ELITE CLINICAL LABORATORY

Comprehensive PGx report

DETAILS	
PATIENT	DOB
Jane Doe	01-01-1900
GENDER	Female
SPECIMEN TYPE	Buccal Swab
ORDERING PHYSICIAN	-
FACILITY	Elite Clinical Lab

ELITE CLINICAL LABORATORY

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LABORATORY INFORMATION	
ACCESSION NUMBER	2XX6271582
COLLECTION DATE	06/03/2020
RECEIVED DATE	09/01/2020
REPORT GENERATED	09/21/2020
LABORATORY DIRECTOR	Albert Chen MD

Current Patient Medication

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

- 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	*1A/*1A	Extensive metabolizer
CYP2B6	*1/*1	Extensive metabolizer
CYP2C8	*1/*1	Extensive metabolizer
CYP2C9	*1/*1	Extensive metabolizer
CYP2C19	*1/*1	Extensive metabolizer
CYP2D6	*1/*39	Extensive metabolizer
CYP3A4	*1/*1	Extensive metabolizer
CYP3A5	*3/*3	Poor metabolizer
CYP4F2	*1/*1	Extensive metabolizer
VKORC1	*1/*1	Warfarin resistance
SLCO1B1	*1/*1	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). * This call was defaulted to the wild-type allele frequency because during review of the genotyping data, the genotype was indeterminate. For copy number: ** This copy number was defaulted to the wild-type frequency because during review of the copy number variation data, the copy number was indeterminate.

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 (yellow check marks), should use the drug as directed (green check marks), or exhibits increased toxicity to the drug (red check marks). Inclusion of Genomic Test Results indicates genotype, haplotype, phenotype, or presence of mutation.

Organization of Table:

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

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

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

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

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

PGx Report - Pain Management

Type: Anti-inflammatory Agent, Analgesic, Antipyretic

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
The Nonsteroidal Antiinflammatory Drugs (NSAIDs)						
Acetic acid derivatives	Nabumetone (Relafen)	CYP1A2	CYP2C19, CYP3A4		✓	
	Indomethacin (Tivorbex)	CYP2C9	CYP2C19		✓	
	Ketorolac (Toradol, Acular, Sprix)	CYP2C8	CYP2C9, UGT2B7		✓	
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		✓	
	Flurbiprofen (Ocufen)	CYP2C9			✓	
	Ketoprofen (Frotek)	CYP3A4	CYP2C9, CYP3A5		✓	
	Fenoprofen (Nalfon, Fenortho)	CYP2C9			✓	
	Vicoprofen (Reprexain, Ibudone)	CYP2D6	CYP3A4		✓	
	Naproxen (Aleve, Naprosyn)	CYP2C9	CYP1A2, CYP2C8		✓	
Anthranilic acid derivatives (Fenamates)	Mefenamic acid (Ponstel)	CYP2C9			✓	
The Non-NSAIDs Analgesic	Acetaminophen (Tylenol)	UGT1A1, UGT1A6, UGT1A9, SULT1A1, GSHs	CYP3A4, CYP3A5, CYP2D6, CYP1A2		✓	

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, UGT2B4, FMO3, CYP3A5, OPRM1		✓	
Esters of morphine	Diacetylmorphine (Heroin)	CES1	CES2, 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, COMT			⊗
Synthetic opioids						
Anilidopiperidine derivatives	Alfentanyl	CYP3A4	CYP3A5, OPRM1		✓	
	Fentanyl (Duragesic, Subsys)	CYP3A4	CYP3A5, OPRM1			⊗
	Sufentanil (Sufenta)	CYP3A4	CYP3A5, OPRM1		✓	
Phenylpiperidine derivatives	Meperidine (Demerol)	CYP2B6	CYP3A4, CYP2C19, CYP3A5		✓	
	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, COMT		✓	
Oripavine derivatives	Buprenorphine (Buprenex, Butrans)	CYP3A4	CYP3A5, CYP2C8, UGT1A1		✓	
Morphinan derivatives	Dextromethorphan (Robitussin, Dayquil)	CYP2D6	CYP3A4, CYP3A5		✓	
Others	Tramadol	CYP2D6	CYP3A4, CYP2B6, CYP3A5, OPRM1, 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		✓	
	Allopurinol (Zyloprim, Aloprim)	AOX1	Renal Excretion, HLA-B*5801		✓	
	Oxypurinol	Renal Excretion			✓	
Recombinant urate oxidase	Rasburicase (Elitek)		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	A/A	Naloxone (Narcan, Evzio)	2B	Patients may have lower cortisol response
OPRM1	rs1799971	A/A	Morphine (Duramorph, Infumorph P/F)	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 (Duragesic, Subsys)	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 (Hysingla, Vicodin)	3	Patients may have a decreased risk for experiencing side effects, including constipation, dry mouth or respiratory depression
COMT	rs4680	*	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	CYP3A5, CYP2C9, CYP2C8		✓	
	Procainamide (Pronestyl, Procan-SR)	CYP2D6			✓	
	Sparteine	CYP2D6			✓	
	Disopyramide (Norpace, Norpace CR)	CYP3A4	CYP3A5, CYP1A2, CYP2C19		✓	
Antiarrhythmic class Ib	Phenytoin (Dilantin Phenytek)	CYP2C19	CYP2C9, CYP3A4, CYP3A5, CYP2D6, HLA-B*1502		✓	
	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		✓	
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		✓	

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		✓	
	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		✓	
	Lisinopril (Zestril)	CES1, Renal Excretion			✓	
	Trandolapril (Mavik)	CES1	CYP2D6, CYP2C9, Renal Excretion		✓	
Renin inhibitors	Aliskiren (Tekturna)	CYP3A4	CYP3A5		✓	
Aldosterone Antagonists	Eplerenone (Inspra)	CYP3A4	CYP3A5		✓	
Loop diuretic	Torasemide (Demadex)	CYP2C9	CYP2C8, Renal Excretion		✓	
	Furosemide	Renal Excretion	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		✓	
Beta-blockers with alpha activity	Carvedilol (Coreg, Coreg CR)	CYP2D6	UGT1A1, UGT2B4, CYP2C9		✓	
	Labetalol (Normodyne, Trandate)	CYP2D6	CYP2C19, UGT1A1		✓	
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, CYP3A5		✓	
	Nimodipine (Nymalize)	CYP3A4	CYP3A5		✓	
	Nicardipine	CYP2C8	CYP2D6, CYP3A4, CYP3A5		✓	
Benzothiazepine	Diltiazem (Cardizem, Tiazac)	CYP3A4	CYP2C19, CYP3A5		✓	
Phenylalkylamine	Verapamil (Verelan, Calan)	CYP3A4	CYP2C8, CYP3A5		✓	
Nonselective	Bepridil (Vascor)	CYP3A4	CYP3A5		✓	
Anti-pulmonary arterial hypertension						
ERA-Dual antagonists	Bosentan (Tracleer)	CYP2C9	CYP3A4, CYP3A5		✓	
	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	ABCB4		✓	
Adrenergic and dopaminergic agents	Epinephrine	MAO	COMT		✓	
	Dopamine	ALDH1A1, ALDH2	MAOA, MAOB, SULT1A3, SULT1A4, COMT		✓	
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, SLCO1B1, HMGCR	CYP3A5, ABCG8, UGT1A1		✓	
	Fluvastatin (Lescol, Lescol XL)	CYP2C9, SLCO1B1	CYP3A4, CYP2C8, UGT1A1		✓	
	Lovastatin (Mevacor, Altoprev)	CYP3A4, SLCO1B1	CYP3A5, UGT1A1		✓	
	Cerivastatin (Baycol, Lipobay)	CYP3A4, SLCO1B1	CYP2C8, CYP3A5		✓	
	Pitavastatin (Livalo)	UGT1A3, UGT2B7	CYP2C9, CYP2C8		✓	
	Pravastatin (Pravachol)	SLCO1B1, HMGCR	APOE		✓	
	Simvastatin	CYP3A4, SLCO1B1	CYP3A5, UGT1A1		✓	
	Rosuvastatin (Crestor)	UGT1A1			✓	
MTTP inhibitors	Lomitapide	CYP3A4	CYP3A5, LDLR		✓	
Drug Therapy for Hypercholesterolemia and Dyslipidemia (GI)						
Cholesterol absorption inhibitors	Ezetimibe (Zetia)	UGT1A1			✓	
Drug Therapy for Hypercholesterolemia and Dyslipidemia (Blood vessels)						
Fibrates	Gemfibrozil (Lopid)	CYP3A4	CYP3A5, UGT1A1		✓	
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 Cardiovascular Treatments & Inhalational Anesthetics

Gene	Marker	Genotype	Drug	Level of Evidence	Results
APOE	rs7412	C/C	Atorvastatin (Lipitor)	2A	Less responsive to Statin treatment
C11ORF65 (ATM)	rs11212617	G/G	Metformin	2B	Patients with Diabetes Mellitus, Type 2 who are treated with metformin may have an increased response to metformin as compared to patients with the AA genotype. An association with increased/decreased response to metformin was not seen in people with impaired glucose tolerance.
APOE	rs7412	C/C	Pravastatin (Pravachol)	3	Less responsive to Statin treatment
APOE	rs7412	C/C	Simvastatin	3	Less responsive to Statin treatment
LDLR	rs688	*	Atenolol	3	
LDLR	rs688	*	Lovastatin (Mevacor, Altoprev)	3	
CACNA1C	rs2239128	*	Nimodipine (Nymalize)	3	
CACNA1C	rs2239128	*	Calcium Channel Blockers	3	
ACE	rs4341	*	Pravastatin (Pravachol)	3	
AGTR1	rs5182	*	Ace Inhibitors	4	
AGTR1	rs5182	*	Perindopril	4	
APOB	rs693	C/C	Lipids		Patients may have reduced susceptibility to Elevated Apolipoprotein B and LDL-Cholesterol
HFE	rs1799945	*	Atenolol		
RYR1	rs118192176	G/G	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	C/C	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.

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, PROC, PROS1	⊗		
	Acenocoumarol	CYP2C9, VKORC1	CYP4F2, CYP2C19, CYP1A2	⊗		
	Phenprocoumon	CYP2C9, VKORC1	CYP4F2, CYP3A4, CYP2C8	⊗		
Direct factor Xa inhibitors	Rivaroxaban (Xarelto)	CYP3A4	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	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	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	C/C	Normal risk
F2		*97G>A	rs1799963	G/G	Normal risk
VKORC1		1173C>T	rs9923231	C/C	Low warfarin sensitivity; high warfarin dosage
MTHFR	Ala222Val	665C>T	rs1801133	*	
MTHFR	Glu429Ala	1286A>C	rs1801131	*	
MTHFR	Ala222Val	665C>T	rs1801133	*	
MTHFR	Glu429Ala	1286A>C	rs1801131	*	

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		✓	
	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			✓	
5-lipoxygenase inhibitor	Zileuton (Zyflo, Zyflo CR)	CYP1A2	CYP2C9, CYP3A4, CYP3A5		✓	
Leukotriene receptor-1 antagonist	Montelukast (Singulair)	CYP3A4	CYP2C9, CYP3A5, ABCC1		✓	
	Pranlukast (Onon)	CYP3A4	CYP3A5		✓	
	Zafirlukast (Accolate)	CYP2C9	CYP3A4, CYP3A5		✓	
Treatment of cystic fibrosis (specifics mutations in the CFTR gene)	Ivacaftor (Kalydeco)	CYP3A4	CYP3A5		✓	

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		✓	
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		✓	
	Hydroxyzine (Vistaril)	ADHs	CYP3A4, CYP3A5		✓	
	Promethazine (Phenergan, Phenadoz)	CYP2D6	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		✓	
	Tolazamide (Tolinase)	CYP2C9			✓	
	Tolbutamide (Orinase)	CYP2C9	CYP2C19, CYP2C8		✓	
Sulfonylurea 2nd generation	Glipizide (Glucotrol)	CYP2C9			✓	
	Glyburide (Diabeta, Glynase)	CYP3A4	CYP2C9, CYP2C19, CYP3A5		✓	
	Gliquidone (Glurenorm)	CYP2C9			✓	
	Gliclazide (Diamicron)	CYP2C9	CYP2C19		✓	
	Glimepiride (Amaryl)	CYP2C9			✓	
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						
Thiazolidinediones	Pioglitazone (Actos)	CYP2C8	CYP3A4, CYP3A5		✓	
	Rosiglitazone (Avandia)	CYP2C8	CYP2C9		✓	
Biguanides	Metformin (Glucophage)	Renal Excretion			✓	
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		✓	
	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		✓	
Substituted alkylamines	Chlorpheniramine (Chlor-Trimeton, Allergy-4-hour)	CYP3A4	CYP3A5		✓	
Phenothiazine derivatives	Promethazine (Phenergan, Phenadoz)	CYP2D6	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		✓	
	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 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, HTR2A		✓	
	Escitalopram (Lexapro)	CYP3A4, CYP2C19	CYP2D6, CYP3A5, HTR2C		✓	
	Dapoxetine (Priligy)	CYP2D6	CYP3A4, CYP3A5, FMO1		✓	
	Fluoxetine (Prozac, Sarafem)	CYP2D6	CYP3A4, CYP2C9, CYP3A5, CYP2C19, HTR2A		✓	
	Paroxetine (Paxil, Seroxat)	CYP2D6	CYP3A4, CYP1A2, CYP3A5, CYP2C9, HTR2A		✓	
	Sertraline (Zoloft)	CYP2B6	CYP2C19, CYP2C9, CYP3A4, CYP2D6		✓	
	Fluvoxamine (Faverin, Fevarin)	CYP2D6	CYP1A2, 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, 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, HTR2A		✓	
	Imipramine (Tofranil)	CYP1A2, CYP2D6	CYP2C19, CYP3A4, CYP3A5		✓	
TCAs that preferentially inhibit the reuptake of norepinephrine	Desipramine (Norpramin)	CYP2D6	CYP1A2, CYP2C19		✓	
	Nortriptyline (Pamelor)	CYP2D6	CYP1A2, CYP2C19		✓	
	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		✓	
	Doxepin (Silenor, Zonalon)	CYP2D6, CYP2C19	CYP1A2, CYP3A4, CYP3A5		✓	
	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, CYP3A5, CYP2C19, CYP2D6		✓	
	Moclobemide (Amira, Aurorix)	CYP2C19	CYP2D6, CYP1A2, HTR2A		✓	
Atypical antidepressants						
SMSs	Vortioxetine (Brintellix)	CYP2D6	CYP2C9, CYP3A4, CYP3A5, UGTs, CYP2C8, CYP2C19, CYP2B6		✓	
NaSSAs	Mirtazapine (Remeron, Remeronsoltab)	CYP1A2	CYP2D6, CYP3A4, CYP3A5, HTR2A		✓	
SARIs	Trazodone (Desyrel)	CYP3A4	CYP2D6, CYP3A5		✓	
	Nefazodone (Serzone)	CYP2D6, CYP3A4	CYP3A5		✓	
Antidepressant and smoking cessation aid	Bupropion (Zyban, Aplenzin)	CYP2B6	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

Gene	Marker	Genotype	Drug	Level of Evidence	Results
GRIK4	rs1954787	*	Citalopram	1B	
GRIK4	rs1954787	*	Antidepressants	2B	

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	*	Fluvoxamine (Faverin, Fevarin)	3	
COMT	rs4680	*	Venlafaxine (Effexor XR)	3	
COMT	rs4680	*	Paroxetine (Paxil, Seroxat)	3	
HTR2A	rs7997012	G/G	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 (Bromidol, Bromodol)	CYP3A4	CYP3A5		✓	
	Droperidol (Inapsine)	CYP3A4	CYP3A5		✓	
	Haloperidol (Haldol)	UGTs, CYP3A4	CYP1A2, CYP2D6, CYP3A5, HTR2C		✓	
Phenothiazines with aliphatic side-chain	Chlorpromazine (Thorazine, Largactil)	CYP2D6	CYP1A2, CYP3A4, CYP3A5		✓	
	Levomepromazine (Nozinan, Levoprome)	CYP3A4	CYP1A2, CYP3A5		✓	
	Promazine (Sparine)	CYP1A2	CYP3A4, CYP2C19, CYP2C9, CYP3A5		✓	
	Cyamemazine (Tercian)	CYP1A2	CYP3A4, CYP2C9, CYP2C8, CYP3A5		✓	
Phenothiazines with piperazine structure	Fluphenazine (Prolixin)	CYP2D6			✓	
	Perphenazine (Trilafon)	CYP2D6			✓	
	Prochlorperazine (Compro)	CYP2D6	CYP3A4, CYP3A5		✓	
	Trifluoperazine (Stelazine)	CYP1A2			✓	
Phenothiazines with piperidine structure	Thioridazine (Mellaril)	CYP2D6	CYP1A2, CYP3A4, CYP2C19, CYP3A5		✓	
Phenothiazines used as an anti-histamine, sedative, and antiemetic	Promethazine (Phenergan, Phenadoz)	CYP2D6	SULTs		✓	
Diphenyl-butylpiperidine	Pimozide (Orap)	CYP3A4, CYP2D6	CYP1A2, CYP3A5		✓	
Thioxanthene derivative	Thiothixene (Navane)	CYP1A2	CYP3A4, CYP3A5		✓	
	Zuclopenthixol (Clopixol)	CYP2D6	CYP3A4, CYP3A5		✓	
Tricyclics	Loxapine (Adasuve)	CYP1A2	CYP3A4, CYP2D6, 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 (Seroquel, Seroquel XR)	CYP3A4, CYP2D6	CYP3A5, CYP1A2, CYP2C9, CYP2C19		✓	
	Asenapine (Saphris, Sycrest)	CYP1A2, UGT1A4	CYP2D6, CYP3A4, CYP3A5		✓	
	Clozapine (Clozaril, FazaClo)	CYP1A2, CYP2D6	CYP3A4, FMO3, CYP2C9, CYP2C19, CYP3A5, SLC6A3, SLC1A1, HTR2C		✓	
Indole derivatives	Sertindole (Serdolect, Serlect)	CYP2D6	CYP3A4, CYP3A5		✓	
	Ziprasidone (Geodon)	CYP3A4	AOX1, CYP3A5		✓	
	Lurasidone (Latuda)	CYP3A4	CYP3A5		✓	
Benzamides	Sulpiride (Eglonyl, Dolmatil)	Renal Excretion			✓	
	Amisulpride (Solian)	Renal Excretion			✓	
Other antipsychotics	Aripiprazole (Abilify)	CYP2D6	CYP3A4, CYP3A5		✓	
	Risperidone	CYP2D6	CYP3A4, CYP3A5, SLC1A1, HTR2A, HTR2C		✓	
	Iloperidone (Fanapt)	CYP2D6	CYP3A4, CYP3A5		✓	
	Paliperidone (Invega, Invega Trinza)	CYP2D6	CYP3A4, CYP3A5		✓	
	Zotepine (Zoleptil)	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	*	Olanzapine (Zyprexa, Zyprexa Relprevv)	3	
COMT	rs4680	*	Haloperidol (Haldol)	3	

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 (ProCentra, Dexedrine Spansule, Adderall)	Renal Excretion, CYP2D6	FMO3, GLYAT		✓	
	Levoamphetamine (Benzedrine)	Renal Excretion, CYP2D6	FMO3		✓	
NDRI	Dexmethylphenidate (Focalin)	CYP2D6	Renal Excretion		✓	
Psychostimulant	Lisdexamfetamine (Vyvanse)	Hydrolysis	CYP2D6, Renal Excretion		✓	
	Methylphenidate (Concerta, Daytrana)	CYP2D6	Renal Excretion, SLC6A2, SLC6A3		✓	
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	CYP3A4, CYP2C9, CYP2D6, CYP1A2, CYP3A5		✓	
	Imipramine (Tofranil)	CYP1A2, CYP2D6	CYP2C19, CYP3A4, CYP3A5		✓	
	Desipramine (Norpramin)	CYP2D6	CYP1A2, CYP2C19		✓	
	Milnacipran (Savella)	UGTs	Renal Excretion		✓	
	Reboxetine (Edronax)	CYP3A4	CYP3A5		✓	
Wakefulness-promoting agent	Modafinil (Provigil)	Hydrolysis, CYP2D6	CYP1A2, CYP3A4, CYP2B6, CYP3A5		✓	
	Armodafinil (Nuvigil)	CYP3A4	CYP3A5		✓	
Anti-insomnia						
Melatonin Receptor Agonist	Ramelteon (Rozerem)	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 (Luminal)	CYP2C19			✓	
Carbamates	Felbamate (Felbatol)	CYP3A4	CYP3A5			⊗
Carboxamides	Carbamazepine (Tegretol, Carbatrol)	CYP3A4, EPHX1	CYP2C8, CYP2B6, CYP1A2, CYP3A5, HLA-B*1502, HLA-A*3101		✓	
Fatty acids	Tiagabine (Gabitril)	CYP3A4	CYP3A5, CYP1A2, CYP2D6, CYP2C19		✓	
Fructose derivatives	Topiramate (Topamax, Qudexy XR)	Renal Excretion	CYPs, UGTs		✓	
GABA analogs	Gabapentin (Neurontin, Gralise)	Renal Excretion			✓	
	Pregabalin (Lyrica)	Renal Excretion			✓	
Hydantoin	Phenytoin (Dilantin Phenytek)	CYP2C19	CYP2C9, CYP3A4, CYP3A5, CYP2D6, HLA-B*1502		✓	
	Mephenytoin (Mesantoin)	CYP2C19	CYP2C8, CYP2C9, CYP2B6, CYP1A2, CYP2D6		✓	
Oxazolidinediones	Trimethadione (Tridione)	CYP2C9	CYP3A4, CYP3A5		✓	
	Paramethadione (Paradione)	CYP2C9			✓	
Pyrimidinedione	Primidone (Mysoline)	CYP2C9	CYP2C19		✓	
Pyrrolidines	Brivaracetam (Briviact)	CYP2C19, CYP2C9	CYP3A4, CYP3A5, CYP2C8, CYP2B6		✓	
	Levetiracetam (Keppra, Spritam)	Renal Excretion			✓	
	Seletracetam	Renal Excretion			✓	
Succinimides	Ethosuximide (Zarontin)	CYP3A4	CYP3A5			⊗
Sulfonamides	Zonisamide (Zonegran)	CYP3A4	CYP2C19, CYP3A5		✓	
Other	Lacosamide (Vimpat)	CYP2C9	CY2C19, CYP3A4		✓	
	Perampanel (Fycompa)	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 (Halcion)	CYP3A4	CYP3A5		✓	
	Brotizolam (Lendormin)	CYP3A4	CYP3A5		✓	
Benzodiazepine Intermediate-acting	Alprazolam (Xanax)	CYP3A4	CYP3A5		✓	
	Bromazepam (Lexotan, Lexotanil)	CYP1A2	CYP2D6		✓	
	Clobazam (Onfi)	CYP2C19	CYP3A4, CYP3A5, CYP2B6		✓	
	Flunitrazepam (Rohypnol)	CYP2C19	CYP2C9, CYP3A4, CYP3A5		✓	
	Estazolam (ProSom)	CYP3A4	CYP3A5		✓	
	Clonazepam (Klonopin)	CYP3A4	CYP2C19, CYP3A5		✓	
	Quazepam (Doral)	CYP3A4	CYP2C19, CYP3A5		✓	
	Lormetazepam (Noctamid, Loramet)	CYP3A4	CYP3A5		✓	
	Nitrazepam (Alodorm, Apodorm)	CYP3A4	CYP3A5		✓	
	Temazepam (Restoril)	CYP2C19	CYP3A4, CYP3A5		✓	
Benzodiazepine Long-acting	Diazepam (Valium, Diastat)	CYP2C19, CYP3A4	CYP3A5, CYP2B6, CYP1A2		✓	
	Clorazepate (Tranxene)	CYP3A4	CYP3A5		✓	
	Chlordiazepoxide (Librium, Poxi)	CYP3A4	CYP3A5		✓	
	Flurazepam (Dalmane, Dalmadorm)	CYP3A4	CYP3A5		✓	
	Nordazepam (Nordaz, Stilny)	CYP3A4	CYP3A5		✓	
Nonbenzodiazepine hypnotic	Zolpidem (Ambien, Edluar)	CYP3A4	CYP3A5, CYP1A2, CYP2D6		✓	
	Zaleplon (Sonata)	AOX1, CYP3A4	CYP3A5		✓	
	Zopiclone (Imovane, Zimovane)	CYP3A4	CYP2C8, CYP2C9, CYP3A5		✓	
	Eszopiclone (Lunesta)	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	May Have Decreased Efficacy	Used As Directed	May Have Increased Toxicity
Anti-Alzheimer disease						
Acetylcholinesterase inhibitor	Tacrine (Cognex)	CYP1A2	CYP2D6		✓	
	Donepezil (Aricept)	CYP2D6	CYP3A4, CYP3A5		✓	
	Galantamine (Razadyne, Razadyne ER)	CYP2D6	CYP3A4, CYP3A5		✓	
NMDA receptor antagonist	Memantine (Namenda, Namenda Titration Pak)	Renal Excretion	UGTs		✓	
Anti-Parkinson disease						
Inhibitor of MAO-B	Selegiline (Emsam, Zelapar)	CYP2B6	CYP2C9, CYP3A4, CYP3A5, FMO3		✓	
	Rasagiline (Azilect)	CYP1A2			✓	
COMT inhibitors	Entacapone (Comtan)	UGT1A9, CYP3A4	CYP3A5		✓	
Dopamine receptor agonists	Bromocriptine (Parlodel, Cycloset)	CYP3A4	CYP3A5		✓	
	Pramipexole (Mirapex)	Renal Excretion			✓	
	Ropinirole (Requip)	CYP1A2	UGTs, Renal Excretion		✓	
Anticholinergics - Antimuscarinics	Diphenhydramine (Benadryl, Banophen)	CYP2D6	CYP3A4, CYP3A5		✓	
Anti-hyperkinetic movement	Tetrabenazine (Xenazine)	CYP2D6	CYP1A2		✓	
Anti-amyotrophic lateral sclerosis drug	Riluzole (Rilutek)	CYP1A2			✓	
Anti-multiple sclerosis						
Sphingosine 1-phosphate Receptor Modulator	Fingolimod (Gilenya)	CYP4F2			✓	
Improvement of walking in patients with multiple sclerosis						
Selective blocker of members of voltage-activated K+ channels	Dalfampridine (Ampyra)	Renal Excretion			✓	
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 (Chloromycetin, Pentamycetin)	CYP2C9			✓	
Lincosamides	Clindamycin (Evoclin, Clindagel)	CYP3A4	CYP3A5		✓	
Antibiotic						
Macrolides	Clarithromycin (Biaxin)	CYP3A4	CYP3A5		✓	
	Erythromycin (Eryc)	CYP3A4			✓	
	Telithromycin (Ketek)	CYP3A4	CYP3A5		✓	
Antibacterials: nucleic acid inhibitors						
DHPS inhibitor Intermediate-acting sulfonamides	Sulfamethoxazole (Bactrim, Sulfatrim)	Renal Excretion	CYP2C9	⊗		
Anaerobic DNA inhibitors/ Nitroimidazole	Tinidazole (Tindamax)	CYP3A4	CYP3A5		✓	
	Ornidazole (dazolic)	CYP3A4	CYP3A5		✓	
DNA-dependent RNA polymerase inhibitors	Rifampicin (Rifadin)	CYP3A4	CYP2C8, CYP3A5, CYP2C19, RE		✓	
	Rifabutin (Mycobutin)	CYP3A4	CYP1A2, CYP3A5		✓	
Other drugs against mycobacteria	Bedaquiline (Sirturo)	CYP3A4	CYP2C8, CYP2C19, CYP3A5		✓	
	Pyrazinamide (Rifater, Tebrazid)	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 (Aralen)	CYP2C8	CYP3A4, CYP3A5		✓	
	Hydroxychloroquine (Plaquenil)	CYP2D6	CYP2C8, CYP3A4, CYP3A5		✓	
	Amodiaquine (Amdaquine, Amobin)	CYP2C8			✓	
	Primaquine (Jasoprim, Malirid)	CYP2D6			✓	
Methanolquinolines	Quinine (Qualaquin)	CYP3A4, CYP2D6	CYP2C19, CYP3A5		✓	
	Mefloquine (Lariam, Mephaquin)	CYP3A4	CYP3A5		✓	
Artemisinin and derivatives	Artemisinin (Alaxin)	CYP3A4	CYP2B6, CYP3A5		✓	
	Artemether (Coartem)	CYP3A4	CYP3A5		✓	
	Arteether (Artemotil)	CYP3A4	CYP2B6, CYP3A5		✓	
Biguanides	Proguanil (Paludrine)	CYP2C19			✓	
Other antimalarials	Halofantrine (Halfan)	CYP3A4	CYP3A5		✓	
	Pentamidine (Nebupent, Pentam)	CYP2C19	CYP1A2, CYP2D6		✓	
Anthelmintic						
Benzimidazoles	Albendazole (Albenza)	CYP3A4	CYP1A2, CYP3A5		✓	
Antifungals						
Imidazoles	Ketoconazole (Nizoral, Xolegel)	CYP3A4	UGT1A1, FMO3, CYP26A1		✓	
Triazoles	Itraconazole (Sporanox)	CYP3A4			✓	
	Voriconazole (Vfend, Vfend IV)	CYP2C19	CYP2C9, CYP3A4, CYP3A5		✓	
	Fluconazole (Diflucan)	Renal Excretion			✓	
Allylamines	Terbinafine (Lamisil, Jock Itch)	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 (Kaletra)	CYP3A4	SLCO1B1, CYP3A5, ABCC1		✓	
	Ritonavir (Norvir)	CYP3A4	CYP2D6, CYP3A5, ABCC1		✓	
	Saquinavir (Invirase)	CYP3A4	CYP3A5		✓	
	Indinavir (Crixivan)	CYP3A4	CYP2D6, CYP3A5		✓	
	Nelfinavir (Viracept)	CYP2C19	CYP3A4, CYP3A5		✓	
	Fosamprenavir (Lexiva)	CYP3A4	CYP3A5		✓	
Protease inhibitor 2nd generation	Atazanavir (Reyataz)	CYP3A4	CYP3A5		✓	
	Darunavir (Prezista)	CYP3A4	CYP3A5, SLCO3A1		✓	
	Tipranavir (Aptivus)	CYP3A4	CYP3A5		✓	
NNRTI 1st generation	Delavirdine (Rescriptor)	CYP3A4	CYP2D6, CYP3A5		✓	
	Efavirenz (Sustiva)	CYP2B6	SLCO3A1		✓	
NNRTI 2nd generation	Nevirapine (Viramune, Viramune XR)	CYP3A4	CYP2B6, CYP3A5, SLCO3A1		✓	
	Etravirine (Intelence)	CYP3A4	CYP2C9, CYP2C19, CYP3A5		✓	
	Rilpivirine (Edurant)	CYP3A4	CYP3A5		✓	
Nucleoside reverse transcriptase inhibitor (NRTI)	Abacavir (Ziagen)	ADH6	UGT1A1, ADK, HLA-B*5701		✓	
Neuraminidase inhibitors/release phase	Zanamivir (Relenza Diskhaler)	Renal Excretion			✓	
	Peramivir (Rapivab)	Renal Excretion			✓	
	Oseltamivir (Tamiflu)	BCHE, ACHE	Renal Excretion		✓	
CCR5 Co-receptor Antagonist	Maraviroc (Selzentry)	CYP3A4	CYP3A5		✓	
Hepatitis C Virus NS3/4A Protease Inhibitor	Boceprevir (Victrelis)	CYP3A4	IFNL3, CYP3A5		✓	
	Telaprevir (Incivek, Incivo)	CYP3A4	CYP3A5, IFNL3		✓	
	Paritaprevir (Viekira, Technivie/Viekirax)	CYP3A4	CYP3A5		✓	
	Simeprevir (Olysio, Sovriad)	CYP3A4	CYP2C8, CYP2C19, CYP3A5, IFNL3		✓	
Other antivirals	Enfuvirtide (Fuzeon)	CYP2C19	CYP1A2		✓	
	Raltegravir (Isentress, Isentress HD)	UGT1A1	SLCO1A2		✓	
	Elvitegravir (Vitekta, Stribild)	CYP3A4	CYP3A5		✓	
	Dolutegravir (Tivicay)	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 (Endoxan, Cytoxan)	CYP2B6	CYP2C19, CYP3A4, CYP2C9, CYP3A5, ALDH1A1, ABCC3		✓	
	Iphosphamide	CYP2B6	CYP3A4, CYP3A5		✓	
Nitrosoureas	Carmustine (Bicnu, Gliadel Wafer)	CYP1A2	Renal Excretion		✓	
Antimetabolites						
Folic acid analogues	Methotrexate (Trexall, Rasuvo)	Renal Excretion	AOX1, SLCO1B1, SLC19A1, ABCC1, ABCC3		✓	
	Pemetrexed (Alimta)	Renal Excretion	SLC19A1		✓	
Purine analogues	Mercaptopurine (Purixan)	XO	TPMT, AOX1, SLC19A1		✓	
	Tioguanine (Tabloid)	HPRT1	TPMT,		✓	
	Cladribine (Leustatin)	DCK	Renal Excretion		✓	
	Clofarabine (Clolar)	DCK	Renal Excretion		✓	
	Nelarabine	ADA	DCK, Renal Excretion, XO		✓	
Pyrimidine analogues	Fluorouracil (Efudex, Fluoroplex)	DPYD, TYMS, MTHFR	TYMP, SLC19A1		✓	
	Cytarabine (Cytosar-U)	CES1, CES2, CDA	TYMP, DPYD, 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 (Marqibo, Vincasar PFS)	CYP3A4	CYP3A5, ABCC3		✓	
	Vinblastine (Alkaban-AQ, Velban)	CYP3A4	CYP3A5		✓	
Podophyllotoxin derivatives	Etoposide (Etopophos, Toposar)	CYP3A4	CYP3A5, CYP1A2, UGT1A1			⊗
	Teniposide (Vumon)	CYP2C19	CYP3A4, CYP3A5		✓	
Taxanes	Paclitaxel (Abraxane)	CYP2C8	CYP3A4, CYP3A5, SLC29A1		✓	
	Docetaxel (Docefrez, Taxotere)	CYP3A4	CYP3A5, ABCC6		✓	
Cytotoxic antibiotics and related substances						
Anthracyclines and related substances	Doxorubicin (Adriamycin, Doxil)	ALDH1A1, ABCB1, GSTP1, NQO1	CYP3A4, CYP2B6, CYP3A5, CYP2C8, CYP2D6, ABCC3		✓	
Other antineoplastic agents						
Platinum compounds	Cisplatin (Platinol)	Renal Excretion, NQO1, GSTP1	LRP2, SLC19A1, ABCC3		✓	
Derivative of camptothecin	Irinotecan	UGT1A1, CYP3A4, CES1, CES2	CYP3A5, CYP2B6, SLCO1B1, UGT1A10, SLC19A1		✓	

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 (Tarceva)	CYP3A4	CYP1A2, CYP3A5		✓	
	Gefitinib (Iressa)	CYP3A4	CYP2D6, CYP3A5		✓	
	Vandetanib (Caprelsa)	CYP3A4	FMO3, FMO1, CYP3A5		✓	
EGFR and epidermal growth factor receptor (HER2)	Lapatinib (Tykerb)	CYP3A4, CYP2C19	CYP2C8, CYP3A5, HLA-DRB*0201, HLA-DRB*0701		✓	
	Neratinib (Nerlynx)	CYP3A4	CYP3A5		✓	
C-KIT and PDGFR	Masitinib (Masivet)	CYP3A4	CYP3A5		✓	
FLT3	Lestaurtinib	CYP3A4	CYP3A5		✓	
RET, VEGFR and EGFR	Vandetanib (Caprelsa)	CYP3A4	FMO3, FMO1, CYP3A5		✓	
c-MET and VEGFR2	Cabozantinib (Cabometyx, Cometriq)	CYP3A4	CYP2C8, CYP3A5		✓	
Multiple targets (c-KIT, FGFR, PDGFR and VEGFR)	Axitinib (Inlyta)	CYP3A4	CYP1A2, CYP2C19, CYP3A5, UGT1A1		✓	
	Nintedanib (Ofev, Vargatef)	CYP1A2	CYP2C9, CYP2C19, CYP2D6		✓	
	Pazopanib (Votrient)	CYP3A4, UGT1A1	CYP1A2, CYP2C8, CYP3A5		✓	
	Ponatinib (Iclusig)	CYP3A4	CYP2C8, CYP2D6, CYP3A5		✓	
	Regorafenib (Stivarga)	CYP3A4	CYP3A5		✓	
	Sorafenib (Nexavar)	CYP3A4	CYP3A5		✓	
	Sunitinib (Sutent)	CYP3A4	CYP3A5		✓	
	Toceranib (Palladia)	CYP3A4	CYP3A5		✓	
Protein kinase inhibitor (non-receptor)						
BCR-ABL	Imatinib (Gleevec)	CYP3A4	CYP3A5, SLCO1A2, SLC22A4		✓	
	Nilotinib (Tasigna)	CYP3A4, UGT1A1	CYP1A2, CYP2C9, CYP2C19, CYP2D6, CYP3A5		✓	
	Dasatinib (Sprycel)	CYP3A4	CYP3A5		✓	
	Ponatinib (Iclusig)	CYP3A4	CYP2C8, CYP2D6, CYP3A5		✓	
Src	Bosutinib (Bosulif)	CYP3A4	CYP3A5		✓	
Janus kinase	Lestaurtinib	CYP3A4	CYP3A5		✓	
	Ruxolitinib (Jakafi)	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 (Zykadia)	CYP3A4	CYP2C9, CYP3A5		✓	
	Crizotinib (Xalkori)	CYP3A4	CYP3A5		✓	
Bruton tyrosine kinase	Ibrutinib (Imbruvica)	CYP3A4	CYP2D6, CYP3A5		✓	
BRAF inhibitor (V600E mutation-positive)	Dabrafenib (Tafinlar)	CYP2C8	CYP3A4, CYP3A5		✓	
Other Targeted therapy						
mTOR Inhibitors	Sirolimus (Rapamune)	CYP3A4	CYP3A5		✓	
	Everolimus (Zortress, Afinitor)	CYP3A4	CYP2C8, CYP3A5		✓	
Hedgehog pathway inhibitor	Vismodegib (Erivedge)	CYP2C9	CYP3A4, CYP3A5		✓	
Hormone antagonists and related agents						
Selective estrogen receptor modulators (SERM)	Toremifene (Fareston)	CYP3A4	CYP2D6, CYP3A5		✓	
	Tamoxifen (Soltamox)	CYP3A4, CYP2D6, CYP2C9	CYP3A5, CYP2B6, FMO1, FMO3, CYP2C19, CYP1A2, F2, F5		✓	
SERD	Fulvestrant (Faslodex)	CYP3A4	CYP3A5		✓	
Anti-androgens	Flutamide (Eulexin)	CYP1A2	CYP3A4, CYP3A5		✓	
	Nilutamide (Nilandron)	CYP2C19	FMO3		✓	
	Bicalutamide (Casodex)	CYP3A4	CYP3A5		✓	
	Enzalutamide (Xtandi)	CYP2C8	CYP3A4, CYP3A5		✓	
Aromatase inhibitors	Anastrozole (Arimidex)	CYP3A4	CYP3A5		✓	
	Letrozole (Femara)	CYP3A4	CYP3A5		✓	
	Exemestane (Aromasin)	CYP3A4	CYP3A5		✓	
Other hormone antagonists and related agents	Abiraterone (Zytiga)	CYP3A4	CYP3A5, SULT2A1		✓	
Hematologic						
Thrombopoiesis Stimulating Agent	Eltrombopag (Promacta)	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 (Myfortic, CellCept)	CYP3A4	CYP3A5, CYP2C8, SLCO1B1, HPRT1		✓	
	Azathioprine (Azasan)	XO	TPMT, AOX1		✓	
Calcineurin Inhibitors	Pimecrolimus (Elidel)	CYP3A4	CYP3A5		✓	
	Tacrolimus (Prograf, Protopic)	CYP3A4	CYP3A5		✓	
	Cyclosporine (Neoral, Sandimmune)	CYP3A4	CYP3A5		✓	
mTOR Inhibitors	Temsirolimus (Torisel)	CYP3A4	CYP3A5		✓	
	Everolimus (Zortress, Afinitor)	CYP3A4	CYP2C8, CYP3A5		✓	
Immunomodulation						
Immunomodulator and anti-angiogenic	Pomalidomide (Pomalyst, Imnovid)	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 (Citopan, Evipan)	CYP2C19	CYP2C9, CYP1A2		✓	
	Thiamylal (Surital, Thioseconal)	CYP2C9			✓	
Benzodiazepines	Diazepam (Valium, Diastat)	CYP2C19, CYP3A4	CYP3A5, CYP2B6, CYP1A2		✓	
	Midazolam (Versed)	CYP3A4	CYP3A5		✓	
Other Anesthetics	Ketamine (Ketalar)	CYP3A4	CYP2B6, CYP2C9, CYP3A5		✓	
Skeletal muscle relaxants						
Muscle Relaxants	Carisoprodol (Soma)	CYP2C19			✓	
	Cyclobenzaprine (Amrix, Fexmid)	CYP1A2	CYP2D6, CYP3A4, CYP3A5		✓	
	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 (Oxytrol, Ditropan XL)	CYP3A4	CYP3A5		✓	
	Tolterodine (Detrol, Detrol LA)	CYP2D6, CYP3A4	CYP2C9, CYP3A5, CYP2C19		✓	
	Solifenacin (VESIcare)	CYP3A4	CYP3A5		✓	
	Darifenacin (Enablex)	CYP2D6	CYP3A4, CYP3A5		✓	
Drugs used in erectile dysfunction						
Phosphodiesterase inhibitors	Sildenafil (Viagra, Revatio)	CYP3A4	CYP2C9, CYP3A5		✓	
	Tadalafil (Cialis, Adcirca)	CYP3A4	CYP3A5		✓	
	Vardenafil (Levitra, Staxyn)	CYP3A4	CYP2C9, CYP3A5		✓	
	Avanafil (Strendra)	CYP3A4	CYP3A5		✓	
	Udenafil (Zydena)	CYP3A4	CYP3A5		✓	
Drugs used in benign prostatic hypertrophy						
Alpha-adrenoreceptor antagonists	Alfuzosin (Uroxatral)	CYP3A4	CYP3A5, Renal Excretion		✓	
	Tamsulosin (Flomax)	CYP3A4	CYP2D6, CYP3A5, Renal Excretion		✓	
	Silodosin (Rapaflo)	CYP3A4	CYP3A5			⊗
Testosterone-5-alpha reductase inhibitors	Finasteride (Proscar, Propecia)	CYP3A4	CYP3A5		✓	
	Dutasteride (Avodart)	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 (Estinyl)	CYP3A4, CYP2C9	CYP3A5, CYP2C19, CYP1A2, UGT1A1		✓	
	Estradiol (Vagifem)	CYP1A2	CYP3A4, CYP3A5, CYP2C8, UGT1A1		✓	
Progestogens	Desogestrel (Azalia, Cerazette)	CYP3A4, HSD3B1	CYP3A5, CYP2C9, CYP2C19, UGT1A1		✓	
	Dienogest (Natazia, Qlaira)	CYP3A4	CYP3A5		✓	
	Mestranol (Ortho-Novum, Norinyl)	CYP2C9			✓	
Emergency contraceptives	Levonorgestrel (Plan B, Next choice)	CYP3A4	CYP3A5		✓	
	Ulipristal (Ella)	CYP3A4	CYP1A2, CYP2D6, CYP3A5		✓	
Androgens						
3-oxoandrosten-(4) derivatives	Testosterone (Androil, Androderm)	CYP3A4, CYP19A1	HSD3B2, CYP3A5, SULTs		✓	
Antiandrogens						
Antiandrogens	Cyproterone (Androcur)	CYP3A4	CYP3A5		✓	
Other sex hormones and modulators of the genital system						
Selective estrogen receptor modulators (SERMs)	Raloxifene	UGT1A1	UGT1A10		✓	
	Bazedoxifene	UGT1A1	UGT1A10		✓	
	Ospemifene (Osphena)	CYP3A4	CYP2C9, CYP3A5, CYP2C19, CYP2B6		✓	
Steroid hormone						
Glucocorticoids	Dexamethasone (Decadron)	CYP3A4	CYP17A1, CYP3A5		✓	
	Cortisol (hydrocortisone) (Solu-cortef, Anucort-hc)	CYP3A4	CYP3A5		✓	
	Prednisone (Deltasone, Rayos)	HSD11B2	CYP3A4, CYP3A5, SLC19A1, SULTs, UGTs		✓	
Thyroid hormone						
Thyroid hormones	Levothyroxine (Synthroid, Tirosint)	DIO2	UGT1A1, SULTs		✓	
	Liothyronine (Triostat)	DIO2	UGT1A1, SULTs		✓	
There are additional SERMs (Tamoxifen and Toremifene) described under antineoplastics)						

PGx Report - Recreational Drugs

Type: 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) (Ecstasy)	Renal Excretion, CYP2D6	CYP1A2, CYP3A4, CYP3A5, FMO3		✓	
	Methamphetamine (Desoxyn, recreational drug)	CYP2D6, Renal Excretion	FMO3, ACSM1, GLYAT		✓	
Barbiturates	Amobarbital	CYP3A4	CYP3A5, CYP2B6, CYP2C9		✓	
	Phenobarbital (Luminal)	CYP2C19			✓	
Benzodiazepines	Alprazolam (Xanax)	CYP3A4	CYP3A5		✓	
	Clonazepam (Klonopin)	CYP3A4	CYP2C19, CYP3A5		✓	
	Diazepam (Valium, Diastat)	CYP2C19, CYP3A4	CYP3A5, CYP2B6, CYP1A2		✓	
Cannabinoids & Related Drugs	Cannabidiol (CBD) (CBD oil)	CYP3A4	CYP2C19, CYP3A5		✓	
	Delta 9-tetra hydrocannabinol (9 THC) (Marinol, Syndros)	CYP2C9	CYP2C19, CYP3A4, CYP3A5		✓	
	Cannabinol (CBN)	CYP2C9	CYP2C19, CYP3A4, CYP3A5		✓	
Synthetic Cannabis	JWH-018	CYP1A2	CYP2C9		✓	
	AM2201	CYP1A2	CYP2C9		✓	
Dissociative Drugs	Ketamine (Ketalar)	CYP3A4	CYP2B6, CYP2C9, CYP3A5		✓	
	Phencyclidine (PCP) (Angel dust)	CYP3A4	CYP3A5, 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/*1A

Phenotype: Extensive metabolizer

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

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.* This call was defaulted to the wild-type allele frequency because during review of the genotyping data, the genotype was indeterminate.

Genotype/Haplotype Details

CYP2B6

Allele Tested: *1, *6, *11, *16.

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	Met46Leu	136A>G	*11	rs35303484	*
CYP2B6	Ile328Thr	983T>C	*16	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

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	A/A
CYP2C8	Arg139Lys	416G>A	*3	rs11572080	C/C
CYP2C8	Ile264Met	792C>G	*4	rs1058930	C/C

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, *8, *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	*
CYP2C9	Lys273Argfs	817delA	*6	rs9332131	A/A
CYP2C9	Arg150His/Leu	449G>A/T	*8/*27	rs7900194	G/G

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.* This call was defaulted to the wild-type allele frequency because during review of the genotyping data, the genotype was indeterminate.

Genotype/Haplotype Details

CYP2C19

Allele Tested: *1, *2, *3, *4, *8, *9, *10, *12, *17.

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	Trp120Arg	358T>C	*8	rs41291556	T/T
CYP2C19	Arg144His	431G>A	*9	rs17884712	G/G
CYP2C19	Pro227Leu	680C>T	*10	rs6413438	C/C
CYP2C19	Ter491Cys	1473A>C	*12	rs55640102	A/A
CYP2C19		-806C>T	*17	rs12248560	*

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.* This call was defaulted to the wild-type allele frequency because during review of the genotyping data, the genotype was indeterminate.

Genotype/Haplotype Details

CYP2D6

Allele Tested: *1, *2, *3, *4A, *4K, *4M, *5, *6A, *6C, *7, *8, *9, *10, *12, *14A, *14B, *17, *34, *39, *41, *69, and CNVs.

Genetic results: CYP2D6 *1/*39

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
CYP2D6	Arg296Cys	886C>T	*2	rs16947	*
CYP2D6	Ser486Thr	1457G>C	*2	rs1135840	G/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	**
CYP2D6	Trp152Glyfs	454delT	*6	rs5030655	A/A
CYP2D6	His324Pro	971A>C	*7	rs5030867	T/T
CYP2D6	Gly169Ter/Arg	505G>T/A	*8/*14	rs5030865	G/G
CYP2D6	Lys281del	841_843delAAG	*9	rs5030656	CTT/CTT
CYP2D6	Pro34Ser	100C>T	*10	rs1065852	*
CYP2D6	Gly42Arg	124G>A	*12	rs5030862	C/C
CYP2D6	Thr107Ile	320C>T	*17	rs28371706	G/G
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. For copy number: ** This copy number was defaulted to the wild-type frequency because during review of the copy number variation data, the copy number was indeterminate.* This call was defaulted to the wild-type allele frequency because during review of the genotyping data, the genotype was indeterminate.

Genotype/Haplotype Details

CYP3A4

Allele Tested: *1, *2, *3, *12, *17.

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	Met445Thr	1334T>C	*3	rs4986910	A/A
CYP3A4	Leu373Phe	1117C>T	*12	rs12721629	G/G
CYP3A4	Phe189Ser	566T>C	*17	rs4987161	A/A

Genotype/Haplotype Details

CYP3A5

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

Genetic results: CYP3A5 *3/*3

Phenotype: Poor metabolizer

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

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	*

CYP4F2 is the most important gene in the metabolism of: Fingolimod.* This call was defaulted to the wild-type allele frequency because during review of the genotyping data, the genotype was indeterminate.

Genotype/Haplotype Details

VKORC1

Allele Tested: *1, *2.

Genetic results: VKORC1 *1/*1

Phenotype: Warfarin resistance

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

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

Genotype/Haplotype Details

TPMT

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

Genetic results: TPMT *1/*1

Phenotype:Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
TPMT	Ala80Pro	238G>C	*2	rs1800462	G/G
TPMT	Ala154Thr	460G>A	*3A or *3B	rs1800460	C/C

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

Genotype/Haplotype Details

UGT1A1

Allele Tested: *1, *6, *27, *80.

Genetic results: UGT1A1 *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
UGT1A1	Gly71Arg	211G>A	*6	rs4148323	G/G
UGT1A1		-364C>T	*80	rs887829	C/C
UGT1A1	Pro229Gln	686C>A	*27	rs35350960	C/C

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

UGT1A1 contributes 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, *2B, *5, *6, *9A, *13, D949V.

Genetic results: DPYD *1/*1

Phenotype: Extensive metabolizer

Gene	Protein change	Nucleotide change	Allele	Marker	Genotype
DPYD		1905+1G>A	*2A	rs3918290	C/C
DPYD	Ile543Val	1627A>G	*2B/*5	rs1801159	*
DPYD	Val732Ile	2194G>A	*6	rs1801160	C/C
DPYD	Cys29Arg	85T>C	*9A/*9B	rs1801265	*
DPYD	Ile560Ser	1679T>G	*13	rs55886062	A/A
DPYD	Asp949Val	2846A>T	D949V	rs67376798	A/A

DPYD is the most important gene in the metabolism of: Cytarabine, Fluorouracil, Tegafur.* This call was defaulted to the wild-type allele frequency because during review of the genotyping data, the genotype was indeterminate.

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.

Genetic results: APOE *3/*3

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

Important for Treatment Using Statins and Metformin.

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.

Laboratory Statement

This Laboratory Developed Test for Real-time PCR analysis of genomic DNA was developed and its performance characteristics established by Genesis Diagnostics, Langhorne, PA. This laboratory is regulated under the Clinical Laboratory Improvement Amendments of 1988 (CLIA) as qualified to perform high-complexity clinical testing and has validated the test's accuracy according to CAP proficiency testing. This test has not been cleared nor approved by the U.S. Food and Drug Administration (FDA). The FDA has determined that such clearance or approval is not necessary. The test was performed by Genesis Diagnostics, a CLIA-certified laboratory (CLIA ID#: 39D1099562).

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/*1A	Extensive metabolizer
CYP2B6	*1/*1	Extensive metabolizer
CYP2C8	*1/*1	Extensive metabolizer
CYP2C9	*1/*1	Extensive metabolizer
CYP2C19	*1/*1	Extensive metabolizer
CYP2D6	*1/*39	Extensive metabolizer
CYP3A4	*1/*1	Extensive metabolizer
CYP3A5	*3/*3	Poor metabolizer
CYP4F2	*1/*1	Extensive metabolizer
VKORC1	*1/*1	Warfarin resistance
SLCO1B1	*1/*1	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	No known phenotype that affects drug metabolism

xpi2VyKcBi.L_B.2FhGw

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