ADVANCED DIAGNOSTICS LABORATORY

Comprehensive PGx report for Jessica Rabbit

PERSONAL DETAILS

PATIENT	Jessica Rabbit
DOB	01-01-1950
GENDER	FEMALE
SPECIMEN TYPE	Oral Fluid
ORDERING PHYSICIAN	Rogger
FACILITY	Toon Town

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LABORATORY INFORMATION

ACCESSION NUMBER	100344
COLLECTION DATE	08/10/2020
RECEIVED DATE	08/14/2020
REPORT GENERATED	09/08/2020
LABORATORY DIRECTOR	Dr. Jeanine Chiaffarano

Current Patient Medication

✓ **Clonidine (Catapres, Kapvay)**

The personalized pharmacogenomics profile of this patient reveals intermediate CYP2D6-mediated metabolism, extensive CYP1A2-mediated metabolism, and extensive CYP3A5-mediated metabolism. For further details, please find supporting evidence in this report or on websites such as www.pharmgkb.org or www.fda.gov.

✓ **Losartan (Cozaar)**

The personalized pharmacogenomics profile of this patient reveals extensive CYP2C9-mediated metabolism, extensive CYP3A4-mediated metabolism, and extensive CYP3A5-mediated metabolism. For further details, please find supporting evidence in this report or on websites such as www.pharmgkb.org or www.fda.gov.

✓ **Diltiazem (Cardizem, Tiazac)**

The personalized pharmacogenomics profile of this patient reveals extensive CYP3A4-mediated metabolism, intermediate CYP2C19-mediated metabolism, and extensive CYP3A5-mediated metabolism. For further details, please find supporting evidence in this report or on websites such as www.pharmgkb.org or www.fda.gov.

✗ **Labetalol (Normodyne, Trandate)**

The personalized pharmacogenomics profile of this patient reveals intermediate CYP2D6-mediated metabolism, and intermediate CYP2C19-mediated metabolism. For further details, please find supporting evidence in this report or on websites such as www.pharmgkb.org or www.fda.gov.

✓ **Mycophenolate mofetil (Myfortic, CellCept)**

The personalized pharmacogenomics profile of this patient reveals extensive CYP3A4-mediated metabolism, extensive CYP3A5-mediated metabolism, and extensive CYP2C8-mediated metabolism. For further details, please find supporting evidence in this report or on websites such as www.pharmgkb.org or www.fda.gov.

✓ **Nifedipine (Procardia, Adalat CC)**

The personalized pharmacogenomics profile of this patient reveals extensive CYP3A4-mediated metabolism, and extensive CYP1A2-mediated metabolism. For further details, please find supporting evidence in this report or on websites such as www.pharmgkb.org or www.fda.gov.

✓ **Pantoprazole (Protonix)**

The personalized pharmacogenomics profile of this patient reveals intermediate CYP2C19-mediated metabolism, extensive CYP3A4-mediated metabolism, and intermediate CYP2D6-mediated metabolism. For further details, please find supporting evidence in this report or on websites such as www.pharmgkb.org or www.fda.gov.

✓ **Clopidogrel (Plavix)**

The personalized pharmacogenomics profile of this patient reveals intermediate CYP2C19-mediated metabolism. For further details, please find supporting evidence in this report or on websites such as www.pharmgkb.org or www.fda.gov.

✓ **Prednisone (Deltasone, Rayos)**

The personalized pharmacogenomics profile of this patient reveals limited PGx information for the hydroxysteroid (11-beta) dehydrogenase 2 (HSD11B2) that is involved in the metabolism of this drug, which is the main mechanism of elimination. In addition, this patient showsextensive CYP3A4-mediated metabolism, and extensive CYP3A5-mediated metabolism. For further details, please find supporting evidence in this report or on websites such as www.pharmgkb.org or www.fda.gov.

! **Tacrolimus (Prograf, Protopic)**

The personalized pharmacogenomics profile of this patient reveals extensive CYP3A4-mediated metabolism, and extensive CYP3A5-mediated metabolism. For further details, please find supporting evidence in this report or on websites such as www.pharmgkb.org or www.fda.gov.

✓ **Valsartan (Diovan)**

The personalized pharmacogenomics profile of this patient reveals extensive CYP2C9-mediated metabolism. For further details, please find supporting evidence in this report or on websites such as www.pharmgkb.org or www.fda.gov.

✗ A medication has potentially reduced efficacy, increased toxicity or the patient has a risk for the indicated condition.

! Guidelines exist for adjusting dosage, increased vigilance or the patient has risk for the indicated condition.

✓ The medication can be prescribed according to standard regimens or the patient's risk for the indicated condition is not increased.

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
CYP2D6	rs16947	2A	Flecainide, Doxepin, Desipramine, Atomoxetine, Risperidone, Clomipramine, Imipramine, Venlafaxine
SLCO1B1	rs4149056	2A	Cerivastatin, Pravastatin, Rosuvastatin
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
CYP2D6	rs16947	4	Methylphenidate, Bufuralol
SLCO1B1	rs4149056	4	Lopinavir, Atrasentan

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

DRUG ALLERGIES

BRIEF MEDICAL HISTORY

GENOTYPE/HAPLOTYPE/PHENOTYPE DETAIL

Gene	Genotype-Haplotype	Phenotype
CYP1A2	*1A/*1L	Extensive metabolizer
CYP2B6	*4/*9 or *1/*6	Intermediate metabolizer
CYP2C8	*1/*1	Extensive metabolizer
CYP2C9	*1/*1	Extensive metabolizer
CYP2C19	*1/*9	Intermediate metabolizer
CYP2D6	*2D/*17	Intermediate metabolizer
CYP3A4	*1A/*1B	Extensive metabolizer
CYP3A5	*1/*1	Extensive metabolizer
CYP4F2	*1/*1	Extensive metabolizer
VKORC1	H4/H7	Sensitive to Warfarin
SLCO1B1	*1B/*1B	Extensive function
TPMT	*1/*1	Extensive metabolizer
UGT1A1	*1/*1	Extensive metabolizer
DPYD	*1/*1	Extensive metabolizer
OPRM1	*1/*1	Sensitive to Opioids

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%.

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.

Dosage

Dosage	Recommendation	Comments
	Use the recommended dosage	
	Use a reduced dosage	
	Use an increased dosage	Minor dosage change
	Use a significantly reduced dosage	
	Use a significantly increased dosage	Major dosage change

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	Nabumetone (Relafen)	CYP1A2	CYP2C19, CYP3A4		✓	
	Indomethacin (Tivorbex)	CYP2C9	CYP2C19		✓	
Enolic acid (Oxicam) derivatives	Meloxicam (Mobic, Vivlodex)	CYP2C9	CYP1A2, CYP3A4, CYP3A5		✓	
	Piroxicam (Feldene)	CYP2C9	CYP3A4, CYP3A5		✓	
	Tenoxicam (Mobiflex)	CYP2C9			✓	
	Lornoxicam (FLEXILOR)	CYP2C9			✓	
Selective COX-2 inhibitors (Coxibs)	Etoricoxib (Arcoxia)	CYP3A4	CYP3A5, CYP2C9, CYP2D6, CYP1A2		✓	
	Parecoxib (Dynastat)	CYP2C9	CYP3A4, CYP3A5		✓	
	Celecoxib (Celebrex)	CYP2C9	CYP2C19		✓	
Propionic acid derivatives	Ibuprofen (Motrin, Advil)	CYP2C9	CYP2C19, CYP2C8, UGT1A3, UGT1A9, UGT2B7		✓	
	Flurbiprofen (Ocufen)	CYP2C9			✓	
	Ketoprofen (Frotek)	CYP3A4	CYP2C9, CYP3A5, UGT1A6, UGT1A9, UGT2B7		✓	
	Fenoprofen (Nalfon, Fenortho)	CYP2C9	UGT2B7		✓	
	Vicoprofen (Reprexain, Ibudone)	CYP2D6	CYP3A4		✓	
	Naproxen (Aleve, Naprosyn)	CYP2C9	CYP1A2, CYP2C8, UGT2B7, SULT1A1, UGT1A3, UGT1A6, UGT1A9		✓	
Anthranilic acid derivatives (Fenamates)	Mefenamic acid (Ponstel)	CYP2C9			✓	
The Non-NSAIDs Analgesic	Acetaminophen (Tylenol)	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	Codeine	CYP2D6	CYP3A4, UGT2B7, UGT2B4, FMO3, CYP3A5, OPRM1	◔		
Esters of morphine	Diacetylmorphine (Heroin)	CES1	CES2, BCHE, OPRM1		✓	
Ethers of morphine	Dihydrocodeine (DHC Plus, Panlor)	CYP3A4	CYP2D6, CYP3A5		✓	
	Ethylmorphine (Codethyline)	CYP2D6	CYP3A4, CYP3A5		✓	
Semi-synthetic alkaloid derivatives	Hydrocodone (Hysingla, Vicodin)	CYP2D6	CYP3A4, CYP3A5, OPRM1		✓	
	Oxycodone (Oxycontin, Roxicodone)	CYP3A4	CYP3A5, CYP2D6, ABCB1, UGT2B7, COMT		✓	
Synthetic opioids						
Anilidopiperidine derivatives	Alfentanyl	CYP3A4	CYP3A5, ABCB1, OPRM1		✓	
	Fentanyl (Duragesic, Subsys)	CYP3A4	CYP3A5, ABCB1, OPRM1		✓	
	Sufentanil (Sufenta)	CYP3A4	CYP3A5, OPRM1		✓	
Phenylpiperidine derivatives	Meperidine (Demerol)	CYP2B6	CYP3A4, CYP2C19, CYP3A5, UGT1A4		✓	
	Ketobemidone (Ketogan)	CYP2C9	CYP3A4, CYP3A5		✓	
Diphenylpropylamine derivatives	Dextropropoxyphene (Darvon)	CYP3A4	CYP3A5, Renal Excretion		✓	
	Levacetylmethadol (Orlaam)	CYP3A4	CYP3A5		✓	
	Loperamide (Anti-diarrhea, Diamode)	CYP3A4	CYP2C8, CYP3A5		✓	
	Methadone (Methadose, Diskets)	CYP3A4	CYP2B6, CYP2D6, CYP3A5, ABCB1, UGT2B7, COMT		✓	
Oripavine derivatives	Buprenorphine (Buprenex, Butrans)	CYP3A4	CYP3A5, CYP2C8, UGT1A1, UGT1A3, UGT2B7		✓	
Morphinan derivatives	Dextromethorphan (Robitussin, Dayquil)	CYP2D6	CYP3A4, CYP3A5		✓	
Others	Tramadol	CYP2D6	CYP3A4, CYP2B6, CYP3A5, OPRM1, SLC22A1, COMT		✓	
	Tapentadol (Nucynta, Nucynta ER)	CYP2C9	CYP2C19, CYP2D6		✓	
	Tilidine (Valoron)	CYP3A4	CYP2C19, CYP3A5		✓	
Anti-opioid	Methylnaltrexone (Relistor)	CYP2D6	CYP3A4, CYP3A5		✓	

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 (Anturane)	CYP2C9	CYP3A4, CYP3A5		✓	
Mitotic inhibitors	Colchicine (Colcrys, Mitigare)	CYP3A4	CYP3A5		✓	
Xanthine oxidase inhibitors	Febuxostat (Uloric)	CYP1A2, CYP2C8	CYP2C9, UGT1A1, UGT1A3, UGT1A9, UGT2B7		✓	
	Allopurinol (Zyloprim, Aloprim)	AOX1	Renal Excretion, HLA-B*5801		✓	
	Oxypurinol	Renal Excretion			✓	
Recombinant urate oxidase	Rasburicase (Elitek)		G6PD, CYB5R1, CYB5R2, CYB5R3, CYB5R4		✓	
DMARDs	Leflunomide (Arava)	CYP1A2			✓	
Anti-inflammatory	Tofacitinib (Xeljanz, Jakvinus)	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	AA	Naloxone (Narcan, Evzio)	2B	
OPRM1	rs1799971	AA	Morphine (Duramorph, Infumorph P/F)	2B	
OPRM1	rs1799971	AA	Alfentanil	2B	
OPRM1	rs1799971	AA	Fentanyl (Duragesic, Subsys)	2B	
OPRM1	rs1799971	AA	Tramadol	2B	
OPRM1	rs1799971	AA	Hydrocodone (Hysingla, Vicodin)	3	
COMT	rs4680	AG	Paroxetine (Paxil, Seroxat)	3	

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 (Cardioquine, Cin-Quin)	CYP3A4, CYP2D6	CYP2E1, CYP3A5, CYP2C9, CYP2C8		✓	
	Procainamide (Pronestyl, Procan-SR)	CYP2D6	NAT2		✓	
	Sparteine	CYP2D6				✓
	Disopyramide (Norpace, Norpace CR)	CYP3A4	CYP3A5, CYP1A2, CYP2C19		✓	
Antiarrhythmic class Ib	Phenytoin (Dilantin Phenytek)	CYP2C19	CYP2C9, CYP3A4, CYP3A5, CYP2D6, ABCB1, EPHX1, HLA-B*1502		✓	
	Tocainide	UGTs			✓	
	Lidocaine (Lidoderm, Xylocaine)	CYP1A2	CYP3A4, CYP3A5		✓	
	Mexiletine (Mexitil)	CYP2D6	CYP1A2		✓	
Antiarrhythmic class Ic	Propafenone (Rythmol SR)	CYP2D6	CYP3A4, CYP1A2, CYP3A5		✓	
	Flecainide (Tambocor)	CYP2D6				✓
	Encainide (Enkaid)	CYP2D6				✓
Antiarrhythmic class II	Carvedilol (Coreg, Coreg CR)	CYP2D6	UGT1A1, UGT2B4, CYP2C9		✓	
	Bisoprolol (Zebeta)	CYP2D6	CYP3A4, CYP3A5		✓	
	Metoprolol (Lopressor, Toprol XL)	CYP2D6	CYP3A4, CYP3A5		✓	
	Propranolol (Hemangeol, Inderal XL)	CYP2D6	CYP1A2, CYP2C19, CYP3A4, CYP3A5, UGT1A9		✓	
Antiarrhythmic class III	Amiodarone (Nexterone, Pacerone)	CYP3A4	CYP2C8, CYP3A5		✓	
	Dronedarone (Multaq)	CYP3A4	CYP3A5		✓	
	Dofetilide (Tikosyn)	Renal Excretion	CYP3A4, CYP3A5		✓	
Antiarrhythmic class IV	Diltiazem (Cardizem, Tiazac)	CYP3A4	CYP2C19, CYP3A5		✓	
	Verapamil (Verelan, Calan)	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 (Cozaar)	CYP2C9	CYP3A4, CYP3A5, UGT1A1, UGT1A3		✓	
	Azilsartan (Edarbi)	CYP2C9			✓	
	Irbesartan (Avapro)	CYP2C9			✓	
	Telmisartan (Micardis)	Biliary Excretion	UGT1A1		✓	
	Olmesartan (Benicar)	Hydrolysis	Renal Excretion, SLCO1B1		✓	
	Valsartan (Diovan)	CYP2C9			✓	
Angiotensin-Converting Enzyme Inhibitors	Captopril (Capoten)	Renal Excretion	CYP2D6		✓	
	Enalapril (Vasotec, Renitec)	CES1, Renal Excretion	CYP3A4, CYP3A5		✓	
	Trandolapril (Mavik)	CES1	CYP2D6, CYP2C9, Renal Excretion		✓	
Renin inhibitors	Aliskiren (Tekturna)	CYP3A4	CYP3A5, ABCB1		✓	
Aldosterone Antagonists	Eplerenone (Inspra)	CYP3A4	CYP3A5		✓	
Loop diuretic	Torasemide (Demadex)	CYP2C9	CYP2C8, Renal Excretion		✓	
	Furosemide	Renal Excretion	UGT1A9, UGT1A10		✓	
Potassium-sparing diuretic	Triamterene (Dyrenium)	CYP1A2			✓	
Vasopressin receptor antagonists	Tolvaptan (Samsca)	CYP3A4	CYP3A5		✓	
Adrenergic release inhibitors	Debrisoquine (Bonipress)	CYP2D6				✓
Peripheral Adrenergic Inhibitors	Reserpine (Raudixin, Serpalan)	CYP2D6				✓
Beta-1 cardioselective beta-blockers	Metoprolol (Lopressor, Toprol XL)	CYP2D6	CYP3A4, CYP3A5		✓	
	Bisoprolol (Zebeta)	CYP2D6	CYP3A4, CYP3A5		✓	
	Nebivolol (Bystolic)	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 (Timoptic, Betimol)	CYP2D6				✓
	Propranolol (Hemangeol, Inderal XL)	CYP2D6	CYP1A2, CYP2C19, CYP3A4, CYP3A5, UGT1A9		✓	
Beta-blockers with alpha activity	Carvedilol (Coreg, Coreg CR)	CYP2D6	UGT1A1, UGT2B4, CYP2C9		✓	
	Labetalol (Normodyne, Trandate)	CYP2D6	CYP2C19, ABCB1, UGT1A1, UGT1A9, UGT2B7			✓
Alpha blockers	Terazosin (Hytrin)	CYP3A4	CYP3A5		✓	
	Doxazosin (Cardura, Cardura XL)	CYP2D6	CYP2C19, CYP3A4, CYP3A5		✓	
α-2 adrenergic agonist	Clonidine (Catapres, Kapvay)	CYP2D6	CYP1A2, CYP3A4, CYP3A5		✓	
	Tizanidine (Zanaflex)	CYP1A2			✓	
Antihypertensives Calcium channel blockers						
Dihydropyridine	Amlodipine (Norvasc)	CYP3A4	CYP3A5		✓	
	Nifedipine (Procardia, Adalat CC)	CYP3A4	CYP1A2, CYP2A6, CYP3A5		✓	
	Nimodipine (Nymalize)	CYP3A4	CYP3A5		✓	
	Nicardipine	CYP2C8	CYP2D6, CYP3A4, CYP3A5		✓	
Benzothiazepine	Diltiazem (Cardizem, Tiazac)	CYP3A4	CYP2C19, CYP3A5		✓	
Phenylalkylamine	Verapamil (Verelan, Calan)	CYP3A4	CYP2C8, CYP3A5, ABCB1		✓	
Nonselective	Bepridil (Vascor)	CYP3A4	CYP3A5		✓	
Anti-pulmonary arterial hypertension						
ERA-Dual antagonists	Bosentan (Tracleer)	CYP2C9	CYP3A4, CYP3A5, SLCO1B3		✓	
	Macitentan (Opsumit)	CYP3A4	CYP2C19, CYP3A5		✓	
Phosphodiesterase inhibitors	Sildenafil (Viagra, Revatio)	CYP3A4	CYP2C9, CYP3A5		✓	
	Tadalafil (Cialis, Adcirca)	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 (Lanoxin, Digox)	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						
Other Drugs Used in Angina						
Other cardiac preparations	Ranolazine (Ranexa)	CYP3A4	CYP2D6, CYP3A5		✓	
	Ivabradine (Corlanor, Procoralan)	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 (Lipitor)	CYP3A4, HMGCR	HMGCR, ABCG2, CYP3A5, ABCB1, ABCG8, UGT1A1, UGT1A3, UGT2B7, KIF6		✓	
	Fluvastatin (Lescol, Lescol XL)	CYP2C9, SLCO1B1	HMGCR, ABCG2, CYP3A4, CYP2C8, UGT1A1, UGT1A3, UGT2B7		✓	
	Lovastatin (Mevacor, Altoprev)	CYP3A4, SLCO1B1	CYP3A5, HMGCR, UGT1A1, UGT1A3		✓	
	Cerivastatin (Baycol, Lipobay)	CYP3A4, SLCO1B1	HMGCR, CYP2C8, CYP3A5		✓	
	Pitavastatin (Livalo)	UGT1A3, UGT2B7	CYP2C9, CYP2C8, ABCB1, HMGCR		✓	
	Pravastatin (Pravachol)	SLCO1B1, HMGCR	KIF6, APOE, ABCA1		✓	
	Simvastatin	CYP3A4, SLCO1B1	ABCG2, HMGCR, CYP3A5, ABCB1, SLCO2B1, UGT1A1, UGT1A3, UGT2B7, KIF6		✓	
	Rosuvastatin (Crestor)	UGT1A1	UGT1A3, ABCG2, HMGCR		✓	
MTTP inhibitors	Lomitapide	CYP3A4	CYP3A5, LDLR		✓	
Drug Therapy for Hypercholesterolemia and Dyslipidemia (GI)						
Cholesterol absorption inhibitors	Ezetimibe (Zetia)	UGT1A1	UGT1A3, UGT2B15		✓	
Drug Therapy for Hypercholesterolemia and Dyslipidemia (Blood vessels)						
Fibrates	Gemfibrozil (Lopid)	CYP3A4	CYP3A5, UGT2B7, UGT1A1, UGT1A3, UGT1A9, UGT2B15		✓	
Drug Therapy for familial hypercholesterolemia						
Cholesterol-reducing drug (antisense oligonucleotide)	Mipomersen (Kynamro)	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
APOE	rs7412	TC	Atorvastatin (Lipitor)	2A	Not as responsive to Statin treatment
APOE	rs7412	TC	Pravastatin (Pravachol)	3	Not as responsive to Statin treatment
APOE	rs7412	TC	Simvastatin	3	Not as responsive to Statin treatment

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 (Xarelto)	CYP3A4	CYP2J2, CYP3A5		●	
	Apixaban (Eliquis)	CYP3A4	CYP3A5		●	
Antiplatelet Drugs						
ADP receptor (P2Y12) inhibitors Nucleotide/nucleoside analogs	Ticagrelor (Brilinta)	CYP3A4	CYP3A5		●	
ADP receptor (P2Y12) inhibitors Thienopyridines	Clopidogrel (Plavix)	CYP2C19	ABCB1, ABCC3		●	
	Prasugrel (Effient)	BCHE, CYP3A4	CYP2B6, CYP2C9, CYP2C19, CYP3A5, CYP2D6		●	
Irreversible cyclooxygenase inhibitors	Aspirin (Ecotrin)	GLYAT, UGTs, Renal Excretion	CYP2C9, CYP3A4, CYP3A5		●	
Phosphodiesterase inhibitors	Cilostazol (Pletal)	CYP3A4	CYP2C19, CYP3A5		●	
Protease-activated receptor-1 (PAR-1) antagonists	Vorapaxar (Zontivity)	CYP3A4	CYP2J2, CYP3A5		●	
Abbreviations: P2Y12, purinergic receptor P2Y12.						

SNPs of Importance for Venous Thromboembolism Risk, Warfarin sensitivity and MTHFR enzyme function

Gene	Protein change	Nucleotide change	Marker	Genotype	Results
F5	Arg534Gln	1601G>A	rs6025	GG	Normal risk
F2		*97G>A	rs1799963	GG	Normal risk
VKORC1		1173C>T	rs9923231	CC	Low warfarin sensitivity; high warfarin dosage
MTHFR	Ala222Val	665C>T	rs1801133	CC	Normal MTHFR enzyme function.
MTHFR	Glu429Ala	1286A>C	rs1801131	AA	Normal MTHFR enzyme function.

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 (Incruse Ellipta)	CYP2D6				●
	Aclidinium (Tudorza Pressair)	CYP2D6	CYP3A4, CYP3A5		●	
Beta2-adrenergic agonist	Arformoterol (Brovana)	CYP2D6, UGT1A1	CYP2C19		●	
	Indacaterol (Arcapta Neohaler)	UGT1A1, CYP3A4	CYP3A5, CYP1A2, CYP2D6		●	
	Formoterol (Perforomist)	CYP2D6	CYP2C19, CYP2C9, CYP2A6		●	
	Salmeterol (Serevent Diskus)	CYP3A4	CYP3A5		●	
	Vilanterol (Breo Ellipta)	CYP3A4	CYP3A5		●	
Corticosteroid	Budesonide (Entocort, Uceris)	CYP3A4	CYP3A5		●	
	Fluticasone (Cutivate, Flonase Allergy Relief)	CYP3A4	CYP3A5		●	
	Mometasone (Nasonex)	CYP3A4	CYP3A5		●	
Phosphodiesterase inhibitor	Roflumilast (Daliresp)	CYP3A4	CYP1A2, CYP3A5		●	
	Theophylline (Theo-24, Elixophylline)	CYP1A2	CYP2E1		●	
5-lipoxygenase inhibitor	Zileuton (Zyflo, Zyflo CR)	CYP1A2	CYP2C9, CYP3A4, CYP3A5		●	
Leukotriene receptor-1 antagonist	Montelukast (Singulair)	CYP3A4	CYP2C9, CYP3A5, SLCO2B1, ABCC1		●	
	Pranlukast (Onon)	CYP3A4	CYP3A5		●	
	Zafirlukast (Accolate)	CYP2C9	CYP3A4, CYP3A5		●	
Treatment of cystic fibrosis (specifics mutations in the CFTR gene)	Ivacaftor (Kalydeco)	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 (Anzemet)	CYP3A4	CYP2D6, CYP3A5		●	
	Tropisetron (Navoban)	CYP3A4	CYP2D6, CYP3A5		●	
Antiemetic, 5-HT3 receptor antagonist Isoquinoline derivative	Palonosetron (Aloxi)	CYP1A2	CYP2D6, CYP3A4, CYP3A5		●	
Antiemetic, 5-HT3 receptor antagonist Indazole derivative	Granisetron (Sancuso, Sustol)	CYP3A4	CYP3A5		●	
Antiemetic, 5-HT3 receptor antagonist	Ondansetron (Zofran, Zuplenz)	CYP2B6	CYP1A2, CYP2D6, CYP3A4, ABCB1		●	
Antiemetic, dopamine-receptor antagonist	Domperidone (Motilium)	CYP3A4	CYP3A5		●	
	Prochlorperazine (Compro)	CYP2D6	CYP3A4, CYP3A5		●	
	Metoclopramide (Reglan)	CYP2D6	CYP1A2, CYB5R1, CYB5R2, CYB5R3, CYB5R4		●	
Antiemetic, NK1 receptor antagonist	Aprepitant (Emend)	CYP3A4	CYP3A5, CYP1A2, CYP2C19		●	
Antiemetic, H1 histamine receptor antagonist	Diphenhydramine (Benadryl, Banophen)	CYP2D6	CYP3A4, CYP3A5, UGT1A3, UGT1A4		●	
	Hydroxyzine (Vistaril)	ADHs	CYP3A4, CYP3A5		●	
	Promethazine (Phenergan, Phenadoz)	CYP2D6	UGT1A3, UGT1A4, SULTs			●
Cannabinoids	Dronabinol (Marinol, Syndros)	CYP2C9	CYP2C19, CYP3A4, CYP3A5		●	
Benzodiazepines	Midazolam (Versed)	CYP3A4	CYP3A5		●	
Anticholinergics	Scopolamine (Transderm scop)	CYP3A4	CYP3A5		●	
Steroids	Dexamethasone (Decadron)	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 (Zantac, Heartburn Relief)	Renal Excretion	CYP1A2, CYP2C19, FMO3, CYP3A4, CYP3A5		✓	
Proton-pump inhibitor	Omeprazole (Zegerid, Prilosec OTC)	CYP2C19	CYP3A4, CYP2C9, CYP3A5		✓	
	Dexlansoprazole (Dexilant)	CYP2C19	CYP3A4, CYP3A5		✓	
	Esomeprazole (Nexium)	CYP2C19	CYP3A4, CYP3A5		✓	
	Lansoprazole (Prevacid)	CYP3A4	CYP2C19, CYP3A5		✓	
	Rabeprazole (AcipHex)	Non Enz	CYP2C19, CYP3A4, CYP3A5		✓	
	Ilaprazole (Noltec)	CYP3A4	CYP3A5		✓	
	Pantoprazole (Protonix)	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 (Lotronex)	CYP2C9	CYP3A4, CYP1A2		✓	
	Cilansetron	CYP3A4	CYP2D6, CYP1A2, CYP2C19, CYP3A5		✓	
Acting on serotonin receptors 5-HT4 agonists	Mosapride (Mopride, Mopid)	CYP3A4	CYP3A5		✓	
	Prucalopride (Resolor, Resotran)	Renal Excretion	CYP3A4, CYP3A5		✓	
Gastroprokinetic						
Serotonin 5-HT$_4$ receptor agonist	Cisapride (Prepulsid, Propulsid)	CYP3A4	CYP3A5		✓	
	Cinitapride (Cintapro, Pemix)	CYP3A4	CYP2C8, CYP3A5		✓	
Dopamine antagonists	Metoclopramide (Reglan)	CYP2D6	CYP1A2, CYB5R1, CYB5R2, CYB5R3, CYB5R4		✓	
	Clebopride	CYP3A4	CYP3A5		✓	
	Domperidone (Motilium)	CYP3A4	CYP3A5		✓	
Antipropulsives						
Opioids	Loperamide (Anti-diarrhea, Diamode)	CYP3A4	CYP2C8, CYP3A5		✓	
Centrally acting anti-obesity drugs						
Stimulant/ Amphetamine/ Appetite suppressant agent	Sibutramine (Meridia)	CYP3A4	CYP3A5		✓	
	Phentermine (Adipex-P, Lomaira)	Renal Excretion	CYP3A4, CYP3A5		✓	
Anorectic	Lorcaserin (Belviq)	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 (Prandin)	CYP2C8	SLCO1B1, CYP3A4, CYP3A5, ABCC8		✓	
	Nateglinide (Starlix)	CYP2C9	CYP3A4, CYP3A5		✓	
Sulfonylurea 1st generation	Chlorpropamide (Diabinese)	Renal Excretion	CYP2D6, G6PD		✓	
	Tolazamide (Tolinase)	CYP2C9			✓	
	Tolbutamide (Orinase)	CYP2C9	CYP2C19, CYP2C8		✓	
Sulfonylurea 2nd generation	Glipizide (Glucotrol)	CYP2C9	G6PD		✓	
	Glyburide (Diabeta, Glynase)	CYP3A4	CYP2C9, CYP2C19, CYP3A5, G6PD		✓	
	Gliquidone (Glurenorm)	CYP2C9			✓	
	Gliclazide (Diamicron)	CYP2C9	CYP2C19		✓	
	Glimepiride (Amaryl)	CYP2C9	G6PD		✓	
DPP-IV inhibitor	Saxagliptin (Onglyza)	CYP3A4	CYP3A5		✓	
	Alogliptin (Nesina)	Renal Excretion	CYP2D6, CYP3A4, CYP3A5		✓	
	Linagliptin (Tradjenta)	Renal Excretion	CYP3A4, CYP3A5		✓	
	Sitagliptin (Januvia)	CYP3A4	CYP2C8, CYP3A5		✓	
Antidiabetic Sensitizers						
Biguanides	Metformin	Renal Excretion				
Thiazolidinediones	Pioglitazone (Actos)	CYP2C8	CYP3A4, CYP3A5		✓	
	Rosiglitazone (Avandia)	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 (Axert)	CYP3A4	CYP2D6, CYP3A5		✓	
	Eletriptan (Relpax)	CYP3A4	CYP3A5		✓	
	Frovatriptan (Frova)	CYP1A2			✓	
	Naratriptan (Amerge)	CYP1A2	CYP2C8, CYP2C9, CYP2D6		✓	
	Sumatriptan	MAO	UGTs, HTR2A		✓	
	Zolmitriptan (Zomig, Zomig ZMT)	CYP1A2			✓	
Ergot alkaloids	Dihydroergotamine (D.H.E.45)	CYP3A4	CYP3A5		✓	
	Ergotamine (Cafergot, Ergomar)	CYP3A4	CYP3A5		✓	
Antihistamines						
Aminoalkyl ethers	Diphenhydramine (Benadryl, Banophen)	CYP2D6	CYP3A4, CYP3A5, UGT1A3, UGT1A4		✓	
Substituted alkylamines	Chlorpheniramine (Chlor-Trimeton, Allergy-4-hour)	CYP3A4	CYP3A5		✓	
Phenothiazine derivatives	Promethazine (Phenergan, Phenadoz)	CYP2D6	UGT1A3, UGT1A4, SULTs			✓
Piperazine derivatives	Hydroxyzine (Vistaril)	ADHs	CYP3A4, CYP3A5		✓	
	Cyclizine (Marezine, Valoid)	CYP2D6			✓	
	Cetirizine (Zyrtec, Aller-tec)	Renal Excretion			✓	
Other antihistamines	Terfenadine (Seldane, Triludan)	CYP3A4	CYP3A5		✓	
	Loratadine (Claritin, Allergy Relief)	CYP3A4, CYP2D6	CYP3A5, CYP2C8, CYP2C9		✓	
	Fexofenadine (Aller-ease, Children's Wal-Fex)	Biliary Excretion	Renal Excretion, CYP3A4, CYP3A5, SLCO2B1		✓	
	Desloratadine	CYP2C8	UGT2B10		✓	
	Astemizole (Hismanal)	CYP3A4	CYP3A5		✓	
Treatment of secondary hyperparathyroidism						
Calcimimetic	Cinacalcet (Sensipar)	CYP3A4	CYP2D6, CYP3A5, CYP1A2		✓	
Abortifacient						
Progestin Antagonist	Mifepristone (Korlym, Mifeprex)	CYP3A4	CYP3A5		✓	
Dermatology Antipsoriatics						
Retinoids	Etretinate	CYP26A1			✓	
	Acitretin	CYP26A1			✓	
Dermatology Anti-acne						
Retinoid	Isotretinoin (Myorisan, Amnesteem)	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 (Celexa)	CYP2C19, CYP2D6	CYP3A4, CYP3A5, SLC6A4, HTR2A			●
	Escitalopram (Lexapro)	CYP3A4, CYP2C19	CYP2D6, CYP3A5, SLC6A4, HTR2C		●	
	Dapoxetine (Priligy)	CYP2D6	CYP3A4, CYP3A5, FMO1		●	
	Fluoxetine (Prozac, Sarafem)	CYP2D6	CYP3A4, CYP2C9, CYP3A5, CYP2C19, SLC6A4, HTR2A		●	
	Paroxetine (Paxil, Seroxat)	CYP2D6	CYP3A4, CYP1A2, CYP3A5, CYP2C9, SLC6A4, HTR2A, DRD3		●	
	Sertraline (Zoloft)	CYP2B6	CYP2C19, CYP2C9, CYP3A4, CYP2D6, SLC6A4		●	
	Fluvoxamine (Faverin, Fevarin)	CYP2D6	CYP1A2, SLC6A4, HTR2A		●	
SMSs	Vilazodone (Viibryd)	CYP3A4	CYP3A5, CYP2C19, CYP2D6		●	
SNRIs	Levomilnacipran (Fetzima)	CYP3A4	CYP2C8, CYP3A5, CYP2C19, CYP2D6		●	
	Milnacipran (Savella)	UGTs	Renal Excretion		●	
	Venlafaxine (Effexor XR)	CYP2D6	CYP2C19, CYP3A4, CYP2C9, CYP3A5, SLC6A3, SLC6A4, HTR2A		●	
	Duloxetine (Cymbalta, Irenka)	CYP2D6	CYP1A2, HTR2A		●	
NRIs	Atomoxetine (Strattera)	CYP2D6	CYP2C19, CYP3A4, CYP3A5, SLC6A2		●	
	Reboxetine (Edronax)	CYP3A4	CYP3A5		●	
	Maprotiline (Ludiomil)	CYP2D6	CYP1A2		●	
TCAs that preferentially inhibit the reuptake of serotonin	Clomipramine (Anafranil)	CYP2D6	CYP3A4, CYP2C19, CYP1A2, CYP2C9, SLC6A4, HTR2A		●	
	Imipramine (Tofranil)	CYP1A2, CYP2D6	CYP2C19, CYP3A4, CYP3A5, UGT1A3, UGT1A4		●	
TCAs that preferentially inhibit the reuptake of norepinephrine	Desipramine (Norpramin)	CYP2D6	CYP1A2, CYP2C19		●	
	Nortriptyline (Pamelor)	CYP2D6	CYP1A2, CYP2C19, ABCB1, SLC6A4			●
	Protriptyline (Vivactil)	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 (Elavil, Vanatrip)	CYP2D6	CYP3A4, CYP2C19, CYP2C9, CYP1A2, CYP2B6, UGT1A3, UGT1A4		●	
	Doxepin (Silenor, Zonalon)	CYP2D6, CYP2C19	CYP1A2, CYP3A4, CYP3A5, UGT1A3, UGT1A4		●	
	Dosulepin (Prothiaden)	CYP2D6, CYP2C9	CYP3A4, CYP1A2, CYP3A5, CYP2C19		●	
TeCAs	Mianserin (Tolvon)	CYP2D6	CYP3A4, CYP1A2, CYP2B6, CYP3A5		●	
	Amoxapine (Asendin)	CYP2D6	CYP3A4, CYP3A5		●	
TCA with antipsychotic and sedative properties	Trimipramine (Surmontil)	CYP2D6	CYP2C19, CYP2C9			●
MAOI	Tranylcypromine (Parnate)	MAO	CYP3A4, CYP2A6, CYP3A5, CYP2C19, CYP2D6		●	
	Moclobemide (Amira, Aurorix)	CYP2C19	CYP2D6, CYP1A2, HTR2A			●
Atypical antidepressants						
SMSs	Vortioxetine (Brintellix)	CYP2D6	CYP2C9, CYP3A4, CYP3A5, UGTs, CYP2A6, CYP2C8, CYP2C19, CYP2B6		●	
NaSSAs	Mirtazapine (Remeron, Remeronsoltab)	CYP1A2	CYP2D6, CYP3A4, CYP3A5, SLC6A4, HTR2A		●	
SARIs	Trazodone (Desyrel)	CYP3A4	CYP2D6, CYP3A5		●	
	Nefazodone (Serzone)	CYP2D6, CYP3A4	CYP3A5, UGT1A6		●	
Antidepressant and smoking cessation aid	Bupropion (Zyban, Aplenzin)	CYP2B6	CYP2E1, CYP3A4, CYP2C9, CYP2D6, CYP1A2, CYP3A5		●	
Antidepressant and anti-anxiety	Buspirone (BuSpar, Vanspar)	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, Antidiabetes, Antilipids, Inhalational anesthetics and Susceptibility to Hereditary Hemochromatosis

Gene	Marker	Genotype	Drug	Level of Evidence	Results
GRIK4	rs1954787	TT	Citalopram	1B	Patients may have a decreased chance of response to Citalopram treatment
GRIK4	rs1954787	TT	Antidepressants	2B	Patients with Depressive Disorder or Depression may be less likely to respond to antidepressant treatment
ATM	rs11212617	AA	Metformin	2B	Patients with diabetes mellitus or polycystic ovarian syndrome who are treated with metformin may have a decreased response to metformin as compared to patients with the CC genotype. An association with increased/decreased response to metformin was not seen in people with impaired glucose tolerance.
LDLR	rs688	CC	Lovastatin	3	Patients may have a smaller decrease in total cholesterol when treated with lovastatin as compared to patients with the TT genotype, and a greater decrease as compared to patients with the CT genotype.
APOB	rs693	CC	Lipids		Patients may have a normal susceptibility to Elevated Apolipoprotein B and LDL-Cholesterol.
HFE	rs1799945	CC	Hemochromatosis		Not a H63D hemochromatosis carrier.
AGTR1	rs5182	CC	Ace Inhibitors	4	Patients with Hypertension may have decreased, but not absent, risk of Myocardial Infarction when treated with Ace Inhibitors as compared to patients with the TT genotype.
RYR1	rs118192176	GG	Inhalational anesthetics	1B	Patients may not develop Malignant Hyperthermia when treated with inhalational anaesthetics (desflurane, enflurane, halothane, isoflurane, methoxyflurane, sevoflurane), either alone or in conjunction with a depolarizing muscle relaxant (specifically, succinylcholine) as compared to patients with genotype AG or AA.
RYR1	rs193922764	CC	Inhalational anesthetics	1B	Patients may not develop Malignant Hyperthermia when treated with inhalational anaesthetics (desflurane, enflurane, halothane, isoflurane, methoxyflurane, sevoflurane), either alone or in conjunction with a depolarizing muscle relaxant (specifically, succinylcholine) as compared to patients with genotype AG or AA.

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
COMT	rs4680	AG	Fluvoxamine (Faverin, Fevarin)	3	Schizophrenia patients may have an intermediate risk for developing extrapyramidal symptoms
COMT	rs4680	AG	Venlafaxine (Effexor XR)	3	Depressive patients and patients with Anxiety Disorders may have an intermediate response
COMT	rs4680	AG	Paroxetine (Paxil, Seroxat)	3	Depressive patients may have an intermediate response
HTR2A	rs7997012	GG	Antidepressants	3	Higher risk of having no response to treatment 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 (Compro)	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 (Phenergan, Phenadoz)	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	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
HTR2C	rs3813929	CC	Olanzapine	3	Patients with psychiatric disorders or schizophrenia may have an increased risk of weight gain
COMT	rs4680	AG	Haloperidol	3	Schizophrenia patients may have an intermediate risk for developing extrapyramidal symptoms

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 (Strattera)	CYP2D6	CYP2C19, CYP3A4, CYP3A5, SLC6A2		✓	
Central alpha-2 Adrenergic Agonist	Clonidine (Catapres, Kapvay)	CYP2D6	CYP1A2, CYP3A4, CYP3A5		✓	
Antidepressants	Bupropion (Zyban, Aplenzin)	CYP2B6	CYP2E1, CYP3A4, CYP2C9, CYP2D6, CYP1A2, CYP3A5		✓	
	Imipramine (Tofranil)	CYP1A2, CYP2D6	CYP2C19, CYP3A4, CYP3A5, UGT1A3, UGT1A4		✓	
	Desipramine (Norpramin)	CYP2D6	CYP1A2, CYP2C19		✓	
	Milnacipran (Savella)	UGTs	Renal Excretion		✓	
	Reboxetine (Edronax)	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 (Tegretol, Carbatrol)	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 (Dilantin Phenytek)	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		✓	
Other	Lacosamide	CYP2C9	CY2C19, CYP3A4		✓	
	Perampanel	CYP3A4	CYP3A5		✓	

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 (Versed)	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		✓	
	Quazepam	CYP3A4	CYP2C19, CYP3A5		✓	
	Lormetazepam	CYP3A4	CYP3A5		✓	
	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 (Benadryl, Banophen)	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			✓	
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.						

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 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	Bedaquiline	CYP3A4	CYP2C8, CYP2C19, CYP3A5		✓	
	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		✓	
	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)	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		✓	

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		✓	
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 (Xeljanz, Jakvinus)	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						
Intravenous agents (non-opioid)						
Barbiturates	Hexobarbital	CYP2C19	CYP2C9, CYP2E1, CYP1A2		✓	
	Thiamylal	CYP2C9			✓	
Benzodiazepines	Diazepam	CYP2C19, CYP3A4	CYP3A5, CYP2B6, CYP1A2		✓	
	Midazolam (Versed)	CYP3A4	CYP3A5		✓	
Other Anesthetics	Ketamine	CYP3A4	CYP2B6, CYP2C9, CYP3A5		✓	
Skeletal muscle relaxants						
Muscle Relaxants	Carisoprodol	CYP2C19				✗
	Cyclobenzaprine	CYP1A2	CYP2D6, CYP3A4, CYP3A5, UGT1A4		✓	
	Tizanidine (Zanaflex)	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 (Viagra, Revatio)	CYP3A4	CYP2C9, CYP3A5		✓	
	Tadalafil (Cialis, Adcirca)	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 (Decadron)	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
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		✓	

Genomic Test Results

Genotype/Haplotype Details

CYP1A2

Allele Tested: *1A, *1C, *1D, *1F, *1K, *1L.

Genetic results: CYP1A2 *1A/*1L

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP1A2		-3860G>A	*1C	rs2069514	GA
CYP1A2		-2467delT	*1D	rs35694136	T_Del
CYP1A2		-729C>T	*1K	rs12720461	CC
CYP1A2		-163C>A	*1F	rs762551	AC

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

CYP2B6

Allele Tested: *1, *4, *5, *6, *7, *9, *16, *18.

Genetic results: CYP2B6 *4/*9 or *1/*6

Phenotype: Intermediate metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2B6	Lys262Arg	785A>G	*4	rs2279343	GA
CYP2B6	Arg487Cys	1459C>T	*5/*7	rs3211371	CC
CYP2B6	Gln172His	516G>T	*6/*9	rs3745274	GT
CYP2B6	Ile328Thr	983T>C	*16	rs28399499	TT

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, *4.

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	Ile264Met	792C>G	*4	rs1058930	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, *2, *3, *4, *5, *6, *7, *8, *27.

Genetic results: CYP2C9 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2C9	Arg144Cys	430C>T	*2	rs1799853	CC
CYP2C9	Ile359Leu	1075A>C	*3	rs1057910	AA
CYP2C9	Ile359Asn	1076T>C	*4	rs56165452	TT
CYP2C9	Asp360Glu	1080C>G	*5	rs28371686	CC
CYP2C9	Lys273Argfs	817delA	*6	rs9332131	AA
CYP2C9	Leu19Ile	55C>A	*7	rs67807361	CC
CYP2C9	Arg150His/Leu	449G>A/T	*8/*27	rs7900194	GG

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, *2, *3, *4, *5, *6, *7, *8, *9, *10, *17.

Genetic results: CYP2C19 *1/*9

Phenotype: Intermediate metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2C19	Splicing defect	681G>A	*2	rs4244285	GG
CYP2C19	Trp212Ter	636G>A	*3	rs4986893	GG
CYP2C19	Met1Val	1A>G	*4	rs28399504	AA
CYP2C19	Arg433Trp	1297C>T	*5	rs56337013	GG
CYP2C19	Arg132Gln	395G>A	*6	rs72552267	GG
CYP2C19	Splicing defect	819+2T>A	*7	rs72558186	TT
CYP2C19	Trp120Arg	358T>C	*8	rs41291556	AA
CYP2C19	Arg144His	431G>A	*9	rs17884712	AG
CYP2C19	Pro227Leu	680C>T	*10	rs6413438	CC
CYP2C19		-806C>T	*17	rs12248560	CC

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, *2D, *3, *4A, *4K, *4M, *4N, *5, *6A, *6C, *7, *8, *9, *10, *11, *14A, *14B, *17, *21, *34, *36, *39, *41, and CNVs.

Genetic results: CYP2D6 *2D/*17

Phenotype: Intermediate metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2D6	Arg296Cys	886C>T	*2	rs16947	AA
CYP2D6	Ser486Thr	1457G>C	*2	rs1135840	CC
CYP2D6	Arg259Glyfs	775delA	*3	rs35742686	AA
CYP2D6	Splicing defect	506-1G>A	*4	rs3892097	GG
CYP2D6	CNV assay		*5/XN	Hs00010001_cn	2
CYP2D6	CNV assay		*5/XN	Hs04502391_cn	2
CYP2D6	Trp152Glyfs	454delT	*6	rs5030655	TT
CYP2D6	His324Pro	971A>C	*7	rs5030867	AA
CYP2D6	Gly169Ter/Arg	505G>T/A	*8/*14	rs5030865	GG
CYP2D6	Lys281del	841_843delAAG	*9	rs5030656	AAGAAG
CYP2D6	Pro34Ser	100C>T	*10	rs1065852	CC
CYP2D6	Splicing defect	181-1G>C	*11	rs201377835	GG
CYP2D6	Thr107Ile	320C>T	*17	rs28371706	TC
CYP2D6	Arg269Profs	805_806insC	*21	rs72549352	Del_Del
CYP2D6	(sing-dup)		*36	CYP2D7/2D6 hybrid *36	WTWT
CYP2D6	Splicing defect	985+39G>A	*41	rs28371725	GG

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

CYP3A4

Allele Tested: *1A, *1B, *2, *3, *6, *12, *22.

Genetic results: CYP3A4 *1A/*1B

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP3A4		-392A>G	*1B	rs2740574	AG
CYP3A4	Ser222Pro	664T>C	*2	rs55785340	AA
CYP3A4	Met445Thr	1334T>C	*3	rs4986910	TT
CYP3A4	Asp277Glufs	830_831insA	*6	rs4646438	Del_Del
CYP3A4	Leu373Phe	1117C>T	*12	rs12721629	CC
CYP3A4		522-191C>T	*22	rs35599367	CC

Genotype/Haplotype Details

CYP3A5

Allele Tested: *1, *3, *6, *7, .

Genetic results: CYP3A5 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP3A5	Splicing defect	689-1A>G	*3	rs776746	AA
CYP3A5	Splicing defect	624G>A	*6	rs10264272	CC
CYP3A5	Thr346Tyrfs	1035_1036insT	*7	rs41303343	Del_Del

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: H7, .

Genetic results: VKORC1 H4/H7

Phenotype: Sensitive to Warfarin

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
VKORC1		-1639A>G	H4	rs9923231	CC
VKORC1		3730G>A	H7	rs7294	AG

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

Genotype/Haplotype Details

TPMT

Allele Tested: *1, *2, *3A, *3B, *3C, *4, .

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	Splicing defect	626-1G>A	*4	rs1800584	GG

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

Genotype/Haplotype Details

UGT1A1

Allele Tested: *1, *6, *80.

Genetic results: UGT1A1 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
UGT1A1	Gly71Arg	211G>A	*6	rs4148323	GG
UGT1A1		-364C>T	*80	rs887829	GG

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

DPYD

Allele Tested: *1, *2A.

Genetic results: DPYD *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
DPYD		1905+1G>A	*2A	rs3918290	GG

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/*1

Phenotype: Sensitive to Opioids

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

Genotype/Haplotype Details

APOE

Allele Tested: *3, *2.

Genetic results: APOE *3/*3

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
APOE	Arg176Cys	526C>T	*2	rs7412	TC

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.

Patient Information Card

An easily portable summary of the report patients can share with their medical professionals. (Please cut along dotted line.)

Pharmacogenomic Test Summary

CYP1A2	*1A/*1L	Extensive metabolizer
CYP2B6	*4/*9 or *1/*6	Intermediate metabolizer
CYP2C8	*1/*1	Extensive metabolizer
CYP2C9	*1/*1	Extensive metabolizer
CYP2C19	*1/*9	Intermediate metabolizer
CYP2D6	*2D/*17	Intermediate metabolizer
CYP3A4	*1A/*1B	Extensive metabolizer
CYP3A5	*1/*1	Extensive metabolizer
CYP4F2	*1/*1	Extensive metabolizer
VKORC1	H4/H7	Sensitive to Warfarin
SLCO1B1	*1B/*1B	Extensive function
TPMT	*1/*1	Extensive metabolizer
UGT1A1	*1/*1	Extensive metabolizer
DPYD	*1/*1	Extensive metabolizer
OPRM1	*1/*1	Sensitive to Opioids
APOE	*3/*3	

For a complete report contact advanceddiagnosticslaboratory.com

CYP4F2

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