

WHAT ARE THE MAIN WAYS DRUG INTERACT?

- **Pharmacokinetic interactions:**
One drug causes alterations in another drug's:
 - **Absorption**
 - **Distribution**
 - **Metabolism**
 - **Excretion**

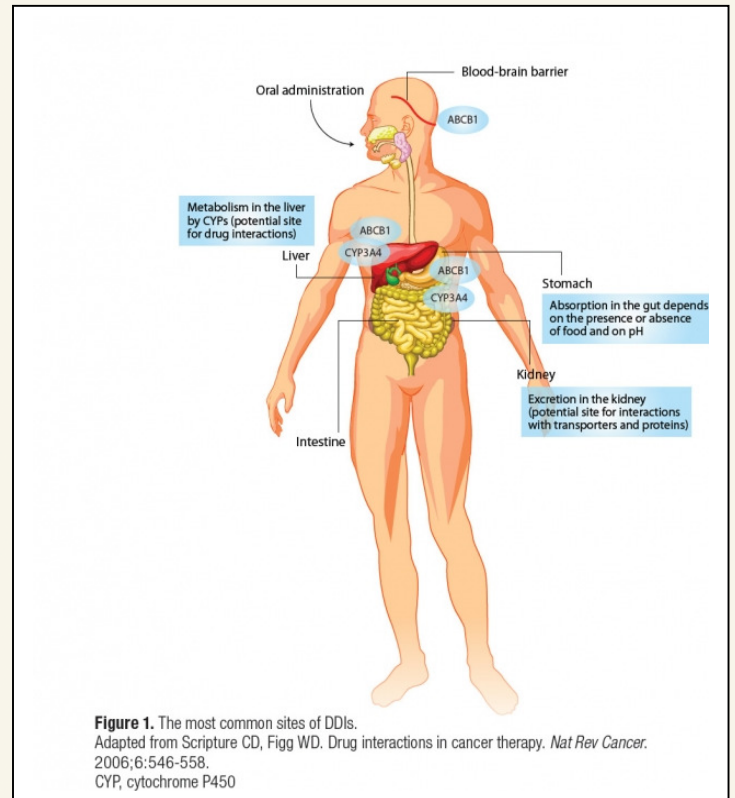
Of these, the most common are probably absorption and metabolism.

- **Pharmacodynamic interactions:**
The effects of one drug on the body alters, enhances, or antagonizes the effects of another drug

PHARMACOKINETIC INTERACTIONS

Absorption: *can be any way the drug is delivered, including GI tract, skin, lungs, and even blood-brain barrier.*

- *Levaquin and magnesium or calcium*
- *Omeprazole and calcium carbonate*



Metabolism: *Changes in either how or how fast the medication is broken down in the body. The most common way is through alteration of hepatic enzymes, known as Cytochrome (CYP) P450*

- *Each enzyme is given an identifier that looks like this: CYP1A2*
- *Drugs can be inducers, inhibitors, or substrates of these enzymes*

PHARMACODYNAMIC INTERACTIONS

Sometimes the effect of one drug on the body will cause an altered, inhibited, or synergistic effect on the other drug.

This can happen with any organ system in the body. Understanding the physiological effects of each is crucial to understanding and evaluating the interaction.

References:

- <http://www.practicalpainmanagement.com/treatments/pharmacological/opioids/common-opioid-drug-interactions-what-clinicians-need-know>
- http://www.medscape.com/viewarticle/758855_5
- <http://jaha.ahajournals.org/content/2/1/e004564.full>
- <http://www.aafp.org/afp/2000/1001/p1607.html>
- http://www.medscape.com/viewarticle/545631_1

Examples of CYP drug interactions:

- **Warfarin** (a CYP2C9 substrate) can have its metabolism blocked by **cranberry** (a CYP2C9 inhibitor) leading to an increased INR.
- **Plavix** (clopidogrel) has to be activated in the body by CYP2C19. Proton-pump inhibitors like **omeprazole** are CYP2C19 inhibitors so could hypothetically make Plavix less effective

Examples of pharmacodynamic interactions:

- Taking **warfarin** and **NSAIDs** together can lead to an increased risk of bleeding.
- **Methotrexate** and **Bactrim** (trimethoprim-sulfamethoxazole) both work by blocking the production of folic acid, and taken together can lead to **severe neutropenia**.