Comprehensive PGx report for [redacted]

PERSONAL DETAILS	
PATIENT	[redacted]
DOB	[redacted]
GENDER	Female
SPECIMEN TYPE	Buccal Swab
ORDERING PHYSICIAN	Self
FACILITY	Immunogenomics

IMMUNOGENOMICS, LLC CLIA:45D2187903
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LABORATORY INFORMATION	
ACCESSION NUMBER	30493510
COLLECTION DATE	01-25-2023
RECEIVED DATE	02-03-2023
REPORT GENERATED	02-13-2023
LABORATORY DIRECTOR	Kevin Rosenblatt, MD

Current Patient Medication

✓ **Metoprolol**

The personalized pharmacogenomics profile of this patient reveals extensive CYP2D6-mediated metabolism, extensive CYP3A4-mediated metabolism, and intermediate 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.

✓ **Tizanidine**

The personalized pharmacogenomics profile of this patient reveals 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**

The personalized pharmacogenomics profile of this patient reveals extensive CYP2C19-mediated metabolism, extensive CYP3A4-mediated metabolism, and extensive 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.

✓ **Gabapentin**

The personalized pharmacogenomics profile of this patient reveals standard renal function. For further details, please find supporting evidence in this report or on websites such as www.pharmgkb.org or www.fda.gov.

✓ **Amlodipine**

The personalized pharmacogenomics profile of this patient reveals extensive CYP3A4-mediated metabolism, and intermediate 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.

✓ **Furosemide**

The personalized pharmacogenomics profile of this patient reveals standard renal function. For further details, please find supporting evidence in this report or on websites such as www.pharmgkb.org or www.fda.gov.

✓ **Duloxetine**

The personalized pharmacogenomics profile of this patient reveals extensive CYP2D6-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.

✓ **Simvastatin**

The personalized pharmacogenomics profile of this patient reveals extensive CYP3A4-mediated metabolism, and intermediate SLCO1B1-mediated function

⊗ 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.

GENOTYPE/HAPLOTYPE/PHENOTYPE DETAIL

Gene	Genotype-Haplotype	Phenotype
CYP1A2	*1F/*1F	Extensive metabolizer
CYP2B6	*1/*1	Extensive metabolizer
CYP2C9	*1/*1	Extensive metabolizer
CYP2C19	*1/*1	Extensive metabolizer
CYP2D6	*2A/*2A	Extensive metabolizer
CYP3A4	*1/*1	Extensive metabolizer
CYP3A5	*1/*3	Intermediate metabolizer
VKORC1	*2/*2	Sensitive to Warfarin
SLCO1B1	*1/*5	Intermediate function
ABCB1	*1/*2	Intermediate function
OPRM1	*1/*1	Sensitive to Opioids
APOE	*3/*4	

Regulatory: Disclosures: Genetic- or single nucleotide variation (SNV) based Pharmacology screening is intended as a tool to guide physicians in prescribing the medications that the patient responds to. Its premier goal is to help doctors select the drugs and doses best suited for each person. This test should NOT be treated as a diagnostic tool. Pharmacogenetic genotype screening is considered a high complexity laboratory-developed test (LDT) by CMS under the Clinical Laboratory Improvement Amendment (CLIA) and is not FDA cleared. The test and performance metrics were validated in-house by **Immunogenomics** technical personnel (or designated scientific advisors) and approved by their Laboratory Director The results are intended for use only by the ordering physician and/or designated healthcare provider. The ordering provider is responsible for 1) ascertaining the medical necessity of the ordered test, 2) resulting diagnoses, 3) management of the medications related to disease and/or decisions based on the data provided. Results rely on collection personnel following specified collection and shipment protocols.

Methodology: Agena Mass Spectrometry based PGx 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 a patient possesses intermediate or high sensitivity phenotypes or that patient has an undetected polymorphism. Absence of finding may be due to drug-drug interaction. This test is performed by Immunogenomics, CLIA:45D2187903, Phone: 832-500-4462, Fax: 832-276-7352, Address: 202 Industrial Blvd, STE 501, Sugar Land, TX 77478. This report is electronically approved by the Medical Director: Dr. Kevin Rosenblatt MD.

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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
The Nonsteroidal Antiinflammatory Drugs (NSAIDs)						
Acetic acid derivatives	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	✓		
	Flurbiprofen	CYP2C9		✓		
	Ketoprofen	CYP3A4	CYP2C9, CYP3A5	✓		
	Fenoprofen	CYP2C9	UGT2B7	✓		
	Vicoprofen	CYP2D6	CYP3A4	✓		
	Naproxen	CYP2C9	CYP1A2	✓		
Anthranilic acid derivatives (Fenamates)	Mefenamic acid	CYP2C9		✓		

PGx Report - Pain Management

Type: Opioid

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Opioid Analgesics						
Opium alkaloids	Codeine	CYP2D6	CYP3A4, CYP3A5, OPRM1	✓		
Ethers of morphine	Dihydrocodeine	CYP3A4	CYP2D6, CYP3A5	✓		
	Ethylmorphine	CYP2D6	CYP3A4, CYP3A5	✓		
Semi-synthetic alkaloid derivatives	Hydrocodone	CYP2D6	CYP3A4, CYP3A5, OPRM1	✓		
	Oxycodone	CYP3A4	CYP3A5, CYP2D6, ABCB1, COMT	✓		
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	✓		
	Ketobemidone	CYP2C9	CYP3A4, CYP3A5	✓		
Diphenylpropylamine derivatives	Dextropropoxyphene	CYP3A4	CYP3A5, Renal Excretion	✓		
	Levacetylmethadol	CYP3A4	CYP3A5	✓		
	Loperamide	CYP3A4	CYP3A5	✓		
	Methadone	CYP3A4	CYP2B6, CYP2D6, CYP3A5, ABCB1, COMT	✓		
Oripavine derivatives	Buprenorphine	CYP3A4	CYP3A5	✓		
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	✓		

PGx Report - Pain Management

Type: Drugs Prescribed for the Treatment of Gout, Antirheumatic

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Drugs Prescribed for Gout						
Uricosurics	Sulfinpyrazone	CYP2C9	CYP3A4, CYP3A5	✓		
Mitotic inhibitors	Colchicine	CYP3A4	CYP3A5	✓		
Xanthine oxidase inhibitors	Febuxostat	CYP1A2	CYP2C9	✓		
	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	A/A	Naloxone	2B	Patients may have lower cortisol response
OPRM1	rs1799971	A/A	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	A/A	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	A/A	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	A/A	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	A/A	Hydrocodone	3	Patients may have a decreased risk for experiencing side effects, including constipation, dry mouth or respiratory depression
COMT	rs4680	A/A	Paroxetine	3	Patients may require a lower dose

PGx Report - Modulation of Cardiovascular Function

Type: Antiarrhythmic

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

PGx Report - Modulation of Cardiovascular Function

Type: Antihypertensive I

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Antihypertensives						
Angiotensin II receptor antagonist	Losartan	CYP2C9	CYP3A4, CYP3A5	✓		
	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	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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Antihypertensives						
Nonselective beta-blockers	Timolol	CYP2D6		✓		
	Propranolol	CYP2D6	CYP1A2, CYP2C19, CYP3A4, CYP3A5	✓		
Beta-blockers with alpha activity	Carvedilol	CYP2D6	CYP2C9	✓		
	Labetalol	CYP2D6	CYP2C19, ABCB1	✓		
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, CYP3A5	✓		
	Nimodipine	CYP3A4	CYP3A5	✓		
Benzothiazepine	Diltiazem	CYP3A4	CYP2C19, CYP3A5	✓		
Phenylalkylamine	Verapamil	CYP3A4	CYP3A5, ABCB1	✓		
Nonselective	Bepridil	CYP3A4	CYP3A5	✓		
Anti-pulmonary arterial hypertension						
ERA-Dual antagonists	Bosentan	CYP2C9	CYP3A4, CYP3A5	✓		
	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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Cardiac stimulants						
Digitalis glycosides	Digoxin	Renal Excretion	ABCB1, ABCB4	✓		
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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Drug Therapy for Hypercholesterolemia and Dyslipidemia (Liver)						
HMG CoA reductase inhibitors Statins	Atorvastatin	CYP3A4	SLCO1B1, ABCG2, CYP3A5, ABCB1, ABCG8, KIF6			●
	Fluvastatin	CYP2C9	SLCO1B1, ABCG2, CYP3A4			●
	Lovastatin	CYP3A4	SLCO1B1, CYP3A5			●
	Cerivastatin	CYP3A4	SLCO1B1, HMGCR,CYP3A5			●
	Pravastatin	SLCO1B1	KIF6, APOE, ABCA1	●		
	Simvastatin	CYP3A4	SLCO1B1, ABCG2, CYP3A5, ABCB1, SLCO2B1, KIF6			●
MTTP inhibitors	Lomitapide	CYP3A4	CYP3A5, LDLR	●		
Drug Therapy for Hypercholesterolemia and Dyslipidemia (Blood vessels)						
Fibrates	Gemfibrozil	CYP3A4	CYP3A5	●		
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
APOE	rs7412	C/C	Atorvastatin	2A	Less responsive to Statin treatment
APOE	rs7412	C/C	Pravastatin	3	Less responsive to Statin treatment
APOE	rs7412	C/C	Simvastatin	3	Less responsive to Statin treatment

PGx Report - Modulation of Cardiovascular Function

Type: Anticoagulant, Antiplatelet

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Blood Coagulation and Anticoagulant, and Antiplatelet Drugs						
Vitamin K antagonist	Warfarin	CYP2C9, VKORC1	CYP2C19, CYP1A2, CYP3A4, PROC, PROS1			●
	Acenocoumarol	CYP2C9, VKORC1	CYP2C19, CYP1A2			●
	Phenprocoumon	CYP2C9, VKORC1	CYP3A4			●
Direct factor Xa inhibitors	Rivaroxaban	CYP3A4	CYP3A5	●		
	Apixaban	CYP3A4	CYP3A5	●		
Antiplatelet Drugs						
ADP receptor (P2Y12) inhibitors Nucleotide/nucleo side 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	CYP3A5	●		
Abbreviations: P2Y12, purinergic receptor P2Y12.						

SNPs of Importance for Venous Thromboembolism Risk

Gene	Protein change	Nucleotide change	Marker	Genotype	Results
F5	Arg534Gln	1601G>A	rs6025	G/G	Normal risk
F2		*97G>A	rs1799963	G/G	Normal risk
MTHFR	Ala222Val	665C>T	rs1801133	G/A	
MTHFR	Glu429Ala	1286A>C	rs1801131	G/T	

PGx Report - Internal Medicine

Type: Drugs Prescribed for the Modulation of Respiratory Function

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Respiratory						
Anticholinergic	Umeclidinium	CYP2D6		⊘		
	Aclidinium	CYP2D6	CYP3A4, CYP3A5	⊘		
Beta2-adrenergic agonist	Arformoterol	CYP2D6	CYP2C19	⊘		
	Indacaterol	CYP3A4	CYP3A5, CYP1A2, CYP2D6	⊘		
	Formoterol	CYP2D6	CYP2C19, CYP2C9	⊘		
	Salmeterol	CYP3A4	CYP3A5	⊘		
	Vilanterol	CYP3A4	CYP3A5	⊘		
Corticosteroid	Budesonide	CYP3A4	CYP3A5	⊘		
	Fluticasone	CYP3A4	CYP3A5	⊘		
	Mometasone	CYP3A4	CYP3A5	⊘		
Phosphodiesterase inhibitor	Roflumilast	CYP3A4	CYP1A2, CYP3A5	⊘		
	Theophylline	CYP1A2		⊘		
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	Used As Directed	May Have Decreased Efficacy	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	✓		
	Hydroxyzine	ADHs	CYP3A4, CYP3A5	✓		
	Promethazine	CYP2D6	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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Histamine H2-receptor antagonists	Ranitidine	Renal Excretion	CYP1A2, CYP2C19, 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	Used As Directed	May Have Decreased Efficacy	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	CYP3A5	✓		
Dopamine antagonists	Metoclopramide	CYP2D6	CYP1A2, CYB5R1, CYB5R2, CYB5R3, CYB5R4	✓		
	Clebopride	CYP3A4	CYP3A5	✓		
	Domperidone	CYP3A4	CYP3A5	✓		
Antipropulsives						
Opioids	Loperamide	CYP3A4	CYP3A5	✓		
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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Antidiabetic Secretagogues						
Meglitinides	Nateglinide	CYP2C9	CYP3A4, CYP3A5	✓		
Sulfonylurea 1st generation	Chlorpropamide	Renal Excretion	CYP2D6, G6PD	✓		
	Tolazamide	CYP2C9		✓		
	Tolbutamide	CYP2C9	CYP2C19	✓		
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	CYP3A5	✓		
Antidiabetic Sensitizers						
Biguanides	Metformin	Renal Excretion		✓		

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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Anti-migraine						
Selective serotonin (5-HT1) agonists	Almotriptan	CYP3A4	CYP2D6, CYP3A5	✓		
	Eletriptan	CYP3A4	CYP3A5	✓		
	Frovatriptan	CYP1A2		✓		
	Naratriptan	CYP1A2	CYP2C9, CYP2D6	✓		
	Zolmitriptan	CYP1A2		✓		
Ergot alkaloids	Dihydroergotamine	CYP3A4	CYP3A5	✓		
	Ergotamine	CYP3A4	CYP3A5	✓		
Antihistamines						
Aminoalkyl ethers	Diphenhydramine	CYP2D6	CYP3A4, CYP3A5	✓		
Substituted alkylamines	Chlorpheniramine	CYP3A4	CYP3A5	✓		
Phenothiazine derivatives	Promethazine	CYP2D6	SULTs	✓		
Piperazine derivatives	Cyclizine	CYP2D6		✓		
	Cetirizine	Renal Excretion		✓		
Other antihistamines	Terfenadine	CYP3A4	CYP3A5	✓		
	Loratadine	CYP3A4, CYP2D6	CYP3A5,CYP2C9	✓		
	Fexofenadine	Biliary Excretion	Renal Excretion, CYP3A4, CYP3A5, SLCO2B1	✓		
	Astemizole	CYP3A4	CYP3A5	✓		
Treatment of secondary hyperparathyroidism						
Calcimimetic	Cinacalcet	CYP3A4	CYP2D6, CYP3A5, CYP1A2	✓		
Abortifacient						
Progestin Antagonist	Mifepristone	CYP3A4	CYP3A5	✓		
Abbreviations: BE, biliary excretion.						

PGx Report - Psychiatry

Type: Antidepressant I

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Antidepressants						
SSRIs	Citalopram	CYP2C19, CYP2D6	CYP3A4, CYP3A5, SLC6A4, HTR2A	✓		
	Escitalopram	CYP3A4, CYP2C19	CYP2D6, CYP3A5, SLC6A4	✓		
	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	CYP3A5, CYP2C19, CYP2D6	✓		
	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	✓		
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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Antidepressants						
TCAs that fairly balanced serotonin-norepinephrine reuptake inhibitors	Amitriptyline	CYP2D6	CYP3A4, CYP2C19, CYP2C9, CYP1A2, CYP2B6	✓		
	Doxepin	CYP2D6, CYP2C19	CYP1A2, CYP3A4, CYP3A5	✓		
	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, CYP3A5, CYP2C19, CYP2D6	✓		
	Moclobemide	CYP2C19	CYP2D6, CYP1A2, HTR2A	✓		
Atypical antidepressants						
SMSs	Vortioxetine	CYP2D6	CYP2C9, CYP3A4, CYP3A5, UGTs,CYP2C19, CYP2B6	✓		
NaSSAs	Mirtazapine	CYP1A2	CYP2D6, CYP3A4, CYP3A5, SLC6A4, HTR2A	✓		
SARIs	Trazodone	CYP3A4	CYP2D6, CYP3A5	✓		
	Nefazodone	CYP2D6, CYP3A4	CYP3A5	✓		
Antidepressant and smoking cessation aid	Bupropion	CYP2B6	CYP3A4, 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 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	A/A	Fluvoxamine	3	Schizophrenia patients may have an increased risk for developing extrapyramidal symptoms
COMT	rs4680	A/A	Venlafaxine	3	Patients with Depressive Disorder may have a decreased response but patients with Anxiety Disorders may have an increased response
COMT	rs4680	A/A	Paroxetine	3	Depressive patients may have an increased response or increased improvement
ANKK1/DRD2	rs1800497	G/G	Bupropion	1B	Patients may be more likely to quit smoking
ANKK1/DRD2	rs1800497	G/G	Antipsychotics	2A	Schizophrenia patients may have an increased risk for tardive dyskinesia
ANKK1/DRD2	rs1800497	G/G	Ethanol	2B	Patients may have a decreased, but not absent, risk for Alcoholism
ANKK1/DRD2	rs1800497	G/G	Clozapine Olanzapine Risperidone	2B	Patients may have decreased but not non-existent risk of side effects including hyperprolactinemia and weight gain
ANKK1/DRD2	rs1800497	G/G	Nicotine	3	Patients may have a decreased likelihood of smoking cessation when treated with nicotine replacement
ANKK1/DRD2	rs1800497	G/G	Risperidone	3	Schizophrenia patients may have less improvement in symptoms

PGx Report - Psychiatry

Type: Typical Antipsychotic

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Typical antipsychotic						
Butyrophenones	Bromperidol	CYP3A4	CYP3A5	✓		
	Droperidol	CYP3A4	CYP3A5	✓		
	Haloperidol	UGTs, CYP3A4	CYP1A2, CYP2D6, CYP3A5, SLC6A4	✓		
Phenothiazines with aliphatic side-chain	Chlorpromazine	CYP2D6	CYP1A2, CYP3A4, CYP3A5	✓		
	Levomepromazine	CYP3A4	CYP1A2, CYP3A5	✓		
	Promazine	CYP1A2	CYP3A4, CYP2C19, CYP2C9, CYP3A5	✓		
	Cyamemazine	CYP1A2	CYP3A4, CYP2C9,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	SULTs	✓		
Diphenyl-butylpiperidine	Pimozide	CYP3A4, CYP2D6	CYP1A2, CYP3A5	✓		
Thioxanthene derivative	Thiothixene	CYP1A2	CYP3A4, CYP3A5	✓		
	Zuclopenthixol	CYP2D6	CYP3A4, CYP3A5	✓		
Tricyclics	Loxapine	CYP1A2	CYP3A4, CYP2D6, CYP3A5	✓		

PGx Report - Psychiatry

Type: Atypical antipsychotic

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Atypical antipsychotic						
Diazepines, Oxazepines, Thiazepines and Oxepines	Quetiapine	CYP3A4, CYP2D6	CYP3A5, CYP1A2, CYP2C9, CYP2C19, SLC6A4	✓		
	Asenapine	CYP1A2	CYP2D6, CYP3A4, CYP3A5	✓		
	Clozapine	CYP1A2, CYP2D6	CYP3A4, CYP2C9, CYP2C19, CYP3A5, SLC6A3, SLC6A4, SLC1A1, 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, 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
COMT	rs4680	A/A	Haloperidol	3	Schizophrenia patients may have an increased 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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Anti ADHD Stimulants						
Amphetamine	Dextroamphetamine	Renal Excretion, CYP2D6	DBH, 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	CYP3A4, CYP2D6, CYP1A2, CYP3A5	✓		
	Imipramine	CYP1A2, CYP2D6	CYP2C19, CYP3A4, CYP3A5	✓		
	Desipramine	CYP2D6	CYP1A2, CYP2C19	✓		
	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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Antiepileptic						
Barbiturates	Phenobarbital	CYP2C19	ABCB1	✓		
Carbamates	Felbamate	CYP3A4	CYP3A5	✓		
Carboxamides	Carbamazepine	CYP3A4	CYP2B6, 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, HLA-B*1502	✓		
	Mephenytoin	CYP2C19	CYP2C9, CYP2B6, CYP1A2, CYP2D6	✓		
Oxazolidinediones	Trimethadione	CYP2C9	CYP3A4, CYP3A5	✓		
	Paramethadione	CYP2C9		✓		
Pyrimidinedione	Primidone	CYP2C9	CYP2C19	✓		
Pyrrolidines	Brivaracetam	CYP2C19, CYP2C9	CYP3A4, CYP3A5,CYP2B6	✓		
	Levetiracetam	Renal Excretion		✓		
	Seletracetam	Renal Excretion		✓		
Succinimides	Ethosuximide	CYP3A4	CYP3A5	✓		
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	Used As Directed	May Have Decreased Efficacy	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	✓		
	Estazolam	CYP3A4	CYP3A5	✓		
	Clonazepam	CYP3A4	CYP2C19, CYP3A5	✓		
	Quazepam	CYP3A4	CYP2C19, CYP3A5	✓		
	Lormetazepam	CYP3A4	CYP3A5	✓		
	Nitrazepam	CYP3A4	CYP3A5	✓		
	Temazepam	CYP2C19	CYP3A4, CYP3A5	✓		
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	CYP2C9, CYP3A5	✓		
	Eszopiclone	CYP3A4	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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Anti-Alzheimer disease						
Acetylcholinesterase inhibitor	Tacrine	CYP1A2	CYP2D6	✓		
	Donepezil	CYP2D6	CYP3A4, CYP3A5	✓		
	Galantamine	CYP2D6	CYP3A4, CYP3A5	✓		
NMDA receptor antagonist	Memantine	Renal Excretion	UGTs	✓		
Anti-Parkinson disease						
Inhibitor of MAO-B	Selegiline	CYP2B6	CYP2C9, CYP3A4, CYP3A5	✓		
	Rasagiline	CYP1A2		✓		
Dopamine receptor agonists	Bromocriptine	CYP3A4	CYP3A5	✓		
	Pramipexole	Renal Excretion	DRD3	✓		
	Ropinirole	CYP1A2	UGTs, Renal Excretion	✓		
Anticholinergics - Antimuscarinics	Diphenhydramine	CYP2D6	CYP3A4, CYP3A5	✓		
Anti-hyperkinetic movement	Tetrabenazine	CYP2D6	CYP1A2	✓		
Anti-amyotrophic lateral sclerosis drug	Riluzole	CYP1A2		✓		
Abbreviations: NMDA, N-methyl-D-aspartate; COMT, Catechol-O-methyltransferase.						

Additional SNP of Importance for different Medical Condition and personality

Gene	Marker	Genotype	Results
APOE	rs429358	C/T	3-fold lifetime increased risk for Alzheimer's disease

PGx Report - Infectology

Type: Antibiotics

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Antibacterials: protein synthesis inhibitors 50S						
Amphenicols	Chloramphenicol	CYP2C9		✓		
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	CYP3A5, CYP2C19, RE	✓		
	Rifabutin	CYP3A4	CYP1A2, CYP3A5	✓		
Other drugs against mycobacteria	Bedaquiline	CYP3A4	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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Antimalarial						
Aminoquinolines	Hydroxychloroquine	CYP2D6	CYP3A4, CYP3A5	✓		
	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		✓		
Triazoles	Itraconazole	CYP3A4		✓		
	Voriconazole	CYP2C19	CYP2C9, CYP3A4, CYP3A5	✓		
	Fluconazole	Renal Excretion		✓		
Allylamines	Terbinafine	CYP2C9	CYP1A2, CYP3A4,CYP2C19	✓		

PGx Report - Infectology

Type: Antiretroviral, Antiviral

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	Used As Directed	May Have Decreased Efficacy	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	ABCB1, SLCO3A1, ABCG2	✓		
NNRTI 2nd generation	Nevirapine	CYP3A4	CYP2B6, CYP3A5, ABCB1, SLCO3A1	✓		
	Etravirine	CYP3A4	CYP2C9, CYP2C19, CYP3A5	✓		
	Rilpivirine	CYP3A4	CYP3A5	✓		
Neuraminidase inhibitors/release phase	Zanamivir	Renal Excretion		✓		
	Peramivir	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	CYP2C19, CYP3A5, IFNL3	✓		
Other antivirals	Enfuvirtide	CYP2C19	CYP1A2	✓		
	Elvitegravir	CYP3A4	CYP3A5	✓		
	Dolutegravir	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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Alkylating agents						
Nitrogen mustard analogues	Cyclophosphamide	CYP2B6	CYP2C19, CYP3A4, CYP2C9, CYP3A5, 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	Cladribine	DCK	Renal Excretion	✓		
	Clofarabine	DCK	Renal Excretion	✓		
	Nelarabine	ADA	DCK, Renal Excretion, XO	✓		

PGx Report - Oncology, Hematology

Type: Antineoplastic II

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	Used As Directed	May Have Decreased Efficacy	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, ABCB1	✓		
	Teniposide	CYP2C19	CYP3A4, CYP3A5, ABCB1	✓		
Taxanes	Docetaxel	CYP3A4	CYP3A5, ABCC6	✓		
Cytotoxic antibiotics and related substances						
Anthracyclines and related substances	Doxorubicin	ALDH1A1, ABCB1, GSTP1, NQO1	CYP3A4, CYP2B6, CYP3A5,CYP2D6, ABCC2, ABCC3	✓		

PGx Report - Oncology, Hematology

Type: Antineoplastic Targeted Therapy I

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	Used As Directed	May Have Decreased Efficacy	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	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	CYP3A5	✓		
Multiple targets (c-KIT, FGFR, PDGFR and VEGFR)	Axitinib	CYP3A4	CYP1A2, CYP2C19, CYP3A5	✓		
	Nintedanib	CYP1A2	CYP2C9, CYP2C19, CYP2D6	✓		
	Pazopanib	CYP3A4	CYP1A2,CYP3A5	✓		
	Ponatinib	CYP3A4	CYP2D6, CYP3A5	✓		
	Regorafenib	CYP3A4	CYP3A5	✓		
	Sorafenib	CYP3A4	CYP3A5	✓		
	Sunitinib	CYP3A4	CYP3A5, ABCG2	✓		
	Toceranib	CYP3A4	CYP3A5	✓		
Protein kinase inhibitor (non-receptor)						
BCR-ABL	Imatinib	CYP3A4	CYP3A5, ABCB1, SLCO1A2, SLC22A4, ABCG2	✓		
	Nilotinib	CYP3A4	CYP1A2, CYP2C9, CYP2C19, CYP2D6, CYP3A5, ABCG2	✓		
	Dasatinib	CYP3A4	CYP3A5, ABCG2	✓		
	Ponatinib	CYP3A4	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	Used As Directed	May Have Decreased Efficacy	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	●		
Other Targeted therapy						
mTOR Inhibitors	Sirolimus	CYP3A4	CYP3A5	●		
	Everolimus	CYP3A4	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, CYP2C19, CYP1A2, F2, F5, ABCC2	●		
SERD	Fulvestrant	CYP3A4	CYP3A5	●		
Anti-androgens	Flutamide	CYP1A2	CYP3A4, CYP3A5	●		
	Nilutamide	CYP2C19	FMO3	●		
	Bicalutamide	CYP3A4	CYP3A5	●		
Aromatase inhibitors	Anastrozole	CYP3A4	CYP3A5	●		
	Letrozole	CYP3A4	CYP3A5	●		
	Exemestane	CYP3A4	CYP3A5	●		
Other hormone antagonists and related agents	Abiraterone	CYP3A4	CYP3A5, SULT2A1	●		
Hematologic						
Thrombopoiesis Stimulating Agent	Eltrombopag	CYP1A2	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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Immunosuppressive						
Antimetabolite	Mycophenolate mofetil	CYP3A4	CYP3A5, UGT1A8, SLCO1B1, ABCC2, HPRT1	●		
Calcineurin Inhibitors	Pimecrolimus	CYP3A4	CYP3A5	●		
	Tacrolimus	CYP3A4	CYP3A5, ABCB1		◔	
	Cyclosporine	CYP3A4	CYP3A5, ABCB1, ABCC2	●		
mTOR Inhibitors	Temsirolimus	CYP3A4	CYP3A5	●		
	Everolimus	CYP3A4	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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Intravenous agents (non-opioid)						
Barbiturates	Hexobarbital	CYP2C19	CYP2C9, 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	Carisoprodol	CYP2C19		✓		
	Cyclobenzaprine	CYP1A2	CYP2D6, CYP3A4, CYP3A5	✓		
	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	Used As Directed	May Have Decreased Efficacy	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	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Hormonal contraceptives						
Estrogens	Ethinylestradiol	CYP3A4, CYP2C9	CYP3A5, CYP2C19, CYP1A2	✓		
	Estradiol	CYP1A2	CYP3A4, CYP3A5	✓		
Progestogens	Desogestrel	CYP3A4, HSD3B1	CYP3A5, CYP2C9, CYP2C19	✓		
	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)	Ospemifene	CYP3A4	CYP2C9, CYP3A5, CYP2C19, CYP2B6	✓		
Steroid hormone						
Glucocorticoids	Dexamethasone	CYP3A4	CYP17A1, CYP3A5	✓		
	Cortisol (hydrocortisone)	CYP3A4	CYP3A5	✓		
	Prednisone	HSD11B2	CYP3A4, CYP3A5, SLC19A1, SULTs, UGTs	✓		
There are additional SERMs (Tamoxifen and Toremifene) described under antineoplastics)						

PGx Report - Recreational Drugs

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

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	Used As Directed	May Have Decreased Efficacy	May Have Increased Toxicity
Amphetamines	3,4-methylenedioxy-methamphetamine (MDMA)	Renal Excretion, CYP2D6	CYP1A2, CYP3A4, CYP3A5	✓		
	Methamphetamine	CYP2D6, Renal Excretion	DBH, ACSM1, GLYAT, DRD3	✓		
Barbiturates	Amobarbital	CYP3A4	CYP3A5, CYP2B6, CYP2C9	✓		
	Phenobarbital	CYP2C19	ABCB1	✓		
Benzodiazepines	Alprazolam	CYP3A4	CYP3A5	✓		
	Clonazepam	CYP3A4	CYP2C19, CYP3A5	✓		
	Diazepam	CYP2C19, CYP3A4	CYP3A5, CYP2B6, CYP1A2	✓		
Cannabinoids & Related Drugs	Cannabidiol (CBD)	CYP3A4	CYP2C19, CYP3A5	✓		
	Delta 9-tetra hydrocannabinol (Δ9_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, CYP1A2	✓		
Ergoline derivatives	Lysergic acid diethylamide (LSD)	CYP3A4	CYP3A5	✓		

Genomic Test Results

Genotype/Haplotype Details

CYP1A2

Allele Tested: *1A, *1C, *1F, *1K, *1L, *7, *11.

Genetic results: CYP1A2 *1F/*1F

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP1A2		-3860G>A	*1C	rs2069514	G/G
CYP1A2		-729C>T	*1K	rs12720461	C/C
CYP1A2		-163C>A	*1F	rs762551	A/A
CYP1A2	Splicing defect	1253+1G>A	*7	rs56107638	G/G
CYP1A2	Phe186Leu	558C>A	*11	rs72547513	C/C

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, *6, *18.

Genetic results: CYP2B6 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2B6	Gln172His	516G>T	*6	rs3745274	G/G
CYP2B6	Ile328Thr	983T>C	*18	rs28399499	T/T

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

CYP2C9

Allele Tested: *1, *2, *3, *4, *5, *6, *8, *11, *12, *13, *15, *27.

Genetic results: CYP2C9 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2C9	Arg144Cys	430C>T	*2	rs1799853	C/C
CYP2C9	Ile359Leu	1075A>C	*3	rs1057910	A/A
CYP2C9	Ile359Asn	1076T>C	*4	rs56165452	T/T
CYP2C9	Asp360Glu	1080C>G	*5	rs28371686	C/C
CYP2C9	Lys273Argfs	817delA	*6	rs9332131	A/A
CYP2C9	Arg150His/Leu	449G>A/T	*8/*27	rs7900194	G/G
CYP2C9	Arg335Trp	1003C>T	*11	rs28371685	C/C
CYP2C9	Pro489Ser	1465C>T	*12	rs9332239	C/C
CYP2C9	Leu90Pro	269T>C	*13	rs72558187	T/T
CYP2C9	Ser162Ter	485C>A	*15	rs72558190	C/C

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, .

Genetic results: CYP2C19 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2C19	Splicing defect	681G>A	*2	rs4244285	G/G
CYP2C19	Trp212Ter	636G>A	*3	rs4986893	G/G
CYP2C19	Met1Val	1A>G	*4	rs28399504	A/A
CYP2C19	Arg433Trp	1297C>T	*5	rs56337013	C/C
CYP2C19	Arg132Gln	395G>A	*6	rs72552267	G/G
CYP2C19	Splicing defect	819+2T>A	*7	rs72558186	T/T
CYP2C19	Trp120Arg	358T>C	*8	rs41291556	T/T
CYP2C19		-806C>T	*17	rs12248560	C/C

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, *2A, *3, *4A, *4M, *6A, *6C, *7, *8, *9, *10, *11, *12, *14A, *14B, *15, *17, *18, *19, *20, *29, *34, *36, *39, *41, *69, and CNVs.

Genetic results: CYP2D6 *2A/*2A

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2D6	Arg296Cys	886C>T	*2	rs16947	G/G
CYP2D6	Ser486Thr	1457G>C	*2	rs1135840	C/C
CYP2D6	Arg259Glyfs	775delA	*3	rs35742686	T/T
CYP2D6	Splicing defect	506-1G>A	*4	rs3892097	C/C
CYP2D6	CNV assay		*5/XN	CYP2D6_CNVs	2
CYP2D6	Trp152Glyfs	454delT	*6	rs5030655	A/A
CYP2D6	His324Pro	971A>C	*7	rs5030867	T/T
CYP2D6	Gly169Ter/Arg	505G>T/A	*8/*14	rs5030865	C/C
CYP2D6	Lys281del	841_843delAAG	*9	rs5030656	A/A
CYP2D6	Pro34Ser	100C>T	*10	rs1065852	A/G
CYP2D6	Splicing defect	181-1G>C	*11	rs201377835	G/G
CYP2D6	Gly42Arg	124G>A	*12	rs5030862	C/C
CYP2D6	46fs	137-138insT	*15	rs774671100	-/-
CYP2D6	Thr107Ile	320C>T	*17	rs28371706	G/G
CYP2D6	468_470dupVPT	4125_4133dupGTGCCCACT	*18	rs765776661	D/D
CYP2D6	255fs	2539_2542delAACT	*19	rs72549353	A/A
CYP2D6	211fs	1973_1974insG	*20	rs72549354	D/D
CYP2D6	Val338Met	1012G>A	*29	rs59421388	C/C
CYP2D6	(sing-dup)		*36	CYP2D7/2D6 hybrid *36	WT/WT
CYP2D6	Splicing defect	985+39G>A	*41	rs28371725	C/C

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: *2, *17, *22.

Genetic results: CYP3A4 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP3A4	Ser222Pro	664T>C	*2	rs55785340	A/A
CYP3A4	Phe189Ser	566T>C	*17	rs4987161	A/A
CYP3A4		522-191C>T	*22	rs35599367	G/G

Genotype/Haplotype Details

CYP3A5

Allele Tested: *1, *2, *3, *6, *7.

Genetic results: CYP3A5 *1/*3

Phenotype: Intermediate metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP3A5	Thr398Asn	1193C>A	*2	rs28365083	G/G
CYP3A5	Splicing defect	689-1A>G	*3	rs776746	T/C
CYP3A5	Splicing defect	624G>A	*6	rs10264272	C/C
CYP3A5	Thr346Tyrfs	1035_1036insT	*7	rs41303343	C/C

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

VKORC1

Allele Tested: *1, *2.

Genetic results: VKORC1 *2/*2

Phenotype: Sensitive to Warfarin

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
VKORC1		-1639G>A	*2	rs9923231	T/T

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

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	A/G

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

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	A/A

Genotype/Haplotype Details

APOE

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

Genetic results: APOE *3/*4

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

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	*1F/*1F	Extensive metabolizer
CYP2B6	*1/*1	Extensive metabolizer
CYP2C9	*1/*1	Extensive metabolizer
CYP2C19	*1/*1	Extensive metabolizer
CYP2D6	*2A/*2A	Extensive metabolizer
CYP3A4	*1/*1	Extensive metabolizer
CYP3A5	*1/*3	Intermediate metabolizer
VKORC1	*2/*2	Sensitive to Warfarin
SLCO1B1	*1/*5	Intermediate function
ABCB1	*1/*2	Intermediate function
OPRM1	*1/*1	Sensitive to Opioids
APOE	*3/*4	
COMT	A/A	

For a complete report contact Immunogenomics.com

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