

Disclaimer: This is educational material intended for health care professionals. This list is not comprehensive for all of the drugs in the pharmacopeia but focuses on commonly used drugs with high levels of evidence that the CYPs (CYP1A2, CYP2C9, CYP2C19, CYP2D6, CYP3A4 and CYP3A5 only) and other select genes are relevant to a given drug's metabolism. If a drug is not listed, there is not enough evidence for inclusion at this time. Other CYPs and other genes not described here may also be relevant but are out of scope for this document. This educational material is not intended to supersede the care provider's experience and knowledge of her or his patient to establish a diagnosis or a treatment plan. All medications require careful clinical monitoring regardless of the information presented here.

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Table 1: Substrates of Cytochrome P450 (CYP) Enzymes

| | | | | | |
|-----------------------------------|---------------------------------------|-------------------------|---------------------------------------|---------------------------|--|
| Allergy | | Labetalol | <i>CYP2C19</i> | Immunosuppressives | |
| Loratadine | <i>CYP3A4</i> | Lidocaine | <i>CYP1A2 CYP2D6 CYP3A4/5</i> | Cyclosporine | <i>CYP3A4/5</i> |
| Analgesic/Anesthesiology | | Losartan | <i>CYP2C9 CYP3A4/5</i> | Sirolimus | <i>CYP3A4/5</i> |
| Codeine | <i>CYP2D6 activates</i> | Lovastatin | <i>CYP3A4/5</i> | Tacrolimus | <i>CYP3A4/5</i> |
| Cyclobenzaprine | <i>CYP1A2 CYP2D6 CYP3A4/5</i> | Metoprolol | <i>CYP2D6</i> | Everolimus | <i>CYP3A4</i> |
| Fentanyl | <i>CYP3A4/5</i> | Nifedipine | <i>CYP3A4/5</i> | Infectious Disease | |
| Hydrocodone | <i>CYP2D6*</i> | Nisoldipine | <i>CYP3A4/5</i> | Boceprevir | <i>CYP3A4/5</i> |
| Methadone | <i>CYP2C19 CYP2C9 CYP2D6 CYP3A4/5</i> | Propafenone | <i>CYP2D6</i> | Clarithromycin | <i>CYP3A4</i> |
| Midazolam | <i>CYP3A4/5</i> | Propranolol | <i>CYP1A2 CYP2C19 CYP2D6</i> | Darunavir | <i>CYP3A4/5</i> |
| Oxycodone | <i>CYP2D6*</i> | Quinidine | <i>CYP3A4</i> | Efavirenz | <i>CYP3A4/5</i> |
| Tramadol | <i>CYP2D6 activates</i> | Ranolazine | <i>CYP2D6 CYP3A4/5</i> | Erythromycin | <i>CYP3A4</i> |
| Anti-inflammatory | | Simvastatin** | <i>CYP3A4/5</i> | Fosamprenavir | <i>CYP3A4/5</i> |
| Celecoxib | <i>CYP2C9</i> | Timolol | <i>CYP2D6</i> | Indinavir | <i>CYP3A4/5</i> |
| Diclofenac | <i>CYP2C9 CYP3A4/5</i> | Verapamil | <i>CYP1A2 CYP2C9 CYP2C19 CYP3A4/5</i> | Nelfinavir | <i>CYP2C19</i> |
| Anticoagulant/Antiplatelet | | Endocrinology | | Nevirapine | <i>CYP3A4/5</i> |
| Apixaban | <i>CYP3A4/5</i> | Chlorpropamide | <i>CYP2C9</i> | Quinine | <i>CYP1A2 CYP2C9 CYP2C19 CYP2D6 CYP3A4/5</i> |
| Clopidogrel | <i>CYP2C19 activates</i> | Glimepiride | <i>CYP2C9</i> | Quinine Sulfate | <i>CYP1A2 CYP2C9 CYP2C19 CYP2D6 CYP3A4/5</i> |
| Ticagrelor | <i>CYP3A4/5</i> | Glyburide | <i>CYP2C9 CYP3A4/5</i> | Saquinavir | <i>CYP3A4/5</i> |
| Warfarin** | <i>CYP2C9</i> | Nateglinide | <i>CYP2C9 CYP3A4/5</i> | Telaprevir | <i>CYP3A4/5</i> |
| Cardiovascular | | Tolbutamide | <i>CYP2C9</i> | Telithromycin | <i>CYP3A4/5</i> |
| Aliskiren | <i>CYP3A4/5</i> | Other | | Terbinafine | <i>CYP1A2 CYP2C9 CYP2C19 CYP3A4/5</i> |
| Amiodarone | <i>CYP3A4/5</i> | Caffeine | <i>CYP1A2</i> | Voriconazole | <i>CYP2C19</i> |
| Amlodipine | <i>CYP3A4/5</i> | Eliglustat | <i>CYP2D6 CYP3A4/5</i> | Neurology | |
| Atorvastatin | <i>CYP3A4/5</i> | Gastroenterology | | Cafegot | <i>CYP3A4/5</i> |
| Azilsartan | <i>CYP2C9 CYP2C19</i> | Aprepitant | <i>CYP3A4/5</i> | Carbamazepine** | <i>CYP3A4/5</i> |
| Carvedilol | <i>CYP2D6</i> | Dexlansoprazole | <i>CYP2C19 CYP3A4/5</i> | Clobazam | <i>CYP2C19</i> |
| Cilostazol | <i>CYP2C19 CYP3A4/5</i> | Dolasetron | <i>CYP2D6 CYP3A4/5</i> | Donepezil | <i>CYP2D6 CYP3A4/5</i> |
| Clonidine | <i>CYP1A2 CYP2D6 CYP3A4/5</i> | Esomeprazole | <i>CYP2C19</i> | Eletriptan | <i>CYP3A4/5</i> |
| Diltiazem | <i>CYP3A4/5</i> | Lansoprazole | <i>CYP2C19</i> | Phenytoin** | <i>CYP2C9</i> |
| Disopyramide | <i>CYP3A4/5</i> | Omeprazole | <i>CYP2C19</i> | Tetrabenazine | <i>CYP2D6</i> |
| Dofetilide | <i>CYP3A4/5</i> | Ondansetron | <i>CYP1A2 CYP2C19 CYP2D6 CYP3A4/5</i> | | |
| Dronedarone | <i>CYP3A4/5</i> | Pantoprazole | <i>CYP2C19</i> | | |
| Eplerenone | <i>CYP3A4/5</i> | Rabeprazole | <i>CYP2C19 CYP3A4/5</i> | | |
| Flecainide | <i>CYP2D6</i> | | | | |
| Guanabenz | <i>CYP1A2</i> | | | | |

Table 1: Substrates of Cytochrome P450 (CYP) Enzymes (continued)

| | | | | | |
|-----------------------|--|------------------|---------------------------------------|-----------------------|-------------------------|
| Oncology | | Desipramine | <i>CYP2D6</i> | Rheumatology | |
| Axitinib | <i>CYP1A2 CYP3A4/5</i> | Diazepam | <i>CYP2C19 CYP3A4/5</i> | Carisoprodol | <i>CYP2C19</i> |
| Belinostat** | <i>CYP2C9 CYP3A4/5</i> | Doxepin | <i>CYP1A2 CYP2D6 CYP3A4/5</i> | Cevimeline | <i>CYP2D6 CYP3A4/5</i> |
| Bortezomib | <i>CYP1A2 CYP2C9 CYP2C19 CYP2D6 CYP3A4/5</i> | Duloxetine | <i>CYP1A2 CYP2D6</i> | Colchicine | <i>CYP3A4/5</i> |
| Bosutinib monohydrate | <i>CYP3A4/5</i> | Escitalopram | <i>CYP2C19</i> | Tofacitinib | <i>CYP2C19 CYP3A4/5</i> |
| Brentuximab vedotin | <i>CYP3A4/5</i> | Fluoxetine | <i>CYP2D6</i> | Sleep Medicine | |
| Cabazitaxel | <i>CYP3A4/5</i> | Fluvoxamine | <i>CYP1A2 CYP2D6</i> | Eszopiclone | <i>CYP3A4/5</i> |
| Dasatinib | <i>CYP3A4/5</i> | Haloperidol | <i>CYP2D6</i> | Modafinil | <i>CYP3A4/5</i> |
| Docetaxel | <i>CYP3A4/5</i> | lloperidone | <i>CYP2D6</i> | Triazolam | <i>CYP3A4/5</i> |
| Enzalutamide | <i>CYP3A4/5</i> | Imipramine | <i>CYP2C19 CYP2D6</i> | Zolpidem | <i>CYP3A4/5</i> |
| Erlotinib | <i>CYP1A2 CYP3A4/5</i> | Milnacipran | <i>CYP2C19 CYP2D6 CYP3A4/5</i> | Urology | |
| Etoposide | <i>CYP3A4/5</i> | Mirtazapine | <i>CYP1A2 CYP2D6 CYP3A4/5</i> | Darifenacin | <i>CYP3A4/5</i> |
| Exemestane | <i>CYP3A4/5</i> | Nortriptyline | <i>CYP2D6</i> | Finasteride | <i>CYP3A4/5</i> |
| Gleevec | <i>CYP1A2 CYP2C9 CYP2C19 CYP2D6 CYP3A4/5</i> | Olanzapine | <i>CYP1A2 CYP2D6</i> | Oxybutynin | <i>CYP3A4/5</i> |
| Ibrutinib | <i>CYP1A2 CYP3A4/5</i> | Paroxetine | <i>CYP2D6</i> | Tamsulosin | <i>CYP2D6 CYP3A4/5</i> |
| Imatinib | <i>CYP1A2 CYP2C9 CYP2C19 CYP2D6 CYP3A4/5</i> | Perphenazine | <i>CYP2D6</i> | Tolterodine | <i>CYP2D6 CYP3A4/5</i> |
| Lapatinib | <i>CYP2C19 CYP3A4/5</i> | Pimozide | <i>CYP2D6</i> | Vardenafil | <i>CYP2C9 CYP3A4/5</i> |
| Paclitaxel | <i>CYP3A4/5</i> | Protriptyline | <i>CYP2D6</i> | | |
| Pazopanib** | <i>CYP1A2 CYP3A4/5</i> | Quetiapine | <i>CYP2D6 CYP3A4/5</i> | | |
| Sorafenib | <i>CYP3A4/5</i> | Risperidone | <i>CYP2D6</i> | | |
| Sunitinib | <i>CYP3A4/5</i> | Sertraline | <i>CYP2C19</i> | | |
| Tamoxifen | <i>CYP2D6 activates</i> | Thioridazine | <i>CYP2D6</i> | | |
| Temsirolimus | <i>CYP3A4/5</i> | Trazodone | <i>CYP3A4/5</i> | | |
| Vemurafenib | <i>CYP3A4/5</i> | Trimipramine | <i>CYP2C19 CYP2D6</i> | | |
| Vincristine | <i>CYP3A4/5</i> | Venlafaxine | <i>CYP2D6</i> | | |
| Psychiatry | | Vortioxetine | <i>CYP2C9 CYP2C19 CYP2D6 CYP3A4/5</i> | | |
| Alprazolam | <i>CYP3A4</i> | Ziprasidone | <i>CYP1A2 CYP3A4/5</i> | | |
| Amitriptyline | <i>CYP2C19 CYP2D6</i> | Pulmonary | | | |
| Aripiprazole | <i>CYP2D6</i> | Dextromethorphan | <i>CYP2D6</i> | | |
| Atomoxetine | <i>CYP2D6</i> | Fluticasone | <i>CYP3A4/5</i> | | |
| Brexpiprazole | <i>CYP2D6 CYP3A4/5</i> | Salmeterol | <i>CYP3A4/5</i> | | |
| Bupropion | <i>CYP2D6 CYP3A4/5</i> | Sildenafil | <i>CYP2C9 CYP3A4/5</i> | | |
| Buspirone | <i>CYP3A4/5</i> | Tadalafil | <i>CYP3A4/5</i> | | |
| Citalopram | <i>CYP2C19</i> | | | | |
| Clomipramine | <i>CYP2C19 CYP2D6</i> | | | | |
| Clonazepam | <i>CYP3A4/5</i> | | | | |
| Clozapine | <i>CYP2D6</i> | | | | |

Legend: The cytochrome P450 (CYP) enzymes responsible for metabolism of commonly used drugs are listed. Note this is not a comprehensive list. Only CYP1A2, CYP2C9, CYP2C19, CYP2D6, CYP3A4 and CYP3A5 and their substrates are considered for this table. Note that in most instances if CYP3A4 is involved in metabolism of a drug, CYP3A5 is also expected to be involved but to a lesser extent (exceptions are noted). In cases where a drug is converted from an inactive or partially active prodrug to an active and therapeutic metabolite by the CYP enzyme shown, the word “activates” is present. *Drug metabolites are more active than the parent drug. **This drug is listed on the Additional Pharmacogenomic Genes & Associated Drugs table.

Table 2: Inhibitors of Cytochrome P450 (CYP) Enzymes

| | | | | | |
|---------------------------------|------------------------------------|---------------------------|--------------------------------------|-----------------------|--|
| Allergy | | Gastroenterology | | Neurology | |
| Chlorpheniramine | CYP2D6 | Aprepitant | CYP3A4/5◆ | Eslicarbazepine | CYP2C19 |
| Clemastine | CYP2D6 | Cimetidine | CYP1A2□ CYP2C19 CYP2D6□ CYP3A4/5□ | Felbamate | CYP2C19 |
| Diphenhydramine | CYP2D6 | Esomeprazole | CYP2C19 | Oxcarbazepine | CYP2C19 |
| Hydroxyzine | CYP2D6 | Lansoprazole | CYP2C19 | Topiramate | CYP2C19 |
| Anesthesiology/Analgesic | | Metoclopramide | CYP2D6 | Oncology | |
| Buprenorphine | CYP3A4/5 ^Δ | Omeprazole | CYP2C19 | Crizotinib | CYP3A4/5 |
| Celecoxib | CYP2D6 | Pantoprazole | CYP2C19 | Dasatinib | CYP3A4/5 |
| Dexmedetomidine | CYP2D6 | Rabeprazole | CYP2C19 | Doxorubicin | CYP2D6 |
| Indomethacin | CYP2C19 | Ranitidine | CYP2D6 | Imatinib | CYP3A4/5 |
| Methadone | CYP2C19 | Infectious Disease | | Lapatinib | CYP3A4/5 |
| Phenylbutazone | CYP2C19 | Atazanavir | CYP3A4/5 | Nilotinib | CYP2C9 CYP2D6 CYP3A4/5 |
| Anticoagulant | | Boceprevir | CYP3A4/5 | Pazopanib | CYP2D6 CYP3A4/5 |
| Ticlopidine | CYP1A2 CYP2C9 CYP2C19 CYP2D6 | Chloramphenicol | CYP2C19 CYP3A4/5 | Teniposide | CYP2C9 |
| Cardiovascular | | Ciprofloxacin | CYP1A2 ^Δ CYP3A4/5 | Psychiatry | |
| Amiodarone | CYP1A2 CYP2C9◆ CYP2D6□ CYP3A4/5 | Clarithromycin | CYP3A4/5 ^Δ | Bupropion | CYP2D6 ^Δ |
| Diltiazem | CYP3A4/5◆ | Delaviridine | CYP3A4/5 | Chlorpromazine | CYP2D6 |
| Dronedarone | CYP2D6 CYP3A4/5◆ | Efavirenz | CYP2C9 CYP2C19 | Citalopram | CYP2D6 |
| Fenofibrate | CYP2C9 | Erythromycin | CYP3A4/5◆ | Clomipramine | CYP2D6 |
| Fluvastatin | CYP2C9 | Fluconazole | CYP2C9 ^Δ CYP3A4/5◆ | Duloxetine | CYP2D6◆ |
| Lovastatin | CYP2C9 | Fosamprenavir | CYP3A4/5 | Escitalopram | CYP2D6 |
| Midodrine | CYP2D6 | Indinavir | CYP3A4/5 ^Δ | Fluoxetine | CYP2C19 CYP2D6 ^Δ |
| Quinidine | CYP2D6 ^Δ | Isoniazid | CYP2C9 CYP2C19 CYP3A4/5 | Fluvoxamine | CYP1A2 ^Δ CYP2C9 CYP2C19 CYP3A4/5 |
| Verapamil | CYP3A4/5◆ | Itraconazole | CYP3A4/5 ^Δ | Haloperidol | CYP2D6 |
| Dermatology | | Ketoconazole | CYP2C19 CYP3A4/5 ^Δ | Paroxetine | CYP2C9 CYP2D6 ^Δ |
| Methoxsalen | CYP1A2 | Nefazodone | CYP3A4/5 ^Δ | Sertraline | CYP2C9 CYP2D6◆ |
| Dietary | | Nelfinavir | CYP3A4/5 ^Δ | Verapamil | CYP3A4/5◆ |
| Grapefruit Juice | CYP3A4/5◆ | Norfloxacin | CYP3A4/5 | Pulmonary | |
| Starfruit | CYP3A4/5 | Quinine Sulfate | CYP2D6 CYP3A4/5 | Zafirlukast | CYP2C9 |
| Drug of Abuse | | Quinolones | CYP1A2 | Rheumatology | |
| Cocaine | CYP2D6 | Ritonavir | CYP2D6 CYP3A4/5 ^Δ | Probenecid | CYP2C19 |
| Endocrinology | | Saquinavir | CYP3A4/5 ^Δ | Sleep Medicine | |
| Cinacalcet | CYP2D6 ^Δ | Sulfamethoxazole | CYP2C9 | Modafinil | CYP2C19 |
| Mifepristone | CYP3A4/5 | Telaprevir | CYP3A4/5 | | |
| | | Telithromycin | CYP3A4/5 ^Δ | | |
| | | Terbinafine | CYP2D6◆ | | |
| | | Voriconazole | CYP2C9 CYP2C19 CYP3A4/5 | | |

Legend: The extent of inhibition may not be well defined and/or the degree of inhibition may vary for the drugs listed. Note this is not an exhaustive list of all CYP inhibitors and only the genes CYP1A2, CYP2C9, CYP2C19, CYP2D6, CYP3A4 and CYP3A5 are considered. Also note that if a drug inhibits CYP3A4 it is expected to induce CYP3A5 although literature proving this for each drug is not available. ^Δ = Strong Inhibitor, ◆ = Moderate Inhibitors, □ = Weak Inhibitors

Table 3: Inducers of Cytochrome P450 (CYP) Enzymes**Anti-Inflammatory**Glucocorticoids *CYP3A4/5***Dietary**Broccoli *CYP1A2*Brussel sprouts *CYP1A2*Char-grilled meat *CYP1A2***Environment**Tobacco *CYP1A2***Endocrinology**Insulin *CYP1A2*Pioglitazone *CYP3A4/5***Gastroenterology**Aprepitant *CYP2C9*Omeprazole *CYP1A2***Infectious Disease**Efavirenz *CYP3A4/5*Fosamprenavir *CYP3A4/5*Nafcillin *CYP1A2*Nevirapine *CYP3A4/5*Rifampin *CYP2C9 CYP2C19**CYP2D6 CYP3A4/5***Neurology**Carbamazepine *CYP1A2 CYP2C19*
*CYP3A4/5*Esllicarbazepine *CYP3A4/5*Oxcarbazepine *CYP3A4/5*Phenobarbital *CYP2C9 CYP3A4/5*Phenytoin *CYP3A4/5***Nutraceutical**St. John's Wort *CYP3A4/5***Oncology**Nilotinib *CYP2C9***Sleep Medicine**Modafinil *CYP1A2 CYP3A4/5*Secobarbital *CYP2C9***Legend:** The extent of induction is not well defined for any of these drugs. Note that this is not a exhaustive list of all CYP inducers and only the genes CYP1A2, CYP2C9, CYP2C19, CYP2D6, CYP3A4 and CYP3A5 are considered. Also note that if a drug inhibits CYP3A4 it is expected to induce CYP3A5 although literature proving this for each drug is not available.**Table 4: Drugs NOT metabolized by CYP1A2, CYP2C9, CYP2C19, CYP2D6, CYP3A4 or CYP3A5 Enzymes****Allergy**

Phenylephrine

Desloratadine

Analgesic/Anesthesiology

Dexmedetomidine

Hydromorphone

Morphine

Naloxone

Propofol

Anti-inflammatory

Beclomethasone

Anticoagulant/Antiplatelet

Dalteparin

Enoxaparin

Heparin

Prasugrel♣

Cardiovascular

Atenolol

Chlorthalidone

Colesevelam

Digoxin

Enalapril

Ezetimibe

Fenofibric acid

Furosemide

Hydralazine

Hydrochlorothiazide

Lisinopril

Nitroglycerin

Rosuvastatin

Telmisartan

Fosinopril

Sotalol

Endocrinology

Ibandronate

Levothyroxine

Metformin

Propylthiouracil

Raloxifene

Vasopressin

Exenatide

Gastroenterology

Certolizumab Pegol

Hematology

Azacitidine

Darbepoetin alfa

Decitabine

Epoetin alfa

Immunosuppressives

Mycophenolate

Infectious Disease

Abacavir**

Atazanavir**

Ceftriaxone

Flucytosine

Levofloxacin

Meropenem

Moxifloxacin

Piperacillin

Vancomycin

Zanamivir

Neurology

Gabapentin

Lamotragine

Levetiracetam

Oxcarbazepine**

Pramipexole

Rivastigmine

Vigabatrin

Oncology

Afinitin⊥

Afutuzumab⊥

Alemtuzumab⊥

Asparaginase

Bevacizumab⊥

Carboplatin

Cetuximab⊥

Ibritumomab⊥

Lenalidomide

Obinutuzumab

Ofatumumab⊥

Oxaliplatin

Panitumumab⊥

Pemetrexed

Pertuzumab⊥

Rituximab⊥

Temozolomide

Thalidomide

Trastuzumab⊥

Vorinostat

Bleomycin

Chlorambucil

Fulvestrant♣

Ophthalmology

Verteporfin

Other

Carglumic acid

Risedronate

Psychiatry

Lorazepam

Varenicline

Pulmonary

Montelukast

Rheumatology

Allopurinol**

Etanercept

Belimumab

Sleep Medicine

Zaleplon

Legend: Drugs not metabolized by CYP1A2, CYP2C9, CYP2C19, CYP2D6, CYP3A4 and CYP3A5. This is not an exhaustive list for all of the alternate drugs in the pharmacopeia but focuses on commonly used drugs. Note that other genes (and factors) may contribute to the metabolism of the listed drugs. In addition, other CYPs and other genes not described here may also be relevant but are out of scope for this document. **This drug is listed on the Additional Pharmacogenomic Genes & Associated Drugs table. ⊥ Genetic or tumor testing maybe needed to establish the indication for use of this drug. ♣ Although a CYP gene is involved in the metabolism of this drug, per the FDA label genetic variation within the gene does not impact or has minimal impact on metabolism.

Table 5: Glucose-6-Phosphate Dehydrogenase (G6PD) Associated Drugs and Compounds**Allergy**

Antazoline[⚡]
 Antistine[⚡]
 Diphenhydramine[⚡]
 Pyribenzamine[⚡]
 Tripelennamine[⚡]

Analgesic

Acetaminophen[⚡]
 Acetanilide[♠]
 Acetophenetidin^Φ
 Aminophenazone[⚡]
 Antipyrine[⚡]
 Aspirin^Φ
 Dipyrone^Φ
 Metamizole^Φ
 Paracetamol[⚡]
 Phenacetin^Φ
 Phenazone[⚡]
 Tiaprofenic acid[⚡]

Anticoagulant

Menadione^Φ
 Menadione sodium bisulfite^Φ
 Menaphthone^Φ
 Phytomenadione^Φ

Cardiovascular

Isosorbide dinitrate[⚡]
 Procainamide[⚡]
 Quinidine Gluconate^Φ
 Quinidine Sulfate[♠]

Dematology

Dapsone[♠]
 Diaphenylsulfone[♠]
 Para-aminobenzoic acid[⚡]

Endocrinology

Chlorpropamide[♠]
 Glibenclamide[♠]
 Glyburide[♠]
 Glimepiride[♠]
 Glipizide[♠]

Gastroenterology

Aminosalicylic acid^Φ
 Mesalazine^Φ
 MoviPrep[♠]
 Salazopyrin^Φ
 Sulfapyridine[♠]
 Sulfasalazine^Φ

Hematology

Acetylphenylhydrazine[♠]
 Methylene blue[♠]
 Methylthioninium chloride[♠]

Infectious Disease

Aldesulfone sodium^Φ
 Aminosalicylic acid^Φ
 Beta-Naphthol[♠]
 Chloramphenicol^Φ
 Chlorguanidine[⚡]
 Chloroquine[♠]
 Ciprofloxacin^Φ
 Dapsone[♠]
 Diaphenylsulfone[♠]
 Furazolidone^Φ
 Glucosulfone[♠]
 Isoniazid[⚡]
 Mafenide[♠]
 Mepacrine^Φ
 Moxifloxacin[♠]
 Nalidixic acid[♠]
 Niridazole[♠]
 Nitrofurantoin[♠]
 Nitrofurazone[♠]
 Nitrofurazone[♠]
 Norfloxacin^Φ
 Ofloxacin^Φ
 Pamaquine[♠]
 Pentaquine^Φ
 Primaquine[♠]
 Proguanil[⚡]
 Promin[♠]
 Pyrimethamine[⚡]
 Quinacrine^Φ
 Quinine^Φ
 Stibophen[♠]
 Streptomycin[⚡]
 Sulfacetamide^Φ
 Sulfacytine[⚡]
 Sulfadiazine^Φ
 Sulfadimidine^Φ
 Sulfafurazone^Φ
 Sulfafurazone^Φ
 Sulfaguandine[⚡]
 Sulfamerazine^Φ
 Sulfamethoxazole[♠]
 Sulfamethoxyipyridazine[⚡]
 Sulfanilamide^Φ
 Sulfisoxazole^Φ
 Sulfoxone^Φ
 Trimethoprim[♠]

Neurology

Benzhexol^Φ
 Levodopa[⚡]
 Phenytoin[⚡]
 Trihexyphynidyl^Φ

Nutraceutical

Acalypha indica extract^Φ
 Ascorbic acid^Φ
 Vitamin C^Φ

Oncology

Dabrafenib[♠]
 Doxorubicin^Φ
 Rasburicase[♠]

Other/Industrial/Environmental

Arsine[♠]
 Napthalene[♠]
 Phenylhydrazine[♠]
 Thiazosulfone^Φ
 Tolonium chloride[♠]
 Toluidine blue[♠]
 Trinitrotoluene[♠]

Rheumatology

Colchicine[⚡]
 Pegloticase[♠]
 Phenylbutazone[⚡]
 Probenecid^Φ
 Sulfapyridine[♠]

Toxicology

Dimercaprol^Φ
 Dimercaptosuccinic acid[♠]
 Isobutyl Nitrite[♠]
 Sodium Nitrite[♠]
 Succimer[♠]

Urology

Phenazopyridine[♠]

Legend: This is a listing of drugs and compounds reviewed for safety in G6PD deficient patients by the Clinical Pharmacogenetics Implementation Consortium (CPIC) and the FDA.

♠ = A compound/drug for which all references with an available review are in agreement that there is a risk of hemolysis in G6PD deficient individuals or the FDA label for the drug/compound indicates the risk is present. Φ = A compound/drug for which conflicting references are available regarding the potential risk of hemolysis in G6PD deficient individuals. ⚡ = Compound/drug for which all references with an available review are in agreement that there is a low risk of hemolysis in G6PD deficient individuals.

Table 6: Additional Pharmacogenomic Genes & Associated Drugs**Anticoagulant/Antiplatelet**Warfarin *VKORC1 CYP4F2 rs12777823***Cardiovascular**Simvastatin *SLC01B1***Infectious Disease**Abacavir *HLA-B*57:01*Atazanavir *UGT1A1[§]*Interferon + Ribavirin *IL28B*Isoniazid *NAT2***Neurology**Carbamazepine *HLA-B*15:02 HLA-A*31:01*Eslicarbazepine *HLA-B*15:02 HLA-A*31:01*Fosphenytoin *HLA-B*15:02 HLA-A*31:01*Lamotrigine *HLA-B*15:02 HLA-A*31:01*Oxcarbazepine *HLA-B*15:02 HLA-A*31:01*Phenytoin *HLA-B*15:02 HLA-A*31:01***Oncology**Irinotecan *UGT1A1[§]*Fluoropyrimidines *DPYD*Nilotinib *UGT1A1[§]*Pazopanib *HLA-B*57:01 UGT1A1[§]*Belinostat *UGT1A1[§]*Cisplatin[□] *TPMT*Mercaptopurine *TPMT NUDT15*Azathioprine *TPMT NUDT15*Thiopurine *TPMT NUDT15***Psychiatry**SSRI response *SLC6A4*Antipsychotics *HTR2A HTR2C*SSRI *HTR2A HTR2C***Rheumatology**Allopurinol *HLA-B *58:01*

Legend: This is not an exhaustive list of all known pharmacogenomic drug gene combinations. Human leukocyte antigen (HLA) – related drugs are shown for HLA-A*31:01, HLA-B*15:02, HLA-B*57:01, and HLA-B*58:01. Drugs impacted by solute carrier organic anion transporter 1B1 (SLC01B1) and UDP – glucuronosyltransferase 1 family peptide A1 (UGT1A1) are listed. § Note that UGT1A1 also has implications for the hereditary forms of unconjugated hyperbilirubinemia (Gilbert syndrome and Crigler-Najjar syndrome). Individuals with a significant decrease in UGT1A1 enzyme activity (example homozygous *28 [TA7/7], and various other genetic variant combinations) may want to consider an alternative to Atazanavir, since they are at risk of developing Atazanavir-associated indirect hyperbilirubinemia. □ Genetic variants in TPMT have been associated with a cisplatin-related ototoxicity.

This is educational material intended for health care professionals. The information provided in the Pharmacogenomic Association Tables are not intended to supersede the care provider's experience and knowledge of her/his patient to establish a diagnosis or a treatment plan. All medications require careful clinical monitoring regardless of the information presented here.

All information listed in the Pharmacogenomic Associations Tables is based on data from:

1. <http://medicine.iupui.edu/clinpharm/ddis/table.aspx>
2. <https://www.pharmgkb.org/view/drug-labels.do>
3. <http://www.fda.gov/drugs/scienceresearch/researchareas/pharmacogenetics/ucm0833378.htm>
4. <http://www.accessdata.fda.gov/scripts/cder/drugsatfda/index.cfm>

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