MEMORIZING PHARMACOLOGY

A Relaxed Approach

by Tony Guerra, Pharm.D

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Tony Guerra, Pharm.D.
First Edition
ISBN: 978-1-329-89844-8 (Print)
ISBN: 978-1-329-93156-5 (mobi)
ISBN: 978-1-329-95124-2 (ePUB)

eBook formatting / conversion: Chris Moore www.fromprinttoebook.com

To Mindy,
Brielle, Rianne, and Teagan

AUTHOR'S NOTE

THE STORY OF PHARMACOLOGY CLASS

As an instructor, I didn't appreciate how tough it was to be a working parent and pharmacology student until I had my triplet daughters. When the girls originally came home, they had trouble coordinating the suck, swallow, breathe that goes with feeding from a bottle, well, three bottles. We fed them for 90 minutes and they slept for 90 minutes – round the clock. They got older, but the crushing emotional and physical exhaustion has continued. Most of my students have jobs and families. I wanted a way for them to study pharmacology while attending to these types of responsibilities.

Tonight, as I lay quietly in bed next to my daughter who will not sleep otherwise, **I recited in my head, from memory, the 200 drugs, generic name, brand name and drug classification, in this book, in order.** Previously during these times, thoughts of "What do I have to do for tomorrow?" ran through my head. Instead, I could relax, stay unhurriedly by my daughter, and remain a committed parent. With this book's techniques, I could study pharmacology in the dark – eyes closed. I knew I was on to something. This could help my overworked students.

After she fell asleep, I got up and starting writing this introduction, but before I could congratulate myself, my other daughter came downstairs insisting that she will never sleep in her bed again. So, here I am, on my couch, half-watching *Better Call Saul*, comforting another daughter between coughing fits, and typing out this introduction, knowing I might see the sunrise before I get to sleep.

Earlier this fall a student emailed me, offering to pay me to read and record his "Top 200 Drugs" list. I was too busy mid-semester, but I did want to create a road map for him and other students that shared his need. Each fall and spring, many health professional students try to learn the "Top 200 Drugs," but get little help in memorization techniques.

This book *will* help, regardless of which Top 200 Drugs your professor assigns. It will also help you answer the question: where do I start studying pharmacology for my board exams? Whether it's the NCLEX-RN (National Council Licensure Examination – Registered Nurse) or NABPLEX (National Association of Boards of Pharmacy Licensure Examination) or another exam, this book will provide a structure for your knowledge to wrap around, much as a garden lattice might hold up vines.

What does Top 200 Drugs mean? At one time, there was a website that listed The Top 200 Drugs in the United States by 1) Number of prescriptions written and 2) Ranked by money spent on each drug. This created two different lists, but their value was clear. **Well-prepared students remember the most frequently prescribed drugs.** The 80/20 rule, or Pareto's principle, predicts that 20% of the medications will represent 80% of those prescribed.

Brutal rote memorization, however, is a poor strategy for managing information overload. Memorizing a brand name, generic name, medication class, therapeutic use, and one adverse effect for 200 drugs represents one-thousand pieces of information. Each new item adds 200 disparate memorization points. Students often ask why they should memorize drugs if they can Google them or look them up in a *Davis Drug Guide for Nurses*. The answer: a properly sorted and memorized list of 200 drugs provides

a framework on which to build your preparation for pharmacology class, the board exams, and clinical practice. But, how did I memorize so many drugs? Follow this thought experiment.

Imagine, instead of playing the part of student, you are the instructor. The class has 200 students and there are exactly 200 seats in the classroom. How do you remember all of their names? How do you know who is absent when you see empty chairs? You could ask the students to sit alphabetically by first name or by last name, but this is college, not grade school. A more organic approach would take time to understand why groups formed as they did.

Students sit in the same seats weekly. As you talk and get to know them, you find out what brings them together. They may have the same undergraduate major, hometown, dorm, previous class, and so forth. There are the front row groups that always asks questions or back row group that asks no questions. Groups come from the same hospital floor or work on a semester project. If someone's absent, you know what group he or she are missing from.

As you learn the drugs in this book, you'll see similar groupings. For example, you'll see thirteen gastrointestinal drugs, five SSRI antidepressants, four benzodiazepines, and three angiotensin-converting enzyme inhibitors. When you bring medicines back from memory, you'll remember if one is missing.

This book provides that specific framework to memorize the most important drugs in a logical order. A good analogy is that learning to drive a car requires essentially the same foundational instruction. However, once you learn, you can drive anywhere (or anything) you want.

After you learn *this* list, you can insert and delete drugs. If you just want to know how to sort that brick of note cards you've got working as a doorstop right now, you can jump to the sorted list of 350 drugs in Chapter 9. I did not put 350 drugs in it because I expect you to memorize that many; rather, I put that many in there because the Top 200 lists from college to college can be so different.

We have a problem, however, because pharmacology instructors and students speak different languages. This causes instructors to get student comments like "He can't teach," "I didn't learn anything in his class," and "C's get degrees, I guess." Professors who cannot connect to students frustrate those who want to learn. I am especially empathetic to parents and students with full-time jobs and international students trying to pick up English *and* the language of pharmacology. I am a parent of three daughters and English is not my first language. Let me show you this disconnect between a student's and a teacher's memorization metaphors.

Pharmacology breaks down to "pharmaco" or "drug" and "logy" which is "study of" with a connecting "o" to make "study of drugs." There is another concept called *pharmacokinetics*. "Pharmaco" means "drug" and "kinetics" means movement, like a kinesiology major is someone who studies – "logy" – body movement – "kinesio."

When, as a pharmacology instructor, I look at the word *pharmacokinetics,* I think of four major principles: *absorption, distribution, metabolism,* and *excretion.* I remember the A-D-M-E mnemonic, pronounced: “add-me.” I remember each principle as matching a certain organ or tissue.

- Absorption happens in the *small intestine’s* villi.
- Distribution occurs via the *blood.*
- Metabolism happens in the *liver.*
- Excretion occurs through the *kidneys.*

With my anatomy and physiology background, I memorized these facts through a metaphor of connected tunnels. A drug travels from the mouth to the small intestine to be *absorbed* and then through blood vessels to be *distributed* to the liver where it’s *metabolized.* Eventually it goes through the kidneys to be *excreted,* further passing through the ureters, into the bladder, and the urethra. That picture is clear and complete in my brain.

I used to assume that my students, some of whom took anatomy and physiology, learned it the same way. That wasn’t true. When asked to create a writing prompt of how they memorized the same idea, my students used a different set of metaphors.

One equated *absorption* with soaking up material in a classroom, *distributing* knowledge to short- and long-term memory, *metabolizing* the information down into manageable topics, and *excretion* to eliminating extraneous pieces of information.

Another student condensed a semester’s worth of developmental psychology into a sentence. She associated the increased surface area of her pregnant belly with the intestine’s *absorption; distribution* with the bloodline that she imparts to her child; changes in her life to accommodate the child, including possibly future drinking after pregnancy, to remember the *metabolism* in the liver; and *excretion* as the expulsion of the child from her home after high school.

After reading that story, can you tell me what *pharmacology* and *pharmacokinetics* mean? Whose story did you use, the instructor’s or the student’s? I don’t think one is better than the other is, but it can be helpful to have a more complete understanding through two points of view.

THE CURSE OF KNOWLEDGE

This divide between expert and novice has a name – “The Curse of Knowledge.” When you have been an expert at something, but you just can’t explain it to someone, it might be because you understand the whole process and they are just learning step-by-step. The same is true in pharm.

Whatever pharmacology text you are using has an author trying to tell the same story from a different expert point of view to novice audiences. I’ve found pharmacology books specifically titled for allied health, athletic training, audiologists, dental hygienists, EMS providers, health professions, massage therapists, medical assistants, medical office workers, nurses, paramedics, pharmacists, pharmacy technicians, physical therapists, physicians, rehabilitation professionals, respiratory care therapists, surgical technologists, veterinary technicians and veterinarians. I stopped counting at twenty. Even as someone writes a textbook, the base of knowledge expands and changes. The better approach starts with a general primer like this, a very small amount of information, 200 drugs in this case, and expands from it.

Then a student can take what he or she specifically needs from discipline-specific pharmacology textbooks.

I have read many of those discipline-specific books and taught in many disciplines, but you get the point – **pharmacology is an ever-expanding subject too big to distill; it's best learned by acquiring a base and building up from there.** I would recommend that you find out how your fellow students learn, but in a big lecture hall, you often don't talk to classmates. This book picks up not only the shortcuts those students use to help them get a better grade in pharm, but also their methods.

TAKING PHARMACOLOGY TWICE, SORT OF

Most of the above-mentioned pharmacology textbooks have the same basic format. The early chapters cover the interactions of the drugs with the body, *pharmacodynamics*, and the body on the drug, *pharmacokinetics*, along with introducing some basic vocabulary. The author divides chapters by pathophysiologic condition and medications follow, e.g., gastrointestinal medicines, then cardiac medicines, and so forth.

However, many sections rely on understanding material from a future section. The instructor has a full overview of all the knowledge, but the student doesn't. Soon, the instructor is talking over the student's head. Here is an example: What medications treat an ulcer and why?

A student can memorize the three medications, **omeprazole (Prilosec), amoxicillin (Amoxil),** and **clarithromycin (Biaxin)** that comprise an ulcer treatment regimen. However, to move up Bloom's taxonomy from knowledge (memorizing "what") to comprehension (understanding "why") requires significant additional information.

- **Omeprazole (Prilosec),** a proton pump inhibitor, reduces stomach acid and gains an advantage over **calcium carbonate (Tums)** and **ranitidine (Zantac)** because of its extended half-life, a measure of the time it takes for a drug in the body to reduce by half.
- **Amoxicillin (Amoxil)** kills the causative agent in most ulcers, *Helicobacter pylori*, a helicopter-shaped bacterium that's sensitive to penicillin antibiotics.
- **Clarithromycin (Biaxin)** reduces the incidence of resistance that can happen with a single broad-spectrum antibiotic like **amoxicillin (Amoxil).**

Instructors teach **omeprazole (Prilosec)** in the earlier gastrointestinal section. Weeks later, students learn how **amoxicillin (Amoxil)** and **clarithromycin (Biaxin)** work in the antimicrobial section of the course. This second major point is critical – **To learn pharmacology requires that a student has already taken pharmacology.** This seems ridiculous, but let's use an apt metaphor, a trip to another country.

CREATING A PRIMER

Imagine you will start college in the fall and have decided to take a four-credit Spanish class. You could hope the teacher slows down to whatever speed you need, or you could study ahead of time. Let's pretend you decide to travel to the Peruvian mountains. (That happens to be where my dad is from.) Although some people speak English, you ask them to speak to you in Spanish so they can help you learn Spanish for your class. Your smartphone doesn't get any signal in the Andes Mountains, so you use pen and paper to write your notes in a small journal, picking up words along the way. At first, you point to objects but, gradually, you can start making sentences. You make notes of words that are especially tricky. For example, the Spanish word embarazada *looks like* the English word embarrassed, but it *means* pregnant. If you make this mistake, your brain will remember the story of that mistake, and you won't make it again. You compare notes with other students and share stories each night. In the end, you have a primer, an introductory book in Spanish that will put you far ahead of your class as you enter college.

The word "primer" has different meanings in various contexts. In auto painting and cosmetics, a primer allows for better adhesion for a secondary product's application. A primer is also a basic language-reading textbook. You can combine these definitions to create a useful analogy. **A pharmacology primer can provide a home base for students to expand a basic framework of vocabulary before they use PowerPoints (sentences) and textbooks (full paragraphs).**

This book is your journal. In the same way you take medical terminology before you take anatomy and physiology, you want to master some of the terms before you start pharm class. The following seven chapters include conversations with students about creating meaning from words in the foreign language of pharmacology. I will talk through how and why I have grouped them as I did. Once you have completed the book, the Comprehensive Drug List should look like conversational and readily pronounceable English.

MEDICATION RECONCILIATION (MED REC)

While this book's focus is to prepare students, I believe it can help patients and caregivers provide accurate medication histories and records – as students of their own conditions. Medical reconciliation or "med rec" is the process of assembling a correct list of patient's medications under what might be some stressful circumstances. When an ambulance comes, you might not remember to take everything with you. Memorizing medications in a logical order ensures the list will always be with you and you can immediately tell EMS responders what the patient is on.

FINAL NOTE

If you invent a great mnemonic and want to share it for a future edition, feel free to email me:

aaguerra@dmacc.edu

I'm always looking for better ways to teach pharm. If you see a student struggling with the language of pharmacology who doesn't have this book or a patient who wants to better understand his or her many prescriptions, please do take the time to recommend it to them.

There was a pharmacology class that I got a standing ovation, just like in the 1972 movie *The Paper Chase*. I hope what you get out of this book is worth your standing up.

Tony Guerra
December 28th, 2015
2:41 AM – Still dark outside.

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INTRODUCTION

GENERIC NAMES VS. BRAND NAMES

From experience, instructors immediately know which names represent *generic* and *brand* drugs. In an academic text, generic names go first in lower case letters followed by a capitalized brand name in parenthesis, e.g., **amphotericin B (Fungizone).** In conversation or other writing, students must have this distinction memorized.

Some licensing exams only use generic names. This is understandable; only one generic name exists for each medication. There is one **"acetaminophen,"** but the brand **Tylenol** is associated with many products. This *does not* mean a student should *not learn* brand names. A dangerous confusion between generic and brand names is that of **Pepto-Bismol** or **Pepto** for short. Let me tell you a story.

On a web page I saw a parent post that she gave her 8-year-old child a teaspoonful of **Pepto,** was that okay? **Pepto-Bismol** is the brand name for the liquid product **bismuth subsalicylate.** That salicylate is similar to **aspirin,** which is **acetylsalicylic acid** and can cause a terrible condition called **Reye's syndrome** in children. What she meant to give her child was **Children's Pepto,** which contains **calcium carbonate,** the active ingredient in **Tums.** As a parent, I understand what happens in the middle of the night. Your child is suffering and the medication instructions are in tiny 4-point font. It's tough to make the right call.

The point is that most brand names will have two to three syllables **(Pepto).** Most generic names have four or more: **calcium carbonate** and **bismuth subsalicylate.** Why is this important?

You want to start developing simple *heuristics,* or rules of thumb, to make it easier to learn the medicines. For example, generic names have stems like the "-cillin" in penicillin class antibiotics; brand names do not. Getting meaning from a brand or generic requires a different rule of thumb. If you don't know if the drug name you are looking at is generic or brand, you are at a terrible disadvantage.

THREE TYPES OF DRUG NAMES

1) The chemical name: First, there is the most complex name, the International Union of Pure and Applied Chemistry (IUPAC) standard name, which makes perfect sense to a chemist who might want to draw the molecule. For example, **Ibuprofen's** chemical name is:

(RS)-2-(4-(2-methylpropyl)phenyl) propanoic acid

Chemists may simplify the chemical name. In this example, the chemical name becomes the common name, Iso-butyl-propanoic-phenolic acid (I bu pro phen), which can be shortened even further to ibuprofen, the generic name.

2) The generic name: With only four syllables, the transformation to **ibuprofen** is an improvement over the chemical name. Patients, however, prefer two to three syllable names. Just as kids cut down computer to "puter" or banana to "nana," patients prefer short names for ease of pronunciation.

If you don't know where to put an emphasis on a generic four syllable drug name, it's usually the penultimate, or second to last, so it would be pronounced **i bu PRO fen.**

You want to make sure to put the right *emphasis* on the right *syllable* or you'll lose credibility. If your patient pushes the call button when you walk *into* the room, you might be mispronouncing some meds.

3) The brand or trade name: Two of the brand names for **ibuprofen** are **Advil** and **Motrin.** Both have two easy-to-pronounce syllables, but don't resemble **ibuprofen** as the brand name because they include *plosives* to make powerful memorable stops in the word. A strong word sounds like strong medicine.

Say each of the following letters and see if you can feel it in your tongue or nose.

Tongue blade occlusion: *t or d*

Tongue body occlusion: *k or g*

Lip occlusion: *b or p*

Nasal stops: *m or n*

Motrin has an "m," a nasal stop; a "t," a tongue blade occlusion; and an "n," another nasal stop. This forces the person saying the word to stop their breath three times, slowing the pronunciation and keeping it on the tongue and / or nose longer, making it sound very strong.

BRAND NAME RULE OF THUMB: CAN INDICATE FUNCTION

The **brand name's** two to three syllables will sometimes hint at the *function* of a drug, i.e., **Lopressor** lowers blood pressure.

The **brand name** is similar to a two- to three-syllable nickname that *hints* at the drug's function, but by law, may not make a claim. Brand names are very much like nicknames such as Betsy or Jack. A non-native English speaker would have no idea that Betsy comes from Elizabeth or Jack comes from Jonathan. Betsy takes the "b-e-t" from Elizabeth and Jack takes the "J" from Jonathan.

You might see brand names do the same, such as the use of "val" in the brand name **Valtrex** (an antiviral), which comes from a part of the generic **valacyclovir** or the "p," "a," and "x" in the brand name **Paxil** (an antidepressant), which come from the generic name paroxetine.

GENERIC NAME RULE OF THUMB: CAN INDICATE CLASS

Lopressor's four syllable generic name, **metoprolol (Toprol, Toprol XL),** has an –olol suffix, which is a **stem** from a credible source.

I know of two stem lists. One is from the **United States Adopted Names Council** on the American Medical Association's website and another is the **World Health Organization's** (WHO) Stem Book. They created stems so when people use generic names, they will know that the drugs with similar stems are probably similar in their actions. This is where the problems start.

Students, recognizing similarities in the endings or beginnings of drug names, start to make up their own rules. In this book, you will learn which stems are credible and verifiable and which are not. Knowing

both will make you much better at spotting them. Most YouTube videos and Quizlet notecards have errors that let you know the author's research is faulty or nonexistent. I am not picking on students; many licensed health professionals give advice and charge money online to view their videos, and some of that advice is dead wrong. However, when used correctly, these prefixes, suffixes, and infixes can be invaluable.

Some of the references, online videos, and online pre-made note cards provide lists deriving stems incorrectly. For example, the nine endings -azole, -en, -ide, -in, -ine, -one, -pam, -sone, and -zine are *not* stems; these are only groups of letters that happen to be at the end of many medication names. Using a group of letters instead of an established stem might lead to a drug classification error.

PREFIXES, SUFFIXES, AND INFIXES

In this book, I will use the terms prefix, suffix, and infix. Generic drug names are invented words and do not always conform to the rules of English. The United States Adopted Names Council properly calls each prefix and suffix that has meaning (e.g., cef- represents cephalosporins or –cillin represents penicillins) a stem.

In the case of penicillin, -cillin is the stem and peni- is a prefix that differentiates peni*cillin* from other penicillin antibiotics such as amoxi*cillin* or ampi*cillin*, etc.

An infix is inside the word to make the classification more specific. The proper stem for a quinolone antibiotic is –oxacin, but cipro*floxacin* has the infix *–fl-* to classify it further as a *fluoro*quinolone, one that contains a fluorine atom.

Stems work as a heuristic, or something that allows us to accelerate our recognition of a class of medications. If there is a list of ten medications that all end in –olol, we can more easily know these medications are beta-blockers.

The stem –adol indicates a drug like **tram<u>adol</u> (Ultram),** is an analgesic (a medication for pain), comprised of an opiate (which means from the opium poppy, but is more generally a term for many narcotics). This has properties as both an agonist (a chemical that stimulates a receptor) and an antagonist (a chemical that blocks or antagonizes a receptor), which is unusual. Usually a chemical is an agonist or antagonist, not both.

The stem -afil in **silden<u>afil</u> (Viagra)** and **tadal<u>afil</u> (Cialis)** represents the phosphodiesterase type-5 (PDE5) inhibitors and indicates that these medications block (inhibit) an enzyme (phosphodiesterase). The inhibition of this enzyme results in stopping the breakdown of a chemical in the corpus cavernosum. This effect helps patients who have erectile dysfunction.

The stem –amivir in **oselt<u>amivir</u> (Tamiflu)** and **zan<u>amivir</u> (Relenza)** is a subclass of the stem –vir that represents the neuraminidase (enzyme) antagonist (inhibitor) group. Neuraminidase is an enzyme critical for influenza virus replication. If the medication in given in a certain time frame, usually within the first 48 hours after symptom onset, it blocks the enzymes necessary for influenza viruses to successfully replicate.

The stem "–azepam" represents antianxiety agents in the benzodiazepine class that are similar to **di<u>azepam</u> (Valium).** Besides anxiety, patients use these medications as a sedative-hypnotic.

That’s a lot of information to get from a few letters.

PRONUNCIATION AND ORGANIC CHEMISTRY WORD PARTS

Pronouncing generic names is often like pronouncing foreign language last names like mine. My last name “Guerra” has a part that’s unpronounceable in regular English because there is no double or rolled “r” sound in English. Drug names might use the same letters you know in the Roman alphabet. However, we pronounce them differently because the sounds that form them come from organic chemists and biochemists.

Note: Below I have italicized the part of the generic name to which the organic molecule corresponds. These are *not* classification stems like –cillin or –azepam, but references to certain chemicals or groups of them.

These words indicate the number of carbon atoms in an attached molecule made up of only carbon and hydrogen atoms:

Methyl – *Methyl*phenidate

METH-ill

Ethyl – Fentan*yl*

ETH-ill

Propyl – Meto*pro*lol

PROP-ill

Butyl – Al*but*erol

BYOOT-ill

Levo and dextro mean left and right respectively:

Levo – *Levo*thyroxine

LEE-vo

Dextro – *Dex*methylphenidate

DEX-trow

These words mean there is a specific element in each molecule:

Thio (sulfur) – Hydrochloro*thi*azide

THIGH-oh

Chloro (chlorine) – Hydro*chloro*thiazide

KLOR-oh

Hydro (hydrogen) – *Hydro*codone

HIGH-droe

Fluoro (fluorine) – Ciprof*l*oxacin

FLOR-oh

These words are branches that attach to the central molecule:

Acetyl – Levetir*acet*am

Uh-SEAT-ill

Alcohol – Tramad*ol*

AL-kuh-haul

Amide – Loper*amide*

UH-myde

Amine – Diphenhydr*amine*

UH-mean

Disulfide – *Disulf*iram

DIE-sulf-eyed

Furan – *Fur*osemide

FYOOR-an

Guanidine – Cimet*idine*

GWAN-eh-dean

Hydroxide – Magnesium *Hydroxide*

HI-drox-eyed

Imidazole – Omepr*azole*

im-id-AZ-ole

Ketone – Spironolact*one*

KEY-tone

Phenol – Acetamino*phen*

FEN-ole

Sulfa – *Sulfa*methoxazole

SULL-fuh

Some chemists name drugs:

- By what they do for the patient, also called the therapeutic class: Anti-depressant
- By their chemical structure: Tricyclic antidepressants (TCAs) (three rings in the compound)
- By the receptor they affect: Beta-blockers
- By the neurotransmitter they affect: Selective serotonin reuptake inhibitor (SSRI)

You will become familiar with these classifications as we progress through the book. That's another big reason you want to be around other people when discussing the medications. You will pick up the pronunciation as you make mistakes or listen to others make mistakes. There is no shame in this; it's a part of learning. You cannot exactly pick up pronunciation from looking at brand and generic names. However, if you pay attention to drug names, you will find clues for building strong mnemonics.

HOMOPHONES

In grade school, you may have learned the word "homophone." Homophones are words that sound the same, but that we spell differently. Some examples include the words "there" and "their," "two" and "too," and "hear" and "here." To remember which meaning is associated with the word, your teacher may have told you to look inside the word for a clue.

In the word "their" you find "heir," such as the person who will inherit something. Then you can associate that the word "their" has to do with the possessive form of a group of people versus "there" which means "in that place."

In the word "two," you can turn the "w" sideways to make a 3, spelling "t3o" to remember that two has to do with a number. Also, "too" has two o's, and you can remember that it has too many o's.

In the word "hear" you find the word "ear," which reminds you this word means to listen, versus "here" which means "in this place."

Those clues are mnemonic devices, something to help your memory. Mnemonics also work in the memorization of drugs.

Note: The word mnemonic comes from the name Mnemosyne, the goddess of memory in Greek mythology.

MNEMONICS IN PHARMACOLOGY

The brand name **Prilosec,** a proton pump inhibitor for reducing stomach acid, contains "Pr" which can be short for "proton" (H+), the ion associated with something acidic. **Prilosec** contains "l-o" which can be short for "low" as in the opposite of high. **Prilosec** contains "sec" which can be short for "secretion."

Prilosec's mechanism of action (MOA) is to inhibit proton pumps and reduce the acid in a person's stomach. By looking at the name of the drug, we can see that "proton" "low" "secretion" means a reduction in protons, helping us remember the meaning of the word.

However, if you only remembered the generic name, **omeprazole,** and forgot what the stem –prazole meant or what the drug was for, you would be in trouble. Brand names serve as a back-up plan.

When developing my mnemonics, I did not call anyone at any brand name drug companies. I just looked at each drug name and used my experience as a teacher of pathophys, pharmacology, and organic and biochemistry, and made up something that seems to make sense, but that, more importantly, will help students remember the drug's drug class and / or function. The FDA does not allow a drug company to name a drug after its intended use, but there are hints in many drug names that you can definitely see.

3 BY 5 NOTECARDS

Many students prefer to use notecards rather than just relying on a book. I think you can get everything you need from this book alone, but I know that 3 by 5 notecards you *make* are much better than any you can *buy.* A book from Harvard University Press titled *Make It Stick: The Science of Successful Learning,* by Peter Brown, goes into why generative (making things) learning is so important.

Notecards are portable. You can sort them and challenge others to sort them like UNO or playing cards. To help you along, I have created a specific order that makes sense out of these 200 cards so you know *how* to sort them. The "how to sort them" aspect is the next level of learning beyond memorizing the purpose of drugs or their generic and brand names.

Drugs next to each other are related and those within a group are in a larger family based on physiologic system. As you go through the book, you will see connections between the drug before and after the one you are studying.

You will also see what *types* of connections are available in addition to those you know already. We will take small steps, but I know you will be impressed when you can name every single drug's brand name, generic name, and class from memory.

Here is what a notecard might look like:

3x5 card front:
famotidine

3x5 card back:
Class: H2 blockers have the stem "-tidine." Looks like "to dine," which can be associated with GERD.

The brand name **Pepcid** has the "pep" from peptic, which means digestion, and the "cid" from acid.

COMPREHENSIVE DRUG LIST DISCUSSION

I didn't make this three-page list to intimidate you. It's just that if you spread out 200 3 x 5 notecards, 10 down and 20 across, it makes an area 4 feet by 8 feet. This list helps you see the whole forest – connections between drugs and stems unapparent in a stack of cards.

Start by memorizing the seven pathophysiologic classes in this book in order as G-M-RINCE, as Grand Mothers RINCE kids' hair (except it's the French r-i-n-c-e instead of the English r-i-n-s-e) to set up the broadest framework. These seven pathophysiologic classes will be the steel reinforcing bars that, when surrounded by concrete, will provide the foundation for your memorizing the gastrointestinal (G), musculoskeletal (M), respiratory (R), immune (I), neuro (N), cardio (C), and endocrine (E) systems' medications.

This G-M-RINCE order places drug classes from easiest to hardest to learn. To make it easier to memorize the whole thing, I had to create some simple rules – a computer programmer might call these algorithms. In each section, these are the two major rules:

1. Each of the seven sections has over-the-counter medications presented first and then prescription medications after. I present all OTC gastrointestinal products before all RX products, so the drugs consumers can physically interact with at the pharmacy come first.

2. I alphabetized drugs in the same class unless there is a pharmacologic reason to consider them out of alphabetical order.

For example, **diphenhydramine,** a 1st-generation antihistamine that starts with "d," would go before **cetirizine,** a 2nd-generation antihistamine that starts with "c." The generational move from 1st to 2nd overrides the alphabetical order. However, **cetirizine** and **loratadine** are both 2nd generation antihistamines so those *are* in alphabetical order. Therefore, the order becomes **diphenhydramine, cetirizine, loratadine** – one first-generation and two second-generation antihistamines.

This is how our brains work – ever consolidating and organizing until meaning emerges from a compact, somewhat fractured list. The ultimate goal is to consolidate all seven chapters in the comprehensive drug list. You shouldn't need 200 notecards to memorize 200 drugs; you should only need 7 – one for each physiologic group.

COMPREHENSIVE DRUG LIST

(Bolded Drugs generally do not require a prescription)

Chapter 1 – Gastrointestinal

Calcium carbonate

Magnesium hydroxide

Famotidine

Ranitidine

Esomeprazole

Omeprazole

Bismuth subsalicylate

Loperamide

Docusate sodium

Polyethylene glycol

Ondansetron

Promethazine

Infliximab

Chapter 2 – Musculoskeletal

Aspirin

Ibuprofen

Naproxen

Acetaminophen

ASA/APAP/Caffeine

Meloxicam

Celecoxib

Morphine

Fentanyl

Hydrocodone/APAP

Oxycodone/APAP

APAP/Codeine

Tramadol

Naloxone

Eletriptan

Sumatriptan

Methotrexate

Abatacept

Etanercept

Alendronate

Ibandronate

Cyclobenzaprine

Diazepam

Allopurinol

Febuxostat

Chapter 3 – Respiratory

Diphenhydramine

Cetirizine

Loratadine

Loratadine-D

Pseudoephedrine

Phenylephrine

Oxymetazoline

Triamcinolone

Guaifenesin/DM

Guaifenesin/codeine

Methylprednisolone

Prednisone

Budesonide/Formoterol

Fluticasone/Salmeterol

Fluticasone

Albuterol

Albuterol/Ipratropium

Tiotropium

Montelukast

Omalizumab

Epinephrine

Chapter 4 – Immune

Neomycin /

Polymyxin-B /

Bacitracin

Butenafine

Influenza vaccine

Docosanol

Amoxicillin

Amoxicillin / Clavulanate

Cephalexin

Ceftriaxone

Cefepime

Vancomycin

Doxycycline

Minocycline

Azithromycin

Clarithromycin

Erythromycin

Clindamycin

Linezolid

Amikacin

Gentamicin

Sulfamethoxazole / Trimethoprim

Ciprofloxacin

Levofloxacin

Metronidazole

Rifampin

Isoniazid (INH)

Pyrazinamide (PZA)

Ethambutol

Amphotericin B

Fluconazole

Nystatin

Oseltamivir

Zanamivir

Acyclovir

Valacyclovir

Palivizumab

Enfuvirtide (T-20)

Maraviroc (MVC)

Efavirenz / Emtricitabine / Tenofovir (EFV/FTC/TDF)

Raltegravir (RAL)

Darunavir (DRV)

Chapter 5 – Neuro

Benzocaine

Lidocaine

Meclizine

Acetaminophen PM

Eszopiclone

Zolpidem

Ramelteon

Citalopram

Escitalopram

Sertraline

Fluoxetine

Paroxetine

Duloxetine

Venlafaxine

Amitriptyline

Isocarboxazid

Bupropion

Varenicline

Alprazolam

Midazolam

Clonazepam

Lorazepam

Dexmethylphenidate

Methylphenidate

Atomoxetine

Lithium

Chlorpromazine

Haloperidol

Risperidone

Quetiapine

Carbamazepine

Divalproex

Phenytoin

Gabapentin

Pregabalin

Levodopa / carbidopa

Selegiline

Memantine

Donepezil

Scopolamine

Chapter 6 – Cardio

Omega-3-Acid E.E.

Niacin

Aspirin (Low Dose)

Mannitol

Furosemide

Hydrochlorothiazide

HCTZ / Triamterene

Spironolactone

Potassium Chloride

Doxazosin

Clonidine

Propranolol

Atenolol

Metoprolol Succinate

Metoprolol Tartrate

Carvedilol

Enalapril

Lisinopril

Losartan

Olmesartan

Valsartan

Diltiazem

Verapamil

Amlodipine

Nifedipine

Nitroglycerin

Atorvastatin

Rosuvastatin

Fenofibrate

Heparin

Enoxaparin

Warfarin

Dabigatran

Clopidogrel

Digoxin

Atropine

Chapter 7 Endocrine and Misc.

Regular Insulin

NPH Insulin

Levonorgestrel

Metformin

Sitagliptin

Glipizide

Glyburide

Glucagon

Insulin lispro

Insulin glargine

Levothyroxine

Propylthiouracil

Testosterone

Ethinyl Estradiol / Norethindrone / Ferrous fumarate (Loestrin 24 Fe)

Ethinyl Estradiol / Norgestimate (Tri-Sprintec)

Ethinyl Estradiol / Etonogestrel (NuvaRing)

Ethinyl Estradiol / Norelgestromin (OrthoEvra)

Oxybutynin

Solifenacin

Tolterodine

Bethanechol

Sildenafil

Tadalafil

Alfuzosin

Tamsulosin

Dutasteride

Finasteride

(Oral contraceptives brand names in parenthesis for clarity)

THE OTC SCAVENGER HUNT

I learned drug names by working in a pharmacy. I recommend you start learning them with this lab activity. Medications you have held will be easier to memorize. If you are in the car driving and listening to the audio version of this book, obviously, just keep going, but I encourage you to try this activity when you have a chance.

Picture finding the drugs in an alphabetical list. It's not very conducive to memorization.

Acetaminophen

Acetaminophen PM

ASA/APAP/Caffeine

Aspirin (Low Dose)

Aspirin (Regular)

Benzocaine

Bismuth subsalicylate

Butenafine

Calcium carbonate

Cetirizine

Diphenhydramine

Docosanol

Docusate sodium

Esomeprazole

Famotidine

Guaifenesin/DM

Ibuprofen

Influenza vaccine

NPH insulin

Regular insulin

Levonorgestrel

Lidocaine

Loperamide

Loratadine

Loratadine-D

Magnesium hydroxide

Meclizine

Naproxen

Neomycin / Polymyxin B / Bacitracin

Niacin

Omega-3 E.E.

Omeprazole

Oxymetazoline

Phenylephrine

Polyethylene gly.

Pseudoephedrine

Ranitidine

Triamcinolone

Now picture (or actually find) this list sorted by pathophysiologic class. This is how pharmacies sort over-the-counter (OTC) drugs for placement on drug store shelves.

Gastrointestinal

Calcium carbonate

Magnesium hydroxide

Famotidine

Ranitidine

Esomeprazole

Omeprazole

Bismuth subsalicylate

Loperamide

Docusate sodium

Polyethylene gly.

Musculoskeletal

Aspirin (Regular)

Ibuprofen

Naproxen

Acetaminophen

Acetaminophen / Aspirin / Caffeine

Respiratory

Diphenhydramine

Cetirizine

Loratadine

Loratadine-D

Pseudoephedrine

Phenylephrine

Oxymetazoline

Triamcinolone

Guaifenesin / DM

Immune

Neomycin / Polymyxin B / Bacitracin

Butenafine

Docosanol

Influenza vaccine

Neuro

Benzocaine

Lidocaine

Meclizine

Acetaminophen PM

Cardio

Omega-3-Fatty E.E.

Niacin

Aspirin (Low Dose)

Endocrine

Regular insulin

NPH insulin

Levonorgestrel

You will find the second list often grouped together in the pharmacy aisles. The same is true in your brain. It remembers drugs in related groups, not in strict alphabetical order. In each chapter, I will build on this concept providing:

- Drug class summaries
- Brand / generic pronunciations
- Mnemonics created by students and instructors
- Two quizzes (one easier / one harder)
- A comprehensive chapter mnemonic

CHAPTER 1 GASTROINTESTINAL

I. PEPTIC ULCER DISEASE

Clinicians diagnose peptic ulcer disease (PUD) when an ulceration of the peptic or digestive tract occurs. Acid is an aggressive factor in the stomach that, if reduced, allows an ulcer to heal. In this chapter we'll focus on antacids, histamine2 receptor antagonists (also known as H2 blockers), and proton pump inhibitors. Note: antibiotics eradicate *Helicobacter pylori,* the organism responsible for the ulcers, but we will tackle those in chapter 4.

ANTACIDS

Antacids, or literally, anti-acids, can contain the elements **calcium** and **magnesium** to raise the stomach's pH. The *pH scale* is like a one-foot long ruler with 14 lines instead of 12. A "0" sits left for the most acidic compounds and a "14" sits right for the most basic or alkaline ones. 7, which is in the middle, is neutral. Stomach acid has a pH of 2; milk is 6; neutral is 7; and blood is 7.35. Why give dairy milk, which is slightly acidic, to calm an acidic stomach? Because 6 is more basic (alkaline) than 2.

Besides acting as an antacid, **calcium carbonate (Tums)** can supplement calcium in a diet and **magnesium hydroxide (Milk of Magnesia)** works as a laxative. Unfortunately, both antacids can **chelate** (bind with) antibiotics like **doxycycline (Doryx)** and **ciprofloxacin (Cipro).**

Calcium carbonate (Tums, Children's Pepto)

CAL-see-um CAR-bow-nate (TUMS)

> Students associate the brand name Tums with the word tummy to remember it's an antacid. **Calcium carbonate (Children's Pepto)** and **bismuth subsalicylate (Adult Pepto-Bismol)** have different ingredients and should not be interchanged.

Magnesium Hydroxide (Milk of Magnesia)

mag-KNEES-e-um high-DROCKS-ide (MILK mag-KNEE-shuh)

> **Milk of Magnesia** looks like dairy milk, which can work similarly to an antacid in calming an acidic stomach. Put together the "milky texture" and the diarrhea of lactose intolerance to remember its laxative effect.

HISTAMINE2 RECEPTOR ANTAGONISTS (H2RAS)

The term H2 blocker (more formally, H2 receptor antagonist) stands for histamine receptor type two (H2) blocker. Histamine2 causes the formation of acid, so blocking its receptors reduces the production of acid. You will notice **ranitidine (Zantac)** and **famotidine (Pepcid)** both end in "tidine." Related drugs often have related stems in their names.

When someone says, "I need an antihistamine," they are generally looking for relief from allergic symptoms like sneezing, runny nose, watery eyes, etc. Those allergy antihistamines affect histamine one

(H1) receptors. We will cover those in the respiratory chapter.

Famotidine (Pepcid)

Fa–MOE–ti–dean (PEP-sid)

Famotidine has the "-tidine" stem indicating it's an H2 blocker. **Pepcid** contains "pep" from "peptic" and "pepsin" that relates to digestion, and "cid" from "acid." One student mentioned Pepsi, the soda, has a pH of 2.4, which is very acidic. She said it always gave her heartburn, so that's how she remembered **Pepcid.** Also, in soda pop, the "p-o-p" and **Pepcid's** "p-e-p" are very similar.

Ranitidine (Zantac)

ra-NI-ti-dean (ZAN-tack)

One student said **ranitidine's** "-tidine" looks like "to dine," the time patients might experience gastroesophageal reflux disease (GERD). **Zantac** looks like a "2" with "antac" after it, so it's an H2 blocker, which works as an ant-agonist to ac-id.

PROTON PUMP INHIBITORS (PPIS)

Proton pump inhibitors (PPIs) block a pump that introduces protons (which are acidic) into the stomach, thus making it less acidic. Prescribers combine PPIs with antibiotics for ulcer triple therapy to kill *H. pylori*.

While **esomeprazole (Nexium)** and **omeprazole (Prilosec)** have the same ending "prazole," notice the only thing that separates **omeprazole** and **esomeprazole** is an "es." Many drugs have chemical structures that have mirror images called enantiomers. Instead of calling them right- and left-handed, we call them "R" and "S" from the Latin words *rectus* (right) and *sinister* (left).

In this case, the "S" form is more active biologically. Putting an "s" in front of omeprazole would make "someprazole," which would be pronounced "some-prazole." Instead, the prefix "es" allows for a separation between the "S" sound and the compound name, as a chemist would pronounce it.

Esomeprazole (Nexium)

es-oh-MEP-rah-zole (NECKS-see-um)

The "prazole" ending means PPI and the "e-s" means "S" for sinister or left-handed. The manufacturer released **Nexium** after **Prilosec** as the "next" PPI drug.

Omeprazole (Prilosec)

oh-MEP-rah-zole (PRY-low-sec)

The "prazole" ending in **omeprazole** indicates proton pump inhibitor (PPI). We remember **Prilosec** by the "Pr" for hydrogen protons (protons, or hydrogen ions, are what make an acid acidic), the "lo" for low, and the "sec" for secretion of those protons. Or, the "o" in Prilosec looks like a zero, and **Pril-"O"-sec** provides zero heartburn.

II. DIARRHEA, CONSTIPATION, AND EMESIS

Diarrhea can lead to dehydration and sometimes we need to intervene and use over-the-counter medications like **bismuth subsalicylate (Pepto-Bismol)** or **loperamide (Imodium).**

Bismuth's **"subsalicylate"** is similar to aspirin (acetyl**salicylic** acid), and is dangerous to young children. **Bismuth subsalicylate (Pepto Bismol)** is not appropriate for children because of the risk of **Reye's syndrome,** a condition involving brain and liver damage that can occur in children with chicken pox or influenza who take **salicylates.**

Opioids like **morphine (Kadian)** decrease gastrointestinal tract motility, causing constipation. Calcium channel blockers like **verapamil (Calan)** block calcium from getting to the bowel's smooth muscle. Prescribers frequently give a stool softener like **docusate sodium (Colace)** and a stimulant laxative for constipation caused by these medications, or due to other causes.

Emesis or vomiting is an effective natural body response to ingested toxins. However, with cancer chemotherapy, we want to prevent chemotherapy-induced nausea and vomiting (CINV) with drugs like **ondansetron (Zofran).**

Manufacturers specially formulate these meds because nausea patients may vomit oral meds.
For example, **ondansetron (Zofran)** comes as an orally disintegrating tablet (ODT) that patients take without water, and **promethazine (Phenergan)** as a rectal suppository.

ANTIDIARRHEALS

Bismuth Subsalicylate (Pepto-Bismol)

BIZ-muth sub-sal-IS-uh-late (pep-TOE BIZ-mol)

> The "b" in **bismuth subsalicylate** reminds students of the black tongue and black stool that some patients experience as side effects. (Note: This discoloration is harmless.) **Pepto** looks like peptic, which has to do with digestion.

Loperamide (Imodium)

Low-PER-uh-mide (eh-MOE-dee-um)

> The "lo" for slow and "per" for peristalsis is how a student remembered **loperamide's** function. **Imodium** is like the word "immobile" in that it slows down the bowel.

CONSTIPATION – STOOL SOFTENER

Docusate Sodium (Colace)

DOCK-you-sate SEWED-e-um (CO-lace)

Docusate sodium softens the stool. Patients use it with opioids like **morphine (Kadian). Docusate** and "penetrate" rhyme, and **docusate sodium** works by helping water penetrate into the bowel. The brand **Colace** improves the colon's pace.

CONSTIPATION – OSMOTIC

Polyethylene Glycol (PEG) 3350 (MiraLax)

pa-Lee-ETH-ill-een GLY-call (MIR-uh-lacks)

I remember **polyethylene glycol** because I have triplets **"poly"** calling **"col"** for me, "Daaaaaad! Can you wipe me?" **MiraLax** is the Miracle Laxative because it's a miracle how good you feel after taking it. By prescription, **Go-Lytely** is a 4-liter plastic bottle of **polyethylene glycol** used for colonoscopy examination preparation. There is nothing "lightly" about it.

ANTIEMETIC – SEROTONIN 5-HT3 RECEPTOR ANTAGONIST

Ondansetron (Zofran, Zofran ODT)

on-DAN-se-tron (ZO-fran)

The "setron" suffix will help you remember **ondansetron** is a serotonin 5-HT3 receptor antagonist for preventing emesis. "O-D-T" stands for orally disintegrating tablet. It is a useful dosage form because it dissolves on the top of the tongue and requires no additional liquid. If you are good at word scrambles, **ondansetron** has every letter but the "i" in serotonin, a neurotransmitter, the majority of which is located in the GI tract.

ANTIEMETIC – PHENOTHIAZINE

Promethazine (Phenergan)

pro-METH-uh-zeen (FEN-er-gan)

Promethazine is an antihistamine sometimes used in liquid form with codeine. It also reduces nausea. In addition to oral, IM, and IV forms, **promethazine** comes in a rectal suppository form if a patient can't take anything by mouth (po).

III. GASTROINTESTINAL AUTOIMMUNE DISORDERS

Autoimmune diseases like ulcerative colitis (UC) occur when the body's immune system inappropriately attacks an area (or areas) of the body. Symptoms of UC include ulcerations and inflammation (-itis) in the colon. **Infliximab (Remicade)** blocks the tumor necrosis factor, alpha (TNF-alpha), to treat this disease.

ULCERATIVE COLITIS

Infliximab (Remicade)

in-FLIX-eh-mab (REM-eh-cade)

> **Infliximab** is a biologic agent, a genetically engineered protein. **Infliximab's** generic name should be broken up as inf + li +xi + mab. The "inf" is a prefix that simply separates it from other similar drugs. The "li" stands for immunomodulator (the target). The "xi" stands for chimeric (the source, e.g., combining genetic material from a mouse, with genetic material from a human). The "x" might also refer to the Greek letter "chi," which looks like an x. The "mab" stands for monoclonal antibody. Conditions like ulcerative colitis can go into remission. **Remicade** is a "remission aide."

GASTROINTESTINAL DRUG QUIZ (LEVEL 1)

Classify these drugs by placing the corresponding drug class letter next to each medication. Try to underline the stems before you start and think about the brand name and function of each drug. (Click here for answers).

1. Calcium carbonate (Tums)
2. Ranitidine (Zantac)
3. Docusate sodium (Colace)
4. Famotidine (Pepcid)
5. Esomeprazole (Nexium)
6. Loperamide (Imodium)
7. Magnesium hydroxide (Milk of Magnesia)
8. Infliximab (Remicade)
9. Omeprazole (Prilosec)
10. Ondansetron (Zofran)

Gastrointestinal drug classes:

A. Antacid
B. Anti-diarrheal
C. Anti-nausea
D. Constipation
E. H2 blocker
F. Proton pump inhibitor
G. Ulcerative colitis

GASTROINTESTINAL DRUG QUIZ (LEVEL 2)

Classify these drugs by placing the corresponding drug class letter next to each medication. Try to underline the stems before you start and remember the brand name and function of each drug. (Click here for answers).

1. Bismuth Subsalicylate
2. Esomeprazole
3. Omeprazole
4. Polyethylene glycol
5. Promethazine
6. Calcium carbonate
7. Famotidine
8. Docusate sodium
9. Loperamide
10. Ranitidine

Gastrointestinal drug classes:

A. Antacid
B. Anti-diarrheal
C. Anti-nausea
D. Constipation
E. H2 blocker
F. Proton pump inhibitor
G. Ulcerative colitis

GI: MEMORIZING THE CHAPTER

Now that you have had a chance to get to know each of the drugs in the list individually, you are ready to memorize the first thirteen medications in order. I have included the connections I made to assist you in memorizing them, but if you have created better ones, use them. Some students copy and paste the GI drug table on the front of a 4 x 6 card and the "brain shorthand" explanation on the back. Remember, bolded drugs are OTC.

Calcium carbonate

Magnesium hydroxide

Famotidine

Ranitidine

Esomeprazole

Omeprazole

Bismuth subsalicylate

Loperamide

Docusate sodium

Polyethylene glycol

Ondansetron

Promethazine

Infliximab

"G" GASTROINTESTINAL

Broadly speaking, there are 13 drugs in the gastrointestinal section. The first six are acid reducers, the next two are antidiarrheals, the next two are laxatives, the next two are antiemetics, and final one is for ulcerative colitis.

Picture in your mind where in the human body these work. Start with the six acid reducers in the stomach, move to the two laxatives and antidiarrheals that work in the intestines / colon, go back up to the antiemetics to prevent vomiting from the mouth, and back down to the colon to the ulcerative colitis medication. Why this up and down and up and down? It's easiest to start at the stomach and work down to the intestines with OTC drugs, then work top to bottom from the mouth to the intestines with RX drugs.

I ordered the first three pairs of acid reducers from the fastest to slowest working: antacids take a few minutes, H2Blockers take about half an hour, and proton pump inhibitors (PPIs) can take as long as a day. "A" for antacid is first. H2Blocker has "2" for the second group. PPI has three letters for third group.

The antacids **calcium carbonate** and **magnesium hydroxide** are both in the same column on the periodic table of elements in alphabetical order. Two H2 Blockers: **famotidine** and **ranitidine** follow. Two PPIs **esomeprazole** and **omeprazole** follow them. Often diarrhea follows an upset stomach, so we treat with **bismuth subsalicylate** and **loperamide.** Use "L" from loperamide to get to "L" for two laxatives: **docusate sodium** and **polyethylene glycol.** Use the "p-o" from polyethylene reversed as "o-p" for **ondansetron** and **promethazine.** You can rectally administer promethazine next to colon to get to the ulcerative colitis medication – **infliximab.**

Can you recite in order: **calcium carbonate, magnesium hydroxide, famotidine, ranitidine, esomeprazole, omeprazole, bismuth subsalicylate, loperamide, docusate sodium, polyethylene glycol, ondansetron, promethazine, infliximab?**

Do you recognize the stems –tidine, -prazole, -sal-, -setron, -liximab and the therapeutic classes they represent?

Once you've answered these two questions for this chapter and the following chapters, you are ready to move on.

CHAPTER 2 MUSCULOSKELETAL

I. NSAIDS AND PAIN

Non-steroidal anti-inflammatory drugs (NSAIDs) (pronounced *EN-SAIDs)* contrast with the steroidal medications used to treat inflammation. The NSAIDs **aspirin (Ecotrin)** and **ibuprofen (Advil, Motrin)** [taken up to four times daily] and **naproxen (Aleve)** [taken twice daily] are available over-the-counter and are for sporadic or mild pain. **Meloxicam (Mobic)** [once daily] isn't OTC and has the longest half-life. *Analgesics* relieve pain. *Antipyretics* reduce fever. NSAIDs are both.

NSAIDs like **ibuprofen** can close an arterial shunt *(patent ductus arteriosus)* in a preemie. Our newborn daughter had this condition. I watched a YouTube video on the surgery to close the shunt and it took only five minutes, but surgery on any NICU neonate runs a great risk. We were thankful a simple NSAID closed the shunt.

A regular pharmacy question is when to use **acetaminophen (Tylenol)** and when to use an **NSAID.** If the patient has inflammation, prescribers prefer NSAIDs, as analgesics like **acetaminophen** will not help. However, if the patient has pain or fever, then either is appropriate. Generally, NSAIDs are not used for pregnant patients, but **acetaminophen (Tylenol)** can be.

Excedrin Migraine contains three drugs: **aspirin** for pain and inflammation, **acetaminophen** for pain, and **caffeine** as a potent vasoconstrictor. It narrows swollen brain vessels.

Common NSAIDs block both cyclooxygenase (COX) -1 and -2 to minimize inflammatory processes. COX-1 blockade reduces inflammation in the body and, unfortunately, the body's natural protection of the stomach lining. Note that a selective COX-2 inhibitor, like **celecoxib (Celebrex)** does not block the protective effect of COX-1 against stomach ulcers and this is why it's supposed to be a better choice.

OTC ANALGESICS – NSAIDS

Aspirin [ASA] (Ecotrin)

AS-per-in (ECK-oh-trin)

> The acronym for aspirin, "ASA," comes from the chemical name: AcetylSalicylicAcid. **Ecotrin** is enteric-coated aspirin.

Ibuprofen (Advil, Motrin)

eye-byou-PRO-fin (ADD-vil, MO-trin)

> Many students try to say that **ibuprofen** and **naproxen** both end with "en." However, many drugs end with "e-n," so that won't help in a large multiple-choice exam. A better mnemonic is to notice that "-profen" from **ibuprofen** is a recognized stem and differs from "proxen" in **naproxen** by only one letter.

Naproxen (Aleve)

nap-ROCKS-in (uh-LEAVE)

While **naproxen** has no formal stem, a student came up with a mnemonic for the brand name: **Aleve will** alleviate pain from strains and sprains.

OTC ANALGESIC – NON-NARCOTIC

Acetaminophen [APAP] (Tylenol)

uh-seat-uh-MIN-no-fin (TIE-len-all)

The brand **Tylenol,** generic **acetaminophen,** and acronym **APAP** all come from the chemical name:

N-acetyl-para-amino-phenol **(Tylenol)**

N-acetyl-para-amino-phenol **(Acetaminophen)**

N-Acetyl-Para-Amino-Phenol **(APAP)**

OTC MIGRAINE – NSAID / NON-NARCOTIC ANALGESIC

Aspirin / Acetaminophen / Caffeine (Excedrin Migraine)

AS-per-in / uh-seat-uh-MIN-oh-fin / KAF-feen (ecks-SAID-rin)

Most students remember **Excedrin Migraine** by the rationale for the combination of **ASA / APAP / caffeine:** inflammation / analgesia / vasoconstriction.

RX ANALGESICS – NSAIDS

Meloxicam (Mobic)

mel-OX-eh-kam (MO-bik)

The "-icam" suffix in the generic name **meloxicam** lets you know it's an NSAID. A student used the "bic" in **Mobic** to remember it treats "big" swelling.

RX ANALGESICS – NSAIDS – COX-2 INHIBITOR

Celecoxib (Celebrex)

sell-eh-COCKS-ib (SELL-eh-breks)

The "–coxib" suffix lets you know celecoxib is a selective COX-2 inhibitor. The commercials for **Celebrex** talk about celebrating relief from inflammatory conditions. Regular NSAIDs like **ibuprofen** and **naproxen** inhibit both COX-1 and COX-2, causing the stomach distress so commonly caused by drugs in the NSAID class. **Celebrex** causes less GI irritation due to its lack of COX-1 inhibition.

II. OPIOIDS AND NARCOTICS

Opioids relieve pain, but have addiction potential. The DEA (Drug Enforcement Agency) categorizes the addictive potential of medications using a drug scheduling system.

Schedule I drugs are illegal substances and have no medical value, such as **heroin.**

Schedule II drugs are potentially addicting, such as the individual drugs **fentanyl (Duragesic, Sublimaze)** and **morphine (Kadian),** and the combination products **hydrocodone / APAP (Vicodin)** and **oxycodone / APAP (Percocet).**

Schedule III drugs are less addicting and include **acetaminophen / codeine (Tylenol with codeine).**

Schedule IV drugs include some sedative-hypnotics (sleeping pills) such as **zolpidem (Ambien)** and mixed opioid analgesics like **tramadol (Ultram).**

Schedule V drugs are often cough medicines like g**uaifenesin / codeine (Cheratussin AC)** that include codeine, but not **codeine** as a drug alone.

An opioid side effect is pinpoint pupils called miosis. A student remembered this by noticing that the words “opioid” and “miosis” both have two little dots over the two i’s that look like pinpoint pupils.

OPIOID ANALGESICS – SCHEDULE II

Morphine (Kadian, MS Contin)

MORE-feen (KAY-dee-en, EM-ES KON-tin)

The generic name **morphine** comes from the ancient Greek god of dreams, Morpheus. **Kadian** might come from cir**cadian** (the twenty-four-hour cycle) because **Kadian** is an extended-release morphine formulation. **MS Contin** stands for **m**orphine **s**ulfate **contin**uous release.

Fentanyl (Duragesic, Sublimaze)

FEN-ta-nil (dur-uh-GEE-zic, SUB-leh-maze)

Fentanyl is troubling because it’s dosed in micrograms, not milligrams. When it was time to give our three-month-old preemie **fentanyl** after her pyloric valve stenosis surgery in the Neonatal Intensive Care Unit (NICU), I made sure to check the calculated dose. **Duragesic** is a long **dura**tion anal**gesic** and comes in a patch that provides relief for 72 hours. **Sublimaze** is an injectable form of **fentanyl.**

Hydrocodone / Acetaminophen (Vicodin)

high-droe-CO-done / uh-seat-uh-MIN-no-fin (VIE-co-din)

Hydrocodone and **oxycodone** differ slightly in chemical structure. **Oxycodone** has one more oxygen than **hydrocodone. Oxycodone/APAP** gets its name from the first three letters of *oxy*gen. **Hydrocodone/APAP** has only one hydrogen and gets its name from the first five letters of *hydro*gen. The "c-o-d-i-n" in **Vicodin** looks like **codeine,** just drop two e's from codeine, so you can remember they are related.

Oxycodone/Acetaminophen (Percocet)

ox-e-CO-done / uh-seat-uh-MIN-no-fin (PER-coe-set)

The "cet" in **Percocet** comes from acetaminophen. Some students use that "codone" and "codeine" look a little alike to remember the similarity, but this is not a true stem and **Percocet** does not contain codeine. Drug companies add **acetaminophen** as a mild analgesic.

OPIOID ANALGESICS – SCHEDULE III

Acetaminophen/Codeine (Tylenol/Codeine, Tylenol #3)

uh-seat-uh-MIN-no-fin with CO-dean

(TIE-len-all with CO-dean, TIE-len-all NUM-ber three)

I am not sure why, but when you say the generic name of **Vicodin,** you say **"hydrocodone with acetaminophen,"** but when you talk about **codeine,** the order is reversed. It's phrased as **"acetaminophen with codeine" (Tylenol w/codeine).**

Students seem to remember both because of the reverse / opposite order. The "#3" in **Tylenol #3** refers to the amount of codeine in combination. For example:

Tylenol #2 15 mg codeine / 300 mg acetaminophen

Tylenol #3 30 mg codeine / 300 mg acetaminophen

Tylenol #4 60 mg codeine / 300 mg acetaminophen

MIXED-OPIOID RECEPTOR ANALGESIC – SCHEDULE IV

Tramadol (Ultram)

TRA-muh-doll (ULL-tram)

Tramadol only weakly affects opioid receptors. For this reason, the DEA did not classify **tramadol** as a controlled substance until 2014. The "–adol" stem indicates that it's a mixed opioid analgesic. Many students have thought of "tram wreck" and "train wreck" as a way to remember that **Ultram** is used for pain.

OPIOID ANTAGONIST

Naloxone (Narcan)

nah-LOX-own (NAR-can)

Naloxone is an opioid receptor antagonist used in opioid overdose situations. Often it's in the L-E-A-N acronym of emergency medicines **lidocaine, epinephrine, atropine,** and **naloxone.** The "nal-" stem in **naloxone** indicates it's an opioid receptor antagonist, but the brand name **Narcan** also hints at a narcotic antagonist.

III. HEADACHES AND MIGRAINES

Common OTC drugs for headache and migraine include the NSAIDs like **aspirin (Ecotrin), ibuprofen (Advil, Motrin), naproxen (Aleve),** and the combination **ASA / APAP / Caffeine (Excedrin Migraine)** reviewed earlier.

Sometimes severe migraines require drugs in the 5-HT1 receptor agonist class, such as **eletriptan (Relpax)** and **sumatriptan (Imitrex)** that work by activating receptors that reduce the swelling associated with migraines. We call them **triptans** because those two syllables are easier to say than "5-hydroxytryptamine receptor agonists" is.

It's important to contrast the terms **agonist** and **antagonist** as opposites. An agonist is a drug that activates a receptor while an antagonist blocks the receptor. There is no reason to *produce* migraines, but a 5-HT1 receptor *antagonist* would likely cause a headache, whereas the corresponding agonist alleviates headaches. One student thought of agonists as when she first stepped on an elliptical exercise machine and it awakened the screen. She thought of antagonist as her own excuses why she could not work out. Another metaphor you will often see is that of dating. There are some funny videos on YouTube about agonism versus antagonism. The agonist is usually someone who wants to get a date and the antagonist tries to block the suitor.

5-HT1 RECEPTOR AGONIST

Eletriptan (Relpax)

el-eh-TRIP-tan (rel-PACKS)

> Remember **eletriptan** from its suffix "–triptan" so you can recognize the many other medications in the triptan class. The brand name **Relpax** combines "pax," the Latin word for "peace" and "Rel," for "relief." I often confused whether this was an agonist or antagonist, but use the "agony" of a migraine to remember triptans as agonists.

Sumatriptan (Imitrex)

Sue-ma-TRIP-tan (IM-eh-treks)

> Remember **sumatriptan** from its suffix "–triptan." Students say it "trips up" a headache. Also, the "i-m" in the brand name **Imitrex** reminds you there is an intramuscular (IM) form for patients who have such a severe migraine that they can't take anything by mouth.

IV. DMARDS AND RHEUMATOID ARTHRITIS

DMARD stands for **D**isease-**M**odifying **A**nti-**R**heumatic **D**rug, which means it works against *rheumatoid arthritis*, an autoimmune disorder. These drugs reduce the progression of the disease as opposed to the treatment of *osteoarthritis*, a condition in which the body has worn down and the joints are inflamed.

Both conditions respond to NSAID anti-inflammatories such as **ibuprofen (Advil, Motrin)** or a**spirin (Ecotrin).** Additionally, glucocorticoids, such as **prednisone (Deltasone),** can further help reduce inflammation in the joints.

Prescribers use special immune-suppressing drugs called DMARDs like **methotrexate (Rheumatrex), abatacept (Orencia)** and **etanercept (Enbrel)** for rheumatoid arthritis.

DMARDS

Methotrexate (Rheumatrex)

meth-oh-TREKS-ate (ROOM-uh-treks)

> One student came up with “Meth o T-Rex ate the rheumatic inflammate.” The “rheuma” in the brand name **Rheumatrex** reminds you it relieves rheumatoid arthritis.

Abatacept (Orencia)

uh-BAT-uh-sep” (or-EN-see-uh)

> **Abatacept** and **etanercept** have complex stems. The “-ta-” infix in **abatacept** means it’s going after T-cell receptors and the suffix “–cept” means that it’s a re**cept**or molecule, either native or modified.

Etanercept (Enbrel)

eh-ta-NER-sept (EN-brell)

> Learn **etanercept** and **abatacept** from the suffix “–cept” with the added sub-stem “-tacept” or “-nercept” respectively. The “-ner-” infix in **etanercept** point out that it goes after tumor necrosis factor receptors.

V. OSTEOPOROSIS

Don't confuse *osteoarthritis*, a joint disease, with *osteoporosis*, a thinning in bone tissue density. Drugs for osteoarthritis include the NSAIDs. Drugs for osteoporosis build bone back up. Humans' bones grow slowly. Therefore, drugs like **alendronate (Fosamax)** can be given weekly, and **ibandronate (Boniva)** can be given monthly. A special precaution for patients using **alendronate** is to not lie down for 30 minutes after taking the medication; for **ibandronate,** it's 60 minutes.

BISPHOSPHONATES

Alendronate (Fosamax)

uh-LEN-dro-nate (FA-seh-max)

Memorize **alendronate** as a calcium metabolism regulator from its "-dronate" stem. Students like to remember that "drone" rhymes with bone. Many students have said that the brand name **Fosamax** looks like "fossil."

Ibandronate (Boniva)

eh-BAND-row-nate" (bo-KNEE-vuh)

Again, the "–dronate" suffix should be your key to the drug class, but having the first three letters of bone in the brand name **Boniva** helps. The generic **ibandronate** contains all the letters in **Boniva** except the "v."

VI. MUSCLE RELAXANTS

The DEA doesn't schedule **cyclobenzaprine (Flexeril),** but does schedule **diazepam (Valium)** as C-IV. Both drugs provide muscle relaxation and relief from muscle spasms.

Cyclobenzaprine (Flexeril)

sigh-clo-BENDS-uh-preen (FLEX-er-ill)

> **Cyclobenzaprine** helps you get bending again.
>
> **Flexeril** improves flexibility.

Di<u>azepam</u> (Valium)

dye-AY-zeh-pam" (VAL-e-um)

> **Diazepam** and benzo**diazep**ine, diazepam's drug class, have similar letters. **<u>Val</u>**erian root is an herbal remedy for anxiety; some think of **Valium** as relaxing both anxiety and muscles in the same way.

VII. GOUT

Gout is an acute inflammatory arthritis we treat acutely (right away) with an NSAID like **ibuprofen (Advil, Motrin)** We can treat also treat gout prophylactically by reducing uric acid, a major component in the crystals that cause the gouty pain. Drugs that alter uric acid levels include **allopurinol (Zyloprim)** and **febuxostat (Uloric).**

URIC ACID REDUCERS

Allopurinol (Zyloprim)

a-loe-PURE-in-all (ZY-low-prim)

> Within **allopurinol,** you can see "uri," which corresponds to the uric acid the medication reduces. You can also remember this is an anti-arthritic by thinking of the joints as becoming "all-pure-and-all."

Febu<u>xostat</u> (Uloric)

fe-BUCKS-oh-stat (YOU-lore-ick)

> The "-xostat" stem in **febuxostat** indicates a <u>x</u>anthine <u>o</u>xidase inhibitor that prevents uric acid from forming. The "x" and "o" in the generic name match xanthine oxidase. The brand name **Uloric** looks like "U" "lower" "uric acid."

MUSCULOSKELETAL DRUG QUIZ (LEVEL 1)

Classify these drugs by placing the corresponding drug class letter next to each medication. Try to underline the stems before you start and think about the brand name and function of each drug. (Click here for answers).

1. Acetaminophen (Tylenol)
2. Alendronate (Fosamax)
3. ASA/APAP/Caffeine (Excedrin)
4. Febuxostat (Uloric)
5. Etanercept (Enbrel)
6. Fentanyl (Duragesic)
7. Hydrocodone / APAP (Vicodin)
8. Ibuprofen (Advil, Motrin)
9. Celecoxib (Celebrex)
10. Sumatriptan (Imitrex)

Musculoskeletal Drug Classes:

A. 5-HT1 receptor agonist
B. Anti-gout
C. Bisphosphonate
D. DMARD
E. Non-narcotic analgesic – single
F. Non-narcotic analgesic combo – headache
G. NSAID not COX-2 selective
H. NSAID COX-2 selective
I. Opioid analgesic

MUSCULOSKELETAL DRUG QUIZ (LEVEL 2)

Classify these drugs by placing the corresponding drug class letter next to each medication. Try to underline the stems before you start and remember the brand name and function of each drug. (Click here for answers).

1. Methotrexate
2. Morphine
3. Abatacept
4. Naproxen
5. Febuxostat
6. Ibandronate
7. Allopurinol
8. Aspirin
9. Alendronate
10. APAP/Codeine

Musculoskeletal Drug Classes:

A. 5-HT1 receptor agonist
B. Anti-gout
C. Bisphosphonate
D. DMARD
E. Non-narcotic analgesic – single
F. Non-narcotic analgesic combo – headache
G. NSAID not COX-2 selective
H. NSAID COX-2 selective
I. Opioid analgesic

MUSCULOSKELETAL: MEMORIZING THE CHAPTER

Aspirin

Ibuprofen

Naproxen

Acetaminophen

ASA/APAP/Caffeine

Meloxicam

Celecoxib

Morphine

Fentanyl

Hydrocodone/APAP

Oxycodone/APAP

APAP/Codeine

Tramadol

Naloxone

Eletriptan

Sumatriptan

Methotrexate

Abatacept

Etanercept

Alendronate

Ibandronate

Cyclobenzaprine

Diazepam

Allopurinol

Febuxostat

"M" MUSCULOSKELETAL

Three OTC NSAIDs, **aspirin, ibuprofen, naproxen,** and then **acetaminophen,** a non-narcotic analgesic. Combine **aspirin / acetaminophen** and **caffeine** to make **Excedrin Migraine.** Use migraine (M) and caffeine (C) to connect **meloxicam** (M) and **celecoxib** (C). Group opioids by DEA class. Start with DEA Schedule II **morphine,** the original agent; then **fentanyl, hydrocodone / APAP,** and **oxycodone / APAP.** Next comes schedule III, **acetaminophen with codeine;** to schedule IV **tramadol;** then to the opioid *narc*otic *antagonist* **naloxone (Narcan);** to migraine agony *agonists* for migraine headache with **eletriptan** and **sumatriptan;** down to rheumatoid arthritis inside the joints with the DMARD **methotrexate,** a non-biologic; to two biologic DMARDs **abatacept** to **etanercept**. From joint pain on to the brittle bones with **alendronate** and **ibandronate** for osteoporosis. Then move out to the muscles and muscle relaxers **cyclobenzaprine** and **diazepam** all the way down to the big toe for the gout meds **allopurinol** and **febuxostat.**

CHAPTER 3 RESPIRATORY

I. ANTIHISTAMINES AND DECONGESTANTS

We divide **antihistamines** into two generations: first and second. **Diphenhydramine (Benadryl)** is a first-generation antihistamine. In addition to its ability to improve allergy symptoms, it usually makes patients sleepy. The second-generation agents cannot pass through the blood-brain barrier and into the central nervous system, which limits the degree of drowsiness patients experience. This second generation includes **cetirizine (Zyrtec)** and **loratadine (Claritin).**

My students came up with a useful / helpful / creative visual to remember the difference between histamine-1 and histamine-2 receptors called the antihistamine snowman. They pictured H1 in the snowman's head because he has only one carrot for his nose, and allergies usually happen in the head / nose. They pictured H2 as the snowman's belly because that's where gastroesophageal reflux disease (GERD) and hyperacidity happen.

Nasal decongestants like **pseudoephedrine (Sudafed)** constrict blood vessels in the nose and sinuses, reducing the amount of mucus that is formed, and can be found in combination with antihistamines. Usually you will see the brand or generic name followed by a hyphen "D" for decongestant, like **Claritin-D** to indicate that **pseudoephedrine** is a product ingredient. These are not over-the-counter (OTC), but behind the counter (BTC) because you have to show an ID to purchase them.

OTC ANTIHISTAMINE 1ST-GENERATION

Diphenhydramine (Benadryl)

dye-fen-HIGH-dra-mean (BEN-uh-drill)

> Many students on YouTube videos and Quizlet notecards mistake **diphenhydramine's** "i-n-e" as a stem because many antihistamines end in "ine." However, so does **morphine** and roughly 20% of all generic names. There is not really a good stem for antihistamines because of this. You can remember the brand name by recognizing **Benadryl** benefits you by drying up your runny nose. Some students also associated the "B" in **Benadryl** with the BBB, the Blood Brain Barrier, which **Benadryl** can pass through. Manufacturers use **diphenhydramine** as the "P-M" in many sleep aids, so associating the "B" in **Benadryl** with bedtime makes sense.

OTC ANTIHISTAMINE 2ND-GENERATION

Cetirizine (Zyrtec)

seh-TIE-rah-zine (ZEER-teck)

> Pronounce the "t-i-r" in **cetirizine** as tear, like teardrop, and I think of **cetirizine** protecting me from tearing from eyes affected by allergies.

Lor<u>atadine</u> (Claritin)

lore-AT-uh-dean (KLAR-eh-tin)

The "–atadine" stem (used to be "–tadine") is helpful in distinguishing **loratadine** from the "–tidine" stem in the H2 receptor antagonists **famotidine** and **ranitidine.** The **Claritin** "clear" commercials resonate with the drug's function of clearing one's head from allergies or clear eyes relieved from allergy.

OTC ANTIHISTAMINE 2ND-GENERATION / DECONGESTANT

Lor<u>atadine</u> / Pseudoephe<u>drine</u> (Claritin-D)

lore-AT-uh-dean / Sue-doe-uh-FED-rin (KLAR-eh-tin dee)

Because **pseudoephedrine** has 15 letters, manufacturers abbreviate it as "hyphen D" for decongestant. Therefore, adding **loratadine,** an antihistamine, to **pseudoephedrine** a decongestant, helps with both runny and stuffy noses.

OTC DECONGESTANTS

Pseudoephe<u>drine</u> (Sudafed)

Sue-doe-uh-FED-rin (Sue-duh-FED)

If you take out the second "e" and drop the "rine" from **pseudoephedrine,** you get the pronunciation of **Sudafed.** One student said she was p-h-e-d up with being congested and that's how she remembered it.

Phenylephrine (NeoSynephrine)

FEN-ill-EF-rin (KNEE-oh-sin-EF-rin)

Phenylephrine sounds a bit like **pseudoephedrine** – they are both decongestants. Patients recognize **pseudoephedrine** by the "hyphen D" and **phenylephrine** by the "PE" abbreviation. **Phenylephrine** is not as strong as **pseudoephedrine** and that's one reason it's available OTC, while **pseudoephedrine** is not.

Oxymetazoline (Afrin)

ox-EE-meh-taz-oh-lin (AF-rin)

Oxymetazoline takes us from physically behind-the-counter (BTC) oral **pseudoephedrine** to over-the-counter oral **phenylephrine** to the intranasal decongestant **oxymetazoline.** The **"Afrin"** brand name sounds like the "ephrine" that forms the ending of **phenylephrine** so you can relate the two decongestants.

II. ALLERGIC RHINITIS STEROID, ANTITUSSIVES AND MUCOLYTICS

Allergic rhinitis is an inflammation (-itis) of the nose (rhin-). We treat it with a local steroid like **triamcinolone (Nasacort Allergy 24HR).** Nasal steroids don't work right away like a topical decongestant such as **oxymetazoline (Afrin)** might; rather, it takes weeks of use until a patient feels relief.

Because the name **"Robitussin"** has been associated with cough relief so long, many students mistakenly confuse plain **Robitussin** (just **guaifenesin)** with **Robitussin DM (guaifenesin / dextromethorphan).** In **Robitussin DM,** the **guaifenesin** acts as a mucolytic to lyse (break up) mucous and chest congestion, while the **DM (dextromethorphan)** acts as the antitussive or cough suppressant. In severe cases, a **codeine**-based prescription product such as **guaifenesin / codeine (Cheratussin AC)** may be used.

OTC ALLERGIC RHINITIS STEROID NASAL SPRAY

Triamcinolone (Nasacort Allergy 24HR)

try-am-SIN-oh-lone (NAY-zuh-cort)

> There is no recognized stem in **triamcinolone,** but often "o-n-e," pronounced like I "own" something, matches the "o-n-e" at the end of **testosterone,** a more familiar steroid. The brand name **Nasacort** reads like a story: "Nasa" for nose, "cort" for corticosteroid, "Allergy" for allergic rhinitis, and "24HR" for how long it works.

OTC ANTITUSSIVE / MUCOLYTIC

Guaifenesin / Dextromethorphan
(Mucinex DM / Robitussin DM)

gwhy-FEN-uh-sin / decks-trow-meth-OR-fan

(MEW-sin-ex dee-em, row-beh-TUSS-in dee-em)

> **Guaifenesin,** pronounced as if you put a "g" in front of "why," is a mucolytic, something that lyses or breaks up mucous. Students remember this because Mr. Mucus from the **Mucinex** commercials is green, which also starts with a "g." **Robitussin** "robs" your cough and "tussin" resembles "tussive." Antitussives are anti-cough medicines.

RX ANTITUSSIVE / MUCOLYTIC

Guaifenesin / Codeine (Cheratussin AC)

gwhy-FEN-uh-sin / CO-dean (CHAIR-uh-tuss-in ay-see)

Sometimes **dextromethorphan (DM)** isn't enough and the patient needs **codeine** to suppress a cough. Most students know **codeine,** but cough and **codeine** both start with "co" and that seems to help. The "chera" in **Cheratussin** comes from the product's cherry flavoring. Some are not sure what the "AC" means; some students think "anti-cough" al-though it's probably "and codeine."

III. ASTHMA

Asthma is a disease of bronchoconstriction (the lung's branches tighten) and inflammation. For immediate relief during an attack, an **albuterol (ProAir HFA)** inhaler is the short-acting bronchodilator that will reverse the bronchoconstriction. **Proventil** is also a brand name for nebulized (a form of mist) **albuterol.** Oral steroids such as **methylprednisolone (Medrol)** and **prednisone (Deltasone)** help reduce lung inflammation after a severe attack.

The combination inhalers **fluticasone / salmeterol (Advair)** or **budesonide / formoterol (Symbicort)** provide relief from both inflammation and bronchoconstriction by combining a steroid and long-acting beta2 receptor agonist (which bronchodilates). Notice that many steroids have "sone" not an official stem, at the end of their names, and that beta2 receptor agonists have the stem "–terol" in the suffix. These long-acting combinations prophylactically prevent asthma attacks.

Ipratropium in **DuoNeb** and **Tiotropium (Spiriva)** are anticholinergic medications. Often these medications cause dry mouth, constipation and other unwanted adverse effects. However, **ipratropium** and **tiotropium (Spiriva)** affect the smooth muscle of the lungs, allowing for bronchodilation and relaxation of the bronchi. Both **albuterol** and **ipratropium** bronchodilate. One is an agonist of beta2 receptors and the other is an antagonist of acetylcholine (ACh).

Montelukast (Singulair) inhibits leukotriene receptors. Leukotrienes cause bronchoconstriction, a process that protects the lungs against foreign contaminants. Drugs in this class end in "–lukast."

Omalizumab (Xolair) is an IgE antagonist and a biologic.

ORAL STEROIDS

Methyl<u>pred</u>nisolone (Medrol)

meth-ill-pred-NISS-uh-lone (MED-rol)

> A student connected "pred" and "predator of inflammation" for generic **methylprednisolone. Methylprednisolone (Medrol)** comes in a 6-day, 21-pill dose pack that gives patients 6 tablets on the first day, 5 on the 2nd, 4 on the 3rd, 3 on the 4th, 2 on the 5th, and 1 on the 6th. This dosing reminds us to taper steroids to allow the adrenal glands time to resume normal function.

<u>Pred</u>nisone (Deltasone)

PRED-ni-sewn (DEALT-uh-sewn)

> Most students know **prednisone,** but many steroid compounds have this unofficial "sone" ending. In this case, the "pred-" is the official stem and is in the prefix position. Note, we find this stem in the middle of the drug name in the steroid methyl**<u>pred</u>**nisolone.

INHALED STEROID/BETA2-RECEPTOR AGONIST LONG-ACTING

Budesonide / Formoterol (Symbicort)

byou-DES-uh-nide / four-MOE-ter-all (SIM-buh-court)

Similar to **fluticasone / salmeterol, budesonide** has the "sone" syllable in the middle of its name, and is pronounced "sone" even though it's spelled "s-o-n." The "–terol" in **formoterol** indicates a beta2 agonist bronchodilator. You can think of the "S-y-m" in the brand name **Symbicort** as symbiotic, meaning "working with," plus "c-o-r-t" for corticosteroid.

Salmeterol / Fluticasone (Advair)

flue-TIC-uh-sewn / Sal-ME-ter-all (ADD-vair)

Recognize the steroid **fluticasone** by the unofficial "sone," and the long-acting bronchodilator **salmeterol** by the "-terol" stem. The brand name **Advair** seems like "add two drugs to get air."

INHALED STEROID

Fluticasone (Flovent HFA, Flovent Diskus, Flonase)

flue-TIC-uh-sewn (FLOW-vent)

The "sone" ending, while not an official stem, is a useful clue that **fluticasone** is a steroid. In the past, inhalers used to feel cold when patients used them because the chlorofluorocarbon (CFC) propellant spray was similar to Freon, the refrigerant used in air conditioning. However, CFCs damage the ozone layer so the new hydrofluoroalkane (HFA) replaces the CFC propellant. The brand name **Flovent HFA** cleverly uses the first two letters of the generic name **fluticasone,** incorporates f-l-o from "airflow" and adds, "vent" to let the patient know this is administered in the mouth. The d-i-s-k-u-s inhaler is a device that looks like a d-i-s-c-u-s (the Frisbee-like thing used in the Olympics) that uses a dry powder for inhalation rather than a propellant and liquid. **Flonase** is the brand name for **fluticasone** administered nasally, and is available OTC.

BETA2 RECEPTOR AGONIST SHORT-ACTING

Albuterol (ProAir HFA)

Al-BYOU-ter-all (PRO-air aitch-ef-ay)

The "-terol" stem of **albuterol** indicates it's a beta-2 adrenergic agonist that causes bronchodilation. Note, the "–terol" stem of **albuterol** does not help you know if it's long acting or short-acting; that distinction has to be memorized. The brand name **ProAir HFA** is straightforward with "Pro" as in "I'm for it" and "Air" for airway.

BETA2 RECEPTOR AGONIST / ANTICHOLINERGIC SHORT-ACTING

Albuterol / Ipratropium (DuoNeb)

Al-BYOU-ter-al / Ih-pra-TROPE-e-um (DUE-oh-neb)

A "-terol" short-acting bronchodilator like **albuterol** can combine with a shorter acting anticholinergic like **ipratropium** (as compared to longer-acting **tiotropium)** in a nebulized form to treat asthma symptoms faster. Instructors use **atropine** as the prototype drug for the anticholinergics and you can see the "-trop-" stem in **atropine, ipratropium,** and **tiotropium.** The brand name **DuoNeb** indicates a duo of drugs in nebulized form.

ASTHMA / COPD – ANTICHOLINERGIC LONG-ACTING

Tiotropium (Spiriva)

tie-oh-TROW-pee-um (Spur-EE-va)

Tiotropium has the same "-trop-" stem as **ipratropium** and is the long-acting version. As with the "–terols," the beta2 receptor agonists, you have to memorize which anticholinergic is long-acting vs. short-acting. **Spiriva** takes the "spir" from respire.

ASTHMA – LEUKOTRIENE RECEPTOR ANTAGONIST

Montelukast (Singulair)

Mon-tee-LUKE-ast (SING-you-lair)

Leukotrienes form in leukocytes (white blood cells) and cause inflammation. By blocking them, **montelukast** helps with the inflammatory component of asthma. The "-lukast" stem is very similar to leukotriene. The **Singulair** brand name comes from its once daily "single" dosing and the "air" it helps to bring into the asthmatic lungs.

ASTHMA – ANTI-IGE ANTIBODY

Omalizumab (Xolair)

oh-mah-liz-YOU-mab (ZOHL-air)

Like **infliximab** for ulcerative colitis, **omalizumab** is a biologic. The "inf-" is a prefix that separates it from other similar drugs. The "-li-" stands for immunomodulator (the target), the "-zu-" stands for humanized (the source) and the "–mab" is for monoclonal antibody. There is a black box warning (a severe warning immediately at the beginning of the package insert) for the possibility of anaphylaxis after the first dose and even a year after the onset of treatment. Therefore, health providers inject **omalizumab** where a medicine for treating anaphylaxis is available. The brand name **Xolair** seems like "exhale" and "air."

IV. ANAPHYLAXIS

Anaphylaxis is a special type of allergic overreaction of the body to something like an insect bite or bee sting. **Epinephrine (EpiPen)** quickly reverses the reaction, keeping the airway open.

Epinephrine (EpiPen)

eh-peh-NEF-rin (EP-ee-pen)

> The word **epinephrine** has a Greek origin. “Epi” means “above,” and “neph” means “kidney.” Above the kidney is the adrenal gland responsible for the body’s natural release of **epinephrine.** The Latinized version of **epinephrine** is adrenaline. The “ad” means “above” and “renal” means “kidney.” The **EpiPen** brand name comes from the injector device that looks somewhat like a pen.

RESPIRATORY DRUG QUIZ (LEVEL 1)

Classify these drugs by placing the corresponding drug class letter next to each medication. Try to underline the stems before you start and think about the brand name and function of each drug. (Click here for answers).

1. Albuterol (ProAir)
2. Cetirizine (Zyrtec)
3. Diphenhydramine (Benadryl)
4. Fluticasone/salmeterol (Advair)
5. Guaifenesin/DM (Robitussin DM)
6. Tiotropium (Spiriva)
7. Loratadine (Claritin)
8. Montelukast (Singulair)
9. Pseudoephedrine (Sudafed)
10. Methylprednisolone (Medrol)

Respiratory drug classes:

A. 1st-generation antihistamine
B. 2nd-generation antihistamine
C. Anticholinergic
D. Decongestant
E. Leukotriene receptor antagonist
F. Mucolytic/cough suppressant
G. Oral steroid
H. Nasal steroid
I. Short-acting bronchodilator
J. Steroid / long-acting bronchodilator

RESPIRATORY DRUG QUIZ (LEVEL 2)

Classify these drugs by placing the corresponding drug class letter next to each medication. Try to underline the stems before you start and remember the brand name and function of each drug. (Click here for answers).

1. Budesonide / formoterol
2. Guaifenesin / codeine
3. Triamcinolone
4. Fluticasone / salmeterol
5. Pseudoephedrine
6. Cetirizine
7. Diphenhydramine
8. Albuterol
9. Montelukast
10. Prednisone

Respiratory drug classes:

A. 1st-generation antihistamine
B. 2nd-generation antihistamine
C. Anticholinergic
D. Decongestant
E. Leukotriene receptor antagonist
F. Mucolytic / cough suppressant
G. Oral steroid
H. Nasal steroid
I. Short-acting bronchodilator
J. Steroid / long-acting bronchodilator

RESPIRATORY: MEMORIZING THE CHAPTER

Diphenhydramine

Cetirizine

Loratadine

Loratadine-D

Pseudoephedrine

Phenylephrine

Oxymetazoline

Triamcinolone

Guaifenesin/DM

Guaifenesin/codeine

Methylprednisolone

Prednisone

Budesonide/Formoterol

Fluticasone/Salmeterol

Fluticasone

Albuterol

Albuterol / Ipratropium

Tiotropium

Montelukast

Omalizumab

Epinephrine

“R” RESPIRATORY

Start with the 1st-generation OTC antihistamine **diphenhydramine,** and then go to the 2nd-generation **cetirizine** (C) alphabetically to 2nd-generation **lor<u>atadine</u>** (L). Add a decongestant to make **lor<u>atadine</u>-D** behind-the-counter (BTC), and then move to what the “hyphen D” stands for – **pseudoephe<u>drine</u>** the decongestant. Then walk into the OTC aisle to get the oral decongestant **phenylephrine** and move up to the nose with the intranasal decongestant **oxymetazoline.** Stay in the nose with an OTC intranasal glucocorticoid **triamcinolone.** Move from nasal congestion to chest congestion with **guaifenesin / dextrometh<u>orphan</u>** to another antitussive combination behind-the-counter, **guaifenesin with codeine.** If that does not work and the coughing inflames your lungs, you might need an oral steroid like **methyl<u>pred</u>nisolone** (M) or **<u>pred</u>nisone** (P). After the acute attack, you might find you have asthma and need to use a prophylactic inhaled steroid in combination with a long-acting beta2 receptor agonist, either **budesonide / formo<u>terol</u>** or **salme<u>terol</u> / fluticasone.** You could individually use the steroid **fluticasone** or **albu<u>terol,</u>** the short-acting beta2 receptor agonist. The beta2 receptor agonist **albu<u>terol</u>** combined with anticholinergic **ipra<u>tropium</u>** makes the duo in **DuoNeb,** or alternatively, the long-acting anticholinergic **tio<u>tropium</u>** can be given alone. If that doesn’t work, use **monte<u>lukast</u>** against leukotrienes or **oma<u>lizumab</u>** against IgE, but remember that **oma<u>lizumab</u>** has a black box warning about anaphylaxis, which would necessitate an injection of **epinephrine.**

CHAPTER 4 IMMUNE

I. OTC ANTIMICROBIALS

Antimicrobials, meaning "against microbes," can generally be divided into three classes: **antibiotics** (drugs for bacteria), **antifungals** (drugs for mycoses or fungi), and **antivirals** (drugs for viruses). Antibiotic brand names don't give good information about drugs because they derive from generic names. As such, creating linkages between drug classes so you can group similar antibiotics becomes critical. For example, penicillins and cephalosporins, along with **vancomycin,** affect bacterial cell walls. By putting them near each other on this list, you can group them into a larger category based on function.

Antifungals and antivirals, in contrast, have brand names that allude to their therapeutic effect. Most students try to be ultra-efficient and just memorize generic names. Just as you have more information if you know a first and last name, you know more about a drug by memorizing both generic and brand names. This backup information is critical under the stress of exams or clinical practice.

ANTIBIOTIC CREAM

Neomycin / Polymyxin B / Bacitracin (Neosporin)

knee-oh-MY-sin / pall-EE-mix-en / bah-seh-TRACE-in (KNEE-oh-spore-in)

> **Neomycin** is an aminoglycoside that is generally toxic to the kidney (nephrotoxic) and ears (ototoxic) when used systemically. However, patients can safely use topical preparations containing **neomycin** such as over-the-counter **Neosporin.** The brand **Neosporin** takes "N-e-o" from **neomycin,** "p-o" from **polymyxin B,** and "r-i-n" from **bacitracin.** We associate "spores" with fungi, and this helps link **Neosporin** to fungal infections.

ANTIFUNGAL CREAM

Butenafine (Lotrimin Ultra)

BYOO-ten-uh-feen (LOW-treh-min)

> **Butenafine** treats topical fungal infections like ringworm, jock itch, and athlete's foot. Sometimes you will see the Latin names for these conditions: tinea coporis (ringworm), tinea cruris (jock itch), and tinea pedis (athlete's foot) respectively.

ANTIVIRAL (PROPHYLAXIS)

Influenza Vaccine (Fluzone, Flumist)

in-FLU-en-zah VACK-seen (FLEW-zone, FLEW-mist)

While some children might need a prescription for the **influenza vaccine,** adults can walk up to the pharmacy counter and get a flu shot at certain pharmacies. Be careful; generic names with "f-l-u," for example, **fluconazole,** an antifungal, and **fluoxetine,** an antidepressant, refer to a fluorine atom in their chemical structure, not to the influenza virus. The "flu" in the vaccine brand names **Fluzone** and **Flumist** indicates influenza, just like **Tamiflu,** an oral medication for influenza infection contains the syllable "flu." The nasal vaccine **Flumist** provide an alternative for patients who don't want an injection.

ANTIVIRAL (ACUTE)

Docosanol (Abreva)

Do-cah-SAN-all (uh-BREE-vah)

Docosanol is a topical antiviral for cold sores caught and treated early. I thought who would pay twenty dollars for a small tube like that? Then I thought of homecoming dances. So, use **docosanol,** so you can go to the ball. **Abreva,** the brand name, hints at therapeutic effect as **docosanol** "abbreviates" the time a cold sore lasts.

II. ANTIBIOTICS AFFECTING CELL WALLS

Bacteria have cell walls. Human cells don't (although they do have cell membranes). This introduces *selectivity*. If a drug targets a tissue or structure that bacteria have but humans don't, it should be selective for the bacteria and safe for the patient.

Penicillins were one of the first antimicrobial classes discovered. **Penicillin's** mechanism of action is to open a bacterium's cell wall, like popping a bubble, to kill it. This killing action is termed bactericidal. However, sometimes we see resistance to a single antibiotic like **amoxicillin (Amoxil).** For example, a child with an ear infection finishes a course of "the pink stuff" and remains sick. **Amoxicillin / clavulanate (Augmentin)** adds the compound clavulanate to protect the **amoxicillin** against an enzyme bacteria produce called a beta-lactamase. The enzyme acquired its name from the chemical structure (a beta lactam) that's in all penicillins. This additional component, **clavulanate,** helps **amoxicillin** work in cases where it had previously failed.

Cephalosporins can have cross-sensitivity with penicillins. Patients allergic to one may be allergic to the other, but this is quite rare. We classify cephalosporins into generations. The first-generation drugs, such as **cephalexin (Keflex),** don't penetrate the cerebrospinal fluid (CSF), have poor gram-negative bacterial coverage (gram-negative bacteria have an extra protective layer and do not take up a gram stain), and are subject to deactivation by beta-lactamase producing bacteria. As we move to third-generation **ceftriaxone (Rocephin)** and fourth-generation **cefepime (Maxipime),** we get good penetration into the CSF, good gram-negative coverage and the antibiotics cover bacteria resistant to beta-lactam drugs.

Vancomycin (Vancocin) is sometimes the last line of defense against a sometimes-deadly bacterial infection like methicillin-resistant *Staphylococcus aureus* (MRSA). To minimize resistance, a special protocol dictates who can and cannot get **vancomycin.** In rare cases, **vancomycin** can cause a hypersensitivity reaction called red man syndrome. **Vancomycin** has special dosing requirements for patient safety and often pharmacists use their expertise to dose it appropriately so that patients receive optimal drug therapy.

ANTIBIOTICS: PENICILLINS

Amoxicillin (Amoxil)

uh-mocks-eh-SILL-in (uh-MOCKS-ill)

> **Amoxicillin** has the "–cillin" stem that indicates its relationship to the penicillin family. The "a-m-o" probably came from the fact that it's an "amino" penicillin. The "-cillin" stem sounds like "cell-in" and can help you remember that **amoxicillin** or, more generally, **penicillins** destroy the cell wall. The brand name **Amoxil** simply removes an "i-c" and "l-i-n" from the generic name.

PENICILLIN / BETA-LACTAMASE INHIBITOR

Amoxicillin / Clavulanate (Augmentin)

uh-mocks-eh-SILL-in / clav-you-LAN-ate (awg-MENT-in)

When **amoxicillin** alone doesn't work, **Augmentin** augments **amoxicillin's** defenses against the bacterial beta-lactamase enzyme with **clavulanate.** I think of the "clavicle," the bone in your shoulder, as protective of the upper lung and associate **clavulanate** with that same protective effect.

CEPHALOSPORINS

Cephalexin (Keflex)

sef-uh-LEX-in (KE-flecks)

With cephalosporins, a newer generation has better properties than the last, relative to what the prescriber is treating. Those advantages include better penetration into the cerebrospinal fluid (CSF), better gram- negative coverage, and better resistance to beta-lactamases. You may lose some gram-positive coverage as you move up the spectrum, however. The "ceph-" is an old stem from the first generation. The new stem "cef-" identifies the newer generations. That's how I remember **cephalexin** as being first generation. The brand name **Keflex** takes some letters from **cephalexin** to make its name.

Ceftriaxone (Rocephin)

sef-try-AX-own (row-SEF-in)

In the generic name, **ceftriaxone's** "cef-" indicates it's a cephalosporin. There is a "tri" in the generic name that you can use to remember it's 3rd generation. **Rocephin,** the brand name, seems to come from Hoffman-LaRoche's patent. The drug company took the "Ro" from "LaRoche," and the "ceph" and "in" from cephalosporin to make **Ro-ceph-in.**

Cefepime (Maxipime)

SEF-eh-peem (MAX-eh-peem)

Cefepime is a fourth-generation cephalosporin. I've remembered it by thinking of four letters "p-i-m-e" that are in both the brand name **Maxipime** and the generic name **cefepime.** Also, at the time, **Maxipime** was the **maximum** generation, the fourth and highest. However now there is a fifth-generation cephalosporin.

GLYCOPEPTIDE

Vancomycin (Vancocin)

van-co-MY-sin (VAN-co-sin)

Vancomycin's "–mycin" stem isn't very useful for finding its therapeutic class. All it really means is that chemists derived **vancomycin** from the *Streptomyces* bacteria. I remember the function as **"vancomycin** will vanquish MRSA." To remember the brand name **Vancocin,** remove the "my" from **vancomycin.**

III. ANTIBIOTICS – PROTEIN SYNTHESIS INHIBITORS – BACTERIOSTATIC

We name bacteriostatic **tetracyclines** like d**oxycycline (Doryx)** and **minocycline (Minocin)** after the four (tetra) member chemical ring (cycline). Tetracyclines and fluoroquinolones both cause photosensitivity and chelation (binding with cations such as the Ca++ in milk or antacids).

We sometimes call **macrolides "erythromycins"** after one of the original drugs in the class. Patients take **azithromycin (Zithromax)** as a double dose on the first day and a single dose the following four days. The double dose is a *loading dose*. Once-daily dosing improves patient compliance. Patients take **clarithromycin (Biaxin)** twice a day – notice the "bi" prefix in the brand name, and we dose **erythromycin (E-Mycin)** four times a day.

Dentists use **clindamycin (Cleocin)** for dental prophylaxis when a patient is penicillin allergic. Patients use it topically for severe acne. When used orally, it can cause a severe condition known as pseudomembranous colitis, also known as antibiotic-associated diarrhea (AAD).

Linezolid (Zyvox) is an oxazolidinone antibiotic that can work on both **methicillin**-resistant *Staphylococcus aureus* (MRSA) and **vancomycin**-resistant enterococci (VRE).

TETRACYCLINES

Doxycycline (Doryx)

docks-ee-SIGH-clean (DOOR-icks).

> I use the "d" in **doxycycline** to remind me that dentists use it to treat periodontal disease. **Doryx,** the brand name, takes the first four letters of **doxycycline** and adds an "r."

Minocycline (Minocin)

MIN-oh-SIGH-clean (MIN-oh-sin)

> **Minocycline,** like **doxycycline** has the **tetracycline** class "-cycline" stem. To create the brand name **Minocin,** the manufacturer dropped the "c-y-c-l" and last "e."

MACROLIDES

Azithromycin (Zithromax Z-Pak)

ay-zith-row-MY-sin" (ZITH-row-max)

> To recognize the three macrolides, **azithromycin, clarithromycin,** and **erythromycin,** you will see the "–mycin" ending, but also a possible infix of "thro-." Be careful: there are macrolides without this infix and stem. The brand name **Zithromax** takes seven letters from **azithromycin** to construct its name. The **Zithromax Z-pak** is a convenient six-tablet package that includes a five-day course, two tablets for a loading dose on day one and one tablet for each thereafter.

Clari<u>thromycin</u> (Biaxin)

Claire-ITH-row-my-sin (bi-AX-in)

Gastroenterologists prescribe **clarithromycin** for peptic ulcer disease (PUD) triple therapy along with **amoxicillin** and a proton pump inhibitor like **omeprazole.** The **Biaxin** brand name indicates the twice daily dosing from the Latin abbreviation b.i.d. or *bis in die.*

Ery<u>thromycin</u> (E-Mycin)

err-ith-row-MY-sin (E-MY-sin)

Some **erythromycin** tablets are bright red and that might be where it got its name. An erythrocyte is a red blood cell, and the word comes from connecting "erythro," the Greek for "red," and "cyte," for cell. The brand name **E-mycin** comes from taking the "rythro" out of the generic name **erythromycin.**

LINCOSAMIDE

Clinda<u>mycin</u> (Cleocin)

clin-duh-MY-sin (KLEE-oh-sin)

Most students remember the adverse effect CDAD (<u>C</u>*lostridium* <u>d</u>*ifficile*-<u>A</u>ssociated <u>D</u>isease) because there is a "c" and a "da" right after in the generic **<u>c</u>lin<u>da</u>mycin.** To make the brand name **Cleocin,** the manufacturer replaced the "i-n-d-a-m-y" in **clindamycin** with "e-o."

OXAZOLIDINONE

Line<u>zolid</u> (Zyvox)

LYNN-ez-oh-lid (ZIE-vocks)

The "-zolid" stem in **linezolid** comes from the **oxa<u>zolid</u>inone** class. I think it's more helpful to think, "Man, **Zyvox** is zolid (solid); it treats two very difficult to treat organisms, MRSA and VRE.

IV. ANTIBIOTICS – PROTEIN SYNTHESIS INHIBITORS – BACTERICIDAL

Bactericidal **aminoglycosides** can damage the kidneys (nephrotoxicity) and ears (ototoxicity). I think of the "side" in **aminoglycoside** and "cide" as in "cidal" to remind me these are killers.

AMINOGLYCOSIDES

Amikacin (Amikin)

am-eh-KAY-sin (AM-eh-kin)

> Some internet sources say that a "cin" ending means an aminoglycoside, but that's not necessarily true. Many antibiotics end in "c-i-n," so I think it's more useful to look at the "a-m-i" that is in the words **aminoglycoside, amikacin** and **Amikin.** The brand name **Amikin** is simply **amikacin** without the "a-c."

Gentamicin (Garamycin)

Jenn-ta-MY-sin (gare-uh-MY-sin)

> Just as practitioners abbreviate **vancomycin** as "vanc" in conversation, they abbreviate **gentamicin** as "gent." The brand name **Garamycin** is similar to **gentamicin** spelled with **"-mycin"** not **"-micin."**

V. ANTIBIOTICS FOR URINARY TRACT INFECTIONS (UTIS) AND PEPTIC ULCER DISEASE (PUD)

Sulfamethoxazole / trimethoprim (Bactrim) is a combination therapy that affects the folic acid in bacteria. Humans can safely ingest folic acid, so it doesn't affect us adversely. However, sulfa medications can sometimes cause allergic reactions. **Sulfamethoxazole** can even cause a rare but life-threatening condition of the skin and mucous membranes known as Stevens-Johnson syndrome. Sulfa drugs clear urinary tract infections (UTIs) and provide prophylaxis (prevention) of certain infections that commonly occur in immunocompromised patients such as HIV patients.

We sometimes call **fluoroquinolones** "floxacins" after their infix "-fl-" + suffix "-oxacin." Like tetracyclines, fluoroquinolones cause photosensitivity (an increased sensitivity to burning from sunlight) and chelation (a binding with cations such as the Ca++ in milk or antacids). **Fluoroquinolones** have a very unusual side effect in that sometimes they can cause tendon rupture, although rarely.

Metronidazole (Flagyl) treats various infections, including *H. Pylori*, as part of triple therapy. A notable side effect of **metronidazole** is the disulfiram reaction where a patient may experience serious nausea and vomiting. Projectile vomiting is rare, but a vivid way to remember **metronidazole's** adverse effect with alcohol.

DIHYDROFOLATE REDUCTASE INHIBITORS

Sulfamethoxazole / Trimethoprim (SMZ-TMP)

sull-fa-meth-OX-uh-zol e /try-METH-oh-prim (ess-em-zee / tee-em-pee)

> **SMZ / TMP** is the acronym for **sulfamethoxazole / trimethoprim.** I want to caution you about seeing sulfa in the name and allergic reactions. While sulfa drugs have "s-u-l-f-a" in them, some drugs have sulfa groups in the chemicals structure, but not in the generic name, e.g., **furosemide**. The academic literature doesn't support cross-sensitivity between allergies to sulfa antibiotics and other sulfonamide containing drugs like **furosemide.** The brand name **Bactrim** contains "b-a-c-t-r-i-m" from **"bacterium."**

FLUOROQUINOLONES

Ciprofloxacin (Cipro)

sip-row-FLOCKS-uh-sin (SIP-row)

> The **quinolone** stem is "-oxacin," but **fluoroquinolones** have the "-fl-" infix also. One student remembered quinolones are for UTIs because Dr. Quinn, Medicine Woman, is female. Women get proportionally more UTIs than men do. By cutting the "–floxacin" stem from the generic name **ciprofloxacin,** the manufacturer made the brand name, **Cipro.**

Levo<u>floxacin</u> (Levaquin)

Lee-vo-FLOCKS-uh-sin (LEV-uh-Quinn)

Levofloxacin is the left-handed (levo) isomer of **ofloxacin,** another **fluoroquinolone.** The brand name combines the “lev” from **<u>lev</u>**ofloxacin and “quin” from fluoro**<u>quin</u>**olone to form **Levaquin.**

NITROIMIDAZOLE

Metro<u>nidazole</u> (Flagyl)

met-ruh-NYE-duh-zole (FLADGE-ill)

The generic name **metronidazole** contains one of the three “i’s” from nitroimidazole, its parent class. Gastroenterologists use **metronidazole** for peptic ulcer disease (PUD). Note that **metronidazole** is technically an antiprotozoal and students look at the “azole” ending, which is a little similar to “ozoal” from “protozoal.” A student learned to give “Flag,”a shorter form of **Flagyl,** for *B. frag* a shortening of the *Bacteroides fragilis* infections.

VI. ANTI-TUBERCULOSIS AGENTS

Prescribers use anti-tuberculosis agents for an extended period (several months) because tuberculosis organisms grow slowly. Multiple drug therapy helps prevent resistance. I use the acronym "r-i-p-e," to remember the four major antituberculosis agents: **rifampin, isoniazid, pyrazinamide,** and **ethambutol.** Non-drug resistant, non-HIV patients take all four drugs for two months, and then **isoniazid** and **rifampin** together for four more months.

Rifampin (Rifadin)

rif-AM-pin (rif-UH-din)

Students remember that **rifampin** turns secretions like tears, sweat, and urine red with its first letter "r." The brand name **Rifadin** simply replaces the "m-p" from **rifampin** with a "d."

Isoniazid (INH)

eye-sew-NIGH-uh-zid (EYE-en-aitch)

There is no "H" in **isoniazid,** so **INH** comes from the chemical name **i**so**n**icotinyl**h**ydrazide. The "n-i" in **isoniazid** reminds students that peripheral **n**eur**i**tis is an adverse effect.

Pyrazinamide (PZA)

pier-uh-ZIN-uh-mide (pee-zee-ay)

The "p" in **pyrazinamide** reminds students that an adverse effect is polyarthritis. **Pyrazinamide's** abbreviation is **PZA.**

Ethambutol (Myambutol)

eh-THAM-byou-tall (my-AM-byou-tall)

The "e" for "eyes" or "o" in **ethambutol** helps remind students that optic neuritis is an adverse effect. To make the brand name, the manufacturer replaced the "eth" in **ethambutol** with "my" in **Myambutol** because *Mycobacterium tuberculosis* is the causative agent.

VII. ANTIFUNGALS

Scientists divide antifungals into two general types: systemic (in the body) and dermatologic or topical (on the skin). Before the advent of antifungals, most systemic fungal infections were deadly. **Amphotericin B (Fungizone)** can treat systemic infections. **Fluconazole (Diflucan)** orally treats vaginal yeast infections. **Nystatin (Mycostatin)** can eliminate thrush or yeast infections.

Amphotericin B (Fungizone)

am-foe-TER-uh-sin bee (FUN-gah-zone)

What about **amphotericin A**? Well, it didn't do anything, so they came up with a**mphotericin B.** While the antibacterials' brand names didn't do a very good job helping to indicate their therapeutic effects, this antifungal's brand name, **Fungizone,** makes it easier to know its therapeutic use.

Fluconazole (Diflucan)

flue-CON-uh-zole (die-FLUE-can)

The "–conazole" ending helps identify **fluconazole** as an antifungal drug. Again, be careful of the "f-l-u" in **fluconazole,** which is for a fluorine atom it contains, not influenza. One student came up with using the first three letters of the brand name **Diflucan** as **"Die fungi!"**

Nystatin (Mycostatin)

NIGH-stat-in (MY-co-stat-in)

Nystatin is an interesting generic name because it ends in "statin." A class of cholesterol lowering drugs, the HMG-CoA reductase inhibitors, commonly referred to as "statins," have a similar ending. A better infix + suffix stem for HMG-CoA reductase inhibitors is "vastatin." To keep from thinking **nystatin** was ever a cholesterol lowering "statin," one student remembered the dosage forms nystatin comes in: powder and liquid to swish / spit / swallow. **Mycostatin,** the brand name, dropped the "ny" from **nystatin** and added "Myco," a prefix often seen with mycoses (fungal infections).

VIII. ANTIVIRALS – NON-HIV

Many antivirals have "-vir-" in the middle or at the end of the generic and / or brand name. Drugs for influenza, such as **oseltamivir (Tamiflu)** and **zanamivir (Relenza)** work when taken within 48 hours of the infection. Drugs for herpes infections such as **acyclovir (Zovirax)** and **valacyclovir (Valtrex)** can help prevent recurrences and treat an infection, but they do not cure the disease.

Respiratory syncytial virus (RSV) is usually unproblematic in healthy adults, but in infants younger than one year old, it can be deadly. A drug like the vaccine **palivizumab (Synagis)** can prevent RSV in at-risk patient populations.

INFLUENZA A AND B

Oseltamivir (Tamiflu)

owe-sell-TAM-eh-veer (TA-mi-flue)

Often family members will all get prescriptions for **oseltamivir** if one person is sick enough or if a family member is immunocompromised. The brand name **Tamiflu** alludes to a drug that "tames the flu." It's prescribed for acute influenza or prophylaxis.

Zanamivir (Relenza)

za-NAH-mi-veer (rah-LEN-zuh)

Zanamivir comes in a Diskhaler, a way to get powder to the lungs. The Diskhaler is difficult for patients with dexterity issues, but provides an alternative to **oseltamivir (Tamiflu).** Think: **Relenza "re**presses influ**enza"** virus or **Relenza** makes "influ**enza rel**ent" (give up).

HERPES SIMPLEX VIRUS & VARICELLA-ZOSTER VIRUS (HSV/VZV)

Acyclovir (Zovirax)

ay-SIGH-clo-veer (zo-VIE-racks)

Zovirax treats Varicella-Zoster virus (VZV) and herpes simplex virus (HSV). You can think of **Zovirax** as a drug that axes Zoster virus. Dosing is five times daily.

Valacyclovir (Valtrex)

Val-uh-SIGH-clo-veer (VAL-trex)

Valacyclovir has **acyclovir** in the name because it's the valine ester. A prodrug like **valacyclovir** turns into an active drug in the body, in this case, **acyclovir. Valacyclovir** allows for twice daily dosing, so prescribers prefer the oral form of **valacyclovir** to **acyclovir** for patient compliance. The brand name, **Valtrex,** includes the "val" from **valacyclovir** plus T-rex, and wrecks a virus.

RESPIRATORY SYNCYTIAL VIRUS (RSV)

Palivizumab (Synagis)

pal-eh-viz-YOU-mab (SIN-uh-giss)

The prefix “p-a-l-i“ has “P” and “I” in it. You can remember **palivizumab** is for pediatrics or infants at risk for RSV. In **palivizumab,** the “pali” is a prefix that separates it from similar drugs. The “-vi-” stands for antiviral (the target), the “-zu-” stands for humanized (the source), and the “–mab” is for monoclonal antibody. This biologic stem + infixes resemble **infliximab (Remicade)** for ulcerative colitis or **omalizumab (Xolair)** for asthma, but with a different clinical purpose.

VIII. ANTIVIRALS – HIV

HIV drugs affect specific targets in the cell or retrovirus. HIV medications, like tuberculosis medications, often work best in drug combinations. I've organized the five HIV drug classes in the order an HIV virus attacks a healthy cell. First, the HIV virus tries to fuse with the cell, then it uses cellular chemokine receptor five (CCR5) to enter the cell. Inside the cell, the HIV virus uses reverse transcriptase, integrase, and protease. HIV medications have three letter abbreviations, as these drugs are not only hard to pronounce, but conversation filled with several multisyllable words can make comprehension difficult.

FUSION INHIBITOR

Enfuvirtide (Fuzeon) (T-20)

En-FYOO-veer-tide (FYOO-zee-on)

It's easier to remember **enfuvirtide's** brand name **Fuzeon** first because it's a fusion inhibitor. Inside the generic name, you see "vir" for antiviral and we pronounce the "f-u" as FYOO. Put that together and you can remember **enfuvirtide** is **Fuzeon,** a fusion inhibitor. I use the "T" in **"T-20"** to remember that "tide" is the last syllable in the generic name.

CELLULAR CHEMOKINE RECEPTOR (CCR5) ANTAGONIST

Maraviroc (Selzentry) (MVC)

MARE-uh-VIR-ock (SELLS-en-tree)

The stem "-vir-" is inside the generic name **maraviroc.** The sub-stem "-viroc" has five letters, with the "c" at the end of the generic name, so you can remember it's a CCR5 antagonist. You can think of **maraviroc** as a "rock" guarding against viral entry. The brand name **Selzentry** sounds a lot like "sentry," someone who guards.

NON-NUCLEOSIDE REVERSE TRANSCRIPTASE INHIBITORS (NNRTIs) WITH 2 NUCLEOSIDE / NUCLEOTIDE REVERSE TRANSCRIPTASE INHIBITORS (NRTIs)

Efavirenz / Emtricitabine / Tenofovir (Atripla) (EFV / FTC / TDF)

eh-FAH-vir-enz / EM-try-SIGH-tah-been / ten-OFF-oh-vir (ay-TRIP-lah)

When you see something complex to memorize, first look at the sub-class of antiviral. Instead of trying to memorize the whole name, try to memorize the stems "-virenz," "-citabine," and "-vir." Then add the other two or three syllables to memorize the whole names of **efavirenz, emtricitabine,** and **tenofovir.** The brand name **Atripla** can be thought of as three drugs, "triple" surrounded by two A's that can stand for "against AIDS."

INTEGRASE STRAND TRANSFER INHIBITOR

Raltegravir (Isentress) (RAL)

ral-TEG-ra-veer (EYE-sen-tress)

Raltegravir is an integrase strand transfer inhibitor. Inside the generic name, you can find the stem "-tegravir" made up of "tegra," a part of integrase and "vir" for antiviral. The brand name **Isentress** also looks like sentry, except it has the "I" to remind you of integrase.

PROTEASE INHIBITOR

Darunavir (Prezista) (DRV)

dar-YOU-nah-veer (Pre-ZIST-uh)

The brand name, in this case, is a little easier. **Prezista** sounds like resist spelled "r-e-z-i-s-t," and the first two letters "p-r" of "protease."

IMMUNE DRUG QUIZ (LEVEL 1)

Classify these drugs by placing the corresponding drug class letter next to each medication. Try to underline the stems before you start and think about the brand name and function of each drug. (Click here for answers).

1. Amoxicillin (Amoxil)
2. Azithromycin (Zithromax)
3. Cefepime (Maxipime)
4. Ceftriaxone (Rocephin)
5. Fluconazole (Diflucan)
6. Gentamicin (Garamycin)
7. Isoniazid (INH)
8. Levofloxacin (Levaquin)
9. Nystatin (Mycostatin)
10. Valacyclovir (Valtrex)

Immune drug classes:

A. 1st-generation cephalosporin
B. 2nd-generation cephalosporin
C. 3rd-generation cephalosporin
D. 4th-generation cephalosporin
E. Antibiotic: aminoglycoside
F. Antibiotic: fluoroquinolone
G. Antibiotic: macrolide
H. Antibiotic: penicillin
I. Antibiotic: sulfa
J. Antibiotic: tetracycline
K. Anti-fungal
L. Anti-tuberculosis
M. Anti-viral (herpes)
N. Anti-viral (HIV)
O. Anti-viral (influenza)

IMMUNE DRUG QUIZ (LEVEL 2)

Classify these drugs by placing the corresponding drug class letter next to each medication. Try to underline the stems before you start and remember the brand name and function of each drug. (Click here for answers).

1. Rifampin
2. Amphotericin B
3. Amikacin
4. Ciprofloxacin
5. Pyrazinamide
6. Acyclovir
7. Cephalexin
8. Sulfamethoxazole / Trimethoprim
9. Erythromycin
10. Oseltamivir

Immune drug classes:

A. 1st-generation cephalosporin
B. 2nd-generation cephalosporin
C. 3rd-generation cephalosporin
D. 4th-generation cephalosporin
E. Antibiotic: aminoglycoside
F. Antibiotic: fluoroquinolone
G. Antibiotic: macrolide
H. Antibiotic: penicillin
I. Antibiotic: sulfa
J. Antibiotic: tetracycline
K. Anti-fungal
L. Anti-tuberculosis
M. Anti-viral (herpes)
N. Anti-viral (HIV)
O. Anti-viral (influenza)

IMMUNE: MEMORIZING THE CHAPTER

Neomycin /

Polymyxin-B /

Bacitracin

Butenafine

Influenza vaccine

Docosanol

Amoxicillin

Amoxicillin / Clavulanate

Cephalexin

Ceftriaxone

Cefepime

Vancomycin

Doxycycline

Minocycline

Azithromycin

Clarithromycin

Erythromycin

Clindamycin

Linezolid

Amikacin

Gentamicin

Sulfamethoxazole / Trimethoprim

Ciprofloxacin

Levofloxacin

Metronidazole

Rifampin

Isoniazid (INH)

Pyrazinamide (PZA)

Ethambutol

Amphotericin B

Fluconazole

Nystatin

Oseltamivir

Zanamivir

Acyclovir

Valacyclovir

Palivizumab

Enfuvirtide (T-20)

Maraviroc (MVC)

Efavirenz / Emtricitabine / Tenofovir (EFV/FTC/TDF)

Raltegravir (RAL)

Darunavir (DRV)

"I" IMMUNE

The sub-algorithm is to start with antibacterial agents, then go to antifungals, then antivirals, which are in alphabetical order b-f-v. So first the OTC antibacterial cream **neomycin / polymyxin-B / bacitracin; butenafine,** the antifungal cream; and the prophylactic antiviral **influenza vaccine;** followed by an acute antiviral – **docosanol.** Begin again with systemic antibacterials, first those that attack the cell wall, the beta lactamase susceptible amino penicillin **amoxicillin,** followed by the augmented beta lactamase resistant **amoxicillin / clavulanate.** Move to cephalosporins in generational order: 1st generation **cephalexin;** to 3rd generation **ceftriaxone;** to 4th generation **cefepime,** the "maximum" generation; to alphabetically last "v" for glycopeptide **vancomycin** for MRSA. From bactericidal cell wall attackers to bacteriostatic inhibitors of protein synthesis, the tetracyclines: **doxycycline** and **minocycline** followed by three macrolides in order of the number of times taken per day: qd (once daily), bid (twice daily), qid (four times daily), **azithromycin, clarithromycin,** and **erythromycin** respectively. Use the "-mycin"

ending to get to **clinda<u>mycin</u>** and the "l-i-n" from clindamycin to go to **line<u>zolid</u>.** Follow with the bactericidal inhibitors of protein synthesis, the aminoglycosides **ami<u>kacin</u>** and **genta<u>micin</u>.** Move to the UTI medications **<u>sulfa</u>methoxazole** and **trimetho<u>prim</u>, ciprofloxacin,** and **levofloxacin;** and from "l" in "levo" to "m" in **metro<u>nida</u>zole,** the antiprotozoal. Then four letters for four TB drugs because over 4 mm is a positive TB test or a ripe, "r-i-p-e" result: **<u>rif</u>ampin** (R), **isoniazid** (I), **pyrazinamide** (P), and **ethambutol** (E). TB patients often have opportunistic fungi, so three antifungals alphabetically follow: **amphotericin B, flu<u>conazole</u>,** and **nystatin.** The antivirals for influenza follow those: **oselt<u>amivir</u>** and **zan<u>amivir</u>;** then **a<u>cyclovir</u>** and **vala<u>cyclovir</u>** for HSV, in order of half-life; then for RSV **pali<u>vizumab</u>;** then for HIV, in order of attack: fusion, CCR5, reverse transcriptase, integrase, and protease. I have to use brand names first because those are easier: **Fuzeon, Selzentry, Atripla, Isentress, Prezista,** and then the generic names for those: **enfu<u>vir</u>tide, mara<u>viroc</u>, (efa<u>virenz</u> / emtri<u>citabine</u> / tenofo<u>vir</u>), ralte<u>gravir</u>** and **daru<u>navir</u>.**

CHAPTER 5 NEURO

I. OTC LOCAL ANESTHETICS AND ANTIVERTIGO

There are two major classes of local anesthetics named after the molecules in the middle of their structures: esters and amides. Esters, such as **benzocaine (Anbesol),** are generally found in topical agents because when given by injection, they are more allergenic (cause allergic reactions). Amides are less allergenic, therefore, **lidocaine,** an amide, is usually well tolerated when injected. Most students know of **cocaine** and remember these amides are local anesthetics through the "–caine" ending association among the three names: **benzocaine, lidocaine,** and cocaine. The over-the-counter (OTC) antiemetic / motion sickness medicine **meclizine (Dramamine)** also has a brand name **Antivert,** for anti-vertigo, which helps memorization.

LOCAL ANESTHETICS – ESTER TYPE

Benzocaine (Anbesol)

BEN-zoh-cane (ANN-buh-sawl)

The "–caine" stem indicates **benzocaine** is a local anesthetic. **Anbesol** numbs an aching tooth.

LOCAL ANESTHETICS – AMIDE TYPE

Lidocaine (Solarcaine)

LIE-doe-cane (SOH-ler-cane)

Lidocaine is often used topically and is available over-the-counter to treat sunburns, hence the brand name **Solarcaine.** Injectable and patch forms of **lidocaine** are also available by prescription. Paramedics often use **lidocaine** for arrhythmias in emergencies as an injectable, which is part of the L-E-A-N acronym for the emergency medicines: **lidocaine, epinephrine, atropine,** and **naloxone.**

ANTIVERTIGO

Meclizine (Dramamine)

MECK-luh-zeen (DRAH-mah-mean)

You can also see "i-z-i-n" from d**iz**z**in**ess in the generic name **meclizine. Antivert** is another brand name of the **antivert**igo drug **meclizine.**

II. SEDATIVE-HYPNOTICS (SLEEPING PILLS)

A patient came into the pharmacy saying his wife wanted **Tylenol PM,** but saw how expensive the brand name product was. I told him that **Tylenol PM** contains **acetaminophen** and **diphenhydramine** and that he could buy both generics separately and it could be cheaper. He thought about it a minute and said, "It might be a little cheaper at first, but when my wife sends me back to get **Tylenol PM,** what she asked for, it might not be cheaper after all." This story highlights the importance of reading OTC labels closely. It's an opportunity for practitioners to help patients understand OTC products.

Sedative-hypnotics like **diphenhydramine** help patients sleep. Most prescription sedative-hypnotics provide hints about their function in their brand names: **Eszopiclone (Lunesta)** contains Luna for "moon," **ramelteon (Rozerem)** refers to REM sleep, and **zolpidem (Ambien)** creates an "ambient" (tranquil) environment.

Although benzodiazepines such as **clonazepam (Klonopin), diazepam (Valium),** and **lorazepam (Ativan)** work as sedative hypnotics, I discuss benzos later in this chapter as they have other functions as well.

OTC – NON-NARCOTIC ANALGESIC / SEDATIVE-HYPNOTIC

Acetaminophen/Diphenhydramine (Tylenol PM)

uh-seat-uh-MIN-no-fin / dye-fen-HIGH-dra-mean (TIE-len-all pee em)

> It's common to combine two drugs like **acetaminophen** for aches and **diphenhydramine,** a sedating 1st- generation antihistamine. One of my students came up with take both "phens" when you want to end up sleepin'.

BENZODIAZEPINE-LIKE

Eszopiclone (Lunesta)

es-zo-PEH-clone (Lou-NES-tuh)

> **Eszopiclone's** generic stem "-clone" will put you in the sleeping zone. Some students point to the "z" in **eszopiclone** for getting your z's. The brand name **Lunesta** uses the Latin for moon (Luna) plus part of the word "rest," which makes it memorable.

Zolpidem (Ambien, Ambien CR)

zole-PEH-dem (AM-bee-en)

> Use the "-pidem" stem to remember **zolpidem** as a sedative-hypnotic. Some students match the brand name **Ambien** with an ambient, sleepy environment. Controlled Release **zolpidem, Ambien CR,** works for people who have difficulty maintaining sleep (DMS) and those who have difficulty falling asleep (DFA). The regular version only works for those with DFA.

MELATONIN RECEPTOR AGONIST

Ra<u>melteon</u> (Rozerem)

ra-MEL-tee-on (row-ZER-em)

The "–melteon" stem in **ra<u>melteon</u>** lets you know it's a melatonin agonist. Another student said the "m-e-l" in **ra<u>mel</u>teon** reminded her of <u>mel</u>low. In **Rozerem,** you can see the "z" for z's, the "r-e-m" for REM (rapid eye movement) sleep. Also, "roze" rhymes with doze.

III. ANTIDEPRESSANTS

Antidepressant classes often intimidate students, so let's take them one word at a time. The selective serotonin reuptake inhibitors (SSRIs) class includes drugs such as **citalopram (Celexa), escitalopram (Lexapro), sertraline (Zoloft), paroxetine (Paxil),** and **fluoxetine (Prozac).** These medications will selectively inhibit reuptake (breakdown) of serotonin within neurons. Increased serotonin levels can improve mood. Note: **escitalopram** has the same "es" prefix (added onto c**italopram)** discussed with the PPIs **esomeprazole** and **omeprazole** where the sinister "S" form is superior.

Similar to the SSRIs are the serotonin-norepinephrine reuptake inhibitors (SNRIs) **duloxetine (Cymbalta)** and **venlafaxine (Effexor).** Be careful – **duloxetine** is an SNRI, yet has the "–oxetine" stem of some SSRIs **(fluoxetine, paroxetine).**

SSRIs and SNRIs carry the names of the neurotransmitters they affect. The tricyclic antidepressant (TCA) class name comes from the chemical structure's three rings. **Amitriptyline (Elavil)** is an example.

The last group of antidepressants includes the monoamine oxidase inhibitors (MAOIs). A word that ends in "ase" is usually an enzyme, so if an antidepressant blocks the enzyme that breaks a neurotransmitter down, then there is more neurotransmitter (the monoamines, in this case) available to elevate the patient's mood. An example of an MAOI is i**socarboxazid (Marplan).**

SELECTIVE SEROTONIN REUPTAKE INHIBITORS (SSRIS)

Citalopram (Celexa)

si-TAL-oh-pram (sell-EX-uh)

> Most students, when seeing two drugs with the same root, **citalopram** and **escitalopram,** quickly put them into long-term memory. One student's trick was to remember that the "p-r-a-m" medications are for de–p–r–ession, but "pram" is not an official stem. I associate the brand name **Celexa** with the word "relax."

Escitalopram (Lexapro)

es-si-TAL-oh-pram (LECKS-uh-pro)

> **Lexapro** takes the last four letters of **Celexa** and adds "pro." You can think of this as the pro-fessional upgrade, as **Lexapro** came after **Celexa.** It's common for an S isomer to come to market after the original drug has become available as a generic.

Sertraline (Zoloft)

SIR-tra-lean" (ZO-loft)

> One should use the "-traline" stem to remember **sertraline** is an SSRI, but most students also memorize the brand name **Zoloft** as "lofting" a depressed patient's mood.

Flu<u>oxetine</u> (Prozac, Sarafem)

flue-OX-uh-teen (PRO-Zack)

Fluoxetine was the first SSRI to make it to market. The "–oxetine" ending is supposed to be for **fluoxetine**-like entities, but you will see "-oxetine" on the SNRI **dul<u>oxetine</u> (Cymbalta)** and ADHD medication **atom<u>oxetine</u> (Strattera),** so be careful.

When **flu<u>oxetine</u>** gained a new indication, for premenstrual dysphoric disorder (PMDD), it also gained a new brand name: **Sarafem** – "Sara" like the girl's name and "fem" for feminine. The highest ranked angels are Sera-p-h-i-m, so combatting PMDD is the work of angels.

I don't know if that's what the drug manufacturer was going for. In addition, by taking a new brand name for another indication, it might have prevented the potential confusion of a patient with depression on **Prozac** and a patient with PMDD on **Sarafem.** The combination of "pro" for positive and the strong sounding "zac" ending makes **Prozac** sound like a strong antidepressant.

Par<u>oxetine</u> (Paxil, Paxil CR)
par-OX-eh-teen (PACKS-ill)

Par<u>oxetine</u> is similar to the SSRI **flu<u>oxetine</u>** with the same "–oxetine" stem. **Paxil** takes "p-a-x-"" from **pa**ro**x**e**t**ine. The controlled-release CR version of **Paxil** is supposed to have fewer initial side effects and be a little easier to dose.

SEROTONIN-NOREPINEPHRINE REUPTAKE INHIBITORS (SNRIS)

Dul<u>oxetine</u> (Cymbalta)

doo-LOX-eh-teen (SIM-bal-tah)

Duloxetine affects serotonin and norepinephrine and one can think of the "du" as duo (two). I have never seen an unhappy cymbal player in a band and "alta" means tall. Students can use either mnemonic to remember **Cymbalta** elevates mood.

Venla<u>faxine</u> (Effexor)

ven-luh-FAX-een (Eff-ECKS-or)

This drug is best memorized by its stem "-faxine." If you look at the "afax" in **venl<u>afax</u>ine** and "Effex" in **<u>Effex</u>or,** you can see some commonalities. **Desvenla<u>faxine</u> (Pristiq),** in the "Memorizing 350 Drugs" chapter is an SNRI also.

TRICYCLIC ANTIDEPRESSANTS (TCAS)

Amitriptyline (Elavil)

ah-meh-TRIP-ta-lean (ELLE-uh-vill)

Using the "tri" in **amitriptyline** helps students remember this is a "T-C-A," or tricyclic antidepressant. It "trips" up depression. Think of the brand **Elavil** as elevating the patient's mood.

MONOAMINE OXIDASE INHIBITOR (MAOI)

Isocarboxazid (Marplan)

iso-car-BOX-uh-zid (MAR-plan)

A student came up with **Marplan** for the atypical sad man who laments, "I so carve boxes" for **isocarboxazid.** In addition, you can take the "m" and "a" from **Marplan** to remember it's an M-A-O-I.

IV. SMOKING CESSATION

There are many nicotine replacement products on the market. I've chosen to focus on two tablets used by prescription that help patients quit smoking: **bupropion (Wellbutrin, Zyban)** and **varenicline (Chantix).**

Bupropion (Wellbutrin, Zyban)

byoo-PRO-pee-on (well-BYOO-trin, ZY-ban)

> **Bupropion** was first marketed as **Wellbutrin,** an atypical antidepressant, one that didn't fit into the SSRIs, SNRIs, TCAs, or MAOIs. Reports must have come in that patients stopped smoking while taking it, so the company repackaged the drug with a new brand name as **Zyban,** to put a "ban" on smoking. There is some risk with this medication, especially in patients with a history of seizures.

Varenicline (Chantix)

Vah-WREN-eh-clean (CHAN-ticks)

> **Varenicline,** another smoking cessation medication, has caused distressing dreams, suicidal thoughts, and other adverse effects. A student, in a southern drawl, remembered varenicline's generic name by saying, "With **varenicline,** 'I'm vary incline ta quit.'" Another came up with "My chant is, 'I don't need my fix' with **Chantix."**

V. BENZODIAZEPINES

Benzodiazepines relieve anxiety, insomnia and muscle spasms. Like the tricyclic antidepressants, benzodiazepines get their name from their chemical structure: a benzene ring and a diazepine ring. Because benzodiazepine has many syllables, most people call them benzos. Examples include a**lprazolam (Xanax), clonazepam (Klonopin), diazepam (Valium),** and **lorazepam (Ativan).** Note benzodiazepines have the similar generic suffixes "–azolam" and "–azepam." Benzos replaced barbiturates as a sleep aid because barbiturates can cause respiratory depression. A student remembered this by thinking of barbiturates (barbs) as literal barbs on razor wire fences that puncture lungs.

Alpr<u>azolam</u> (Xanax)

Al-PRAY-zo-lam (ZAN-ax)

> You should remember benzodiazepines by their two endings, "–azolam" or "–azepam." Be careful as a number of online and highly regarded test prep resources, including those by licensed professionals, refer to benzodiazepine stems as "–pam" or "–lam." That is incorrect. This will lead you to think drugs that are not benzos are in the class. For example, **verapamil (Calan)** is a calcium channel blocker and **lamotrigine (Lamictal)** is an antiepileptic. I've even seen a well-regarded resource indicate that **citalopram** has a –pam suffix at the end, and that's understandable as some patients drop the "r," pronouncing it "citalo-pam," but this is incorrect. **Alprazolam** has one z; benzodiazepine has two; **Xanax** sounds like a "z" to help you get a snooze and "x's" out anxiety too. You can also look at the word **Xanax** and see the "a-n-x" from anxiety.

Mid<u>azolam</u> (Versed)

meh-DAZE-oh-lam (VER-said)

> You should remember **midazolam** through the "-azolam" stem, but there are other tips you can use. There are two m's in **midazolam** for the memories you can't form since **midazolam** causes anterograde amnesia. Just as your *ante*brachium is your forearm, and the *ante* is the money poker players put out before the dealer deals, *ante*rograde amnesia is the inability to form memories. Alternatively, you can use the brand name; I can't remember the "verse you just said" for **Versed.**

Clon<u>azepam</u> (Klonopin)

kloe-NAZ-uh-pam (KLON-uh-pin)

> **Clonazepam** should be remembered from the "–azepam" stem. The brand name **Klonopin** uses the phonetic spelling of generic **clonazepam's** first four letters "c-l-o-n."

Lor<u>azepam</u> (Ativan)

lore-A-zeh-pam (AT-eh-van)

> Remember **lorazepam** through the "–azepam" stem or think about the brand name **Ativan** vanquishing anxiety.

VI. ADHD MEDICATIONS

ADHD (attention-deficit-hyperactivity disorder) stimulants calm a patient who has a hyperactive mind and / or body without a sedative effect. Examples include the drugs **dexmethylphenidate (Focalin)** and **methylphenidate (Concerta).** These two medications have the same root, **methylphenidate.**
In chemistry, compounds direct plane-polarized light to either the left or right. These terms are "d" or "(+)" for dextrorotatory compounds rotating plane-polarized light to the right, and "l" or "(-)" for levorotatory compounds rotating plane-polarized light to the left. **Dexmethylphenidate** rotates plane-polarized light to the right. **Dexmethylphenidate** should be more effective, last longer, and have fewer side effects than methylphenidate.

Atomoxetine (Strattera) is a non-stimulant medication and because there's not a potential for abuse, it doesn't carry a DEA schedule. It's *not* an SSRI like **fluoxetine,** even though it ends in "–oxetine."

STIMULANT – SCHEDULE II

Dexmethylphenidate (Focalin)

dex-meth-ill-FEN-eh-date (FOE-ca-lin)

> When I was a student, I could remember that **Focalin** and **Concerta** both had **methylphenidate** in their names, but I could never remember which was **dexmethylphenidate** and which was **methylphenidate.** Then I thought of the "F" in **"Focalin"** as following the "d-e" (like in the alphabet) in **dexmethylphenidate** to help me. To remember **Focalin** is for ADHD, you think of **Focalin** helping a patient focus.

Methylphenidate (Ritalin, Concerta)

meth-ill-FEN-eh-date (con-CERT-uh)

> **Methylphenidate** has many brand names, including **Ritalin** and **Concerta.** Most students seem to already know **methylphenidate,** but remember that **Concerta** can help a patient concentrate.
> To remember it's an amphetamine, one student said she thought of staying up all night at a concert with **Concerta. Concerta** is a long-acting medication that needs to be taken only once a day.

NON-STIMULANT – NON-SCHEDULED

Atomoxetine (Strattera)

AY-toh-mocks-e-teen (stra-TER-uh)

> Note the "–oxetine" stem here is also not an SSRI antidepressant, but a non-stimulant medication for ADHD. **Strattera** helps straighten patients' attention.

VII. BIPOLAR DISORDER

Mood stabilizers such as **lithium** are especially likely to cause electrolyte imbalances. If you look at the periodic table, you see that lithium (Li) and sodium (Na) are in the same group (the alkali metals) and both have a +1 charge as an ion. Because of this similarity, what happens to sodium will happen to **lithium,** causing either a toxic or a subtherapeutic state if too much **lithium** is retained or excreted, respectively. Other meds, like **risperidone,** can help control certain symptoms of the disease until the **lithium** level is correct.

SIMPLE SALT

Lithium (Lithobid)

LITH-e-um (LITH-oh-bid)

> **Lithium** sits in the same group on the periodic table of elements as the Latin *Natrium* (Na), commonly known as the chemical element sodium. The body has trouble telling the difference between lithium and sodium, and too much or too little salt can wreak havoc on **lithium** levels. A way to remember this is the saying, "Where the salt goeth, the **lithium** goeth." The "b-i-d" in the brand name **Lithobid** is the Latin *bis-in-die*, or a twice-daily dosing schedule.

VIII. SCHIZOPHRENIA

We break the medication classification for schizophrenia into typical (1st-generation) or atypical (2nd-generation). We further divide the typical antipsychotics **chlorpromazine (Thorazine)** and **Haloperidol (Haldol)** into low potency and high potency, respectively.

While these two antipsychotics have the same therapeutic effects, their side effect profiles are different. Low potency drugs like **chlorpromazine** cause more sedation, but fewer extrapyramidal symptoms. Extrapyramidal symptoms are movement disorders associated with antipsychotics.

High potency drugs like **haloperidol** cause more extrapyramidal symptoms (movement disorders), but less sedation. We prescribe typical antipsychotics for positive symptoms such as delusions, hallucinations and paranoia.

Atypical antipsychotics such as **quetiapine (Seroquel)** and **risperidone (Risperdal)** cause fewer extrapyramidal effects, but have more negative metabolic effects like weight gain, diabetes, and hyperlipidemia. Second-generation drugs work for positive symptoms, such as delusions, as well as negative symptoms, such as poor motivation and emotional and social withdrawal.

FIRST GENERATION ANTIPSYCHOTIC (FGA) LOW POTENCY

Chlorpromazine (Thorazine)

Klor-PRO-mah-zeen (THOR-uh-zeen)

> **Chlorpromazine** was the first antipsychotic. While it carries side effects, it represented a new treatment option for schizophrenic patients. Generational classifications are especially important in antipsychotics because of differences in both side effects and effects on positive versus negative symptoms. Thor is a mythical god, and you can think of **Thorazine** as helping people who have delusions of mythical people.

FIRST GENERATION ANTIPSYCHOTIC (FGA) HIGH POTENCY

Haloperidol (Haldol)

hal-low-PEAR-eh-doll (HAL-doll)

> Use the "-peridol" stem to recognize this 1st-generation high potency drug. Many students think of the "halo" in **haloperidol** to remember this is high potency. To make the brand name **Haldol,** they just took the first and last three letters of the generic name **haloperidol.**

SECOND-GENERATION ANTIPSYCHOTICS (SGA) (ATYPICAL ANTIPSYCHOTICS)

Risperidone (Risperdal)

ris-PEAR-eh-done (RIS-per-doll)

Note the stem "–peridol" from **haloperidol** and "–peridone" from **risperidone** are similar; that can help you remember both of these are antipsychotics. The brand name **Risperdal** and generic name **risperidone** share the opening letters "r-i-s-p-e-r." One student thought of risper and whisper, as in calming the whispering voices.

Quetiapine (Seroquel)

Kweh-TIE-uh-peen (SEAR-uh-kwell)

In **quetiapine,** you should use the "-tiapine" stem to recognize that this is a 2nd-generation antipsychotic. If you switch the "i" and "t" in **quetiapine,** you get the word "quiet," as in quieting the voices. **Seroquel,** the brand name, shares the "q-u-e" from **quetiapine** and quell means to silence someone.

IX. ANTIEPILEPTICS

The traditional anti-epileptic drugs **carbamazepine (Tegretol), divalproex (Depakote),** and **phenytoin (Dilantin)** have been around for a long time and we usually know what to expect with their use.

We may have less experience with the newer anti-epileptics, such as **gabapentin (Neurontin)** and **pregabalin (Lyrica),** but they are often just as effective as the traditional drugs. Neurologists try medications in a patient until one drug relieves the seizure symptoms.

TRADITIONAL ANTIEPILEPTICS

Carbamazepine (Tegretol)

car-bah-MAZE-uh-peen (TEG-reh-tawl)

> While **carbamazepine's** "-pine," pronounced, "peen," is the stem, it's not very useful because the –"-pine" ending just means a chemical has three rings. Instead, think either of seizures being "carbed" (curbed) or of being "amazed" that the seizures are "stopping" using the letters inside c**arb-amaze-pine.** I remember the brand name **Tegretol** has the "t-r-o-l" in control, as in to control seizures.

Divalproex (Depakote)

dye-VAL-pro-ex (DEP-uh-coat)

> While you can find "v-a-l" in many medication names, it is helpful to think of the "val" in **divalproex** and it's similarity with the "v-u-l" in convulsions. I know it's a stretch. One student thought of **divalproex** as a pro at extracting seizures.

Phenytoin (Dilantin)

FEN-eh-toyn (DYE-lan-tin)

> The "–toin" stem helps you remember **phenytoin** is an antiepileptic. **Dilantin** and shakin' almost rhyme.

NEWER ANTIEPILEPTICS

Gabapentin (Neurontin)

GA-ba-PEN-tin (NER-on-tin)

> The "-gab" stem is a little misleading. Neither **gabapentin** nor **pregabalin** directly affect gamma-amino-butyric-acid (GABA) receptors. However, having them both have the same stem helps set a memory device for the newer antiepileptics. The "neu" in **Neurontin** is one way to remember that this is a newer drug.

Pregabalin (Lyrica)

pre-GAB-uh-lin (LEER-eh-ca)

A lyre is a musical instrument and a lyric is a line in a song. Either way, you can think of a seizure coming back into harmony with **Lyrica.**

X. PARKINSON'S, ALZHEIMER'S, MOTION SICKNESS

Most people associate Parkinson's with the celebrity actor Michael J. Fox of *Back to the Future* fame. Using a drug like **levodopa / carbidopa (Sinemet)** for Parkinson's works to restore dopamine, a neurotransmitter responsible for proper motor function that is seriously depleted by the disease.

Concerning Alzheimer's, I remember vividly calling my grandmother and telling her "I love you," to which she responded, "I hope your wife doesn't find out." There is a cruelty in Alzheimer's, and the patients and their caregivers desperately need your help. A drug like **donepezil** works to restore the neurotransmitter acetylcholine, by reducing its breakdown by acetylcholinesterase.

PARKINSON'S

Levodopa / Carbidopa (Sinemet)

LEE-vo-doe-pa / CAR-bid-oh-pa" (SIN-uh-met)

> Increased dopamine is critical to dealing with the disease. **Sinemet** combines **levodopa** and **carbidopa** to work synergistically. **Carbidopa** doesn't actually have an antiparkinsonian effect, but it reduces the degradation of **levodopa** so more is available to the patient from a smaller dose.

Selegiline (Eldepryl)

se-LEDGE-eh-lean (EL-duh-pril)

> The "–giline" stem should be your hint that **selegiline** is a Parkinson's medication. You can find the letters of the word senile in the generic name **selegiline.** I used to confuse this as an Alzheimer's medication, but it's not, so I was being a little senile. The brand name **Eldepryl** helps you remember that it relieves symptoms of Parkinson's disease, a condition more prevalent in the "elderly."

ALZHEIMER'S

Memantine (Namenda)

Meh-MAN-teen (Nuh-MEN-duh)

> The generic name **memantine** has "mem" for memory in it. The brand name **Namenda** comes from *N*-Methyl-D-aspartate **(NMDA),** the receptor it antagonizes. One of my students always thought of **Namenda** as mending the brain.

Donepezil (Aricept)

Doe-NEP-eh-zill (AIR-eh-sept)

> When I think of **donepezil** as an Alzheimer's medication, I think, "I don't remember zilch!" The brand name **Aricept** improves perception and Alzheimer's patients' powers of recollection. A student thought of the "air" in **Aricept** as helping a patient who acts somewhat spacey or air-headed.

MOTION SICKNESS

Scopolamine (Transderm-Scop)

sco-POL-uh-mean (trans-DERM SCOPE)

Transderm-Scop is a transdermal form of **scopolamine,** for motion sickness. “Trans” means across, “derm” means “skin,” so across-the-skin **scopolamine.** It’s often used for patients on cruise ships.

NERVOUS SYSTEM DRUG QUIZ (LEVEL 1)

Classify these drugs by placing the corresponding drug class letter next to each medication. Try to underline the stems before you start and think about the brand name and function of each drug. (Click here for answers).

1. Alprazolam (Xanax)
2. Amitriptyline (Elavil)
3. Atomoxetine (Strattera)
4. Citalopram (Celexa)
5. Dexmethylphenidate (Focalin)
6. Divalproex (Depakote)
7. Haloperidol (Haldol)
8. Isocarboxazid (Marplan)
9. Levodopa / Carbidopa (Sinemet)
10. Zolpidem (Ambien)

Nervous System Drug Classes:

A. ADHD drug / non-stimulant
B. ADHD drug / stimulant
C. Antidepressant: MAOI
D. Antidepressant: SNRI
E. Antidepressant: SSRI
F. Antidepressant: TCA
G. Antiepileptic: Newer
H. Antiepileptic: Traditional
I. Antipsychotic: Atypical
J. Antipsychotic: Typical
K. Benzodiazepine
L. Parkinson's
M. Sedative-hypnotic
N. Simple salt

NERVOUS SYSTEM DRUG QUIZ (LEVEL 2)

Classify these drugs by placing the corresponding drug class letter next to each medication. Try to underline the stems before you start and remember the brand name and function of each drug. (Click here for answers).

1. Venlafaxine
2. Diazepam
3. Phenytoin
4. Quetiapine
5. Isocarboxazid
6. Eszopiclone
7. Fluoxetine
8. Citalopram
9. Selegiline
10. Lithium

Nervous System Drug Classes:

A. ADHD drug/non-stimulant
B. ADHD drug/stimulant
C. Antidepressant: MAOI
D. Antidepressant: SNRI
E. Antidepressant: SSRI
F. Antidepressant: TCA
G. Antiepileptic: Newer
H. Antiepileptic: Traditional
I. Antipsychotic: Atypical
J. Antipsychotic: Typical
K. Benzodiazepine
L. Parkinson's
M. Sedative-hypnotic
N. Simple salt

NEURO: MEMORIZING THE CHAPTER

Benzocaine

Lidocaine

Meclizine

Acetaminophen PM

Eszopiclone

Zolpidem

Ramelteon

Citalopram

Escitalopram

Sertraline

Fluoxetine

Paroxetine

Duloxetine

Venlafaxine

Amitriptyline

Isocarboxazid

Bupropion

Varenicline

Alprazolam

Midazolam

Clonazepam

Lorazepam

Dexmethylphenidate

Methylphenidate

Atomoxetine

Lithium

Chlorpromazine

Haloperidol

Risperidone

Quetiapine

Carbamazepine

Divalproex

Phenytoin

Gabapentin

Pregabalin

Levodopa/carbidopa

Selegiline

Memantine

Donepezil

Scopolamine

"N" NEURO

The four neuro OTC drugs are the local anesthetics **benzocaine** and **lidocaine,** which are an ester and amide respectively. **Meclizine** is for dizziness, and **acetaminophen / diphenhydramine** is for insomnia. Connect this with other anti-insomniacs the benzodiazepine-like sedative-hypnotics **eszopiclone, zolpidem,** and melatonin receptor agonist **ramelteon.** No sleep = depression. Five SSRI antidepressants: **citalopram** and **escitalopram, sertraline** in the middle followed by three "–oxetines:" **fluoxetine** and **paroxetine** (the SSRIs) and **duloxetine** (the SNRI) and **venlafaxine** the SNRI; followed by, in order of safety, the TCA **amitriptyline** and the MAOI **isocarboxazid.** Move from depression to smoking: **bupropion** and **varenicline,** smoking while anxious, two –azolams: **alprazolam** and **midazolam** and two -azepams **clonazepam** and **lorazepam.** "A" anxious to the "A"DHD stimulants **dexmethylphenidate, methylphenidate,** to non-stimulant **atomoxetine;** to "m-o" from atomoxetine for m-o-o-d stabilizer **lithium;** then "L" from lithium to low potency 1st-generation **chlorpromazine,** to high potency "halo" **haloperidol,** "–peridol" to "–peridone," 2nd generation whisper **risperidone** to whisper-quiet **quetiapine;** pine to traditional antiepileptics **carbamazepine, divalproex** and **phenytoin** to two newer antiepileptics Neu-rontin (which is **gabapentin)** and **pregabalin.** From epileptic motion to Parkinsonian

motion: **carbi<u>dopa</u> / levo<u>dopa</u>** and **sele<u>giline</u>** senility to Alzheimer's memory is done: **memantine** to "D" **done<u>pezil</u>** and "D" dizzy **scopolamine.**

CHAPTER 6 CARDIO

I. OTC ANTIHYPERLIPIDEMICS AND ANTIPLATELET

Few over-the-counter (OTC) medications help a patient with cardiologic issues. Both **Omega-3-acid ethyl esters (Lovaza)** and **Niacin (Niaspan ER)** come as brand name and OTC products, and are used to reduce cholesterol's impact on the patient. Plain **aspirin (Ecotrin)** in a low-dose of 81 milligrams helps prevent platelets from clotting, reducing a patient's chance of a heart attack.

OTC ANTIHYPERLIPIDEMICS

Omega-3-acid ethyl esters (Lovaza)

Oh-MEG-uh THREE AS-sid ETH-ill EST-ers (Loh-VAH-zah)

> **Omega-3-fatty acids** are available over-the-counter, but there is also a prescription version that undergoes rigorous FDA testing. **Lovaza** is a prescription brand name, but you can find **omega-3-fatty acids** over-the-counter commonly labeled as "Fish Oil."

Niacin (Niaspan ER)

NYE-uh-sin (NYE-uh-span ee-ar)

> A vitamin like **niacin** can reduce cholesterol levels in the body, however it may cause facial flushing that an **aspirin** thirty minutes before treatment prevents.

OTC ANTIPLATELET

Aspirin (Ecotrin)

AS-per-in (ECK-oh-trin)

> The 81mg daily **aspirin** dosage is not for analgesia or fever reduction. Rather, it keeps platelets from sticking, helping prevent strokes and heart attacks.

II. DIURETICS

The order of important structures in the nephron goes from *glomerulus* to *proximal convoluted tubule* (something in close proximity is near) to *Loop of Henle* to *distal convoluted tubule* (something that's distant or distal is far) to the *collecting duct*. The order of diuretics would then be:

1. Osmotic diuretics like **mannitol (Osmitrol)** work at the proximal convoluted tubule (PCT).
2. Loop diuretics like **furosemide (Lasix)** affect the Loop of Henle.
3. Thiazide diuretics like **hydrochlorothiazide (Microzide)** work at the distal convoluted tubule (DCT).
4. Potassium sparing diuretics like **triamterene (Dyrenium)** and **spironolactone (Aldactone)** work at the collecting duct.

Picture a water slide. A lot of water flows at the top (the glomerulus). A trickle flows at the bottom (the collecting duct). Similarly, diuretics produce less diuresis as they continue down the waterslide.
The order from most to least diuresis is osmotic > loop > thiazide > potassium sparing.

OSMOTIC

Mannitol (Osmitrol)

MAN-eh-tall (OZ-meh-trawl)

> **Mannitol,** an osmotic diuretic reduces intracranial pressure in an emergency. The brand name **Osmitrol** combines the class of medication "osmotic," and adds that it helps control brain swelling. The actor Bruce Lee died from this event.

LOOP

Furosemide (Lasix)

Fyoor-OH-seh-mide (LAY-six)

> Chemists named this class of diuretics after the part of the nephron the drug works in, the Loop of Henle. While the "–semide" stem indicates a "furosemide-type" diuretic, that's like defining a word with the word itself. One student said, "I have to pee furiously" as her mnemonic since loop diuretics produce significant diuresis. The brand name **Lasix** indicates it lasts six hours.

THIAZIDE

Hydrochlorothiazide (Microzide)

High-droe-klor-oh-THIGH-uh-zide (MY-crow-zide)

Thiazide diuretics get their class name from the stem of generic drugs like **hydrochlorothiazide.** The abbreviation HCTZ comes from "h" for hydro, "c" for chloro, "t" for thia, and "z" for zide. Thiazides don't produce as much diuresis as loop diuretics, but are excellent for initial treatment of hypertension. While the "hydro" in **hydrochlorothiazide** stands for the hydrogen atom, you can think of "hydro" as "water" for diuretic. The brand **Microzide** has thiazide's last four letters.

POTASSIUM SPARING AND THIAZIDE

Triamterene / Hydrochlorothiazide (Dyazide)

try-AM-terr-een / High-droe-klor-oh-THIGH-uh-zide (DIE-uh-zyde)

The combination of a potassium sparing diuretic **(triamterene)** and thiazide **(hydrochlorothiazide)** keeps potassium levels in balance while producing modest diuresis. The brand name **Dyazide** is triamterene's old brand name **Dyrenium** plus the last five letters of **hydrochlorothiazide.**

POTASSIUM SPARING

Spironolactone (Aldactone)

spear-oh-no-LACK-tone (Al-DAK-tone)

Spironolactone is another potassium sparing diuretic, but this drug can cause gynecomastia. Gynecomastia is an enlargement of male breasts. To remember **spironolactone** works in the collecting duct, I look at the "lactone," and think "last one." I know a lactone is a kind of chemical structure, but its place of action sticks in my head with this mnemonic.

To come up with the brand name, the manufacturer simply replaced the "spironol" of **spironolactone** with "ald" to make **Aldactone.** The "ald" is especially important because **spironolactone** blocks aldosterone, an important steroid hormone that helps the body retain sodium and water when blood pressure drops.

ELECTROLYTE REPLENISHMENT

Potassium chloride (K-Dur)

poe-TASS-ee-um klor-eyed (Kay-Dur)

Potassium chloride is a supplement often administered when a potassium sparing diuretic is contraindicated or when a loop diuretic lowers a patient's potassium levels. The "K" in **K-Dur** is the chemical symbol for potassium. The "Dur" is for long duration.

III. UNDERSTANDING THE ALPHAS AND BETAS

Confusion about alpha-adrenergic antagonists like **doxazosin (Cardura)** and beta-adrenergic antagonists like **propranolol (Inderal)** comes from seeing the receptor names, alpha and beta, instead of drug classifications; e.g., both **doxazosin** and **propranolol** are blood pressure lowering pills.

Alpha and beta are the first two letters of the Greek alphabet and name the receptors where these medications work. An adrenergic *agonist* works *like* adrenaline while an adrenergic *antagonist* works in the *opposite* way.

The prefix "adren" refers to the adrenal glands. The adrenal glands are *above* (ad) the *kidney* (renal) and secrete adrenaline. The suffix "ergic" refers to the Greek for "works like." Therefore, these drugs work like **adrenaline.** Note: **Adrenaline** and **epinephrine** are the same. **Epinephrine** uses the Greek translation of *above* (epi) and *kidney* (neph) to make **epinephrine** instead of the Latin form, **adrenaline.**

Instead of calling a drug a blood pressure pill (antihypertensive), its therapeutic class, prescribers classify a drug by the receptor it affects. By calling **propranolol (Inderal)** a beta-blocker, it's easier not to pigeonhole a drug into one use. Beta-blockers, for example, can treat angina pectoris, congestive heart failure, stage fright, and migraine, in addition to hypertension. **Doxazosin,** the alpha-blocker, also has multiple uses, including hypertension and benign prostatic hyperplasia (BPH). This is why classifying by the receptor name alpha or beta makes more sense.

Furthermore, there are receptor sub-types. Beta-1 receptors are concentrated in the heart (and we have one heart), and beta-2 receptors are concentrated in the lungs (and we have two lungs). You can find them in other places in the body, but for our introductory purposes, it's useful to think in this way.

If a beta-blocker is *non-selective,* like **propranolol (Inderal),** it can affect both beta-1 receptors in the heart to lower heart rate (good), block beta-2 receptors in the lungs and cause bronchoconstriction (bad). An asthmatic patient might have an adverse reaction to a drug that bronchoconstricts as a side effect.

We prefer **metoprolol (Lopressor)** to control blood pressure because it's selective for just the heart; it's classified as *beta-1 selective*. However, the body will try to compensate for this reduction in blood pressure by vasoconstricting arterioles.

Carvedilol (Coreg), a 3rd-generation beta-blocker, shows that it might be the best choice because it has vasodilating effects to counteract the vasoconstriction as well as cardiac effects.

ALPHA-1 ANTAGONIST

Doxazosin (Cardura)

Docks-AZ-oh-sin (car-DUR-uh)

> The blockade of alpha-1 receptors by **doxazosin** causes vasodilation and subsequent reduction in blood pressure. Memorize the stem "–azosin" as an alpha-blocker. You can also link the brand name, as **Cardura** provides durable cardiac relief of hypertension.

ALPHA-2 AGONIST

Clonidine (Catapres)

KLAH-neh-deen (CAT-uh-press)

Clonidine works in the brain by affecting alpha-2 receptors to reduce peripheral vascular resistance. You can look at the brand name **Catapres** and think of catabolize (break down) pressure (blood pressure).

Prescribers use **clonidine** in ADHD as single therapy or with stimulants like **methylphenidate (Concerta).** I had the weirdest experience at the gym. A parent had a loud and lengthy discussion with a psychiatrist about her child's **clonidine** and **Concerta** while lifting weights. I never forgot the **clonidine / Concerta** tandem after that.

BETA BLOCKERS – 1ST-GENERATION – NON-BETA-SELECTIVE

Propranolol (Inderal)

Pro-PRAN-uh-lawl (IN-dur-all)

Propranolol's last four letters have the "–olol" beta-blocker stem. The "o-l-o-l" looks like two letter "b's" backwards. Alternatively, if you "oh, laugh out loud," your heart rate goes down from stress relief. If you think of the last "al" in the brand name **Inderal** as it blocks "all" beta-receptors, you can remember this is a non-selective blocker.

BETA BLOCKERS – 2ND-GENERATION – BETA-SELECTIVE

Atenolol (Tenormin)

uh-TEN-oh-lol (Teh-NOR-min)

While the "–olol" in **atenolol** identifies this medication as a beta-blocker, a student does have to memorize that **atenolol** is 2nd generation. You can do that by memorizing its position after a non-selective first generation **propranolol** in this book or by seeing the "ten" in **atenolol** and knowing it's divisible by two. The "Ten" in the brand name **Tenormin** also matches to the "ten" in a**ten**olol.

Metoprolol tartrate (Lopressor)

meh-TOE-pruh-lawl TAR-trait (low-PRESS-or)

Practitioners rarely highlight the distinction in salts like tartrate and succinate, but it's important to recognize, as **metoprolol tartrate** and **metoprolol succinate** work for different lengths of time.

It would have been nice if the succinate was short acting and the tartrate, long acting; then alphabetical order would have worked or "s" for short acting. That it goes contrary to this logic is how I remember which is which. You can use the brand name **Lopressor** to remind you that **Lopressor** lowers blood pressure.

Metoprolol succinate (Toprol XL)

meh-TOE-pruh-lawl SUCKS-sin-ate" (TOE-prall ex-ell)

Metoprolol succinate is a long-acting form of **metoprolol.** The XL, often used to identify clothing as extra-large, indicates an extra-long acting effect in medications like **Toprol XL.**

BETA BLOCKERS – 3RD-GENERATION – NON-BETA-SELECTIVE, VASODILATING

Carvedilol (Coreg)

car-veh-DILL-awl (CO-reg)

I'm not sure if it was intentional to create a kind of hybrid stem with the "dil" replacing the first "o" in "olol," but you can remember **carvedilol** works by both vasodilation and beta-blockade in this way. The only official stem, however, is the "-dil-." I remember the brand name **Coreg** because it regulates coronary function.

IV. THE RENIN-ANGIOTENSIN-ALDOSTERONE-SYSTEM DRUGS

The RAAS, or renin-angiotensin-aldosterone system, controls blood pressure. By defining a few words in this system, we can better understand how the drugs work. The word **renin** comes from **renal** for kidneys, and this enzyme converts angiotensinogen to angiotensin I. Angiotensin converting enzyme (ACE) converts **angiotensin I** to **angiotensin II.** Angiotensin II is a potent vasoconstrictor and increases blood pressure when that is what our body needs. **Aldosterone** causes the retention of sodium and water, which can further increase blood pressure.

Angiotensin converting enzyme inhibitors (ACE inhibitors) such as **enalapril (Vasotec)** and **lisinopril (Zestril)** stop the body from creating this potent vasoconstrictor, thereby reducing hypertension.

ARBs, or angiotensin II receptor blockers, such as **losartan (Cozaar), olmesartan (Benicar),** and **valsartan (Diovan),** block or inhibit the connection between angiotensin II and the receptor that would cause vasoconstriction. This class of drugs is often used as an alternative to an ACE inhibitor when a patient experiences cough as a side effect from an ACE inhibitor.

Here is a mnemonic a student of mine who loved literature made up. It might help you remember the difference: D'artagnan the musketeer has to be "sartan" with the bARB of his blade, otherwise, he'll not be an ACE in April, I'm afraid.

ANGIOTENSIN CONVERTING ENZYME INHIBITORS (ACEIS)

Enalapril (Vasotec)

eh-NAL-uh-pril (VA-zo-teck)

> Sometimes students simply refer to the ACEIs like **enalapril** as "prils" based on the stem "-pril." While **enalapril** is taken orally, **enalaprilat** is an injectable form and active metabolite of **enalapril.** The brand **Vasotec** alludes to vasodilation on the vasculature.

Lisinopril (Zestril)

lie-SIN-oh-pril (ZES-tril)

> **Lisinopril,** like **enalapril,** works to block the vasoconstricting effects of angiotensin II. A student came up with **"Lisinopril** thrills an overworked heart, blocking angiotensin II from getting a start."

ANGIOTENSIN II RECEPTOR BLOCKERS (ARBS)

Losartan (Cozaar)

low-SAR-tan (CO-zar)

> Angiotensin II receptor blockers like **losartan** are often called ARBs and should be learned by the suffix "-sartan." The brand name **Cozaar** looks like it has R-A-A-S backwards (for renin-angiotensin-aldosterone-system) with a "z" replacing the "s."

Olmesartan (Benicar)

Ole-meh-SAR-tan (BEN-eh-car)

Olmesartan is another ARB identified by its "–sartan" stem. The brand name **Benicar** hints that the drug will benefit the cardiac system.

Valsartan (Diovan)

val-SAR-tan (DYE-oh-van)

Identify the generic name **valsartan** by its "–sartan" stem. **Diovan** has three of the letters of the generic name **v**alsart**an.**

V. CALCIUM CHANNEL BLOCKERS (CCBS)

Both calcium channel blocker (CCB) classes, the non-dihydropyridines and dihydropyridines, are vasodilators. However, the non-dihydropyridines **diltiazem (Cardizem)** and **verapamil (Calan)** also affect the heart directly and are antidysrhythmics. **Amlodipine (Norvasc)** and **nifedipine (Procardia)** are two dihydropyridines that only vasodilate.

If a patient needs a calcium channel blocker to prevent uterine contractions, **nifedipine (Procardia)** would be the best choice because it does not suppress the mother's and fetus's hearts as the non-dihydropyridines would.

In our daughters' case, the doctor prescribed low dose **nifedipine** so the calcium channel blockers did not suppress four hearts – my wife's and three unborn daughters'.

NON-DIHYDROPYRIDINES

Diltiazem (Cardizem)

dill-TIE-uh-zem (CAR-deh-zem)

> The "–tiazem" stem identifies **diltiazem** as a non-dihydropyridine. The brand name **Cardizem** adds the first five letters from cardiac to the last three letters of the generic diltiazem.

Verapamil (Calan)

ver-APP-uh-mill (KALE-en)

> One of my students came up with "Vera and Pam are ill and need this calcium blocking cardiac pill," for **verapamil.** Often **verapamil** is associated with constipation. My grandmother, a Navy nurse, used to put a **verapamil** tablet on my grandfather's breakfast cereal spoon. I always thought my grandfather was silently praying before he ate. When I finally asked him why he was so quiet, he said something to the effect of, "I'm deciding whether I want to eat or poop today." The brand name **Calan** takes three letters from the word calcium and two from channel blocker.

DIHYDROPYRIDINES

Amlodipine (Norvasc)

am-LOW-duh-peen (NOR-vasc)

> Students usually recognize **amlodipine's** "–dipine" stem, not only as a dihydropyridine, but also as a dip in blood pressure. A way to remember the brand name **Norvasc** is to think of the "n-o-r" from normalizes and the "v-a-s-c" from vasculature.

Nifedipine (Procardia)

nigh-FED-eh-peen (pro-CARD-e-uh)

Nifedipine is a dihydropyridine with the "–dipine" stem. **Procardia** takes the "p-r-o" from "promotes" and "c-a-r-d-i-a" from "cardiac" so you can remember the brand **Procardia** as promoting cardiac health.

VI. VASODILATOR

Nitroglycerin (Nitrostat)

nigh-trow-GLI-sir-in (NYE-trow-stat)

"Nitro-"is a World Health Organization (WHO) stem. **Nitroglycerin** converts to nitric oxide, a vasodilator. Make sure the patient sits when he takes the med because it causes significant dizziness. With **Nitrostat,** think "nitrous" from sports cars – the patient and blood pressure drop "stat."

VII. ANTIHYPERLIPIDEMICS

Medications for elevated cholesterol fall into several categories, including the "statins," which are more properly called the HMG-CoA reductase inhibitors, and the fibric acid derivatives. It's better to recognize statins such as **atorvastatin (Lipitor)** and **rosuvastatin (Crestor)** with the infix + suffix "–vastatin" because **nystatin (Mycostatin)** an antifungal medication contains "statin" in its name.

HMG-COA REDUCTASE INHIBITORS

Atorvastatin (Lipitor)

uh-TORE-va-stat-in (LIP-eh-tore)

> Students use letters of the HMG-CoA class to memorize potential adverse effects: "H" for hepatotoxicity, "M" for myositis, "G" for gestation (can't use during pregnancy). Brand name **Lipitor** is a lipid gladiator.

Rosuvastatin (Crestor)

Row-sue-vuh-STAT-in (CRES-tore)

> Like **atorvastatin, rosuvastatin** shares the "–vastatin" ending. Remember **Crestor** decreases cholesterol.

FIBRIC ACID DERIVATIVES

Fenofibrate (Tricor)

fen-oh-FIE-brate (TRY-core)

> A drug like **fenofibrate** has the obvious stem "–fibrate," a triglyceride lowering fibric acid derivative. **Tricor** lowers triglycerides to help your coronary status.

VIII. ANTICOAGULANTS AND ANTIPLATELETS

Anticoagulants affect clotting factors to help prevent thrombosis. The injectable anticoagulants **enoxaparin (Lovenox)** or **heparin** and the oral anticoagulant **warfarin (Coumadin)** affect coagulation in slower moving blood vessels like veins. **Dabigatran (Pradaxa)** works as an anticoagulant, but does not require monitoring with blood tests like **warfarin** and **heparin.**

Platelets stop bleeding by creating clots. However, patients with excess cholesterol might have a plaque that makes the clot more likely in a dangerous place. The antiplatelet drugs **aspirin (Ecotrin)** and **clopidogrel (Plavix)** decrease how "sticky" platelets are in high-pressure vessels such as arteries to prevent the clot and ensuing heart attack or stroke.

ANTICOAGULANTS

Enoxaparin (Lovenox)

e-knocks-uh-PEAR-in (LOW-ven-ox)

> **Enoxaparin** and **heparin** share the "–parin" stem because they are related. **Enoxaparin** is more expensive per dose, but patients can use it at home. It's also used as bridge therapy in a patient who is starting **warfarin** therapy. **Lovenox** is a low molecular weight heparin for deep vein thrombosis prevention.

Heparin

HEP-uh-rin

> **Heparin** and "bleedin'" sort of rhyme to remember its primary adverse effect. A student mentioned the actor Dennis Quaid's twins, who received a double dose of **heparin** that caused bleeding. Sometimes knowing a celebrity with a condition helps memory.

Warfarin (Coumadin)

WAR-fa-rin (KOO-ma-din)

> That the "–parin" stem from the anticoagulants **heparin** and **enoxaparin** and "–farin" stem of **warfarin** are similar. This reminds students they are all anticoagulants. Students associate bleeding with warfare. The INR (international normalized ratio), a way of measuring **warfarin's** effectiveness, monitors the patient who is on therapy. "I-N-R" happen to be the last three letters of **warfarin.**
> A student said that **warfarin** has "far" in it, as in you have to go far to have blood drawn. A way to remember Vitamin K affects **Coumadin** and coagulation is to spell **Coumadin** with a "K" instead of a "C."

Dabigatran (Pradaxa)

da-bih-GA-tran (pra-DAX-uh)

Memorize **dabigatran's** "–gatran" stem to note the difference between anticoagulants. **Dabigatran** doesn't need INR monitoring like **warfarin** does. Note the last three letters in **dabigatran** as not being "I-N-R."

ANTIPLATELET

Clopidogrel (Plavix)

klo-PID-oh-grel (PLA-vix)

Clopidogrel and **aspirin** work similarly leading to a reduced likelihood that platelets will stick together and clot. **Plavix** vexes platelets and keeps the blood thin.

IX. CARDIAC GLYCOSIDE AND ANTICHOLINERGIC

A cardiac glycoside, such as **digoxin (Lanoxin),** increases the force of contraction of the heart. We call this a positive inotropic effect. Also an antidysrhythmic, **digoxin** changes the electrochemistry of the heart to prevent dysrhythmias.

Atropine (AtroPen), an anticholinergic, prevents bradycardia, a drop in heart rate. **Atropine** can treat certain cholinergic poisonings.

CARDIAC GLYCOSIDE

Digoxin (Lanoxin)

di-JOCKS-in (la-KNOCKS-in)

Digoxin treats congestive heart failure by increasing the force of the heart's contractions. **Digoxin** is derived from the plant *Digitalis lanata.* In Latin, *Digitalis* means something like hand or "digits," while *lanata* means "wooly" because the actual plant is fuzzy. Therefore, **digoxin** comes from the name *digitalis,* and brand name **Lanoxin** comes from *lanata.* Alternatively, you could remember that **Lanoxin** and **digoxin** keep your heartbeat rockin'.

ANTICHOLINERGIC

Atropine (AtroPen)

ah-trow-PEEN (ah-trow-PEN)

Atropine causes anticholinergic (anti = against, cholinergic = of acetylcholine) effects. Anticholinergic effects fall under the broad category of "dry." Use the ABDUCT mnemonic, as in anticholinergics "abduct" water: Anhidrosis, Blurry vision (secondary to dry eyes), Dry mouth, Urinary retention, Constipation, and Tachycardia. This tachycardic side effect therapeutically prevents bradycardia in patients undergoing certain procedures.

Note: Cholinergic effects would include "wet" effects: sweating, lacrimation (watery eyes), hypersalivation, urinary incontinence, diarrhea, and bradycardia.

CARDIO DRUG QUIZ (LEVEL 1)

Classify these drugs by placing the corresponding drug class letter next to each medication. Try to underline the stems before you start and think about the brand name and function for each drug. (Click here for answers).

1. Atorvastatin (Lipitor)
2. Clopidogrel (Plavix)
3. Enalapril (Vasotec)
4. Enoxaparin (Lovenox)
5. Furosemide (Lasix)
6. Hydrochlorothiazide (Microzide)
7. Losartan (Cozaar)
8. Metoprolol (Lopressor)
9. Nifedipine (Procardia)
10. Spironolactone (Aldactone)

Cardio drug classes:

A. ACE inhibitor (ACEI)
B. Alpha blocker
C. Angiotensin receptor blocker (ARB)
D. Anticoagulant
E. Antiplatelet
F. Beta blocker: selective
G. Beta blocker: non-selective
H. CCB – dihydropyridine
I. CCB – non-dihydropyridine
J. Cardiac glycoside
K. Diuretic: Loop
L. Diuretic: Osmotic
M. Diuretic: Potassium sparing
N. Diuretic: Thiazide
O. HMG-CoA reductase inhibitor
P. Vasodilator

CARDIO DRUG QUIZ (LEVEL 2)

Classify these drugs by placing the corresponding drug class letter next to each medication. Try to underline the stems before you start and remember the brand name and function of each drug. (Click here for answers).

1. Diltiazem
2. Carvedilol
3. Olmesartan
4. Hydrochlorothiazide
5. Doxazosin
6. Amlodipine
7. Nitroglycerin
8. Lisinopril
9. Digoxin
10. Warfarin

Cardio drug classes:

A. ACE inhibitor (ACEI)
B. Alpha blocker
C. Angiotensin receptor blocker (ARB)
D. Anticoagulant
E. Antiplatelet
F. Beta blocker: selective
G. Beta blocker: non-selective
H. CCB – dihydropyridine
I. CCB – non-dihydropyridine
J. Cardiac glycoside
K. Diuretic: Loop
L. Diuretic: Osmotic
M. Diuretic: Potassium sparing
N. Diuretic: Thiazide
O. HMG-CoA reductase inhibitor
P. Vasodilator

CARDIO: MEMORIZING THE CHAPTER

Omega-3-Acid E.E.

Niacin

Aspirin (Low Dose)

Mannitol

Furosemide

Hydrochlorothiazide

HCTZ/Triamterene

Spironolactone

Potassium Chloride

Doxazosin

Clonidine

Propranolol

Atenolol

Metoprolol Succinate

Metoprolol Tartrate

Carvedilol

Enalapril

Lisinopril

Losartan

Olmesartan

Valsartan

Diltiazem

Verapamil

Amlodipine

Nifedipine

Nitroglycerin

Atorvastatin

Rosuvastatin

Fenofibrate

Heparin

Enoxaparin

Warfarin

Dabigatran

Clopidogrel

Digoxin

Atropine

"C" CARDIO

"O" from cardio to **Omega-3 acid ethyl esters** to **niacin** to **aspirin** you need to take before the niacin to prevent flushing. Flushing five diuretics in nephron order: **mannitol, furosemide, hydrochlorothiazide, HCTZ / triamterene, spironolactone** (potassium sparing), then **potassium chloride** to alphas: alpha 1 **doxazosin,** alpha 2 **clonidine;** to betas: 1st-generation beta 1 and beta 2 **propranolol;** 2nd-generation, beta 1 only, **atenolol, metoprolol tartrate** short acting to **metoprolol succinate** long acting; to 3rd-generation **carvedilol.** Dil to pril ACEIs **enalapril, lisinopril.** ARBs "l-o-v" **losartan, olmesartan** and **valsartan;** "-sartan" to CCBs non-dihydropyridines **diltiazem** and **verapamil** to the dihydropyridines **amlodipine** and **nifedipine** vasodilating only; CCBs to **nitroglycerin,** a vasodilator. Nitroglycerin brand name **Nitrostat** to stat-ins: **atorvastatin** to **rosuvastatin;** LDL to lowered triglycerides, **fenofibrate** fibs children tell to parents, parenteral **enoxaparin** and **heparin,** "-parin" to "-farin," **warfarin** enteral anticoagulant with **dabigatran,** "d" to **digoxin** for CHF and **atropine** to prevent a bradycardic mess.

CARDIODE TO JOY

Cardiode to Joy, sung to the tune of Beethoven's *Ode to Joy,* is a mnemonic that you can sing, hum or just say that attaches many of the common cardio drug endings and classes to their functions.

o-l-o-l-p-r-i-l-and-s-a-r-t-a-n

be-ta-block-er-ace-in-hib-i-tor-and-ARBs-suff-ix-end

as-pir-in-and-clo-pid-o-grel-both-block-plate-lets-round-a-stent

war-fa-rin-and-hep-a-rin-are-both-an-ti-co-ag-u-lants

stat-ins-low-er-chol-est-ter-ol

dig-keeps-your-heart-from-fail-in

ver-a-pa-mil-and-am-lo-di-pine

both-block-cal-cium-chan-nels.

CHAPTER 7 ENDOCRINE / MISC.

I. OTC INSULIN AND EMERGENCY CONTRACEPTION

Most people don't think of insulin as an over-the-counter medication, but a prescription is not required for **regular insulin** or **NPH insulin** (intermediate duration of action) for self-pay patients. Alphabetically "N" comes before "R," but the convention is to put them in order from shortest to longest acting.

Pharmacies refrigerate insulins for stability. Insulins are expensive, so drug stores keep them in the pharmacy refrigerator not only to prevent theft, but so they know that the insulin hasn't left the refrigerator and been exposed to room temperatures. An insulin vial's box has the rectangular shape of a refrigerator to help you remember.

Emergency contraception is a form of birth control used after unprotected sex to keep a patient from getting pregnant. **Levonorgestrel (Plan B)** is a relatively recent introduction. In 1999, it was prescription only, and then it became available behind-the-counter (BTC), but is now available OTC.

Regular insulin (Humulin R)

REG-you-lar IN-su-lin (HUE-myou-lin ARE)

> **Regular insulin** is short acting, but not to be confused with the shortest-acting insulins available, such as **Humalog.** Prescribers can use **regular insulin** when patients need to adjust dosages on a sliding scale. Insulin used to come from a pig (porcine) or cow (bovine), but now matches human insulin because of molecular engineering. Therefore, the Eli Lilly brand name **Humulin** simply squishes the words human and insulin together.

NPH insulin (Humulin N)

en-pee-aitch IN-su-lin(HUE-myou-lin EN)

> The "N-P-H" in **NPH insulin** stands for neutral protamine Hagedorn. The neutral protamine refers to how Hagedorn, the inventor, chemically altered the insulin. The "e-n" pronunciation of the letter "N" sounds a little like "i-n" and can help you remember it's an intermediate acting insulin.

Levonorgestrel (Plan B One-Step)

LE-·vo-·nor-JESS-trel (plan-bee won-step)

You can recognize **levonorgestrel** as a progestin hormone product by the "gest" stem. Take it within 72 hours after sexual intercourse. It can cause nausea, so some flat soda might help calm this down. It's now called **Plan B One-Step** because it used to take two steps or two doses to provide this contraception.

I used to work in a college town pharmacy and every Saturday and Sunday morning, I would have a ton of students coming to pick up Plan B. Every time, the man drove, and the woman was in the passenger seat. When I told the male student it was fifty bucks for the **Plan B,** he would invariably look at her, and then pay. One time, however, I overheard her say, "Oh no, you just didn't." Remember the "g-e-s-t" from that "just" that is part of the word **Levonorgestrel.**

II. DIABETES AND INSULIN

Diabetes mellitus is a condition of chronic excess blood sugar. There are three types: type I, which we previously called juvenile onset diabetes; type II, which we referred to as adult-onset diabetes; and gestational diabetes, a condition where a pregnant woman becomes diabetic. Depending on the condition, there are different drugs that can help lower blood sugar. Almost all oral medications have "gl," or "glu" for "glucose" in their names. Four of these drugs include **metformin (Glucophage), sitagliptin (Januvia), glipizide (Glucotrol)** and **glyburide (DiaBeta).** I memorized them in alphabetical order of their drug classes: biguanide **(metformin),** dipeptidyl peptidase-4 (DPP-4) **(sitagliptin),** and sulfonylurea **(glipizide** and **glyburide).**

Insulin for diabetes comes from the Latin word insula, which means island. The islets of Langerhans in your pancreas have cells that produce insulin (beta cells), which lowers blood sugar; and cells that produce glucagon (alpha cells), which tells the body to raise blood glucose levels.

There are four major classes of insulin used in treatment:

- *Rapid acting* starts working in 15 minutes and lasts 4 hours, e.g., **insulin lispro (Humalog).**
- *Short acting* works in 30 minutes and lasts about 6 to 8 hours, e.g., **regular insulin (Humulin R).**
- *Intermediate duration* **NPH insulin (Humulin N)** works in an hour or two and lasts 14-24 hours.
- *Long duration* **insulin glargine (Lantus, Toujeo)** starts working in an hour and lasts 24 hours.

ORAL ANTI-DIABETICS – BIGUANIDES

Metformin (Glucophage)

met-FOUR-men (GLUE-co-fage)

> One student came up with this mnemonic, "If you met four men on **Glucophage,** they are diabetic then." Phagocytosis is the process of cell eating. You can use the brand name **Glucophage** to think of the medication as eating, or "phage-ing" glucose.

ORAL ANTI-DIABETICS – DPP-4 INHIBITORS

Sitagliptin (Januvia)

sit-uh-GLIP-tin (ja-NEW-vee-uh)

> Although the "-gliptin" stem helps us recognize **sitagliptin** as an anti-diabetic, students associate the sugar you might put in "Lipton" iced tea with **sitagliptin.** The brand name **Januvia** ends in "v-i-a" and is similar to "d-i-a" from diabetes.

ORAL ANTI-DIABETICS – SULFONYLUREAS 2ND-GENERATION

Glipizide (Glucotrol)

GLIP-eh-zide (GLUE-co-trawl)

The "gli-" stem in **glipizide** indicates an antihyperglycemic medication. The brand name **Glucotrol** alludes to the control of blood glucose in diabetics.

Glyburide (DiaBeta)

GLY-byour-ide (die-uh-BAY-ta)

The "gly-" stem in **glyburide** is archaic, and has been replaced in new medicines by the stem "gli-." The brand name **DiaBeta** combines the "d-i-a" from diabetic, and the "B-e-t-a" from the Beta cells, which release insulin.

HYPOGLYCEMIA

Glucagon (GlucaGen)

GLUE-ca-gone (glue-ca-JEN)

Remember the generic with, "I use **glucagon** when the glucose is gone." **GlucaGen,** the brand name, generates glucose when a patient is hypoglycemic.

RX INSULIN

Insulin lispro (Humalog)

IN-su-lin LICE-pro (HUE-mah-log)

Insulin glargine would precede **insulin lispro** alphabetically, but the convention is to list the medications shorter acting to longer acting. I use my Spanish language to help memorize that **insulin lispro** is rapid acting. When I was in Mexico on a zip line, the person in the first tower would say, "Listo, listo," meaning "You ready, I'm ready." Then I would fly fast down that zip cord. **Humalog** is a human insulin analog. I always pictured a log floating down rapids fast to remember **Humalog** is a rapid acting insulin.

Insulin glargine (Lantus, Toujeo)

IN-su-lin GLAR-Jean (LAN-tuss, TWO-jzeh-oh)

With **insulin glargine,** I think of glaring and lurking, someone who is *slowly* creeping around. One student came up with **"Lantus** lasts all day long, take it at night, and your life will be prolonged." I've also heard "lazy **Lantus"** used to help remember it's a 24-hour drug.

III. THYROID HORMONES

Thyroid hormone stimulates the heart, metabolism, and helps with growth. A hyperthyroid patient's body uses energy too quickly because of the extra thyroid hormone in circulation.

This patient can use **propylthiouracil (PTU)** to reduce the effects of the thyroid hormone. Hypothyroid patients need extra thyroid hormone, such as **levothyroxine (Synthroid),** for replacement.

HYPOTHYROIDISM

Levothyroxine (Synthroid)

Lee-vo-thigh-ROCKS-een (SIN-throyd)

The generic name **levothyroxine** has the "thyro" from thyroid in the name; you just have to remember it's for supplementation. The brand name **Synthroid** combines the words synthetic and thyroid.

HYPERTHYROIDISM

Propylthiouracil (PTU)

pro-pill-thigh-oh-YOUR-uh-sill (pee-tee-you)

PTU takes "p" from propyl, "t" from "thio," and "u" from uracil in the generic **propylthiouracil**. Although "thio" means there is a sulfur atom in the molecule, you can think of it as thyroid lowering.

IV. HORMONES AND CONTRACEPTION

Testosterone is an androgen steroid hormone that naturally comes from the male testes. As a medication, prescribers use it to supplement conditions of low testosterone.

Pharmaceutical birth control, commonly known as "the pill," traditionally came from a combined oral contraceptive pill (COCP) that has a combination of an estrogen and a progestin. There are many variations of "the pill" including **Loestrin 24 Fe.** The Fe stands for ferrous, or iron, on the periodic table. The tri-phasic birth controls, such as **Tri-Sprintec,** have three different doses of an estrogen and progestin, taken variously throughout the month to mimic the body's naturally changing hormone levels. Two novel birth control delivery methods include a vaginally inserted ring **(NuvaRing)** and a transdermal patch **(OrthoEvra).**

TESTOSTERONE

Testosterone (AndroGel)

Tess-TOSS-ter-own (ANN-droh GEL)

> Most people know the steroid hormone **testosterone,** but note the stem for a steroid is "ster." "Andro" is the Greek prefix for male and gel is the vehicle in **AndroGel,** indicating it's a "gel" for a "male."

CONTRACEPTION – COMBINED ORAL CONTRACEPTIVES

Norethindrone / ethinyl estradiol / ferrous fumarate (Loestrin 24 Fe)

Nor-eth-IN-drone / ETH-in-ill es-tra-DYE-all

(Low-ES-trin EF-ee Twen-TEE fore)

> It's important to first memorize the estrogen stem "estr-" and progestin stem "-gest-." Then I got a little rhyme crazy with the contraceptive brand name mnemonics. One rhyme goes: **"Loestrin 24 Fe** reduces the length of menstruation, with iron supplementation, to prevent an anemic situation."

Norgestimate / ethinyl estradiol (Tri-Sprintec)

Nor-JESS-teh-mate / ETH-in-ill es-tra-DYE-all"

> For most hormone-based contraceptives, it's important to note both the estrogen stem "estr-"and progestin stem "-gest-." And here's another rhyme: **"Tri-Sprintec** is triphasic, take three different doses, in seven-day spaces."

CONTRACEPTION – PATCH

Norelgestromin / ethinyl estradiol (OrthoEvra)

Nor-el-JESS-tro-min / ETH-in-ill es-tra-DYE-all (OR-thoe EV-rah)

One student thought of the "Norel" in **norelgestromin** as "not oral" to remember this is a patch. Another rhyme highlights the places a woman should place the patch and length of time to leave it there: **"OrthoEvra** is a patch, put it on your arm, your abs, your buttock or back, and then take it off a week after that."

CONTRACEPTION – RING

Etonogestrel / ethinyl estradiol (NuvaRing)

Et-oh-no-JESS-trel / ETH-in-ill es-tra-DYE-all" (NEW-va-ring)

A student thought of the "Etono" in **etonogestrel** as "Eat, oh no" to remember it's not an oral tablet. A final rhyme and then I promise, no more: **"NuvaRing** is one way to keep the stork away before you are ready for parenting a bay-bay" (By the way, just as an aside, there is no time when you are actually ready for parenting.)

V. OVERACTIVE BLADDER, URINARY RETENTION, ERECTILE DYSFUNCTION, BENIGN PROSTATIC HYPERPLASIA

Frequently the words incontinence, urinary retention, impotence, and benign prostatic hyperplasia are confused:

- **Overactive bladder (OAB) (incontinence)** is an inability to retain urine due to overactive bladder.
- **Urinary retention** is a difficulty in urination.
- **Erectile dysfunction (ED) (impotence)** is the inability to achieve or maintain an erection.
- **Benign prostatic hyperplasia (BPH)** is a benign (not harmful) prostate growth or increase in size.

We try not to use the terms "incontinence" or "impotence" because of the harshness to the words.

OVERACTIVE BLADDER

Oxybutynin (Ditropan, Oxytrol OTC)

ox-e-BYOU-tin-in (DIH-trow-pan)

One student remembered **oxybutynin** as keepin' the urin' in. Both **Ditropan** and **Oxytrol** have the "t-r-o" from control for controlling an overactive bladder.

Solifenacin (VESIcare)

sol-eh-FEN-a-sin (VEH-si-care)

Solifenacin is given once daily, so thinking about it as "slow-fenacin" helps in remembering this point. Also, **solifenacin** solves the problem of urine that needs to be "fenced in." **VESIcare** contains *vesica*, which means "bladder" in Latin.

Tolterodine (Detrol)

toll-TER-oh-dean (DEH-trawl)

The generic name **tolterodine** has the "t-r-o" from control in the name as well. **Detrol** helps control the detrusor muscle, keeping urine in.

URINARY RETENTION

Bethanechol (Urecholine)

beh-THAN-uh-call (yur-eh-CO-lean)

The "chol" in **bethanechol** helps you remember it's cholinergic. While anticholinergics are dry, cholinergics do the opposite and make things wet. This drug assists the bladder muscles in expelling urine. The brand name **Urecholine** alludes to how it affects urination through cholinergic effects.

ERECTILE DYSFUNCTION (PDE-5 INHIBITORS)

Sildenafil (Viagra)

sill-DEN-uh-fill (vie-AG-rah)

There is a scene with Jack Nicholson in the movie *Something's Gotta Give* that reminds us **sildenafil** shouldn't be used with nitrates like **nitroglycerin. Viagra** brings viable growth – an erection.

Tadalafil (Cialis)

ta-DAL-uh-fill (see-AL-is)

Cialis is the weekend pill because it, unlike **sildenafil,** lasts the weekend, as it has a long half-life. I asked some students about how they remembered **tadalafil** and I'm hesitant to share their mnemonic. One said you just think "ta-dah" as in "surprise." I stopped them before they started on to how they remember the "fil" part of the generic name. **Cialis** is the dual bathtub commercials drug.

BPH – ALPHA BLOCKER

Tamsulosin (Flomax)

tam-syoo-LOW-sin (FLOW-Max)

Flomax allows for maximum urinary flow. The "osin" ending is not an actual stem, but a way to connect **tamsulosin** and **alfuzosin** as being similar.

Alfuzosin (Uroxatral)

al-fyoo-ZOH-sin (YUR-ox-uh-trall)

With BPH, there is sometimes difficulty with urine control and I think the brand **Uroxatral** sounds a little like "Urine control."

BPH – 5-ALPHA-REDUCTASE INHIBITOR

Dutasteride (Avodart)

due-TAS-ter-ide (AH-vo-dart)

Use the "–steride" stem to recognize the 5-alpha-reductase inhibitors like **dutasteride.** The "ster" for steroid helps you remember it's for men (and prostate).

Finasteride (Proscar, Propecia)

fin-AS-ter-ide" (PRO-scar, pro-PEE-shuh)

To connect the brand name **Proscar** to the generic **finasteride,** a professor told me of a student who used the phrase "That pro's car is the finest ride." **Proscar** is for prostate **car**e. **Finasteride's** other brand name, **Propecia,** alludes to hair growth and is to reverse of alopecia (hair loss).

ENDOCRINE / MISC. DRUG QUIZ (LEVEL 1)

Classify these drugs by placing the corresponding drug class letter next to each medication. Try to underline the stems before you start and think about the brand name and function of each drug. (Click here for answers).

1. Glipizide (Glucotrol)
2. Glucagon (GlucaGen)
3. Glyburide (DiaBeta)
4. Insulin glargine (Lantus)
5. Levothyroxine (Synthroid)
6. Metformin (Glucophage)
7. Propylthiouracil (PTU)
8. Regular insulin (Humulin R)
9. Solifenacin (VESIcare)
10. Sildenafil (Viagra)

Endocrine system drug classes:

A. Anti-diabetic
B. BPH – 5-alpha-reductase inhibitor
C. BPH – alpha blocker
D. Contraception – COCP triphasic
E. Contraception – COCP with iron
F. Contraception – patch
G. Contraception – ring
H. For hypoglycemia
I. For hypothyroidism
J. For hyperthyroidism
K. Erectile dysfunction
L. OAB
M. Insulin – long acting
N. Insulin – short acting
O. Urinary retention

ENDOCRINE / MISC. DRUG QUIZ (LEVEL 2)

Classify these drugs by placing the corresponding drug class letter next to each medication. Try to underline the stems before you start and remember the brand name and function of each drug. (Click here for answers).

1. Dutasteride
2. Tamsulosin
3. Tolterodine
4. Tadalafil
5. Norethindrone / ethinyl estradiol / Fe
6. Norelgestromin / ethinyl estradiol
7. Oxybutynin
8. Bethanechol
9. Sildenafil
10. Finasteride

Endocrine system drug classes:

A. Anti-diabetic
B. BPH – 5-alpha-reductase inhibitor
C. BPH – alpha blocker
D. Contraception – COCP triphasic
E. Contraception – COCP with iron
F. Contraception – patch
G. Contraception – ring
H. For hypoglycemia
I. For hypothyroidism
J. For hyperthyroidism
K. Erectile dysfunction
L. OAB
M. Insulin – long acting
N. Insulin – short acting
O. Urinary retention

ENDOCRINE: MEMORIZING THE CHAPTER

Regular Insulin

NPH Insulin

Levonorgestrel

Metformin

Sitagliptin

Glipizide

Glyburide

Glucagon

Insulin lispro

Insulin glargine

Levothyroxine

Propylthiouracil

Testosterone

Ethinyl Estradiol / Norethindrone / Ferrous fumarate

(Loestrin 24 Fe)

Ethinyl Estradiol / Norgestimate

(Tri-Sprintec)

Ethinyl Estradiol / Etonogestrel

(NuvaRing)

Ethinyl Estradiol / Norelgestromin

(OrthoEvra)

Oxybutynin

Solifenacin

Tolterodine

Bethanechol

Sildenafil

Tadalafil

Alfuzosin

Tamsulosin

Dutasteride

Finasteride

(Oral contraceptives brand names in parenthesis for clarity)

"E" ENDOCRINE

Start with the OTC two middle peak insulins from the "r" and "n" in endocrine: **regular insulin** and **insulin NPH;** then Plan B One-Step **levonorgestrel.** RX: four oral antidiabetics in order of drug class: the biguanide **metformin,** the DPP-4 **sitagliptin,** and two sulfonylureas **glipizide** and **glyburide;** then **glucagon** for when the glucose is gone. On to prescription shortest and longest acting insulins: **insulin aspart (Humalog)** and **insulin glargine (Lantus).** "T" in lantus to "T" thyroid level low **(levothyroxine),** to thyroid level high **(PTU).** "T" again to low T **testosterone.** Testosterone "-ster-" stem to estrogen "estr-" stem. **Ethinyl estradiol** "estr-" times four in four oral contraceptives, from high on the body to low starting with an oral (po) form with iron, another p.o. tri-phasic, a belly patch, and vaginal ring, brand names are easier first, Loestrin 24 Fe, Tri-Sprintec, OrthoEvra patch, NuvaRing. Generic progestins are next: **norethindrone, norgestimate, norelgestromin, etonogestrel.** Overactive bladder (OAB) **oxybutynin, solifenacin,** and **tolterodine,** to the opposite – urinary retention: **bethanechol;** to a lack of erection by half-life: **sildenafil** short and **tadalafil** long, but also **tadalafil** for BPH and alpha-blockers **alfuzosin** and **tamsulosin,** and 5-alpha reductase **dutasteride** and **finasteride.**

CHAPTER 8 MATCHING EXAMS

Congratulations! You've made it through the first 200 drugs in this book. I hope that you've started to commit the mnemonics to memory and found suffixes and prefixes you can count on to help you remember drug classes.

The following pages include two final exams. The first final exam provides generic and brand names for the medications, and is a little easier. The second final exam, like some of your board exams, provides only generic names for a greater challenge.

If you feel you want more of a review, you can look at the summary of prefixes and suffixes in the index and then move on to the exams.

Remember to underline the drug stems first and picture what chapter you learned them in.

After you are done, review the ones you missed and shore up some memorization gaps. Then you are ready to go from 200 drugs to 350 drugs (if you really want to).

MATCHING EXAM 1, QUESTIONS 1-25, CH. 1-3

(Click here for answers).

___1 Loperamide (Imodium)

___2 Acetaminophen (Tylenol)

___3 Allopurinol (Zyloprim)

___4 APAP / Codeine (Tylenol/Codeine)

___5 Budesonide / Formoterol (Symbicort)

___6 Omeprazole (Prilosec)

___7 Esomeprazole (Nexium)

___8 Febuxostat (Uloric)

___9 Guaifenesin / Dextromethorphan (Robitussin DM)

__10 Fluticasone / Salmeterol (Advair)

__11 Hydrocodone / APAP (Vicodin)

__12 Fentanyl (Duragesic)

__13 Famotidine (Pepcid)

__14 Docusate sodium (Colace)

__15 Celecoxib (Celebrex)

__16 Aspirin [ASA] (Ecotrin)

__17 Alendronate (Fosamax)

__18 Albuterol (ProAir)

__19 ASA / APAP / Caffeine (Excedrin)

__20 Bismuth subsalicylate (Pepto-Bismol)

__21 Calcium carbonate (Tums)

__22 Guaifenesin / Codeine (Cheratussin AC)

__23 Cetirizine (Zyrtec)

__24 Diphenhydramine (Benadryl)

__25 Etanercept (Enbrel)

a. 1st-generation antihistamine

b. 2nd-generation antihistamine

c. 5-HT3 receptor antagonist

d. Antacid

e. Anticholinergic for asthma

f. Anti-diarrheal

g. Anti-gout

h. Anti-nausea

i. Bisphosphonate

j. DMARD

k. H2 blocker

l. Laxative

m. Mucolytic/cough

o. Non-narcotic analgesic

q. Opioid analgesic

s. Short-acting bronchodilator

n. Non-narcotic analgesic combo

p. NSAID

r. Proton pump inhibitor

t. Steroid/bronchodilator

MATCHING EXAM 1, QUESTIONS 26-50, CH. 4

(Click here for answers).

__26 Raltegravir (Isentress)

__27 Amoxicillin / Clavulanate (Augmentin)

__28 Ceftriaxone (Rocephin)

__29 Doxycycline (Doryx)

__30 Levofloxacin (Levaquin)

__31 Sulfamethoxazole / Trimethoprim (Bactrim)

__32 Cephalexin (Keflex)

__33 Ethambutol (Myambutol)

__34 Rifampin (Rifadin)

__35 Isoniazid (INH)

__36 Amikacin (Amikin)

__37 Cefepime (Maxipime)

__38 Amphotericin B (Fungizone)

__39 Amoxicillin (Amoxil)

__40 Azithromycin (Zithromax)

__41 Fluconazole (Diflucan)

__42 Oseltamivir (Tamiflu)

__43 Minocycline (Minocin)

__44 Clarithromycin (Biaxin)

__45 Gentamicin (Garamycin)

__46 Pyrazinamide (PZA)

__47 Nystatin (Mycostatin)

__48 Erythromycin (E-Mycin)

__49 Ciprofloxacin (Cipro)

__50 Acyclovir (Zovirax)

a. 1st-generation cephalosporin

b. 2nd-generation cephalosporin

c. 3rd-generation cephalosporin

d. 4th-generation cephalosporin

e. Antibiotic: aminoglycoside

f. Antibiotic: fluoroquinolone

g. Antibiotic: macrolide

h. Antibiotic: penicillin

i. Antibiotic: sulfa

j. Antibiotic: tetracycline

k. Antifungal

l. Antituberculosis

m. Antiviral: herpes

o. Antiviral: Influenza

n. Antiviral: HIV

MATCHING EXAM 1, QUESTIONS 51-75, CH. 5

(Click here for answers).

__51 Sertraline (Zoloft)

__52 Carbamazepine (Tegretol)

__53 Cyclobenzaprine (Flexeril)

__54 Divalproex (Depakote)

__55 Gabapentin (Neurontin)

__56 Lithium (Lithobid)

__57 Meclizine (Antivert)

__58 Lidocaine (Solarcaine)

__59 Fluoxetine (Prozac)

__60 Escitalopram (Lexapro)

__61 Clonazepam (Klonopin)

__62 Benzocaine (Anbesol)

__63 Amitriptyline (Elavil)

__64 Atomoxetine (Strattera)

__65 Dexmethylphenidate (Focalin)

__66 Escitalopram (Lexapro)

__67 Haloperidol (Haldol)

__68 Lorazepam (Ativan)

__69 Levodopa / Carbidopa (Sinemet)

__70 Donepezil (Aricept)

__71 Citalopram (Celexa)

__72 Alprazolam (Xanax)

__73 Chlorpromazine (Thorazine)

__74 Eszopiclone (Lunesta)

__75 Isocarboxazid (Marplan)

a. ADHD drug/non-stimulant

b. ADHD drug/stimulant

c. Alzheimer's

d. Antidepressant: MAOI

e. Antidepressant: SNRI

f. Antidepressant: SSRI

g. Antidepressant: TCA

h. Antiepileptic: newer

i. Antiepileptic: traditional

j. Antipsychotic: 2nd generation

k. Antipsychotic: 1st-generation

l. Benzodiazepine

m. Local anesthetic

o. Parkinson's

q. Simple salt

n. Muscle relaxer

p. Sedative-hypnotic

r. Vertigo/motion sickness

MATCHING EXAM 1, QUESTIONS 76-100, CH. 6-7

(Click here for answers).

__76 Norethindrone / Ethinyl estradiol / Fe (Loestrin Fe)

__77 Bethanechol (Urecholine)

__78 Amlodipine (Norvasc)

__79 Diltiazem (Cardizem)

__80 Glucagon (GlucaGen)

__81 Finasteride (Proscar)

__82 Hydrochlorothiazide (Microzide)

__83 Regular insulin (Humulin R)

__84 HCTZ / Triamterene (Dyazide)

__85 Oxybutynin (Ditropan)

__86 Clopidogrel (Plavix)

__87 Norgestimate / Ethinyl estradiol (Tri-Sprintec)

__88 Propranolol (Inderal)

__89 Furosemide (Lasix)

__90 Enalapril (Vasotec)

__91 Insulin glargine (Lantus)

__92 Enoxaparin (Lovenox)

__93 Atorvastatin (Lipitor)

__94 Digoxin (Lanoxin)

__95 Norelgestromin / Ethinyl estradiol (OrthoEvra)

__96 Dutasteride (Avodart)

__97 Glipizide (Glucotrol)

__98 Heparin

__99 Glyburide (DiaBeta)

_100 Etonogestrel / Ethinyl estradiol (NuvaRing)

a. ACE inhibitor

b. ARB

c. Anticoagulant

d. Antidiabetic

e. Antiplatelet

f. Beta blocker

g. BPH: 5-alpha-reductase inhibitor

h. BPH: Alpha blocker

i. Calcium channel blocker

j. Cardiac glycoside

k. Contraception

l. Diuretic

m. For hypoglycemia

o. For hypothyroidism

q. Erectile dysfunction

s. Longer duration insulin

u. Urinary retention

n. For hyperthyroidism

p. HMG-CoA reductase inhib.

r. OAB

t. Slower acting insulin

v. Vasodilator

MATCHING EXAM 2, QUESTIONS 1-25, CH. 1-3

(Click here for answers).

___1 Loratadine

___2 Diphenhydramine

___3 Ranitidine

___4 Pseudoephedrine

___5 Esomeprazole

___6 Naproxen

___7 Triamcinolone

___8 Infliximab

___9 Loperamide

__10 Bismuth subsalicylate

__11 Ibuprofen

__12 Magnesium hydroxide

__13 Methotrexate [MTX]

__14 Cetirizine

__15 Hydrocodone / APAP

__16 Prednisone

__17 Sumatriptan

__18 Tiotropium

__19 Promethazine

__20 Polyethylene glycol

__21 Oxycodone / APAP

__22 Omeprazole

__23 Ondansetron

__24 Morphine

__25 Methylprednisolone

a. 1st-generation antihistamine

b. 2nd-generation antihist.

c. 5-HT3 receptor antagonist

d. Antacid

e. Anticholinergic for asthma

f. Anti-diarrheal

g. Anti-gout

h. Anti-nausea

i. Decongestant

j. DMARD

k. H2 blocker

l. Laxative

m. Mucolytic/cough

o. Non-narcotic analgesic

q. Opioid analgesic

s. Steroid

n. Non-narcotic analg. combo

p. NSAID

r. Proton pump inhibitor

t. Ulcerative colitis

MATCHING EXAM 2, QUESTIONS 26-50, CH. 4

(Click here for answers).

__26 Doxycycline

__27 Amoxicillin

__28 SMZ / TMP

__29 Amphotericin B

__30 Erythromycin

__31 Ceftriaxone

__32 Rifampin

__33 Isoniazid

__34 Cephalexin

__35 Ethambutol

__36 Nystatin

__37 Minocycline

__38 Valacyclovir

__39 Zanamivir

__40 Amikacin

__41 Gentamicin

__42 Clarithromycin

__43 Cefepime

__44 Oseltamivir

__45 Fluconazole

__46 Ciprofloxacin

__47 Amoxicillin / Clavulanate

__48 Levofloxacin

__49 Pyrazinamide

__50 Darunavir

a. 1st-generation cephalosporin

b. 2nd-generation cephalospor.

c. 3rd-generation cephalosporin

d. 4th-generation cephalospor

e. Antibiotic: aminoglycoside

f. Antibiotic: fluoroquinolone

g. Antibiotic: macrolide

h. Antibiotic: penicillin

i. Antibiotic: sulfa

j. Antibiotic: tetracycline

k. Antifungal

l. Antituberculosis

m. Antiviral: herpes

o. Antiviral: influenza

n. Antiviral: HIV

MATCHING EXAM 2, QUESTIONS 51-75, CH. 5

(Click here for answers).

__51 Selegiline

__52 Sertraline

__53 Quetiapine

__54 Escitalopram

__55 Meclizine

__56 Isocarboxazid

__57 Gabapentin

__58 Levodopa / Carbidopa

__59 Memantine

__60 Phenytoin

__61 Ramelteon

__62 Citalopram

__63 Venlafaxine

__64 Trazodone

__65 Pregabalin

__66 Fluoxetine

__67 Lorazepam

__68 Haloperidol

__69 Lidocaine

__70 Paroxetine

__71 Risperidone

__72 Zolpidem

__73 Scopolamine

__74 Methylphenidate

__75 Lithium

a. ADHD drug / non-stimulant

b. ADHD drug/stimulant

c. Alzheimer’s

d. Antidepressant: MAOI

e. Antidepressant: SNRI

f. Antidepressant: SSRI

g. Antidepressant: TCA

h. Antiepileptic: Newer

i. Antiepileptic: Traditional

j. Antipsychotic: 2nd-generat.

k. Antipsychotic: 1st-generation

l. Benzodiazepine

m. Local anesthetic

o. Parkinson’s

q. Simple salt

n. Muscle relaxer

p. Sedative-hypnotic

r. Vertigo / motion sickness

MATCHING EXAM 2, QUESTIONS 76-100, CH. 6-7

(Click here for answers).

__76 Levothyroxine

__77 Spironolactone

__78 Tolterodine

__79 Rosuvastatin

__80 Carvedilol

__81 Olmesartan

__82 Lovastatin

__83 Lisinopril

__84 Metformin

__85 Oxybutynin

__86 Atorvastatin

__87 Valsartan

__88 Tamsulosin

__89 Nifedipine

__90 Propylthiouracil

__91 Losartan

__92 Propranolol

__93 Tadalafil

__94 Sildenafil

__95 Verapamil

__96 Glipizide

__97 Enalapril

__98 Mannitol

__99 Metoprolol

__100. Warfarin

a. ACE inhibitor

b. Angiotensin receptor blocker

c. Anticoagulant

d. Antidiabetic

e. Antiplatelet

f. Beta blocker

g. BPH: 5-alpha-reductase inhib.

h. BPH: Alpha blocker

i. Calcium channel blocker

j. Cardiac glycoside

k. Contraception

l. Diuretic

m. For hypoglycemia

o. For hypothyroidism

q. Erectile dysfunction

s. Longer duration insulin

n. For hyperthyroidism

p. HMG-CoA reductase inhibitor

r. OAB

t. Slower acting insulin

CHAPTER 9 LEARNING 350 DRUGS

BUILDING ON WHAT YOU'VE LEARNED

Now that you have the list of 200 memorized, you can supplement it. I'm going to add 150 more drugs so you can see how the first 200 can act as a lattice on which to build. I've left the original 200 in un-bolded type and **bolded** the new ones, with a discussion following each list regarding my own rationale.

CHAPTER 1 – GASTROINTESTINAL

MEDICATIONS

I. Peptic Ulcer Disease

Antacids

1. Calcium Carbonate (Tums)

2. Magnesium Hydroxide (Milk of Magnesia)

Histamine-2 Receptor Antagonists (H2RAs)

3. Famotidine (Pepcid)

4. Ranitidine (Zantac)

Proton Pump Inhibitors (PPIs)

5. Dexlansoprazole (Dexilant)

6. Esomeprazole (Nexium)

7. Omeprazole (Prilosec)

8. Lansoprazole (Prevacid)

9. Pantoprazole (Protonix)

10. Rabeprazole (AcipHex)

II. Diarrhea, constipation, and emesis

Antidiarrheals

11. Bismuth Subsalicylate (Pepto-Bismol)

12. Loperamide (Imodium)

13. Diphenoxylate / atropine (Lomotil)

Constipation – Stool softener

14. Docusate sodium (Colace)

Constipation – Osmotic

15. Polyethylene glycol (PEG) 3350 (MiraLax)

Constipation – Miscellaneous

16. Lubiprostone (Amitiza)

Antiemetic – Serotonin 5-HT3 receptor antagonist

17. Ondansetron (Zofran)

Antiemetic – Phenothiazine

18. Prochlorperazine (Compazine)

19. Promethazine (Phenergan)

III. Autoimmune disorders

Ulcerative colitis

20. Infliximab (Remicade)

DISCUSSION

With the proton pump inhibitors, **esomeprazole** (the (S) enantiomer of **omeprazole)** and **dexlansoprazole** (the (R)(+) enantiomer of **lansoprazole)** could be considered superior and segregated. Nevertheless, I just to put the PPIs in alphabetical order by generic name: **dexlansoprazole (Dexilant), esomeprazole (Nexium), omeprazole (Prilosec), lansoprazole (Prevacid), pantoprazole (Protonix),** and **rabeprazole (AcipHex).** Some of these newer brand names cleverly hint at function: **Prevacid** will "prevent acid," **Protonix** "nixes protons," **AcipHex** combines "a-c-i" from acid, "pH" from the pH scale, and "ex" meaning to get rid of.

Under antidiarrheals, **diphenoxylate with atropine (Lomotil)** would alphabetically precede **loperamide.** I put it *after* **loperamide** because **diphenoxylate with atropine** represents an increase in the aggressiveness of treatment from OTC to prescription. The brand name **Lomotil** spells out "low motility" for slowing down diarrhea. The **atropine** is there to prevent someone from crushing the **diphenoxylate** and injecting it illicitly.

I would also put **lubiprostone (Amitiza)** after **docusate sodium** and **polyethylene glycol** because it's a prescription item and would represent an escalation in the aggressiveness of treatment for constipation. While the "-prost-" stem indicates prostaglandin, it doesn't really help with immediate therapeutic recognition. With the laxative **lubiprostone,** I would think of using lube to propel a stone out of the body. **Prochlorperazine (Compazine)** and **promethazine (Phenergan)** share the same first three letters, "p-r-o," and last five letters, "a-z-i-n-e." While this isn't a stem, both are phenothiazines. By memorizing these two drugs in alphabetical order, you can use this similarity to recognize their comparable antiemetic function. Both happen to be available in suppository formulations as well.

MEDICATIONS

I. NSAIDs and pain

OTC Analgesics – NSAIDs

21. Aspirin [ASA] (Ecotrin)

22. Ibuprofen (Advil, Motrin)

23. Naproxen (Aleve)

OTC Analgesic – Non-narcotic

24. Acetaminophen [APAP] (Tylenol)

OTC Migraine – NSAID / Non-narcotic analgesic

25. ASA/APAP/Caffeine (Excedrin Migraine)

RX Migraine – Narcotic and Non-narcotic analgesic

26. Butalbital / APAP / Caffeine (Fioricet)

RX Analgesics – NSAIDs

27. Diclofenac sodium extended release (Voltaren XR)

28. Etodolac (Lodine)

29. Indomethacin (Indocin)

30. Meloxicam (Mobic)

31. Nabumetone (Relafen)

RX Analgesics – NSAIDs – COX-2 inhibitor

32. Celecoxib (Celebrex)

II. Opioids and narcotics

Opioid analgesics – Schedule II

33. Morphine (Kadian, MS Contin)

34. Fentanyl (Duragesic, Sublimaze)

35. Hydrocodone / Acetaminophen (Vicodin)

36. Hydrocodone / Chlorpheniramine (Tussionex)

37. Hydrocodone / Ibuprofen (Vicoprofen)

38. Methadone (Dolophine)

39. Oxycodone (OxyIR, Oxycontin)

40. Oxycodone / Acetaminophen (Percocet)

Opioid analgesics – Schedule III

41. Acetaminophen w/codeine (Tylenol/codeine)

Mixed-opioid receptor analgesic – Schedule IV

42. Tramadol (Ultram)

43. Tramadol / Acetaminophen (Ultracet)

Opioid antagonist

44. Naloxone (Narcan)

45. Buprenorphine / Naloxone (Suboxone) [CIII]

III. Headaches and migraine

5-HT1 receptor agonist

46. Eletriptan (Relpax)

47. Sumatriptan (Imitrex)

IV. DMARDs and rheumatoid arthritis

48. Methotrexate (Rheumatrex)

49. Abatacept (Orencia)

50. Etanercept (Enbrel)

V. Osteoporosis

Bisphosphonates

51. Alendronate (Fosamax)

52. Ibandronate (Boniva)

53. Risedronate (Actonel)

VI. Selective estrogen receptor modulator (SERM)

54. Raloxifene (Evista)

VII. Muscle relaxants

55. Baclofen (Lioresal)

56. Carisoprodol (Soma)

57. Cyclobenzaprine (Flexeril)

58. Diazepam (Valium)

59. Metaxalone (Skelaxin)

60. Methocarbamol (Robaxin)

61. Tizanidine (Zanaflex)

VIII. Gout

62. Colchicine (Colcrys)

Uric acid reducers

63. Allopurinol (Zyloprim)

64. Febuxostat (Uloric)

DISCUSSION

Adding **butalbital,** a barbiturate, to **acetaminophen** and **caffeine** in **Fioricet** provides an escalation from the OTC **aspirin/acetaminophen/caffeine** combination in **Excedrin Migraine.** I pair those two drugs in my mind to help remember their therapeutic function.

For the NSAIDs I simply alphabetized four additions around **meloxicam. Diclofenac sodium extended-release (Voltaren XR**) is a generic name derived from its chemical structure 2-(2,6-dichloranilino) phenylacetic acid with a change from "p-h" to "f" in the middle. **Etodolac (Lodine)** shares the same generic stem, "ac." The manufacturers of **indomethacin** simply removed the middle "metha" to get the brand name **Indocin. Nabumetone's** brand name **Relafen** sounds a little like getting pain relief with an "en-said."

In combination medications, I put the shared generic drug first, followed by the additional drug. After **hydrocodone / acetaminophen (Vicodin),** I followed with the **hydrocodone / chlorpheniramine (Tussionex)** and **hydrocodone / ibuprofen (Vicoprofen). Tussionex** is a pineapple-flavored liquid antitussive, hence the brand name. **Vicoprofen** is like **Vicodin,** but with **ibuprofen** instead of **acetaminophen.** Therefore, the manufacturer replaced the "i-b-u" of **ibuprofen** with "V-i-c-o" of **Vicodin.**

I put **methadone (Dolophine)** in alphabetically although its primary purpose is to help patients addicted to opiates get off narcotics, not provide pain relief. **Oxycodone** by itself comes in an immediate release form, **OxyIR,** and an extended release form, **OxyContin.** The "c-o-n-t-i-n" means continuous release. Many people mispronounce this as oxy-cotton, using a word they are familiar with.

Tramadol with **acetaminophen (Ultracet)** follows **tramadol** by itself. The manufacturer took the brand name **Ultram** (for **tramadol** alone), dropped the "m" and added "acet" from **acetaminophen.**

Patients use **buprenorphine / naloxone (Suboxone)** like **methadone** to help detox from opiate addiction. The **naloxone** is there to keep patients from crushing the drug and injecting it.

Risedronate (Actonel) is simply another bisphosphonate that you can recognize from the "-dronate" stem. We classify the selective estrogen receptor modulator (SERM) **raloxifene (Evista)** as an antiestrogen by its "–ifene" stem.

There are many muscle relaxants and I have simply alphabetized them by generic name: **baclofen (Lioresal), carisoprodol (Soma), metaxalone (Skelaxin), methocarbamol (Robaxin),** and **tizanidine (Zanaflex).** Some of the brand names hint at muscle relaxation, e.g., **Soma** sounds like somnolence (sleepiness), and if you are a literature nerd, this drug was a hallucinogen in Aldous Huxley's 1932 book, *Brave New World*. **Skelaxin** alludes to "skeletal relaxin'," **Robaxin** and relaxin' go together, and **Zanaflex** ends with "flex" for increased flexibility.

Colchicine (Colcrys) relieves an acute gouty attack, so I put that before the uric acid reducers that treat chronic increased uric acid. The "crys" in **Colcrys** sounds like the painful gouty crystals that often form in the big toe. Google "gouty crystal" images and you'll see that they look like needles.

MEDICATIONS

I. Antihistamines and decongestants

Antihistamine – 1st-generation

65. Diphenhydramine (Benadryl)

66. Hydroxyzine (Atarax)

OTC Antihistamine – 2nd-generation

67. Cetirizine (Zyrtec)

68. Loratadine (Claritin)

OTC Antihistamine – 3nd generation

69. Fexofenadine (Allegra)

70. Levocetirizine (Xyzal)

OTC Antihistamine – Eye Drops

71. Olopatadine (Patanol, Pataday)

Antihistamine – Nasal Spray

72. Azelastine (Astelin)

OTC Antihistamine – 2nd generation / Decongestant

73. Loratadine-D (Claritin-D)

BTC/OTC Decongestants

74. Pseudoephedrine (Sudafed) [BTC]

75. Phenylephrine (NeoSynephrine) [OTC]

76. Oxymetazoline (Afrin) [OTC]

II. Allergic rhinitis steroid, antitussives, and mucolytics

Allergic rhinitis steroid

77. Mometasone nasal inhaler (Nasonex)

78. Triamcinolone (Nasacort Allergy 24HR)

OTC Antitussive / Mucolytic

79. Guaifenesin/DM (Mucinex DM, Robitussin DM)

RX Antitussive / Mucolytic

80. Guaifenesin / Codeine (Cheratussin AC)

RX Antitussive

81. Benzonatate (Tessalon Perles)

III. Asthma

Oral steroids

82. Dexamethasone (Decadron)

83. Methylprednisolone (Medrol)

84. Prednisone (Deltasone)

Ophthalmic steroid

85. Loteprednol ophthalmic (Lotemax)

Inhaled steroid / Beta2 receptor agonist

86. Budesonide / Formoterol (Symbicort)

87. Fluticasone / Salmeterol (Advair)

Inhaled steroid

88. Budesonide (Rhinocort, Pulmicort Flexhaler)

89. Fluticasone (Flonase, Flovent HFA, Flovent Diskus)

Beta2 receptor agonist short acting

90. Albuterol (ProAir HFA, Proventil)

91. Levalbuterol (Xopenex HFA)

Beta2 receptor agonist / Anticholinergic

92. Albuterol / Ipratropium (DuoNeb)

93. Albuterol / Ipratropium (Combivent)

Anticholinergic

94. Tiotropium (Spiriva)

Leukotriene receptor antagonist

95. Montelukast (Singulair)

Anti-IgE antibody

96. Omalizumab (Xolair)

IV. Anaphylaxis

97. Epinephrine (EpiPen)

DISCUSSION

I added the first-generation antihistamine **hydroxyzine (Atarax)** after **diphenhydramine (Benadryl).** The "x-y-z" inside **hydroxyzine** matches the brand name of a third-generation antihistamine **Xyzal.** The third-generation antihistamine **fexofenadine (Allegra)** is a safe active metabolite of **terfenadine (Seldane),** a drug the manufacturer removed from the market because of cardiac side effects. **Levocetirizine (Xyzal)** is not the active metabolite, but rather the left enantiomer of **cetirizine (Zyrtec).**

From oral antihistamines, I moved to ophthalmic (eye) and nasal forms. **Olopatadine (Patanol, Pataday)** shares the "–atadine" antihistamine stem of **loratadine.** The two "o's" at the beginning of the generic **olopatadine** look like eyes. **Azelastine (Astelin)** is a medicine you stick in your nose.

Prescription drugs sometimes transition to over-the-counter (OTC), so I just put **mometasone (Nasonex),** alphabetically before another allergic rhinitis steroid **triamcinolone (Nasacort Allergy 24 HR).**

Benzonatate (Tessalon Perles) doesn't work like codeine, but as a local anesthetic to decrease the sensitivity of lung receptors, reducing your need to cough. The "Tess" looks like "tussive" and you can think of getting a pearl (as from a oyster) stuck in your throat. This drug is not in any way an anxiolytic (benzodiazepine), but it's interesting that the name contains the letters "b-e-n-z-o."

Dexamethasone (Decadron) is another oral steroid. The ophthalmic preparation **l<u>o</u>tepredn<u>o</u>l (Lotemax)** has two o's for eyes, and comes after the two "pred" oral steroids, **methylprednisolone** and **prednisone.**

Budesonide (Rhinocort, Pulmicort flexhaler) bears a resemblance to **fluticasone** in that it comes as an over-the-counter nasal spray and prescription inhaler. "Rhino" is for nose and "cort" is for <u>cort</u>icosteroid.

Levalbuterol (Xopenex) is the enantiomer of **albuterol,** so it should work a little bit better. I think of "<u>open</u>" and "<u>ex</u>hale" when I see the brand name **X<u>opene</u>x. DuoNeb** and **Combivent** have identical ingredients, but I wanted to make clear **DuoNeb** is a <u>neb</u>ulization solution and **Combivent** is a <u>combi</u>ned inhaler.

MEDICATIONS

I. OTC Antimicrobials

Antibiotic cream

98. Neomycin / Polymyxin B / Bacitracin (Neosporin)

99. Mupirocin (Bactroban) [RX]

Antifungal cream

100. Butenafine (Lotrimin Ultra)

101. Terbinafine (Lamisil)

102. Clotrimazole / Betamethasone (Lotrisone) [RX]

Vaccinations [Some RX, some antibacterial]

103. Diphtheria toxoid (Boostrix)

104. Haemophilus influenzae Type B (Pedvax HIB)

105. Influenza vaccine (Fluzone, Flumist)

106. Measles, Mumps and Rubella (MMR)

107. Meningococcal (conjugate and polysaccharide) (Menomune)

108. Pertussis in combination

109. Pneumococcal (conjugate and polysaccharide) (Prevnar 13, Pneumovax 23)

110. Polio

111. Rotavirus (RotaTeq)

112. Tetanus in combination

113. Varicella (Varivax)

114. Zoster (Zostavax)

Antiviral OTC

115. Docosanol (Abreva)

II. Antibiotics that affect the cell wall

Penicillins

116. Amoxicillin (Amoxil)

117. Penicillin (Veetids)

Penicillin/Beta-lactamase inhibitor

118. Amoxicillin / Clavulanate (Augmentin)

Cephalosporins [by generation]

119. Cephalexin (Keflex) [1st]

120. Cefuroxime (Ceftin) [2nd]

121. Cefdinir (Omnicef) [3rd]

122. Ceftriaxone (Rocephin) [3rd]

123. Cefepime (Maxipime) [4th]

Glycopeptide

124. Vancomycin (Vancocin)

III. Antibiotics – Protein Synthesis Inhibitors (Bacteriostatic)

Tetracyclines

125. Doxycycline (Doryx)

126. Minocycline (Minocin)

127. Tetracycline (Sumycin)

Macrolides

128. Azithromycin (Zithromax)

129. Clarithromycin (Biaxin)

130. Erythromycin (E-Mycin)

131. Fidaxomicin (Dificid)

Lincosamide

132. Clindamycin (Cleocin)

Oxazolidinone

133. Linezolid (Zyvox)

IV. Antibiotics – Protein Synth. Inhibitors (Bactericidal)

Aminoglycosides

134. Amikacin (Amikin)

135. Gentamicin (Garamycin)

V. Antibiotics for Urinary Tract Infections (UTIs) and Peptic Ulcer Disease (PUD)

OTC Urinary tract analgesic

136. Phenazopyridine (Uristat)

Nitrofuran

137. Nitrofurantoin (Macrobid, Macrodantin)

Dihydrofolate reductase inhibitor

138. Sulfamethoxazole / Trimethoprim (Bactrim DS)

Fluoroquinolones

139. Ciprofloxacin (Cipro)

140. Gatifloxacin ophthalmic (Zymar)

141. Levofloxacin (Levaquin)

142. Moxifloxacin (Avelox) / [Ophth. is Vigamox]

Nitroimidazole

143. Metronidazole (Flagyl)

VI. Anti-tuberculosis agents

144. Rifampin (Rifadin)

145. Isoniazid (INH)

146. Pyrazinamide (PZA)

147. Ethambutol (Myambutol)

VII. Antifungals

148. Amphotericin B (Fungizone)

149. Fluconazole (Diflucan)

150. Ketoconazole (Nizoral)

151. Nystatin (Mycostatin)

VIII. Antivirals – Non-HIV

Influenza A and B

152. Oseltamivir (Tamiflu)

153. Zanamivir (Relenza)

Herpes simplex virus & Varicella-Zoster Virus HSV/VZV

154. Acyclovir (Zovirax)

155. Valacyclovir (Valtrex)

Respiratory Syncytial Virus RSV

156. Palivizumab (Synagis)

Hepatitis

157. Entecavir (Baraclude)

158. Hepatitis A (Havrix)

159. Hepatitis B (Recombivax HB)

HPV

160. Human papillomavirus (Gardasil)

IX. Antivirals – HIV

Fusion Inhibitor

161. Enfuvirtide (Fuzeon) (T-20)

CCR5 Antagonist

162. Maraviroc (Selzentry) (MVC)

Non-nucleoside reverse transcriptase inhibitors (NNRTI) with two nucleoside / nucleotide reverse transcriptase inhibitors (NRTIs)

163. Efavirenz (Sustiva) [NNRTI]

164. Emtricitabine / Tenofovir (Truvada) [NRTIs]

165. Efavirenz / Emtricitabine / Tenofovir (Atripla) [NNRTI / NRTIs] (EFV / FTC / TDF)

Integrase Strand Transfer Inhibitor

166. Raltegravir (Isentress) (RAL)

Protease Inhibitor

167. Atazanavir (Reyataz) (ATV)

168. Darunavir (Prezista) (DRV)

X. Miscellaneous

169. Albendazole (Albenza) [Anthelmintic]

170. Hydroxychloroquine (Plaquenil) [Antimalarial]

171. Nitazoxanide (Alinia) [Antiprotozoal]

DISCUSSION

I added the prescription antibiotic, **mupirocin (Bactroban)** for impetigo. Then I alphabetically listed the antifungal **terbinafine (Lamisil)** after **butenafine (Lotrimin Ultra).** By adding **betamethasone,** a steroid, to **clotrimazole,** an OTC antifungal, the combination becomes prescription-only **Lotrisone.** I listed the vaccinations around the influenza vaccine. Some require a prescription (depending on varying state laws) and some are antibacterial. I alphabetized them by generic name: **diphtheria toxoid (Boostrix);** ***Haemophilus influenzae*** **Type B (Pedvax HIB); influenza vaccine (Fluzone, Flumist); Measles, Mumps** and **Rubella (MMR); Meningococcal,** both **conjugate and polysaccharide, (Menomune); Pertussis in combination; Pneumococcal,** both **conjugate and polysaccharide (Prevnar 13, Pneumovax 23), Polio, Rotavirus (RotaTeq);** and **Tetanus in combination.** Note, **Varivax** and **Zostavax** prevent varicella (chickenpox) and herpes zoster (shingles) respectively. The "vax" in the brand names indicates "vaccine."

Penicillin (Veetids) follows **amoxicillin** alphabetically. **Cefuroxime (Ceftin),** a second-generation cephalosporin, fits in with **cefdinir (Omnicef),** a third-generation cephalosporin

Tetracycline (Sumycin), although it's essentially unavailable, would follow alphabetically after **doxycycline** and **minocycline.** The "dax" in the name **fidaxomicin (Dificid)** might come from its source, *Dactylosporangium aurantiacum.* The brand name **Dificid** indicates its primary therapeutic use against *Clostridium difficile.*

Phenazopyridine (Uristat) is an over-the-counter urinary tract analgesic that allows a patient to get some relief before she can see her physician for treatment of a bladder infection. **Nitrofurantoin (Macrobid, Macrodantin)** is a nitrofuran antibiotic, as the first brand name implies, and is taken twice daily as indicated by the "b-i-d" in the name. I alphabetically added **gatifloxacin ophthalmic (Zymar)** and **moxifloxacin (Avelox, Vigamox). Vigamox** is an ophthalmic preparation, and contains "v-i" for vision. The antifungal **ketoconazole (Nizoral)** fits alphabetically with the other "azole" antifungal **fluconazole (Diflucan).**

Entecavir (Baraclude) is for active hepatitis infections, while both **Hepatitis A (Havrix)** and **Hepatitis B (Recombivax HB)** vaccines are preventative. **Gardasil** guards against human papillomavirus (HPV).

I put the HIV medications in category order. **Efavirenz (Sustiva)** is an NNRTI, and both **emtricitabine** and **tenofovir (Truvada)** are nucleotide reverse transcriptase inhibitors (NRTIs). Those three medications are the same medications as are in **Atripla.** The protease inhibitor **atazanavir (Reyataz)** fits in alphabetically.

I finish the immune section with a miscellaneous group I alphabetized by generic name. **Albendazole (Albenza)** is an anthelmintic, which means "against worms;" **hydroxychloroquine (Plaquenil)** is an antimalarial; and **nitazoxanide (Alinia)** is an antiprotozoal.

MEDICATIONS

I. OTC Local anesthetics and antivertigo

Local anesthetics

172. Benzocaine (Anbesol) [Ester type]

173. Lidocaine (Solarcaine) [Amide type]

Antivertigo

174. Meclizine (Dramamine, Antivert [RX])

II. Sedative-hypnotics (Sleeping pills)

OTC Non-narcotic analgesic / Sedative-hypnotic

175. Acetaminophen PM (Tylenol PM)

Benzodiazepine-like

176. Eszopiclone (Lunesta)

177. Zolpidem (Ambien)

Melatonin receptor agonist

178. Ramelteon (Rozerem)

Miscellaneous

179. Trazodone (Desyrel)

III. Antidepressants

Miscellaneous / SSRI

180. Vilazodone (Viibryd)

Selective serotonin reuptake inhibitors (SSRIs)

181. Citalopram (Celexa)

182. Escitalopram (Lexapro)

183. Sertraline (Zoloft)

184. Fluoxetine (Prozac, Sarafem)

185. Paroxetine (Paxil, Paxil CR)

Serotonin-Norepinephrine reuptake inhibitors (SNRIs)

186. Duloxetine (Cymbalta)

187. Desvenlafaxine (Pristiq)

188. Venlafaxine (Effexor)

Tricyclic antidepressants (TCAs)

189. Amitriptyline (Elavil)

190. Doxepin (Sinequan)

191. Nortriptyline (Pamelor)

Tetracycylic antidepressant (TeCA) Noradrenergic and specific serotonergic antidepressants (NaSSAs)

192. Mirtazapine (Remeron)

Monoamine oxidase inhibitor (MAOI)

193. Isocarboxazid (Marplan)

IV. Smoking Cessation

194. Bupropion (Wellbutrin, Zyban)

195. Varenicline (Chantix)

V. Barbiturates

196. Phenobarbital (Luminal)

VI. Benzodiazepines

197. Alprazolam (Xanax)

198. Midazolam (Versed)

199. Clonazepam (Klonopin)

200. Lorazepam (Ativan)

201. Temazepam (Restoril)

VII. Non-benzodiazepine / non-barbiturate

202. Buspirone (Buspar)

VIII. ADHD medications

Stimulant – Schedule II

203. Amphetamine/Dextroamphetamine (Adderall)

204. Dexmethylphenidate (Focalin)

205. Lisdexamfetamine (Vyvanse)

206. Methylphenidate (Concerta)

Non-stimulant – non-scheduled

207. Atomoxetine (Strattera)

IX. Bipolar Disorder

Simple salt

208. Lithium (Lithobid)

X. Schizophrenia

First generation antipsychotic (FGA) (low potency)

209. Chlorpromazine (Thorazine)

First generation antipsychotic (FGA) (high potency)

210. Haloperidol (Haldol)

Second-generation antipsychotic (SGA)

211. Aripiprazole (Abilify)

212. Olanzapine (Zyprexa)

213. Risperidone (Risperdal)

214. Quetiapine (Seroquel)

XI. Antiepileptics

Traditional antiepileptics

215. Carbamazepine (Tegretol)

216. Divalproex (Depakote)

217. Phenytoin (Dilantin)

Newer antiepileptics

218. Gabapentin (Neurontin)

219. Lamotrigine (Lamictal)

220. Levetiracetam (Keppra)

221. Oxcarbazepine (Trileptal)

222. Pregabalin (Lyrica)

223. Topiramate (Topamax)

224. Ziprasidone (Geodon)

XII. Parkinson's, Alzheimer's, Motion sickness

Parkinson's

225. Benztropine mesylate (Cogentin)

226. Levodopa / Carbidopa (Sinemet)

227. Selegiline (Eldepryl)

228. Pramipexole (Mirapex ER)

229. Ropinirole (Requip, Requip XL)

Alzheimer's

230. Memantine (Namenda)

231. Donepezil (Aricept)

Motion sickness

232. Scopolamine (Transderm-Scop)

DISCUSSION

In practice, **trazodone (Desyrel)** helps patients sleep. **Vilazodone (Viibryd)** is newer, launched in 2011, and is a selective serotonin reuptake inhibitor with partial agonism at the 5-HT1A receptor. **Desvenlafaxine (Pristiq)** is the enantiomer of **venlafaxine (Tranxene).** I added the tricyclic antidepressants (TCAs) **doxepin (Sinequan)** and **nortriptyline (Pamelor)** before the tetracyclic antidepressant (TeCA) **mirtazapine (Remeron). Remeron** is a noradrenergic and specific serotonergic antidepressant (NaSSA).

I put the barbiturate **phenobarbital (Luminal)** before benzodiazepines because, chronologically, it came earlier and was a more dangerous predecessor. **Temazepam (Restoril)** is a benzodiazepine marketed for sleep disorders, i.e. for "rest" or "restoration." Just as nonfiction literature is classified as "not" fiction, **buspirone (Buspar)** is classified as a non-barbiturate, non–benzodiazepine.

I alphabetized the ADHD medications: **Amphetamine** with **dextroamphetamine (Adderall)** and **Lisdexamfetamine (Vyvanse),** which has a British "–fetamine" ending. I added two second-generation antipsychotics, **aripiprazole (Abilify)** and **olanzapine (Zyprexa). Abilify** helps a schizophrenic have more "ability to function in society." The WHO "–piprazole" stem is discouraged because it has the PPI "–prazole" stem in it. Newer antiepileptics include **lamotrigine (Lamictal),** which has "ictal," meaning seizure. **Levetiracetam (Keppra), Oxcarbazepine (Trileptal), topiramate (Topamax), ziprasidone (Geodon)** are newer antiseizure meds. The Parkinson's medication **benztropine mesylate (Cogentin)** hints at cognition. **Pramipexole (Mirapex)** twists around the generic name. **Ropinirole (Requip)** "equips" a patient to deal with Parkinson's.

MEDICATIONS

I. OTC Antihyperlipidemics and antiplatelet

Antihyperlipidemics

233. Omega-3-acid ethyl esters (Lovaza)

234. Niacin (Niaspan ER)

Antiplatelet

235. Aspirin (Ecotrin)

II. Diuretics

Osmotic

236. Mannitol (Osmitrol)

Loop

237. Furosemide (Lasix)

Thiazide

238. Hydrochlorothiazide (Microzide)

Potassium sparing and thiazide

239. Triamterene/Hydrochlorothiazide (Dyazide)

Potassium sparing

240. Spironolactone (Aldactone)

Electrolyte replenishment

241. Potassium chloride (K-DUR)

III. Understanding the Alphas and Betas

Alpha-1 antagonist

242. Doxazosin (Cardura)

243. Terazosin (Hytrin)

Alpha-2 agonist

244. Clonidine (Catapres)

Beta-blocker – 1st-generation – non-beta selective

245. Propranolol (Inderal)

Beta-blockers – 2nd-generation – beta selective

246. Atenolol (Tenormin)

247. Atenolol / Chlorthalidone (Tenoretic)

248. Bisoprolol / Hydrochlorothiazide (Ziac)

249. Metoprolol succinate (Toprol-XL)

250. Metoprolol tartrate (Lopressor)

Beta-blocker – 3rd-generation – non-beta selective vasodilating

251. Carvedilol (Coreg)

252. Labetalol (Normodyne)

253. Nebivolol (Bystolic)

IV. Renin-angiotensin-aldosterone system (RAAS)

ACE Inhibitors (ACEIs)

254. Benazepril / HCTZ (Lotensin HCT)

255. Enalapril (Vasotec)

256. Fosinopril (Monopril)

257. Quinapril (Accupril)

258. Lisinopril (Zestril)

259. Lisinopril / Hydrochlorothiazide (Zestoretic)

260. Ramipril (Altace)

Angiotensin II receptor blockers (ARBs)

261. Candesartan (Atacand)

262. Irbesartan (Avapro)

263. Irbesartan / Hydrochlorothiazide (Avalide)

264. Losartan (Cozaar)

265. Losartan / Hydrochlorothiazide (Hyzaar)

266. Olmesartan (Benicar)

267. Olmesartan / HCTZ (Benicar HCT)

268. Telmisartan / HCTZ (Micardis HCT)

269. Valsartan (Diovan)

270. Valsartan / HCTZ (Diovan HCT)

V. Calcium channel blockers (CCBs)

Non-dihydropyridines

271. Diltiazem (Cardizem)

272. Verapamil (Calan)

Dihydropyridines

273. Amlodipine (Norvasc)

274. Amlodipine / Atorvastatin (Caduet)

275. Amlodipine / Benazepril (Lotrel)

276. Amlodipine / Valsartan (Exforge)

277. Felodipine (Plendil)

278. Nifedipine (Procardia)

VI. Vasodilators

279. Hydralazine (Apresoline)

280. Isosorbide mononitrate (Imdur)

281. Nitroglycerin (Nitrostat)

VII. Anti-anginal

282. Ranolazine (Ranexa)

VIII. Antihyperlipidemics

HMG-CoA reductase inhibitors

283. Atorvastatin (Lipitor)

284. Lovastatin (Mevacor)

285. Pravastatin (Pravachol)

286. Rosuvastatin (Crestor)

287. Simvastatin (Zocor)

Fibric acid derivatives

288. Fenofibrate (Tricor)

289. Gemfibrozil (Lopid)

Bile acid sequestrant

290. Colesevelam (Welchol)

Cholesterol absorption blocker

291. Ezetimibe (Zetia)

292. Ezetimibe / Simvastatin (Vytorin)

IX. Anticoagulants and antiplatelets

Anticoagulants

293. Enoxaparin (Lovenox)

294. Heparin

295. Warfarin (Coumadin)

296. Dabigatran (Pradaxa)

297. Rivaroxaban (Xarelto)

298. Apixaban (Eliquis)

Antiplatelet

299. Aspirin / Dipyridamole (Aggrenox)

300. Clopidogrel (Plavix)

301. Prasugrel (Effient)

302. Ticagrelor (Brilinta)

X. Cardiac glycoside and Anticholinergic

Cardiac glycoside

303. Digoxin (Lanoxin)

Anticholinergic

304. Atropine (AtroPen)

XI. Antidysrhythmic

305. Amiodarone (Cordarone)

DISCUSSION

The cardio drugs are mostly combinations of old drugs. The alpha-1 antagonist **terazosin (Hytrin)** has an "–azosin" ending and **Hytrin** takes six letters from "hypertension." **Atenolol** with **chlorthalidone** is **Tenoretic. Tenoretic** takes the "T-e-n-o-r" from **Tenormin** and adds "r-e-t-i-c" from "diuretic." **Bisoprolol (Zebeta)** and **hydrochlorothiazide (Microzide)** combine to form **Ziac. Labetalol (Normodyne)** has "beta" in the generic name. Instead of "–olol" for beta-blocker, the stem is –alol for alpha / beta-blocker. **Nebivolol's** brand name **(Bystolic)** takes letters from systolic (the top blood pressure number) and diastolic (the bottom number).

I grouped renin angiotensin aldosterone system (RAAS) drugs in alphabetical order. For drugs that have a second component, I put the single drug first. I won't go into the medications because by learning "–pril," "-sartan," and "-thiazide," you will know what each drug from 254 to 270 is for.

Benazepril (Lotensin) becomes **Lotensin HCT** when the manufacturer adds **hydrochlorothiazide. Fosinopril (Monopril)** and **Quinapril (Accupril)** are unusual in that the ACE inhibitor stem in both their brand and generic names. When a manufacturer adds **hydrochlorothiazide (Microzide)** to **Lisinopril (Zestril),** it becomes **Zestoretic** by adding the last letters of "diuretic" to the name. The manufacturers of ARBs similarly create brand names for new combination products by adding either "-lide," "Hy-," or "HCT." The calcium channel blocker additions also add nothing that isn't in the original 200: "-dipine" for the CCB dihydropyridine, "-vastatin" for the HMG-CoAs, and "–pril" for the ACEIs.

Ranolazine (Ranexa) and **hydralazine (Apresoline)** both have similar endings, but **ranolazine** *treats* angina pectoris and **hydralazine** may *cause* angina pectoris. I grouped **hydralazine** with another vasodilator, **isosorbide dinitrate (Imdur).** The "nitrate" helps you remember this is in the same class as **nitroglycerin.**

I listed the HMG-CoA reductase inhibitors **lovastatin (Mevacor), pravastatin (Pravachol),** and **simvastatin (Zocor)** alphabetically. The brand names hint at coronary or cholesterol. You can see the "fib" in their fibric acid derivative **gemfibrozil (Lopid).** That brand name **Lopid** hints at "lowering lipids." The bile acid sequestrant **colesevelam (Welchol)** has both a generic and brand name with a hint at cholesterol. **Ezetimibe (Zetia)** is a cholesterol absorption blocker, a different type of drug, and can be combined with an HMG-CoA like **simvastatin (Zocor)** to make **Vytorin.**

The anticoagulants **dabigatran (Pradaxa), rivaroxaban (Xarelto),** and **Apixaban (Eliquis)** are usually coupled because they don't require monitoring like their counterpart, **warfarin (Coumadin). Dipyridamole / aspirin (Aggrenox)** work together to prevent clots and the brand name can be thought of as "aggregate not." **Prasugrel (Effient)** and **Ticagrelor (Brilinta)** share a "–grel" stem with **clopidogrel (Plavix).** Effient is the word "efficient" without the "c-i," so may be efficient at thinning platelets. **Ticagrelor (Brilinta)** has demonstrated superiority to **clopidogrel.** The brand name **Amiodarone (Cordarone)** and the brand and generic share the "arone" lettering. Cardiologists can also use beta-blockers, calcium channel blockers, and **digoxin** as antidysrhythmics.

MEDICATIONS

I. OTC Insulin and emergency contraception

306. Regular Insulin (Humulin R)

307. NPH Insulin (Humulin N)

308. Levonorgestrel (Plan B One-Step)

II. Diabetes and insulin

Biguanides

309. Metformin (Glucophage)

310. Metformin / Glyburide (Glucovance)

DPP-4 Inhibitors (Gliptins)

311. Linagliptin (Tradjenta)

312. Saxagliptin (Onglyza)

313. Sitagliptin (Januvia)

Meglitinides (Glinides)

314. Repaglinide (Prandin)

Sulfonylureas – 2nd-generation

315. Glyburide (DiaBeta)

316. Glimepiride (Amaryl)

317. Glipizide (Glucotrol)

Thiazolidinediones (Glitazones)

318. Pioglitazone (Actos)

319. Rosiglitazone (Avandia)

Incretin mimetics

320. Exenatide (Byetta)

321. Liraglutide (Victoza)

Hypoglycemia

322. Glucagon (GlucaGen)

RX Insulin

323. Insulin aspart (Novolog)

324. Insulin lispro (Humalog)

325. Insulin detemir (Levemir)

326. Insulin glargine (Lantus, Toujeo)

III. Thyroid hormones

Hypothyroidism

327. Levothyroxine (Synthroid)

Hyperthyroidism

328. Propylthiouracil (PTU)

IV. Hormones and contraception

Low testosterone

329. Testosterone (AndroGel)

Estrogens and / or Progestins

330. Estradiol (Estrace, Estraderm)

331. Conjugated estrogens (Premarin)

332. Conjugated estrogens / Medroxyprogesterone (Prempro, Premphase)

333. Progesterone (Prometrium)

334. Medroxyprogesterone (Provera)

Combined oral contraceptive pill (COCP)

335. Ethinyl estradiol / norethindrone / Fe (Loestrin 24 Fe)

336. Ethinyl estradiol / norgestimate (Tri-Sprintec)

Patch

337. Ethinyl estradiol / norelgestromin (OrthoEvra)

Ring

338. Ethinyl estradiol / etonogestrel (NuvaRing)

V. Overactive bladder, urinary retention, erectile dysfunction (ED), benign prostatic hyperplasia (BPH)

Overactive bladder

339. Oxybutynin (Ditropan)

340. Darifenacin (Enablex)

341. Solifenacin (VESIcare)

342. Tolterodine (Detrol)

Urinary retention

343. Bethanechol (Urecholine)

Erectile dysfunction – PDE-5 inhibitors

344. Sildenafil (Viagra)

345. Vardenafil (Levitra)

346. Tadalafil (Cialis)

BPH – Alpha-blocker

347. Alfuzosin (Uroxatral)

348. Tamsulosin (Flomax)

BPH – 5-alpha-reducase inhibitor

349. Dutasteride (Avodart)

350. Finasteride (Proscar, Propecia)

DISCUSSION

I alphabetized the antidiabetic oral medications by class. Manufacturers combine the biguanide **metformin (Glucophage)** with the sulfonylurea **glyburide (DiaBeta)** to make **Glucovance** – an advance in glucose lowering. Patients refer to DPP-4 inhibitors **linagliptin (Tradjenta)** and **saxagliptin (Onglyza)** by their stem "-gliptin," the meglitinide **repaglinide (Prandin),** as a "-glinide," and the thiazolidinediones **pioglitazone (Actos)** and **rosiglitazone (Avandia),** as "-glitazones." Both incretin mimetics **exenatide (Byetta)** and **liraglutide (Victoza)** are injectables. **Insulin aspart (Novolog)** is another insulin analog. **Insulin detemir (Levemir)** is a long-acting insulin like **Lantus.**

Estrogens first, then combo estrogen / progestin products, then progesterone products, recognizable by their "estr-" and "-gest-" stems respectively. **Estradiol (Estrace, Estraderm)** has brand names with the estrogen stem. **Premarin** is for "pregnant mare's urine," the drug's source. **Prempro** and **Premphase** have different estrogen / progestin levels. **Progesterone (Prometrium)** and **medroxyprogesterone (Provera)** are progestin tablets.

Darifenacin (Enablex) and **solifenacin (VESIcare)** have the same "–fenacin" stem. Both work for overactive bladder (OAB). The **Enablex** brand name hints at "enabling" the patient to "exit" the house when the OAB might have kept them in. **Vardenafil (Levitra)** seems to have the same "-den-" infix as **sildenafil (Viagra).** To levitate is to rise above the ground, so the brand **Levitra** hints at the rising erection.

BONUS CHAPTER FINAL REVIEW

END OF SEMESTER

At the end of term, there is an awkward and hurried separation. Instead of saying goodbye, or having some closing ritual, a student takes a test, leaves, and may never talk to the instructor again. Nevertheless, they have just taken their final exam. Shouldn't we talk about it and acknowledge what they've learned over term and all of that? These questions that follow are final exam questions from one of my old essay tests. No pressure here – that doesn't fit the tone of this book. I just want you to read the question and see if you can answer it based on what you've learned in the book, but most importantly, does the answer make sense to you now that you know all of these drugs' names?

INTRODUCTION – BASIC PRINCIPLES

1. Provide definitions for affinity, intrinsic activity, agonist and antagonist.

Affinity – while affinity in lay language comes from the Latin "ad" and "finis," meaning "to a border" it later came to signify a relationship. In pharmacology and more generally, biochemistry, it indicates a drug's attraction to a receptor.

Intrinsic Activity – how well a drug produces the greatest response. An analogy for the difference between affinity and intrinsic activity would be the relationship between two people. A person might have an affinity for someone else (like them), but produce no intrinsic activity (the other person doesn't like them back).

Agonist – a chemical that binds to a receptor to produce a respons. Be careful, this does not mean it's *good* or *bad;* simply that it activates a receptor. For example, a person can turn a light on or off. Light is good for visibility, darkness is good when developing photographs. The hand (the agonist) activates the receptor (light switch) in both cases.

Antagonist – a chemical that binds to a receptor to block the agonist. For example, you wanted to take someone to prom, but that person decided to take her brother because she doesn't want to deal with any drama. The brother serves as the antagonist; he gets in the way. Other analogies include:

Protestors blocking your way to work or school.

A bathtub drain plug preventing water from draining.

A cornerback blocking a catch to a wide receiver.

2. Match the four pharmacokinetic principles with their appropriate organ systems (one is actually a tissue, not an organ).

First, you need to understand the four pharmacokinetic principles: **absorption, distribution, metabolism, and excretion** (sometimes referred to as ADME). Imagine traveling through the body's gastrointestinal tract.

Absorption – First, if you take the medication orally, it goes through the stomach and then into the small intestine. It's a mistake to think that the stomach is the area of greatest absorption. Villi, hair-like projections, line the *intestines* and greatly increase the surface area for drug absorption.

Distribution – *Blood* is a tissue and transports medication throughout the body. The circulatory system works as the paperboy and delivers newspapers along a route.

Metabolism – Think of the words *anabolism* (to build up, like anabolic steroids) and *catabolism* (break down), then see how the *meta* fits in. In Greek, meta means "after" or "beyond." The *liver* often produces these changes, therefore *metabolism* explains the product "after" the liver.

Excretion – While we have many sites of excretion (sweat, breast milk, feces, kidneys), generally drug removal and excretion occurs through the *kidneys* in urine.

3. Provide four medications, two with matching stems in the prefix position, two with matching stems in suffix position. What does having a matching (United States Adopted Names Council Approved) stem mean about the relationship between the drugs?

Cefepime (Maxipime) and **ceftriaxone (Rocephin)** both have "cef-"at the beginning of the generic medication names. Two drugs with similar names may or may not be related. To be sure, a person would have to consult the list put out by the United States Adopted Names Council currently found on the American Medical Association's (AMA) website. In this case, "cef-"is an official stem for "cephalosporins."

However, to say that both **famotidine (Pepcid)** and **loratadine (Claritin)** have the same endings does not mean the same thing as two drugs having "cef-"as prefixes. While both end in "–ine," they are not in the same class of medications. The USANC recognizes –**tidine** as the stem for *H2-receptor antagonists (cimetidine type)*, a medication for gastrointestinal issues and recognizes –**atadine** in the *tricyclic histaminic-H1 receptor antagonists, loratadine derivatives (formerly -tadine)*. In plain English, that means if you connect these two drugs by only –ine, you assert an H2 blocker for acid does the same thing an H1 blocker does for allergies, which is not true. A correct example of medications with two USANC approved stems in the suffix positions includes **peni*cillin*** and **amoxi*cillin*,** both penicillin class antibiotics.

4. What does metabolic inhibition and metabolic induction do to the level of a drug in the body?

Metabolic induction increases metabolism and decreases drug levels while metabolic inhibition slows metabolism and increases drug levels. When you think of inhibiting something, it means to stop it from happening. An ACEI like **enalapril** is an angiotensin converting enzyme inhibitor. Therefore, this medication stops the angiotensin-converting enzyme from working. In the same way, metabolic inhibition is to stop (inhibit) metabolism. This is a little tricky because there is an inverse relationship. If you increase inhibition, you stop the factory (usually in the liver) from metabolizing a drug (breaking it down or changing it), then you will have *more* drug around because *less* is broken down.

Induction is a word you've probably heard with labor, which is "to induce labor" is to make it happen faster. That can be a good thing if a woman goes too far beyond the normal human 40-week term, there can be serious consequences for the fetus. In this case, induction is to make the factory (usually in the liver)

break down or change (metabolize) medication faster. If you break down medications faster, you have *less* drug in the circulation.

5. Provide the names of two pairs of drugs with the same root drug (not stem in the prefix or suffix position), but one is the S- isomer of the other. How does the S- affect the efficacy of the medication and what is its Latin origin?

The same root in a medication means that it's probably racemic. This is a term from organic chemistry. For example, **esomeprazole (Nexium)** and **omeprazole (Prilosec)** both have the same root as do esc**italopram (Lexapro)** and **citalopram (Celexa).** The S- and R- isomers of a chemical or drug are mirror images of each other and sometimes one is effective and one is not. In the case of these four medications, the S- isomer is the effective one. **Omeprazole** and **citalopram** are both combinations of S- and R-, meaning they contain the ineffectual R- isomer. We use the letters "e-s" instead of "s" because by only using the letter "s," **citalopram** would become "scitalopram," giving two different drugs the same pronunciation. The "s" comes from the Latin "sinister," which means left, because people who were left-handed were thought to be sinister. The "r" means "rectus," which is Latin for right.

CHAPTER 1 – GASTROINTESTINAL

1. Provide an example of an antacid, H2 blocker, and proton pump inhibitor and match a unique disease state / condition to each medication.

Antacids include medications such as **magnesium hydroxide (Milk of Magnesia)** or **calcium carbonate (Tums).** Patients use both for hyperacidic states, but **magnesium hydroxide** relieves constipation and **calcium carbonate** supplements calcium deficiency. Patients use H2-blockers such as **famotidine (Pepcid)** or **ranitidine (Zantac)** for conditions such as gastroesophageal reflux disease (GERD), with the advantage of less frequent dosing than antacids. A triple drug regimen includes a PPI such as **esomeprazole (Nexium)** for peptic ulcer disease (PUD).

2. Contrast one over-the-counter anti-diarrheal and one prescription antidiarrheal and the reason for choosing one over the other.

Patients with diarrhea, but without an active GI infection, use over-the-counter antidiarrheals like **loperamide (Imodium)** or **bismuth subsalicylate (Pepto-Bismol).**

Prescribers employ antibiotics and rehydration to treat infectious diarrhea. Antidiarrheals keep toxins in the patient's gastrointestinal system.

3. Contrast an over-the-counter anti-nausea and one prescription only anti-nausea mediation and provide a specific appropriate use for each one.

Patients use OTC **meclizine (Dramamine)** for motion sickness. Its old brand name **Antivert** implies anti-vertigo. A prescription medication like **ondansetron (Zofran)** prevents chemotherapy-induced nausea and vomiting (CINV). Patients take this prior to chemotherapy.

4. Define chelation. Provide two medications from separate drug classes that would chelate together and describe the impact of this on the drugs' effectiveness.

The binding of one chemical to another, involving a metal, is chelation. We might not think of **calcium** and **magnesium** as metals, especially when we find them in a **Tums** tablet or **Milk of Magnesia** liquid, but they bind to some medications, especially antibiotics like **doxycycline (Doryx)** and **ciprofloxacin (Cipro).**

A good way to think of this is to use the example of table salt, sodium chloride (NaCl). When isolated, sodium (Na) is caustic and explosive. We use chlorine (Cl) in pools and it can be very toxic as well. However, put sodium and chloride together and they form an inert entity, suitable for popcorn and consumption.

We don't want an inert antibiotic, but with chelation of **doxycycline** with magnesium, calcium, or aluminum, that's what we might get. As such, prescribers recommend patients limit dairy and antacids to at least a half-hour before or two hours after ingestion of the medication.

5. Provide two drug examples of laxative medications.

The osmotic agent **polyethylene glycol (MiraLax)** or stool softener **docusate (Colace)** combats constipation often caused by opioid analgesic use.

1. Compare the potency and analgesic efficacy of prescription strength ibuprofen (Motrin) 800 mg and naproxen (Naprosyn) 500 mg.

Prescription **Ibuprofen (Motrin)** 800mg is about as potent as 500 mg of **naproxen (Naprosyn).** Sometimes a patient will look to get the "strongest" medicine and mistake the higher milligram strength for a stronger medicine. Two medications that are equipotent (equal in potency) have no advantage in analgesic efficacy (how effective a pain medicine is) based on milligram strength.

Since it's a tie for efficacy, a practitioner might look to the daily dosing requirements to make a choice. A patient would need to take **ibuprofen** four times a day whereas we dose **naproxen** twice daily. It's easier to remember to take two tablets daily. This is **naproxen's** advantage, not its potency.

2. Identify three medications, one for each level of the pain scale at ten, five and three. Provide a rationale for their particular use and the DEA class of each medication, if any.

While the pain scale uses one-point increments from zero (no pain) to ten (worst possible pain), it's convenient to divide it into three general regions: about ten, five, and three.

Opioid analgesics like morphine relieve pain at the highest level. **Morphine** is DEA Schedule II, the most addicting class of legal meds. **Hydrocodone / acetaminophen** falls around the middle of the pain scale. It's also DEA Schedule II. OTC **Ibuprofen** provides relief at the bottom of the scale.

3. Contrast a DMARD and an NSAID. Provide an example of each, and rationale for their use.

A DMARD stands for Disease Modifying Anti-Rheumatic Drug. The DMARD **Methotrexate (Rheumatrex)** suppresses the immune response in an auto-immune disease like rheumatoid arthritis. An NSAID is a non-steroidal anti-inflammatory drug. The NSAID **ibuprofen** provides relief from inflammation or osteoarthritis.

4. Rationalize one therapeutic use of ASA over APAP and APAP over ASA.

ASA stands for acetylsalicylic acid, or **aspirin. Aspirin** relieves inflammation, thins platelets, provides analgesia, and reduces fever. **Acetaminophen** provides analgesia and reduces fever, but does not affect platelets nor provide an anti-inflammatory response. Pregnant patients might use **acetaminophen** as **aspirin** poses significant risk to the fetus. Children with fever use **acetaminophen** rather than **aspirin** to avoid Reye's syndrome or an increased bleeding risk.

5. Provide a rationale for each of the three medications found in Excedrin Migraine.

Excedrin contains **aspirin, acetaminophen,** and **caffeine** and each ingredient relieves the pain of a headache. **Aspirin** helps curb inflammation and acts as an analgesic. A drug like **acetaminophen** helps with analgesia, but without additive adverse gastrointestinal effects. **Caffeine** causes vascular vasoconstriction, to reduce the pain of a swollen blood vessel in the brain. If headaches are the result of the inflammation and vasodilation in the brain, where there is no room to expand, then reducing inflammation and vasodilation would reverse these effects.

CHAPTER 3 – RESPIRATORY

1. Provide an example of an over-the-counter and a prescription-only cough suppressant. Then describe a specific concern regarding the type of patient who gets the prescription-only cough suppressant.

An over-the-counter mucolytic / cough suppressant such as **guaifenesin / dextromethorphan (Robitussin DM)** relieves a dry unproductive cough. If the cough doesn't respond to the over-the-counter remedy, we prescribe a liquid antitussive such as **acetaminophen** with **codeine.** Prescribers must use caution when providing this addictive DEA scheduled medication to patients with a history of narcotic abuse.

2. Contrast an H1 antihistamine with an H2 antihistamine, identifying an example of each and relate the therapeutic function of each to treatment of two specific pathophysiologic conditions.

An H1 antihistamine clears seasonal allergy symptoms. The first-generation **diphenhydramine (Benadryl)** sedates, whereas second-generation forms **loratadine (Claritin)** or **cetirizine (Zyrtec)** do not. We refer to anti-allergy medications as simply "antihistamines." An H2 antihistamine reduces acidity in patients with gastroesophageal reflux disease (GERD). Medications such as **famotidine (Pepcid)** or **ranitidine (Zantac)** fall into this class. We refer to them as H2-blockers to avoid confusion. Stay vigilant as the two stems, –atadine and –tidine, differ by only two letters.

3. Give an example of a 1st- and a 2nd-generation antihistamine (generic and brand name) and provide an explanation for the difference between the adverse effects of the two.

A first-generation antihistamine such as **diphenhydramine (Benadryl)** causes sedation. A second-generation antihistamine, such as **loratadine (Claritin)** or **cetirizine (Zyrtec),** does not. Second-generation antihistamines don't cross the blood-brain-barrier to introduce CNS suppression associated with drowsiness.

4. Identify the two major components of asthma and provide an example of a medication that would treat each component and note any specific roots / suffixes.

Asthma is a condition of bronchoconstriction and inflammation. As such, a medication that produced bronchodilation and an anti-inflammatory effect would be effective. **Fluticasone / salmeterol (Advair)** manages asthma prophylactically. **Fluticasone** is a steroid that provides an anti-inflammatory effect.

While "-sone" appears in many steroids, there are medications that have -sone and are not steroids. For example, we classify **dapsone** as an antibiotic used for leprosy or pneumocystis pneumonia. **Salmeterol** is a long-acting beta2 agonist that provides bronchodilation. Using **fluticasone / salmeterol** does not preclude the need for **albuterol.** Remember, the suffix –terol indicates a beta2 agonist.

5. Provide three different steroidal medications used to manage asthma.

A severe asthma attack often requires **prednisone (Deltasone)** to reduce the inflammation. Severe bronchial inflammation responds to **methylprednisolone (Medrol),** a derivative of **prednisolone.** The **fluticasone** in **Advair** or **budesonide** in **Symbicort** reduces asthmatic severity and incidence.

1. Identify three unique macrolide medications, their dosing schedules and effect on compliance.

Three macrolides include **erythromycin (E-Mycin)** dosed four times daily, **clarithromycin (Biaxin),** dosed twice a day, and **azithromycin (Zithromax)** dosed once daily with a doubled loading dose. Patient compliance improves with fewer doses.

2. Identify five major drug classes related to the common cold. Provide their therapeutic effects.

While a drugstore aisle of cold medications contains an overwhelming number of medications, five major drug classes comprise the bulk of the ingredients.

The *analgesic*, ibuprofen (Motrin, Advil) relieves fever, pain, and inflammation whereas acetaminophen (Tylenol) only relieves fever and pain.

Antihistamines help with runny nose, watery eyes, sneezing. Sometimes **diphenydramine** "PM" provides a means to improve sleep.

The *decongestant* **pseudoephedrine (Sudafed)** clears congestion. Patients often mistake decongestants for antihistamines. A decongestant doesn't help with allergy symptoms.

Antitussives such as **dextromethorphan,** e.g., the DM in Robitussin, suppress cough.

The *mucolytic* **guaifenesin** found in **Robitussin** and **Mucinex** breaks up mucous. Mucolytic means "mucous" + "break down."

3. Identify three disadvantages of a first-generation cephalosporin versus a third-generation cephalosporin and the general mechanism of action of the cephalosporin class.

A first-generation cephalosporin such as **cephalexin (Keflex)** has poor penetration to the cerebrospinal fluid (CSF), weak Gram-negative coverage, and poor resistance to beta-lactamases, specifically cephalosporinases.

A third-generation medication like **ceftriaxone (Rocephin)** has the opposite characteristics, with strong gram-negative coverage, the ability to penetrate the CSF, and good action against beta-lactamases.

The general mechanism of the cephalosporin class resembles penicillin. They inhibit the formation of bacterial cell wall, cause the cell wall to leak and cause death. Think of a bubble popping. Thus, cephalosporins are bactericidal.

4. Identify the advantage of amoxicillin / clavulanate (Augmentin) vs. amoxicillin alone and explain the general mechanism of action of the penicillin class.

Amoxicillin by itself is susceptible to beta-lactamase attack, specifically penicillinases, rendering it ineffective.

Clavulanate provides no additional antibiotic coverage, but does protect the **amoxicillin** from beta-lactamases. Penicillin class antibiotics inhibit cell wall synthesis.

5. Provide the mechanism of action (MOA) of a tetracycline medication, two examples of tetracyclines, and two therapeutic uses.

Tetracyclines inhibit protein synthesis and include doxycycline **(Doryx)** and **minocycline (Minocin).** Three uses for tetracyclines include periodontal disease, acne, and as part of a multiple antibiotic regimen in peptic ulcer disease.

6. Identify how sulfamethoxazole and trimethoprim work synergistically to kill bacteria and identify the life-threatening side effect sulfa medications can rarely cause.

Sulfamethoxazole and **trimethoprim** inhibit a bacteria's ability to produce folic acid at two different parts of the folic acid production cycle. Because humans can ingest folic acid and do not have to make their own, they are relatively unaffected. The life-threatening side effect associated with sulfa drugs is Stevens – Johnson syndrome (SJS), a hypersensitivity reaction involving the skin. Sulfa drugs can cause a tendency to burn easily when exposed to sunlight.

7. Provide a summary of the difference between gram-negative and gram-positive organisms and the effectiveness of two different cephalosporin generations against them.

Gram-positive and gram-negative organisms have different outer layers and as such, stain differently when processed in a lab. A gram-negative organism does not take up the Gram stain while a gram-positive organism does. Gram-positive organisms have a plasma membrane and thick peptidoglycan layer that retains the stain. In contrast, gram-negative organisms have a plasma membrane, a thin peptidoglycan layer, an outer polysaccharide, and a protein layer that does not take up the stain.

First-generation medications, such as **cephalexin (Keflex),** work well against gram-positive organisms, but not gram-negative. **Cefepime (Maxipime),** a fourth-generation cephalosporin, works well against both. First-generation cephalosporins are narrow spectrum and fourth-generation cephalosporins broad spectrum with their additional coverage. Both produce bactericidal cell wall destruction.

8. Identify two medications, one bactericidal and one bacteriostatic, detailing how each medication works to create this effect based on their mechanism of action.

Bactericidal medications cause bacterial death, whereas bacteriostatic medications interfere with bacteria's reproductive process without killing the bacteria outright.

The bactericidal **penicillins, cephalosporins,** and **vancomycin** inhibit cell wall synthesis. Bacteriostatic **macrolides, tetracyclines,** and **clindamycin** affect ribosomes and replication.

9. Provide three unique types of antiviral medications and the pathophysiologic state each would treat.

Three antiviral types include those for human immunodeficiency virus (HIV), influenza, and herpes zoster. **Enfuvirtide (Fuzeon)** comprises part of a multi-drug regimen to combat HIV. Influenza, if caught within the first 48 hours, yields to **zanamivir (Relenza)** or **oseltamivir (Tamiflu).** Herpes zoster outbreaks respond to **acyclovir (Zovirax)** and **valacyclovir (Valtrex).**

1. Review the importance of sodium balance and lithium as it relates to their position on the periodic table.

Sodium (Na) and lithium (Li) align on the left side of the periodic table under group one, the alkali metals. Because they both work as cations with a plus one (a positive charge), the body treats them similarly.

2. Review why you would use an ester or an amide as it relates to local parenteral anesthesia.

Two classes of local anesthetic include the esters and the amides. Esters and amides are functional groups from organic chemistry and provide a useful way to classify local anesthetics. Esters, such as **benzocaine,** when metabolized, end up as a para-aminobenzoic acid (PABA) metabolite. This is probably the source of many allergic reactions. If a patient has an allergy to PABA, they may also have issues with methylparaben, a preservative metabolized to PABA. As such, we generally limit esters for topical use. We prefer the amide **lidocaine** without that PABA issue.

3. Identify three classes of antidepressants. Provide an example of a drug in each class and a basis for the nomenclature (how it's named). Rank them from safest to least safe.

Three antidepressant classes include the selective serotonin reuptake inhibitors (SSRIs), the tricyclic antidepressants (TCAs), and monoamine oxidase inhibitors (MAOIs).

We name the SSRIs, such as **paroxetine (Paxil)** or **citalopram (Celexa),** after the *single* neurotransmitter serotonin. The serotonin-norepinephrine reuptake inhibitors (SNRIs) like **venlafaxine (Effexor)** take their class name from *two* neurotransmitters. We name the tricyclic antidepressants, such as **amitriptyline (Elavil),** after the shape of the molecule. A tricyclic molecule contains *three* rings. We name the MAOIs, such as **isocarboxazid (Marplan),** after the enzyme they affect. Without regard to dosages, it's generally accepted that SSRIs are the safest antidepressants, followed by the TCAs and MAOIs.

4. Identify the advantages of a benzodiazepine over a barbiturate related to side effects. Provide an example of each medication (generic and brand names).

The benzodiazepines, such as **alprazolam (Xanax)** or **lorazepam (Ativan),** provide anxiety relief more safely than a barbiturate such as **phenobarbital (Luminal)** that can easily lead to a lethal overdose. Both are equally effective.

5. Identify four medications that can induce sleep / drowsiness from four unique medication classes.

Benzodiazepines such as **temazepam (Restoril)** and**Diphenhydramine,** a first-generation antihistamine, cause drowsiness. **Barbiturates,** though dangerous, induce sleep. **Non-benzodiazepine** sedative-hypnotics like **eszopiclone (Lunesta)** also help a patient rest.

6. Identify a common over-the-counter sleep aid and contrast that to a specific sedative-hypnotic as it relates to DEA considerations.

Over-the-counter sleep aids such as **acetaminophen / diphenhydramine (Tylenol PM)** and **diphenhydramine (Benadryl)** are unscheduled. They do not carry addictive potential. However, the Drug Enforcement Agency (DEA) classifies sedative hypnotics, such as **zolpidem (Ambien),** as schedule IV. This is a concern for patients with a history of narcotic abuse.

7. What generation holds high / low potency antipsychotics? Provide an example of a high and low potency antipsychotic. What are major differences between high and low potency antipsychotics' side effects and therapeutic effects?

The first generation distinguishes between high and low potency antipsychotics. For example, **chlorpromazine (Thorazine)** is a low potency antipsychotic and **haloperidol (Haldol)** is a high potency antipsychotic. That potency simply means the equivalent milligram strength for **haloperidol** will be smaller than **chlorpromazine.** An important distinction is that low potency medications tend to cause more sedation and less incidence of movement disorders (extrapyramidal symptoms (EPS)). High potency medications tend to cause less sedation and more EPS.

8. What are differences between typical and atypical antipsychotics as they relate to side effects and therapeutic effects? Provide an example of each.

Speaking broadly, the first-generation or typical antipsychotics like **haloperidol (Haldol)** have more movement disorders like the extrapyramidal symptoms and work only on positive symptoms of psychosis such as hallucinations. Second-generation (atypical) **antipsychotics** like **risperidone (Risperdal)** help patients with both positive and negative symptoms. However, second-generation antipsychotics are more likely to cause diabetes, hyperlipidemia, and weight gain.

9. Contrast the treatment of a simple headache versus migraine, providing medication examples for the treatment of these two conditions. Discuss one medication used for migraine prophylaxis.

The over-the-counter analgesic **acetaminophen (Tylenol)** or a non-steroidal anti-inflammatory drug (NSAID), such as **ibuprofen** or **naproxen** relieves a simple acute headache. While **Excedrin Migraine** contains **acetaminophen, aspirin,** and **caffeine,** a very severe migraine might not respond to this over-the-counter remedy. A serotonin receptor agonist such as **sumatriptan (Imitrex)** relieves an acute severe migranous attack. A prophylactic migraine medication might include a beta-blocker such as **propranolol (Inderal),** a tricyclic antidepressant like **amitriptyline (Elavil),** or an antiepileptic such as **divalproex (Depakote).**

CHAPTER 6 – CARDIO

1. Contrast the use of a beta1 adrenergic agonist and a beta1 adrenergic antagonist in two unique pathophysiologic states.

It's important to know the equation for cardiac output before tackling this question. Cardiac output = stroke volume x heart rate.

A beta1-agonist treats congestive heart failure or cardiogenic shock because the increase in heart rate should increase the cardiac output. What you do to the right side of the equation will influence the left side of the mathematical equation.

A selective beta1-antagonist, like **metoprolol,** reduces hypertension and chronic increases in blood pressure. It might seem counterintuitive to use a beta-blocker in heart failure, because if you reduce heart rate on the right side of the equation, cardiac output should also go down. However, if the heart beats so fast it cannot fill, reducing the speed of the heart allows for more filling time and thereby improve stroke volume and cardiac output.

2. Provide a therapeutic indication (does not have to be cardiac) for a Beta-1 antagonist and a Beta-2 agonist. Include two examples of Beta-1 antagonists and two examples of Beta-2 agonists (can be combination medications).

A beta-1 selective antagonist like **metoprolol succinate (Toprol XL)** reduces hypertension. Another beta-blocker, **propranolol (Inderal)** prevents migraines.

A beta-2 agonist bronchodilates. Two examples include the rescue inhaler **albuterol (ProAir)** and the combination medication **fluticasone / salmeterol (Advair).** The salmeterol component is a long acting beta-2 agonist.

3. What do RAAS, ACE, ACEI and ARB stand for? Identify an ACEI and an ARB.

The RAAS stands for the renin-angiotensin-aldosterone system. ACE is an acronym that stands for angiotensin converting enzyme (you pronounce the whole word). ACEI is an initialism (you pronounce each letter individually) that stands for angiotensin converting enzyme inhibitor. ARB is an acronym that stands for angiotensin II receptor blocker.

RAAS: renin-angiotenin-aldosterone system

ACE: angiotensin converting enzyme

ACEI: angiotensin converting enzyme inhibitor

ARB: angiotensin II receptor blocker

Lisinopril (Zestril) is an ACE inhibitor and prevents an angiotensin-converting enzyme from converting angiotensin I to angiotensin II (the potent vasoconstrictor). **Valsartan (Diovan)** ends with the –sartan stem, identifying it as an ARB. This medication blocks the receptors that angiotensin II binds to that produce vasoconstriction.

4. Identify a dihydropyridine and non-dihydropyridine CCB. Provide a rationale for the use of one over another in the treatment of dysrhythmias and uterine contractions.

A non-dihydropyridine calcium channel blocker might include **diltiazem (Cardizem)** or **verapamil (Calan)**. These CCBs affect the heart directly and are potent anti-dysrhythmics. However, these medications would not be used to prevent uterine contractions in a pregnant woman because of their cardiosuppressive effects on the mother's and fetus' hearts. Dihydropyridines like **nifedipine (Procardia)** reduce uterine contractions through calcium blockade. It's safer because its mechanism of action comes from vasodilation rather than cardiosuppression. This makes dihydropyridines inappropriate for dysrhythmias.

5. What do DCT and PCT stand for? Provide examples of a medication that works at each and outline potential adverse effects.

The distal convoluted tubule (DCT) and proximal convoluted tubule (PCT) are part of the nephron in the kidney. A diuretic that works at the PCT would include **mannitol,** for acutely raised intracranial pressure. Adverse effects could include dehydration and hypotension. **Hydrochlorothiazide (Microzide)** works at the distal convoluted tubule and causes hypokalemia. This is why manufacturers pair **hydrochlorothiazide (Microzide)** with **triamterene (Dyrenium),** a potassium-sparing diuretic that counters the hypokalemic effect.

6. Identify the relative effects of HCTZ, furosemide (Lasix), and spironolactone (Aldactone) on water loss and the movement of potassium.

As a diuretic's site of action extends further from the glomerulus, less diuresis (water loss) is expected. In order of proximity to the glomerulus, **furosemide (Lasix)** works at the Loop of Henle, **hydrochlorothiazide (Microzide)** at the distal convoluted tubule (DCT), and **spironolactone (Aldactone)** at the collecting duct.

As such, **furosemide** provides the most diuresis and causes the greatest loss of potassium. **Hydrochlorothiazide** produces less diuresis than a loop diuretic, but more than a potassium-sparing diuretic and has the potential to cause hypokalemia. The potassium-sparing diuretic **spironolactone** causes only moderate diuresis, but may lead to hyperkalemia, not hypokalemia.

7. Identify three pathophysiologic states that benefit from diuresis (don't have to be cardiac). Provide three diuretic medications used for those states.

Treat uncomplicated hypertension with **hydrochlorothiazide (Microzide)** and a potassium-sparing diuretic like **triamterene (Dyrenium)** or the combination medication **hydrochlorothiazide / triamterene (Dyazide).** The edema (swelling due to excess water) secondary to congestive heart failure responds to **furosemide (Lasix),** a loop diuretic. **Mannitol** reduces acutely raised intracranial pressure.

8. Provide the advantages and disadvantages of warfarin (Coumadin), heparin, and enoxaparin (Lovenox).

Warfarin (Coumadin) has the advantage of oral administration but requires monitoring of the international normalized ratio (INR). The INR measures blood coagulation and helps a health care professional make dosage adjustment decisions.

Patients can take the injectable **enoxaparin (Lovenox)** home. **Heparin** requires more frequent dosing, injections, monitoring and hospitalization, but is relatively inexpensive.

9. Include an HMG-CoA medication adversely affected by grapefruit juice and the potential effects of this interaction.

Grapefruit juice affects the metabolism in some drugs, such as the HMG-CoA reductase inhibitor **atorvastatin (Lipitor).** This effect is less so or nonexistent with **rosuvastatin (Crestor).** Grapefruit juice also affects the calcium channel blockers **nifedipine (Procardia)** and **verapamil (Calan).** As with the HMG-CoAs, within a class of medications, one drug might interact, while another does not.

10. Outline two potential pathophysiologic complications of HMG-CoA reductase inhibitors. Identify two unique HMG-CoAs.

Muscle soreness or pain appears in about 1 in 10 patients, with the rarer side effects including myopathy (more severe muscle pain) and rhabdomyolysis (a muscle tissue breakdown). Two HMG-CoAs include **rosuvastatin (Crestor)** and **atorvastatin (Lipitor).**

CHAPTER 7 – ENDOCRINE / MISC.

1. Provide two advantages of the use of glucophage (Metformin) over other antidiabetic medications.

Glucophage (Metformin) generally has a low incidence of hypoglycemia and can induce a small amount of weight loss during treatment. In addition, it reduces LDL (bad cholesterol) and slightly raises HDL (good cholesterol) levels.

2. Provide three signs and / or symptoms of hypo- and hyper- thyroidism and a medication used for each condition.

Hypothyroid patients present with chronic fatigue, constipation, weight gain, and bradycardia. Generally, supplementation is effective with **levothyroxine (Synthroid).** Low iodine may also be a cause.
A hyperthyroid patient might present with the opposite symptoms: nervousness, tachycardia, anxiety, and insomnia. **Propythiouracil (PTU)** is a preferred treatment.

3. Identify two insulin types, their time course of action, and one special consideration.

Insulin glargine (Lantus) works for the entire day and improves the blood sugar profile of a diabetic. **Humulin R,** a faster acting insulin, works with an insulin pump.

4. Identify six anticholinergic effects and the opposing six cholinergic effects. Identify one anticholinergic medication and one medication that would cause cholinergic effects and their therapeutic uses.

Anticholinergic effects fall under the broad category of dryness, i.e., **a**nhidrosis, **b**lurry vision (secondary to dry eyes), **d**ry mouth, **u**rinary retention, **c**onstipation, and **t**achycardia. **(abduct** water)

Cholinergic effects include sweating, lacrimation (watery eyes), hypersalivation, urinary incontinence, diarrhea, and bradycardia.

An anticholinergic medication includes **tolterodine (Detrol)** for urinary incontinence. The brand name refers to "cont**rol**ling the **det**rusor" muscle overactivity. **Bethanechol (Urecholine),** a cholinergic, relieves urinary retention. The brand name might allude to urinary retention and the cholinergic receptors affected.

5. Identify two physiologic systems that alpha-1 blockers affect. Provide two examples of alpha-1 blocking medications. Note how their brand names allude to their therapeutic effect.

Alpha-blockers work for benign prostatic hyperplasia (BPH) and hypertension. **Tamsulosin (Flomax)** provides "maximum flow of urine" by relaxing the smooth muscle in the prostate. **Doxazosin (Cardura)** helps improve hypertension and affects the "card"iovascular system.

6. Provide a drug interaction that might occur with sildenafil (Viagra) and a vasodilator.

There is a potential for a dangerous sudden decrease in the systemic blood pressure with **nitroglycerin (Nitrostat).**

7. Provide two examples of birth control medications that fall outside of the traditional 21 active pills, 7 inactive pills.

Ortho Evra (norelgestromin / ethinyl estradiol) is a patch that's put on the upper outer arm, abdomen, or buttocks for 21 days, removed for 7 days, and then a new patch is applied.

Nuvaring (etonogestrel / ethinyl estradiol) is a contraceptive ring that's inserted vaginally for 21 days. The patient has seven drug free days and then inserts another ring.

EPILOGUE

WHY MEMORIZATION MATTERS

The tone of this book is one of relaxation, a step-wise and logical progression from easy to hard material with a bit of humor. In the print book, I didn't share just what prompted me to become so passionate about extending this information – a terrible test of my competence as a father and health professional and a clear need for memorization.

My intention was to create an audiobook that I would read, so I couldn't include this story because I can't read it myself without breaking down completely. Writing the story provided a means for me to deal with the emotional trauma it caused. I have a brilliant narrator lined up and would like to share this story in the ebook and audiobook, originally published in an outstanding literary journal – *Intima: A Journal of Narrative Medicine* in the Spring 2014 issue.

THERE WILL BE NO PROBLEMS

Baby C has had it tough from the time she was inside the womb, a quiet girl flipping in the corner, kicking from time to time, but mostly playing by herself until her sister, Baby A, tried to break out at 19 weeks. In a sweat-soaked hospital bed, I held my wife's hair as she vomited into a Cinderella pink bucket. Hours before, she volunteered to have magnesium sulfate infused into her vein to stop her contracting uterus, the shell loosely holding our unborn triplet daughters. My wife's shivers turned violent as the doctor doubled the dose trying to delay the preterm contractions in hopes that a stitch could be inserted, shutting her incompetent cervix. Should we have allowed the doctor to stab a javelin of potassium chloride into a Doppler pounding fetal heart, reducing and aborting one daughter that the others might have a chance to live? Did we sentence our daughters to die at 19 weeks because we kept all three?

The news came that morning from our perinatologist. The contractions slowed enough that he was able to push Baby A back in, tie the cervix with a cerclage procedure, and put mom on hospital bed rest. Days turned into weeks and into months until week 27 and 2 days when the dam broke. I posted "babies are coming" on our Facebook pages and the streams of electronic congratulations came in. A painful juxtaposition to what we knew about babies that are born before 28 weeks. A well-intentioned neonatologist told us "you must make it to week 28."

We learned each week closer to 28 lessens the risk of retinopathy of prematurity (ROP), necrotizing enterocolitis (NEC), patent ductus arteriosus (PDA), respiratory distress syndrome (RDS), intraventricular hemorrhage (IVH), or of finding the children cannot survive in this world and die. We toured the NICU and after seeing two children the size of a dollar bill, I asked that we return to her room. My wife's only time off hospital bed rest is a 15- minute wheelchair ride every 48 hours. She turns it down.

The anesthesiologist, a likeable Duke graduate, ended up playing the role of husband assuaging my wife while I called the play-by-play to her by looking over the sheet that served as a screen. A medical resident had his leg up on the table to leverage the retractor that opened my wife's antiseptic covered yellow belly. I had asked if he could deliver the babies vaginally and the doctor assured me he could, if I could get them to agree to all come out headfirst.

It was not the scalpel making the bikini cut, the Pfannenstiel incision or the creeping blood, or even the exposed peritoneal cavity that worried us. Silence did.

We held hands and welcomed the three screams that came from the girls not much larger than a soda can. It would be their last cry for weeks. As the perinatologist closed my wife's abdominal wall with sutures, I went up to their room. Seventeen people were in their triplet suite, a corner office with three parallel Giraffe incubators lit up like tanning beds, bathing the girls in UV rays that would reduce their bilirubin, a danger to their brains. A machine would breathe for them. A machine warmed them. A machine fed them.

I sign a release form for their upcoming blood transfusions. I'm told to come back in half an hour. I return in 10 minutes after talking to the family and get kicked out. I find my wife loosely thumbing the green button of a morphine pump. A nurse tries to give me a congratulatory hug. I retreat, crashing into a wall to avoid being touched.

Baby A, long and lithe, the giant at two pounds, looked to be the healthiest. Baby B, a scrapper who fought every needle and prod, matched her sister Baby C at one pound six ounces. Baby C lay swaddled by the window, a place for the parents to look outside and away. Baby C kept having apneic spells where she desatted, quietly trying to slip away in the shadow of the red alarm. The cardiologist found a hole in a blood vessel above her heart, patent ductus arteriosus, and if medicine did not close it, he would have to operate. A second round of indomethacin, an anti-inflammatory, finally relayed the message to the patent ductus that the baby was no longer in the womb, and could close.

Baby C still struggled from time to time, an idiopathic infection that came and went and reflux that burned her esophagus. She had trouble catching up with her sisters who needed less oxygen support. From time to time Baby C would vomit her milk, usually half an hour after a feeding.

This last emetic episode came as she was alone in a room that her sisters had already vacated for home. Weeks later, the hospital staff felt they could trust us to take her home, that we knew what we were doing, and that she would be fine in our care – a third child with a third apnea monitor.

The apnea monitor is a box a little bigger than a hardcover book that fires a piercing scream meant to both wake the child and the parent when it stops detecting motion. Imagine putting your ear to an eighteen-wheeler's horn as it blows. It's easy to get comfortable with the false alarms; it's easy to want to turn them off.

Baby C lay quietly next to me on the floor of the nursery as we watched Iowa State University's unranked football team take a 21-to-0 lead on Texas Tech on a small television screen. The camera panned to a small contingent of fans excited they made the trip to Lubbock. Nothing could go wrong for the Cyclones.

In frank juxtaposition, Baby C's baby monitor fired, waking her sisters who started their own punishing screams in the cribs above. Baby C did not cry, but vomited a small amount of milk and began to turn purple. I called to her, asking her to breathe for me, screamed for my wife and began CPR. Well, I tried CPR.

When would we ever actually use CPR? The practice baby in class felt like a toy, a hard plastic shell whose chest pushed down neatly when I did the 100 compressions. My stomach knotted from lunch that

day, so I excused myself a couple of times, missing some content, like trying to read a book, watch television and surf the net at the same time.

On our nursery floor, Baby C felt limp, like a stuffed animal, an infant turning crimson in her nightclothes. I ripped the sleeper to find the tiny xiphoid process and started to press down with my two fingers wiping the sting from my eyes. I screamed for my wife. No answer. I put a breath in her tiny mouth, but it hit a wall to spurt some vomit from her nose into her oxygen cannula. I screamed again for my wife who I later found was in the master bedroom brushing her teeth with an electric toothbrush, and could not hear.

“What do you want me to do?” she asked.

“Call 9-1-1,” I said.

My father saved my life when I spiked a fever so high he had to submerge me kicking and screaming into a tub of water filled with ice. My father passed his test.

Together, we worked. Compressions and breaths until one of us remembered: An infant should have their nose and mouth covered when putting in a breath. Newton’s third law, an equal and opposite reaction, pushed the curdled milk against the blocked pyloric valve, bouncing it back into her stomach and out her esophagus. A pool of vomit and tiny violin strings of blood covered the mat. I followed the little green hose to her oxygen concentrator running it up to five liters.

The haze of the policeman, the paramedics, my wife, my future life without my daughter, my life with my daughter, an infant in the back of the ambulance, the minutes before the one-hour surgery to correct, the pediatric surgeon’s enormous hands, the surgeon’s baritone words.

“There will be no problems,” he said. “But … ,”

“There will be no problems.”

APPENDIX

ANSWERS TO DRUG QUIZZES (LEVEL 1)

Gastrointestinal drugs

1. A 2. E 3. D 4. E 5. F 6. B 7. A/D 8. G 9. F 10. C

2. –tidine 4. –tidine 5. –prazole 8. –liximab 9. –prazole 10. -setron

Musculoskeletal drugs

1. E 2.C 3. F 4. B 5. D 6. I 7. I 8. G 9. H 10. A

2. –dronate 4. –xostat 5. –nercept 8. –profen 9. –coxib 10. -triptan

Respiratory drugs

1. I 2. B 3. A 4. J 5. F 6. C 7. B 8. E 9. D 10. G

1. –terol 4. –terol 6. –tropium 7. –atadine 8. –lukast 9. –drine 10. -pred-

Immune system drugs

1. H 2. G 3. D 4. C 5. K 6. E 7. L 8. F 9. K 10. M

1. –cillin 2. –thromycin 3. Cef- 4. Cef- 5. –conazole 6. –micin 8. -floxacin 10. –cyclovir

Nervous system drugs

1. K 2. F 3. A 4. E 5. B 6. H 7. J 8. C 9. L 10. M

1. –azolam 2. -triptyline 3. –oxetine 7. –peridol 9. –dopa 10. –pidem

Cardio system drugs

1. O 2. E 3. A 4. D 5. K 6. N 7. C 8. F 9. H 10. M

1. –vastatin 2. –grel 3. –pril 4. –parin 5. –semide 6. -thiazide 7. –sartan 8. –olol 9. –dipine

Endocrine / Misc. system drugs

1. A 2. H 3. A 4. M 5. I 6. A 7. J 8. N 9. L 10. K

1. Gli- 3. Gly- 6. –formin 9. –fenacin 10. –afil

ANSWERS TO DRUG QUIZZES (LEVEL 2)

Gastrointestinal drugs

1. B 2. F 3. F 4. D 5. C 6. A 7. E 8. D 9. B 10. E

1. -sal- 2. –prazole 3. –prazole 7. –tidine 10. –tidine

Musculoskeletal drugs

1. D 2. I 3. D 4. G 5. B 6. C 7. B 8. G 9. C 10. I

1. –trexate 3. –tacept 5. –xostat 6. -dronate 9. -dronate

Respiratory drugs

1. J 2. F 3. H 4. J 5. D 6. B 7. A 8. I 9. E 10. G

1. –terol 4. –terol 5. –drine 8. –terol 9. –lukast 10. Pred-

Immune system drugs

1. L 2. K 3. E 4. F 5. L 6. M 7. A 8. I 9. G 10. O

1. Rif- 3. –kacin 4. –floxacin 6. –cyclovir 7. Ceph- 8. Sulfa- / -prim 9. –thromycin 10. -amivir

Nervous system drugs

1. D 2. K 3. H 4. I 5. C 6. M 7. E 8. E 9. L 10. N

1. –faxine 2. –azepam 3. –toin 4. –tiapine 6. –clone 7. –oxetine 9. –giline

Cardio system drugs

1. I 2. G 3. C 4. N 5. B 6. H 7. P 8. A 9. J 10. D

1. –tiazem 2. –dil- (-olol) 3. –sartan 4. –thiazide 5. –azosin 6. –dipine 7. Nitro- 8. –pril 10. –farin

Endocrine / Misc. system drugs

1. B 2. C 3. L 4. K 5. E 6. F 7. L 8. O 9. K 10. B

1. –steride 4. –afil 5. estr- 6. -gest- / estr 9. –afil 10. -steride

ANSWERS TO FINAL EXAM (LEVEL 1)

1 f Anti-diarrheal

2 o Non-narcotic analgesic

3 g Anti-gout

4 q Opioid analgesic

5 t Steroid/bronchodilator

6 r Proton pump inhibitor

7 r Proton pump inhibitor

8 g Anti-gout

9 m Mucolytic/cough

10 t Steroid/bronchodilator

11 q Opioid analgesic

12 q Opioid analgesic

13 k H2 blocker

14 l Laxative

15 p NSAID

16 p NSAID

17 i Bisphosphonate

18 s Short-acting bronchodilator

19 n Non-narcotic analgesic

20 f Anti-diarrheal

21 d Antacid

22 m Mucolytic/cough

23 b 2nd-generation antihistamine

24 a 1st-generation antihistamine

25 j DMARD

26 n Antiviral: HIV

27 h Antibiotic: penicillin

28 c 3rd-generation cephalosporin

29 j Antibiotic: tetracycline

30 f Antibiotic: fluoroquinolone

31 i Antibiotic: sulfa

32 a 1st-generation cephalosporin

33 l Antituberculosis

34 l Antituberculosis

35 l Antituberculosis

36 e Antibiotic: aminoglycoside

37 d 4th-generation cephalosporin

38 k Antifungal

39 h Antibiotic: penicillin

40 g Antibiotic: macrolide

41 k Antifungal

42 o Antiviral: Influenza

43 j Antibiotic: tetracycline

44 g Antibiotic: macrolide

45 e Antibiotic: aminoglycoside

46 l Antituberculosis

47 k Antifungal

48 g Antibiotic: macrolide

49 f Antibiotic: fluoroquinolone

50 m Antiviral: herpes

51 f Antidepressant: SSRI

52 i Antiepileptic: traditional

53 n Muscle relaxer

54 i Antiepileptic: traditional

55 h Antiepileptic: newer

56 q Simple salt

57 r Vertigo/motion sickness

58 m Local anesthetic

59 f Antidepressant: SSRI

60 f Antidepressant: SSRI

61 l Benzodiazepine

62 m Local anesthetic

63 g Antidepressant: TCA

64 a ADHD drug/non-stimulant

65 b ADHD drug/stimulant

66 f Antidepressant: SSRI

67 k Antipsychotic: 1st-generation

68 l Benzodiazepine

69 o Parkinson's

70 c Alzheimer's

71 f Antidepressant: SSRI

72 l Benzodiazepine

73 k Antipsychotic: 1st-generation

74 p Sedative-hypnotic

75 d Antidepressant: MAOI

76 k Contraception

77 u Urinary retention

78 i Calcium channel blocker

79 i Calcium channel blocker

80 m For hypoglycemia

81 g BPH: 5-alpha-reductase inhibitor

82 l Diuretic

83 t Slower acting insulin

84 l Diuretic

85 r OAB

86 e Antiplatelet

87 k Contraception

88 f Beta blocker

89 l Diuretic

90 a ACE inhibitor

91 s Longer duration insulin

92 c Anticoagulant

93 p HMG-CoA reductase inhibitor

94 j Cardiac glycoside

95 k Contraception

96 g BPH: 5-alpha-reductase inhibitor

97 d Antidiabetic

98 c Anticoagulant

99 d Antidiabetic

100 k Contraception

ANSWERS TO FINAL EXAM (LEVEL 2)

1 b 2nd-generation antihistamine

2 a 1st-generation antihistamine

3 k H2 blocker

4 i Decongestant

5 r Proton pump inhibitor

6 p NSAID

7 s Steroid

8 t Ulcerative colitis

9 f Anti-diarrheal

10 f Anti-diarrheal

11 p NSAID

12 d Antacid

13 j DMARD

14 b 2nd-generation antihistamine

15 q Opioid analgesic

16 s Steroid

17 c 5-HT3 receptor antagonist

18 e Anticholinergic for asthma

19 h Anti-nausea

20 l Laxative

21 q Opioid analgesic

22 r Proton pump inhibitor

23 h Anti-nausea

24 q Opioid analgesic

25 s Steroid

26 j Antibiotic: tetracycline

27 h Antibiotic: penicillin

28 i Antibiotic: sulfa

29 k Antifungal

30 g Antibiotic: macrolide

31 c 3rd-generation cephalosporin

32 l Antituberculosis

33 l Antituberculosis

34 a 1st-generation cephalosporin

35 l Antituberculosis

36 k Antifungal

37 j Antibiotic: tetracycline

38 m Antiviral: herpes

39 o Antiviral: influenza

40 e Antibiotic: aminoglycoside

41 e Antibiotic: aminoglycoside

42 g Antibiotic: macrolide

43 d 4th-generation cephalosporin

44 o Antiviral: influenza

45 k Antifungal

46 f Antibiotic: fluoroquinolone

47 h Antibiotic: penicillin

48 f Antibiotic: fluoroquinolone

49 l Antituberculosis

50 n Antiviral: HIV

51 o Parkinson’s

52 f Antidepressant: SSRI

53 j Antipsychotic: 2nd-generation

54 f Antidepressant: SSRI

55 r Vertigo / motion sickness

56 d Antidepressant: MAOI

57 h Antiepileptic: Newer

58 o Parkinson’s

59 c Alzheimer’s

60 i Antiepileptic: Traditional

61 p Sedative-hypnotic

62 f Antidepressant: SSRI

63 e Antidepressant: SNRI

64 p Sedative-hypnotic

65 h Antiepileptic: Newer

66 f Antidepressant: SSRI

67 l Benzodiazepine

68 k Antipsychotic: 1st-generation

69 m Local anesthetic

70 f Antidepressant: SSRI

71 j Antipsychotic: 2nd-generation

72 p Sedative-hypnotic

73 r Vertigo / motion sickness

74 b ADHD drug / stimulant

75 q Simple salt

76 o For hypothyroidism

77 l Diuretic

78 r OAB

79 p HMG-CoA reductase inhibitor

80 f Beta blocker

81 b Angiotensin receptor blocker

82 p HMG-CoA reductase inhibitor

83 a ACE inhibitor

84 d Antidiabetic

85 r OAB

86 p HMG-CoA reductase inhibitor

87 b Angiotensin receptor blocker

88 h BPH: Alpha blocker

89 i Calcium channel blocker

90 n For hyperthyroidism

91 b Angiotensin receptor blocker

92 f Beta blocker

93 q Erectile dysfunction

94 q Erectile dysfunction

95 i Calcium channel blocker

96 d Antidiabetic

97 a ACE inhibitor

98 l Diuretic

99 f Beta blocker

100 c Anticoagulant

ALPHABETICAL LIST OF STEMS

ac
anti-inflammatory agents (acetic acid derivatives)

adol
analgesics (mixed opiate receptor agonists/antagonists)

afil
phosphodiesterase type 5 (PDE5) inhibitors

alol
combined alpha and beta blockers

amivir
neuraminidase inhibitors

astine
antihistaminics (histamine-H1 receptor antagonists)

atadine
tricyclic histaminic-H1 receptor antagonists, loratadine derivatives (formerly -tadine)

azepam
antianxiety agents (diazepam type)

azolam
(WHO stem) diazepam derivatives

azosin
antihypertensives (prazosin type)

barb
barbituric acid derivatives

bendazole
anthelmintics (tibendazole type)

caine
local anesthetics

cavir
carbocyclic nucleosides

cef
cephalosporins

citabine
nucleoside antiviral / antineoplastic agents, cytarabine or azarabine derivatives

cillin
peni<u>cillin</u>s

clone
hypnotics/tranquilizers (zopi<u>clone</u> type)

conazole
systemic antifungals (mi<u>conazole</u> type)

coxib
cyclooxygenase-2 inhibitors

cycline
antibiotics (tetra<u>cycline</u> derivatives)

cyclovir
antivirals (a<u>cyclovir</u> type)

dil
vaso<u>dil</u>ators (undefined group)

dipine
phenylpyridine vasodilators (nife<u>dipine</u> type)

dopa
<u>dopa</u>mine receptor agonists

dralazine
antihypertensives (hy<u>drazine</u>-phthalazines)

drine
sympathomimetics

dronate
calcium metabolism regulators

estr
<u>estr</u>ogens

farin
war<u>farin</u> analogs

faxine
antianxiety, antidepressant inhibitor of norepinephrine and dopamine re-uptake

fenacin
muscarinic receptor antagonists

fetamine
am<u>fetamine</u> derivatives

fibrate
antihyperlipidemics (clofibrate type)

floxacin
fluoroquinolone (not on Stem List)

formin
hypoglycemics (phenformin type)

gab
gabamimetics

gatran
thrombin inhibitors (argatroban type)

gest
progestins

giline
Monoamine oxidase (MAO) inhibitors, type B

gli (was gly)
antihyperglycemics

glinide
antidiabetic, sodium glucose co-transporter 2 (SGLT2) inhibitors, not phlorozin derivatives

gliptin
dipeptidyl aminopeptidase-IV inhibitors

glitazone
peroxisome proliferator activating receptor (PPAR) agonists (thiazolidene derivatives)

glutide
glucagon-like peptide (GLP) analogs

gly
antihyperglycemics

grel
platelet aggregation inhibitors, primarily platelet P2Y12 receptor antagonists

icam
anti-inflammatory agents (isoxicam type)

ifene
antiestrogens of the clomifene and tamoxifen groups

imibe
antihyperlipidaemics, acyl CoA: cholesterol acyltransferase (ACAT) inhibitors

iodarone
indicates high iodine content antiarrhythmic

kacin
antibiotics obtained from *Streptomyces kanamyceticus* (related to kanamycin)

liximab
monoclonal antibodies

lizumab
monoclonal antibodies

lukast
leukotriene receptor antagonists

mantine
antivirals/antiparkinsonians (adamantane derivatives)

melteon
selective melatonin receptor agonist

methacin
anti-inflammatory agents (indomethacin type)

micin
antibiotics *(Micromonospora* strains)

mycin
antibiotics *(Streptomyces* strain)

nal
narcotic agonists/antagonists (normorphine type)

navir
HIV protease inhibitors (saquinavir type)

nercept
tumor necrosis factor receptors

nicline
nicotinic acetylcholine receptor partial agonists/agonists

nidazole
antiprotozoal substances (metronidazole type)

nifur
5-nitrofuran derivatives

nitro
(WHO stem) NO2 derivatives

olol
beta-blockers (propranolol type)

orphan
narcotic antagonists/agonists (morphinan derivatives)

oxacin
antibacterials (quinolone derivatives)

oxanide
antiparasitics (salicylanilide derivatives)

oxetine
antidepressants (fluoxetine type)

pamil
coronary vasodilators (verapamil type)

parin
heparin derivatives and low molecular weight (or depolymerized) heparins

peg
PEGylated compounds, covalent attachment of macrogol (polyethylene glycol) polymer

peridol
antipsychotics (haloperidol type)

peridone
antipsychotics (risperidone type)

pezil
acetylcholinesterase inhibitors used in the treatment of Alzheimer's disease

pidem
hypnotics/sedatives (zolpidem type)

pin(e)
tricyclic compounds

piprazole
(WHO stem) psychotropics, phenylpiperazine derivatives (future use is discouraged due to conflict with stem -prazole)

prazole
antiulcer agents (benzimidazole derivatives)

pred
prednisone and prednisolone derivatives

pril
antihypertensives (ACE inhibitors)

prim
antibacterials (trimethoprim type)

profen
anti-inflammatory/analgesic agents (ibuprofen type)

prost
prostaglandins

racetam
nootropic agents (learning, cognitive enhancers), piracetam type

rifa
antibiotics (rifamycin derivatives)

sal
anti-inflammatory agents (salicylic acid derivatives)

sartan
angiotensin II receptor antagonists

semide
diuretics (furosemide type)

setron
serotonin 5-HT3 receptor antagonists

sidone
antipsychotic with binding activity on serotonin (5-HT2A) and dopamine (D2) receptors

spirone
anxiolytics (buspirone type)

ster
steroids (androgens, anabolics)

steride
testosterone reductase inhibitors

sulfa
antimicrobials (sulfonamides derivatives)

tacept
T-cell receptors

tegravir
integrase inhibitors

terol
bronchodilators (phenethylamine derivatives)

thiazide
diuretics (thiazide derivatives)

thromycin
macrolide (not on Stem List)

tiapine
antipsychotics (dibenzothiazepine derivatives)

tiazem
calcium channel blockers (diltiazem type)

tide
peptides

tidine
H2-receptor antagonists (cimetidine type)

toin
antiepileptics (hydantoin derivatives)

traline
selective serotonin reuptake inhibitors (SSRI)

trexate
antimetabolites (folic acid derivatives)

triptan
antimigraine agents (5-HT1 receptor agonists); sumatriptan derivatives

triptyline
antidepressants (dibenzol[a.d.]cycloheptane derivatives)

trop(ium)
atropine derivative, (quaternary ammonium salt)

trop(ine)
atropine derivatives; Subgroups: tertiary amines (e.g., benztropine)

uracil
uracil derivatives used as thyroid antagonists and as antineoplastics

vastatin
antihyperlipidemics (HMG-CoA inhibitors)

vir
antivirals

virenz
non-nucleoside reverse transcriptase inhibitors; benzoxazinone derivatives

viroc
CC chemokine receptor type 5 (CCR5) antagonists

vudine
antineoplastics; antivirals (zidovudine group) (exception: edoxudine)

xaban
antithrombotics, blood coagulation factor XA inhibitors

xostat
xanthine oxidase/dehydrogenase inhibitors

zolid
oxazolidinone antibacterials

CHAPTER 1: GASTROINTESTINAL

liximab
monoclonal antibodies

peg
PEGylated compounds, covalent attachment of macrogol (polyethylene glycol) polymer

prazole
antiulcer agents (benzimidazole derivatives)

prost
prostaglandins

sal
anti-inflammatory agents (salicylic acid derivatives)

setron
serotonin 5-HT3 receptor antagonists

tidine
H2-receptor antagonists (cimetidine type)

CHAPTER 2: MUSCULOSKELETAL

ac
anti-inflammatory agents (acetic acid derivatives)

adol
analgesics (mixed opiate receptor agonists/antagonists)

coxib
cyclooxygenase-2 inhibitors

dronate
calcium metabolism regulators

icam
anti-inflammatory agents (isoxicam type)

ifene
antiestrogens of the clomifene and tamoxifen groups

liximab
monoclonal antibodies

methacin
anti-inflammatory agents (indomethacin type)

nal
narcotic agonists/antagonists (normorphine type)

nercept
tumor necrosis factor receptors

profen
anti-inflammatory/analgesic agents (ibuprofen type)

tacept
T-cell receptors

trexate
antimetabolites (folic acid derivatives)

triptan
antimigraine agents (5-HT1 receptor agonists); sumatriptan derivatives

xostat
xanthine oxidase/dehydrogenase inhibitors

CHAPTER 3: RESPIRATORY

atadine
tricyclic histaminic-H1 receptor antagonists, loratadine derivatives (formerly -tadine)

astine
antihistaminics (histamine-H1 receptor antagonists)

drine
sympathomimetics

lizumab
monoclonal antibodies

lukast
leukotriene receptor antagonists

orphan
narcotic antagonists/agonists (morphinan derivatives)

pred
prednisone and prednisolone derivatives

terol
bronchodilators (phenethylamine derivatives)

trop(ium)
atropine derivative (quaternary ammonium salt)

CHAPTER 4: IMMUNE

amivir
neuraminidase inhibitors

bendazole
anthelmintics (tibendazole type)

cavir
carbocyclic nucleosides

cef
cephalosporins

cillin
penicillins

citabine
nucleoside antiviral / antineoplastic agents, cytarabine or azarabine derivatives

conazole
systemic antifungals (miconazole type)

cycline
antibiotics (tetracycline derivatives)

cyclovir
antivirals (acyclovir type)

floxacin
fluoroquinolone (not on Stem List)

kacin
antibiotics obtained from *Streptomyces kanamyceticus* (related to kanamycin)

lizumab
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micin
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antibiotics *(Streptomyces* strain)

navir
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5-nitrofuran derivatives

oxacin
antibacterials (quinolone derivatives)

oxanide
antiparasitics (salicylanilide derivatives)

prim
antibacterials (trimethoprim type)

rifa
antibiotics (rifamycin derivatives)

sulfa
antimicrobials (sulfonamides derivatives)

tegravir
integrase inhibitors

thromycin
macrolide (not on Stem List)

vir
antivirals

virenz
non-nucleoside reverse transcriptase inhibitors; benzoxazinone derivatives

viroc
CC chemokine receptor type 5 (CCR5) antagonists

vudine
antineoplastics; antivirals (zidovudine group) (exception: edoxudine)

zolid
oxazolidinone antibacterials

CHAPTER 5: NEURO

azepam
antianxiety agents (diazepam type)

azolam
(WHO stem) diazepam derivatives

caine
local anesthetics

clone
hypnotics/tranquilizers (zopiclone type)

dopa
dopamine receptor agonists

faxine
antianxiety, antidepressant inhibitor of norepinephrine and dopamine re-uptake

gab
gabamimetics

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Monoamine oxidase (MAO) inhibitors, type B

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selective melatonin receptor agonist

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selective serotonin reuptake inhibitors (SSRI)

triptyline
antidepressants (dibenzol[a,d] cycloheptane derivatives)

nicline
nicotinic acetylcholine receptor partial agonists/agonists

barb
barbituric acid derivatives

spirone
anxiolytics (buspirone type)

fetamine
amfetamine derivatives

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(WHO stem) psychotropics, phenylpiperazine derivatives (future use is discouraged due to conflict with stem -prazole)

racetam
nootropic agents (learning, cognitive enhancers), piracetam type

sidone
antipsychotic with binding activity on serotonin (5-HT2A) and dopamine (D2) receptors

tropine
atropine derivatives; Subgroups: tertiary amines (e.g., benztropine)

mantine
antivirals/antiparkinsonians (adamantane derivatives)

CHAPTER 6: CARDIO

alol
combined alpha and beta blockers

azosin
antihypertensives (prazosin type)

dil
vasodilators (undefined group)

dipine
phenylpyridine vasodilators (nifedipine type)

dralazine
antihypertensives (hydrazine-phthalazines)

farin
warfarin analogs

fibrate
antihyperlipidemics (clofibrate type)

gatran
thrombin inhibitors (argatroban type)

grel
platelet aggregation inhibitors, primarily platelet P2Y12 receptor antagonists

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heparin derivatives and low molecular weight (or depolymerized) heparins

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antihypertensives (ACE inhibitors)

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angiotensin II receptor antagonists

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diuretics (furosemide type)

thiazide
diuretics (thiazide derivatives)

tiazem
calcium channel blockers (diltiazem type)

trop(ine)
atropine derivatives; Subgroups: tertiary amines (e.g., benztropine)

vastatin
antihyperlipidemics (HMG-CoA inhibitors)

xaban
antithrombotics, blood coagulation factor XA inhibitors

CHAPTER 7: ENDOCRINE / MISC.

afil
phosphodiesterase type 5 (PDE5) inhibitors

estr
estrogens

fenacin
muscarinic receptor antagonists

formin
hypoglycemics (phenformin type)

gest
progestins

gli (was gly)
antihyperglycemics

glinide
antidiabetic, sodium glucose co-transporter 2 (SGLT2) inhibitors, not phlorozin derivatives

gliptin
dipeptidyl aminopeptidase-IV inhibitors

glitazone
peroxisome proliferator activating receptor (PPAR) agonists (thiazolidene derivatives)

glutide
glucagon-like peptide (GLP) analogs

gly
antihyperglycemics

ster
steroids (androgens, anabolics)

steride
testosterone reductase inhibitors

tide
peptides

uracil
uracil derivatives used as thyroid antagonists and as antineoplastics

MEMORIZING PHARMACOLOGY

A Relaxed Approach

As a working parent of 4-year-old triplet daughters, I understand time management presents one of the greatest barriers to my pharmacology students' success. Many students feel that cold sense of overwhelm and information overload.

This easy-to-read guide organizes pharmacology into manageable, logical steps you can fit in short pockets of time. The proven system helps you memorize medications quickly and form immediate connections. With mnemonics from students and instructors, you'll see how both sides approach learning.

After you've finished the 200 Top Drugs in this book, reading pharmacology exam questions will seem like reading plain English. You'll have a new understanding of pharmacology to do better in class, clinical and your board exam. You'll feel the confidence you'd hoped for as a future health professional.

INCLUDES:

- Compact summaries
- Concrete mnemonics
- Chapter quizzes
- Comprehensive exams