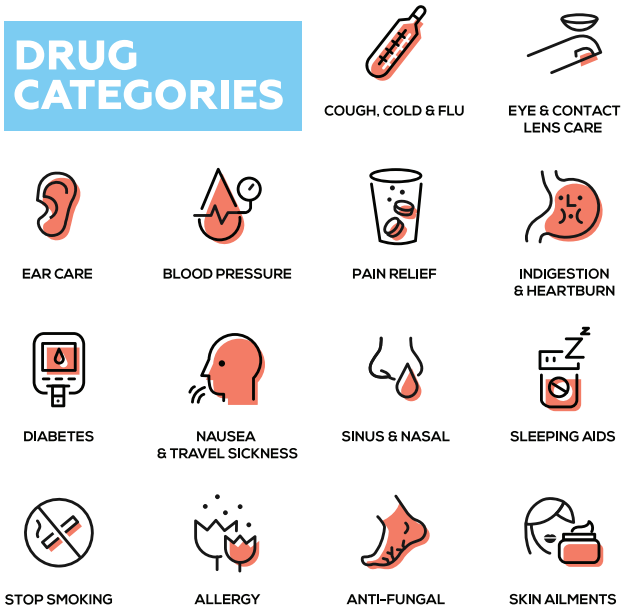
Drug Classifications

THERE ARE so many drugs available today and a number of different ways to classify them. A drug class encompasses drugs that share something in common; therefore drugs can belong to more than one kind of drug class. Drugs can be classified based upon their similar chemical structures, how they work, or which diseases and disorders they treat.



Objective:

Review drug classifications and associated vocabulary and differentiate between brand and generic drugs.

Key Terms:

adverse reaction
analgesics
anesthetics
anti-infectives
antineoplastics
brand name
cardiovascular
dermatological
gastrointestinal
generic drugs
hormones
musculoskeletal
neoplasms
neurological
ophthalmic
otic
psychotropic
renal
respiratory
therapeutic effect

How to Classify Drugs

DRUG CLASSIFICATIONS AND ASSOCIATED VOCABULARY

A drug classification is used to describe medications that are grouped together because of their similarities. Many times drugs in the same class have the same mechanism of action. This information can assist the prescriber in determining the expected **therapeutic effect**, a

desired effect for treating a disease, and also possible **adverse reactions**, an undesired harmful effect resulting from a medication. Drugs are classified according to a number of different criteria, depending on the group doing the classifying and the reason for classification. There are four main methods of classifying drugs.

- Therapeutic use: classifying drugs based upon the type of condition they are used to treat.
- Mode of action: classifying drugs based upon the specific way in which the body responds to the drug.
- Mechanism of action: classifying drugs based upon the specific biochemical reaction that occurs when you take a drug.
- Chemical structure: classifying drugs based upon the arrangement of chemical bonds between atoms in a molecule.

Based on these classification methods, some drugs may be grouped together under one system but not another. In other cases, a drug may have multiple uses or actions, and may be included in multiple drug classes. The aim of classifying drugs is to ensure that the patient uses the drug safely and achieves the utmost benefit from the drug.

Every time you take a drug, your body chemistry is altered. This effect is meant to be therapeutic, but it can also cause side effects that may be harmful. Taking multiple drugs can cause your body chemistry to be changed in such a way that a drug is far less effective or the side effects are far more severe. By noting the classification of a drug, the prescriber can have a better understanding of what to expect when you take it, and which drugs you can switch to if needed.

Analgesics

Analgesics: an agent producing diminished sensation to pain without loss of consciousness. There are several types of analgesics:

- nonsteroidal anti-inflammatory drugs (ibuprofen)
- salicylates (aspirin)
- general (acetaminophen)
- narcotics (morphine)

FIGURE 1. Pain relievers are medicines that reduce or relieve headaches, sore muscles, arthritis, or other aches and pains. There are many different pain medicines and each has advantages and risks.

Anesthetics

Anesthetic: agents that cause an absence of sensation or pain. Anesthetic agents are classified as either local or general.

- local anesthetics block pain conduction from peripheral nerves to the central nervous system without causing the loss of consciousness.
- general anesthetics depress the central nervous system to a level of unconsciousness.

Anti-Infectives

Anti-Infectives: agents that treat disease produced by microorganisms such as bacteria, viruses, fungi, and parasites. Common drug classes of anti-infectives are:

- antibiotics (bacteria)
- antifungals (fungus)
- antivirals (virus)

Antineoplastics

Antineoplastics: agents that inhibit the new growth of cancer cells or **neoplasms**, new and abnormal growth of tissue in some part of the body.

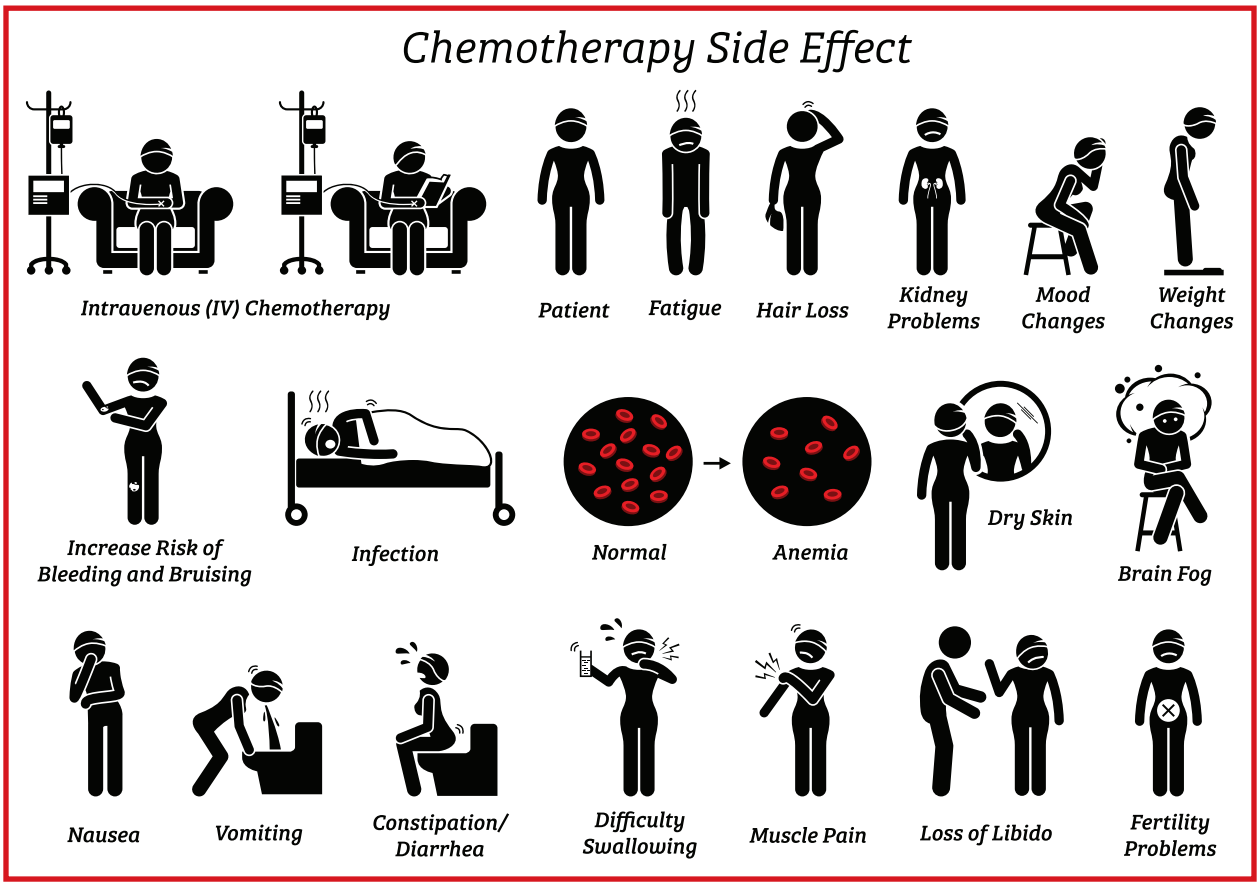


FIGURE 2. Antineoplastic drugs are medicines that are used to treat some forms of cancer. These anti cancer drugs often harm healthy cells in an attempt to kill the cancer cells. Killing normal cells can cause some unpleasant side effects.

Cardiovascular

Cardiovascular: agents that treat disease associated with the heart and blood vessels.

- antianginals (chest pain)
- antirrhythmics (variation from the normal rhythm of heart)

- anticoagulants (prevent blood from clotting)
- antihyperlipidemics (high levels of fat proteins)
- antihypertensives (high blood pressure)
- vasopressors (constrict blood vessels)

Dermatological

Dermatological: agents that treat conditions related to the skin. These conditions can occur on or in the skin.

Gastrointestinal

Gastrointestinal: agents that are used to treat disorders of the stomach and or the intestines.

- anti-diarrheal (diarrhea)
- anti-emetics (vomiting)
- anti-ulcer (ulcer)
- gastroesophageal reflux disease (heartburn)
- laxatives (constipation)
- stool softeners (constipation)

Hormones

Hormones: special chemical messengers in the body that control most major bodily functions, from simple basic needs like hunger to complex systems like reproduction.

FURTHER EXPLORATION...

ONLINE CONNECTION:
Minimize Medication Risk: Prevent Medication Interactions

Drugs can be classified according to a number of different criteria. These different ways of classifying drugs can be confusing, since most drugs may be included in multiple classes. However, knowing how a drug is classified can help to prevent drug interactions. Drug interactions may make your drugs less effective, cause unexpected side effects, or increase the action of your drug. Read the article "Minimize medication risk: prevent medication interactions" at the web site http://www.bemedwise.org/medication-safety/medication-interactions. Review the examples of drug interactions that can occur. Share the 5 tips to avoid drug interactions with any of your family members who take prescription or over the counter medications. Remember to ask your pharmacist if you have any questions about any medications you or your family members take.

- anti-hyperglycemics (diabetes)
- female hormones (contraceptives)
- male hormones (male characteristics)
- thyroid disorders (hyperthyroidism and hypothyroidism)

Musculoskeletal

Musculoskeletal: an agent that treats conditions involving the muscles, bones, tendons, ligaments, and nerves. Common drug classes used to treat musculoskeletal conditions are:

- benzodiazepines (seizures)
- muscle relaxants (muscle spasms)
- nonsteroidal anti-inflammatory drugs (ibuprofen)
- anti-rheumatics (rheumatoid arthritis)
- anti-gout (gout)
- biphosphonates (bone disorders)

FIGURE 3. If you have a musculoskeletal condition, it is likely that you use medication to help you manage your condition and symptoms. Together with strategies such as exercise, weight management, and a good night's sleep, medications can help you to live well.

Neurological

Neurological: agents that treat or correct disruptions or dysfunction of the complex chemical process of nerve transmission in the central nervous system.

- anti-alzheimer (Alzheimer's Disease)
- anti-epileptic (seizures)
- anti-parkinson (Parkinson's disease)

Ophthalmic

Ophthalmic: relating to the eye, and **Otic**, relating to the ear: agents that are used to treat various conditions of the eyes and the ears.

- analgesics (eye or ear pain)antibiotics (pink eye)

- corticosteroids (seasonal allergies)
- prostaglandins (glaucoma)

Psychotropic

Psychotropic: agents that affect behavior, psychiatric state, and sleep. They act on the brain to suppress or control the symptoms of common psychological disorders such as bipolar disorder, anxiety, depression, schizophrenia, and drug dependency.

- antipsychotics (hallucinations)
- benzodiazepines (anxiety)
- hypnotics (sleep)
- monoamine oxidase inhibitor (depression)
- serotonin and norepinephrine reuptake inhibitor (depression)
- selective serotonin reuptake inhibitors (anxiety)

Renal

Renal: agents that treat diseases of the kidneys, ureters, bladder, and urethra.

- alpha blockers (benign prostatic hyperplasia)
- antibiotics (infections)
- diuretics (urine output)

Respiratory

Respiratory: agents that are used to relieve, treat, or prevent breathing diseases such as asthma, bronchitis, and pneumonia.

- antibiotics (infections)
- antihistamines (allergy)
- antitussive (cough)
- bronchodilators (increase airway diameter)
- corticosteroids (asthma)
- decongestants (relieve nasal congestion)
- expectorants (remove mucus)

FIGURE 4. Medications can improve the lives of individuals suffering from many different diseases and conditions. However, taking too much medication can increase the risk of side effects and dangerous drug interactions.

BRAND AND GENERIC DRUGS

Drugs often have several names. When a drug is first discovered, it is given a chemical name. The chemical name describes the atomic or molecular structure of the drug. The chemical name is usually too complex for general use. When a drug is approved by the Food and Drug Administration (FDA) it is given a brand and a generic name.

Generic and brand names must be unique to prevent one drug from being mistaken for another when drugs are prescribed and prescriptions are dispensed. Generic names are usually more complicated and harder to remember that brand names. Brand names are usually catchy, often related to the drug's intended use, and are relatively easy to remember.

Brand Name

A **brand name** drug is a drug that is patented and sold by one manufacturer. The brand name is developed by the company requesting approval for the drug and identifies it as the exclusive property of that company. A manufacturer of a brand name drug can make that drug without any competition.

When a company brings a new drug onto the market, it has spent substantial money on research, development, and marketing of the drug. A patent is granted that gives the company that developed the drug an exclusive right to sell the drug as long as the patent is in effect. An example of a brand name drug is "Advil." Advil is the trade mark name of the drug although its generic or chemical name is ibuprofen.

Generic

When a drug patent is nearing expiration, manufacturers can apply to the FDA for permission to make and sell generic versions of the drug. **Generic drugs** are copies of brand name drugs that have exactly the same dosage, intended use, effects, side effects, route of administration, risks, safety, and strength as the original drug. Their effects on the body are exactly the same as those of their brand name counterpart.

The FDA requires that generic drugs be as safe and effective as brand name drugs and that those generic drugs contain the same active ingredients as their brand name counterparts. Generic drug manufacturers are allowed to have different inactive ingredients. Inactive ingredients such as dyes, fillers, flavors, and coatings may be different, so generic drugs often look different from the brand name counterpart. Generic

FIGURE 5. Cost is the main difference between generic and brand name prescription drugs. Unlike brand companies, generic manufacturers compete directly on price, resulting in lower prices for consumers.

drugs are less expensive because the manufacturers have not had the expenses of developing and marketing a new drug. When multiple companies begin producing and selling a drug, the competition among them can also drive the price down even further.

The following is a list of commonly prescribed brand name drugs and their generic counterparts.

Brand Name Drug	Generic equivalent	Medical use
Abilify	Aripiprazole	Psychosis, Depression
Adderall	Dextroamphetamine and Levoamphetamine	ADHD treatment
Advil	Ibuprofen	Painkiller, fever reducer
Advair Diskus, Seretide	Fluticasone + Salmeterol	Asthma
Agiolax	Sphagula husk + Senna	Gastrointestinal disorders
Allegra	Fexofenadine	Seasonal allergies
Amoxil	Amoxicillin	Antibiotic used to treat infection
Atripla	Emtricitabine/tenofovir/efavirenz	HIV infection
Avastin	Bevacizumab	Colorectal cancer
Copaxone	Glatiramer	Multiple sclerosis
Crestor	Rosuvastatin	Cholesterol
Cymbalta	Duloxetine	Depression, Anxiety disorders
Enbrel	Etanercept	Rheumatoid arthritis
Epogen	Erythropoietin	Anemia
Humira	Adalimumab	Rheumatoid arthritis
Januvia	Sitagliptin	Diabetes
Lantus	Insulin analog (Insulin glargine)	Type 2 and type 1 diabetes
Lipitor	Methylphenidate	Cholesterol
Lyrica	Pregabalin	Neuropathic pain
Motrin	Ibuprofen	Painkiller, fever reducer
Neosporin	Neomycin	Infection
Neulasta	Filgrastim	Neutropenia
Nurofen	Ibuprofen	Painkiller, fever reducer
OxyContin	Oxycodone	Pain
Prevacid	Lansoprazole	Acid reflux, GERD
Prozac	Fluoxetine	Depression, OCD

Brand Name Drug	Generic equivalent	Medical use
Provigil	Modafinil	Narcolepsy, obstructive sleep apnea
Remicade	Infliximab	Crohn's disease, Rheumatoid arthritis
Ritalin	Methylphenidate	ADHD, postural orthostatic tachycardia syndrome and narcolepsy
Rituxan, MabThera	Rituximab	Non-Hodgkin's Lymphoma Rheumatoid arthritis
Spiriva	Tiotropium	Chronic obstructive pulmonary disease
Tamiflu	Oseltamivir	Flu
Truvada	Tenofovir + Emtricitabine	HIV infection
Tylenol	Acetaminophen	Pain reliever, Fever reducer
Vicodin	Acetaminophen + hydrocodone	Moderate to severe pain relief
Vyvanse	Lisdexamfetamine dimesylate	ADHD treatment
Xanax	Alprazolam	Anxiety, Panic disorders

Note: Reprinted from "Brand Name Drugs vs Generic Drugs." Diffen LLC, n.d. Web 28 Apr 2019. https://www.diffen.com/difference/Brand_Name_Drugs_vs_Generic_Drugs.

Summary:

Drugs can be classified in several different ways. The four main ways to classify drugs are based on therapeutic use, mode of action, mechanism of action, and chemical structure. In many cases, a drug may have multiple uses or actions, and may be included in multiple drug classes. The aim of drug classification is to ensure that the patient uses the drug safely and achieves the utmost benefit from the drug. When a drug is approved it is given a brand name and a generic name. Many patients prefer generic drugs because they cost less than their brand name counterparts.

Checking Your Knowledge:

1. Explain the four main ways to classify drugs.
2. Explain the reason for classifying drugs and why it can be difficult to do so.
3. Differentiate between analgesics and anesthetics.
4. Differentiate between anti-infectives and antineoplastics.

5. List at least 2 examples from each of the drug classification categories listed in this lesson and what conditions they are used to treat.
6. Describe the differences between brand name drugs and generic drugs.

Expanding Your Knowledge:

Access the web site http://www.bemedwise.org/acetaminophen/teen-influencers. Read about how to educate teens on the safe use of acetaminophen. Click on Teach Teens to Use Acetaminophen Safely and Appropriately. Ask your instructor if you can share this information with the students in your school.

Web Links:

Classification of Drugs
https://byjus.com/chemistry/classification-drugs/

Generic Drug Facts
https://www.fda.gov/drugs/generic-drugs/generic-drug-facts

Types of Drugs
https://www.britannica.com/science/drug-chemical-agent/Types-of-drugs