

# STEP 1 REVIEW

## PHARMACOLOGY

High-Yield Clinical Presentations



MED STUDENT SUCCESS

# GENERAL CONCEPTS



- Dose–response curve shifts right
- Same max effect achievable
- Overcome with  $\uparrow$  dose
- Competes at same receptor
- $\uparrow$   $K_m$ , same  $V_{max}$

- Max effect reduced
- Increasing dose doesn't help
- Binds irreversible or allosterically
- $\downarrow$   $V_{max}$

- Weak receptor activation
- $\downarrow$  efficacy of full agonist

**Competitive  
Antagonist**

**Noncompetitive  
Antagonist**

**Partial Agonist**

- Drugs with 0 order elimination (constant AMOUNT of drug eliminated per unit time)

- Drug A and B given together have a greater effect than individually

- Decreased OCP effectiveness
- Increases enzyme synthesis

**Phenytoin, Ethanol,  
Aspirin (PEA drugs)**

**Synergy**

**CYP450 inducers  
(rifampin, phenytoin,  
carbamazepine)**

- Increases drug toxicity
- Decreases enzyme activity

- Large Vd
- Stored in fat/tissues
- Long half-life

- 4-5 half lives

**CYP450 inhibitors**

**(cimetidine, erythromycin, ketoconazole)**

**Lipophilic drugs**

**Time to steady state**

# AUTONOMICS



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- Treat urinary retention
- Muscarinic agonist
- Can cause diarrhea, sweating

- Farmer develops diarrhea, constricted pupils, bradycardia, lacrimation and salivation
- Treat with atropine

**Bethanechol**

**Organophosphate  
poisoning/cholinergic  
OD**

- Alpha 1 agonist
- Vasoconstriction
- Can lead to HTN and reflex bradycardia

- Acute asthma relief
- Beta 2 agonist
- Can cause tremor and tachycardia

- Increases contractility of the heart
- Beta agonist
- Used in cardiac stress test

**Phenylephrine**

**Albuterol**

**Dobutamine**

- Used for BPH
- Blocks alpha 1
- Can cause orthostasis

- Nonselective beta blocker
- Don't give to  
asthma/COPD patients

- Central alpha 2 agonist
- Can treat HTN but also  
causes rebound HTN

**Tamsulosin**

**Propranolol/carvedilol**

**Clonidine**

# CARDIOLOGY



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- Improves survival in HF
- Can cause cough and angioedema due to elevated bradykinin

- Similar to ACE-I but no cough/angioedema

- Na/K inhibition
- Can cause vision issues and arrhythmias

**ACE inhibitors (-pril)**

**ARBs (- sartan)**

**Digoxin**

- Vasodilator that increases NO
- Can cause drug induced lupus

- Antiarrhythmic drug that blocks K, Na, Ca channels
- Can cause liver, lung, thyroid dysfunction
- Can cause blue-gray skin

- Tx erectile dysfunction
- Increases cGMP
- Don't give with nitrates due to hypotension risk

**Hydralazine**

**Amiodarone**

**PDE5-inhibitor  
(sildenafil)**

- **Beta blocker that prolongs QT**

**Sotalol**

- **Diuretic often used in heart failure**
- **Can cause low K, Ca, ototoxicity**

**Furosemide**

- **Antianginal med that decreases preload**

**Nitrates**

- Aldosterone antagonist
- Can cause breast enlargement and hyperkalemia

**Spironolactone**

- Aldosterone antagonist that does not cause gynecomastia

**Eplerenone**

- BP med that can cause leg swelling

- Antiarrhythmic med that decreases AV node conduction
- Can cause constipation

**Dihydropyridine  
CCB (amlodipine)**

**Non-Dihydropyridine  
CCB (verapamil,  
diltiazem)**

# RESPIRATORY



- Beta agonist used in acute asthma attack

**Albuterol**

- 5-LO inhibitor

**Zileuton**

- Mast cell stabilizer

**Cromolyn**

- COPD tx
- Muscarinic antagonist

**Ipratropium/tiotropium**

- Leukotriene receptor blocker
- Used in asthma ppx

**Montelukast**

- IgE monoclonal Ab
- Used in severe allergic asthma

**Omalizumab**

- PDE inhibitor that increases cAMP
- Narrow therapeutic index/lots of side effects so rarely used in asthma

**Theophylline**

# PSYCHIATRY



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- Increases GABA A frequency
- Tx acute panic attack and alcohol withdrawal
- Respiratory depression with alcohol use

- Increases GABA A duration

- Tx resistant schizophrenia
- Can cause agranulocytosis and seizures

**Benzodiazepine  
(alprazolam/oxazepam)**

**Barbiturates (-barbital)**

**Clozapine**

- Can be used to tx MDD, neuropathy
- Wide QRS in overdose
- Give bicarb in overdose

- Antipsychotic that causes elevated prolactin

- Psych pt with elevated temp, rigidity
- Tx with dantrolene

**TCA**

**Risperidone**

**Neuroleptic Malignant Syndrome**

- Tx benzo OD by competitive benzo receptor antagonism

**Flumazenil**

- Treats bipolar disorder and SIADH
- Can cause nephrogenic DI

**Lithium**

- Antipsychotics that cause weight gain

**Olanzapine, clozapine**

- **SSRI with longest half-life**
- **Can cause sexual dysfunction**

- **Causes serotonin syndrome (elevated temp, clonus, hyperreflexia)**

- **Atypical antidepressant that causes weight gain, increased appetite, sedation**

**Fluoxetine**

**SSRI + MAOI**

**Mirtazapine**

- Norepi and dopamine reuptake inhibitor
- MDD + smoking tx
- Can cause seizures

- MDD med that causes sleepiness and prolonged erection

- Patient with schizophrenia develops resting tremors

**Bupropion**

**Trazodone**

**Haloperidol**

# Neurology



- Absence seizure tx

**Ethosuximide**

- Seizure tx in pregnant pt

**Lamotrigine/levetiracetam**

- Blocks Na channels
- Teratogenic and causes gingival hyperplasia

**Phenytoin**

- Dopamine to tx Parkinsons
- Carbidopa is given with this med

**Levodopa**

- MAO-B inhibitor to tx Parkinson

**Selegiline**

- NMDA receptor antagonist
- Tx Alzheimer

**Memantine**

- AChase inhibitor that increases ACh
- Tx Alzheimer
- Can cause bradycardia

- Migraine ppx
- Works on Na channel and GABA
- Can cause birth defects

- 5HT1B/1D agonist
- Stops migraine attack
- Can cause vasoconstriction, avoid in HTN/CAD

**Donepezil**

**Valproic acid**

**Sumatriptan**

# ANTIMICROBIALS



- Inhibits cell wall synthesis
- Can cause red man syndrome and elevated cr

## **Vancomycin**

- Inhibits DNA gyrase
- Can cause QT prolongation and tendon rupture

## **Fluoroquinolones**

- Antibiotics that covers anaerobes
- Can cause metallic taste and adverse effects with alcohol

## **Metronidazole**

- Red/orange body fluids
- RNA polymerase inhibition
- TB tx, meningitis ppx

**Rifampin**

- TB tx
- Eye issues

**Ethambutol**

- Antibiotic classes that prolong QT

**Macrolides, FQ**

- TB tx
- Mycolic acid synthesis inhibition
- Give with B6 to prevent neuropathy

- Reversible 30S inhibitor
- Causes grey teeth, photosensitivity
- Decreased drug absorption with  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Fe}^{2+}$

- Cephalosporins used to treat pseudomonas

**Isoniazid**

**Tetracyclines**

**Ceftazidime and cefepime**

- Drug used to treat syphilis or strep throat

- Resistance can occur due to amino acid modification of D-Ala-D-Ala to D-Ala-D-Lac

- Irreversible 30S inhibitor
- Pt develops ringing in the ears, increased BUN and cr, numbness/tingling

**Penicillin**

**Vancomycin**

**Aminoglycosides  
(gentamicin, tobramycin,  
amikacin)**

- HSV treatment

**Acyclovir**

- Tx influenza
- Neuraminidase inhibitor  
to prevent viral release

**Oseltamivir**

# ENDOCRINE



- 1st line drug in T2DM
- Can cause lactic acidosis
- Avoid in renal failure

- Slows gastric emptying and leads to weight loss
- Can cause pancreatitis

- Hyperthyroidism medication given in pregnancy
- Can cause agranulocytosis
- Inhibits peripheral conversion of T4 to T3

**Metformin**

**GLP-1 agonist (-tide like liraglutide)**

**PTU**

- DM med that closes K<sup>+</sup> channels and increases insulin
- Can cause hypoglycemia and weight gain

- PPAR $\gamma$  activation
- Don't give in HF patients

- $\alpha$ -glucosidase inhibitor
- Can cause GI side effects

**Sulfonylureas**

**Thiazolidinediones  
(-glitazone)**

**Acarbose**

- Increases glucose dependent insulin secretion by inhibiting an enzyme that breaks down incretins like GLP

- ADH antagonist
- Tx SIADH

- Irreversible alpha blocker
- Tx pheochromocytoma

- Somatostatin analog that decreases GH, insulin, glucagon
- Can treat acromegaly

**DPP-4 Inhibitors (-gliptin)**

**Tolvaptan**

**Phenoxybenzamine**

**Octreotide**

- Dopamine agonists used to tx prolactinomas

- Inhibits osteoclasts
- Osteoporosis tx
- Can cause jaw necrosis and esophagitis

- Blocks RANKL and prevents osteoclast activation

**Bromocriptine and cabergoline**

**Bisphosphonates**

**Denosumab**

# HEMATOLOGY/ONCOLOGY



- Topoisomerase II inhibition
- Can cause heart issues that is treated with dexrazoxane

**Doxorubicin**

- MT inhibition
- Can cause neuropathy

**Vincristine**

- MT inhibition
- Can cause bone marrow suppression

**Vinblastine**

- Breaks DNA strands
- Can cause lung issues like pulmonary fibrosis

**Bleomycin**

- DHFR inhibitor
- Used in cancer and RA
- Tx toxicity with folinic acid (leucovorin)

**Methotrexate**

- Alkylating agent that can cause hemorrhagic cystitis
- Prevent with mesna

- Inhibits thymidylate synthase

- DNA cross-linking agent
- Causes peripheral neuropathy

**Cyclophosphamide**

**5-Fluorouracil**

**Cisplatin**

- Activates antithrombin
- Prolongs PTT
- Can cause low platelets

**Heparin**

- Inhibits vit K epoxide reductase
- Teratogenic

**Warfarin**

- Increases HbF
- Inhibits ribonucleotide reductase
- Sickle cell tx

**Hydroxyurea**

- Direct Xa inhibitor

**Apixaban**

- ADP receptor inhibitor  
that prevents platelet  
aggregation

**Clopidogrel**

- Irreversible COX1 and  
COX2 inhibitor  
- Antiplatelet at low doses  
and antiinflammatory at  
high doses

**Aspirin**

# TOXICOLOGY



- Respiratory alkalosis and metabolic acidosis
- Ear ringing

- Treatment for liver failure from tylenol overdose

- Pinpoint pupils and respiratory depression

**Aspirin overdose**

**N-acetylcysteine**

**Naloxone for opioid overdose**

- Heparin reversal

**Protamine sulfate**

- Teratogenic anticoagulant

**Warfarin**

- Warfarin reversal

**Vitamin K, FFP, PCC**

- TCA overdose

**Bicarb**

- Benzo overdose

**Flumazenil**

- Aspirin overdose

**Bicarb**

- Tx iron overdose

**Deferoxamine**

- Tx methanol poisoning

**Fomepizole**

- Lead poisoning

**EDTA**

- Cyanide poisoning

**Hydroxocobalamin**

- Methemoglobinemia

**Methylene blue**

- CO poisoning

**Hyperbaric oxygen**

# RENAL



- Diuretic that causes ototoxicity
- Acts on the thick ascending limb of LOH to inhibit Na/K/2Cl

- Loop diuretic given to pt with sulfa allergy that can't take furosemide

- Decreased bicarb absorption by inhibitor carbonic anhydrase
- Can cause metabolic acidosis

**Furosemide**

**Ethacrynic acid**

**Acetazolamide**

- Osmotic diuretic that can initially elevate ICP
- Can cause pulmonary edema

**Mannitol**

- ADH analog
- Tx central DI and enuresis

**Desmopressin**

- Blocks NaCl reabsorption in DCT
- Causes hypercalcemia

**Hydrochlorothiazide**

# Gastrointestinal



- **Blocks acid secretion by irreversible H<sup>+</sup>/K<sup>+</sup> ATPase inhibition**
- **Tx GERD**

**PPI (-prazole)**

- **COX inhibition, blocks PG production**
- **Can cause gastric ulcers and kidney injury**

**NSAIDs**

- **Coats ulcer**
- **Requires acidic environment**

**Sucralfate**

- Dopamine agonist that promotes gastric emptying
- Tx gastroparesis

- 5-HT3 antagonist
- Treats N/V
- QT prolongation

- Osmotic laxative
- Can treat HE

- Bile acid sequestrant
- Lowers LDL

**Metoclopramide**

**Ondansetron**

**Lactulose**

**Cholestyramine**

# IMMUNOLOGY



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- Monoclonal antibody that inhibits TNFalpha
- TB reactivation risk
- Used in Crohns/UC

**Infliximab**

- Calcineurin inhibitor
- Can cause nephrotoxicity and gingival hyperplasia

**Cyclosporine**

- mTOR inhibitor that blocks IL-2 signaling
- Can cause thrombocytopenia

**Sirolimus**

# DERMATOLOGY



- Tx severe acne
- Teratogenic and need to be on 2 forms of birth control

**Isotretinoin**

- Vitamin D analog
- Tx psoriasis

**Calcipotriene**

- Tx scabies

**Permethrin**

# REPRODUCTIVE



- Blocks estrogen receptor
- Tx breast cancer
- Increases risk of endometrial cancer

**Tamoxifen**

- Decreases estrogen synthesis
- Aromatase inhibitor
- Can cause osteoporosis

**Anastrozole**

- GnRH agonist
- Has an initial flare that eventually downregulates GnRH receptors
- Tx prostate cancer

**Leuprolide**

- Progesterone antagonist
- Used in abortion with misoprostol

**Mifepristone**

- Androgen receptor blocker used with leuprolide in prostate cancer

**Flutamide**

- Emergency contraception that delays ovulation

**Levonorgestrel**

# MSK



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- Gout flare tx
- Inhibits MT
- Causes GI side effects

**Colchicine**

- XO inhibitor
- Chronic gout prevention

**Allopurinol**

- Increases uric acid excretion

**Probenecid**

# THANK YOU!

## Questions?

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More STEP Resources: [medstudentsuccess.com](http://medstudentsuccess.com)

