressive Disorder or Depression may be more likely to respond to antidepressant treatment
HTR2A	rs6313	TC	Paroxetine	3	Patients with depression may have a reduced risk of adverse medication reactions

Additional SNPs of Importance for the Treatment of Depression and Psychosis, and the Treatment of Alcohol and Tobacco Use Disorders

Gene	Marker	Genotype	Drug	Level of Evidence	Results
HTR2A	rs6311	TC	Escitalopram	3	Patients with anxiety disorder may have an intermediate risk of adverse cognitive effects
HTR2A	rs6311	TC	Fluvoxamine	3	Depressive patients may have an increased risk of gastrointestinal side effects and decreased response
COMT	rs4680	GG	Fluvoxamine	3	Schizophrenia patients may have a decreased risk for developing extrapyramidal symptoms
COMT	rs4680	GG	Venlafaxine	3	Patients with Depressive Disorder may have increased response but patients with Anxiety Disorders may have a decreased response
COMT	rs4680	GG	Paroxetine	3	Depressive patients may have a decreased response or decreased improvement
ANKK1/DRD2	rs1800497	CC	Bupropion	1B	Patients may be more likely to quit smoking
ANKK1/DRD2	rs1800497	CC	Antipsychotics	2A	Schizophrenia patients may have an increased risk for tardive dyskinesia
ANKK1/DRD2	rs1800497	CC	Ethanol	2B	Patients may have a decreased, but not absent, risk for Alcoholism
ANKK1/DRD2	rs1800497	CC	Clozapine Olanzapine Risperidone	2B	Patients may have decreased but not non-existent risk of side effects including hyperprolactinemia and weight gain
ANKK1/DRD2	rs1800497	CC	Nicotine	3	Patients may have a decreased likelihood of smoking cessation when treated with nicotine replacement
ANKK1/DRD2	rs1800497	CC	Risperidone	3	Schizophrenia patients may have less improvement in symptoms
HTR2A	rs7997012	AG	Antidepressants	3	Reduced risk of having no response to treatment (higher improvement) with antidepressants

PGx Report - Psychiatry

Type: Typical Antipsychotic

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Typical antipsychotic						
Butyrophenones	Bromperidol	CYP3A4	CYP3A5		✓	
	Droperidol	CYP3A4	CYP3A5		✓	
	Haloperidol	UGTs, CYP3A4	CYP1A2, CYP2D6, CYP3A5, SLC6A4, HTR2C		✓	
Phenothiazines with aliphatic side-chain	Chlorpromazine	CYP2D6	CYP1A2, UGT1A3, UGT1A4, CYP3A4, CYP3A5		✓	
	Levomepromazine	CYP3A4	CYP1A2, CYP3A5		✓	
	Promazine	CYP1A2	CYP3A4, CYP2C19, CYP2C9, CYP3A5		✓	
	Cyamemazine	CYP1A2	CYP3A4, CYP2C9, CYP2C8, CYP3A5		✓	
Phenothiazines with piperazine structure	Fluphenazine	CYP2D6			✓	
	Perphenazine	CYP2D6			✓	
	Prochlorperazine	CYP2D6	CYP3A4, CYP3A5		✓	
	Trifluoperazine	CYP1A2	UGT1A4		✓	
Phenothiazines with piperidine structure	Thioridazine	CYP2D6	CYP1A2, CYP3A4, CYP2C19, CYP3A5		✓	
Phenothiazines used as an anti-histamine, sedative, and antiemetic	Promethazine	CYP2D6	UGT1A3, UGT1A4, SULTs		✓	
Diphenyl-butylpiperidine	Pimozide	CYP3A4, CYP2D6	CYP1A2, CYP3A5		✓	
Thioxanthene derivative	Thiothixene	CYP1A2	CYP3A4, CYP3A5		✓	
	Zuclopenthixol	CYP2D6	CYP3A4, CYP3A5		✓	
Tricyclics	Loxapine	CYP1A2	CYP3A4, CYP2D6, UGT1A3, UGT1A4, CYP3A5		✓	

PGx Report - Psychiatry

Type: Atypical antipsychotic

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Atypical antipsychotic						
Diazepines, Oxazepines, Thiazepines and Oxepines	Olanzapine	UGT1A4	CYP1A2, CYP2D6, FMO3, FMO1, SLC6A4, SLC1A1, HTR2A, HTR2C, DRD3		✓	
	Quetiapine	CYP3A4, CYP2D6	CYP3A5, CYP1A2, CYP2C9, CYP2C19, SLC6A4		✓	
	Asenapine	CYP1A2, UGT1A4	CYP2D6, CYP3A4, CYP3A5		✓	
	Clozapine	CYP1A2, CYP2D6	CYP3A4, FMO3, CYP2C9, CYP2C19, CYP3A5, CYP2A6, UGT1A3, UGT1A4, SLC6A3, SLC6A4, SLC1A1, HTR2C, DRD3		✓	
Indole derivatives	Sertindole	CYP2D6	CYP3A4, CYP3A5		✓	
	Ziprasidone	CYP3A4	AOX1, CYP3A5		✓	
	Lurasidone	CYP3A4	CYP3A5		✓	
Benzamides	Sulpiride	Renal Excretion			✓	
	Amisulpride	Renal Excretion			✓	
Other antipsychotics	Aripiprazole	CYP2D6	CYP3A4, CYP3A5, DRD3		✓	
	Risperidone	CYP2D6	CYP3A4, CYP3A5, ABCB1, SLC6A4, SLC1A1, HTR2A, HTR2C, DRD3		✓	
	Iloperidone	CYP2D6	CYP3A4, CYP3A5		✓	
	Paliperidone	CYP2D6	CYP3A4, CYP3A5		✓	
	Zotepine	CYP3A4	CYP1A2, CYP3A5, CYP2D6		✓	

Additional SNPs of Importance in Treatment that Includes the Use of Antipsychotics and for the Treatment of Autism

Gene	Marker	Genotype	Drug	Level of Evidence	Results
HTR2A	rs6311	TC	Risperidone	3	Children with autism may have intermediate response to treatment
HTR2C	rs6318	GG	Olanzapine	3	Schizophrenia patients may have a decreased risk of weight gain
COMT	rs4680	GG	Haloperidol	3	Schizophrenia patients may have a decreased risk for developing extrapyramidal symptoms
DRD3	rs6280	TT	Olanzapine	3	Schizophrenia patients may have reduced positive symptom improvement and positive symptom remission
DRD3	rs6280	TT	Clozapine	3	Schizophrenia patients may have a better response to treatment
DRD3	rs6280	TT	Risperidone	3	Children with Autism may have an intermediate response to treatment
DRD1	rs4532	TT	Methylphenidate or Dextroamphetamine	3	Patients with attention deficit hyperactivity disorder (ADHD) may have a decreased severity of social withdrawal or nausea

Other genetic and clinical factors may also influence a patient's response to medications.

PGx Report - Neurology

Type: Drugs Prescribed for the Treatment of ADHD, Related Drugs

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Anti ADHD Stimulants						
Amphetamine	Dextroamphetamine	Renal Excretion, CYP2D6	DBH, FMO3, GLYAT		✓	
	Levoamphetamine	Renal Excretion, CYP2D6	FMO3		✓	
NDRI	Dexmethylphenidate	CYP2D6	Renal Excretion		✓	
Psychostimulant	Lisdexamfetamine	Hydrolysis	CYP2D6, Renal Excretion		✓	
	Methylphenidate	CYP2D6	Renal Excretion, SLC6A2, SLC6A3, SLC6A4, DRD3		✓	
Anti ADHD Non-stimulants						
NERI	Atomoxetine	CYP2D6	CYP2C19, CYP3A4, CYP3A5, SLC6A2		✓	
Central alpha-2 Adrenergic Agonist	Clonidine	CYP2D6	CYP1A2, CYP3A4, CYP3A5		✓	
Antidepressants	Bupropion	CYP2B6	CYP2E1, CYP3A4, CYP2C9, CYP2D6, CYP1A2, CYP3A5		✓	
	Imipramine	CYP1A2, CYP2D6	CYP2C19, CYP3A4, CYP3A5, UGT1A3, UGT1A4		✓	
	Desipramine	CYP2D6	CYP1A2, CYP2C19		✓	
	Milnacipran	UGTs	Renal Excretion		✓	
	Reboxetine	CYP3A4	CYP3A5		✓	
Wakefulness-promoting agent	Modafinil	Hydrolysis, CYP2D6	CYP1A2, CYP3A4, CYP2B6, CYP3A5		✓	
	Armodafinil	CYP3A4	CYP3A5		✓	
Anti-insomnia						
Melatonin Receptor Agonist	Ramelteon	CYP1A2	CYP2C19, CYP3A4, CYP3A5		✓	

Abbreviations: ADHD, Attention deficit hyperactivity disorder; NERI; norepinephrine reuptake inhibitor, NDRI, norepinephrine-dopamine reuptake inhibitor.

PGx Report - Neurology

Type: Drugs Prescribed for the Treatment of Epilepsy

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antiepileptic						
Barbiturates	Phenobarbital	CYP2C19	ABCB1		✓	
Carbamates	Felbamate	CYP3A4	CYP2E1, CYP3A5			●
Carboxamides	Carbamazepine	CYP3A4, EPHX1	CYP2C8, CYP2B6, UGT2B7, CYP1A2, CYP3A5, ABCB1, HLA-B*1502, HLA-A*3101, ABCC2		✓	
Fatty acids	Tiagabine	CYP3A4	CYP3A5, CYP1A2, CYP2D6, CYP2C19		✓	
Fructose derivatives	Topiramate	Renal Excretion	CYPs, UGTs		✓	
GABA analogs	Gabapentin	Renal Excretion			✓	
	Pregabalin	Renal Excretion			✓	
Hydantoin	Phenytoin	CYP2C19	CYP2C9, CYP3A4, CYP3A5, CYP2D6, ABCB1, EPHX1, HLA-B*1502		✓	
	Mephenytoin	CYP2C19	CYP2C8, CYP2C9, CYP2B6, CYP1A2, CYP2D6		✓	
Oxazolidinediones	Trimethadione	CYP2C9	CYP2E1, CYP3A4, CYP3A5		✓	
	Paramethadione	CYP2C9			✓	
Pyrimidinedione	Primidone	CYP2C9	CYP2C19		✓	
Pyrrolidines	Brivaracetam	CYP2C19, CYP2C9	CYP3A4, CYP3A5, CYP2C8, CYP2B6		✓	
	Levetiracetam	Renal Excretion			✓	
	Seletracetam	Renal Excretion			✓	
Succinimides	Ethosuximide	CYP3A4	CYP3A5, CYP2E1		✓	
Sulfonamides	Zonisamide	CYP3A4	CYP2C19, CYP3A5		✓	
Triazines	Lamotrigine	UGT1A4	UGT2B7, HLA-B*1502		✓	
Other	Lacosamide	CYP2C9	CY2C19, CYP3A4		✓	
	Perampanel	CYP3A4	CYP3A5		✓	
	Retigabine	UGT1A4	NAT2			●

Abbreviations: GABA, gamma-aminobutyric acid.

PGx Report - Neurology

Type: Anxiolytic, Hypnotic, Sedative, Anticonvulsant, Muscle Relaxants

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Anxiolytic, Hypnotic, Sedative, Anticonvulsant, and Muscle Relaxant						
Benzodiazepine Short-acting	Midazolam	CYP3A4	CYP3A5		✓	
	Triazolam	CYP3A4	CYP3A5		✓	
	Brotizolam	CYP3A4	CYP3A5		✓	
Benzodiazepine Intermediate-acting	Alprazolam	CYP3A4	CYP3A5		✓	
	Bromazepam	CYP1A2	CYP2D6		✓	
	Clobazam	CYP2C19	CYP3A4, CYP3A5, CYP2B6			✗
	Flunitrazepam	CYP2C19	CYP2C9, CYP3A4, CYP3A5, NAT2		✓	
	Estazolam	CYP3A4	CYP3A5		✓	
	Clonazepam	CYP3A4	CYP2C19, CYP3A5, NAT2			✗
	Oxazepam-r	UGT2B7	UGT1A9			✗
	Quazepam	CYP3A4	CYP2C19, CYP3A5		✓	
	Lormetazepam	CYP3A4	CYP3A5		✓	
	Lorazepam-r	UGT2B7				✗
	Nitrazepam	CYP3A4	CYP3A5, NAT2			✗
	Temazepam	CYP2C19	CYP3A4, CYP3A5, UGT2B7		✓	
Benzodiazepine Long-acting	Diazepam	CYP2C19, CYP3A4	CYP3A5, CYP2B6, CYP1A2		✓	
	Clorazepate	CYP3A4	CYP3A5		✓	
	Chlordiazepoxide	CYP3A4	CYP3A5		✓	
	Flurazepam	CYP3A4	CYP3A5		✓	
	Nordazepam	CYP3A4	CYP3A5		✓	
Nonbenzodiazepine hypnotic	Zolpidem	CYP3A4	CYP3A5, CYP1A2, CYP2D6		✓	
	Zaleplon	AOX1, CYP3A4	CYP3A5		✓	
	Zopiclone	CYP3A4	CYP2C8, CYP2C9, CYP3A5		✓	
	Eszopiclone	CYP3A4	CYP2E1, CYP3A5		✓	

PGx Report - Neurology

Type: Drugs Prescribed for the Treatment of Alzheimer's and Parkinson's, Related Drugs

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Anti-Alzheimer disease						
Acetylcholinesterase inhibitor	Tacrine	CYP1A2	CYP2D6		✓	
	Donepezil	CYP2D6	CYP3A4, CYP3A5		✓	
	Rivastigmine	ACHE	BCHE, CHAT		✓	
	Galantamine	CYP2D6	CYP3A4, CYP3A5		✓	
NMDA receptor antagonist	Memantine	Renal Excretion	UGTs		✓	
Anti-Parkinson disease						
Inhibitor of MAO-B	Selegiline	CYP2B6	CYP2C9, CYP3A4, CYP3A5, CYP2A6, FMO3			✗
	Rasagiline	CYP1A2			✓	
COMT inhibitors	Entacapone	UGT1A9, CYP3A4	CYP2A6, CYP3A5, UGT1A6, UGT2B7, UGT2B15			✗
Dopamine receptor agonists	Bromocriptine	CYP3A4	CYP3A5		✓	
	Pramipexole	Renal Excretion	DRD3		✓	
	Ropinirole	CYP1A2	UGTs, Renal Excretion		✓	
Anticholinergics - Antimuscarinics	Diphenhydramine	CYP2D6	CYP3A4, CYP3A5, UGT1A3, UGT1A4		✓	
Anti-hyperkinetic movement	Tetrabenazine	CYP2D6	CYP1A2		✓	
Anti-amyotrophic lateral sclerosis drug	Riluzole	CYP1A2			✓	
Anti-multiple sclerosis						
Sphingosine 1-phosphate Receptor Modulator	Fingolimod	CYP4F2			✓	
Anthracenedione	Mitoxantrone	CYP2E1			✓	
Dihydroorotate dehydrogenase inhibitor	Teriflunomide	Hydrolysis	NATs , SULTs		✓	
Improvement of walking in patients with multiple sclerosis						
Selective blocker of members of voltage-activated K+ channels	Dalfampridine	Renal Excretion	CYP2E1		✓	
Abbreviations: NMDA, N-methyl-D-aspartate; COMT, Catechol-O-methyltransferase.						

Additional SNP of Importance for hypersensitivity

Gene	Marker	Genotype	HLA	Drug	Results
FLOT1	rs3909184	CC	HLA-B*1502	Carbamazepine Lamotrigine Phenytoin	
HCP5	rs2395029	TT	HLA-B*5701	Abacavir	Normal risk for medication-induced hypersensitivity

The variant allele for rs1061235(T) serves as a proxy for the HLA-A*3101 allele, the variant allele for rs3909184(C) serves as a proxy for the HLA-B*1502 allele, the variant allele for rs2395029(G) serves as a proxy for the HLA-B*5701 allele.

PGx Report - Infectology

Type: Antibiotics

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antibacterials: protein synthesis inhibitors 50S						
Amphenicols	Chloramphenicol	CYP2C9	UGT2B7		✓	
Lincosamides	Clindamycin	CYP3A4	CYP3A5		✓	
Antibiotic						
Macrolides	Clarithromycin	CYP3A4	CYP3A5		✓	
	Erythromycin	CYP3A4			✓	
	Telithromycin	CYP3A4	CYP3A5		✓	
Antibacterials: nucleic acid inhibitors						
DHPS inhibitor Short-acting sulfonamides	**Sulfadimidine**	**NAT2**	Renal Excretion			✗
	Sulfapyridine	**NAT2**	Renal Excretion			✗
DHPS inhibitor Intermediate-acting sulfonamides	Sulfamethoxazole	Renal Excretion	NAT2, CYP2C9		✓	
Anaerobic DNA inhibitors/ Nitroimidazole	Tinidazole	CYP3A4	CYP3A5		✓	
	Ornidazole	CYP3A4	CYP3A5		✓	
DNA-dependent RNA polymerase inhibitors	Rifampicin	CYP3A4	CYP2C8, CYP3A5, CYP2C19, CYP2A6, RE		✓	
	Rifabutin	CYP3A4	CYP1A2, CYP3A5		✓	
Other drugs against mycobacteria	Dapsone	CYP2E1	NAT2, CYP3A4, CYP2C9, CYP3A5, CYP2D6, UGT1A9, G6PD		✓	
	Bedaquiline	CYP3A4	CYP2C8, CYP2C19, CYP3A5		✓	
	Isoniazid	**NAT2**	CYP2E1, Renal Excretion			✗
	Pyrazinamide	AOX1, XDH	CYP1A2, CYP3A4, CYP3A5, RE		✓	
Abbreviations: DHPS, Dihydropteroate synthase.						

PGx Report - Infectology

Type: Antimalarial, Anthelmintic, Antifungal

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Antimalarial						
Aminoquinolines	Chloroquine	CYP2C8	CYP3A4, CYP3A5, G6PD		✓	
	Hydroxychloroquine	CYP2D6	CYP2C8, CYP3A4, CYP3A5		✓	
	Amodiaquine	CYP2C8			✓	
	Primaquine	CYP2D6	G6PD		✓	
Methanolquinolines	Quinine	CYP3A4, CYP2D6	CYP2C19, CYP3A5, G6PD		✓	
	Mefloquine	CYP3A4	CYP3A5		✓	
Artemisinin and derivatives	Artemisinin	CYP3A4	CYP2B6, CYP3A5			✗
	Artemether	CYP3A4	CYP3A5		✓	
	Artesunate	CYP2A6			✓	
	Arteether	CYP3A4	CYP2B6, CYP3A5			✗
Biguanides	Proguanil	CYP2C19			✓	
Other antimalarials	Halofantrine	CYP3A4	CYP3A5		✓	
	Pentamidine	CYP2C19	CYP1A2, CYP2D6		✓	
Anthelmintic						
Benzimidazoles	Albendazole	CYP3A4	CYP1A2, CYP3A5		✓	
Antifungals						
Imidazoles	Ketoconazole	CYP3A4	UGT1A1, FMO3, CYP26A1		✓	
Triazoles	Itraconazole	CYP3A4			✓	
	Voriconazole	CYP2C19	CYP2C9, CYP3A4, CYP3A5		✓	
	Fluconazole	Renal Excretion			✓	
Allylamines	Terbinafine	CYP2C9	CYP1A2, CYP3A4, CYP2C8, CYP2C19		✓	

PGx Report - Infectology

Type: Antiretroviral, Antiviral

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Protease inhibitor 1st generation	Lopinavir	CYP3A4	SLCO1B1, CYP3A5, ABCC1, ABCC2		✓	
	Ritonavir	CYP3A4	CYP2D6, CYP3A5, ABCC1		✓	
	Saquinavir	CYP3A4	CYP3A5		✓	
	Indinavir	CYP3A4	CYP2D6, CYP3A5, ABCC4		✓	
	Nelfinavir	CYP2C19	CYP3A4, CYP3A5		✓	
	Fosamprenavir	CYP3A4	CYP3A5		✓	
Protease inhibitor 2nd generation	Atazanavir	CYP3A4	CYP3A5, ABCB1		✓	
	Darunavir	CYP3A4	CYP3A5, SLCO3A1		✓	
	Tipranavir	CYP3A4	CYP3A5		✓	
NNRTI 1st generation	Delavirdine	CYP3A4	CYP2D6, CYP3A5		✓	
	Efavirenz	CYP2B6	CYP2A6, ABCB1, SLCO3A1, ABCG2			✗
NNRTI 2nd generation	Nevirapine	CYP3A4	CYP2B6, CYP3A5, ABCB1, SLCO3A1			✗
	Etravirine	CYP3A4	CYP2C9, CYP2C19, CYP3A5		✓	
	Rilpivirine	CYP3A4	CYP3A5		✓	
Nucleoside reverse transcriptase inhibitor (NRTI)	Zidovudine	UGT2B7	Renal Excretion, UGT1A9, SLCO3A1, ABCC1, ABCC4		✓	
	Abacavir	ADH6	UGT1A1, ADK, HLA-B*5701		✓	
Neuraminidase inhibitors/release phase	Zanamivir	Renal Excretion			✓	
	Peramivir	Renal Excretion			✓	
	Oseltamivir	BCHE, ACHE	Renal Excretion		✓	
CCR5 Co-receptor Antagonist	Maraviroc	CYP3A4	CYP3A5		✓	
Hepatitis C Virus NS3/4A Protease Inhibitor	Boceprevir	CYP3A4	IFNL3, CYP3A5		✓	
	Telaprevir	CYP3A4	CYP3A5, IFNL3		✓	
	Paritaprevir	CYP3A4	CYP3A5		✓	
	Simeprevir	CYP3A4	CYP2C8, CYP2C19, CYP3A5, IFNL3		✓	
Other antivirals	Enfuvirtide	CYP2C19	CYP2E1, CYP1A2		✓	
	Raltegravir	**UGT1A1**	SLCO1A2			✗
	Elvitegravir	CYP3A4	CYP3A5		✓	
	Dolutegravir	UGT1A1, CYP3A4	CYP3A5			✗

Abbreviations: NNRTI, Non-Nucleoside Reverse Transcriptase Inhibitors; CCR5, C-C chemokine receptor type 5.

PGx Report - Oncology, Hematology

Type: Antineoplastic I

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Alkylating agents						
Nitrogen mustard analogues	Cyclophosphamide	CYP2B6	CYP2C19, CYP3A4, CYP2C9, CYP3A5, EPHX1, ALDH1A1, ABCC3			✗
	Iphosphamide	CYP2B6	CYP3A4, CYP3A5			✗
Nitrosoureas	Carmustine	CYP1A2	Renal Excretion		✓	
Antimetabolites						
Folic acid analogues	Methotrexate	Renal Excretion	AOX1, SLCO1B1, SLC19A1, ABCC1, ABCC2, ABCC3, ABCG2		✓	
	Pemetrexed	Renal Excretion	SLC19A1		✓	
Purine analogues	Mercaptopurine	XO	TPMT, NUDT15, AOX1, SLC19A1		✓	
	Tioguanine	HPRT1	TPMT, NUDT15		✓	
	Cladribine	DCK	Renal Excretion		✓	
	Clofarabine	DCK	Renal Excretion		✓	
	Nelarabine	ADA	DCK, Renal Excretion, XO		✓	
Pyrimidine analogues	Fluorouracil	DPYD, TYMS, MTHFR	NQO1, GSTP1, UMPS, TYMP, SLC19A1, ABCG2		✓	
	Cytarabine	CES1, CES2, CDA	TYMP, DPYD, TYMS, SLCO1B1, SLC29A1		✓	
	Tegafur	CYP2A6	DPYD, TYMS		✓	

PGx Report - Oncology, Hematology

Type: Antineoplastic II

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Plant alkaloids and other natural products						
Vinca alkaloids and analogues	Vincristine	CYP3A4	CYP3A5, ABCC3		✓	
	Vinblastine	CYP3A4	CYP3A5		✓	
Podophyllotoxin derivatives	Etoposide	CYP3A4	CYP3A5, CYP1A2, CYP2E1, ABCB1, UGT1A1			●
	Teniposide	CYP2C19	CYP3A4, CYP3A5, ABCB1		✓	
Taxanes	Paclitaxel	CYP2C8	CYP3A4, CYP3A5, ABCB1, SLC29A1		✓	
	Docetaxel	CYP3A4	CYP3A5, EPHX1, SLCO1B3, ABCC6		✓	
Cytotoxic antibiotics and related substances						
Anthracyclines and related substances	Doxorubicin	ALDH1A1, ABCB1, GSTP1, NQO1	CYP3A4, CYP2B6, CYP3A5, CYP2C8, CYP2D6, ABCC2, ABCC3		✓	
	Mitoxantrone	CYP2E1			✓	
Other antineoplastic agents						
Platinum compounds	Cisplatin	Renal Excretion, NQO1, GSTP1	EPHX1, GSTM1, ABCB1, XPC, LRP2, SLC19A1, ABCC2, ABCC3		✓	
Derivative of camptothecin	Irinotecan	UGT1A1, CYP3A4, CES1, CES2	CYP3A5, CYP2B6, UGT1A4, SLCO1B1, BCHE, UGT1A9, UGT1A10, SLC19A1, SLCO1B3, ABCG2			●

PGx Report - Oncology, Hematology

Type: Antineoplastic Targeted Therapy I

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Protein kinase inhibitor (receptor)						
Epidermal growth factor receptor (EGFR)	Erlotinib	CYP3A4	CYP1A2, CYP3A5		✓	
	Gefitinib	CYP3A4	CYP2D6, CYP3A5, ABCG2		✓	
	Vandetanib	CYP3A4	FMO3, FMO1, CYP3A5		✓	
EGFR and epidermal growth factor receptor (HER2)	Lapatinib	CYP3A4, CYP2C19	CYP2C8, CYP3A5, HLA-DQA1*0201, HLA-DRB1*0701		✓	
	Neratinib	CYP3A4	CYP3A5		✓	
C-KIT and PDGFR	Masitinib	CYP3A4	CYP3A5		✓	
FLT3	Lestaurtinib	CYP3A4	CYP3A5		✓	
RET, VEGFR and EGFR	Vandetanib	CYP3A4	FMO3, FMO1, CYP3A5		✓	
c-MET and VEGFR2	Cabozantinib	CYP3A4	CYP2C8, CYP3A5		✓	
Multiple targets (c-KIT, FGFR, PDGFR and VEGFR)	Axitinib	CYP3A4	CYP1A2, CYP2C19, CYP3A5, UGT1A1		✓	
	Nintedanib	CYP1A2	CYP2C9, CYP2C19, CYP2D6, CYP2E1		✓	
	Pazopanib	CYP3A4, UGT1A1	CYP1A2, CYP2C8, CYP3A5			●
	Ponatinib	CYP3A4	CYP2C8, CYP2D6, CYP3A5		✓	
	Regorafenib	CYP3A4	UGT1A9, CYP3A5		✓	
	Sorafenib	CYP3A4	UGT1A9, CYP3A5		✓	
	Sunitinib	CYP3A4	CYP3A5, ABCG2		✓	
	Toceranib	CYP3A4	CYP3A5		✓	
Protein kinase inhibitor (non-receptor)						
BCR-ABL	Imatinib	CYP3A4	CYP3A5, ABCB1, SLCO1A2, SLC22A4, ABCG2		✓	
	Nilotinib	CYP3A4, UGT1A1	CYP1A2, CYP2C9, CYP2C19, CYP2D6, CYP3A5, ABCG2		✓	
	Dasatinib	CYP3A4	CYP3A5, ABCG2		✓	
	Ponatinib	CYP3A4	CYP2C8, CYP2D6, CYP3A5		✓	
Src	Bosutinib	CYP3A4	CYP3A5		✓	
Janus kinase	Lestaurtinib	CYP3A4	CYP3A5		✓	
	Ruxolitinib	CYP3A4	CYP3A5		✓	
	Pacritinib	CYP3A4	CYP3A5		✓	
	Tofacitinib	CYP3A4	CYP2C19, CYP3A5		✓	

PGx Report - Oncology, Hematology

Type: Antineoplastic Targeted Therapy II

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Protein kinase inhibitor (non-receptor)						
EML4-ALK	Ceritinib	CYP3A4	CYP2C9, CYP3A5		✓	
	Crizotinib	CYP3A4	CYP3A5		✓	
Bruton tyrosine kinase	Ibrutinib	CYP3A4	CYP2D6, CYP3A5		✓	
BRAF inhibitor (V600E mutation-positive)	Dabrafenib	CYP2C8	CYP3A4, CYP3A5, G6PD		✓	
Other Targeted therapy						
mTOR Inhibitors	Sirolimus	CYP3A4	CYP3A5		✓	
	Everolimus	CYP3A4	CYP2C8, CYP3A5		✓	
Hedgehog pathway inhibitor	Vismodegib	CYP2C9	CYP3A4, CYP3A5		✓	
Hormone antagonists and related agents						
Selective estrogen receptor modulators (SERM)	Toremifene	CYP3A4	CYP2D6, CYP3A5		✓	
	Tamoxifen	CYP3A4, CYP2D6, CYP2C9	CYP3A5, CYP2B6, FMO1, FMO3, CYP2C19, CYP1A2, UGT1A3, UGT1A4, SULT1A1, F2, F5, ABCC2		✓	
SERD	Fulvestrant	CYP3A4	CYP3A5		✓	
Anti-androgens	Flutamide	CYP1A2	CYP3A4, CYP3A5		✓	
	Nilutamide	CYP2C19	FMO3		✓	
	Bicalutamide	CYP3A4	CYP3A5		✓	
	Enzalutamide	CYP2C8	CYP3A4, CYP3A5		✓	
Aromatase inhibitors	Anastrozole	CYP3A4	CYP3A5, UGT1A4		✓	
	Letrozole	CYP3A4	CYP2A6, CYP3A5		✓	
	Exemestane	CYP3A4	CYP3A5		✓	
Other hormone antagonists and related agents	Abiraterone	CYP3A4	CYP3A5, SULT2A1		✓	
Hematologic						
Thrombopoiesis Stimulating Agent	Eltrombopag	CYP1A2	CYP2C8, F5, SERPINC1		✓	

Abbreviations: C-KIT, tyrosine-protein kinase Kit; PDGFR, Platelet-derived growth factor receptor; FLT3, FMS-like tyrosine kinase-3; RET, RET proto-oncogene; VEGFR, Vascular endothelial growth factor receptor; Src, Proto-oncogene tyrosine-protein kinase Src; EML4-ALK, echinoderm microtubule associated protein like 4 – anaplastic lymphoma kinase; BRAF, proto-oncogene B-Raf; mTOR, mammalian target of rapamycin; SERD, selective estrogen receptor down-regulator.

PGx Report - Organ Transplantation

Type: Immunosuppressive, Immunomodulation

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Immunosuppressive						
Antimetabolite	Mycophenolate mofetil	CYP3A4	CYP3A5, CYP2C8, UGT2B7, UGT1A8, UGT1A9, SLCO1B1, SLCO1B3, ABCC2, HPRT1		✓	
	Azathioprine	XO	TPMT, NUDT15, AOX1		✓	
Calcineurin Inhibitors	Pimecrolimus	CYP3A4	CYP3A5		✓	
	Tacrolimus	CYP3A4	CYP3A5, ABCB1, UGT2B7		✓	
	Cyclosporine	CYP3A4	CYP3A5, ABCB1, UGT2B7, ABCC2		✓	
mTOR Inhibitors	Temsirolimus	CYP3A4	CYP3A5		✓	
	Everolimus	CYP3A4	CYP2C8, CYP3A5		✓	
Immunomodulation						
Immunomodulator and anti-angiogenic	Pomalidomide	CYP1A2	CYP3A4, CYP2C19, CYP2D6, CYP3A5		✓	

PGx Report - Anesthesiology

Type: Anesthetic, Muscle Relaxant

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Inhaled Anesthetics						
Inhaled Agents	Enflurane	CYP2E1			✓	
	Halothane	CYP2E1	CYP3A4, CYP2A6, CYP3A5		✓	
	Isoflurane	CYP2E1	CYP2B6		✓	
	Methoxyflurane	CYP2E1	CYP1A2, CYP2C9, CYP2D6		✓	
	Sevoflurane	CYP2E1			✓	
Intravenous agents (non-opioid)						
Barbiturates	Hexobarbital	CYP2C19	CYP2C9, CYP2E1, CYP1A2		✓	
	Thiamylal	CYP2C9			✓	
Benzodiazepines	Diazepam	CYP2C19, CYP3A4	CYP3A5, CYP2B6, CYP1A2		✓	
	Midazolam	CYP3A4	CYP3A5		✓	
Other Anesthetics	Ketamine	CYP3A4	CYP2B6, CYP2C9, CYP3A5		✓	
Skeletal muscle relaxants						
Muscle Relaxants	Succinylcholine	BCHE			✓	
	Carisoprodol	CYP2C19			✓	
	Cyclobenzaprine	CYP1A2	CYP2D6, CYP3A4, CYP3A5, UGT1A4		✓	
	Tizanidine	CYP1A2			✓	

PGx Report - Urology

Type: Drugs Prescribed for the Treatment of Incontinence, Erectile Dysfunction, Benign Prostatic Hypertrophy

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Drugs for urinary frequency and incontinence						
Anticholinergic	Oxybutynin	CYP3A4	CYP3A5		✓	
	Tolterodine	CYP2D6, CYP3A4	CYP2C9, CYP3A5, CYP2C19		✓	
	Solifenacin	CYP3A4	CYP3A5		✓	
	Darifenacin	CYP2D6	CYP3A4, CYP3A5		✓	
Drugs used in erectile dysfunction						
Phosphodiesterase inhibitors	Sildenafil	CYP3A4	CYP2C9, CYP3A5		✓	
	Tadalafil	CYP3A4	CYP3A5		✓	
	Vardenafil	CYP3A4	CYP2C9, CYP3A5		✓	
	Avanafil	CYP3A4	CYP3A5		✓	
	Udenafil	CYP3A4	CYP3A5		✓	
Drugs used in benign prostatic hypertrophy						
Alpha-adrenoreceptor antagonists	Alfuzosin	CYP3A4	CYP3A5, Renal Excretion		✓	
	Tamsulosin	CYP3A4	CYP2D6, CYP3A5, Renal Excretion		✓	
	Silodosin	CYP3A4	UGT2B7, CYP3A5			✓
Testosterone-5-alpha reductase inhibitors	Finasteride	CYP3A4	CYP3A5		✓	
	Dutasteride	CYP3A4	CYP3A5		✓	

PGx Report - Endocrinology

Type: Contraceptives, Androgens, Antiandrogens, Glucocorticoid, Thyroid

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Hormonal contraceptives						
Estrogens	Ethinylestradiol	CYP3A4, CYP2C9	CYP3A5, CYP2C19, CYP1A2, UGT1A1		●	
	Estradiol	CYP1A2	CYP3A4, CYP3A5, CYP2C8, UGT1A1, UGT1A9		●	
Progestogens	Desogestrel	CYP3A4, HSD3B1	CYP3A5, CYP2C9, CYP2C19, UGT1A1		●	
	Dienogest	CYP3A4	CYP3A5		●	
	Mestranol	CYP2C9			●	
Emergency contraceptives	Levonorgestrel	CYP3A4	CYP3A5		●	
	Ulipristal	CYP3A4	CYP1A2, CYP2D6, CYP3A5		●	
Androgens						
3-oxoandrosten-(4) derivatives	Testosterone	CYP3A4, CYP19A1	HSD3B2, CYP3A5, UGT2B15, SULTs			●
Antiandrogens						
Antiandrogens	Cyproterone	CYP3A4	CYP3A5		●	
Other sex hormones and modulators of the genital system						
Selective estrogen receptor modulators (SERMs)	**Raloxifene**	**UGT1A1**	UGT1A8, UGT1A10			●
	Bazedoxifene	**UGT1A1**	UGT1A8, UGT1A10			●
	Ospemifene	CYP3A4	CYP2C9, CYP3A5, CYP2C19, CYP2B6		●	
Steroid hormone						
Glucocorticoids	Dexamethasone	CYP3A4	CYP17A1, CYP3A5		●	
	Cortisol (hydrocortisone)	CYP3A4	CYP3A5		●	
	Prednisone	HSD11B2	CYP3A4, CYP3A5, SLC19A1, SULTs, UGTs		●	
Thyroid hormone						
Thyroid hormones	Levothyroxine	DIO2	UGT1A1, SULTs		●	
	Liothyronine	DIO2	UGT1A1, UGT1A9, SULTs		●	
There are additional SERMs (Tamoxifen and Toremifene) described under antineoplastics)						

PGx Report - Recreational Drugs

Type: Alcohol, Barbiturates, Benzodiazepines, Cannabinoids, Synthetic Cannabis, Dissociative Drugs, Tobacco

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Alcohol	**Ethanol**	**ADH1B**	ALDH2, ADH1A, CYP2E1	◐		
Amphetamines	3,4-methylenedioxy-methamphetamine (MDMA)	Renal Excretion, CYP2D6	CYP1A2, CYP3A4, CYP3A5, FMO3		●	
	Methamphetamine	CYP2D6, Renal Excretion	DBH, FMO3, ACSM1, GLYAT, DRD3		●	
Barbiturates	Amobarbital	CYP3A4	CYP3A5, CYP2B6, CYP2C9, CYP2A6			●
	Phenobarbital	CYP2C19	ABCB1		●	
Benzodiazepines	Alprazolam	CYP3A4	CYP3A5		●	
	Clonazepam	CYP3A4	CYP2C19, CYP3A5, NAT2			●
	Diazepam	CYP2C19, CYP3A4	CYP3A5, CYP2B6, CYP1A2		●	
Cannabinoids & Related Drugs	Cannabidiol (CBD)	CYP3A4	CYP2C19, CYP3A5		●	
	Delta 9-tetra hydrocannabinol (∆9 THC)	CYP2C9	CYP2C19, CYP3A4, CYP3A5		●	
	Cannabinol (CBN)	CYP2C9	CYP2C19, CYP3A4, CYP3A5		●	
Synthetic Cannabis	JWH-018	CYP1A2	CYP2C9		●	
	AM2201	CYP1A2	CYP2C9		●	
Dissociative Drugs	Ketamine	CYP3A4	CYP2B6, CYP2C9, CYP3A5		●	
	Phencyclidine (PCP)	CYP3A4	CYP3A5, CYP2A6, CYP1A2		●	
Ecgonine derivative	Cocaine	BCHE, CES2	CYP3A4, CYP3A5, SLC6A3		●	
Ergoline derivatives	Lysergic acid diethylamide (LSD)	CYP3A4	CYP3A5		●	
Tobacco	Nicotine	CYP2A6, FMO3	UGT1A9, UGT1A4, UGT2B7, CYP2B6, SLC6A3			●

Additional SNPs of Importance for Recreational Drugs

Gene	Marker	Genotype	Drug	Level of Evidence	Results
OPRD1	rs2236857	AA	Heroin		Patients may have a lower tendency for heroin addiction
DBH	rs1611115	TC	Analgesics	3	Patients with substance withdrawal syndrome may have a decreased likelihood of headache when discontinuing the use of analgesics (such as opioids, NSAIDs, triptans, ergot)

Genomic Test Results

Genotype/Haplotype Details

CYP1A1

Allele Tested: *1, *3, *4, *5, *7, *8.

Genetic results: CYP1A1 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP1A1		*595T>C	*3	rs1800031	TT
CYP1A1	Thr461Asn	1382C>A	*4	rs1799814	GG
CYP1A1	Arg464Ser	1390C>A	*5	rs41279188	GG
CYP1A1	Glu426Terfs	1275_1276insT	*7	rs72547510	DD
CYP1A1	Ile448Asn	1343T>A	*8	rs72547509	TT

CYP1A1 contribute in the metabolism of several drugs including: Amodiaquine, Estrogens, Erlotinib, Gefitinib, Warfarin.

Genotype/Haplotype Details

CYP1A2

Allele Tested: *1A, *1B, *1E, *1F, *1G, *1J, *1K, *3, *4, *5, *6, *7, *8, *11, *15, *16.

Genetic results: CYP1A2 *1F/*1B

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP1A2	Asn516Asn	1548T>C	*1B	rs2470890	TC
CYP1A2		-739T>G	*1E	rs2069526	TT
CYP1A2		-729C>T	*1K	rs12720461	CC
CYP1A2		-163C>A	*1F	rs762551	AC
CYP1A2	Asp348Asn	1042G>A	*3	rs56276455	GG
CYP1A2	Ile386Phe	1156A>T	*4	rs72547516	AA
CYP1A2	Cys406Tyr	1217G>A	*5	rs55889066	GG
CYP1A2	Arg431Trp	1291C>T	*6	rs28399424	CC
CYP1A2	Splicing defect	1253+1G>A	*7	rs56107638	GG
CYP1A2	Arg456His	1367G>A	*8	rs72547517	GG
CYP1A2	Phe186Leu	558C>A	*11	rs72547513	CC
CYP1A2	Pro42Arg	125C>G	*15	rs72547511	CC
CYP1A2	Arg377Gln	1130G>A	*16	rs72547515	CC

CYP1A2 is the most important gene in the metabolism of: Asenapine, Bromazepam, Carmustine, Clozapine, Cyamemazine, Cyclobenzaprine, Eltrombopag, Estradiol, Febuxostat, Flutamide, Frovatriptan, Imipramine, Leflunomide, Lidocaine, Loxapine, Mirtazapine, Nabumetone, Naratriptan, Nintedanib, Palonosetron, Pomalidomide, Promazine, Pyrazinamide, Ramelteon, Rasagiline, Riluzole, Ropinirole, Tacrine, Theophylline, Thiothixene, Tizanidine, Triamterene, Trifluoperazine, Zileuton, Zolmitriptan.

Drugs and substances known to induce CYP1A2 activity include: beta-naphthoflavone, char-grilled meat, Marijuana, Modafinil, Omeprazole, Tobacco.

Drugs and substances known to inhibit CYP1A2 activity include: Amiodarone, Efavirenz, Fluoroquinolones, Fluvoxamine, Ticlopidine, Verapamil.

CYP1A2 activity is dependent upon hepatic and renal function status as well as age.

Genotype/Haplotype Details

CYP2A6

Allele Tested: *1A, *2, *7, *8, *9, *17.

Genetic results: CYP2A6 *1A/*1A

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2A6	Leu160His	479T>A	*2	rs1801272	TT
CYP2A6	Ile471Thr	1412T>C	*7	rs5031016	TT
CYP2A6	Arg485Leu	1454G>T	*8	rs28399468	GG
CYP2A6		-48T>G	*9	rs28399433	TT
CYP2A6	Val365Met	1093G>A	*17	rs28399454	GG

CYP2A6 is the most important gene in the metabolism of: Artesunate, Nicotine, Tegafur.

Drugs and substances known to induce CYP2A6 activity include: Pentobarbital, Phenobarbital, Rifampicin.

Drugs and substances known to inhibit CYP2A6 activity include: Grapefruit juice flavonoids, Ketoconazole, Methoxsalen, Pilocarpine, Tranylcypromine.

Genotype/Haplotype Details

CYP2B6

Allele Tested: *1, *5, *6, *7, *8, *9, *10, *11, *12, *13, *14, *15, *18, *19, *20, *21, *22, *26, *27, *28.

Genetic results: CYP2B6 *9/*9 or *9/*6 or *6/*6

Phenotype: Intermediate metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2B6	Arg487Cys	1459C>T	*5/*7	rs3211371	CC
CYP2B6	Gln172His	516G>T	*6/*9	rs3745274	TT
CYP2B6	Lys139Glu	415A>G	*8/*13	rs12721655	AA
CYP2B6	Arg22Cys	64C>T	*10	rs8192709	CC
CYP2B6	Met46Leu	136A>G	*11	rs35303484	AA
CYP2B6	Gly99Glu	296G>A	*12	rs36060847	GG
CYP2B6	Arg140Gln	419G>A	*14	rs35773040	GG
CYP2B6	Ile391Asn	1172T>A	*15	rs35979566	TT
CYP2B6	Ile328Thr	983T>C	*16	rs28399499	TT
CYP2B6	Arg336Cys	1006C>T	*19	rs34826503	CC
CYP2B6	Thr168Ile	503C>T	*20	rs36056539	CC
CYP2B6	Pro428Thr	1282C>A	*21	rs35010098	CC
CYP2B6		-82T>C	*22	rs34223104	TT
CYP2B6	Pro167Ala	499C>G	*26	rs3826711	CC
CYP2B6	Met198Thr	593T>C	*27	rs36079186	TT
CYP2B6	Arg378Ter	1132C>T	*28	rs34097093	CC

CYP2B6 is the most important gene in the metabolism of: Bupropion, Cyclophosphamide, Efavirenz, Iphosphamide, Meperidine, Ondansetron, Selegiline, Sertraline.

Drugs and substances known to induce CYP2B6 activity include: Artemisinin, Carbamazepine, Efavirenz, Nevirapine, Phenobarbital, Phenytoin, Rifampicin.

Drugs and substances known to inhibit CYP2B6 activity include: Clopidogrel, Orphenadrine, Thiotepa, Ticlopidine, Voriconazole.

Genotype/Haplotype Details

CYP2C8

Allele Tested: *1, *2, *3, *5, *11.

Genetic results: CYP2C8 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2C8	Ile269Phe	805A>T	*2	rs11572103	AA
CYP2C8	Arg139Lys	416G>A	*3	rs11572080	GG
CYP2C8	Lys399Arg	1196A>G	*3	rs10509681	TT
CYP2C8	Thr159Profs	475delA	*5	rs72558196	II
CYP2C8	Glu274Ter	820G>T	*11	rs78637571	CC

CYP2C8 is the most important gene in the metabolism of: Amodiaquine, Chloroquine, Dabrafenib, Desloratadine, Enzalutamide, Isotretinoin, Nicardipine, Paclitaxel, Pioglitazone, Repaglinide, Rosiglitazone.

Drugs and substances known to induce CYP2C8 activity include: Rifampicin.

Drugs and substances known to inhibit CYP2C8 activity include: Gemfibrozil, Montelukast, Trimethoprim.

Genotype/Haplotype Details

CYP2C9

Allele Tested: *1, *3, *4, *5, *8, *9, *10, *11, *12, *13, *14, *15, *16, *18, *27, *31.

Genetic results: CYP2C9 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2C9	Ile359Leu	1075A>C	*3	rs1057910	AA
CYP2C9	Ile359Asn	1076T>C	*4	rs56165452	TT
CYP2C9	Asp360Glu	1080C>G	*5	rs28371686	CC
CYP2C9	Arg150His/Leu	449G>A/T	*8/*27	rs7900194	GG
CYP2C9	His251Arg	752A>G	*9	rs2256871	TT
CYP2C9	Glu272Gly	815A>G	*10	rs9332130	AA
CYP2C9	Arg335Trp	1003C>T	*11	rs28371685	CC
CYP2C9	Pro489Ser	1465C>T	*12	rs9332239	CC
CYP2C9	Leu90Pro	269T>C	*13	rs72558187	TT
CYP2C9	Arg125His	374G>A	*14	rs72558189	GG
CYP2C9	Ser162Ter	485C>A	*15	rs72558190	CC
CYP2C9	Thr299Ala	895A>G	*16	rs72558192	AA
CYP2C9	Asp397Ala	1190A>C	*18	rs72558193	AA
CYP2C9	Ile327Thr	980T>C	*31	rs57505750	TT

CYP2C9 is the most important gene in the metabolism of: Acenocoumarol, Alosetron , Azilsartan, Bosentan, Cannabinol (CBN), Celecoxib, Chloramphenicol, Delta 9-tetra hydrocannabinol (▵9_THC), Dronabinol, Fenoprofen, Flurbiprofen, Fluvastatin, Gliclazide, Glimepiride, Glipizide, Gliquidone, Ibuprofen, Indomethacin, Irbesartan, Ketobemidone, Lacosamide, Lornoxicam, Losartan, Mefenamic acid, Meloxicam, Mestranol, Naproxen, Nateglinide, Paramethadione, Parecoxib, Phenprocoumon, Piroxicam, Primidone, Sulfinpyrazone, Tapentadol, Tenoxicam, Terbinafine, Thiamylal, Tolazamide, Tolbutamide, Torasemide, Trimethadione, Valsartan, Vismodegib, Warfarin, Zafirlukast.

Drugs and substances known to induce CYP2C9 activity include: Carbamazepine, Nevirapine, Phenobarbital, Rifampicin, Secobarbital.

Drugs and substances known to inhibit CYP2C9 activity include: Amentoflavone, Amiodarone, Apigenin, Isoniazid, Fluconazole, Miconazole, Sulfaphenazole, Valproic acid.

Genotype/Haplotype Details

CYP2C19

Allele Tested: *1, *2B, *3, *4, *5, *6, *7, *8, *9, *10, *12, *16, *17, *22, *27, *35.

Genetic results: CYP2C19 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2C19	Glu92Asp	276G>C	*2B	rs17878459	GG
CYP2C19	Trp212Ter	636G>A	*3	rs4986893	GG
CYP2C19	Met1Val	1A>G	*4	rs28399504	AA
CYP2C19	Arg433Trp	1297C>T	*5	rs56337013	CC
CYP2C19	Arg132Gln	395G>A	*6	rs72552267	GG
CYP2C19	Splicing defect	819+2T>A	*7	rs72558186	TT
CYP2C19	Trp120Arg	358T>C	*8	rs41291556	TT
CYP2C19	Arg144His	431G>A	*9	rs17884712	GG
CYP2C19	Pro227Leu	680C>T	*10	rs6413438	CC
CYP2C19	Ter491Cys	1473A>C	*12	rs55640102	AA
CYP2C19	Argl442Cys	1324C>T	*16	rs192154563	CC
CYP2C19		-806C>T	*17	rs12248560	CC
CYP2C19	Arg186Pro	557G>C	*22	rs140278421	GG
CYP2C19		-1041G>A	*27	rs7902257	GG
CYP2C19		332-23A>G	*35	rs12769205	AA

CYP2C19 is the most important gene in the metabolism of: Brivaracetam, Carisoprodol, Citalopram, Clobazam, Clopidogrel, Dexlansoprazole, Diazepam, Enfuvirtide, Esomeprazole, Flunitrazepam, Hexobarbital, Mephenytoin, Moclobemide, Nelfinavir, Nilutamide, Omeprazole, Pantoprazole, Pentamidine, Phenobarbital, Phenytoin, Proguanil, Rabeprazole, Temazepam, Teniposide, Voriconazole.

Drugs and substances known to induce CYP2C19 activity include: Artemisinin, Carbamazepine, Efavirenz, Norethisterone, Rifampicin, Ritonavir, St. John's Wort.

Drugs and substances known to inhibit CYP2C19 activity include: Chloramphenicol, Esomeprazole, Felbamate, Fluvoxamine, Isoniazid, Lansoprazole, Moclobemide, Omeprazole.

Genotype/Haplotype Details

CYP2D6

Allele Tested: *1, *2, *3, *6A, *6C, *7, *8, *9, *11, *12, *14, *17, *19, *20, *29, *31, *34, *35, *39, *41, *42, *44, *47, *51, *54, *62, *81, *100, *101.

Genetic results: CYP2D6 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2D6	Arg296Cys	886C>T	*2	rs16947	GG
CYP2D6	Ser486Thr	1457G>C	*2	rs1135840	GG
CYP2D6		-1584C>G	*2A	rs1080985	CC
CYP2D6	Arg259Glyfs	775delA	*3	rs35742686	II
CYP2D6	Trp152Glyfs	454delT	*6	rs5030655	TT
CYP2D6	His324Pro	971A>C	*7	rs5030867	TT
CYP2D6	Gly169Ter/Arg	505G>T/A	*8/*14	rs5030865	GG
CYP2D6	Lys281del	841_843delAAG	*9	rs5030656	II
CYP2D6	Splicing defect	181-1G>C	*11	rs201377835	CC
CYP2D6	Gly42Arg	124G>A	*12	rs5030862	GG
CYP2D6	Thr107Ile	320C>T	*17	rs28371706	CC
CYP2D6	255fs	2539_2542delAACT	*19	rs72549353	AACTAACT
CYP2D6	211fs	1973_1974insG	*20	rs72549354	DD
CYP2D6	Val338Met	1012G>A	*29	rs59421388	CC
CYP2D6	Arg440His	1319G>A	*31	rs267608319	CC
CYP2D6	Val11Met	31G>A	*35	rs769258	GG
CYP2D6	Splicing defect	985+39G>A	*41	rs28371725	GG
CYP2D6	Gln364Cysfs	1088_1089insGT	*42	rs72549346	DD
CYP2D6	Splicing defect	985+1G>C	*44	rs72549349	CC
CYP2D6	Arg25Trp	73C	*47	rs267608313	GG
CYP2D6	Glu334Ala	1001A>C	*51	rs72549348	TT
CYP2D6	Thr261Ile	782C>T	*54	rs267608297	GG
CYP2D6	Arg441Cys	1168C>T	*62	rs730882251	CC
CYP2D6	Arg269Ter	805C>T	*81	rs367543000	CC
CYP2D6	Ser288Argfs	864delC	*100	rs267608279	II
CYP2D6	Met321Ilefs	810_828del19	*101	rs730882170	II

CYP2D6 is the most important gene in the metabolism of: Aclidinium, Amitriptyline, Amoxapine, Arformoterol, Aripiprazole, Atomoxetine, Bisoprolol, Carvedilol, Chlorpromazine, Clomipramine, Clonidine, Codeine, Cyclizine, Dapoxetine, Darifenacin, Debrisoquine, Desipramine, Dexmethylphenidate, Dextromethorphan, Diphenhydramine, Donepezil, Dosulepin, Doxazosin, Doxepin, Duloxetine, Encainide, Ethylmorphine, Flecainide, Fluoxetine, Fluphenazine, Fluvoxamine, Formoterol , Galantamine, Hydrocodone, Hydroxychloroquine, Iloperidone, Labetalol, Lisdexamfetamine, Lorcaserin, Maprotiline, Methamphetamine, Methylnaltrexone, Methylphenidate, Metoclopramide, Metoprolol, Mexiletine, Mianserin, Modafinil, Nebivolol, Nefazodone, Nortriptyline, Paliperidone, Paroxetine, Perphenazine, Primaquine, Procainamide, Prochlorperazine, Promethazine, Propafenone, Propranolol, Protriptyline, Reserpine, Risperidone, Sertindole, Sparteine, Tetrabenazine, Thioridazine, Timolol, Tolterodine, Tramadol, Trimipramine, Umeclidinium, Venlafaxine, Vicoprofen, Vortioxetine, Zuclopenthixol.

In Caucasians, approximately 6 -10% are CYP2D6 poor metabolizers and up to 7% are ultrarapid drug metabolizers.

Drugs and substances known to induce CYP2D6 activity include: Dexamethasone, Glutethimide, Rifampicin.

Drugs and substances known to inhibit CYP2D6 activity include: Bupropion, Fluoxetine, Paroxetine, Quinidine, Ritonavir.

Genotype/Haplotype Details

CYP2E1

Allele Tested: *1, *2, *4, *7.

Genetic results: CYP2E1 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2E1	Arg76His	227G>A	*2	rs72559710	GG
CYP2E1	Val179Ile	535G>A	*4	rs6413419	GG
CYP2E1		-333T>A	*7	rs2070673	TT

CYP2E1 is the most important gene in the metabolism of: Dalfampridine, Dapsone, Enflurane, Halothane, Isoflurane, Methoxyflurane, Mitoxantrone, Sevoflurane.

Drugs and substances known to induce CYP2E1 activity include: Ethanol, Isoniazid.

Drugs and substances known to inhibit CYP2E1 activity include: Disulfiram

Genotype/Haplotype Details

CYP3A4

Allele Tested: *1A, *1B, *2, *3, *6, *7, *8, *10, *11, *12, *13, *15, *16, *17, *18, *20, *22, *26.

Genetic results: CYP3A4 *1A/*1A

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP3A4		-392A>G	*1B	rs2740574	AA
CYP3A4	Ser222Pro	664T>C	*2	rs55785340	AA
CYP3A4	Met445Thr	1334T>C	*3	rs4986910	TT
CYP3A4	Asp277Glufs	830_831insA	*6	rs4646438	DD
CYP3A4	Gly56Asp	167G>A	*7	rs56324128	GG
CYP3A4	Arg130Gln	389G>A	*8	rs72552799	CC
CYP3A4	Asp174His	520G>C	*10	rs4986908	
CYP3A4	Thr362Met	1088C>T	*11	rs67784355	GG
CYP3A4	Leu373Phe	1117C>T	*12	rs12721629	CC
CYP3A4	Pro416Leu	1247C>T	*13	rs4986909	CC
CYP3A4	Arg162Gln	485G>A	*15	rs4986907	GG
CYP3A4	Thr185Ser	554C>G	*16	rs12721627	CC
CYP3A4	Phe189Ser	566T>C	*17	rs4987161	TT
CYP3A4	Leu293Pro	878T>C	*18	rs28371759	TT
CYP3A4	Lys487_Pro488delinsLysThrArgfs	1461_1462insA	*20	rs67666821	DD
CYP3A4		522-191C>T	*22	rs35599367	CC
CYP3A4	Arg268Ter	802C>T	*26	rs138105638	GG

Genotype/Haplotype Details

CYP3A5

Allele Tested: *1A, *1D, *3A, *3B, *3K, *3L, *4, *5, *6, *7, *8, *9.

Genetic results: CYP3A5 *3A/*3A

Phenotype: Poor metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP3A5	Splicing defect	689-1A>G	*3	rs776746	GG
CYP3A5	His30Tyr	58C>T	*3B	rs28383468	CC
CYP3A5		*14C>T	*1D/*3	rs15524	TT
CYP3A5	Gln200Arg	599A>G	*4	rs56411402	TT
CYP3A5	Splicing defect	T>C	*5	rs55965422	AA
CYP3A5	Splicing defect	624G>A	*6	rs10264272	CC
CYP3A5	Thr346Tyrfs	1035_1036insT	*7	rs41303343	DD
CYP3A5	Arg28Cys	82C>T	*8	rs55817950	GG
CYP3A5	Ala337Thr	1009G>A	*9	rs28383479	GG
CYP3A5	Phe446Ser	1337T>C	*3K	rs41279854	AA

CYP3A4/5 are the most important genes in the metabolism of: Abiraterone, Albendazole, Alfentanyl, Alfuzosin, Aliskiren, Almotriptan, Alprazolam, Amiodarone, Amlodipine, Amobarbital, Anastrozole, Apixaban, Aprepitant, Armodafinil, Arteether, Artemether, Artemisinin, Astemizole, Atazanavir, Atorvastatin, Avanafil, Axitinib, Bedaquiline, Bepridil, Bicalutamide, Boceprevir, Bosutinib, Bromocriptine, Bromperidol, Brotizolam, Budesonide, Buprenorphine, Buspirone, Cabozantinib, Cannabidiol (CBD), Carbamazepine, Ceritinib, Cerivastatin, Chlordiazepoxide, Chlorpheniramine, Cilansetron, Cilostazol, Cinacalcet, Cinitapride, Cisapride, Clarithromycin, Clebopride , Clindamycin, Clonazepam, Clorazepate, Colchicine, Cortisol (hydrocortisone), Crizotinib, Cyclosporine, Cyproterone, Darunavir, Dasatinib, Delavirdine, Desogestrel, Dexamethasone, Dextropropoxyphene, Dienogest, Dihydrocodeine, Dihydroergotamine, Diltiazem, Disopyramide, Docetaxel, Dolasetron, Domperidone, Dronedarone, Droperidol, Dutasteride, Eletriptan, Elvitegravir, Eplerenone, Ergotamine, Erlotinib, Erythromycin, Escitalopram, Estazolam, Eszopiclone, Ethinylestradiol, Ethosuximide, Etoposide, Etoricoxib, Etravirine, Everolimus, Exemestane, Felbamate, Fentanyl, Finasteride, Flurazepam, Fluticasone, Fosamprenavir, Fulvestrant, Gefitinib, Gemfibrozil, Glyburide, Granisetron, Halofantrine, Haloperidol, Hydroxyzine, Ibrutinib, Ilaprazole, Imatinib, Indinavir, Itraconazole, Ivabradine, Ivacaftor, Ketamine, Ketoconazole, Ketoprofen, Lansoprazole, Lapatinib, Lestaurtinib, Letrozole, Levacetylmethadol, Levomepromazine, Levomilnacipran, Levonorgestrel, Loperamide, Lopinavir, Loratadine, Lormetazepam, Lovastatin, Lurasidone, Lysergic acid diethylamide (LSD), Macitentan, Maraviroc, Masitinib, Mefloquine, Methadone, Midazolam, Mifepristone, Mometasone, Montelukast, Mosapride, Mycophenolate mofetil, Neratinib, Nevirapine, Nifedipine, Nilotinib, Nimodipine, Nitrazepam, Nordazepam, Ornidazole, Ospemifene, Oxybutynin, Oxycodone, Pacritinib, Paritaprevir, Pazopanib, Perampanel , Phencyclidine (PCP), Pimecrolimus, Pimozide, Ponatinib, Pranlukast, Prednisone, Quazepam, Quetiapine, Quinidine, Quinine, Ranolazine, Reboxetine, Regorafenib, Rifabutin, Rifampicin, Rilpivirine, Ritonavir, Rivaroxaban, Roflumilast, Ruxolitinib, Salmeterol, Saquinavir, Saxagliptin, Scopolamine, Sibutramine, Sildenafil, Silodosin, Simeprevir, Simvastatin, Sirolimus, Sitagliptin, Solifenacin, Sorafenib, Sufentanil, Sunitinib, Tacrolimus, Tadalafil, Tamoxifen, Tamsulosin, Telaprevir, Telithromycin, Temsirolimus, Terazosin, Terfenadine, Testosterone, Tiagabine, Ticagrelor, Tilidine, Tinidazole, Tipranavir, Toceranib, Tofacitinib, Tolvaptan, Toremifene, Trazodone, Triazolam, Tropisetron, Udenafil, Ulipristal, Vandetanib, Vardenafil, Verapamil, Vilanterol, Vilazodone, Vinblastine, Vincristine, Vorapaxar, Zaleplon, Ziprasidone, Zolpidem, Zonisamide, Zopiclone, Zotepine.

Drugs and substances known to induce CYP3A4/5 activity include: Carbamazepine, Efavirenz, Nevirapine, Phenobarbital, Phenytoin, Pioglitazone, Rifabutin, Rifampicin, St. John's Wort, Troglitazone.

Drugs and substances known to inhibit CYP3A4/5 activity include: Chloramphenicol, Clarithromycin, Grapefruit juice flavonoids, Indinavir, Itraconazole, Ketoconazole, Nefazodone, Nelfinavir, Ritonavir.

Genotype/Haplotype Details

CYP4F2

Allele Tested: *1, *3.

Genetic results: CYP4F2 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP4F2	Val433Met	1297G>A	*3	rs2108622	CC

CYP4F2 is the most important gene in the metabolism of: Fingolimod.

Genotype/Haplotype Details

VKORC1

Allele Tested: H1, H2, H3, H4H2, H6, H7, H8, H9.

Genetic results: VKORC1 H2/H7

Phenotype: Warfarin resistance

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
VKORC1		497T>G	H2	rs2884737	AC
VKORC1		2255T>C	H3	rs2359612	AG
VKORC1		1542C>G	H3	rs8050894	GC
VKORC1		1173T>C	H4	rs9934438	AG
VKORC1		-1639A>G	H4	rs9923231	TC
VKORC1		3730G>A	H7	rs7294	AG
VKORC1		776C>A	H8	rs17880887	CC
VKORC1		173+525C>T	H9	rs17708472	GG

The VKORC1 gene encodes the vitamin K epoxide reductase enzyme, the drug target of Warfarin.

Genotype/Haplotype Details

SLCO1B3

Allele Tested: *1A, *1B, *2, *3, *4, *5, *9, *11, *13, *14, *15, *17, *19, *21, *22, *23.

Genetic results: SLCO1B3 *233I/*233I

Phenotype: Extensive function

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
SLCO1B3	Ser112Ala	334T>G	*112A	rs4149117	GG
SLCO1B3	Met233Ile	699G>A	*233I	rs7311358	AA

SLCO1B3 is an important pharmacokinetic gene affecting drug disposition. Pharmaceutical agents affected include: Carboplatin, Docetaxel, Mycophenolate mofetil, Paclitaxel.

Genotype/Haplotype Details

ABCB1

Allele Tested: *1, *2.

Genetic results: ABCB1 *1/*2

Phenotype: Intermediate function

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
ABCB1	Ile1145Ile	3435C>T	*6	rs1045642	CC
ABCB1	Gly412Gly	1236C>T	*8	rs1128503	TC

ABCB1 is an important pharmacokinetic gene modifying drug disposition. Pharmaceutical agents affected include: Alfentanyl, Aliskiren, Atazanavir, Atorvastatin, Carbamazepine, Cisplatin, Clopidogrel, Cyclosporine, Digoxin, Doxorubicin, Efavirenz, Etoposide, Fentanyl, Imatinib, Labetalol, Methadone, Morphine, Nevirapine, Nortriptyline, Ondansetron, Oxycodone, Paclitaxel, Phenobarbital, Phenytoin, Pitavastatin, Pravastatin, Risperidone, Simvastatin, Tacrolimus, Verapamil.

Genotype/Haplotype Details

ABCG2

Allele Tested: *1, *141K, *126Ter.

Genetic results: ABCG2 *1/*1

Phenotype: Extensive function

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
ABCG2	Gln141Lys	421C>A	*141K	rs2231142	CC
ABCG2	Gln126Ter	376C>T	*126Ter	rs72552713	GG

ABCG2 is an important pharmacokinetic gene affecting drug disposition. Pharmaceutical agents affected include: Acetaminophen, Atorvastatin, Docetaxel, Doxorubicin, Erlotinib, Fluoropyrimidines, Gefitinib, Imatinib, Irinotecan, Lovastatin, Lamivudine, Methotrexate, Pazopanib, Paclitaxel, Pravastatin, Simvastatin, Uricosurics, Zidovudine.

Genotype/Haplotype Details

ADH1B

Allele Tested: *1, *2, *3.

Genetic results: ADH1B *2/*2

Phenotype: Ultrarapid metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
ADH1B	His48Arg	143A>G	*2	rs1229984	GG
ADH1B	Arg370Cys	1108C>T	*3	rs2066702	CC

ADH1B, also frequently known as ADH2 or ADH beta, is a Class I alcohol dehydrogenase gene. Alcohol dehydrogenases metabolize ethanol to acetaldehyde, which is successively metabolized by aldehyde dehydrogenases (ALDH1A, ALDH2 genes) to acetate.

Gene	Protein change	Nucleotide change	Marker	Genotype	Positive findings
ALDH2	Glu504Lys	1510G>A	rs671	GG	Normal hangovers. Normal risk of Alcoholism

ALDH2 metabolize acetaldehyde. Individuals heterozygous or homozygous for the Lys504 ALDH2 gene metabolize acetaldehyde poorly and are consequently susceptible to certain adverse effects of acetaldehyde. These effects include: facial flushing, systemic dermatitis, urticaria, and alcohol-induced respiratory reactions such as exacerbation of asthma bronchoconstriction and rhinitis.

Genotype/Haplotype Details

SULT1A1

Allele Tested: *1, *3, *4.

Genetic results: SULT1A1 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
SULT1A1	Val223Met	667A>G	*3	rs1801030	AA
SULT1A1	Arg37Gln	110G>A	*4	rs72547527	CC

SULT1A1 contribute in the metabolism of several drugs including: Acetaminophen, Naproxen, Propofol, Tamoxifen.

Genotype/Haplotype Details

EPHX1

Allele Tested: *1, *113His, *139Arg.

Genetic results: EPHX1 *113His/*139Arg

Phenotype: Ultrarapid metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
EPHX1	Tyr113His	337T>C	*113His	rs1051740	TC
EPHX1	His139Arg	416A>G	*139Arg	rs2234922	AG

EPHX1 contribute in the metabolism of several drugs including: Carbamazepine, Cisplatin, Cyclophosphamide, Docetaxel, Phenprocoumon, Phenytoin, Warfarin.

Genotype/Haplotype Details

NAT2

Allele Tested: *4, *5A, *5B, *5C, *5D, *5E, *5G, *5J, *6A, *6B, *6C, *6E, *7A, *7B, *11A, *12A, *12B, *12C, *13, *14A, *14B, *14C, *14D, *14E, *14F, *14G, *17, *19, .

Genetic results: NAT2 *6A/*6A

Phenotype: Poor acetylator

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
NAT2	Ile114Thr	341T>C	*5	rs1801280	TT
NAT2	Arg197Gln	590G>A	*6	rs1799930	AA
NAT2	Gly286Glu	857G>A	*7	rs1799931	GG
NAT2	Leu161Leu	481C>T	*11	rs1799929	CC
NAT2	Arg268Lys	803A>G	*12	rs1208	AA
NAT2	Tyr94Tyr	282C>T	*13	rs1041983	TT
NAT2	Arg64Gln	191G>A	*14	rs1801279	GG
NAT2	Gln145Pro	434A>C	*17	rs72554616	AA
NAT2	Arg64Trp	190C>T	*19	rs1805158	CC

NAT2 is the most important gene in the metabolism of: Hydralazine, Isoniazid, Isosorbide dinitrate, and certain sulfonamides such as Sulfadimidine, Sulfapyridine.

NAT2 contribute in the metabolism of several drugs including: Caffeine, Dapsone, Flunitrazepam, Procainamide, Nitrazepam.

Genetic results: SLCO1B3 *233I/*233I

Genotype/Haplotype Details

TPMT

Allele Tested: *1, *2, *3A, *3B, *3C, *3D, *4, *8, *14, *29, *37.

Genetic results: TPMT *1/*1

Phenotype:Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
TPMT	Ala80Pro	238G>C	*2	rs1800462	GG
TPMT	Ala154Thr	460G>A	*3A or *3B	rs1800460	GG
TPMT	Tyr240Cys	719A>G	*3A or *3C	rs1142345	AA
TPMT	Glu98Ter	292G>T	*3D	rs72552739	CC
TPMT	Splicing defect	626-1G>A	*4	rs1800584	GG
TPMT	Arg215His	644G>A	*8	rs56161402	CC
TPMT	Met1Val	1A>G	*14	rs9333569	AA
TPMT	Met1Thr	2T>C	*29	rs267607275	TT
TPMT	Cys216Ter	648T>A	*37	rs398122996	TT

TPMT contribute in the metabolism of several drugs including: Azathioprine, Mercaptopurine, Thioguanine.

Genotype/Haplotype Details

GSTP1

Allele Tested: *1A, *1B, *1D, *1C.

Genetic results: GSTP1 *1A/*1B

Phenotype: Intermediate metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
GSTP1	Ile105Val	313A>G	*1B or *1C	rs1695	AG
GSTP1	Ala114Val	341C>T	*1C or *1D	rs1138272	CC

GSTP1 contribute in the metabolism of several drugs including: Cisplatin, Doxorubicin, Fluorouracil.

Genotype/Haplotype Details

BCHE

Allele Tested: *1, *70G, *418V, *271M.

Genetic results: BCHE *1/*1

Phenotype: Extensive function

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
BCHE	Asp98Gly	293A>G	*98G	rs1799807	AA
BCHE	Gly418Val	1253G>T	*418V	rs28933390	GG
BCHE	Thr271Met	812C>T	*271M	rs28933389	CC

BCHE is the most important gene in the metabolism of: Succinylcholine.

BCHE contribute in the metabolism of several drugs including: Cocaine, Oseltamivir, Prasugrel, Rivastigmine.

Genotype/Haplotype Details

UGT1A1

Allele Tested: *1, *6, *7, *27, *29, *60, *80.

Genetic results: UGT1A1 *80/*60

Phenotype: Poor metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
UGT1A1	Gly71Arg	211G>A	*6	rs4148323	GG
UGT1A1		-364C>T	*80	rs887829	AG
UGT1A1	Tyr486Asp	1453T>G	*7	rs34993780	TT
UGT1A1	Pro229Gln	686C>A	*27	rs35350960	CC
UGT1A1	Arg367Gly	1099C>G	*29	rs55750087	CC
UGT1A1		862-10021T>G	*60	rs4124874	AC

UGT1A1 is the most important gene in the metabolism of: Bazedoxifene, Ezetimibe, Irinotecan, Raloxifene, Raltegravir, Rosuvastatin.

UGT1A1 contribute in the metabolism of several drugs including: Abacavir, Acetaminophen, Arformoterol, Atorvastatin, Axitinib, Buprenorphine, Carvedilol, Desogestrel, Dolutegravir, Ethinylestradiol, Estradiol, Etoposide, Febuxostat, Fluvastatin, Gemfibrozil, Indacaterol, Ketoconazole, Labetalol, Levothyroxine, Liothyronine, Losartan, Lovastatin, Morphine, Naltrexone, Nilotinib, Pazopanib, Simvastatin, Telmisartan.

Genotype/Haplotype Details

UGT1A4

Allele Tested: *1, *2.

Genetic results: UGT1A4 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
UGT1A4	Pro24Thr	70C>A	*2	rs1799807	CC

UGT1A4 is the most important gene in the metabolism of: Lamotrigine, Olanzapine, Retigabine.

Genotype/Haplotype Details

UGT1A6

Allele Tested: *1, *2.

Genetic results: UGT1A6 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
UGT1A6	Ser7Ala	19T>G	*2	rs6759892	TT
UGT1A6	Thr181Ala	541A>G	*2	rs2070959	AA
UGT1A6	Arg184Ser	552A>C	*2	rs1105879	TT

UGT1A6 contribute in the metabolism of several drugs including: Acetaminophen, Entacapone, Ketoprofen, Naproxen, Nefazodone, Valproic acid.

Genotype/Haplotype Details

UGT1A8

Allele Tested: *1, *2.

Genetic results: UGT1A8 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
UGT1A8	Ala173Gly	518C>T	*2	rs1042597	CC

UGT1A8 contribute in the metabolism of several drugs including: Bazedoxifene, Morphine, Mycophenolate mofetil, Raloxifene, Valproic acid.

Genotype/Haplotype Details

UGT2B7

Allele Tested: *1a, *1d, *2b.

Genetic results: UGT2B7 *2b/*2b

Phenotype: Intermediate metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
UGT2B7	Arg124Arg	372A>G	*1d	rs28365063	AA
UGT2B7		-161C>T	*2b	rs7668258	TT

UGT2B7 is the most important gene in the metabolism of: Clofibrate, Diclofenac, Hydromorphone, Morphine, Lorazepam-r, Naloxone, Naltrexone, Oxazepam-r, Oxymorphone, Zidovudine.

Genotype/Haplotype Details

DPYD

Allele Tested: *1, *2A, *2B, *3, *5, *7, *9A, *10, *9B, *12, *13, D949V, M166V.

Genetic results: DPYD *12/*12

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
DPYD		1905+1G>A	*2A	rs3918290	GG
DPYD	Ile543Val	1627A>G	*2B/*5	rs1801159	GG
DPYD	Pro633Glnfs	1898delC	*3	rs72549303	II
DPYD	Phe100Serfs	295_298delTCAT	*7	rs72549309	II
DPYD	Arg235Trp	703C>T	*8	rs1801266	CC
DPYD	Cys29Arg	85T>C	*9A/*9B	rs1801265	TC
DPYD	Arg886His	2612C>T	*9B	rs1801267	GG
DPYD	Val995Phe	2983G>T	*10	rs1801268	GG
DPYD	Glu386Ter	1156G>T	*12	rs78060119	CC
DPYD	Ile560Ser	1679T>G	*13	rs55886062	TT
DPYD	Asp949Val	2846A>T	D949V	rs67376798	AA
DPYD	Met166Val	496A>G	M166V	rs2297595	TC

DPYD is the most important gene in the metabolism of: Cytarabine, Fluorouracil, Tegafur.

Genotype/Haplotype Details

OPRM1

Allele Tested: *1, *2.

Genetic results: OPRM1 *1/*2

Phenotype: Intermediate sensitivity to Opioids

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
OPRM1	Asn40Asp	118A>G	*2	rs1799971	AG

Genotype/Haplotype Details

NUDT15

Allele Tested: *1, *3, .

Genetic results: NUDT15 *1/*1

Phenotype: Thiopurines resistance

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
NUDT15	Arg139Cys	415C>T	*2/*3	rs116855232	CC

Genotype/Haplotype Details

APOE

Allele Tested: *3, *2, *4, *1.

Genetic results: APOE *3/*3

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
APOE	Arg176Cys	526C>T	*2	rs7412	CC
APOE	Cys130Arg	388T>C	*4	rs429358	TT

Genotype/Haplotype Details

G6PD

Allele Tested: B, M, Kaiping, Canton, Kalyan, Viangchan, .

Genetic results: G6PD B/B

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
G6PD	Leu323Pro	968T>C	A-	rs76723693	CC
G6PD	Ser218Phe	653C>T	M	rs5030868	GG
G6PD	Arg493His	1478G>A	Kaiping	rs72554664	TT
G6PD	Arg489Leu	1376G>T	Canton	rs72554665	CC
G6PD	Asp350His	1048G>C	Mira d'Aire	rs34193178	GG
G6PD	Val291Met	871G>A	Viangchan	rs137852327	GG
G6PD	Phe173Trp	519C>G	Miaoli	NC_000023.11:g.154534463G>C	GG

Risk of Laboratory Technical Problems or Laboratory Error

Standard and effective procedures are in place at testing laboratory to protect against and prevent both technical and operational problems although problems may still occur. Errors can occur due to improper sample collection by patients and physicians. Damage to sample can occur during shipment due to such issues as improper paperwork, mislabeled/misaddressed packaging, loss/delay in receipt of sample at certified testing lab, etc. Issues which may prevent the lab from obtaining results include, but are not limited to: contamination of DNA sample; human &/or testing system error; results which cannot be interpreted; and, mislabeling of DNA sample.

When such issues are encountered, the lab may request a new sample. Re-testing does not guarantee that results will be obtained.

There is a statistically small percentage of inaccurate reporting that may include, but is not limited to such issues as: a false report that a genotype is present. Such errors may cause, but is not limited to: incorrect decisions/recommendations on medical treatment; incorrect decisions/recommendations on diet and/or fitness plans. In cases where laboratory error is suspected or is proven to have occurred, the patient's healthcare professional may recommend/request additional evaluation/testing. Additional testing may be recommended/requested to verify results for any reason presented by patient's healthcare professional.

Limitations

Testing purpose(s): 1) To provide information on how tested individual's genetic profile may affect carrier status for: a) certain inherited disease, b) reaction to certain drugs, c) risk of certain common health conditions, and/or d) response to selected diet, exercise, and/or nutrition recommendations. 2) To obtain information on tested individual's ancient ancestry. Testing purposes are dependent upon specific genetic testing ordered by patient's healthcare professional. Based on testing results, patients should make no changes to medical care [including, but not limited to, changes in dosage or frequency of medication, diet and/or exercise regimens, or pregnancy planning] without the advice of and consultation with a healthcare professional.

Genetic testing is an evolving science. Current testing protocols and results are based on the current/existing developments, information and testing techniques known at this time.

In the future, new variants may be identified and/or more research may be developed on the significance of currently identified variants that will drive changes in the interpretation of previously obtained genetic testing results. Current testing may not include identification of certain variants associated with: diet, exercise or nutrition; disease; and/or, drug response due to these issues.

Factors such as age, diet, ethnicity, family health history, and/or personal health, not related to genetics can also impact the likelihood of developing certain conditions or exhibiting certain drug reactions. Therefore, patients may not always exhibit and/or require the specific diet, nutrition and/or exercise, disease, or drug response expected or consistent with his/her genetic test results.

The genetic associations of certain conditions, particularly those related to diet and exercise, have only been observed/studied in Caucasian populations only. This limitation means that interpretations and recommendations are made in the context of Caucasian-only studies and results may or may not be relevant to those tested who are non-Caucasian or mixed ethnicity individuals.

Healthcare professionals may recommend additional testing to be performed by an independent laboratory or consult with an outside, independent genetic counselor or healthcare professional.