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Here is the Instructor’s Manual for the 7th edition of *Drugs and Behavior*.

Each chapter test bank starts with a summary of the chapter. The test bank questions include at least 30 multiple choice questions, 15 short answer questions, and 5 essay questions per chapter and cover the majority of the content of each chapter. All questions are categorized according to Bloom’s taxonomy of learning from Knowing to Hypothesize in order to facilitate test construction at the desirable level of testing.

The 7th edition is vastly different from the 6th edition. Although all chapters have the same internal organization as in previous editions, numerous new tables and graphs have been added to facilitate understanding and learning of the material. Most sections have been updated to reflect advances in research and changes in patterns of drug use and treatment. This is reflected in an increased emphasis on psychotherapeutic drugs, and the omission of the chapter on inhalants.

Thank you for choosing Drugs and Behavior, 7th Edition, and best wishes.

William A. McKim, Stephanie D. Hancock
Anna Hicks
INSTRUCTOR’S NOTES

The first chapter introduces some of the basic concepts of pharmacology to the beginning student. It is not meant to turn the student into a pharmacologist, but should supply enough information that the student will be able to understand these concepts when they encounter them later in the book. In fact, later chapters about specific classes of drugs each contain sections that deal with many of the concepts from Chapter 1, such as pharmacokinetics. Students therefore should be familiar with the material in this chapter in order to get the most out of the rest of the book. Nevertheless, it has been my experience that many students do not fully understand many of these basic concepts until they are reintroduced to them a few times later in the book and they can see more clearly how these concepts relate to the effects of specific drugs. For this reason, it is always a good idea to illustrate the material in this chapter with examples. The book provides quite a few examples, but it may be beneficial to provide more.

Most students already have some familiarity with recreational drugs and medicines. They have encountered and perhaps been confused by drug names, they know that the effects of drugs do not last forever and that dose is important, and that different drugs are administered by different routes. As a result, there is always a natural curiosity about the mechanisms in the body responsible for these changes. In addition, most have heard of terminology such as LD50 and half-life and so it is usually not difficult to engage a student’s interest in a precise description of what these terms actually mean.

In many cases we often hear and use terms like “side effects”, “antagonism”, and “potency” without knowing what they really mean. Students are usually eager to understand these concepts and are often surprised to find out that they did not really understand them. In fact, the distinction between potency and effectiveness is sometimes not fully appreciated by experienced researchers. The acquisition of language is an important goal of this chapter.

We have found that students have the most difficulty with the concept of pKa, and at one point we considered leaving it out of the chapter and substituting a brief statement such as “drugs that are bases are not easily absorbed when taken orally”. This is, after all, a major implication of pKa and an important one for students to know. We did not do this, however, because understanding the concept of pKa makes it easier to understand many other facts encountered elsewhere in the text, such as free-basing of psychomotor stimulants, for example. The effort, in this case, is worth it.

Chapter 2 is designed to be a review of basic Psychology concepts, particularly concerning research designs that are applicable to Behavioral Pharmacology. Most students with a background in Psychology will already be familiar with this material and most of the ideas introduced in this chapter. Nevertheless, it serves as a useful review and draws the students’ attention to concepts that are particularly relevant to material covered later in the book. Particular attention is drawn to experimental control, especially the use of placebo controls in drug research.
Chapter 2 is also designed to help students improve their ability to critically assess studies that they may learn about through the media. Most of the stories we hear in the popular press about drug-related research concern nonexperimental research, or involve clinical trials of new drugs. Both these topics are given separate sections in this chapter. It is usually not difficult to find a current news story about drug research that can be used to illustrate these points.

This chapter also contains a discussion of a number of behavioral measures frequently used in behavioral pharmacology both with humans and nonhumans. This discussion will serve as a review of these tests. Particular attention has been paid to tests and measures that appear repeatedly later in the text in individual chapters about specific drugs. The behavioral measures introduced in this chapter can serve as a reference when it or its abbreviation is mentioned later.

Finally there is a brief discussion of dissociation and the stimulus properties of drugs. These concepts are not likely to have been encountered in earlier psychology courses and so should be given particular attention. If you choose to not lecture on this chapter, it would be a good idea to at least make sure your students understand drug state discrimination procedures as they will encounter them many times later in the text.

In chapter 3, we demonstrate how mechanisms of traditional learning theory, classical and operant conditioning, can help us understand concepts such as tolerance and withdrawal, which are normally thought of as strictly physiological in nature. The concept of dependence is discussed here, but only insofar as it relates to withdrawal symptoms. A more extensive discussion of dependence is found in Chapter 5. Traditionally, the term dependence has been used to mean two things: a) the compulsive (addictive) use of a drug; and b) that person will have withdrawal symptoms when they stop using a drug. It is vital that these two ideas be separated. The state of physiological dependence is no longer an explanation of addiction, even though many people still use the terminology as though it is. This point cannot be stressed enough. It is addressed again in Chapter 5.

It is also important to make sure that the student understands that tolerance does not occur to a drug, but to the effects of a drug. Understanding this distinction is necessary for understanding the entire chapter.

This chapter demonstrates how the effects of drugs can be conditioned in the same way as any other physiological response, except that we must pay attention to what happens in the body when the drug is given. In many cases, the conditioned stimulus reliably precedes the body’s attempt to resist the effect of a drug. In this case, the conditioned response will be a physiological response opposite to that produced by the drug. This can explain both conditioned tolerance and conditioned withdrawal responses.

Chapter 3 also deals with sensitization to drugs and discusses the differences and similarities between tolerance and sensitization. It is important to understand sensitization because the concept is revisited later in Chapter 5 in the discussion of addictive behavior. The chapter now contains a discussion of opponent process theory, and expectation and context effects.
Chapter 4 provides a basic overview of neurophysiology, particularly as it relates to the effects of drugs. Most of the information contained in this chapter is a refresher for students who have a course on neuroscience. Students without a background, however, often have difficulty with some of the concepts and very often are dazzled and confused by the array of technical names and terms that they are encountering for the first time. As a result, it is often necessary to spend extra time discussing these concepts in class.

It is important that the student at least be able to recognize the names of the better-known neurotransmitters because they will be encountering them again and again later in the book. These include dopamine, serotonin (stress that serotonin and 5-HT are the same thing), norepinephrine, glutamate, and GABA. It is also important to convey the concept that the ultimate effect of a neurotransmitter depends on the receptor site at which it operates. Neurotransmitters have many different receptor sites and so the function of a neurotransmitter can be different in many parts of the nervous system that have different receptors. This also means that drugs that affect different receptor sites of the same neurotransmitter can also have different effects that can last for varying durations. In this chapter and in the specific chapters on particular drug classes we discuss different types of receptors and explain how many receptor sites are made up of combinations of different subunits. This knowledge can explain how drugs can be designed to generate specific effects by targeting specific receptor subtypes.

The tour of the nervous system is brief and deals mostly with parts of the central and peripheral nervous systems that will be discussed later in the book. Once again, students without a background will find it challenging to keep these centers straight, but later in the course they may find it helpful to refer back to this chapter when these parts of the nervous system are discussed further.

Finally chapter 4 also contains a brief discussion of the development of the nervous system. This section is designed to show why and how the nervous system is so vulnerable to drugs when it is forming in the unborn child. It concludes with a new section on brain imaging techniques now commonly used to explore the mechanisms of action of drugs and the effects of long term use on the brain. These include PET, and MRI and fMRI (including BOLD).

The aim of Chapter 5 is to dispel old myths and inaccurate presumptions about the nature of addictive behavior and provide, as a substitute, models derived from research started in the 1960s and based on the operant analysis of behavior showing that the delivery of a drug could be a reinforcing stimulus. We discuss the neurophysiology of reinforcement and show how all self-administered drugs affect this system either directly or indirectly, and present several prominent theories of how addiction develops from these changes in neural functioning.

We depend heavily on the DSM in discussing drug use and addiction as well as in later chapters where we discuss depression and psychosis. The current DSM-IV-TR is due to be replaced in 2013. This may present the instructor with a difficulty. We acknowledge this upcoming revision in the text and explain not only what the DSM-IV-TR says, but include a description of many of the recommendations and discussions of what changes should be made in the DSM-5. Instructors may take advantage of the publication of the DSM-5 and use this new
information to stimulate student interest by describing what changes were actually made.

Chapters 6-15 each deal with a particular class of drugs and are organized in a similar manner, discussing origins, history, pharmacokinetics, neurophysiology, effects on the body and on behavior, self-administration, discriminative stimulus properties, withdrawal and tolerance, harmful effects, and treatments.
CHAPTER SUMMARY

- Drugs can have four different kinds of names: a chemical name, a generic name, at least one trade name, and usually many street names.
- Doses of a drug are usually described in terms of concentration (i.e., mg of drug/kg body weight).
- Dose–response curves (DRCs) are graph curves that show changes in the effect of a drug that are produced by changes in the dose.
- The ED_{50} (median effective dose) is the dose of a drug that either has a particular effect in 50 percent of the subjects to whom it is given or produces in an individual an effect equivalent to 50 percent of the maximum effect that the drug will have at any dose. The LD_{50} (median lethal dose) is the dose of a drug that will be lethal to 50 percent of the subjects.
- The safety of a drug can be described by the TI (therapeutic index), which is the LD_{50} divided by the ED_{50}.
- When comparing two drugs that have the same effect, the drug with the lower ED_{50} is the more potent. The drug with the greater maximum effect is the more effective.
- All drugs have a number of effects. The effect that the drug is being consumed for is the main or primary effect, and all others are side effects.
- If one drug shifts the DRC of a second drug to the right, the drugs are said to be antagonistic. If the DRC is shifted to the left, the effects are additive. Potentiation or a superadditive effect occurs if the effects of a drug mixture are greater than what might be expected if the effects were simply added together.
- Pharmacokinetics is the study of how drugs move into, around, and out of the body.
- Parenteral administration involves injecting a drug through the skin, using a syringe and a hollow needle. Parenteral injections may be subcutaneous, intramuscular, intraperitoneal, or intravenous. Drugs may also be injected directly into veins through a permanently implanted catheter or into the central nervous system through a permanently implanted cannula.
- Drugs are absorbed from parenteral sites by diffusing into the blood through pores in the walls of capillaries.
Drugs in the form of gases and/or smoke may be inhaled into the lungs and enter the blood. Drugs that are inhaled reach the brain more quickly than drugs taken by any other route.

Drugs taken orally must pass through the stomach before they can be absorbed from the small intestine.

Molecules of drugs that are ionized (i.e., have an electric charge) are not lipid soluble and are absorbed poorly from the digestive system. The rate of absorption of a drug can be altered by changing the pH of the digestive system because this can alter the percentage of ionized molecules.

The pKa of a drug is the pH at which the molecules of a drug are 50 percent ionized.

Drugs that are not lipid soluble have difficulty passing through membranes and get into the brain slowly because of the blood–brain barrier. Highly lipid-soluble drugs are sometimes absorbed rapidly into body fat and are released slowly.

In transdermal administration, drugs are absorbed directly through the skin.

Factors that affect the distribution of drugs in the body are lipid solubility, the blood–brain barrier, protein binding, and the presence of active and passive transport mechanisms.

In the kidney, most of the fluid in the blood is released into one end of the nephron. As the fluid passes through, water and nutrients are reabsorbed. Ionized drugs and many drug metabolites are not reabsorbed. They pass through the length of the nephron and are excreted in the urine.

The liver, the body’s chemical factory, uses the process of metabolism to change drug molecules into metabolites, which may then be eliminated by the kidneys. The liver controls metabolism using enzymes, which act as catalysts to speed up certain chemical reactions.

First-pass metabolism refers to the metabolism of a drug in the digestive system or liver before it gets into general circulation.

Enzymes can be stimulated by repeated use of a drug or by other drugs, or they can be depressed by age, other drugs, and some foods.

Half-life is the time taken for the body to get rid of half of a circulating drug.

The therapeutic window refers to the range of blood levels of a drug between the lowest therapeutically effective blood level and a level that causes undesirable side effects.

Multiple Choices

1-1. Which of the following drug names can be patented?
   A. trade names.
   B. chemical names.
   C. generic names.
   D. nonproprietary names.
   E. street names.

Bloom’s Taxonomy: Know
1-2. Which type of drug name is also known as the proprietary name?
   A. trade name.
   B. chemical name.
   C. generic name.
   D. the formulation.
   E. street name.
Bloom’s Taxonomy: Know

1-3. The drug name "2-3'-dichloro-methphantasticant" is most likely a
   A. trade name.
   B. chemical name.
   C. generic name.
   D. proprietary name.
   E. street name.
Bloom’s Taxonomy: Know

1-4. Strictly speaking, the trade name of a drug refers to
   A. the active ingredient in a pill.
   B. the formulation.
   C. the excipients.
   D. the drug company.
   E. the medical classification.
Bloom’s Taxonomy: Understand

1-5. When a drug name such as SKF 10,047 is used, the letters refer to
   A. the type of condition the drug is used for.
   B. the chemical formula of the active ingredient.
   C. the government classification of the drug.
   D. the name of the drug company.
   E. none of the above.
Bloom’s Taxonomy: Know

1-6. The term “formulation” refers to
   A. the trade name of a medication.
   B. the active ingredient in a medication.
   C. the dose that is recommended.
   D. the combination of excipients and active ingredients in a medication.
   E. the side effects of a medication.
Bloom’s Taxonomy: Know

1-7. The effect of a drug is directly related to
   A. the concentration of the drug at its site of action.
   B. the dose of the drug.
   C. the number of pills consumed.
D. the size of the tablet.
E. the concentration of the vehicle.

Bloom’s Taxonomy: Know

1-8. Because the effect of a drug often depends on the concentration at its site of action, drugs are often administered in terms of
   A. mg of drug.
   B. mg of drug /kg body weight.
   C. the specific gravity of the drug.
   D. the molecular weight of the drug.
   E. the concentration in the vehicle.

Bloom’s Taxonomy: Know

1-9. The dose scale on a dose response curve is usually in
   A. log units.
   B. exponents of dose.
   C. whole numbers.
   D. multiples of 10.
   E. percentages of dose.

Bloom’s Taxonomy: Know

1-10. When dosage comparisons are made between humans and smaller animals like rats and mice
   A. it is not necessary to give higher doses to the rats and mice in terms of mg/Kg.
   B. it is necessary to give lower doses to the rats and mice in terms of mg/Kg.
   C. the same dose can be used if it is in terms of mg/Kg.
   D. smaller animals generally metabolize drugs faster than larger animals.
   E. smaller animals generally metabolize drugs more slowly than larger animals.

Bloom’s Taxonomy: Understand

1-11. Dose response curves are often plotted on a log scale because
   A. log scales are least sensitive.
   B. many physiological effects show up as a straight line when plotted on a log scale.
   C. it permits greater precision at the high end of the dosage range.
   D. it permits greater precision at the low end of the dosage range.
   E. both B. and D.

Bloom’s Taxonomy: Know

1-12. The generic name is also known as the
   A. proprietary name.
   B. nonproprietary name.
   C. chemical name.
   D. formulation.
   E. proper name.

Bloom’s Taxonomy: Know
1-13. Which of the following is an excipient?
   A. filler.
   B. coloring agent.
   C. binding agent.
   D. coating.
   E. all of the above.
Bloom’s Taxonomy: Know

1-14. Drug doses are usually reported in terms of
   A. weight.
   B. volume.
   C. concentration.
   D. density.
   E. mg.
Bloom’s Taxonomy: Know

1-15. The ED50 is the
   A. the median lethal dose.
   B. the median effective dose.
   C. the mean lethal dose.
   D. the mean effective dose.
   E. the dose used to treat erectile dysfunction in men over 50.
Bloom’s Taxonomy: Know

1-16. The LD1 of a drug is
   A. the dose that will kill 99 percent of subjects.
   B. the dose that will kill 1 percent of subjects.
   C. the dose that will be effective in 99 percent of subjects.
   D. the dose that will be effective in 1 percent of subjects.
   E. none of the above. LD1 is the generic name of a nerve gas.
Bloom’s Taxonomy: Know

1-17. If the ED50 of a drug is 36 mg/Kg and the LD50 is 360 mg/Kg, the TI is:
   A. 0.1
   B. 1.0
   C. 10.0
   D. 100.0
   E. none of the above. The TI cannot be determined from these numbers.
Bloom’s Taxonomy: Understand

1-18. When comparing the TI of two drugs
   A. the drug with the lower TI is safer.
   B. the drug with the higher TI is safer.
   C. the drug with the lower TI is the most therapeutically useful.
D. the drug with the higher TI is the least therapeutically useful.
E. the dose with the higher TI is more potent.

Bloom’s Taxonomy: Apply

1-19. The dose that kills 50% of the individuals tested is called
   A. the lethal dose.
   B. the median effective dose.
   C. the mean lethal dose.
   D. the median lethal dose.
   E. the TI.

Bloom’s Taxonomy: Know

1-20. Drug A and Drug B both suppress appetite to the same extent, but Drug A has an ED50 of 115 mg/kg and Drug B has an ED50 of 50 mg/kg. Therefore,
   A. Drug A is more potent than Drug B.
   B. Drug A is more effective than Drug B.
   C. Drug A is less potent than Drug B.
   D. Drug A is less effective than Drug B.
   E. There is not enough information to answer this question.

Bloom’s Taxonomy: Apply

1-21. Drug A and Drug B are both appetite suppressants, but Drug A will cause rats to reduce food consumption by 50% at its most effective dose and Drug B will cause rats to reduce food consumption by 30% at its most effective dose. The ED50 of Drug A and B is the same. Therefore,
   A. Drug A is more potent than Drug B.
   B. Drug A is more effective than Drug B.
   C. Drug A is less potent than Drug B.
   D. Drug A is less effective than Drug B.
   E. There is not enough information to answer this question.

Bloom’s Taxonomy: Apply

1-22. A side effect of a drug is an effect that
   A. occurs at the lowest dose.
   B. a drug is taken for.
   C. is not wanted.
   D. causes harm.
   E. occurs at doses higher than those that cause the main effect.

Bloom’s Taxonomy: Know

1-23. Antagonism is demonstrated when the effect of one drug is to
   A. change the effectiveness of another drug.
   B. make another drug more potent.
   C. reduce the time course of another drug.
   D. lower the DRC of another drug.
E. shift the DRC of another drug to the right.

Bloom’s Taxonomy: Understand

1-24. Which of the following is not a type of drug interaction?
   A. additive effect.
   B. superadditive effect.
   C. antagonism.
   D. super antagonism.
   E. potentiation.

Bloom’s Taxonomy: Know

1-25. If the DRC of one drug is shifted to the left by another drug then this indicates
   A. a negative interaction.
   B. a superadditive effect.
   C. an additive effect.
   D. antagonism.
   E. either B. or C.

Bloom’s Taxonomy: Know

1-26. If the DRC of one drug is shifted to the right by another drug then this indicates
   A. a negative interaction.
   B. a superadditive effect.
   C. an additive effect.
   D. antagonism.
   E. either B. or C.

Bloom’s Taxonomy: Understand

1-27. If you take an aspirin to reduce a fever, which of the following is (are) side effect(s)?
   A. a decrease in blood clotting time.
   B. decreased inflammation.
   C. pain reduction.
   D. none of A., B., and C.
   E. all of A., B., and C.

Bloom’s Taxonomy: Know

1-28. Drugs affect the operation of the body
   A. at all tissues that they come in contact with.
   B. by altering the functioning of all organs.
   C. only at specific places called "sites of action."
   D. only at the place where they are administered.
   E. only if administered directly at the site of action.

Bloom’s Taxonomy: Know

1-29. Which of the following is a parenteral route of administration?
   A. transdermal.
B. inhalation.
C. oral.
D. subcutaneous.
E. none of the above.

Bloom’s Taxonomy: Know

1-30. The movement of drugs into, around, and out of the body is called
A. pharmacokinetics.
B. absorption.
C. distribution.
D. excretion.
E. elimination.

Bloom’s Taxonomy: Know

1-31. A vehicle is
A. what a drug is dissolved in before it can be injected.
B. the container used to transport a drug.
C. a container used to store an unstable drug.
D. a term used to refer to a syringe and needle.
E. a transport mechanism across a membrane.

Bloom’s Taxonomy: Know

1-32. The high concentration of drug at the site of administration is called
A. a bolus.
B. a concentration bubble.
C. a diffusion gradient.
D. the SOA (source of absorption).
E. the PMC (point of maximum concentration).

Bloom’s Taxonomy: Know

1-33. A subcutaneous injection of a drug is sometimes known as
A. skinning.
B. skin popping.
C. S.C.
D. a sub-q injection.
E. all of B., C., and D.

Bloom’s Taxonomy: Know

1-34. I.P. injections are more commonly used in
A. pigeons.
B. humans.
C. monkeys.
D. rats and mice.
E. none of the above. I.P. injections are no longer commonly used in any species.

Bloom’s Taxonomy: Know
1-35. Intrathecal and intraventricular administration of a drug are sometimes used to
   A. inject the drug directly into the blood.
   B. anesthetize an animal.
   C. treat rabies.
   D. produce very fast results.
   E. isolate the site of action of a drug to the CNS.

Bloom’s Taxonomy: Understand

1-36. Which type of drug is sometimes given as a depot injection?
   A. antidepressant.
   B. antipsychotic.
   C. antibacterial.
   D. hallucinogen.
   E. nicotine.

Bloom’s Taxonomy: Know

1-37. A capillary is
   A. a very fine needle used to inject drugs directly into the ventricles.
   B. another name for a depot injection.
   C. a tiny blood vessel.
   D. another name for a suppository.
   E. only found in the brain.

Bloom’s Taxonomy: Know

1-38. Drugs administered by inhalation
   A. are not as potent as when they are administered by I.V.
   B. can never be eliminated in the breath.
   C. must be volatile gases.
   D. are delivered to the brain more rapidly than drugs administered by I.V.
   E. have a longer duration of action than when administered by I.V.

Bloom’s Taxonomy: Understand

1-39. One reason why gasses are used as general anesthetics is because
   A. they are easily tolerated.
   B. they tend not to be concentrated in the liver.
   C. there is significant first pass metabolism of gasses.
   D. their blood levels are easy to control because they can be exhaled.
   E. they are the only substances that can cause anesthesia.

Bloom’s Taxonomy: Apply

1-40. What happens to drugs that are administered intranasally?
   A. they are absorbed through the mucous membranes of the nasal cavity.
   B. they are inhaled into the lungs and absorbed from there.
   C. they run down the throat into the stomach.
1-41. When most substances burn in air, a gas is created which blocks the ability of the blood to carry oxygen. This gas is
A. carbon monoxide.
B. carbon dioxide.
C. THC.
D. dioxin.
E. complex hydrocarbons.

1-42. The rate at which a drug is absorbed from the digestive system is influenced by which of the following?
A. pH of the drug.
B. pH of the contents of the digestive system.
C. food in the stomach.
D. none of A., B., and C.
E. all of A., B., and C.

1-43. The olive oil partition coefficient is
A. a measure of pH.
B. a measure of pKa.
C. a measure of lipid solubility.
D. a measure of bioavailability.
E. none of the above.

1-44. Ion trapping occurs when
A. the Enterprise's core drive is phase modulated.
B. acids and bases become trapped at the side of the membrane that is basic and acidic, respectively.
C. the neuron's membrane potential returns to its resting state following an action potential.
D. ions become bound to blood proteins.
E. none of the above.

1-45. The pKa of a drug is
A. the pH at which it becomes lipid soluble.
B. the pH at which it dissolves in water.
C. the pH at which it can pass through a membrane.
D. the pH at which half of its molecules are ionized.
1-46. Because caffeine is a base, we might expect that it would be slowly absorbed from the acidic environment of the digestive system. This is not the case because
A. caffeine has a pKa lower than the pH of the digestive system.
B. caffeine has a pKa higher than the pH of the digestive system.
C. caffeine is neither a base nor an acid and does not ionize.
D. because of the structure of caffeine, even ionized molecules are lipid soluble.
E. none of the above.

1-47. If a drug is 50% ionized in the digestive system, what percent of its molecules will be absorbed, given enough time?
A. nearly 0%
B. 25%
C. 50%
D. 75%
E. almost 100%

1-48. Drugs that are weak acids
A. tend to become concentrated on the acidic side of a membrane.
B. tend to become concentrated on the basic side of a membrane.
C. can sometimes dissolve a membrane.
D. cannot cross the blood-brain barrier.
E. are never well absorbed from the digestive system.

1-49. Special cells that wrap themselves around capillaries in the brain and block the pores make up the
A. blood-brain barrier.
B. the great brain barrier.
C. the keratin layer.
D. Bowman’s Capsule.
E. passive transport layer.

1-50. Which of the following drugs is readily absorbed transdermally?
A. caffeine.
B. morphine.
C. aspirin.
D. nicotine.
E. endital.
1-51. Active transport mechanisms are different from passive transport mechanisms because they
A. use energy.
B. can concentrate molecules against diffusion.
C. are located only in the brain.
D. are located only in the kidney.
E. both A. and B.
Bloom’s Taxonomy: Know

1-52. Which of the following statements about the placenta is true?
A. the placenta is the intermediary organ between the fetus and the wall of the uterus.
B. the placenta offers significant protection of the fetus by blocking drugs in the mother’s blood from entering the blood of the fetus.
C. the placenta metabolizes waste products created by the metabolism of the fetus.
D. all of the above are true.
E. none of the above are true.
Bloom’s Taxonomy: Know

1-53. Nephrons work by
A. filtering impurities out of the blood.
B. filtering everything out of the blood and reabsorbing what is required by the body.
C. metabolizing impurities and toxins.
D. changing the structure of drugs and making them less lipid soluble.
E. none of the above. Nephrons are found in the brain.
Bloom’s Taxonomy: Know

1-54. You can increase the ability of the kidneys to excrete barbiturates (weak acids) by
A. giving a drug that makes the urine more acidic.
B. giving a drug that makes the urine more basic.
C. giving a drug that makes the blood more acidic.
D. giving a drug that makes the blood more acidic.
E. none of the above. You cannot change the ability of the kidneys to excrete any drug.
Bloom’s Taxonomy: Apply

1-55. Metabolism that takes place before a drug is fully absorbed and distributed around the body is called
A. initial metabolic disposition.
B. initial metabolic activity.
C. preabsorptive enzymatic activity.
D. first pass metabolism.
E. none of the above.
Bloom’s Taxonomy: Know

1-56. Half-life is a measure of
A. lipid solubility.
B. tolerance.
C. metabolic tolerance.
D. the rate of excretion.
E. enzyme induction.

Bloom’s Taxonomy: Know

1-57. Which of the following routes of administration produces the highest peak blood level of a drug?
A. I.P.
B. I.M.
C. I.V.
D. S.C.
E. P.O.

Bloom’s Taxonomy: Know

1-58. Medicines should be given in such a way that the concentration in the blood stays in a range between a level that is too low to be effective and a level so high it will have toxic effects. This range is called the
A. therapeutic window.
B. therapeutic index.
C. median effective dose.
D. medicinal zone.
E. therapeutic range.

Bloom’s Taxonomy: Understand

1-59. Which of the following drugs is excreted in a way that cannot be described in terms of half-life?
A. morphine.
B. barbiturates.
C. alcohol.
D. nicotine.
E. none of the above. All drugs have a half-life.

Bloom’s Taxonomy: Know

1-60. Which of the following blocks the enzyme alcohol dehydrogenase?
A. barbiturate.
B. alcohol.
C. nicotine.
D. disulfiram (Antabuse).
E. none of the above.

Bloom’s Taxonomy: Know

1-61. Cytochrome P4503A4 is a (an)
A. receptor blocker.
B. metabolite of alcohol.
C. inhibitor of enzymes.

D. enzyme.

E. ingredient in St. John’s wort.

Bloom’s Taxonomy: Know

1-62. Which of the following foods can block the metabolism of some drugs, including certain antidepressants and cholesterol-lowering drugs?
   A. egg whites.
   B. aged cheese.
   C. grapefruit.
   D. bananas.
   E. chocolate.

Bloom’s Taxonomy: Know

1-63. St. John’s wort can stimulate the enzyme that destroys which of the following drugs?
   A. oral contraceptives.
   B. the immunosuppressant cyclosporine.
   C. the tranquillizer alprazolam.
   D. none of A., B., or C.
   E. all of A., B., and C.

Bloom’s Taxonomy: Know

1-64. Which of the following can alter the rate of metabolism of some drugs?
   A. age.
   B. species.
   C. use of other drugs.
   D. none of A., B., and C.
   E. all of A., B., and C.

Bloom’s Taxonomy: Know

Short Answers

1. Describe three factors that can alter the rate of drug metabolism.
   Bloom’s Taxonomy: Understand

2. Describe first-pass metabolism and provide two examples of compounds that might change the rate of first-pass metabolism.
   Bloom’s Taxonomy: Understand

3. Explain Therapeutic Index (TI), use LD50 and ED50 to describe the importance of TI.
   Bloom’s Taxonomy: Understand

4. Explain why administration of gaseous anesthetics hardly ever leads to an overdose. Compare gases to inhalation of smoke, what is the difference?
   Bloom’s Taxonomy: Understand
5. A researcher will give rats a dose of 50 mg/kg of a certain drug, however a physician administering the same drug to a human patient will prescribe 5mg/kg. Explain why there is a difference in the dosage?
Bloom’s Taxonomy: Apply

6. Imagine that you were a nicotine molecule, follow the route of nicotine from the tobacco to the brain.
Bloom’s Taxonomy: Apply

7. If you were to design an experiment in which you had to manipulate the activity of area specific region in the central nervous system, which administration route would you choose? Explain.
Bloom’s Taxonomy: Apply

8. If a person suffering from an overdose of heroin is given an antagonistic drug, describe what happens to the ED50 and LD50 of heroin in the dose response curve?
Bloom’s Taxonomy: Apply

9. Why does a patient with an overdose of barbiturates benefit from drugs that turn urine more basic?
Bloom’s Taxonomy: Apply

10. Why is it important to know ED50 and LD50?
Bloom’s Taxonomy: Analyze

11. Explain why it is not safe to take alcohol and sleeping pills at the same time?
Bloom’s Taxonomy: Analyze

12. Explain why you would have to be cautious of certain herbal medicines if you are taking prescription medication?
Bloom’s Taxonomy: Analyze

13. What is the importance of the placental and blood-brain barriers?
Bloom’s Taxonomy: Analyze

14. A new drug compound that is a base is proposed to be marketed as p.o administration, but the pharmacists question the effectiveness. If you were to decide about the permission of sale for this drug, what would you ask from the pharmaceutical company, and why?
Bloom’s Taxonomy: Evaluate

15. You see an advertisement that promotes metabolism boosting grapefruit juice to lose weight, and claims that it is beneficial for patients with cardiovascular disease. Explain how you would react on such an add?
Bloom’s Taxonomy: Evaluate

Essays
1. Describe pKa value of drugs, and explain why certain drugs cannot be administered orally. 
Bloom’s Taxonomy: Apply

2. Discuss why animal testing during pre-clinical evaluation of new experimental drugs is invaluable.
Bloom’s Taxonomy: Evaluate

3. Explain why Aspirin is recommended to a patient suffering from cardiovascular disease, however if a patient has a comorbid bleeding disorder, Aspirin is not recommended. Why would an over-the-counter pain medicine help with cardiovascular problems?
Bloom’s Taxonomy: Apply

4. If you were given Antabuse drug, what would happen if you were to drink alcohol?
Bloom’s Taxonomy: Analyze

5. If you were to design a drug that cures depression, and the medicine could be taken orally, what considerations would you need to make regarding the pharmacology of the newly designed drug?
Bloom’s Taxonomy: Hypothesize
Chapter 2
Behavioral Analysis of Drug Effects

CHAPTER SUMMARY

- Scientific experiments consist of an independent variable that is manipulated by a researcher and a dependent variable that is measured. In most experimental research in behavioral pharmacology, the independent variable is the presence of a drug in the body, and the dependent variable is some aspect of behavior.

- Treatment of control subjects in an experiment should be as similar as possible to treatment of experimental subjects. For this reason, control subjects are usually given a placebo, an inactive substance administered in exactly the same way as the drug. This procedure controls for differences that result from the placebo effect.

- The placebo effect refers to the observation that when people expect a drug, they often show effects of a drug even if they are administered only an ineffective substance.

- Experimental and control conditions may be administered to the same subjects on different occasions (within-subjects design) or to different subjects (between-subjects design).

- A double-blind procedure, where neither the researcher nor the experimental participant knows which group they are in, is used to eliminate the effect of experimenter bias.

- The three-groups design is used in testing new therapeutic drugs. In this design there is a drug group, a placebo group, and a group that receives an established treatment.

- In nonexperimental drug research, when relationships between two measured variables are found, one cannot assume the existence of any causal relationships between variables.

- The performance of the senses is determined by measuring their threshold. Cognitive performance is measured by tests of the ability to process, store, and retrieve information. Motor performance may be measured by simple or choice reaction time, or pursuit rotor tests.

- Effects of drugs on unconditioned behavior of nonhumans can be measured by observing the amount of activity in an open field or using an inclined plane or an elevated plus maze. Analgesic effects can be measured as paw lick latency on a hot plate.

- Conditioned behavior may be classical or operant. In classical conditioning, involuntary reflexive behavior is brought under the control of a previously neutral stimulus. This is also known as Pavlovian conditioning. In operant conditioning, voluntary behavior is brought under control by delivery of a contingent reinforcement.

- When reinforcement is not given for every response but is given according to some pattern, the pattern is called a schedule of reinforcement.

- Animals can be trained to avoid and escape a noxious stimulus such as an electric shock.
• Dissociation refers to the fact that information acquired in one drug state may not be readily available in another drug state.

• Animals can be trained to make one response after being given a drug and a different response after being given saline or a different drug. The responses of an animal trained to discriminate a drug can be a useful tool in testing the biochemical mechanisms responsible for the subjective effects of a drug.

• Therapeutic drugs are first screened for effect and safety using nonhumans. They then go through four phases of testing on humans.

**Multiple Choices**

2-1. What were the reason(s) that promoted the development of behavioral pharmacology into a separate field of research in 1950s?

A. toxicity of widely used psychoactive drugs  
B. general worry about increased drug abuse  
C. success and commercial use of antipsychotic drugs  
D. need to develop animals tests to study promising psychoactive compounds  
E. Both C and D

**Bloom’s Taxonomy: Know**

2-2. An independent variable is the variable in an experiment that

A. an experimenter must control for.  
B. is manipulated by the experimenter.  
C. is measured by the experimenter.  
D. is usually a measure of behavior.  
E. is frequently a within-subject measure.

**Bloom’s Taxonomy: Understand**

2-3. A dependent variable in an experiment is the variable that

A. is measured by the experimenter.  
B. is frequently a drug dose in behavioral pharmacology research.  
C. must be controlled for by using a placebo.  
D. is manipulated by the experimenter.  
E. is difficult to predict ahead of time.

**Bloom’s Taxonomy: Understand**

2-4. If you can only use a small number of subjects in your experiment

A. you should use a within-subjects design.  
B. you should use a between-subjects design.  
C. you cannot do any meaningful research.  
D. you must use a nonexperimental design.  
E. use laboratory animals rather than humans.

**Bloom’s Taxonomy: Apply**
2-5. A research design that compares the behavior of a subject under the influence of a drug with the behavior of the same subject after being given a placebo is
A. a statistically significant design.
B. a within-subject design.
C. a dependent variable design.
D. not properly controlled.
E. a between-subject design.
Bloom’s Taxonomy: Know

2-6. In behavioral pharmacology research, a placebo is used
A. to calm anxious participants.
B. to determine the toxicity of a drug combination.
C. as a control.
D. only in within-subject designs.
E. to plot the DRC.
Bloom’s Taxonomy: Know

2-7. How many groups are there in a balanced placebo design?
A. 1
B. 2
C. 3
D. 4
E. 5
Bloom’s Taxonomy: Know

2-8. A double blind experiment is
A. where a participant closes both eyes and reports hallucinations.
B. where the participant does not know whether he/she is in the experimental or the control group.
C. where neither the researcher nor the participant knows whether a given participant is in a control or in an experimental condition.
D. where only those given a placebo are not told which group they are in.
E. none of the above.
Bloom’s Taxonomy: Know

2-9. Nonexperimental research
A. can demonstrate that a relationship does not exist.
B. can demonstrate that a drug causes adverse effects.
C. must be used with humans for ethical reasons.
D. determines whether there is a relationship between two manipulated events.
E. cannot demonstrate that one event causes another.
Bloom’s Taxonomy: Understand

2-10. SMA refers to
A. Stimulus Management Activity.
B. Spontaneous Motor Activity.
C. Stimulus-bound Movement, Type A.
D. Super Modulated Associations.
E. Special Stimulus Attributes.

Bloom’s Taxonomy: Know

2-11. Which of the following is a measure of muscle tone in rats?
   A. inclined plane test.
   B. pursuit rotor.
   C. elevated plus maze.
   D. paw lick latency.
   E. DSST.
Bloom’s Taxonomy: Know

2-12. Which of the following is a measure of analgesia in rats?
   A. inclined plane test.
   B. pursuit rotor.
   C. elevated plus maze.
   D. paw lick latency.
   E. DSST.
Bloom’s Taxonomy: Know

2-13. Which of the following is a measure of anxiety in rats?
   A. inclined plane test.
   B. pursuit rotor.
   C. elevated plus maze.
   D. paw lick latency.
   E. DSST.
Bloom’s Taxonomy: Know

2-14. If the paw lick latency decreases, this indicates
   A. greater analgesia.
   B. less analgesia.
   C. tolerance.
   D. decrease in anxiety.
   E. decrease in muscle tone.
Bloom’s Taxonomy: Apply

2-15. Ivan Pavlov studied
   A. operant conditioning.
   B. classical conditioning.
   C. spontaneous motor activity.
   D. schedules of reinforcement.
   E. REM sleep.
Bloom’s Taxonomy: Know
2-16. Which of the following is not a schedule of reinforcement?
   A. FR 3.
   B. FI 10 min.
   C. DRL.
   D. SMA.
   E. VR 10.
Bloom’s Taxonomy: Know

2-17. The situation where a response terminates a stimulus that precedes a shock is called
   A. punishment.
   B. escape.
   C. avoidance.
   D. Sidman avoidance.
   E. AMPT.
Bloom’s Taxonomy: Understand

2-18. The situation where a response terminates a shock is called
   A. punishment.
   B. escape.
   C. avoidance.
   D. Sidman avoidance.
   E. AMPT.
Bloom’s Taxonomy: Understand

2-19. Drugs that are useful in treating anxiety and psychosis in humans will also normally
   A. block avoidance responding in doses that have no effect on escape responding.
   B. block escape responding in doses that have no effect on avoidance responding.
   C. slow responding on an FR and increase FI responding.
   D. be subject to abuse.
   E. be highly toxic.
Bloom’s Taxonomy: Apply

2-20. If you can only remember when you are drunk things that you learned when you are drunk, this is an example of
   A. dissociation.
   B. alcoholic amnesia.
   C. drug-state discrimination.
   D. mithridatism.
   E. none of the above.
Bloom’s Taxonomy: Know

2-21. Which of the following is a procedure that can tell us about the subjective drug experience of nonhumans?
   A. drug-state discrimination.
   B. operant analysis of behavior.
   C. spontaneous motor activity.
2-22. In a drug discrimination learning task, one drug will generalize to another when the two drugs produce
   A. euphoria.
   B. gas pains.
   C. a hallucinogenic experience.
   D. a similar subjective effect.
   E. either A. or C.

Bloom’s Taxonomy: Understand

2-23. Rate of self-administration is not a good measure of the relative reinforcing capacity of different drugs. This is because of which of the following?
   A. drugs may have effects that can interfere with the ability of the organism to make the response.
   B. some drugs may have the effect of stimulating the response.
   C. it has been shown that the rate of responding does not reflect the reinforcing properties of any stimulus.
   D. all drugs are so reinforcing that the animal responds at the maximum rate possible.
   E. both A. and B.

Bloom’s Taxonomy: Understand

2-24. Breaking point is
   A. the dose of a drug that is no longer reinforcing.
   B. the point of food deprivation at which an animal will choose food over a given dose of a drug.
   C. the point at which price increases of a drug will cause a person to reduce consumption.
   D. the dose that will completely suppress responding on a progressive ratio schedule.
   E. the point where the demand on a progressive ratio schedule causes an organism to cease responding.

Bloom’s Taxonomy: Know

2-25. Which of the following techniques have been used to measure the reinforcing value of a stimulus?
   A. progressive ratio
   B. choice
   C. place conditioning
   D. all of A., B., and C.
   E. none of A., B., or C.

Bloom’s Taxonomy: Know

2-26. Introspection is
   A. the subjective study of one's own mind.
B. a method of behaviorism.
C. a branch of psychopharmacology.
D. a method of investigation that is never used in psychopharmacology.
E. an index of CFF.

Bloom’s Taxonomy: Know

2-27. The POMS and the ARCI are
   A. sleep stages.
   B. research institutes.
   C. enzymes.
   D. paper and pencil tests of subjective drug effects.
   E. indices of drug effectiveness.

Bloom’s Taxonomy: Know

2-28. Critical frequency at fusion is
   A. a measure of bar pressing rate.
   B. a measure of visual acuity.
   C. a measure of reaction time.
   D. a measure of arousal.
   E. a schedule of reinforcement.

Bloom’s Taxonomy: Know

2-29. Which of the following is not a direct measure of motor performance?
   A. simple reaction time
   B. pursuit rotor task.
   C. complex reaction time.
   D. respondent conditioning
   E. hand steadiness.

Bloom’s Taxonomy: Know

2-30. If a new drug appears safe and effective when tested on nonhumans it then goes into a four-phase program of testing on humans. Expanded clinical trials are conducted in
   A. phase 1.
   E. phase 2.
   C. phase 3.
   D. phase 4.
   E. none of the above. Expanded clinical trials are conducted before the four testing phases are initiated.

Bloom’s Taxonomy: Know

Short Answers

1. Explain the difference between of an independent variable and a dependent variable in a scientific experiment.
   Bloom’s Taxonomy: Understand
2. Explain why a placebo control group is needed in behavioral pharmacology.
   Bloom’s Taxonomy: Understand

3. What is a double-blind procedure?
   Bloom’s Taxonomy: Understand

4. Why is dissociation an important concept in behavioral pharmacology?
   Bloom’s Taxonomy: Understand

5. What are the four most common schedules of reinforcement, and how can they be applied in behavioral pharmacology?
   Bloom’s Taxonomy: Apply

6. Explain the differences between classical conditioning and operant conditioning, and how they can be used in behavioral pharmacology.
   Bloom’s Taxonomy: Apply

7. Explain the new drug development process; include descriptions of pre-clinical and clinical trials in your answer.
   Bloom’s Taxonomy: Apply

8. Why are avoidance and escape tasks used in behavioral pharmacology?
   Bloom’s Taxonomy: Apply

9. Describe some tests that can be used to study the effects of psychoactive drugs on human performance.
   Bloom’s Taxonomy: Apply

10. Describe and analyze the usefulness of the open-field test and elevated plus maze in testing anxiolytic drugs in nonhumans. How many times can you use these tests in the evaluation process?
    Bloom’s Taxonomy: Analyze

11. Explain the drug discrimination task used with rats in behavioral pharmacology. Analyze and explain why it is an important and useful test.
    Bloom’s Taxonomy: Analyze

12. What would happen if a placebo control was not used in a drug clinical trial?
    Bloom’s Taxonomy: Analyze

13. Why do you think that the double-blind procedure and the three-group design are important in drug testing?
    Bloom’s Taxonomy: Analyze

14. What type of performance in humans can be affected by psychoactive drugs? Describe the types of tests that can be performed to detect such effects.
Bloom’s Taxonomy: Evaluate

15. Compare pre-clinical testing methods and the measures used to study human performance. How well do you think they complement each other?

Bloom’s Taxonomy: Evaluate

**Essays**

1. If you were to design a research study with mice to test a new psychoactive drug, describe all the factors you have to include in your study design.
   Bloom’s Taxonomy: Apply

2. Describe the drug discrimination task and paw lick latency test used in nonhumans in behavioral pharmacology. Analyze and explain the differences between these two tests.
   Bloom’s Taxonomy: Apply

3. Which part of the drug development process is the most important, in your opinion - pre-clinical, clinical, or post-surveillance? Explain your answer.
   Bloom’s Taxonomy: Analyze

4. Evaluate the process of new drug development. Is there anything that could be left out, or shortened, due to any special circumstances? In your opinion, is the whole, lengthy, complicated process needed?
   Bloom’s Taxonomy: Evaluate

5. If you were to design the perfect drug testing protocol, what would you include in your design?
   Bloom’s Taxonomy: Hypothesize
Chapter 3
How We Adapt To Drugs – Tolerance, Sensitization, and Expectation

CHAPTER SUMMARY

• Tolerance is defined as (a) the decreased effectiveness (or potency) of a drug that results from repeated administrations or (b) the necessity of increasing the dose of a drug in order to maintain its effectiveness after repeated administrations.

• Tolerance develops and dissipates to different effects of drugs at different rates, and so it is likely to be the result of many different processes.

• There are a number of different mechanisms that can cause tolerance. These include pharmacokinetic tolerance, changes in metabolism of the drug’s pharmacodynamic tolerance, changes in the physiology to compensate for the effect of the drug, and behavioral tolerance, or conditioned changes in behavior that compensate for the effect of the drug.

• Much tolerance arises from homeostatic mechanisms, but this will develop only where the effect of the drug has some biological significance to the organism.

• Dependence is when withdrawal symptoms occur when the use of the drug is stopped or decreases. For many drugs, withdrawal symptoms will occur when the use of the drug is stopped. Withdrawal symptoms are thought to be the expression of the compensatory (opposite) effect of the drug, expressed in the absence of the drug.

• Hangover can be thought of as an acute withdrawal symptom.

• Pavlov was the first researcher to demonstrate that stimuli, if paired with the administration of a drug a sufficient number of times, will eventually come to elicit some of the effects of the drug through classical conditioning processes. Later research has shown that, quite often, the effect that becomes conditioned is a physiological response opposite to the unconditioned effect of the drug. It appears as though the compensatory response becomes conditioned.

• Stimuli that are always present when a drug is given will come to elicit conditioned compensatory responses that diminish the effect of the drug. This tolerance does not occur when the drug is given in the absence of these stimuli. When a placebo is administered in the presence of stimuli that predict the drug, a drug compensatory response is sometimes seen. These conditioned compensatory responses are expressed as conditioned withdrawal.

• It has been demonstrated that if a drug interferes with the ability of an organism to obtain reinforcement, tolerance will develop quickly. If there is no reinforcement for compensating for the effect of a drug, tolerance may not develop. Similarly, tolerance to some effects develops only if the organism is reinforced for showing drug compensatory responses.

• Sensitization occurs where a drug effect increases with repeated administrations. Sensitization can be conditioned to specific environments. Sensitization occurs to only some effects of some drugs. These include increases in activity caused by reinforcing drugs, increased
stereotyped behaviors caused by psychomotor stimulants, and the reinforcing effects of a drug.

- The expectations of experimental subjects can have a great influence on the effect of a drug. This is the placebo effect. Brain pathways that mediate the expectancy effect have been identified.

- The context in which a drug is administered can also influence its effect. This includes whether the drug is self-administered and whether it is administered in a familiar or a novel environment.

Multiple Choices

3-1. Which of the following defines tolerance?
   A. a decrease in the effectiveness of a drug resulting from repeated administrations.
   B. a decrease in the potency of a drug resulting from repeated administrations.
   C. the necessity to increase the dose of a drug to achieve the same effect after repeated administrations.
   D. a shift to the right of the DRC resulting from repeated administrations.
   E. all of the above.
   Bloom’s Taxonomy: Know

3-2. Tolerance develops to different effects at different rates. This means that
   A. tolerance cannot be studied scientifically.
   B. we cannot predict when tolerance will occur.
   C. there must be more than one mechanism of tolerance.
   D. many overdoses can be attributed to the sudden loss of tolerance.
   E. some people develop tolerance to a drug faster than others.
   Bloom’s Taxonomy: Know

3-3. Tolerance can develop to the effects of a drug during a single administration. This is referred to as
   A. acute tolerance.
   B. cross tolerance.
   C. Mithridatism.
   D. tachyphylaxis.
   E. both A. and D.
   Bloom’s Taxonomy: Know

3-4. Tolerance that occurs after one or two administrations of a drug is called
   A. acute tolerance.
   B. cross tolerance.
   C. mithridatism.
   D. tachyphylaxis.
   E. both A. and D.
   Bloom’s Taxonomy: Know
3-5. Pharmacodynamic tolerance is also known as
   A. cellular tolerance.
   B. homeostasis.
   C. metabolic tolerance.
   D. physiological tolerance.
   E. both A. and D.
   Bloom’s Taxonomy: Know

3-6. When tolerance for one drug diminishes the effect of another related drug, this is called
   A. tolerance.
   B. acute tolerance.
   C. tachyphylaxis.
   D. behavioral tolerance.
   E. cross tolerance.
   Bloom’s Taxonomy: Know

3-7. Enzyme induction
   A. is important in the development of pharmacokinetic tolerance.
   B. is caused by an enzyme blocker like disulfiram.
   C. slows the metabolism in younger members of a species.
   D. accounts for the different levels of an enzyme in different species.
   E. is a major cause of accidental drug overdose.
   Bloom’s Taxonomy: Know

3-8. Pharmacokinetic tolerance is also called
   A. acute tolerance.
   B. behavioral tolerance.
   C. cross tolerance.
   D. dispositional tolerance.
   E. cellular tolerance.
   Bloom’s Taxonomy: Know

3-9. Enzyme induction is responsible for which type of tolerance?
   A. acute tolerance.
   B. pharmacokinetic tolerance.
   C. pharmacodynamic tolerance.
   D. behavioral tolerance.
   E. none of the above. Enzyme levels are not responsible for any kind of tolerance.
   Bloom’s Taxonomy: Know

3-10. When a drug effect is greater at a specific blood level when the concentration in the blood
      is rising compared to at the same blood level when the concentration in the blood is
      falling, this is called
      A. acute tolerance.
      B. cross tolerance.
C. metabolic tolerance.
D. behavioral tolerance.
E. none of the above. Tolerance cannot develop that quickly.

Bloom’s Taxonomy: Know

3-11. Tolerance to the anorexic effects of amphetamine will develop in rats
A. whenever the drug is repeatedly administered.
B. whenever the drug is repeatedly administered to hungry animals.
C. whenever the drug is repeatedly administered to satiated rats.
D. whenever the drug is repeatedly administered to hungry rats in the presence of food.
E. whenever the drug is repeatedly administered to hungry rats in the absence of food.

Bloom’s Taxonomy: Understand

3-12. Tolerance that develops as a result of learning to compensate for the effect of a drug is called
A. cross tolerance.
B. behavioral tolerance.
C. metabolic tolerance.
D. physiological tolerance.
E. acute tolerance.

Bloom’s Taxonomy: Know

3-13. When physiological changes occur in response to the discontinuation of a repeatedly administered drug, this indicates a state of
A. acute tolerance.
B. behavioral tolerance.
C. dependence.
D. habituation.
E. none of the above.

Bloom’s Taxonomy: Understand

3-14. Physiological changes that occur as a result of discontinuation of a repeatedly administered drug are called
A. withdrawal symptoms.
B. physical or physiological dependence.
C. dependence.
D. abstinence disruption.
E. all of the above.

Bloom’s Taxonomy: Know

3-15. Physiological changes that take place during withdrawal are often in the direction opposite to the direct effect of the drug that caused them. This indicates
A. that the body is responding to a metabolite of the drug.
B. that the body is readjusting to the absence of the drug.
C. that withdrawal symptoms are independent of the direct effect of the drug.
D. that there is nothing a person can do to avoid withdrawal.
E. withdrawal symptoms will last longer if the drug is taken intermittently.

Bloom’s Taxonomy: Understand

3-16. Withdrawal symptoms are often less intense with drugs that
   A. are administered orally.
   B. are used absorbed rapidly.
   C. are absorbed slowly.
   D. are eliminated slowly.
   E. are eliminated quickly.

Bloom’s Taxonomy: Understand

3-17. If you have been taking a drug like morphine for a while and then you are given a
       morphine antagonist, this will
   A. cause severe withdrawal in minutes.
   B. have no effect.
   C. cause a drug-like experience.
   D. create tolerance to the drug.
   E. delay the onset of withdrawal.

Bloom’s Taxonomy: Apply

3-18. Withdrawal symptoms are usually
   A. physiological changes similar to the effect of the drug.
   B. physiological changes that are opposite to the effect of the drug.
   C. physiological changes that are the same for every dependence-producing drug.
   D. less severe if the drug is discontinued abruptly.
   E. not seen when the drug is administered by inhalation.

Bloom’s Taxonomy: Understand

3-19. The Solomon and Corbit theory explains
   A. withdrawal symptoms.
   B. tolerance.
   C. hangover.
   D. all of the above.
   E. none of the above.

Bloom’s Taxonomy: Apply

3-20. The theory that talks about A and B processes that are opposite was formulated by
   A. Solomon and Corbit.
   B. Shepard Siegel.
   C. Donald Overton.
   D. Barrett and Smith.
   E. Muriel Vogel-Sprott.

Bloom’s Taxonomy: Know

3-21. In some cases withdrawal symptoms are not seen, even though there is considerable
       tolerance to a drug. This may be because
A. the tolerance was not based on a physiological process.
B. the drug was administered i.p.
C. the compensatory response dissipated as fast as the drug was eliminated.
D. the organism was administered the drug in the same environment as the placebo.
E. none of the above.

Bloom’s Taxonomy: Apply

3-22. Which experimental procedure was used by Barrett and Smith to demonstrate the opponent process theory of Solomon and Corbit?
A. classical conditioning.
B. dissociation.
C. drug state discrimination.
D. respondent conditioning.
E. paw lick latency.

Bloom’s Taxonomy: Apply

3-23. When a neutral stimulus is paired with a drug, the stimulus will sometimes acquire the properties of the drug through conditioning. When this happens, the stimulus is the
A. conditioned stimulus.
B. conditioned response.
C. unconditioned stimulus.
D. unconditioned response.
E. none of the above.

Bloom’s Taxonomy: Apply

3-24. Conditioned drug effects
A. are usually more intense than the effect of the drug.
B. are very difficult to demonstrate.
C. are usually in a direction opposite to the drug effect.
D. do not last long.
E. have only been shown for analgesic effects morphine.

Bloom’s Taxonomy: Know

3-25. Conditioned withdrawal symptoms
A. can explain relapse in some cases.
B. cannot be used to explain relapse.
C. disappear when withdrawal is over.
D. only go away through extinction.
E. both A. and D.

Bloom’s Taxonomy: Understand

3-26. Siegel demonstrated that much of the tolerance of rats to morphine disappeared when the rats were tested with morphine in a different environment. This is an example of
A. metabolic tolerance.
B. physiological tolerance.
C. sensitization.
D. behavioral tolerance.
E. None of the above.

Bloom’s Taxonomy: Know

3-27. The existence of conditioned compensatory responses can explain
A. withdrawal.
B. tolerance.
C. dissociation.
D. homeostasis.
E. both A. and B.

Bloom’s Taxonomy: Know

3-38. When Siegel demonstrated that tolerance developed to repeated injections of morphine in the same environment, but that the tolerance disappeared when the injection was later given in a different environment, he demonstrated the existence of
A. metabolic tolerance.
B. behavioral tolerance.
C. physiological tolerance.
D. a non-generalization effect.
E. tolerance neglect.

Bloom’s Taxonomy: Understand

3-39. An experiment by Campbell and Seiden showed that rats could overcome the effects of amphetamine on DRL if they were allowed to practice the DRL after being given the drug. This is an example of which type of tolerance?
A. pharmacodynamic tolerance.
B. metabolic tolerance.
C. behavioral tolerance based on operant conditioning.
D. behavioral tolerance based on respondent conditioning.
E. reverse tolerance.

Bloom’s Taxonomy: Understand

3-40. Shepard Siegel suggested that unexplained heroin overdose may be caused by
A. a loss of tolerance resulting from taking heroin in a new environment.
B. a loss of metabolic tolerance resulting from liver damage.
C. a sudden increase in the potency of the drug resulting from conditioned drug effects.
D. accidentally administering the drug into an artery rather than a vein.
E. none of the above. All heroin overdoses are explained by taking too much heroin.

Bloom’s Taxonomy: Know

3-41. In your book, experiments were described that showed that rats show tolerance to the effect of amphetamine on DRL performance, but not FI performance. This is because
A. amphetamine has no effect on FI performance, but speeds performance in the DRL.
B. not enough trials were given.
C. amphetamine causes the rats to lose reinforcements in the DRL, but not the FI.
D. amphetamine was given after the FI trials and before the DRL trials.
E. rats on the FI schedule are given feedback on the effectiveness of their performance.

Bloom’s Taxonomy: Understand

3-42. Sensitization is the same as reverse of tolerance. Apart from that, sensitization differs from tolerance in that it
   A. does not occur in humans.
   B. only can be demonstrated with amphetamines and other stimulants.
   C. cannot be conditioned to neutral stimuli present when the drug is administered.
   D. may last for a longer period of time that tolerance.
   E. there is no cross sensitization.

Bloom’s Taxonomy: Understand

3-43. Sensitization is most often demonstrated using which of the following drug effects?
   A. the effect of drugs on DRL.
   B. the effect of drugs on behavioral activation.
   C. the effect of drugs on analgesia.
   D. the effect of drugs on body temperature.
   E. the effect of drugs on reinforcement.

Bloom’s Taxonomy: Know

3-44. If an animal shows sensitization to drug B after repeated administrations of drug A, this is an example of
   A. generalization.
   B. non-specific sensitization.
   C. cross sensitization.
   D. behavioral tolerance.
   E. none of the above. This never happens.

Bloom’s Taxonomy: Know

3-45. It has been suggested that sensitization of the mesolimbic dopamine system is responsible for
   A. tolerance.
   B. withdrawal.
   C. drug abuse.
   D. enzyme induction.
   E. the placebo effect.

Bloom’s Taxonomy: Know

3-46. The experiment of Colloca and Benedetti in the placebo effect used an unusual placebo control group that consisted of
   A. participants who received a placebo, but did not know it.
   B. participants who received the analgesic, but did not know it.
   C. participants who received no drug and were told that they would get an analgesic later.
   D. participants who received the placebo only in a distinctive environment.
   E. subjects who received the drug only in a distinctive novel environment.
Bloom’s Taxonomy: Understand

3-47. Using a PET scan, Volkow showed that the effects of methylphenidate on the brain and on reports of being “high” were greater if
A. participants were not expecting the drug.
B. participants were expecting the drug.
C. participants did not administer the drug to themselves.
D. participants were experience in pain.
E. participants were in a familiar environment.

Bloom’s Taxonomy: Know

Short Answers

1. Compare pharmacokinetic and pharmacodynamic tolerance, what are the main differences?
Bloom’s Taxonomy: Understand

2. Describe three examples of different types of tolerance.
Bloom’s Taxonomy: Understand

3. Explain withdrawal symptoms; include discussion of A- and B-processes as discussed in the textbook.
Bloom’s Taxonomy: Understand

4. Explain what physical dependence is, and how it relates to withdrawal symptoms.
Bloom’s Taxonomy: Understand

5. Explain why conditioned stimuli cause symptoms that are the opposite of the drug effects.
Bloom’s Taxonomy: Apply

6. Is it possible to get rid of conditioned withdrawal symptoms, and if yes explain how?
Bloom’s Taxonomy: Apply

7. Compare sensitization and tolerance, what are the differences?
Bloom’s Taxonomy: Apply

8. Explain why it is important to understand the placebo effect?
Bloom’s Taxonomy: Apply

9. How does expectancy interfere with drug trial results, give one example used in the textbook?
Bloom’s Taxonomy: Apply

10. Describe what withdrawal symptoms are by using Barrett and Smith experiment with rats (chlordiazepoxide injection).
Bloom’s Taxonomy: Analyze

11. Explain why heroin might cause an unexpected overdose in users with a long history of
heroin abuse and tolerance.
Bloom’s Taxonomy: Analyze

12. Explain expectancy of drug effects by using the experiment by Volkow (PET results after methylphenidate administration).
Bloom’s Taxonomy: Analyze

13. Explain why DRL schedule was used in the Campbell and Seiden (1973) experiment described in the textbook where rats were given amphetamine.
Bloom’s Taxonomy: Analyze

14. Describe using a specific example of a drug how acute tolerance might happen during one single administration, and what effect the tolerance might have on performance levels.
Bloom’s Taxonomy: Evaluate

15. What is substance dependence based on what you learned from this chapter?
Bloom’s Taxonomy: Evaluate

Essays

1. How does expectancy interfere with drug trial results? Give one example of such a situation from research discussed in the textbook.
Bloom’s Taxonomy: Apply

2. Explain expectancy and placebo effects by using the experiment by Colloca and Benedetti (2005).
Bloom’s Taxonomy: Apply

3. Discuss operant conditioning of tolerance by using the Campbell and Seiden (1973) experiment described in the textbook.
Bloom’s Taxonomy: Analyze

4. Explain why is it important to know what type of tolerance a new drug causes, especially when the drug is proposed to be used as a long term therapeutic drug.
Bloom’s Taxonomy: Evaluate

5. Imagine you were a heroin addict, and you had developed conditioned withdrawal symptoms, how would you minimize chances of relapse after deciding to quit taking heroin?
Bloom’s Taxonomy: Hypothesize
CHAPTER SUMMARY

- Nervous tissue is made up of nerve cells called neurons, which are excitable. Their excitability depends on the breakdown of the resting potential, which is the difference in electrical charge between the inside and the outside of the membrane of each cell. The resting potential is a result of uneven distribution of ions on either side of the membrane.

- There are more positively charged ions outside the neuron than inside. This uneven distribution of ions is created by the Na⁺/K⁺ ion pump. Ion channels permit the flow of specific ions across the cell membrane at a specific rate. Some ion channels may be opened either by the presence of a chemical or by a change in the resting potential.

- When the cell membrane on an axon is depolarized to a certain point (called the threshold), ion channels open, and the resting potential can no longer be maintained and breaks down. This condition is called an action potential. The resting potential then quickly restores itself.

- Action potentials are not generated when the resting potential of the dendrites and cell body are depolarized. Instead, an excitatory postsynaptic potential is generated that passively spreads over the surface of the membrane.

- Action potentials move away from the cell body, along the cell’s axon, to synapses very near the cell body and dendrites of another neuron. They stimulate the second neuron by releasing a chemical called a neurotransmitter into the tiny gap between the cells.

- The transmitter interacts with receptor sites on the membrane of the postsynaptic cell. Depending on the nature of the receptor site, the effect will be to cause either depolarization (an increase in the excitability of the postsynaptic cell called an EPSP) or hyperpolarization (a decrease in the excitability of the postsynaptic cell called an IPSP).

- Neurotransmitters may cause other longer-acting effects on the postsynaptic cell by causing the release of second messengers and by modifying the expression of genes that create receptor sites and ion channels.

- Production of action potentials at a cell’s axon depends on the sum of the excitation and inhibition at all the synapses on its dendrites and cell body at any given time.

- Autoreceptors are located on the presynaptic membrane and regulate the concentration of neurotransmitter, and sometimes the postsynaptic cell and other nearby cells release chemical messengers that can modify the release of neurotransmitters.

- The nervous system has two major divisions. The central nervous system is made up of all the neurons in the brain and spinal cord; all other neurons make up the peripheral nervous system, which is further divided into the somatic and the autonomic nervous systems. The autonomic nervous system also has two parts: the parasympathetic system, which controls the vegetative
involuntary functions of the body on an ongoing basis, and the sympathetic nervous system, which prepares the body for the sudden expenditure of energy, or the fight-or-flight response.

- The central part of the spinal cord is gray matter (cell bodies) surrounded by white matter (myelinated axons), which consists of fiber bundles of axons running to and from the brain.

- The medulla, located at the base of the brain, controls breathing and other autonomic functions. The cerebellum controls the smooth movement of muscles. The reticular activating system controls arousal. The Raphé system, conversely, is important in causing sleep.

- The locus coeruleus sends norepinephrine projections to the limbic system and the cortex. It is associated with anxiety and panic, and it seems to be responsible for withdrawal from opiates. The central gray is important in mediating responses to pain. It contains opiate receptors and is one site of action for the analgesic effects of the opiates.

- The basal ganglia form part of the extrapyramidal motor system. The striatum is the input side of the basal ganglia, and the pallidum is the output side. Together with the cortex, they form a loop that controls motor activity.

- The limbic system controls emotions and motivation. It is made up of a number of centers, including the hypothalamus, which controls eating and drinking and contains reinforcement centers.

- The nucleus accumbens receives dopaminergic input from the ventral tegmental area. This is the mesolimbic dopamine system, which is important in motivation and reinforcement of natural motivations and drug self-administration.

- The cortex makes up the uppermost surface of the brain and receives direct input from many senses. It also has direct control over voluntary movement. The cortex contains centers that permit us to recognize speech and written language and enable us to speak and write.

- The frontal and prefrontal cortex are important in thinking and decision making, attention, and working memory.

- The development of the brain is a complex process that involves the formation, migration, and connection of billions of neurons. Because migration and synapse formation are controlled by substances that resemble neurotransmitters, drugs that affect the functioning of the central nervous system can be teratogens and can severely disrupt the development of the nervous system.

- Acetylcholine, epinephrine, norepinephrine, dopamine, serotonin, GABA, glutamate, and some peptides can act as neurotransmitters. Some can also act as neuromodulators and neurohormones.

- Drugs have their effect by interfering with some aspect of synaptic transmission. Among other things, they can block receptor sites, stimulate receptor sites, block the metabolism or reuptake of neurotransmitters, and interfere with second messengers.

- Each neurotransmitter can have a number of different receptor sites and the effect of the neurotransmitter is determined by the type of neurotransmitter.
A number of neuroimaging techniques are now widely used to study the effects of drugs. These include PET, and its variation SPECT, and MRI and fMRI.

Multiple Choices

4-1. Which of the following is NOT a part of a neuron?
   A. dendrites.
   B. axon.
   C. glial.
   D. axon hillock.
   E. membrane.
Bloom’s Taxonomy: Know

4-2. The resting potential of a neuron is about
   A. -70 millivolts.
   B. -70 microvolts.
   C. neutral.
   D. 70 millivolts.
   E. 70 microvolts.
Bloom’s Taxonomy: Know

4-3. The resting potential is caused by
   A. the axon hillock.
   B. static electric charges built up by friction.
   C. the rotation of charged particles.
   D. the uneven distribution of ions inside and outside the cell.
   E. the release of ions by neighboring neurons.
Bloom’s Taxonomy: Understand

4-4. Depolarization refers to
   A. an increase in the resting potential.
   B. a decrease in the resting potential.
   C. spontaneous fluctuations in the resting potential.
   D. small leaks of transmitters.
   E. inhibition.
Bloom’s Taxonomy: Understand

4-5. An ion channel is
   A. a phase modulator in the impulse drive of the Enterprise.
   B. a groove in the neuronal membrane that attracts ions.
   C. an opening in glial cells for axons to pass through.
   D. an opening in neuronal membranes through which ions may pass.
   E. none of the above.
Bloom’s Taxonomy: Know
4-6. Which of the following can directly open a gated ion channel?
   A. a difference in electrical potential between the inside and outside of the neuron.
   B. activity at a receptor site.
   C. high concentrations of NaCl.
   D. activity of ion pumps.
   E. both A. and B.

Bloom’s Taxonomy: Apply

4-7. The "all-or-none" law refers to
   A. drug metabolism.
   B. ionization of bases in acids.
   C. absorption by inhalation.
   D. EPSP.
   E. action potentials.

Bloom’s Taxonomy: Know

4-8. The presence of myelin on dendrites has which effect on the transmission of action potentials?
   A. blocks action potentials.
   B. slows transmission.
   C. has no effect.
   D. speeds transmission.
   E. none of the above. Myelin is found only on axons.

Bloom’s Taxonomy: Apply

4-9. The membrane of dendrites and cell bodies do not produce action potentials. Instead we see what we call
   A. the action hillock.
   B. myelin.
   C. ion pumps.
   D. an excess of Na+ ion.
   E. post synaptic potentials.

Bloom’s Taxonomy: Understand

4-10. Which of the following is not found at a synapse?
   A. axon hillock.
   B. vesicles.
   C. cleft.
   D. receptor sites.
   E. transmitter.

Bloom’s Taxonomy: Know

4-11. If a neurotransmitter has the effect of depolarizing the membrane at a synapse, this may be referred to as
   A. excitation.
   B. EPSP.
C. inhibition.
D. IPSP.
E. both A. and B.
Bloom’s Taxonomy: Understand

4-12. Depolarization is when
A. the resting potential moves closer to firing threshold.
B. the resting potential moves further from firing threshold.
C. the cell membrane becomes more excited.
D. the cell membrane becomes less excited.
E. an action potential occurs.
Bloom’s Taxonomy: Apply

4-13. If a neurotransmitter has the effect of hyperpolarizing the membrane at a synapse, this may be referred to as
A. excitation.
B. EPSP.
C. inhibition.
D. IPSP.
E. both C. and D.
Bloom’s Taxonomy: Understand

4-14. Different action potentials arriving at the dendrites and cell body of a neuron
A. cancel each other out.
B. are independent events and do not affect each other.
C. may summate if they arrive in different places at the same time.
D. may summate if they arrive close together in time at the same synapse.
E. both C. and D.
Bloom’s Taxonomy: Understand

4-15. Some receptor sites are not directly connected to an ion channel. They influence the operation of an ion channel by releasing a _____________ inside the cell which directly changes the operation of an ion channel.
A. neurotransmitter.
B. neuromodulator.
C. second messenger.
D. releasing factor.
E. none of the above.
Bloom’s Taxonomy: Know

4-16. Second messengers may activate a protein which lasts much longer and alters the functioning of receptors and ion channels. This is called a
A. releasing factor.
B. kinase.
C. transcription factor.
D. DNA.
4-17. Which of the following is a common second messenger?
   A. cyclic AMP.
   B. adenosine.
   C. MAO.
   D. CREB.
   E. kinase.
Bloom’s Taxonomy: Know

4-18. CREB and c-fos are
   A. neurotransmitters.
   B. second messengers.
   C. neuromodulators.
   D. transcription factors.
   E. kinases.
Bloom’s Taxonomy: Know

4-19. Neurotransmitters can indirectly induce very long term or permanent changes on the
   excitability of the post synaptic neuron by altering the expression DNA in the nucleus. This is
   done by activating
   A. ion channels.
   B. active transport mechanisms.
   C. receptor sites.
   D. transcription factors.
   E. kinases.
Bloom’s Taxonomy: Know

4-20. A substance that works at a synapse to either increase or decrease the action of the normal
   neurotransmitter is called a
   A. neurofunctional accelerator (NFA).
   B. monoamine.
   C. catechol-0-methyltransferase (COMT).
   D. neuromodulator.
   E. psychomotor stimulant.
Bloom’s Taxonomy: Know

4-21. Autoreceptors
   A. regulate the release of neurotransmitter.
   B. are located on the presynaptic membrane.
   C. are receptors located on axons.
   D. are sensitive to second messengers inside the postsynaptic cell.
   E. both A. and B.
Bloom’s Taxonomy: Know
4-22. The functional difference between the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS) is
   A. the SNS prepares the body for a sudden expenditure of energy and the PNS handles routine functions.
   B. the PNS prepares the body for a sudden expenditure of energy and the SNS handles routine functions.
   C. the SNS uses ACh and the PNS uses both ACh and E.
   D. the ganglia of the PNS are interconnected.
   E. none of the above.
Bloom’s Taxonomy: Know

4-23. In the spinal cord
   A. sensory nerves enter from the dorsal side.
   B. sensory nerves enter from the ventral side.
   C. motor axons leave from the ventral side.
   D. motor axons leave from the dorsal side.
   E. both A. and C.
Bloom’s Taxonomy: Know

4-24. One function of the medulla is to
   A. control the initiation and coordination of smooth body movement.
   B. control sleep.
   C. control respiration.
   D. control the pleasurable effects of reinforcers.
   E. integrate perception with memories.
Bloom’s Taxonomy: Know

4-25. The RAS
   A. activates the brain.
   B. enables animals to sleep.
   C. contains the median forebrain bundle.
   D. is the main mediator of pain signals.
   E. is necessary for the effects of punishment to control behavior.
Bloom’s Taxonomy: Know

4-26. The Raphé system
   A. controls the experience of pleasure.
   B. controls sleep.
   C. contains the hypothalamus.
   D. is the primary site of action of the tranquillizers like Valium.
   E. is another name for the limbic system.
Bloom’s Taxonomy: Know

4-27. The center in the lower brain that is 50-70% noradrenergic is
   A. the RAS.
   B. the Raphé system.
C. the periaqueductal grey.
D. the cerebellum.
E. the locus coeruleus.

Bloom’s Taxonomy: Know

4-28. The locus coeruleus
A. is inhibited by GABA.
B. is associated with panic and anxiety.
C. is active during withdrawal from opiates.
D. is primarily noradrenergic.
E. is all of the above.

Bloom’s Taxonomy: Know

4-29. The function of the cerebellum is to
A. control the coordination of smooth body movement.
B. control sleep.
C. control respiration.
D. control the pleasurable effects of reinforcers.
E. integrate perception with memories.

Bloom’s Taxonomy: Know

4-30. The system in the brain that mediates both pain and punishment is
A. the Raphé system.
B. the RAS.
C. the basal ganglia.
D. the periaqueductal gray.
E. medial forebrain bundle.

Bloom’s Taxonomy: Know

4-31. People suffering from Parkinson's disease have a DA depletion in
A. the basal ganglia.
B. the medial forebrain bundle.
C. the cerebellum.
D. the central gray.
E. the cortex.

Bloom’s Taxonomy: Know

4-32. The striatum, the caudate nucleus and the putamen are part of
A. the cortex.
B. the sympathetic nervous system.
C. the central gray.
D. the limbic system.
E. basal ganglia.

Bloom’s Taxonomy: Know

4-33. The brain system that seems to be in control of emotions is
A. the Raphé system.
B. the limbic system.
C. the central gray.
D. the basal ganglia.
E. the RAS.

Bloom’s Taxonomy: Know

4-34. Which of the following is (are) involved in coordination of motor activity?
   A. basal ganglia.
   B. periaqueductal grey.
   C. cerebellum.
   D. Raphé nuclei.
   E. both A. and C.

Bloom’s Taxonomy: Know

4-35. Which of the following does not belong to the limbic system?
   A. septum.
   B. amygdala.
   C. cerebellum.
   D. hypothalamus.
   E. none of the above.

Bloom’s Taxonomy: Know

4-36. The parts of the cortex that contains areas responsible for thought and cognition are located in the
   A. frontal cortex.
   B. temporal lobes.
   C. central sulcus.
   D. visual cortex.
   E. none of the above. Thought and cognition are located throughout the entire cortex.

Bloom’s Taxonomy: Know

4-37. When drugs interfere with the fetal development of the nervous system in a way that causes a deficit in the organism's behavior after birth, it is called
   A. functional teratology.
   B. synaptic migration.
   C. cellular differentiation.
   D. behavioral integrative disruption.
   E. masking.

Bloom’s Taxonomy: Understand

4-38. Two reasons why behaviorally-active drugs are especially potent teratogens are that
   A. they cross the blood-brain barrier easily and they are highly ionized.
   B. they resemble chemicals that control neural migration and they penetrate the brain easily.
   C. they are potent neurotoxins and the developing fetus is unable to metabolize
them.
D. they cause a swelling in neural membranes and they block receptor sites that control development.
E. their metabolites are toxic to rapidly dividing cells and they can alter DNA transcription.

Bloom’s Taxonomy: Apply

4-39. The effect of a neurotransmitter at a synapse can be terminated by
A. the presence of an enzyme.
B. the presence of inhibitory neurotransmitters in the synapse.
C. reabsorption into the presynaptic terminal membrane.
D. none of the above. Neurotransmitters are basically unstable and spontaneously disintegrate.
E. both A. and C.

Bloom’s Taxonomy: Understand

4-40. 5-HT is another name for
A. serotonin.
B. dopamine.
C. IPSP.
D. beta-lipotropin.
E. peptides.

Bloom’s Taxonomy: Know

4-41. Which of the following is not a transmitter?
A. dopamine.
B. acetylcholinesterase.
C. GABA.
D. epinephrine.
E. norepinephrine.

Bloom’s Taxonomy: Know

4-42. Which of the following is a monoamine or biogenic amine neurotransmitter?
A. 5-HT.
B. MAO.
C. acetylcholine.
D. GABA.
E. beta-lipotropin.

Bloom’s Taxonomy: Know

4-43. MAO is the enzyme that destroys which transmitter(s)?
A. epinephrine.
B. norepinephrine.
C. dopamine.
D. none of A., B., or C.
E. all of A., B., and C.
Bloom’s Taxonomy: Know

4-44. Which of the following is always an inhibitory transmitter?
   A. norepinephrine.
   B. epinephrine.
   C. dopamine.
   D. GABA.
   E. PCPA.

Bloom’s Taxonomy: Know

4-45. The major excitatory neurotransmitter in the brain is
   A. acetylcholine.
   B. dopamine.
   C. GABA.
   D. endorphin.
   E. glutamate.

Bloom’s Taxonomy: Know

4-46. Which of the following is a means by which a drug can alter the functioning of a synapse?
   A. decreasing the activity of the enzyme that destroys a neurotransmitter.
   B. blocking the receptor site for a neurotransmitter.
   C. altering the reuptake of a neurotransmitter.
   D. changing the amount of transmitter released into the synapse.
   E. all of the above.

Bloom’s Taxonomy: Understand

4-47. MAO and COMT are enzymes that destroy which of the following?
   A. acetylcholine.
   B. serotonin.
   C. endorphin.
   D. GABA.
   E. none of the above.

Bloom’s Taxonomy: Know

4-48. Which of the following neurotransmitters have receptors subtypes that are called alpha and beta?
   A. serotonin.
   B. norepinephrine.
   C. GABA.
   D. endorphins.
   E. glutamate.

Bloom’s Taxonomy: Know

4-49. Which of the following neurotransmitters have NMDA receptors?
   A. serotonin.
   B. norepinephrine.
4-50. Which of the following neurotransmitters have receptor sites known as mu, delta and kappa?
   A. opioid-type peptides.
   B. norepinephrine.
   C. GABA.
   D. acetylcholine
   E. glutamate.
Bloom’s Taxonomy: Know

4-51. Radioactive tracer isotopes are used in which of the following imaging techniques?
   A. EEG.
   B. PET.
   C. MRI.
   D. FMRI.
   E. BOLD
Bloom’s Taxonomy: Know

4-52. PET scans can be used
   A. to determine blood flow to different regions of the brain.
   B. to determine glucose metabolism in different parts of the brain.
   C. to determine the location of drug receptor binding sites.
   D. to determine the distribution of psychoactive drugs in the brain.
   E. all of the above.
Bloom’s Taxonomy: Understand

4-53. A superconducting magnet is used in which type of imaging?
   A. EEG.
   B. PET.
   C. SPECT.
   D. MRI.
   E. none of the above.
Bloom’s Taxonomy: Know

4-55. The disadvantage(s) of using MRI is/are
   A. it requires a specially constructed room with magnetic shielding.
   B. it has low spatial and temporal resolution.
   C. it must use radioactive chemicals.
   D. it is very time consuming.
   E. all of the above.
Bloom’s Taxonomy: Apply
Short Answers

1. List the major functions of glial cells in the nervous system.
Bloom’s Taxonomy: Understand

2. Describe the structure of a neuron.
Bloom’s Taxonomy: Understand

3. Describe resting potential and how it is generated in every cell in the body.
Bloom’s Taxonomy: Understand

4. Explain how action potential is initiated in the axon hillock.
Bloom’s Taxonomy: Understand

5. Compare the conduction of action potential along a myelinated versus a non-myelinated axon.
Bloom’s Taxonomy: Apply

6. What is the difference between excitation and inhibition of the post-synaptic neuron in the synapse?
Bloom’s Taxonomy: Apply

7. Describe the steps of chemical neurotransmission in the synapse.
Bloom’s Taxonomy: Apply

8. Describe three ways how drugs can interfere with neurotransmission in the synapse.
Bloom’s Taxonomy: Apply

9. Describe the differences between sympathetic and parasympathetic nervous systems.
Bloom’s Taxonomy: Apply

10. Describe two brain structures and their major functions described in the textbook that locate at the midbrain.
Bloom’s Taxonomy: Analyze

11. Describe two brain structures and their major functions described in the textbook that locate at the forebrain.
Bloom’s Taxonomy: Analyze

12. Compare GABA and glutamate neurotransmitters, and how they differ in the effects they cause in the brain.
Bloom’s Taxonomy: Analyze

13. Compare antagonistic drug and agonistic drug, what are the similarities and differences?
Bloom’s Taxonomy: Analyze

14. Why neurotransmitters are synthesized by the neurons, why they do not float freely in the
brain in excess amounts?
Bloom’s Taxonomy: Evaluate

15. What are some of the advantages of MRI compared to PET?
Bloom’s Taxonomy: Evaluate

**Essays**

1. Describe the nervous system, and explain some of the functions of the CNS and the PNS.
   Bloom’s Taxonomy: Apply

2. Describe chemical neurotransmission starting from changes in membrane potentials in the presynaptic neuron’s cell body, to axon hillock, along the axon, and ending in the post-synaptic membrane.
   Bloom’s Taxonomy: Apply

3. Explain, and describe in detail five different ways how drugs can modulate neurotransmission.
   Bloom’s Taxonomy: Analyze

4. What are some of the advantages and disadvantages of MRI?
   Bloom’s Taxonomy: Evaluate

5. Imagine you were to develop a drug that would antagonize the effects of a deadly neurotoxin. Explain how this new drug would work to prevent death.
   Bloom’s Taxonomy: Hypothesize
CHAPTER SUMMARY

- Because drug abuse appeared to be particularly compulsive and self-destructive, historically, it was viewed as an abnormal type of behavior that could not be explained by the same rules that govern normal behavior.

- Originally, people who abused drugs were thought to be deficient in willpower or morality, and drug abuse was thought to be a problem for the clergy and the church to handle. Later, the medical profession became involved in attempts to treat people who were abusing opium and morphine because these substances were widely used as medicines. The idea that addiction was a disease was proposed in the mid-1800s but did not become formally recognized as such until the 1950s. Substance dependence is now officially a disorder in the DSM-IV, and it has been proposed to be changed to Substance Use Disorder in the revised DSM-5.

- Despite explanations involving biochemical deficiency, the disease of addiction has never been identified. There are two types of disease theories. Preexisting vulnerabilities and diseases theories say that some people are born with a predisposition to become addicted, and exposure theories that say that excessive exposure to a drug will make you an addict.

- The physical dependence model suggests that excessive drug use is motivated by avoidance of withdrawal symptoms that occur when a person stops using a drug. Proponents of the dependence model explain the abuse of drugs that do not cause physical dependence by suggesting that these drugs cause psychological dependence.

- In the 1950s, when it became known that nonhumans would give themselves drugs in the same manner as humans, it was easily demonstrated that some assumptions of the disease model and the physical dependence model were not correct.

- Experiments with nonhumans showed that physical dependence was not necessary for self-administration.

- Nearly all the drugs that nonhumans will self-administer are used and abused by humans. The exceptions are most hallucinogens.

- In humans and nonhumans, the pattern of self-administration of particular drugs is similar. Researchers came to realize that drug administration could control the behavior of organisms in the same way as more traditional positive reinforcers, such as food and water.

- A positive reinforcer is any stimulus that will increase the frequency of a response on which it is contingent. It often is accompanied by the experience of pleasure, but this is not necessary.

- The positive reinforcement explanation of drug use and addiction may seem to be circular, but it can be shown that the brain mechanisms of positive reinforcement are similar to those common to all drugs that are used and abused.
• The following factors can alter the incentive value of drugs: type of drug, dose, genetics, relief of some unpleasant symptoms, task demands, stress, deprivation, exposure to the same or other drugs, physical dependence, and extended access to the drug.

• A part of the brain important in motivation is the mesolimbic dopamine system, which is composed of cells in the ventral tegmental area that release dopamine in the nucleus accumbens. This system, in conjunction with the motor loop and the learning and memory system, is responsible for positive reinforcement by giving stimuli incentive salience; that is, these stimuli are easily noticed, and we are attracted to them—we want them. This is not a pleasure system.

• All drugs that are self-administered are known to cause a release of dopamine in the mesolimbic dopamine system.

• The incentive sensitization theory proposes that with repeated administration, the reinforcing effects of a drug (incentive value) and related stimuli become sensitized. This means that the drug and related stimuli will have increased incentive salience, which expresses itself as craving for the drug.

• Another neurological theory is the hedonic dysregulation theory, which proposes that with repeated use of a drug, an opponent process or compensatory response increases. This causes tolerance to the pleasurable effect of the drug. In addition, the set point of the pleasure system changes so that the person becomes increasingly insensitive to pleasure. As a result, the person must take increasing amounts of the drug.

• Drug addiction involves a dysfunction in information processing and integration amongst multiple brain regions that comprise four interrelated circuits. These circuits regulate “reward/saliency” (e.g., nucleus accumbens and ventral tegmental area), “motivation/drive” (e.g., orbitofrontal cortex and motor cortex), “memory/conditioning” (e.g., amygdala and hippocampus), and “inhibitory control/executive function” (e.g., dorsolateral prefrontal cortex and anterior cingulate gyrus).

• NIDA proposes principles for drug abuse treatments that are based on all aspects of functioning that have been disrupted by drug use, helping the individual maintain a drug-free lifestyle and re-establish their place in the family, workplace, and society. Treatment approaches can be behavioural, and pharmacological, or both to maintain sobriety.

Multiple Choices

5-1. The American Association for the Care of Inebriates in 1870 claimed that
   A. alcohol abuse was a moral weakness.
   B. alcohol abusers should be handled by the church and the legal system.
   C. inebriety was a disease.
   D. alcohol abuse was a result to a toxin in the blood.
   E. both A. and B.

Bloom’s Taxonomy: Know
5-2. The DSM-IV classes Substance Abuse as a(n)
   A. illness.
   B. disease.
   C. disorder.
   D. pathology.
   E. deviance.
Bloom’s Taxonomy: Know

5-3. The DSM-IV presents criteria for the diagnosis of which of the following?
   A. substance abuse
   B. habituation
   C. addiction
   D. substance dependence
   E. both A. and D.
Bloom’s Taxonomy: Know

5-4. The ICD-10 is published by
   A. the American Psychiatric Association.
   B. the American Psychological Association.
   C. the World Health Organization.
   E. none of the above.
Bloom’s Taxonomy: Know

5-5. Social reformers in the 19th century proclaimed alcoholism to be a disease because
   A. there was overwhelming scientific proof.
   B. Jellinek’s book The Disease Concept of Alcoholism had just been published.
   C. they wanted to dispel the idea that alcoholics had a moral weakness and deserved punishment.
   D. there was no other obvious explanation for self-destructive behavior.
   E. both A. and B.
Bloom’s Taxonomy: Know

5-6. E.M. Jellinek’s theory of alcoholism is
   A. a drug exposure theory.
   B. a preexisting disease theory.
   C. widely accepted by the Alcoholics Anonymous movement.
   D. a withdrawal theory.
   E. both B. and C.
Bloom’s Taxonomy: Apply

5-7. According to the textbook, the term "psychological dependence"
   A. was invented to explain why people took drugs that had no apparent physiological withdrawal symptoms.
   B. refers to drug self-administration that is motivated by fear of psychological withdrawal symptoms.
C. is based on complex neurological responses in the brain.
D. can be used as an explanation of drug use.
E. all of the above.
Bloom’s Taxonomy: Understand

5-8. What is it called when withdrawal symptoms occur after a frequently administered drug has been discontinued or reduced?
A. dependence.
B. mithridatism.
C. tachyphylaxis.
D. pharmacodynamic tolerance.
E. kicking the habit.
Bloom’s Taxonomy: Apply

5-9. Experiments that study human drug self-administration in hospital ward settings have which of the following disadvantages?
A. only people with a history of drug use can be used as subjects.
B. it is difficult to keep track of the exact dose that a person administers.
C. it is unethical.
D. most subjects quit the experiment before it is finished.
E. humans behave quite differently when they know that their behavior is being observed.
Bloom’s Taxonomy: Know

5-10. Nonhumans will learn to press a lever to avoid an infusion of which of the following drugs?
A. aspirin.
B. heroin.
C. alcohol.
D. LSD.
E. nicotine.
Bloom’s Taxonomy: Know

5-11. In the experiment by Pickens and Thompson (1968) it was shown that
A. rats would not self-administer cocaine.
B. monkeys would press a level that caused an infusion of cocaine because the cocaine had the effect of stimulating all behavior.
C. the pattern of level pressing for cocaine on an FR schedule was similar to the pattern generated by other reinforcers on the same schedule.
D. the light that was paired with the drug was acting as a reinforcer.
E. none of the above.
Bloom’s Taxonomy: Apply

5-12. When saline was substituted for cocaine in the self-administration experiment by Pickens and Thompson
A. there was a short burst of lever pressing before the rat stopped responding.
B. responding gradually slowed down before stopping.
C. responding stopped immediately.
D. responding did not stop.
E. responding increased.

Bloom’s Taxonomy: Apply

5-13. Laboratory animals will not self-administer drugs through which of the following routes of administration?
   A. oral.
   B. intragastric.
   C. intraventricular.
   D. inhalation.
   E. none of the above. Laboratory animals will self-administer drugs via all of these routes of administration.

Bloom’s Taxonomy: Know

5-14. Which type of drug is generally found to have the greatest abuse potential or abuse liability?
   A. opioids such as heroin.
   B. tranquillizers such as Valium.
   C. psychomotor stimulants such as cocaine.
   D. antidepressants such as Prozac.
   E. solvent vapors.

Bloom’s Taxonomy: Know

5-15. In the choice experiment by Harriet de Wit and Chris Johanson using human subjects, it was shown that
   A. highly anxious subjects did not choose diazepam more frequently than a placebo.
   B. highly anxious subjects chose diazepam more frequently than a placebo.
   C. highly anxious subjects could not tell the difference between diazepam and a placebo.
   D. subjects with normal anxiety levels preferred diazepam because they claimed to enjoy the subjective effects.
   E. highly anxious subjects were more likely to become dependent on diazepam.

Bloom’s Taxonomy: Understand

5-16. Which of the following is NOT a factor that has been shown to enhance the reinforcing value of a drug?
   A. stress.
   B. experience with the drug.
   C. experience with another drug.
   D. physical dependence.
   E. boredom.

Bloom’s Taxonomy: Know

5-17. Relief from which of the following symptoms has been shown to be reinforcing in humans?
A. relief from anxiety by Valium in anxious people.
B. relief from pain by opiate drugs.
C. relief from depression in people experiencing a depressive episode.
D. appetite suppression in overweight people.
E. none of the above.

Bloom’s Taxonomy: Know

5-18. Responding for a drug reinforcer can be stimulated by a non-contingent administration of that reinforcer. This is called
A. physical dependence.
B. conditioned incentive.
C. second order schedule.
D. priming.
E. the Matching Law.

Bloom’s Taxonomy: Apply

5-19. Place conditioning and second-order schedules are techniques for studying
A. priming.
B. physical dependence.
C. conditioned incentive.
D. substitution.
E. stress.

Bloom’s Taxonomy: Understand

5-20. What procedure shows that a light paired with a reinforcer can acquire reinforcing properties in an operant conditioning task?
A. second order schedule.
B. place conditioning.
C. priming.
D. progressive ratio schedule.
E. opponent process.

Bloom’s Taxonomy: Understand

5-21. The reinforcement system in the brain consists of
A. the hippocampus, amygdala, and cortex.
B. the cortex, thalamus, and the basal ganglia.
C. the nucleus accumbens and the ventral tegmental area.
D. none of the above.
E. all of A., B., and C.

Bloom’s Taxonomy: Know

5-22. The learning and memory system in the brain consists of
A. the hippocampus, amygdala, and cortex.
B. the cortex, thalamus, and the basal ganglia.
C. the nucleus accumbens and the ventral tegmental area.
D. none of the above.
5-23. The motor loop in the brain consists of
   A. the hippocampus, amygdala, and cortex.
   B. the cortex, thalamus, and the basal ganglia.
   C. the nucleus accumbens and the ventral tegmental area.
   D. none of the above.
   E. all of A., B., and C.

5-24. The mesolimbic dopamine system is made up of which of the following?
   A. the hippocampus, amygdala, and cortex.
   B. the cortex, thalamus, and the basal ganglia.
   C. the nucleus accumbens and the ventral tegmental area.
   D. none of the above.
   E. all of A., B., and C.

5-25. Drugs act as positive reinforcers because they activate which of the following?
   A. the hippocampus, amygdala, and cortex.
   B. the cortex, thalamus, and the basal ganglia.
   C. the nucleus accumbens and the ventral tegmental area.
   D. none of the above.
   E. all of A., B., and C.

5-26. The difference between drug reinforcement and other natural reinforcers is that
   A. natural reinforcers show satiation and there appears to be no natural limit to drug
      reinforcement.
   B. drug reinforcement is more immediate than natural reinforcers.
   C. drug reinforcers and natural reinforcers use different brain mechanisms.
   D. natural reinforcers are more powerful than drug reinforcers.
   E. both A. and B.

5-27. The part(s) of the brain involved in the reinforcement system is (are)
   A. the nucleus accumbens.
   B. the thalamus.
   C. the ventral tegmental area.
   D. the hippocampus.
   E. both A. and C.

5-28. The process called incentive salience causes us to
   A. notice stimuli that have been associated with reinforcement.
B. avoid tastes that are unfamiliar.
C. “like” certain stimuli.
D. “want” certain stimuli.
E. both A. and D.
Bloom’s Taxonomy: Apply

5-29. Nearly all drugs and natural reinforcers cause
   A. a decrease in activity of GABA in the cortex.
   B. an increase in noradrenaline activity in the nucleus accumbens.
   C. an increase in dopamine activity in the nucleus accumbens.
   D. an increase in dopamine activity in the basal ganglia.
   E. all of the above.
Bloom’s Taxonomy: Understand

5-30. The mesolimbic dopamine system and the nucleus accumbens can be thought of as
   A. a liking system.
   B. a pleasure system.
   C. a wanting system.
   D. a sensory system.
   E. none of the above.
Bloom’s Taxonomy: Know

5-31. One difference between drug reinforcers and natural reinforcers is
   A. natural reinforcers are stronger.
   B. natural reinforcers have a satiation mechanism whereas drug reinforcers do not.
   C. drug reinforcers tend to have slower effects than natural reinforcers.
   D. drug reinforcers use a different brain circuitry than natural reinforcers.
   E. natural reinforcers do not show tolerance whereas drug reinforcers do.
Bloom’s Taxonomy: Understand

5-32. The incentive sensitization theory was proposed by
   A. Robinson and Berridge.
   B. Donald O. Hebb.
   C. Koob and Le Moal.
   D. Solomon and Corbit.
   E. Richard Herrnstein.
Bloom’s Taxonomy: Know

5-33. Excessive incentive salience can explain
   A. craving.
   B. wanting.
   C. liking.
   D. euphoria.
   E. hedonic dysregulation.
Bloom’s Taxonomy: Understand
5-34. According to Incentive Sensitization Theory, the subjective consequence of activation of the mesolimbic dopamine system is
   A. liking.        
   B. pain.         
   C. reinforcement. 
   D. wanting.      
   E. withdrawal.  
Bloom’s Taxonomy: Understand

5-35. Brain imaging studies in addicts and former addicts show stimuli associated with drug use
   A. are neutral stimuli. 
   B. are subject to more cognitive processing. 
   C. cause pleasure. 
   D. cause withdrawal sickness. 
   E. slow the processing of information in the cortex. 
Bloom’s Taxonomy: Apply

5-36. When the set point of a homeostatic process constantly changes, this is called
   A. dysregulation. 
   B. dysphoria. 
   C. allostasis. 
   D. discounting. 
   E. none of the above. Set points never change. 
Bloom’s Taxonomy: Know

5-37. Hedonic dysregulation theory proposes that
   A. psychological dependence model of addiction can be explained by brain processes 
   B. Brain reward systems and the antireward systems are out of balance due to drug abuse 
   C. Addiction involves disrupted neurotransmitter functioning and neuroadaptation in the mesolimbic dopamine system 
   D. Participation in other non-drug activities are less and less reinforcing, and eventually their control over behavior diminishes in addiction 
   E. All of the above. 
Bloom’s Taxonomy: Understand

5-38. Hypoactivity of the prefrontal cortex relates to drug addiction as it
   A. decreases drive to use drugs 
   B. reduces decision-making ability to regulate drug abuse 
   C. decreases dopamine release in the nucleus accumbens 
   D. helps an addict to realize the abuse problem 
   E. increases decision-making ability to regulate drug abuse 
Bloom’s Taxonomy: Understand
Short Answers

1. Compare drug abuse and drug dependence disorders as they are defined in DSM-IV.
   Bloom’s Taxonomy: Understand

2. Describe and compare physical drug dependence and psychological drug dependence.
   Bloom’s Taxonomy: Understand

3. Explain why Pickens and Thompson (1968) experiment was important for the drug dependence research?
   Bloom’s Taxonomy: Understand

4. List and describe four factors that can alter the reinforcing value of drugs.
   Bloom’s Taxonomy: Understand

5. How does the positive reinforcement model explain drug abuse?
   Bloom’s Taxonomy: Apply

6. Describe the mesolimbic dopamine system, and how it relates to drug dependence.
   Bloom’s Taxonomy: Apply

7. How does the incentive sensitization theory explain the development of drug addiction?
   Bloom’s Taxonomy: Apply

8. How does the hedonic dysregulation theory explain the development of drug addiction?
   Bloom’s Taxonomy: Apply

9. What is detoxification treatment?
   Bloom’s Taxonomy: Apply

10. Explain why replacement therapy (such as methadone for heroin) to prevent withdrawal syndrome most likely will not work if used as the only treatment option?
    Bloom’s Taxonomy: Analyze

11. Why is it stated in the textbook that one of the greatest challenges in treating substance abuse is to overcome denial?
    Bloom’s Taxonomy: Analyze

12. Explain why it is said that the drug dependence is based on wanting not liking?
    Bloom’s Taxonomy: Analyze

13. Why do you think detoxification is not a sufficient treatment in helping an addict to stop taking the drug-of-choice?
    Bloom’s Taxonomy: Analyze

14. Explain why hypoactivity of prefrontal cortex is an important factor in drug addiction.
15. Discuss some of the principles of an optimal drug treatment plan as suggested by NIDA.

**Essays**

1. Explain how positive reinforcement model approaches drug dependence problem.
   Bloom’s Taxonomy: Apply

2. Compare incentive sensitization and hedonistic dysregulation theories in how they explain the development of drug addiction.
   Bloom’s Taxonomy: Apply

3. Explain how hypoactivity of the prefrontal cortex relates to longterm drug abuse.
   Bloom’s Taxonomy: Analyze

4. Explain how drugs that modulate mesolimbic dopamine system might be beneficial in treatment of drug addiction.
   Bloom’s Taxonomy: Evaluate

5. Describe the optimal drug abuse treatment program. In your discussion include personal, family, career, medical, and legal problems that the individual affected by drug addiction might have.
   Bloom’s Taxonomy: Hypothesize
Chapter 6

Alcohol

CHAPTER SUMMARY

• Ethyl alcohol is created during the fermentation of the sugar contained in fruits and grains. Fermented beverages, such as wine and beer, have low alcohol content (10 to 15 percent). The concentration of alcohol can be increased by distillation. The result is hard liquor, which usually has an alcohol content of 40 to 50 percent.

• Alcohol has been consumed in fermented fruit by our fruit-eating ancestors for millions of years but has been deliberately made for only about the past 10,000 years.

• Alcohol consumption in the United States has cycled through highs and lows. Currently, its use is declining.

• Alcohol levels in the blood can be measured with a Breathalyzer and are usually reported in terms of percentage, or milligrams of alcohol in 100 milliliters of blood, or in SI units.

• Alcohol is consumed orally. It is absorbed quickly and distributed evenly in body water. It easily crosses the blood–brain barrier and the placental barrier.

• Most of the alcohol consumed is metabolized by the enzyme alcohol dehydrogenase at a constant rate, which averages about 15 mg per 100 ml of blood per hour.

• Alcohol does not have a specific receptor site but is known to alter the functioning of neurotransmitters, including glutamate and GABA.

• Even at low levels, alcohol disrupts performance and can interfere with complex activities. It generally causes feelings of happiness and reduces the ability of aversive events to control behavior. Higher doses cause loud, vigorous behavior, and even higher doses cause loss of consciousness and, finally, death.

• Alcohol can cause memory disruption in the form of either a grayout (fragmentary memory loss due to dissociation) or an en bloc blackout (complete loss of the ability to form new memories while intoxicated).

• Increasing BAL is associated with an increased risk of being involved in an automobile accident, and the risk is much higher in young and inexperienced drivers.

• The discriminative stimulus effects are similar to the barbiturates and can be blocked by a serotonin receptor blocker.

• Tolerance develops to the effects of alcohol through many different processes. Alcohol causes physical dependence, and the withdrawal symptoms of the late major type (delirium tremens) can be quite severe and may even cause death if not treated.
• Both humans and nonhumans self-administer alcohol in a similar pattern involving binges and erratic periods of abstinence. Consumption is influenced by culture, gender, age, and availability.

• There are many explanations of excessive drinking or alcoholism. The disease model claims that alcoholism is a disease and that alcoholics are different from nonalcoholics even before they start drinking. In addition, because of “loss of control,” alcoholics can never drink in moderation and are unable to control their drinking.

• There is little evidence to support alcohol loss of control in alcoholics, and only small differences have been found between those with a positive family history of alcoholism and those with a negative family history.

• Alcohol can cause physical dependence. It also causes a hangover.

• Alcohol has many harmful effects, including death by respiratory suppression in high doses. Acute effects can cause both industrial and automobile accidents, and continuous use can cause cirrhosis of the liver, Wernicke–Korsakoff syndrome, and various types of cancer and heart disease. In addition, if taken during pregnancy, alcohol can cause various malformations of the fetus known as fetal alcohol syndrome (FAS) or alcohol-related neurobehavioral disorder (ARND).

• Low to moderate levels of alcohol consumption can have health benefits, including reduction in the risk of cardiac disease and stroke.

• Excessive alcohol use, or alcoholism, can be treated, but success rates are low.

• There are numerous treatments for alcoholism, including Alcoholics Anonymous and pharmacotherapies such as disulfiram and naltrexone.

Multiple Choices

6-1. Isopropyl, methyl, and ethyl are
   A. types of fermentation.
   B. metabolites.
   C. enzymes.
   D. types of alcohol.
   E. proof spirits.

Bloom’s Taxonomy: Know

6-2. In fermentation, ethanol is created by the action of
   A. heat.
   B. water.
   C. yeasts.
   D. carbon dioxide.
   E. alcohol.

Bloom’s Taxonomy: Know
6-3. In fermentation
   A. sugar is converted to alcohol and carbon dioxide.
   B. carbon dioxide is converted into water and alcohol.
   C. sugar is converted into alcohol and carbon monoxide.
   D. alcohol is consumed by yeasts and the result is carbon dioxide and water.
   E. none of the above.
Bloom’s Taxonomy: Know

6-4. Distillation
   A. is a result of the action of yeasts.
   B. can increase the concentration of alcohol because the boiling point of alcohol is lower than that of water.
   C. was invented in the 19th century and caused the gin epidemic.
   D. was practiced regularly by the ancient Greeks at their symposia.
   E. is the process used to make wine from grape juice.
Bloom’s Taxonomy: Know

6-5. The earliest evidence that humans were brewing alcoholic beverages in China dates back
   A. 1,000 years.
   B. 2,500 years.
   C. 5,000 years.
   D. 7,000 years.
   E. 9,000 years.
Bloom’s Taxonomy: Know

6-6. The temperance movement was the most successful in the United States in the 1900s because
   A. it was in tune with the moral tenor of the new republic.
   B. it filled the same social function as drinking.
   C. it provided a sense of righteousness that a tavern could not.
   D. alcohol was becoming very expensive.
   E. all of A., B., and C.
Bloom’s Taxonomy: Know

6-7. Currently, alcohol use in the United States is declining,
   A. and will likely continue to decline.
   B. and will likely level off and remain stable.
   C. and will likely return to a peak level in about years 2040-2050.
   D. but no patterns exist and so future use is completely unpredictable.
   E. but will increase if there is another war or some major stressful event.
Bloom’s Taxonomy: Know

6-8. Which of the following is in SI Units?
   A. 80.0 mg alcohol/100 ml blood.
   B. 0.08 mg%.
C. 1.74 mmol/l of blood.
D. 80 mg alcohol/dl blood.
E. 0.08%.

Bloom’s Taxonomy: Know

6-9. Which of the following can influence the oral absorption of alcohol?
   A. food.
   B. carbonation.
   C. concentration of alcohol.
   D. none of the above.
   E. all of A., B., and C.

Bloom’s Taxonomy: Know

6-10. First pass metabolism of alcohol is
   A. the alcohol excreted in the first urination after drinking has started.
   B. metabolism of alcohol by the MEOS.
   C. metabolism of alcohol by alcohol dehydrogenase, the first step in alcohol metabolism.
   D. the metabolism of alcohol in the stomach before absorption.
   E. responsible for stomach ulcers.

Bloom’s Taxonomy: Know

6-11. First pass metabolism of alcohol
   A. is reduced by taking H2 receptor antagonists.
   B. is less in women than in men.
   C. is reduced when the stomach is empty.
   D. all of A., B., and C.
   E. none of A., B., or C.

Bloom’s Taxonomy: Know

6-12. The time for blood alcohol levels to reach the beginning of the plateau is variable, but is
   usually about
   A. 10 minutes.
   B. 30 minutes.
   C. 40 minutes.
   D. 60 minutes.
   E. 90 minutes.

Bloom’s Taxonomy: Know

6-13. It is possible to convert the BAL in mg/100 ml to percent
   A. by shifting the decimal 3 places to the left.
   B. by shifting the decimal 3 places to the right.
   C. by shifting the decimal 2 places to the left.
   D. by shifting the decimal 2 places to the right.
   E. none of the above. Conversion is not possible because they are measures of two
different things.

Bloom’s Taxonomy: Understand
6-14. The first step in the metabolism of alcohol is controlled by
   A. formaldehyde.
   B. acetaldehyde.
   C. aldehyde dehydrogenase.
   D. alcohol dehydrogenase.
   E. none of the above.
Bloom’s Taxonomy: Know

6-15. Acetyl Coenzyme A, a byproduct of alcohol metabolism, is used by the body to produce
   A. thiamine.
   B. energy.
   C. fatty acids and steroids.
   D. ethanol and methanol.
   E. both B. and C.
Bloom’s Taxonomy: Know

6-16. The MEOS is
   A. a metabolite of alcohol.
   B. another name for acetyl-coenzyme A.
   C. a system for metabolizing alcohol.
   D. responsible for increased tolerance to alcohol in heavy drinkers.
   E. both C. and D.
Bloom’s Taxonomy: Know

6-17. Pat and Chris have the same body weight and drink the same amount of alcohol under the
   same conditions. Pat will reach a higher blood alcohol level if
   A. Pat is a woman and Chris is a man.
   B. Pat is a man and Chris is a woman.
   C. Pat and Chris are both women, but Chris is drinking on an empty stomach and Pat
     has had a meal.
   D. Chris is drinking sparkling wine and Pat is drinking still wine.
   E. it is not possible to answer this question with the information provided.
Bloom’s Taxonomy: Apply

6-18. Alcohol alters the effect of glutamate by
   A. blocking the glutamate receptor site.
   B. blocking the ion channel controlled by glutamate.
   C. blocking the metabolism of glutamate.
   D. stimulating the glutamate receptor site.
   E. none of the above. Alcohol has no effect on glutamate transmission.
Bloom’s Taxonomy: Know

6-19. Alcohol causes the release of dopamine in the nucleus accumbens by
   A. stimulating the 5-HT₃ receptor.
   B. blocking DA reuptake .
6-20. An amethystic is
   A. a drug that has a similar effect to alcohol.
   B. a member of a class of drugs that potentiate alcohol.
   C. a class of substances that antagonize the effects of alcohol.
   D. a substance that relieves alcohol hangover.
   E. a monk that abstains from all contact with alcohol or people who consume alcohol.
Bloom’s Taxonomy: Know

6-21. “Amethystic” is the name for a substance that
   A. speeds the absorption of alcohol.
   B. slows the absorption of alcohol.
   C. blocks first pass metabolism of alcohol.
   D. counteracts the effects of alcohol.
   E. none of the above.
Bloom’s Taxonomy: Know

6-22. Which of the following is/are able to reverse all of the effects of alcohol?
   A. RO 15-4513.
   B. some serotonin receptor blockers.
   C. opiate antagonists.
   D. coffee.
   E. none of the above.
Bloom’s Taxonomy: Know

6-23. Alcohol can cause which of the following perceptual effects?
   A. increases in absolute and difference thresholds at high doses.
   B. decreased visual acuity.
   C. decreased peripheral vision.
   D. decreased pain sensitivity.
   E. all of the above.
Bloom’s Taxonomy: Know

6-24. Studies with the POMS and the ARCI show that
   A. alcohol has a biphasic effect on mood.
   B. alcohol causes a decrease in visual sensitivity.
   C. alcohol increases peripheral blood flow.
   D. alcohol activates dopamine in the nucleus accumbens.
   E. alcohol activates the medial forebrain centers involved in decision making.
Bloom’s Taxonomy: Know

6-25. Alcohol impairs tasks involving hand-eye coordination. PET studies have shown that this
may be because
A. alcohol inhibits the motor cortex.
B. alcohol blocks sodium ion channels on the axons of motor nerves.
C. alcohol blocks dopamine receptors in the extrapyramidal motor system.
D. alcohol reduces blood flow to the cerebellum.
E. alcohol inhibits neurons in the basal ganglia.

Bloom’s Taxonomy: Know

6-26. A sensitive measure if alcohol is the Romberg _______ Test
   A. Sway.
   B. Strength.
   C. Reaction Time.
   D. Rotor.
   E. Coordination.

Bloom’s Taxonomy: Know

6-27. Alcohol causes the skin to turn pink because of
   A. embarrassment.
   B. sexual stimulation.
   C. excessive urination alters the pH of the blood.
   D. increased energy created by stimulation of the citric acid cycle.
   E. dilation of blood vessels in the skin.

Bloom’s Taxonomy: Apply

6-28. Grayout is
   A. when alcohol causes amnesia because memories of events are never formed.
   B. a result of dissociation.
   C. an amnesia that occurs only in light drinkers.
   D. an alcohol amnesia, but events can be recalled if the person is reminded of them.
   E. both B. and D.

Bloom’s Taxonomy: Understand

6-29. A fragmentary blackout is also known as
   A. a true blackout.
   B. an alcoholic blackout.
   C. a grayout.
   D. AAML (Alcohol Associated Memory Loss).
   E. en bloc blackout.

Bloom’s Taxonomy: Know

6-30. An en bloc blackout is
   A. when alcohol causes amnesia because memories of events are never formed.
   B. a result of dissociation.
   C. an amnesia that occurs only in light drinkers.
   D. an alcohol amnesia where events can be recalled if the person is reminded of them.
   E. both B. and D.
Bloom’s Taxonomy: Know

6-31. The curve relating the probability of being involved in a fatal crash to BAL
   A. increases in a straight line with increasing BAL.
   B. increases more rapidly at higher BALs.
   C. is different for different age groups.
   D. is different for different genders.
   E. both B. and C.

Bloom’s Taxonomy: Know

6-32. Low blood alcohol levels (less than 50 mg/100 ml blood) are most likely to cause
   automobile accidents in drivers of which age group?
   A. 16 to 17 years.
   B. 18 to 24 years.
   C. 25 to 34 years.
   D. 35 to 54 years.
   E. 55 to 65 years.

Bloom’s Taxonomy: Know

6-33. High blood alcohol levels (greater than 100 mg/100 ml blood) are least likely to cause
   automobile accidents in drivers of which age group?
   A. 16 to 17 years.
   B. 18 to 24 years.
   C. 25 to 34 years.
   D. 35 to 54 years.
   E. 55 to 65 years.

Bloom’s Taxonomy: Know

6-34. Alcohol tends to increase behavior that is normally suppressed by punishment or adverse
   consequences. This is
   A. grayout.
   B. depression.
   C. disinhibition.
   D. the Romberg effect.
   E. CER.

Bloom’s Taxonomy: Know

6-35. The stimulus properties of alcohol
   A. are completely unique.
   B. are exactly the same as the barbiturates.
   C. generalize to the barbiturates, but can be discriminated from the barbiturates.
   D. will generalize to the benzodiazepines and other depressants.
   E. are weak and require many trials to demonstrate.

Bloom’s Taxonomy: Understand

6-36. The stimulus properties of alcohol can be blocked by
A. haloperidol - a D\textsubscript{2} receptor blocker.
B. 5-HT\textsubscript{3} receptor blockers.
C. GABA\textsubscript{A} receptor blockers.
D. caffeine.
E. none of the above. The stimulus properties of alcohol cannot be blocked.

Bloom’s Taxonomy: Know

6-37. Which of the following types of tolerance has/have been demonstrated with alcohol?
A. acute tolerance.
B. chronic tolerance.
C. metabolic tolerance.
D. behavioral tolerance.
E. all of the above.
Bloom’s Taxonomy: Know

6-38. Chronic use of alcohol can cause withdrawal effects that
A. are seldom serious and never life threatening.
B. are frequently treated by physicians with caffeine or other mild stimulants.
C. last less than two days.
D. frequently involve hallucinations of large animals with unusual coloring.
E. can cause death if not treated.
Bloom’s Taxonomy: Know

6-39. Which of the following correctly label(s) the possible withdrawal symptoms associated
with the abstinence of alcohol consumption after chronic use?
A. late major syndrome.
B. chronic alcohol syndrome (CAS).
C. early minor syndrome.
D. grayout.
E. both A and C.
Bloom’s Taxonomy: Understand

6-40. Delirium tremens is also known as
A. early minor symptoms.
B. late major symptoms.
C. DTs.
D. all of the above.
E. both B. and C.
Bloom’s Taxonomy: Know

6-41. As people get older they tend to
A. drink alcohol more frequently, but in smaller quantities on each occasion.
B. drink alcohol more frequently in the same quantities on each occasion.
C. drink alcohol less frequently, but in larger quantities on each occasion.
D. drink alcohol less frequently, and in smaller quantities on each occasion.
E. drink alcohol at the same frequency, but in smaller quantities on each occasion.
Bloom’s Taxonomy: Know

6-42. Cross-cultural studies have shown that alcohol consumption in most cultures is
A. generally a male activity.
B. practiced outside the home and not in the company of family members.
C. acceptable for men.
D. not acceptable for mothers and priests.
E. all of the above.

6-43. As people get older
A. alcohol consumption increases.
B. alcohol consumption does not change.
C. alcohol consumption declines.
D. they drink more, but they achieve the same BAL as they did when younger.
E. they tend to switch from wines and beers to hard liquor.

6-44. E.M. Jellinek wrote a book called
A. “Loss of Control.”
B. “The Disease Concept of Alcoholism.”
C. “Behavioral Analysis of Alcoholism.”
D. “Alcoholics Anonymous.”
E. “Physical Dependence on Alcohol.”

6-45. According to Jellinek, the change from becoming a problem drinker to a gamma alcoholic is indicated by
A. physical dependence indicated by withdrawal symptoms such as the DTs.
B. constant tremors.
C. loss of control.
D. continued drinking even though it is causing health, financial and family problems.
E. both A. and C.

6-46. Attempts to identify a physiological basis for alcoholism by comparing alcoholics with non-alcoholics are hindered by
A. a reluctance on the part of alcoholics to take part in studies.
B. possible differences in the physiology of alcoholics due to abuse of alcohol.
C. lack of support for the disease model.
D. Alcoholics Anonymous.
E. none of the above.

6-47. The lethal BAL for alcohol that causes death within an hour or two is
A. 80 mg/100 ml.
B. 100 mg/100 ml.
C. 400 mg/100 ml.
D. 500 mg/100 ml.
E. 1000 mg/100 ml.

Bloom’s Taxonomy: Know

6-48. The TI of alcohol is about
   A. 1.0
   B. 3.3
   C. 10
   D. 100
   E. 3500

Bloom’s Taxonomy: Know

6-49. Moderate alcohol consumers
   A. have less risk of death from heart attack than abstainers.
   B. have the same probability of death as abstainers when all types of mortality are considered.
   C. have a greater risk of death than abstainers.
   D. who are over 60 years old have a greater risk of death than abstainers over 60.
   E. both A. and B.

Bloom’s Taxonomy: Know

6-50. Prolonged alcohol abuse may eventually lead to cirrhosis of the liver which is characterized by
   A. the development of scar tissue on the liver.
   B. the development of "liver spots" on the skin.
   C. the reduction of fat levels in the liver.
   D. an enhanced immune system.
   E. no involvement of the liver whatsoever.

Bloom’s Taxonomy: Know

6-51. Korsakoff's psychosis
   A. results from a deficiency of thiamin.
   B. is another name for alcohol withdrawal.
   C. is also known as cerebellar syndrome.
   D. is a result of the effects of alcohol on the liver.
   E. is the cause of Fetal Alcohol Syndrome.

Bloom’s Taxonomy: Know

6-52. Which of the following is NOT a belief held by those who believe alcoholism is a disease?
   A. there is no cure for alcoholism.
   B. drinking can only be controlled by relying on a stronger power such as God.
   C. members are expected to attend regular meetings for extended periods of time.
   D. it is possible for alcoholics to become social drinkers with support from fellow members.
E. the organization only wants to help those that want to stop drinking.

Bloom’s Taxonomy: Understand

6-53. Antabuse is a chemical treatment of alcoholism that
   A. blocks the enzyme that breaks down alcohol.
   B. blocks the enzyme that breaks down acetaldehyde.
   C. relieves the stress and anxiety that causes people to drink.
   D. diminishes the severity of withdrawal.
   E. diminishes the need to drink by blocking serotonin receptors.

Bloom’s Taxonomy: Know

6-54. Which is the most successful type of treatment for alcoholism?
   A. A.A.
   B. pharmacotherapies.
   C. counseling.
   D. antabuse.
   E. none of the above. All have about the same success rate.

Bloom’s Taxonomy: Know

Short Answers

1. Describe alcohol first-pass metabolism in females versus in males.
   Bloom’s Taxonomy: Understand

2. Describe the metabolism pathway for alcohol in the liver.
   Bloom’s Taxonomy: Understand

3. Describe the main behavioral effects of alcohol in low BAC compared to high BAC.
   Bloom’s Taxonomy: Understand

4. Describe what effects alcohol has on glutamate and GABA functions in the brain.
   Bloom’s Taxonomy: Understand

5. Briefly summarize the methods of alcohol production.
   Bloom’s Taxonomy: Apply

6. Explain why alcohol is a nervous system depressant.
   Bloom’s Taxonomy: Apply

7. Describe the grayout and en-bloc memory blackouts during alcohol intoxication.
   Bloom’s Taxonomy: Apply

8. Describe two ways how to increase blood alcohol concentration by enhanced absorption of alcohol.
   Bloom’s Taxonomy: Apply
9. What are the effects of alcohol on driving abilities in younger drivers?
Bloom’s Taxonomy: Apply

10. Explain how alcohol can be considered reinforcing based on its effect on the mesolimbic dopamine system.
Bloom’s Taxonomy: Analyze

11. Explain the difference between gamma alcoholics and problem drinkers.
Bloom’s Taxonomy: Analyze

12. What are the main adverse effects of long term alcohol abuse?
Bloom’s Taxonomy: Analyze

13. Are there any benefits of alcohol drinking, and which population might benefit the most?
Bloom’s Taxonomy: Analyze

14. How does Alcoholics Anonymous support those who attempt to stop alcohol abuse?
Bloom’s Taxonomy: Evaluate

15. Discuss the pharmacological treatments for alcoholism, which drugs have been shown to reduce drinking?
Bloom’s Taxonomy: Evaluate

**Essays**

1. Describe in detail the types of tolerance alcohol can cause.
Bloom’s Taxonomy: Apply

2. Describe in detail the effects of alcohol on human performance.
Bloom’s Taxonomy: Apply

3. Describe the withdrawal syndrome seen after prolonged alcohol abuse; include the effects on the glutamate and the GABA systems in the brain.
Bloom’s Taxonomy: Analyze

4. Compare Alcoholics Anonymous treatment program and the pharmacological treatment options, which has a higher success rate?
Bloom’s Taxonomy: Evaluate

5. Why do you think it is so difficult for an alcoholic to stop drinking?
Bloom’s Taxonomy: Hypothesize
Chapter 7

Anxiolytics and Sedative-Hypnotics

CHAPTER SUMMARY

- Anxiolytics are used to treat agitation and anxiety, and sedative-hypnotics are used to sedate people and help them sleep (i.e., they are sleeping pills).

- The benzodiazepines are a class of drugs that was developed in the 1950s and became popular during the 1960s and 1970s for the control of anxiety and insomnia. Benzodiazepines replaced the barbiturates because they are much safer. There are newer drugs introduced in the late 1990s called Z drugs that appear to be replacing the benzodiazepines.

- These drugs are absorbed readily after oral administration. They may also be injected, depending on the medical reason the drug is being used. Their speed of absorption depends on their lipid solubility. Highly lipid-soluble drugs are redistributed into body fat.

- Benzodiazepines and barbiturates enhance the action of GABA, an inhibitory transmitter found widely throughout the brain. They act via their own receptors, which are located on the GABA<sub>A</sub> receptor–chloride ionophore complex. This action potentiates the ability of GABA to stabilize the cell membrane. As a result, they are called positive GABA<sub>A</sub> modulators. At higher doses, barbiturates but not benzodiazepines are able to open the ion channel directly.

- The benzodiazepines and barbiturates essentially have similar effects and the speed of action determined their use; fast-acting drugs were used as sedative-hypnotics, while longer-acting drugs were used as anxiolytics.

- The GABA receptor–ionophore complex is made of five different subunits, and there are many different varieties of subunits. Different subunits are located in receptors in different sites that control different systems. The Z drugs appear to selectively affect different subunits, so these drugs can specifically target different symptoms.

- The effects of the benzodiazepines on human performance are similar to those of alcohol. Some of these effects are still evident on the day following the use of barbiturates and benzodiazepines as sleeping pills, although the individual may not be aware of the effects. Some of the newer sedative-hypnotics like zopiclone do not appear to have this residual effect. High doses of barbiturates but not benzodiazepines cause death from respiratory depression, which results from a depression of the respiratory centers in the medulla.

- In low doses, the benzodiazepines cause decreases in arousal and vigor and increases in fatigue and confusion. They also decrease feelings of anxiety—their chief medical use. They interfere with memory and slow reaction time, and the drug impairs other skills, including driving. This effect is potentiated by alcohol.

- The benzodiazepines can cause amnesia for events that occur while they are in effect and have an effect on explicit memories.
There have been ample demonstrations that the benzodiazepines increase behaviors suppressed by punishment. This effect in nonhumans predicts the antianxiety effect of these drugs in humans.

Tolerance develops to many of the effects of these drugs, including their therapeutic effects.

There are two separate patterns of withdrawal from the benzodiazepines: (a) the sedative-hypnotic type, similar to withdrawal from alcohol and the barbiturates, and (b) low-dose benzodiazepine withdrawal, which emerges slowly after therapeutic doses have been stopped. The symptoms of anxiety, panic, irregular heartbeat, and memory impairment come and go in cycles of about 10 days and may last for 6 months to a year.

Benzodiazepines have reinforcing properties in both humans and nonhumans and are readily self-administered. In humans, there are two patterns of use: (a) iatrogenic or physician-caused use and (b) illegal street use. The illegal pattern is characterized by episodic binges. Benzodiazepines are frequently used in conjunction with other drugs such as heroin, cocaine, or alcohol. Flunitrazepam (Rohypnol) appears to be the most highly preferred benzodiazepine for street use.

Because of their lethal effects, the barbiturates have caused many accidental poisonings. Benzodiazepines are much safer but can be fatal when combined with high doses of alcohol.

Multiple Choices

7-1. Which of the following disorder is related to physical symptoms such as increased heart rate, shortness of breath, and fear of dying?
   A. Obsessive compulsive disorder
   B. Panic disorder
   C. Posttraumatic stress disorder
   D. Depression
   E. Generalized anxiety disorder
   Bloom’s Taxonomy: Know

7-2. Which was the first benzodiazepine synthesized?
   A. chlordiazepoxide
   B. diazepam
   C. oxazepam
   D. nitrazepam
   E. clonazepam
   Bloom’s Taxonomy: Know

7-3. Which of the following is not a benzodiazepine?
   A. diazepam
   B. flurazepam
   C. oxazepam
   D. clonazepam
E. None of the above. They are all benzodiazepines.
Bloom’s Taxonomy: Know

7-4. Which benzodiazepine is highly lipid soluble and reaches its peak concentration the brain in 30 to 60 minutes?
   A. chlordiazepoxide
   B. diazepam
   C. oxazepam
   D. chlorpromazine
   E. N-desmethyldiazepam
Bloom’s Taxonomy: Know

7-5. Benzodiazepines are absorbed more rapidly when taken orally than intramuscularly because
   A. they are weak acids.
   B. they have a pKa of 5.
   C. they are lipid-soluble.
   D. they tend to bind to protein at the IM injection site.
   E. All of A., B., and C.
Bloom’s Taxonomy: Understand

7-6. The rates of absorption of which drug can be drastically increased after drinking alcohol?
   A. barbital
   B. diazepam
   C. zaleplon
   D. methaqualone
   E. meprobamate
Bloom’s Taxonomy: Know

7-7. Which of the benzodiazepines does not appear to have any active metabolites?
   A. diazepam
   B. chlordiazepoxide
   C. oxazepam
   D. flurazepam
   E. clorazepate
Bloom’s Taxonomy: Know

7-8. Benzodiazepines alter the functioning of which transmitter?
   A. dopamine
   B. NE
   C. 5-HT
   D. peptides
   E. GABA
Bloom’s Taxonomy: Know

7-9. The metabolism of benzodiazepines can be slowed by
   A. alcohol.
7-10. The benzodiazepines have which effect on the GABA receptor-ionophore complex?
A. they act as GABA agonists at the GABA receptor
B. they act as GABA antagonists at the GABA receptor
C. they potentiate the ability of GABA to open the ionophore
D. they directly cause the ionophore to open
E. they compete with GABA for GABA receptors
Bloom’s Taxonomy: Understand

7-11. Which GABA receptor is directly linked to gated chloride channel?
A. GABA_A
B. GABA_B
C. GABA_C
D. GABA_D
E. GABA_E
Bloom’s Taxonomy: Understand

7-12. Which of the following have a low affinity for the benzodiazepine receptor and have a weak effect?
A. diazepam
B. flunitrazepam
C. midazolam
D. triazolam
E. abecarnil
Bloom’s Taxonomy: Know

7-13. A positive GABA modulator
A. stimulates the release of GABA
B. blocks the release of GABA
C. increases the ability of GABA to open the chloride ionophore via the GABA_A receptor.
D. alters the subunits of the GABA receptor-chloride ionophore complex.
E. None of the above.
Bloom’s Taxonomy: Apply

7-14. How many subunits make up the GABA receptor-chloride channel complex?
A. 1
B. 2
C. 3
D. 4
E. 5
Bloom’s Taxonomy: Know
7-15. Which drug is capable of acting only at GABA receptors with a particular subunit?
A. diazepam
B. pentobarbital
C. qualudes
D. Z drugs
E. None of the above. All these drugs affect all types of GABA receptors.

Bloom’s Taxonomy: Apply

7-16. Which of the following acts at GABA_B receptors?
A. diazepam
B. zopiclone
C. pentobarbital
D. GHB
E. None of the above

Bloom’s Taxonomy: Know

7-17. An inverse agonist at a benzodiazepine receptor will cause
A. increases in anxiety
B. decreases in anxiety
C. sleep
D. reinforcing effects
E. increases in inhibitory tone.

Bloom’s Taxonomy: Apply

7-18. Which of the following is not an effect of therapeutical doses of benzodiazepines?
A. muscle relaxation
B. anticonvulsant effects
C. increased appetite
D. respiratory depression
E. increase in beta waves and a decrease in alpha waves in the EEG

Bloom’s Taxonomy: Understand

7-19. Which of the following is a disadvantage of using the benzodiazepines to treat insomnia?
A. respiratory depression
B. low margin of safety
C. REM suppression
D. hangover
E. Both C. and D.

Bloom’s Taxonomy: Understand

7-20. Which of the following changes in feelings have been reported after taking benzodiazepines?
A. increases in fatigue
B. increases in confusion
C. decreases in arousal
D. decreases in vigor
E. All of the above

Bloom’s Taxonomy: Know

7-21. The stimulus properties of the benzodiazepines will generalize to which of the following drugs?
   A. amphetamine
   B. chlorpromazine
   C. haloperidol
   D. barbiturates
   E. None of the above

Bloom’s Taxonomy: Know

7-22. Which of the following benzodiazepines is most likely to increase “liking” and “take again” scores in healthy volunteers?
   A. diazepam
   B. triazolam
   C. flunitrazepam
   D. clonazepam
   E. alprazolam

Bloom’s Taxonomy: Know

7-23. Benzodiazepines are effective in relieving anxiety in what percent of anxious individuals?
   A. 10-12%
   B. 30-40%
   C. 40-50%
   D. 60-70%
   E. 90-100%

Bloom’s Taxonomy: Know

7-24. Which type of memory is affected by the benzodiazepines?
   A. implicit memory
   B. explicit memory
   C. long term memory
   D. short term memory
   E. none of the above.

Bloom’s Taxonomy: Apply

7-25. The sedative-hypnotic type withdrawal symptoms are seen when benzodiazepines have been stopped after
   A. being used in higher than recommended therapeutic doses for at least a month.
   B. being used at recommended therapeutic doses for at least a month.
   C. being used at higher than recommended therapeutic doses for six months.
   D. being used at recommended therapeutic doses for six months.
   E. Both A. and D.

Bloom’s Taxonomy: Understand
7-26. Low dose withdrawal syndrome to benzodiazepines is seen after the drug has been taken at recommended doses for longer than  
   A. one month.  
   B. two months.  
   C. four months.  
   D. six months.  
   E. None of the above. Low doses of benzodiazepines do not cause withdrawal symptoms.  
Bloom’s Taxonomy: Know

7-27. Most benzodiazepine abuse is a result of  
   A. physician prescribing practices.  
   B. fear of withdrawal.  
   C. easy availability on the street.  
   D. the intense feelings of pleasure caused by the drug.  
   E. the association of the drug with the middle class.  
Bloom’s Taxonomy: Know

7-28. Some of the symptoms of low-dose benzodiazepine withdrawal are  
   A. tremors, delirium and cramps.  
   B. anxiety, panic and increased blood pressure.  
   C. decreased heart rate, confusion and awakenings.  
   D. a fear of multiple-choice questions and small furry creatures.  
   E. None of the above  
Bloom’s Taxonomy: Know

7-29. The term "iatrogenic" means  
   A. physician caused.  
   B. a type of seizure.  
   C. physical dependency.  
   D. cancer causing.  
   E. a safe medical use.  
Bloom’s Taxonomy: Know

7-30. Which of the following is a short-acting benzodiazepine popular on the street with young people. It is also known as “Mexican Valium” or “roofies?”  
   A. chlordiazepoxide  
   B. diazepam  
   C. flunitrazepam  
   D. midazolam  
   E. nitrazepam  
Bloom’s Taxonomy: Know

7-31. With which class of drugs is it possible to target specific symptoms such as anxiety without producing sedative-hypnotic side effects?  
   A. barbiturates
B. benzodiazepines

C. Z drugs

D. none of the above

E. all of A. B. and C.

Bloom’s Taxonomy: Apply

**Short Answers**

1. Describe the history of barbiturates, also discuss the abuse potential of the barbiturates, and the current therapeutical availability.
Bloom’s Taxonomy: Understand

2. Describe the history of benzodiazepines, also discuss the abuse potential of the benzodiazepines, and the current therapeutical availability.
Bloom’s Taxonomy: Understand

3. What are Z-drugs, and why would they be prescribed?
Bloom’s Taxonomy: Understand

4. Describe the withdrawal symptoms due to high dose benzodiazepine abuse.
Bloom’s Taxonomy: Understand

5. Discuss the most common anxiety-related disorders, why is it important to develop new anxiolytic drugs?
Bloom’s Taxonomy: Apply

6. Explain why benzodiazepines have replaced barbiturates in treatment of anxiety and insomnia.
Bloom’s Taxonomy: Apply

7. Describe some of the problems related to benzodiazepine long-term therapeutical use for treatment of anxiety or insomnia.
Bloom’s Taxonomy: Apply

8. What is Rohypnol, and how does it work?
Bloom’s Taxonomy: Apply

9. What are the treatment options for someone who wants to stop taking benzodiazepines?
Bloom’s Taxonomy: Apply

10. What are the advantages of Z-drugs?
Bloom’s Taxonomy: Analyze

11. Describe the two types of benzodiazepine abuse.
Bloom’s Taxonomy: Analyze
12. Why taking benzodiazepine to relieve test anxiety would not be the best choice?  
Bloom’s Taxonomy: Analyze

13. Compare panic disorder and posttraumatic disorder, and suggest pharmacological treatment options.  
Bloom’s Taxonomy: Analyze

14. In your opinion, are the newer Z-drugs any safer than the barbiturates?  
Bloom’s Taxonomy: Evaluate

15. Compare the abuse potential and side effect of barbiturates, benzodiazepines, and Z-drugs.  
Bloom’s Taxonomy: Evaluate  

**Essays**

1. As a physician describing anxiolytics to someone with a posttraumatic disorder, what other additional therapy options would you consider?  
Bloom’s Taxonomy: Apply

2. Summarize the history of anxiolytic medication from barbiturates to benzodiazepines to Z-drugs. In your opinion are the Z-drugs any safer than barbiturates?  
Bloom’s Taxonomy: Apply

3. Compare the abuse potential and side effect of barbiturates, benzodiazepines, and Z-drugs.  
Bloom’s Taxonomy: Analyze

4. Describe the neurophysiological and behavioral effects of a new anxiolytic drug that is able to relieve test-anxiety without having a sedative side effect.  
Bloom’s Taxonomy: Evaluate

5. If you were the physician prescribing anxiolytics to patients with anxiety-disorders, what are the challenges you might face when making prescription decisions?  
Bloom’s Taxonomy: Hypothesize
CHAPTER 8
Tobacco and Nicotine

CHAPTER SUMMARY

- Nicotine is a drug found exclusively in the tobacco plant, which is consumed either by smoking or chewing or as snuff. It may also be administered in the form of a transdermal patch, nicotine chewing gum, or nasal spray.
- Nicotine is absorbed best from the lungs and is distributed rapidly throughout the body. It is excreted unchanged by the kidneys and metabolized by the liver. It has a variable half-life of about 90-150 minutes.
- Nicotine stimulates and then inactivates nicotinic cholinergic receptors as dose increases. It has effects on both the central and the peripheral nervous system. It causes elevated levels of catecholamines, and it stimulates dopamine in the mesolimbic dopamine reinforcement system.
- Brain imaging studies show that pleasure reported by people who are smoking is correlated with increased dopamine receptor activation in the striatum, where the nucleus accumbens is located.
- Intravenous nicotine causes euphoric feelings in smokers but may cause unpleasant symptoms in nonsmokers. Even though nicotine increases the arousal level in the brain, smokers report that nicotine causes a feeling of relaxation.
- Some studies have shown that nicotine has little effect on performance, but others have concluded that nicotine at certain levels can enhance performance on some tasks.
- Nicotine’s unpleasant withdrawal symptoms include irritability, weight gain, and sleep disturbances. Withdrawal can interfere with performance and has been shown to increase brain activity normally associated with drowsiness.
- Although nicotine is not self-administered by nonhumans as readily as many other drugs, tobacco is a powerful reinforcer for humans.
- Smoking is not healthy. Tobacco smoking has been linked to heart disease, lung diseases such as emphysema and lung cancer, and cancer of the mouth and bladder. Smoking during pregnancy causes increases in the rate of stillbirths and illness in the newborn. Environmental tobacco smoke—both mainstream smoke (smoke inhaled and expelled by smokers) and sidestream smoke (uninhaled smoke from a burning cigarette)—have been shown to present health hazards to nonsmokers.
- As an aid to quitting, nicotine replacement therapy has been developed. However neither the replacement therapy or pharmacological treatments are any more effective than traditional group behavioral therapies.
Multiple Choices

8-1. The principal source of tobacco today is from the plant
   A. Nicotiana tabacum.
   B. Nicotiana rustica.
   C. Nicotiana nicotianine.
   D. Cannabis sativa.
   E. all of A., B., and C.
Bloom’s Taxonomy: Know

8-2. Tobacco originated in
   A. Africa.
   B. Asia.
   C. America.
   D. China.
   E. England.
Bloom’s Taxonomy: Know

8-3. In 1604 Britain, King James I refuted claims of the medical benefits of smoking tobacco in his essay entitled
   A. “The Perils of Tobacco”.
   B. “A Counterblaste to Tobacco”.
   C. “A Refutation of the Medical Benefits of Tobacco”.
   D. “The Evils of Tobacco Smoking”.
   E. “The Infection of Tobacco”.
Bloom’s Taxonomy: Know

8-4. Excluding use by North American native peoples, which of the following methods of tobacco consumption originated in the United States?
   A. cigarettes.
   B. cigars.
   C. snuff.
   D. chewing.
   E. none of the above. All means of popular consumption are European in origin.
Bloom’s Taxonomy: Know

8-5. Which event coincided with the beginning of a decline in popular tobacco consumption?
   A. the publication of "A Counterblaste to Tobacco".
   B. the isolation of nicotine.
   C. the founding of the American temperance movement.
   D. the imposition of tobacco taxes by the British government.
   E. the publication of the U.S. Surgeon General's report in 1964.
Bloom’s Taxonomy: Know

8-6. Which of the following statements regarding global tobacco use is true?
   A. use of tobacco in developing countries is declining.
B. use of tobacco in developing countries is rising.
C. use of tobacco in industrialized nations is declining.
D. both A. and C. are true.
E. both B. and C. are true.

Bloom’s Taxonomy: Know

8-7. Nicotine can be absorbed from cigar and pipe smoke without inhaling because
A. the smoke causes the saliva to become basic and the nicotine is not ionized so it can be absorbed.
B. it is present in a higher concentration in pipe and cigar smoke and diffuses into the blood faster.
C. pipe and cigar smoke taste better and tend to be held in the mouth longer.
D. pipe and cigar smoke are flue-cured and this changes the pH of the nicotine so that it is less likely to be ionized at the pH of the saliva.
E. smoke from pipe and cigars is poorly absorbed from the lungs.

Bloom’s Taxonomy: Apply

8-8. Which of the following is NOT a nicotine replacement therapy?
A. nicotine chewing gum.
B. nicotine patch.
C. nicotine nasal spray.
D. bupropion (Zyban).
E. nicotine inhalers.

Bloom’s Taxonomy: Apply

8-9. Which of the following blocks the receptor stimulated by nicotine?
A. muscarine.
B. atropine.
C. curare.
D. cotenine.
E. ACh.

Bloom’s Taxonomy: Understand

8-10. Nicotine, at the doses used by most smokers, causes
A. a decrease in the patellar reflex.
B. a decrease in muscle strength.
C. a decrease in hand steadiness.
D. respiratory depression.
E. both A. and C.

Bloom’s Taxonomy: Know

8-11. Which of the following is/are effect(s) that smoking has on the skin?
A. drop in skin temperature.
B. increase in wrinkles and aging.
C. decrease in blushing.
D. decrease in sensitivity of touch.
8-12. When people stop smoking
   A. there is no change in mood.
   B. mood worsens and stays bad till smoking resumes.
   C. mood worsens, but returns to normal within three to four weeks.
   D. mood worsens, but returns to normal within three to four weeks and then becomes better that it was during smoking over the next 10 weeks.
   E. mood improves immediately.

8-13. BOLD imaging shows that when chronic smokers abstain from nicotine
   A. performance on a memory task declines.
   B. performance on a simple memory task requires more cognitive activity.
   C. the dorsolateral prefrontal cortex is active during the memory task.
   D. performance on a simple memory task improves whereas performance on a difficult memory task declines.
   E. all of A., B., and C.

8-14. Which of the following describes the effects of nicotine on SMA of nonhumans?
   A. on the first administration there is a decrease and then an increase.
   B. a decrease.
   C. an increase.
   D. on the first few administrations there is a depression after which there is an increase to fairly high levels.
   E. no change in the SMA of nonhumans.

8-15. Symptoms of nicotine withdrawal can be relieved by
   A. chewing gum.
   B. the taste and smell of tobacco.
   C. drinking alcohol.
   D. smoking a denicotinized cigarette.
   E. both B. and D.

8-16. In some experiments, the stimulus properties of nicotine partially generalize to which of the following?
   A. chlordiazepoxide.
   B. caffeine.
   C. d-amphetamine.
   D. pentobarbital.
   E. none of the above.
8-17. The self-administration patterns of nicotine in nonhumans resembles which of the following drugs?
   A. cocaine.
   B. amphetamine.
   C. alcohol.
   D. barbiturates.
   E. none of the above. Nicotine is self-administered by nonhumans under a limited set of conditions.
Bloom’s Taxonomy: Apply

8-18. Which theory of nicotine self-administration is considered to be correct?
   A. the constant blood level theory.
   B. the nicotine bolus theory.
   C. the dual reinforcement model.
   D. the above theories are not mutually exclusive and all may be correct to some extent.
   E. none of the above. All of these theories have been proven incorrect.
Bloom’s Taxonomy: Understand

8-19. The dual reinforcement model explains the self-administration of which drug?
   A. alcohol.
   B. diazepam.
   C. barbiturates.
   D. chlordiazepoxide.
   E. nicotine.
Bloom’s Taxonomy: Know

8-20. The use of nicotine gum to help stop tobacco smoking is an example of which type of therapy?
   A. behavior therapy.
   B. replacement therapy.
   C. psychotherapy.
   D. contracting.
   E. flavor aversion therapy.
Bloom’s Taxonomy: Understand

8-21. Which of the following is not a means of delivering nicotine as an aid to smoking cessation?
   A. transdermal patch.
   B. nicotine gum.
   C. nicotine nasal spray.
   D. nicotine pills.
   E. none of the above. All are used.
Bloom’s Taxonomy: Know

8-22. Which of the following is (are) more likely to be seen in babies born to mothers who
smoke during pregnancy?
   A. lighter birthweight.
   B. more likely to be born prematurely.
   C. more likely to be ill.
   D. more likely to die soon after birth.
   E. all of the above.
Bloom’s Taxonomy: Know

8-23. Because of different combustion temperatures
   A. sidestream smoke has a lower pH than mainstream smoke.
   B. sidestream smoke is absorbed more completely in the same concentrations.
   C. the concentration of carcinogens and toxins is higher in sidestream smoke than
      mainstream smoke.
   D. sidestream smoke is more likely to cause SIDS.
   E. mainstream smoke is more concentrated than sidestream smoke.
Bloom’s Taxonomy: Know

8-24. Nicotine vaccines such as TA-NIC and NicVAX
   A. stimulate the body’s immune system to create antibodies that block nicotine from
crossing the blood-brain barrier.
   B. produce nausea and vomiting when tobacco use occurs, causing the smoker to
associate nicotine consumption with sickness.
   C. create high levels of nicotine antibodies in all people who get vaccinated.
   D. block nicotine receptors in the nucleus accumbens.
   E. block the release of dopamine in the nucleus accumbens.
Bloom’s Taxonomy: Understand

8-25. The experiment with rats and nicotine by Caggiula (2001) demonstrated that
   A. Nicotine is a robust reinforcer in nonhumans.
   B. Conditioned clues associated with nicotine delivery are crucial for nicotine self-
administration.
   C. Conditioned clues associated with nicotine delivery are not crucial for nicotine self-
administration.
   D. The rats did not learn to self-administer nicotine.
   E. Nicotine interfered with conditioned learning.
Bloom’s Taxonomy: Apply

8-26. Which theory of nicotine self-administration has been suggested to explain why smoking
is the most addicting way of consuming tobacco?
   A. psychological tool theory.
   B. physical dependence theory.
   C. titration theory.
   D. nicotine bolus theory.
   E. disease theory.
Bloom’s Taxonomy: Understand
8-27. A nicotine bolus results when
   A. inhaled nicotine does not dissipate in the blood and reaches the brain in high concentration.
   B. tobacco is formed into a small ball for chewing.
   C. moist snuff is tucked into the cheek and absorbed through the mucus membranes.
   D. tobacco is formed into a ball for smoking in a pipe.
   E. chewing tobacco is swallowed and absorbed in the digestive tract.

Bloom’s Taxonomy: Understand

8-28. The half-life of nicotine is estimated to be about
   A. 10 minutes.
   B. 30 minutes.
   C. 1 hour.
   D. 2 hours.
   E. 3 hours.

Bloom’s Taxonomy: Know

8-29. Which of these drugs has a similar function to nicotine in the CNS and alleviates withdrawal from nicotine via binding to mesolimbic dopamine system?
   A. Bupropion
   B. Antabuse
   C. Naltrexone
   D. Varenicline
   E. Sativex

Bloom’s Taxonomy: Know

8-30. Which of the therapy options seems to be most efficient in aiding smoking cessation?
   A. Bupropion
   B. Physician advice
   C. Group behavior therapy
   D. Naltrexone
   E. Nicotine replacement therapy

Bloom’s Taxonomy: Know

Short Answers

1. Describe the history of tobacco use in North-America; include discussion about how the views of the health hazards have changed.
   Bloom’s Taxonomy: Understand

2. Why there is no need to inhale cigar smoke?
   Bloom’s Taxonomy: Understand

3. What happens to nicotine when it is ingested (p.o)?
   Bloom’s Taxonomy: Understand
4. Explain the neuropharmacology of nicotine in the CNS.
Bloom’s Taxonomy: Understand

5. List some of the effects of nicotine in the PNS.
Bloom’s Taxonomy: Apply

6. List some of the effects of nicotine in the CNS.
Bloom’s Taxonomy: Apply

7. Explain why nicotine is a reinforcing drug?
Bloom’s Taxonomy: Apply

Bloom’s Taxonomy: Apply

9. How does varenicline help in smoking cessation?
Bloom’s Taxonomy: Apply

10. Compare the dual reinforcement model and nicotine bolus theory in how they explain nicotine addiction.
Bloom’s Taxonomy: Analyze

11. List some of the harmful effects of tobacco, and compare them to the possible harmful effects of nicotine.
Bloom’s Taxonomy: Analyze

12. What are some non-nicotine factors that might explain nicotine addiction?
Bloom’s Taxonomy: Analyze

13. Do nonhumans self-administer nicotine? If yes, why and how? If not, why not?
Bloom’s Taxonomy: Analyze

14. What are the advantages and challenges of immunization therapy for nicotine addiction?
Bloom’s Taxonomy: Evaluate

15. Compare three pharmaceutical therapies that aid in smoking cessation.
Bloom’s Taxonomy: Evaluate

**Essays**

1. Explain how and why nonhumans self-administer nicotine.
Bloom’s Taxonomy: Apply

2. Explain how nicotine might stimulate cognitive functions.
Bloom’s Taxonomy: Apply
3. Compare the dual reinforcement model, nicotine bolus theory and constant blood level theory in how they explain nicotine addiction.
Bloom’s Taxonomy: Analyze

4. Describe nicotine withdrawal, and explain why the success rates in smoking cessation are so low?
Bloom’s Taxonomy: Evaluate

5. Discuss why pharmaceutical therapy alone is often not sufficient to aid in smoking cessation? What other interventions would you suggest?
Bloom’s Taxonomy: Hypothesize
CHAPTER SUMMARY

- The three commonly used methylxanthine drugs are caffeine, found mainly in coffee; theophylline, found in tea; and theobromine, found in chocolate. Caffeine is also added to some cola beverages, headache medications, and over-the-counter stimulants.

- Beverages that contain methylxanthines have been used in Europe and North America since the 1600s, and their popularity has made them important commodities. Their trading and taxation have played an important role in commerce and history.

- The methylxanthines are readily absorbed orally and distributed throughout the body. After its oral administration, caffeine reaches peak blood levels in 30 to 60 minutes. It is metabolized in the liver and eliminated slowly, with a half-life of about 3.5 hours.

- The main neurophysiological effect of the methylxanthines is that they block receptors of the inhibitory neuromodulator adenosine.

- Caffeine improves performance on boring and tiring tasks.

- Caffeine can delay sleep. Sleep after caffeine is lighter, and people are more easily awakened.

- In nonhumans, caffeine stimulates spontaneous activity and can cause automutilation at larger doses. Operant analysis of the effects of caffeine has shown that its effects are similar to those of amphetamine, with some important differences.

- Caffeine can act as a discriminative stimulus and will generalize partially to cocaine. Humans can also detect the presence of caffeine in low concentrations.

- Doses of 100 to 200 mg of caffeine administered to people who are not tolerant to caffeine are experienced as pleasant, and when it is given intravenously, people report a “high” similar to cocaine. Higher doses are often reported to be unpleasant.

- Tolerance develops to many of the effects of caffeine in both humans and nonhumans. Withdrawal symptoms, consisting of headaches and restlessness, have been reported at doses as low as 100 mg a day. Withdrawal peaks between 20 and 48 hours and may last as long as a week.

- Although humans consume vast quantities of caffeine, it is not a robust reinforcer in laboratory animals. It usually requires a period of forced administration before it will serve as a reinforcer. Humans will choose beverages and capsules containing caffeine if they report pleasant subjective effects and are physically dependent on caffeine.
• It is possible to meet the DSM-IV criteria for “substance abuse” with caffeine.
• The average caffeine consumption in North America is over 120 mg per person per day. Most caffeine is consumed in the form of coffee.
• There is evidence of a detrimental effect of caffeine on reproduction and a possible association with heart disease.
• At higher doses (10 to 15 cups a day), the drug can cause caffeinism, with symptoms indistinguishable from anxiety neurosis. Even at low doses, caffeine may worsen the symptoms of neurosis and psychosis and diminish the effectiveness of some psychotherapeutic drugs.

Multiple Choices

9-1. Which of the following is not a member of the methylxanthines?
   A. caffeine.
   B. theophylline.
   C. theoxanthine.
   D. theobromine.
   E. none of the above. All are members of the methylxanthines.
Bloom’s Taxonomy: Know

9-2. Caffeine was first isolated by
   A. Leo Sternbach.
   B. Emil Fischer.
   C. Ferdinand Runge.
   D. Wolfgang von Gothe.
   E. Chen Nung.
Bloom’s Taxonomy: Know

9-3. Which of the following is NOT a species of coffee plants?
   A. Coffea arabica.
   B. Coffea canephora.
   C. Coffea robusta.
   D. Coffea cacao.
   E. none of the above. All are species of coffee plants.
Bloom’s Taxonomy: Know

9-4. Coffee contains which of the following methylxanthines?
   A. caffeine and theobromine.
   B. caffeine and theophylline.
   C. theobromine and theophylline.
   D. only caffeine.
   E. caffeine, theobromine, and theophylline.
Bloom’s Taxonomy: Know
9-5. The coffee plant is native to which country?
   A. Ethiopia.
   B. Mexico.
   C. Peru.
   D. Italy.
   E. China.
Bloom’s Taxonomy: Know

9-6. While actual quantities vary according to the type of coffee and how it is prepared, the amount of caffeine in a cup of coffee is usually estimated at
   A. 10 mg.
   B. 50 mg.
   C. 100 mg.
   D. 500 mg.
   E. 1000 mg.
Bloom’s Taxonomy: Know

9-7. *Camellia sinensis* is the source of which beverage?
   A. coffee.
   B. tea.
   C. youpon.
   D. guarana.
   E. chocolate.
Bloom’s Taxonomy: Know

9-8. Which of the following is NOT a methylxanthine-containing beverage?
   A. tea.
   B. maté.
   C. yaupon.
   D. black drink.
   E. none of the above. All are methylxanthine-containing beverages.
Bloom’s Taxonomy: Know

9-9. Which of the following comes from seed pods which grow on the trunk and main branches of a tree?
   A. coffee.
   B. tea.
   C. chocolate.
   D. kola.
   E. cassina.
Bloom’s Taxonomy: Know

9-10. In addition to theophylline, a cup of tea contains an average of ____ mg of caffeine.
   A. 10.
   B. 15.
Bloom’s Taxonomy: Know

9-11. Today, the bulk of the world’s supply of cocoa comes from
   A. South America.
   B. Asia.
   C. China.
   D. West Africa.
   E. Europe.

Bloom’s Taxonomy: Know

9-12. The methylxanthines are bases and in the acidic environment of the digestive system
   A. they ionize and become poorly lipid soluble.
   B. they are quickly metabolized into inactive metabolites.
   C. they are not easily digested.
   D. they become highly lipid soluble.
   E. they do not ionize because they have an extremely low pKa.

Bloom’s Taxonomy: Understand

9-13. After drinking tea or coffee, peak blood levels of caffeine are generally reached
   A. within 5 to 10 minutes.
   B. within 10 to 15 minutes.
   C. within 15 to 30 minutes.
   D. within 30 to 60 minutes.
   E. within 60 to 120 minutes.

Bloom’s Taxonomy: Know

9-14. In human adults, what percent of caffeine is excreted unchanged?
   A. less than two percent.
   B. between five and ten percent.
   C. between ten and forty percent.
   D. fifty percent.
   E. more than eighty-five percent.

Bloom’s Taxonomy: Know

9-15. The half-life of caffeine ranges
   A. from 30 minutes to 1 hour.
   B. from 1 to 2 hours.
   C. from 2.5 to 4.5 hours.
   D. from 4.5 to 6.5 hours.
   E. from 6 to 8 hours.

Bloom’s Taxonomy: Know

9-16. Caffeine metabolism in women
A. is faster during pregnancy.
B. is slower during pregnancy.
C. does not change during pregnancy.
D. is altered by the menstrual cycle.
E. both B. and D.

Bloom’s Taxonomy: Understand

9-17. Which of the following slows the excretion of caffeine?
A. exercise.
B. simultaneous consumption of alcohol.
C. cold.
D. pregnancy.
E. pretreatment with phenobarbital.

Bloom’s Taxonomy: Know

9-18. To which of the following receptors do the methylxanthines bind and cause most of their effects?
A. dopamine receptors.
B. serotonin receptors.
C. glutamate receptors.
D. adenosine receptors.
E. glycine receptors.

Bloom’s Taxonomy: Understand

9-19. One medical use of theophylline is in the treatment of
A. asthma.
B. sleep disorders.
C. narcolepsy.
D. anxiety.
E. caffeinism.

Bloom’s Taxonomy: Know

9-20. Caffeine is found in many over-the-counter headache remedies because
A. it is an effective bronchodilator.
B. it causes vasodilation in the periphery.
C. it causes vasoconstriction in the periphery.
D. it causes vasodilation in the brain.
E. it causes vasoconstriction in the brain.

Bloom’s Taxonomy: Apply

9-21. Which of the following best characterizes the effect of caffeine on human performance?
A. it causes a minimal improvement in all tasks.
B. it improves all tasks of an intellectual nature, but has no effect on physical tasks.
C. it improves performance only on tasks that are not degraded by fatigue.
D. it only improves performance on tasks that are degraded by fatigue.
E. it only causes the belief that performance has improved, but really has no effect on
Bloom’s Taxonomy: Apply

9-22. Which of the following best characterizes the effect of caffeine on human athletic performance?
A. it improves performance on tasks that require muscle strength.
B. it improves performance on tasks that require intense output for a short duration.
C. it improves performance on tasks that require submaximal output for an extended period.
D. all of the above. Caffeine improves all types of athletic performance in sufficient doses.
E. none of the above. Caffeine does not improve any type of athletic performance.

Bloom’s Taxonomy: Apply

9-23. Recent evidence suggests that most reports of improvements in human performance that result following the consumption of caffeine are due to
A. the relief of caffeine withdrawal.
B. increased blood flow to the muscles.
C. the stimulating effects of caffeine on the frontal cortex.
D. all of the above.
E. none of the above.

Bloom’s Taxonomy: Understand

9-24. The first person to experiment with the effects of caffeine on the conditioned behavior of nonhumans was
A. B.F. Skinner.
B. Shepard Siegel.
C. Ivan Pavlov.
D. W.A. McKim.
E. John B. Watson.

Bloom’s Taxonomy: Know

9-25. Which of the following best describes the effect of caffeine on sleep?
A. it causes insomnia and increases total sleep time.
B. it causes insomnia and reduces total sleep time.
C. it induces sleep and has no effect on total sleep time.
D. it induces sleep and raises the acoustic arousal threshold.
E. its sleep-inducing effects can be blocked by barbiturates.

Bloom’s Taxonomy: Understand

9-26. At large doses, caffeine can cause automutilation in rats. Automutilation refers to
A. an unprovoked attack by the rat directed at the laboratory assistant.
B. a rat biting its own tail and paws.
C. gnawing on objects in the cage.
D. the production of "zombie-like" behavior.
E. all of the above.
Bloom’s Taxonomy: Understand

9-27. In a drug state discrimination task, to which of the following drugs will caffeine-trained rats generalize the caffeine response?
   A. theophylline.
   B. amphetamine.
   C. nicotine.
   D. methylphenidate.
   E. none of the above.

Bloom’s Taxonomy: Know

9-28. Turkey or look-alike drugs designed to mimic amphetamine or cocaine often contain
   A. caffeine.
   B. ephedrine.
   C. phenylpropanolamine.
   D. epinephrine.
   E. all of the above, except D.

Bloom’s Taxonomy: Know

9-29. Caffeine withdrawal symptoms
   A. start within 12 to 28 hours, peak at 20 to 51 hours, and can last from 2 to 9 days.
   B. start within 1 to 10 hours, peak at 12 hours, and are over within 2 days.
   C. start within 28 hours and may continue at a low level for months.
   D. start within 10 to 12 hours, peak after about 36 hours, and are gone within a week.
   E. do not occur.

Bloom’s Taxonomy: Know

9-30. Human caffeine self-administration studies have shown which of the following factors can contribute to caffeine preference?
   A. physical dependence.
   B. having a first degree relative with a caffeine preference.
   C. reporting pleasant subjective effects from caffeine.
   D. having a history of sedative hypnotic abuse.
   E. both A. and C.

Bloom’s Taxonomy: Know

9-31. Physiological tolerance to the effects of chronic caffeine is demonstrated by which of the following neurophysiological findings?
   A. increased number of dopamine receptors.
   B. decreased number of dopamine receptors.
   C. increased number of adenosine receptors.
   D. decreased number of adenosine receptors.
   E. increased number of benzodiazepine receptors.

Bloom’s Taxonomy: Apply

9-32. Reports of withdrawal from caffeine in humans date back to the year 1833. The most
common symptom of caffeine withdrawal is
A. nausea.
B. irritability.
C. headache.
D. stomach cramps.
E. sweating.
Bloom’s Taxonomy: Know

9-33. Most of the research reporting clinically-significant withdrawal symptoms associated with abstinence from caffeine
A. used participants who knew that the study was examining caffeine withdrawal and is therefore prone to the placebo effect.
B. had experimenters who knew which group participants were assigned to and is therefore prone to experimenter bias.
C. both A. and B.
D. used double-blind studies and therefore cannot be explained by placebo effects of experimenter bias.
E. none of the above. There are no studies reporting clinically-significant symptoms of caffeine withdrawal.
Bloom’s Taxonomy: Apply

9-34. In self-administration studies using nonhumans
A. caffeine is a robust reinforcer and is readily self-administered by a variety of species.
B. patterns of self-administration are regular with no periods of voluntary abstinence.
C. progressively higher doses were administered across sessions.
D. all of the above.
E. none of the above.
Bloom’s Taxonomy: Understand

9-35. Citizens of which of the following regions drink the most coffee?
A. North America.
B. Italy.
C. South America.
D. Scandinavian countries.
E. Russia.
Bloom’s Taxonomy: Know

9-36. Caffeinism is usually seen at doses of caffeine above which of the following?
A. 100 mg/day.
B. 500 mg/day.
C. 1000 mg/day.
D. 1800 mg/day.
E. none of the above.
Bloom’s Taxonomy: Know

9-37. Caffeinism appears to be due to which of the following physiological effects of caffeine?
A. central vasoconstriction.
B. adenosine receptor blocking.
C. phosphodiesterase inhibition.
D. release of calcium ions.
E. benzodiazepine receptor blocking.

Bloom’s Taxonomy: Know

Short Answers

1. List the main sources of naturally occurring methylxanthines. 
Bloom’s Taxonomy: Understand

2. What are methylxanthines, and what types of every day sources are there for the methylxanthines? 
Bloom’s Taxonomy: Understand

3. Describe the absorption and distribution of caffeine, include description of pKa of caffeine. 
Bloom’s Taxonomy: Understand

4. Describe the effects of methylxanthines on the body. 
Bloom’s Taxonomy: Understand

5. Explain why caffeine is a stimulant compound? 
Bloom’s Taxonomy: Apply

6. What are the benefits of drinking coffee? 
Bloom’s Taxonomy: Apply

7. Do you think caffeine withdrawal should be included in the DSM-5, explain your answer. 
Bloom’s Taxonomy: Apply

8. What are the possible harmful effects of caffeine? 
Bloom’s Taxonomy: Apply

9. What is caffeinism? 
Bloom’s Taxonomy: Apply

10. Why would caffeine be found in look-alike drugs sold as psychomotor stimulants? 
Bloom’s Taxonomy: Analyze

11. Discuss why or why not caffeine dependence should be included in the DSM-5. 
Bloom’s Taxonomy: Analyze

12. Why it is not good for someone with anxiety to drink high doses of caffeine containing drinks? 
Bloom’s Taxonomy: Analyze
13. Describe two situations in which caffeine consumption might have benefits?
Bloom’s Taxonomy: Analyze

14. What is your opinion, should there be regulations on energy drinks consumed by teenagers?
Bloom’s Taxonomy: Evaluate

15. What are the effects of caffeine on reproduction?
Bloom’s Taxonomy: Evaluate

**Essays**

1. Describe the absorption, distribution and metabolism of methylxanthines.
   Bloom’s Taxonomy: Apply

2. Describe how caffeine works as a stimulant drug in the CNS.
   Bloom’s Taxonomy: Apply

3. Discuss why or why not caffeine dependence should be included in the DSM-5.
   Bloom’s Taxonomy: Analyze

4. Summarize the beneficial and harmful effects of caffeine in humans.
   Bloom’s Taxonomy: Evaluate

5. The use of soft drinks and energy drinks is increasing among teenagers in North-America. Is this a concern?
   Bloom’s Taxonomy: Hypothesize
CHAPTER SUMMARY

- All the drugs covered in this chapter—amphetamines (including crystal meth), ephedrine, cocaine, and cathinone—have a similar effect on the nervous system; they all increase activity at synapses that use a monoamine (MA) as a transmitter.

- Cocaine, ephedrine, and cathinone are derived from plant material, but the amphetamines are synthetic.

- Amphetamine and cocaine are weak bases. Although they can be absorbed from the digestive system, they are much more effective when injected, sniffed, or smoked and inhaled. They are easily distributed throughout the body and are extensively metabolized by the liver and excreted in the urine. Cocaine has a much shorter half-life than the amphetamines.

- The amphetamines and cathinone increase activity at MA synapses by stimulating leakage of the transmitter, increasing the amount of transmitter released, and blocking reuptake of the transmitter. Cocaine works by blocking uptake of the transmitter.

- MA systems in the brain are closely related to the mesolimbic dopamine system, which governs reinforcement, and the basal ganglia of the nigrostriatal system, which regulate body movement.

- The psychomotor stimulants improve mood. When amphetamine and cocaine are taken in high doses by inhaling or intravenous injection, they cause intense feelings of pleasure called rushes. After the effects of the psychomotor stimulants have worn off, a period of depression usually ensues.

- When taken continuously at high doses, by humans or nonhumans, the psychomotor stimulants cause stereotyped behavior—the senseless repetition of a meaningless act. In humans, high doses may also cause paranoid behavior and psychosis.

- At low doses, the amphetamines and cocaine can improve performance in certain activities and can eliminate the effect of fatigue on most cognitive and perceptual tasks and on athletic activity.

- The amphetamines can cause dissociation and are readily discriminated from saline. All the psychomotor stimulants and antidepressants will generalize to each other but do not generalize to any other type of drug.

- Withdrawal from amphetamines and cocaine is characterized by intense depression, and fMRI and PET studies have detected changes in frontal cortex activity associated with disruption of decision-making capabilities even after a year of abstinence from amphetamine.
• The psychomotor stimulants are readily self-administered by both humans and nonhumans, and the pattern of self-administration is similar in most species. It consists of a run of self-administration lasting for days or hours during which there is very little eating or sleeping, followed by a period of abstinence and recovery. This period is followed by another run.

• Excessive cocaine use and the associated lifestyle can be unhealthy. Many who inject cocaine do not use sterile needles, and this contributes to the spread of AIDS. Continuous use of high doses of psychomotor stimulants can make people paranoid and psychotic, and cause sudden death in susceptible individuals.

• Among the treatments being developed for cocaine and psychomotor stimulant abuse are antidepressant drugs that reduce withdrawal depression. Other drugs that seem to be helpful are modafinil, naltrexone and bupropion. Alternate therapies offer social and monetary rewards for remaining abstinent.

Multiple Choices

10-1. Which of the following is not a monoamine?
   A. ACh.
   B. DA.
   C. NE.
   D. E.
   E. 5-HT.

   Bloom’s Taxonomy: Know

10-2. Which of the following monoamines is an indoleamine?
   A. ACh.
   B. DA.
   C. NE.
   D. E.
   E. 5-HT.

   Bloom’s Taxonomy: Know

10-3. Which of the following drugs is synthetic?
   A. cocaine.
   B. cathinone.
   C. amphetamine.
   D. ephedrine.
   E. none of the above. All of these occur naturally.

   Bloom’s Taxonomy: Know

10-4. Cathinone is also known as
   A. khat.
   B.quat.
10-5. Adderall is the most common trade name for
   A. methamphetamine.
   B. d-amphetamine.
   C. l-amphetamine.
   D. dl-amphetamine.
   E. methylphenidate.

10-6. Dexedrine is the trade name for
   A. methamphetamine.
   B. d-amphetamine.
   C. l-amphetamine.
   D. dl-amphetamine.
   E. methylphenidate.

10-7. The substance known as "ephedrine" in Russia is
   A. methcathinone.
   B. cocaine.
   C. methamphetamine.
   D. a mixture of ephedrine and caffeine.
   E. methylphenidate.

10-8. Among the following, who enthusiastically promoted cocaine as a cure for many of the ills of mankind?
   A. Albert Neimann.
   B. Angelo Mariani.
   C. Dr. Palo Mantegazza.
   D. Sigmund Freud.
   E. Gordon Alles.

10-9. In the 1800s, Karl Koller discovered that the only legitimate medical use for cocaine was as
   A. an antidepressant.
   B. a sleeping potion.
   C. a treatment for alcoholism.
   D. a local anesthetic.
   E. none of the above. Cocaine has never been medically useful.
10-10. Cocaine was included in the Harrison Narcotic Act along with opium and morphine because
   A. it has the same physiological effects as these narcotics.
   B. it has the same behavioral effects as these narcotics.
   C. it had been linked in the popular mind with corruption and crime.
   D. it was believed that cocaine was transformed into morphine in the body.
   E. none of the above. Cocaine is not a narcotic and control could not be legislated by the Harrison Narcotic Act.
Bloom’s Taxonomy: Know

10-11. According to legend, the medicinal properties of ephedrine were first identified more than 5000 years ago by
   A. Ko Kuei Chen.
   B. C.F. Schmidt.
   C. Chen Nung.
   D. Angelo Mariani.
   E. John S. Pemnerton.
Bloom’s Taxonomy: Know

10-12. Ephedrine replaced epinephrine as a treatment for asthma because
   A. ephedrine was much more stable than epinephrine.
   B. ephedrine could be taken in pill form whereas epinephrine had to be injected.
   C. ephedrine had a longer duration of action compared to epinephrine.
   D. ephedrine was less toxic than epinephrine.
   E. all of the above.
Bloom’s Taxonomy: Understand

10-13. Traditionally, Indians of the Andes would consume coca leaves mixed with lime. This was because
   A. cocaine is a base and has a pKa of 8.7.
   B. cocaine is an acid and has a pKa of 8.7.
   C. it was necessary to mask the bitter taste.
   D. they believed that cocaine was a gift of the god Mamacoca and the lime was a means of showing respect.
   E. the lime destroyed the bacteria that caused the leaf of the coca bush to deteriorate.
Bloom’s Taxonomy: Apply

10-14. "Crack" is
   A. a mixture of cocaine HCl and baking soda.
   B. a mixture of cocaine HCl and table salt.
   C. another name for coca paste or coca base.
   D. a mixture of amphetamine and cocaine that is highly addicting.
   E. a street name for pure cocaine HCl.
Bloom’s Taxonomy: Understand
10-15. Which is the most effective method for increasing the efficiency of the kidneys in excreting amphetamine?
   A. making the urine more acidic.
   B. making the urine more basic.
   C. consumption by the oral route.
   D. using the free base.
   E. exercise.
Bloom’s Taxonomy: Apply

10-16. Which of the following is (are) neurophysiological effect(s) of amphetamines?
   A. they cause a leak of transmitter.
   B. they increase the amount of transmitter released at the synapse by the arrival of an action potential.
   C. they block the reuptake of the transmitter.
   D. none of the above.
   E. all of A., B., and C.
Bloom’s Taxonomy: Know

10-17. According to PET studies, what percentage of dopamine transporter molecules must be blocked by cocaine in order for the user to experience a drug-induced high?
   A. at least 17%.
   B. at least 27%.
   C. at least 37%.
   D. at least 47%.
   E. at least 57%.
Bloom’s Taxonomy: Know

10-18. PET studies suggest that doses of cocaine that are regularly used by humans block what percentage of dopamine transporter molecules?
   A. between 20 and 37%.
   B. between 40 and 57%.
   C. between 60 and 77%.
   D. between 80 and 97%.
   E. none of the above. Cocaine does not block dopamine transporter molecules at regularly-used doses.
Bloom’s Taxonomy: Know

10-19. Amphetamines were useful in the treatment of asthma because they are
   A. muscle relaxants.
   B. vasodilators.
   C. bronchoconstrictors.
   D. bronchodilators.
   E. none of the above. Amphetamines cannot be used to treat asthma.
Bloom’s Taxonomy: Know

10-20. PET studies show that cocaine-induced euphoria correlates with
A. a reduction in brain glucose metabolism that rebounds to above-normal levels during the first week of withdrawal.
B. an increase in brain glucose metabolism that decreases to below-normal levels during the first week of withdrawal.
C. a reduction in brain glucose metabolism that continues throughout the withdrawal period.
D. an increase in brain glucose metabolism that continues throughout the withdrawal period.
E. none of the above. Cocaine-induced euphoria cannot be quantified using the PET technique.

Bloom’s Taxonomy: Apply

10-21. EEG recordings of brainwave activity following cocaine injection show that
A. cocaine-induced euphoria is associated with increased alpha activity over the parietal and occipital lobes.
B. cocaine-induced dysphoria is associated with a below-baseline level of activity over the parietal and occipital lobes.
C. cocaine-induced euphoria is associated with a below-baseline level of activity over the temporal and frontal lobes.
D. both A. and B.
E. both B. and C.

Bloom’s Taxonomy: Apply

10-22. Punding is the human equivalent of
A. circling behavior in nonhumans.
B. excessive eating in nonhumans.
C. brain damage in nonhumans.
D. stereotyped behavior in nonhumans.
E. formication in nonhumans.

Bloom’s Taxonomy: Know

10-23. The symptoms of amphetamine-induced monoamine psychosis are virtually indistinguishable from those of
A. obsessive compulsive disorder.
B. bipolar disorder.
C. dissociative identity disorder.
D. major depressive disorder.
E. paranoid schizophrenia.

Bloom’s Taxonomy: Know

10-24. The cocaine-induced sensation of bugs crawling under the skin is called
A. fornication.
B. formication.
C. cocaine-induced writhing.
D. coca itch.
E. going cold turkey.
10-25. Which of the following statements best describes the effects of amphetamine on human performance?
   A. it degrades most types of performance.
   B. it has no reliable effect on performance.
   C. it only improves performance that has been degraded by fatigue.
   D. in addition to improving performance that has been degraded by fatigue, it will improve some maximal drug-free performance in some tasks.
   E. it improves all performance.

Bloom’s Taxonomy: Understand

10-26. Which of the following is a form of amphetamine-induced stereotyped behavior in rodents?
   A. sniffing.
   B. head bobbing.
   C. rearing on the hind legs.
   D. gnawing and biting.
   E. all of the above.

Bloom’s Taxonomy: Know

10-27. Automutilation is likely a form of stereotyped behavior, but it may also be a result of
   A. the rate dependent effect.
   B. acute tolerance.
   C. paranoid psychotic behavior.
   D. automatism.
   E. formication.

Bloom’s Taxonomy: Know

10-28. What effect does amphetamine have on the food and water consumption of most species?
   A. increases eating, but decreases drinking.
   B. decreases eating, but increases drinking.
   C. decreases both eating and drinking.
   D. increases both eating and drinking.
   E. none of the above. Amphetamine does not affect either eating or drinking.

Bloom’s Taxonomy: Know

10-29. The rate-dependency effect was first noticed by
   A. Peter Dews.
   B. Kelleher and Morse.
   C. Pickens and Thompson.
   D. Gosta Rylander.
   E. Sigmund Freud.

Bloom’s Taxonomy: Know

10-30. One major exception to the rate dependency effect of amphetamine is
A. behavior suppressed by punishment.
B. FI10-FR30.
C. avoidance.
D. operant behavior.
E. respondent behavior.

Bloom’s Taxonomy: Apply

10-31. Rats trained to discriminate amphetamine from saline will generalize the amphetamine response to which of the following?
   A. caffeine.
   B. nicotine.
   C. some MAO inhibitors.
   D. hallucinogens.
   E. barbiturates.

Bloom’s Taxonomy: Apply

10-32. Which of the following effects of amphetamine show(s) reverse tolerance or sensitization?
   A. appetite suppression.
   B. insomnia.
   C. effects on DRL performance.
   D. stereotyped behavior and convulsions.
   E. stimulus effects.

Bloom’s Taxonomy: Know

10-33. Withdrawal from amphetamine is characterized by
   A. depression.
   B. insomnia.
   C. decreased appetite.
   D. stomach cramps.
   E. convulsions.

Bloom’s Taxonomy: Know

10-34. The severity of depression that occurs during withdrawal from psychomotor stimulant drugs
   A. is related to the dose and the duration of the intake period.
   B. is not related to the dose or the duration of the intake period.
   C. is related to the dose but not to the duration of the intake period.
   D. is not related to the dose but is related to the duration of the intake period.
   E. none of the above. Depression does not occur during withdrawal from psychomotor stimulants.

Bloom’s Taxonomy: Understand

10-35. A "speed ball" is a combination of cocaine (or amphetamine) and
   A. barbiturates.
   B. alcohol.
C. heroin.
D. benzodiazepines.
E. nicotine.

Bloom’s Taxonomy: Know

10-36. During abstinence from psychomotor stimulants such as amphetamine and methamphetamine, risky or dysfunctional decision-making processes correspond with
A. reduced dorsolateral prefrontal cortex activation, as measured by fMRI.
B. reduced dorsolateral prefrontal cortex activation, as measured by PET.
C. increased dorsolateral prefrontal cortex activation, as measured by PET.
D. both A. and B.
E. both A. and C.

Bloom’s Taxonomy: Apply

10-37. Monkeys carefully regulate their cocaine intake when
A. the drug is available all the time.
B. the drug is available for only a few hours a day.
C. the drug is administered on a FI-FR schedule.
D. the animal has had considerable experience with the drug.
E. none of the above. Monkeys are unable to regulate cocaine self-administration.

Bloom’s Taxonomy: Understand

10-38. Which pattern of self-administration characterizes cocaine when it is freely available?
A. regular, evenly spaced responding.
B. high rates of responding followed by irregularly spaced gaps of abstinence.
C. high rates of responding followed by periods of abstinence on a regular cycle.
D. high rates of responding followed by periods of abstinence during which withdrawal seizures are observed.
E. none of the above. Cocaine is not self-administered.

Bloom’s Taxonomy: Understand

10-39. PET studies of nonhuman primates given doses of methamphetamine comparable to those administered by humans during a binge demonstrate that
A. methamphetamine administration results in significant reductions in dopamine transporter density within the striatum.
B. methamphetamine administration results in significant increases in dopamine transporter density within the striatum.
C. methamphetamine dose is unrelated to changes in dopamine transporter density within the striatum.
D. much larger doses than those used recreationally by humans must be given in order to alter dopamine transporter densities within the striatum of nonhuman primates.
E. methamphetamine administration affects dopamine transporter densities within the striatum but only within hours of its administration.

Bloom’s Taxonomy: Apply

10-40. Which of the following options is NOT effective in preventing relapse into stimulant use
among former addicts?
   A. positive reinforcement such as money for clean urine samples.
   B. opioid antagonist naltrexone.
   C. stimulant drug modafinil.
   D. antidepressant drug bupropion.
   E. SSRI antidepressants such as fluoxetine.
Bloom’s Taxonomy: Know

Short Answers

1. What are the sources of cocaine and amphetamines?
   Bloom’s Taxonomy: Understand

2. Describe the history of cocaine use.
   Bloom’s Taxonomy: Understand

3. Describe the history of amphetamine use.
   Bloom’s Taxonomy: Understand

4. What are the different administration routes and available forms of cocaine?
   Bloom’s Taxonomy: Understand

5. What are the different administration routes and available forms of amphetamine?
   Bloom’s Taxonomy: Apply

6. Explain the neurophysiology of cocaine.
   Bloom’s Taxonomy: Apply

7. Explain the neurophysiology of amphetamines.
   Bloom’s Taxonomy: Apply

8. What are the differences between neurophysiological effects of cocaine and amphetamines?
   Bloom’s Taxonomy: Apply

9. Why is it said that psychomotor stimulants are positive reinforcers in nonhumans?
   Bloom’s Taxonomy: Apply

10. What is Ritalin, and does it have any therapeutical use?
    Bloom’s Taxonomy: Analyze

11. What are the medical uses of amphetamines?
    Bloom’s Taxonomy: Analyze

12. What are the effects of psychomotor stimulants on the body?
    Bloom’s Taxonomy: Analyze
13. What is monoamine psychosis, and what causes it? How is it treated?
Bloom’s Taxonomy: Analyze

Bloom’s Taxonomy: Evaluate

15. Describe the pharmacotherapies available for psychomotor stimulant addiction, and comment on the effectiveness.
Bloom’s Taxonomy: Evaluate

**Essays**

1. What are the sources of the different psychomotor stimulants described in the textbook?
Bloom’s Taxonomy: Apply

2. What are the differences between neurophysiological effects cocaine, cathinone and amphetamines?
Bloom’s Taxonomy: Apply

3. Describe the harmful effects of cocaine abuse starting from abuse to addiction.
Bloom’s Taxonomy: Analyze

Bloom’s Taxonomy: Evaluate

5. What are the challenges with psychomotor stimulant addiction treatment?
Bloom’s Taxonomy: Hypothesize
Chapter 11
Opioids

CHAPTER SUMMARY

- The opioids are a class of natural and synthetic drugs. Opium, derived from the opium poppy, is the source of morphine and codeine. Heroin is made by slightly altering the morphine molecule to make it more lipid soluble and, consequently, more potent. Synthetic opioids such as pethidine, methadone, and LAAM have a different chemical structure but have the same site of action and similar physiological effects. These drugs are sometimes referred to as narcotics or narcotic analgesics.

- Opium has been used for centuries in the Middle East. It was spread by Arab traders from there to Africa, China, and Europe, where in the sixteenth and seventeenth centuries it was widely used as a medicine. Its popularity grew until the middle of the 1800s, when legal restrictions were placed on its use in England. In the United States, all opioids were banned by the Harrison Narcotic Act of 1914.

- Most opioids are not well absorbed from the digestive system; they need to be inhaled or injected for full effect. The opioids are metabolized primarily in the liver and have a half-life of 2 to 4 hours, except for some synthetics such as methadone or LAAM, which have much longer half-lives.

- The body uses endogenous opioid chemicals called endorphins or enkephalins as both neurotransmitters and neuromodulators. There are several opioid receptors—mu, kappa, and delta. The mu receptor is responsible for reinforcing and many analgesic effects.

- One opioid system involves the spinal cord and a part of the brain known as the periaqueductal or central gray. It is thought that some of the analgesic properties of the opioids are mediated by this mechanism. Opioids also activate the nucleus accumbens and depress the respiratory center.

- Opioids cause a sleepy, dreamy state. When taken intravenously, they cause rushes, or feelings of intense pleasure resembling orgasm.

- Mu agonists cause feelings of pleasure and rushes at high doses in experienced users but often have unpleasant effects on inexperienced subjects.

- Chronic opioid use causes constipation and diminished sex drive and sexual performance, but if doses are not too high, chronic use does not interfere with intellectual or physical abilities.

- The opioids slow the behavior of nonhumans responding on both positively and negatively reinforced schedules. They slow avoidance responding at doses that do not affect escape but do not increase punishment-suppressed behavior.

- Tolerance to the different effects of opioids develops at different rates. Withdrawal symptoms occur after chronic opioid use, and the severity of withdrawal increases with higher chronic doses. These symptoms may last for about 3 days, and although very unpleasant, they are not life threatening.
Humans and nonhumans will readily self-administer mu agonists whether they are physically dependent or not. The typical pattern is to start at low doses and increase dosage as tolerance develops. Once a stable pattern has been achieved, daily doses seldom change, and there is little variability from day to day. Intake is not cyclic, and voluntary withdrawal symptoms are seldom seen.

Although chronic opioid use has few serious direct physical effects, the indirect effects of using the drug and the addicted lifestyle can be serious.

The most popular current treatment is maintenance on a long-acting opioid such as methadone or buprenorphine.

Multiple Choices

11-1. Technically, the term “narcotic” defines a class of drugs that
   A. reduces pain.
   B. is highly addictive.
   C. causes sleep.
   D. binds to opioid receptors.
   E. all of the above.
   Bloom’s Taxonomy: Know

11-2. Which of the following is not a synthetic or semisynthetic opioid?
   A. methadone.
   B. naloxone.
   C. meperidine.
   D. morphine.
   E. oxycodone.
   Bloom’s Taxonomy: Know

11-3. Heroin is created by
   A. heating the cultivated sap of the opium poppy to very high temperatures.
   B. chemically separating the heroin molecule from its HCl base by using ether.
   C. adding the synthetic opioid, fentanyl, to cocaine.
   D. adding two acetyl groups to morphine.
   E. none of the above. Heroin is a naturally-occurring opioid that is not “created”.
   Bloom’s Taxonomy: Understand

11-4. The half-life of morphine is
   A. 3 - 6 hours.
   B. 2 hours.
   C. 10 - 25 hours.
   D. 3.5 hours.
   E. 1.5 hours.
   Bloom’s Taxonomy: Know
11-5. Which of the following opioids has the longest half-life?
   A. morphine.
   B. codeine.
   C. LAAM.
   D. methadone.
   E. heroin.
Bloom’s Taxonomy: Know

11-6. Heroin is more potent than morphine because
   A. it has a greater affinity at the opioid receptor.
   B. it works at a different opioid receptor.
   C. it is more highly lipid soluble.
   D. it is not excreted as efficiently by the kidneys.
   E. all of the above
Bloom’s Taxonomy: Understand

11-7. The endorphins are
   A. the naturally occurring opioids found in opium.
   B. the synthetic opioids used as analgesics.
   C. the class of drugs that are used in maintenance therapies for addicts.
   D. substances that occur in the body that act at opioid receptor sites.
   E. a type of opioid receptor site.
Bloom’s Taxonomy: Know

11-8. Which of the following is a pure opioid antagonist?
   A. cyclazocine.
   B. pentazocine.
   C. nalorphine.
   D. methadone.
   E. naloxone.
Bloom’s Taxonomy: Know

11-9. Which of the following is NOT a type of brain opioid receptor?
   A. delta.
   B. alpha.
   C. mu.
   D. kappa.
   E. none of the above. All are types of opioid receptors.
Bloom’s Taxonomy: Know

11-10. fMRI BOLD imaging shows that heroin administration increases signal intensity in the
   A. mesolimbic dopamine system.
   B. amygdala.
   C. hippocampus.
   D. locus coeruleus.
11-11. Which of the following centers in the brainstem are depressed by the opioids?
   A. respiration center.
   B. vomiting center.
   C. cough center.
   D. none of the above.
   E. all of A., B., and C.
Bloom’s Taxonomy: Apply

11-12. The most serious direct medical consequence of the continuous use of opioids is
   A. lowered blood pressure.
   B. pinpoint pupils.
   C. degeneration in moral behavior.
   D. constipation.
   E. psychotic behavior.
Bloom’s Taxonomy: Know

11-13. Which of the following best characterizes the effects of opioids on sleep?
   A. they cause a sleepy sensation.
   B. they do not increase sleeping time.
   C. they decrease REM sleep.
   D. they are useful in aiding sleep of those kept awake by pain.
   E. all of the above.
Bloom’s Taxonomy: Apply

11-14. In the classic study by Lasagana, it was shown that students who were inexperienced
   with opioids
   A. found opioids very pleasurable and were eager to repeat the experience.
   B. enjoyed the opioid high, but were afraid of becoming "hooked" so they did not
   volunteer for further trials.
   C. reported that opioids made them sick and only 2 of 20 wanted to repeat the
   experience.
   D. became very ill when given opioids for the first time, but reported that the rush they
   experienced made it worthwhile.
   E. none of the above. The Lasagna study used only experienced users.
Bloom’s Taxonomy: Understand

11-15. The experiment by Thompson and Schuster found that monkeys would self-administer
   morphine and that animals giving themselves morphine
   A. were unable to maintain adequate responding for food or shock avoidance.
   B. were able to maintain adequate responding for food, but could not avoid shocks.
   C. were unable to maintain adequate responding for food, but could avoid shocks.
   D. were able to maintain food responding and shock avoidance adequately except during
   withdrawal.
E. could not maintain food and shock avoidance responding within 6 hours of morphine delivery.

Bloom’s Taxonomy: Apply

11-16. "Yen" sleep is
A. a withdrawal symptom of the opioids.
B. the name for the sleepy feeling produced by opioids.
C. a symptom of opioid overdose.
D. a restless sort of sleep during which there is suppression of REM that is characteristic of heroin addicts.
E. none of the above.

Bloom’s Taxonomy: Know

11-17. Which of the following will relieve withdrawal from the opioids?
A. cocaine.
B. nicotine.
C. alcohol.
D. naloxone.
E. PCP.

Bloom’s Taxonomy: Know

11-18. Most heroin users report that they were given their first heroin
A. by a pusher.
B. by someone they did not know, but who was not a pusher.
C. by a friend.
D. mixed with another drug.
E. by a physician.

Bloom’s Taxonomy: Know

11-19. After five to ten years of use many heroin addicts in their thirties and forties spontaneously discontinue using the drug. This is called
A. burnout.
B. coke out.
C. maturing out.
D. winding down.
E. kicking the habit.

Bloom’s Taxonomy: Know

11-20. Recently, addiction workers are reporting an increasing number of heroin-addicted
A. teenagers.
B. mothers.
C. seniors.
D. young adults.
E. all of the above.

Bloom’s Taxonomy: Know
11-21. Many deaths attributed to heroin overdoses may be a result of which of the following?
   A. I.V. quinine.
   B. AIDS.
   C. traces of toxins left over from the refining process of heroin.
   D. hepatitis B.
   E. all of the above.
   Bloom’s Taxonomy: Know

11-22. Which of the following have NOT been used as maintenance drugs for heroin addicts?
   A. heroin.
   B. LAAM.
   C. methadone.
   D. buprenorphine.
   E. none of the above. All have been used.
   Bloom’s Taxonomy: Know

11-23. "Chipping" refers to
   A. twitching of the arms and legs during withdrawal.
   B. obtaining and administering heroin.
   C. intravenous administration of heroin.
   D. the occasional use of heroin.
   E. the process of getting strung out.
   Bloom’s Taxonomy: Know

11-24. Deaths from heroin overdose
   A. most frequently occur in new users following the first administration of heroin.
   B. are increasing due to the higher purity of street heroin.
   C. is a very rare cause of death among chronic heroin users.
   D. most frequently occur in people who have used heroin for 5 to 10 years.
   E. result from cardiac arrhythmia.
   Bloom’s Taxonomy: Understand

11-25. What is thought to have caused the death of terrorists and hostages during the 2002 Chechen takeover of a theater in Moscow?
   A. a gas containing carfentanil was pumped into the theater and inhaled by some in an uncontrolled, high dose.
   B. a gas possibly containing the anesthetic halothane was pumped into the theater and inhaled by some in an uncontrolled, high dose.
   C. many victims were not treated quickly enough with naloxone.
   D. many victims were not treated quickly enough with methadone.
   E. all of A., B., and C.
   Bloom’s Taxonomy: Apply

11-26. SPECT imaging shows that, during withdrawal from chronic heroin,
   A. participants show a widespread increase in cerebral blood flow to the frontal, parietal, and temporal lobes of the brain.
B. participants show a widespread reduction in cerebral blood flow to the frontal, parietal, and temporal lobes of the brain.
C. alterations in cerebral blood flow are long lasting and do not return to normal despite long periods of heroin abstinence.
D. both A. and C.
E. both B. and C.

Bloom’s Taxonomy: Apply

11-27. PET and fMRI studies demonstrate that opioid users and former users show abnormal activation of the anterior cingulate cortex during decision-making errors on the
A. Cambridge Risk Task.
B. Wisconsin Card Sorting Test.
C. Digit Symbol Substitution Test.
D. Addiction Research Center Inventory.
E. Profile of Mood States.

Bloom’s Taxonomy: Know

11-28. What advantage(s) does methadone have over heroin as a maintenance drug?
A. it can be taken orally.
B. it postpones withdrawal for 24 hours.
C. it acts as an antagonist to heroin.
D. none of the above. There is no advantage to using methadone over heroin.
E. all of A., B., and C.

Bloom’s Taxonomy: Apply

11-29. PET imaging shows that methadone occupies mu opioid receptors and reduces the availability of these receptors by
A. 6 to 19%.
B. 19 to 32%.
C. 32 to 45%.
D. 45 to 58%.
E. 58 to 71%.

Bloom’s Taxonomy: Know

11-30. When methadone is used as a maintenance drug in the U.S., it has been shown to
A. reduce sickness and death associated with illicit drug use.
B. normalize disruptions of immune and endocrine functions.
C. reduce the transfer of HIV/AIDS.
D. reduce criminal activity.
E. all of the above.

Bloom’s Taxonomy: Understand

11.31. The recent data in U.S indicates that the most common cause for drug poisoning was
A. heroin abuse
B. cocaine abuse
C. prescription opioids abuse
11.32 According to the National Survey on Drug Use and Health in 2010 the greatest number of users classified as having abuse or dependence problem was due to which of these drugs?

A. heroin  
B. cocaine  
C. prescription opioids  
D. amphetamine  
E. alcohol  

Bloom’s Taxonomy: Know

Short Answers

1. What is opium, and what are the opioids found in opium?  
Bloom’s Taxonomy: Understand

2. Give examples of synthetic opioids.  
Bloom’s Taxonomy: Understand

3. Describe the history of Heroin.  
Bloom’s Taxonomy: Understand

4. What are endorphins, and what are some of the physiological effects of endorphins?  
Bloom’s Taxonomy: Understand

5. Why do different opioids have different effects?  
Bloom’s Taxonomy: Apply

6. What are the major opioid receptors found in the CNS, and what are some of the differences in their physiological effects?  
Bloom’s Taxonomy: Apply

7. Explain how an opioids antagonistic drug, such as naloxone helps in opioid overdose?  
Bloom’s Taxonomy: Apply

8. Describe the harmful effects of opioids.  
Bloom’s Taxonomy: Apply

Bloom’s Taxonomy: Apply

10. Discuss whether or not cognitive performance is affected by longterm opioid use.  
Bloom’s Taxonomy: Analyze
11. Why opioids are challenging pain medications?
Bloom’s Taxonomy: Analyze

12. Describe detoxification procedure as treatment for opioid addiction.
Bloom’s Taxonomy: Analyze

Bloom’s Taxonomy: Analyze

14. Describe the antagonistic treatments in opioid addiction.
Bloom’s Taxonomy: Evaluate

15. Discuss the problems that an opioid addict might have to face during his/her life.
Bloom’s Taxonomy: Evaluate

**Essays**

1. What are the challenges with longterm pain treatment with opioids?
Bloom’s Taxonomy: Apply

2. Explain why opioids are such a challenge for current pain treatment programs?
Bloom’s Taxonomy: Apply

3. Explain how mu receptor binding relates to analgesic and reinforcing properties of opioids.
Bloom’s Taxonomy: Analyze

4. Compare maintenance and antagonistic treatments in opioids addiction.
Bloom’s Taxonomy: Evaluate

5. Describe in your opinion the optimal treatment plan for an opioid addict.
Bloom’s Taxonomy: Hypothesize
CHAPTER SUMMARY

- Antipsychotic drugs are also referred to as neuroleptic drugs or major tranquilizers. They are used in the treatment of schizophrenia and bipolar disorder.
- Extrapyramidal motor effects (also known as parkinsonian effects or neuroleptic effects) are common side effects of antipsychotic drugs. These effects constitute a movement disorder similar to Parkinson’s disease.
- People suffering from schizophrenia lose touch with reality. They misunderstand events going on around them and make inappropriate intellectual and emotional responses to those events. Positive symptoms include hallucinations and delusions. Negative symptoms include a loss of initiative, flattening of affect, and alogia (impoverished speech and thought).
- Typical antipsychotic drugs are effective only against positive symptoms, but the newer, atypical antipsychotic drugs are effective on both positive and negative symptoms and have fewer side effects on movement.
- Chlorpromazine was marketed in 1955. Along with other similar antipsychotics, it dramatically reduced the number of patients in mental hospitals throughout the world.
- Antipsychotics are administered orally and are distributed throughout the body. They easily cross the placental and blood–brain barriers. Because they are highly lipid soluble, they have very long half-lives.
- Antipsychotics work by blocking the dopamine D2 receptors in the mesolimbic system. They cause parkinsonian movement disorders and tardive dyskinesia by blocking D2 receptors in the nigrostriatal system.
- Newer, atypical antipsychotic drugs have a low affinity for D2 receptors but a high affinity for D3 and D4 receptors that are not located in the nigrostriatal system. They also block a serotonin receptor that has the effect of diminishing the activity of glutaminergic activity in the cortex. These differences may explain why the atypical drugs do not have serious extrapyramidal side effects and are effective in treating negative symptoms.
- When given to normal people, antipsychotics cause a feeling of tiredness, and the effects are never described as pleasant.
- Antipsychotics decrease general activity levels of nonhumans and have a rate-dependent effect on operant behavior. They decrease avoidance behavior in doses that have no effect on escape behavior.
- Tolerance to the antipsychotic effect of these drugs does not appear to develop, and withdrawal symptoms are rare. They are never self-administered by nonhumans and are not abused by humans.
- Antipsychotics can depress sexual interest and performance in males and interfere with menstruation in females.
Multiple Choices

12-1. Which of the following is NOT true about psychosis
   A. can be a brief event caused by drugs or toxins.
   B. can arise due to Alzheimer’s disease.
   C. does not include hallucinations.
   D. can include delusions.
   E. includes schizophrenia.
Bloom’s Taxonomy: Know

12-2. Which of the following is a negative symptom of schizophrenia?
   A. affective flattening.
   B. feelings of grandeur.
   C. hallucinations and delusions.
   D. irrational beliefs.
   E. loosening association between ideas.
Bloom’s Taxonomy: Know

12-3. Which of the following is NOT a positive symptom of schizophrenia?
   A. affective flattening.
   B. feelings of grandeur.
   C. hallucinations and delusions.
   D. irrational beliefs.
   E. loosening association between ideas.
Bloom’s Taxonomy: Know

12-4. Which of the following is NOT a negative symptom of schizophrenia?
   A. affective flattening.
   B. anhedonia.
   C. hallucinations and delusions.
   D. alogia.
   E. social withdrawal.
Bloom’s Taxonomy: Know

12-5. Which of the following is NOT a factor in the development of schizophrenia?
   A. Genetics
   B. Environment
   C. Lack of exercise
   D. Birth complications
   E. Viral infections
Bloom’s Taxonomy: Know

12-6. Which of the following is NOT an abnormality found in the brain of a schizophrenic patient?
   A. Hyperactivity within mesolimbic dopamine system.
   B. Dysfunctional glutamate transmission.
C. Enlarged third and lateral brain ventricles.
D. Vulnerability to Parkinson’s disease.
E. Lessened volume in 50 different brain regions.

Bloom’s Taxonomy: Understand

12-7. Misregulation of which of the following neurotransmitter systems is largely responsible for the negative and positive symptoms in schizophrenia?
   A. endorphins and enkephalins
   B. endorphins
   C. dopamine
   D. glutamate
   E. dopamine and glutamate

Bloom’s Taxonomy: Understand

12-8. Which of the following is thought to underlie the positive symptoms of schizophrenia?
   A. Excess dopamine in the nigrostriatal pathway.
   B. Excess dopamine in the mesolimbic pathway.
   C. Excess dopamine in the mesocortical pathway.
   D. Lack of dopamine activity within mesolimbic pathway.
   E. Lack of dopamine activity within mesocortical pathway.

Bloom’s Taxonomy: Apply

12-9. Which of the following is thought to underlie the negative symptoms of schizophrenia?
   A. Excess dopamine in the nigrostriatal pathway.
   B. Excess dopamine in the mesolimbic pathway.
   C. Excess dopamine in the mesocortical pathway.
   D. Lack of dopamine activity within mesolimbic pathway.
   E. Lack of dopamine activity within mesocortical pathway.

Bloom’s Taxonomy: Apply

12-10. Which of the following summarizes the findings of the neurophysiological dysfunctions found in the schizophrenic brain?
   A. Excess dopamine activity within mesocortical pathway that drives hypoactivity within mesolimbic dopamine system, and additional degeneration of brain structures.
   B. Hyperactivity of the frontal lobes and regeneration of brain structures.
   C. Lack of dopamine activity within mesocortical pathway that drives hypoactivity within mesolimbic dopamine system, and additional regeneration of brain structures.
   D. Lack of dopamine activity within mesolimbic pathways.
   E. Lack of dopamine activity within mesocortical pathway that drives hyperactivity within mesolimbic dopamine system, and additional degeneration of brain structures.

Bloom’s Taxonomy: Apply

12-11. The antipsychotic drugs were discovered by Henri Laborit while he was experimenting with drugs that might be used to treat
   A. surgical shock.
   B. depression.
C. tuberculosis.
D. mania.
E. syphilis

Bloom’s Taxonomy: Know

12-12. The term "neuroleptic" refers to
A. antidepressant drugs.
B. antianxiety drugs.
C. psychotherapeutic drugs.
D. antipsychotic drugs.
E. all of the above.

Bloom’s Taxonomy: Know

12-13. The difference(es) between typical and atypical antipsychotic drugs is (are) that
A. typical antipsychotics have more parkinsonian side-effects than atypical antipsychotics.
B. typical antipsychotics are normally more useful in treating negative symptoms of schizophrenia.
C. atypical antipsychotics are more useful in treating bipolar disorder than typical antipsychotics.
D. atypical antipsychotics can cause pleasant subjective effects and are subject to abuse.
E. they are identical drugs, and do not have any differences.

Bloom’s Taxonomy: Understand

12-14. Which of the following is true about typical and atypical antipsychotic drugs?
A. atypical antipsychotics have more parkinsonian side-effects than typical antipsychotics.
B. typical antipsychotics are normally more useful in treating positive symptoms of schizophrenia, and they have strong D₂-binding.
C. atypical antipsychotics are more useful in treating bipolar disorder than typical antipsychotics.
D. atypical antipsychotics can cause pleasant subjective effects and are subject to abuse.
E. atypical antipsychotics are normally more useful in treating positive symptoms of schizophrenia, and they have strong D₂-binding.

Bloom’s Taxonomy: Understand

12-15. Which of the following is true about atypical antipsychotic drugs?
A. atypical antipsychotics are normally useful in treating both positive and negative symptoms of schizophrenia, and they have weak D₂-binding.
B. atypical antipsychotics have more parkinsonian side-effects than typical antipsychotics.
C. atypical antipsychotics are more useful in treating bipolar disorder than typical antipsychotics.
D. atypical antipsychotics can cause pleasant subjective effects and are subject to abuse.
E. atypical antipsychotics are normally more useful in treating positive symptoms of schizophrenia, and they have strong D₂-binding.
Bloom’s Taxonomy: Understand

12-16. Which of the following is true about atypical antipsychotic drugs?
   A. atypical antipsychotics have more parkinsonian side-effects than typical antipsychotics.
   B. atypical antipsychotics have weak binding to D_3 and D_4 receptors thus they have less parkinsonian side effects.
   C. atypical antipsychotics are more useful in treating bipolar disorder than typical antipsychotics.
   D. atypical antipsychotics have stronger binding to D_3 and D_4 receptors thus they have less parkinsonian side effects.
   E. atypical antipsychotics are normally more useful in treating positive symptoms of schizophrenia, and they have strong D_2-binding.

Bloom’s Taxonomy: Understand

12-17. It is believed that antipsychotics have parkinsonian side effects because they
   A. block dopamine receptors in the nigrostriatal system.
   B. block acetylcholine receptors in the mesolimbic system.
   C. block dopamine receptors in the mesolimbic system.
   D. block acetylcholine receptors in the nigrostriatal system.
   E. none of the above.

Bloom’s Taxonomy: Understand

12-18. The blocking of the D_2 receptors of the dopaminergic ______________ seems to be responsible for the antipsychotic effects of most neuroleptics.
   A. mesolimbic system.
   B. nigrostriatal system.
   C. caudate putamen.
   D. basal ganglia.
   E. cortical system.

Bloom’s Taxonomy: Understand

12-19. A new third-generation antipsychotic drug Abilify (aripiprazole) is different from typical and atypical antipsychotic because
   A. It has weak binding properties to NMDA receptors.
   B. It has strong binding properties to NMDA receptors.
   C. It is partial agonist to D_2, D_3 and D_4 receptors.
   D. It is non-partial agonist to D_2, D_3 and D_4 receptors.
   E. It is GABA antagonist.

Bloom’s Taxonomy: Understand

12-20. Antipsychotic drugs are sometimes given as depot injections because
   A. they are not readily absorbed orally.
   B. they have a terrible taste that most people dislike.
   C. they can become addicting if the patient is allowed to take them at any time.
   D. they have undesirable side effects when taken by other routes.
E. patients do not like them and do not take them reliably on their own.

Bloom’s Taxonomy: Know

12-21. The half-life of antipsychotic is about
   A. 2 hrs
   B. 4 hrs
   C. 8 hrs
   D. 11-58 hrs
   E. 5 days
Bloom’s Taxonomy: Know

12-22. After taking antipsychotics drugs for a period of time, about 30 percent of patients show a condition called
   A. epilepsy.
   B. tardive dyskinesia.
   C. delirium tremens.
   D. akathesia.
   E. physical dependence.
Bloom’s Taxonomy: Know

12-23. Effects of antipsychotic include
   A. Dry mouth, reddening of eyes, increased heart beat.
   B. Tremors, slow motor functions, akathisia.
   C. Euphoria, happiness, elation.
   D. Sleepiness, sadness, hungriness.
   E. Mania, hallucinations, delusions.
Bloom’s Taxonomy: Know

12-24. Antipsychotic drugs
   A. have a very high therapeutic index and are extremely safe.
   B. are often used to commit suicide.
   C. have a very low therapeutic index and are quite toxic.
   D. are responsible for many overdose deaths.
   E. all of B., C., and D.
Bloom’s Taxonomy: Know

12-25. Antipsychotics tested in nonhumans cause
   A. Euphoria, happiness, elation.
   B. Sleepiness, sadness, hungriness.
   C. Mania, hallucinations, delusions.
   D. Dissociation, plastic immobility, decreased aggression.
   E. Impairments in conditioned behavior.
Bloom’s Taxonomy: Know

12-26. Which of the following best describes the abuse potential of the antipsychotic drugs?
   A. they are highly reinforcing and subject to abuse.
B. they are modestly reinforcing and sometimes sold on the street as "downers".
C. they are only reinforcing to those who have a history of sedative-hypnotic abuse.
D. they are never abused.
E. the abuse potential has not been determined.

Bloom’s Taxonomy: Know

12-27. Withdrawal from antipsychotic include
   A. Sleepiness, sadness, hungriness.
   B. Euphoria, happiness, elation.
   C. Dissociation, plastic immobility, decreased aggression.
   D. Impairments in conditioned behavior.
   E. Antipsychotics do not usually cause withdrawal.

Bloom’s Taxonomy: Know

12-28. Apart from the treatment of psychotic behavior, the antipsychotics are used to treat
   A. nausea.
   B. Tourette’s syndrome.
   C. delirium tremens.
   D. hiccups.
   E. all of the above.

Bloom’s Taxonomy: Know

12-29. Which of the following conditions are not treated with antipsychotic drugs?
   A. Huntington's chorea.
   B. infertility.
   C. surgical shock.
   D. stuttering.
   E. psychosis induced by hallucinogenic drugs.

Bloom’s Taxonomy: Know

12-30. Compliance with antipsychotic drugs has been shown to be
   A. Good as patients benefit from the drug.
   B. Good as patients find the effects reinforcing.
   C. Poor as patients continue taking the medication.
   D. Poor as patients stop taking the medication.
   E. Ineffective as symptoms do not disappear.

Bloom’s Taxonomy: Understand

**Short Answers**

1. Describe the negative and positive symptoms of schizophrenia.
   Bloom’s Taxonomy: Understand

2. Compare the typical and atypical antipsychotic drugs.
   Bloom’s Taxonomy: Understand
3. What are some of the factors known to relate to the development of schizophrenia?
   Bloom’s Taxonomy: Understand

4. What are some of the dysfunctions found in the brain of a schizophrenic?
   Bloom’s Taxonomy: Understand

5. How do the typical antipsychotic drugs alleviate the symptoms of schizophrenia?
   Bloom’s Taxonomy: Apply

6. How do the atypical antipsychotic drugs alleviate the symptoms of schizophrenia?
   Bloom’s Taxonomy: Apply

7. Are the newer atypical antipsychotic drugs better in alleviating symptoms in schizophrenia than the older typical antipsychotics?
   Bloom’s Taxonomy: Apply

8. What are some of the problems with antipsychotics?
   Bloom’s Taxonomy: Apply

9. What are the effects of antipsychotics on nonhuman behavior?
   Bloom’s Taxonomy: Apply

10. What are the benefits of antipsychotics?
    Bloom’s Taxonomy: Analyze

11. Explain why antipsychotics have side effects that resemble Parkinson’s disease.
    Bloom’s Taxonomy: Analyze

12. Describe the effects of antipsychotics on the body in humans.
    Bloom’s Taxonomy: Analyze

13. Describe the roles of dopamine and glutamate dysfunctions in the brain that underlie schizophrenia.
    Bloom’s Taxonomy: Analyze

14. What is compliance, and how is it related to antipsychotics?
    Bloom’s Taxonomy: Evaluate

15. Describe some of the challenges related to antipsychotic medication.
    Bloom’s Taxonomy: Evaluate

**Essays**

1. Describe what is known about the onset of schizophrenia.
   Bloom’s Taxonomy: Apply
2. How do the typical and atypical antipsychotic drugs alleviate symptoms in schizophrenia?
   Bloom’s Taxonomy: Apply

3. Why is it said that the atypical antipsychotic drugs are not better in alleviating symptoms in schizophrenia than the typical antipsychotics?
   Bloom’s Taxonomy: Analyze

4. Explain the latest advancements in the knowledge about the dysfunctions of the brain that might cause schizophrenia.
   Bloom’s Taxonomy: Evaluate

5. Even though the antipsychotics have decreased the number of patients at psychiatric wards, what are the challenges that remain in the treatment of schizophrenia?
   Bloom’s Taxonomy: Hypothesize
Chapter 13
Antidepressants

CHAPTER SUMMARY

- There are two types of first-generation antidepressants: (a) monoamine oxidase inhibitors (MAOIs) and (b) tricyclic antidepressants. Second-generation antidepressants make up a diverse group that includes the selective serotonin reuptake inhibitors (SSRIs), and third-generation or atypical include norepinephrine reuptake inhibitors, dopamine reuptake inhibitors, and a variety of others.
- Depression has symptoms such as loss of appetite, loss of energy, sleeping problems, intense feelings of guilt or worthlessness, and thoughts of suicide.
- The antidepressants are absorbed orally and reach peak blood levels in about 4 hours.
- Most tricyclics have very long half-lives; the half-lives of the second-generation antidepressants are usually shorter.
- All agents that act as antidepressants have the effect of increasing transmission at serotonergic synapses. There is a delay of several weeks in the start of the therapeutic effect of the antidepressants.
- The MAOIs also block the destruction of toxic substances found in some foods. People taking MAOIs should not eat foods like pickled herring and some types of cheese; they can cause a buildup of tyramine.
- Clinical trials show that there is a high rate of placebo effect for antidepressants, but antidepressants are more effective than a placebo.
- Increases in violence and suicide have been reported with SSRIs after they have been taken for several weeks. This is sometimes associated with restlessness and akathesia, especially in children and young people.
- Tolerance develops to many of the effects of antidepressants. Withdrawal symptoms are sometimes seen when the drug is discontinued abruptly.
- Antidepressants do not appear to be reinforcing in nonhumans and are never abused or taken for recreational purposes.
- The tricyclics and SSRIs have been shown to cause problems in sexual functioning; both sexes report difficulty in achieving orgasm.

Multiple Choices

13-1. Which are some of the symptoms of depression?
   A. Anhedonia.
   B. Loss of appetite.
   C. Lack of energy.
   D. Suicidality.
13-2. Depression is categorized in DSM-IV as
   A. Psychosis.
   B. Bereavement.
   C. Mood disorder.
   D. Stress.
   E. Dysthymic disorder.

13-3. It has been estimated that about what percent of the population of the United States experiences a depression in their lifetime?
   A. less than 1%.
   B. 2%.
   C. 4%.
   D. 10%.
   E. 13-17%.

13-4. Monoamine theory cannot explain depression entirely because
   A. It has been shown that monoamine levels are higher than normal in depression.
   B. There is a lag time between the start of the medication and alleviation of symptoms.
   C. There is an immediate alleviation of depression.
   D. Only some of the symptoms are helped by the medication.
   E. None of the above.

13-5. The recent research indicates that diminished activity of which of the following neurotransmitters mainly relates to the onset of depression?
   A. Anandamide.
   B. Endorphine.
   C. Dysnorphin.
   D. 5-HT.
   E. GABA.

13-6. Which of the following releases serotonin?
   A. Raphe Nuclei.
   B. Locus Coeruleus.
   C. Central Gray.
   D. Cerebellum.
   E. Basal Ganglia.

13-7. Glucocorticoid theory of depression suggests that
A. Serotonin is broken down by cortisol.
B. High cortisol levels lead to decreased stimulation of the brain and HPA axis.
C. High cortisol levels stimulate the brain and can lead to dysfunctions within HPA axis and monoamine systems.
D. Low cortical levels lead to decreased stimulation of the brain leading to depression.
E. Low cortisol levels lead to dysfunctions within HPA axis and monoamine systems.

Bloom’s Taxonomy: Apply

13-8. Imipramine is a
   A. SSRI.
   B. tricyclic antidepressant.
   C. second generation antidepressant.
   D. MAO inhibitor.
   E. none of the above. Imipramine is an antipsychotic.

Bloom’s Taxonomy: Know

13-9. Prozac is which type of antidepressant?
   A. TCA.
   B. SSRI.
   C. MAOI.
   D. first generation antidepressant.
   E. none of the above. Prozac is a tranquillizer.

Bloom’s Taxonomy: Know

13-10. The newer third-generation antidepressants are called
   A. TCAs.
   B. SSRIs.
   C. MAOIs.
   D. SNRIs.
   E. PBTs.

Bloom’s Taxonomy: Know

13-11. The antidepressant properties of MAO inhibitor, iproniazid, were discovered accidentally while trying to find a treatment for
   A. mania.
   B. depression.
   C. tuberculosis.
   D. schizophrenia.
   E. anorexia.

Bloom’s Taxonomy: Know

13-12. Although all of these drugs increase activity at MA synapses, which of the following is not a psychomotor stimulant?
   A. d-amphetamine.
   B. methylphenidate.
   C. cocaine.
D. ephedrine.
E. imipramine

Bloom’s Taxonomy: Understand

13-13. The blocking of the enzyme monoamine oxidase will cause monoamine levels to
A. rise slowly.
B. fall slowly.
C. resist alteration.
D. develop a rhythmic pattern.
E. none of the above.

Bloom’s Taxonomy: Understand

13-14. Down-regulation refers to
A. a decrease in frequency of drug administration to compensate for an increase in dose.
B. a compensating decrease in heart rate in response to drugs which increase blood pressure.
C. a depression in mood after the use of antidepressants is stopped.
D. a law controlling the prescribing of antidepressants.
E. a reduction in the sensitivity or number of receptor sites of a transmitter after a period of overstimulation.

Bloom’s Taxonomy: Apply

13-15. People should not eat cheese or drink wine after taking which of the following?
A. tricyclic antidepressants.
B. some MAO inhibitors.
C. second generation antidepressants.
D. psychomotor stimulants.
E. antipsychotics.

Bloom’s Taxonomy: Know

13-16. Tricyclic antidepressants function mainly by
A. Blocking reuptake of 5-HT and NE.
B. Causing leakage of neurotransmitters.
C. Increasing the amount of released DA.
D. Stimulating monomine receptors.
E. Activating secondary messengers.

Bloom’s Taxonomy: Understand

13-17. SSRI antidepressants function mainly by
A. Blocking reuptake of 5-HT and NE.
B. Causing leakage of neurotransmitters.
C. Increasing the amount of released DA.
D. Stimulating monomine receptors.
E. Blocking reuptake of 5-HT.

Bloom’s Taxonomy: Understand
13-18. The half-life of fluoxetine is about
   A. 6 hours
   B. 30 hours
   C. 48 hours
   D. 3 days
   E. 4 days
Bloom’s Taxonomy: Know

13-19. Serotonin syndrome can result from
   A. A very long wash-out period.
   B. A very short wash-out period.
   C. Combination of psychomotor stimulants and SSRIs.
   D. Combination of alcohol and SSRIs.
   E. Combination of cheese and SSRIs.
Bloom’s Taxonomy: Apply

13-20. Which of the following drugs is used to treat insomnia?
   A. methylphenidate.
   B. phenmetrazine.
   C. MAO inhibitors.
   D. second generation antidepressants.
   E. tricyclic antidepressants.
Bloom’s Taxonomy: Know

13-21. What are the subjective effects of antidepressants?
   A. Euphoria and happiness.
   B. Good mood.
   C. Mental stimulation.
   D. Increased reaction time.
   E. None of the above.
Bloom’s Taxonomy: Apply

13-22. Which of the following drugs has been used as a "personality cosmetic?"
   A. amitriptyline.
   B. bupropion.
   C. fluoxetine.
   D. maprotiline.
   E. moclobemide.
Bloom’s Taxonomy: Know

13-23. Which of the following characterizes the effect of tricyclic antidepressants on aversively-motivated behavior?
   A. their effect on avoidance and escape is similar to the antianxiety drugs, and their effect on punished behavior is similar to amphetamine.
   B. their effect on avoidance and escape is similar to amphetamine, and their effect on punished behavior is similar to the antianxiety drugs.

C. their effect on avoidance, escape, and punished behavior is similar to amphetamine.
D. their effect on avoidance, escape, and punished behavior is similar to the antianxiety drugs.
E. their effect has not been determined because of their slow onset of action.

Bloom’s Taxonomy: Understand

13-24. The discriminative stimulus properties of antidepressants
   A. are powerful and generalize to antipsychotics.
   B. are weak.
   C. cannot be measured since nonhumans do not like to take the drug.
   D. are powerful but do not generalize to other drugs.
   E. are only apparent after long-term exposure to the drug.

Bloom’s Taxonomy: Understand

13-25. Withdrawal from which of the following can be serious and can include bodily symptoms and delusions
   A. TCAOs.
   B. MAOIs.
   C. SSRIs.
   D. SNRIs.
   E. None of the above.

Bloom’s Taxonomy: Understand

13-26. Which of the following best characterizes the pattern of self-administration of tricyclic antidepressants in nonhumans?
   A. regular, evenly spaced responding.
   B. high rates of responding followed by irregularly spaced periods of abstinence.
   C. high rates of responding followed by periods of abstinence on a regular cycle.
   D. high rates of responding followed by periods of abstinence during which withdrawal seizures are observed.
   E. none of the above. Tricyclic antidepressants are not self-administered.

Bloom’s Taxonomy: Understand

13-27. The black box warnings for those until age 24 were added to SSRIs because
   A. There were indications of increased serotonin syndrome.
   B. There were indications of increased obesity risk.
   C. There were indications of increased cardiovascular disease risk.
   D. There were indications of increased suicidality.
   E. There were indications of increased.

Bloom’s Taxonomy: Know

13-28. What is the therapeutic index of the tricyclic antidepressants?
   A. 10-15.
   B. 15-50.
   C. 50-500.
   D. 500-1000.
E. over 1000.

Bloom’s Taxonomy: Know

13-29. Many antidepressants have been indicated to cause
   A. Sexual dysfunction.
   B. Sexual arousal.
   C. Euphoria.
   D. Increased talking.
   E. Fainting.

Bloom’s Taxonomy: Know

13-30. Which of the following is an effective treatment for depression?
   A. Electroconvulsive therapy.
   B. St John’s wort.
   C. Deep brain stimulation.
   D. Cognitive behavioral therapy.
   E. All of the above

Bloom’s Taxonomy: Know

Short Answers

1. Explain the main symptoms of depression.
   Bloom’s Taxonomy: Understand

2. Explain the monoamine theory of depression.
   Bloom’s Taxonomy: Understand

3. What are SSRIs?
   Bloom’s Taxonomy: Understand

4. What are some of the differences between MAOIs and TCAs?
   Bloom’s Taxonomy: Understand

5. Why the monoamine theory of depression is not sufficient in explaining depression?
   Bloom’s Taxonomy: Apply

6. Explain how stress can cause depression.
   Bloom’s Taxonomy: Apply

7. What are some of the side effects of antidepressants?
   Bloom’s Taxonomy: Apply

8. What is serotonin syndrome?
   Bloom’s Taxonomy: Apply
9. What are the effects of antidepressants on body?
Bloom’s Taxonomy: Apply

10. Which of the current available antidepressant is the safest? Why?
Bloom’s Taxonomy: Analyze

11. Compare SSRIs and SNRIs in how they alleviate depression.
Bloom’s Taxonomy: Analyze

12. Explain why serotonin system dysfunction is thought to be the major reason causing depression.
Bloom’s Taxonomy: Analyze

13. Why was there a black box warning added to SSRIs? Is this warning still relevant?
Bloom’s Taxonomy: Analyze

14. What other treatment than pharmacotherapies are available for depression?
Bloom’s Taxonomy: Evaluate

15. According to the recent research are antidepressants any more effective than placebos?
Bloom’s Taxonomy: Evaluate

**Essays**

1. Explain how HPA axis relates to depression.
Bloom’s Taxonomy: Apply

2. Compare the neurophysiology of MAIOs, TCAs and SSRIs.
Bloom’s Taxonomy: Apply

3. What are the possible reasons why there is a delay of several weeks in alleviation of depression symptoms after initiation of antidepressant medication?
Bloom’s Taxonomy: Analyze

4. Describe other available treatments than pharmacotherapies for depression.
Bloom’s Taxonomy: Evaluate

5. Discuss the possible reasons why placebos are often as effective as antidepressants in treating depression.
Bloom’s Taxonomy: Hypothesize
CHAPTER SUMMARY

- There may be three species of cannabis plant, although many believe that there is only one species, *Cannabis sativa*, with two distinct phenotypes. One, widely called hemp, has low levels of active ingredient. The other phenotype grows in warmer climates, has a high content of active ingredient, and is used primarily as an intoxicant.

- Although there are a great many cannabinoids, the primary active ingredient in cannabis is delta-9-tetrahydrocannabinol (THC). A number of synthetic cannabinoid-like drugs have also been developed for medical applications.

- Marijuana is made from the dried leaves and flowers of the cannabis plant and is not very potent. Hashish is the resin from the flowering tops of the female plant and is 10 times more potent than marijuana. Hashish can be refined and concentrated into liquid called hash oil.

- THC is absorbed very poorly from the digestive system and is usually inhaled in the form of smoke, which is a much more efficient system of administration. After inhalation, effects may begin in 30 to 60 minutes. The effects disappear within an hour or so.

- In the late 1980s, a receptor for THC was isolated and located in many parts of the brain. Later, an endogenous cannabinoid, anandamide, was discovered. Cannabinoid receptors are located on presynaptic neurons and serve to modulate neurotransmitter release in response to endogenous cannabinoids released from the postsynaptic neuron.

- THC has several physiological effects. It causes bloodshot eyes, decreases the pressure in the eyeball, increases appetite and heart rate, and can act as an antiemetic and an anticonvulsant.

- At high doses, cannabis acts like a hallucinogen, but at the low doses common in North American use, the drug is reported to cause a pleasurable high. Cannabis causes temporal disintegration; that is, the user loses the ability to store information in the short term and is easily distracted.

- Cannabis can interfere with driving performance. Roadside screening tests for marijuana intoxication are being developed.

- THC has distinctive stimulus properties and will cause dissociation in both humans and nonhumans. The stimulus properties will generalize to other cannabinoids but not to any other drug.

- Tolerance develops to most of the effects of the cannabinoids.

- Withdrawal symptoms have been reported in humans and nonhumans but are usual only after continuous administration of fairly high doses. Some of the withdrawal symptoms reported are appetite change, restlessness and cravings for cannabis.

- Cannabinoids are self-administered by nonhumans. Humans will work to earn marijuana and will titrate dosage, though not very accurately.

- The belief that cannabis causes violence and aggression has no support in research.
Multiple Choices

14-1. How many phenotypes of *Cannabis sativa* are there?
   A. one.
   B. two.
   C. three.
   D. four.
   E. more than four.
Bloom’s Taxonomy: Know

14-2. Which of the following contribute(s) to the effect of Cannabis?
   A. delta-9-THC.
   B. delta-8-THC.
   C. cannabinol.
   D. cannabidiol.
   E. all of the above.
Bloom’s Taxonomy: Know

14-3. Which of the following contribute(s) to the analgesia, hypothermia, and catalepsy seen in mice following administration of marijuana smoke?
   A. delta-9-THC.
   B. delta-8-THC.
   C. cannabinol.
   D. cannabidiol.
   E. all of the above.
Bloom’s Taxonomy: Know

14-4. Which of the following cannabis preparations is made by boiling cannabis in alcohol or a solvent?
   A. marijuana.
   B. hashish.
   C. charas.
   D. hash oil.
   E. bhang.
Bloom’s Taxonomy: Know

14-5. Which of the following has the highest concentration of active ingredients?
   A. hash oil.
   B. marijuana.
   C. ganja.
   D. hashish.
   E. bhang.
Bloom’s Taxonomy: Know

14-6. Data from the Domestic Cannabis cultivation indicate that the average THC content of
marijuana in 2008 was
A. under 1.5 percent.
B. about 3.5 percent.
C. over 5.0 percent.
D. over 7.0 percent.
E. over 10 percent.
Bloom’s Taxonomy: Know

14-7. The THC content in crossbred and hydroponically grown marijuana such as *sinsemilla* can be as high as
A. 1.5 percent.
B. 3.5 percent.
C. 5.0 percent.
D. 10.0 percent.
E. 30 percent.
Bloom’s Taxonomy: Know

14-8. Sativex is a drug containing natural cannabinoids and used medically to treat
A. nausea associated with chemotherapy.
B. neuropathic pain associated with multiple sclerosis.
C. pressure in the eye associated with glaucoma.
D. withdrawal symptoms associated with abstinence from marijuana.
E. all of the above.
Bloom’s Taxonomy: Know

14-9. Who was the 19th century French physician who suggested that cannabis might be useful in the treatment of mental illness?
A. Theophile Gautier.
B. J.J. Moreau de Tours.
C. Rabalais.
D. W.B. O'Shaughnessy.
E. Ducas-Carota.
Bloom’s Taxonomy: Know

14-10. After smoking marijuana, traces of THC may remain in the body for as long as
A. three to four minutes.
B. three to four hours.
C. 30 days.
D. three to four days.
E. two to three weeks.
Bloom’s Taxonomy: Understand

14-11. THC alters neural functioning by
A. altering the properties of the membrane in the manner of general anesthetics and alcohol.
B. blocking sodium ion channels.
C. working at a receptor site.
D. interfering with the synthesis of a neurotransmitter.
E. enhancing the activity of endogenous opiates.

Bloom’s Taxonomy: Apply

14-12. Discovery of the first THC receptor to be identified can be credited to
   A. Albert Hoffman.
   B. Timothy Leary and Richard Alpert.
   C. Leo Sternbeck.
   D. Linda Matsuda and Miles Herkinham.
   E. Harriet deWit and Gordon Alles.

Bloom’s Taxonomy: Know

14-13. Cannabinoid receptors are located in
   A. the spleen.
   B. the hypothalamus.
   C. brainstem.
   D. spinal cord.
   E. all the above.

Bloom’s Taxonomy: Know

14-14. Anandamide is
   A. a name given to an endogenous cannabinoid.
   B. a name given to an endogenous opioid receptor.
   C. a name given to an endogenous sigma receptor.
   D. a name given to an endogenous benzodiazepine receptor.
   E. none of the above. Anandamide is a synthetic cannabinoid.

Bloom’s Taxonomy: Know

14-15. THC is sometimes used medically
   A. to treat glaucoma.
   B. to treat nausea and vomiting.
   C. to treat spasticity.
   D. to treat arthritis.
   E. all of the above.

Bloom’s Taxonomy: Know

14-16. Which of the following is not a direct effect of THC on the body?
   A. dilation of the pupils.
   B. bloodshot eyes.
   C. drooping eyelids.
   D. dry mouth.
   E. increase in heart rate.

Bloom’s Taxonomy: Know

14-17. Which of the following best characterizes the effect of high doses of marijuana on sleep?
A. it increases REM sleep and dreaming.
B. it induces sleep and increases sleep time.
C. it causes restlessness and insomnia.
D. THC withdrawal causes frequent awakenings and nightmares.
E. there is a depression in the amplitude of delta waves.

Bloom’s Taxonomy: Know

14-18. Which aspect of the environment influences most the subjective effect of marijuana?
A. psychedelic lighting.
B. the mood of others present.
C. rock music.
D. watching television.
E. carrying on a conversation.

Bloom’s Taxonomy: Understand

14-19. "Temporal disintegration" caused by THC refers to
A. a loss in the ability to retain and coordinate information for a purpose.
B. the feeling that time is going by too quickly.
C. perceptions which tend to break up.
D. vision that seems jumpy as though things were being seen in a stroboscopic light.
E. none of the above. Temporal disintegration is seen only after taking a more potent hallucinogen like LSD.

Bloom’s Taxonomy: Understand

14-20. Attempts at using the Standardized Field Sobriety Test as a roadside screening tool to assess for marijuana intoxication have revealed that
A. varying levels of marijuana intoxication are undetectable using this test.
B. a large proportion of drug-free participants were classified as intoxicated.
C. 100% of participants who had smoked marijuana were classified as intoxicated.
D. only participants who had smoked low-dose THC were classified as intoxicated.
E. the test was useful in distinguishing marijuana users from drug-free participants.

Bloom’s Taxonomy: Apply

14-21. Rats trained to discriminate THC from saline will generalize the THC response to which of the following?
A. LSD.
B. PCP.
C. amphetamine.
D. mescaline.
E. none of the above.

Bloom’s Taxonomy: Understand

14-22. Which of the following is NOT a symptom of THC withdrawal in humans?
A. cravings.
B. appetite change.
C. thoughts of cannabis.
D. cramps.
E. None of the above. There are no withdrawal from THC.

Bloom’s Taxonomy: Know

14-23. Marijuana smoking in North America has been different from consumption patterns in countries where the drug has been used for a longer time. The difference(s) is (are)
A. North Americans consume less per day on the average.
B. there are a smaller percentage of daily users in North America.
C. in North America, most users eventually decrease their use and stop.
D. none of the above.
E. all of A., B., and C.

Bloom’s Taxonomy: Know

14-24. A "freak-out"
A. occurs only when taking high doses of cannabis.
B. is a term used to describe "rave" parties.
C. is a panic that arises from hallucinations and perceptual distortions.
D. is a form of memory loss associated with cannabis use.
E. both A. and C.

Bloom’s Taxonomy: Know

14-25. The "gateway" theory suggests that
A. marijuana causes an unsteady gait in heavy users.
B. marijuana causes people to pursue a life of crime and violence.
C. marijuana leads to the use of other more powerful drugs.
D. marijuana causes a lack in achievement motivation.
E. none of the above. The stepping stone theory applies to benzodiazepines.

Bloom’s Taxonomy: Know

14-26. Studies examining the relationship between cannabis use and the onset of schizophrenia have shown that
A. heavy cannabis use causes schizophrenia.
B. heavy cannabis use speeds or precipitates the onset of schizophrenic symptoms in all drug users.
C. heavy cannabis use speeds or precipitates the onset of schizophrenic symptoms only in people who would have developed the disease anyway.
D. the proportion of a population experiencing schizophrenic symptoms is directly related to trends in cannabis use in that population.
E. there is no relationship between cannabis use and experiencing schizophrenic symptoms.

Bloom’s Taxonomy: Apply

14-27. Marijuana smoke contains
A. 50% to 70% less carcinogenic material than tobacco smoke.
B. 20% less carcinogenic material than tobacco smoke.
C. the same amount of carcinogenic material than tobacco smoke.
D. 20% more carcinogenic material than tobacco smoke.
E. 50 to 70% more carcinogenic material than tobacco smoke.

Bloom’s Taxonomy: Know

14-28. Common factor model suggests that
   A. Gateway theory about cannabis is true.
   B. Cannabis has a direct relationship with hard-drug use.
   C. Gateway theory about cannabis is somewhat true.
   D. Individuals degree of drug exposure correlates with hard-drug use, not cannabis use alone.
   E. Individuals degree of drug exposure does not correlate with hard-drug use, but cannabis use alone.

Bloom’s Taxonomy: Understand

14-29. Research about cannabis and permanent intellectual impairment seems to suggest that
   A. cannabis in low doses causes brain damage.
   B. cannabis does not cause brain damage at all.
   C. cannabis in high doses causes brain damage.
   D. long-term cannabis use might cause mild impairments in cognitions, and especially if the use is stopped early these effects disappear.
   E. long-term cannabis does not cause impairments in cognitions.

Bloom’s Taxonomy: Apply

14-30. The relationship between cannabis and cancer prevalence is
   A. very clear, cannabis is known to cause cancer.
   B. somewhat confusing, as some studies suggest correlation, and others not.
   C. not studied in detail.
   D. very clear, cannabis does not cause cancer.
   E. very clear, cannabis damages DNA and creates mutations frequently.

Bloom’s Taxonomy: Understand

**Short Answers**

1. Which plants are the sources of natural cannabinoids?
   Bloom’s Taxonomy: Understand

2. What sources of THC are available for someone wanting to use medical marijuana?
   Bloom’s Taxonomy: Understand

3. Describe the history of Cannabis plant.
   Bloom’s Taxonomy: Understand

4. Describe the different preparations of cannabis.
   Bloom’s Taxonomy: Understand

5. Compare the oral and inhalation administration routes of cannabis.
Bloom’s Taxonomy: Apply

6. Explain why is it possible to detect traces of THC in body even 30 days after use?
Bloom’s Taxonomy: Apply

7. Compare CB₁ and CB₂ receptors.
Bloom’s Taxonomy: Apply

8. How does THC work in the brain?
Bloom’s Taxonomy: Apply

9. Describe the effects of cannabis on body.
Bloom’s Taxonomy: Apply

10. List some of the effects of cannabis based on the neurophysiology.
Bloom’s Taxonomy: Analyze

11. List some of the effects of cannabis based on the locations of the cannabinoid receptors in the body.
Bloom’s Taxonomy: Analyze

12. List some of the effects of cannabis based on the locations of the cannabinoid receptors in the brain.
Bloom’s Taxonomy: Analyze

13. Describe medical use of cannabis; explain three disorders/conditions that might be treated with cannabis.
Bloom’s Taxonomy: Analyze

14. What are the effects of cannabis on cognitive functions in longterm users vs. young users?
Bloom’s Taxonomy: Evaluate

15. Is cannabis use harmful or beneficial?
Bloom’s Taxonomy: Evaluate

**Essays**

1. Describe the neurophysiology of THC.
Bloom’s Taxonomy: Apply

2. What are the endogenous cannabinoids, and how do they function in the brain?
Bloom’s Taxonomy: Apply

3. Consider the harmful and beneficial effects of cannabis.
Bloom’s Taxonomy: Analyze
4. Discuss the recent data related to cannabis use and mental disturbance, cognitive decline, amotivational syndrome and gateway theory. Is there enough scientific data to support the relationship?
   Bloom’s Taxonomy: Evaluate

5. If cannabis was legal, but regulated similarly to alcohol, what would happen in your opinion?
   Bloom’s Taxonomy: Hypothesize
Chapter 15
Hallucinogens, Phantasticants, and Club Drugs

CHAPTER SUMMARY

- Hallucinogens are a class of drugs that cause hallucinations. Other drugs discussed in this chapter may be called many names depending on why they are taken. These include phantasticants, psychedelics (mind manifesters), entactogens (touching within), and empathogens (empathy creators). Many are used as club drugs.

- The indoleamine-like drugs include LSD, psilocybin, and DMT, and the catecholamine-like drugs include mescaline and ecstasy.

- LSD is an extremely potent hallucinogen that resembles serotonin. It was synthesized in 1943 but did not become popular until the 1960s, when it was extensively used.

- LSD is sold on the street as hits in blotters, gelatin, and sugar cubes. It is effective orally.

- The indoleamine-like and catecholamine-like drugs all are agonists at a specific serotonin receptor, and this increases the responses of glutaminergic neurons in the cortex.

- In general, the hallucinatory experience starts out with colored visions of tunnel, spiral, and lattice shapes that move. Meaningful images start to become incorporated into these images, and finally there is a rapid succession of meaningful scenes.

- LSD also has empathogenic effects, and people often experience profound feelings of a mystical or religious nature.

- Tolerance develops and dissipates rapidly to the effects of LSD and psilocybin.

- Indoleamine-like hallucinogens are only rarely self-administered by nonhumans, but human use is widespread among many cultures. In the United States, its use has been dropping since 1996.

- There are a large number of synthetic drugs that combine the properties of catecholamine-like drugs and amphetamine. The best known is MDMA, also known as ecstasy.

- Ecstasy enhances social intimacy and is considered an empathogen and entactogen and is widely used as a club drug.

- Ecstasy is taken orally, is absorbed in 2 hours, and has a half-life of about 8 hours. It enhances the release and blocks the reuptake of catecholamines, primarily serotonin.

- Ecstasy is self-administered by nonhumans.

- Heavy use of ecstasy causes a depletion of serotonin in the brain and the effects of this last for months and cause sleep disorders and anxiety. Acute doses at raves cause a loss of heat regulation accompanied by dehydration and heatstroke symptoms.
• **Salvia** (*Salvia dinorum*) is a psychoactive plant that causes short-term visions and dissociative effects similar to LSD, however Salvinorin A, the active ingredient is not similar to other drugs. It is thought to bind to κ-opioid receptor.

• Phencyclidine (PCP) and ketamine are dissociative anesthetics. They can be inhaled, injected, or taken orally. Their effects are felt within minutes.

• The dissociative anesthetics block NMDA receptors for glutamate in the cortex. They can block memories for events during their effect and can induce thought disorders. They induce numbness, relaxation, and analgesia. With continuous use, tolerance develops, and there are withdrawal symptoms.

• Nonhumans self-administer dissociative anesthetics.

• Psychosis caused by the dissociative anesthetics can sometimes last long after the drug has been used, and there have been a number of accidental deaths reported.

• Dextromethorphan is widely used in over-the-counter cough suppressants. Both it and its metabolite dextrophan block the NMDA receptor for glutamate and have effects similar to the dissociative anesthetics.

• Dextrophan is more potent than dextromethorphan, so speeded metabolism enhances its effect.

• Nonhumans readily self-administer dextromethorphan.

• GHB is a metabolite of GABA. It was used as a medicine in Europe and became available in health food stores as a dietary supplement. It was made illegal in the United States in 1990, but it also has a legitimate medical use.

• GHB is taken orally. Its effects begin in 15 to 30 minutes and peak between 25 and 45 minutes. It has a half-life of 30 to 50 minutes. Low doses cause relaxation and sleep. High doses cause unarousable sleep or coma.

• GHB has its own receptor in the CNS and modifies the activity of many other neurotransmitters.

• GHB acts like an anesthetic, but it seems to be causing a cataleptic state. It causes an alcohol-like intoxication with amnesia. At therapeutic doses it causes normal sleep with normal EEG patterns and can be used to treat narcolepsy.

• GHB is not self-administered by nonhumans. In the United States, its use increased in the 1990s but appears to have leveled off. Tolerance and withdrawal effects have been reported.

• Mephedrone is a synthetic euphoria causing stimulant similar to amphetamine that can be swallowed, snorted, smoked or injected. The neurophysiological effect might be due blocking of reuptake of serotonin and dopamine.

**Multiple Choices**
15-1. The term "psychedelic" means
A. mind manifesting.
B. psychosis mimicking.
C. causes hallucinations.
D. causes distorted sensations.
E. provider of cosmic insight.
Bloom’s Taxonomy: Know

15-2. A disease known as "St. Anthony's Fire" was a result of consuming
A. hashish.
B. phencyclidine.
C. ergot-infected grain.
D. Amanita muscaria.
E. ibogamine.
Bloom’s Taxonomy: Know

15-3. Who discovered and first experienced LSD?
A. Timothy Leary.
B. Dr. Richard Alpert.
C. R. Gordon Wasson.
D. Albert Hoffman.
E. Dr. V.L. Stromberg.
Bloom’s Taxonomy: Know

15-4. Which of the following was (were) directly or indirectly responsible for the popularization of LSD in the 1960s?
A. Timothy Leary.
B. Humphry Osmond.
C. Sigmund Freud.
D. the discovery that the psilocybe mushroom would grow uncultivated in most parts of the United States.
E. both A. and C.
Bloom’s Taxonomy: Know

15-5. What was the first hallucinogen used by Timothy Leary?
A. LSD.
B. psilocybin.
C. amanita muscaria.
D. mescaline.
E. datura.
Bloom’s Taxonomy: Know

15-6. The subjective effect of LSD is most similar to which of the following drugs?
A. alcohol.
B. cocaine.
C. heroin.
D. marijuana.
E. barbiturates.

Bloom’s Taxonomy: Understand

15-7. A “hit” of LSD sold on the street typically contains how much of the drug?
A. 0 to 300 micrograms.
B. 300 to 600 micrograms.
C. 600 to 900 micrograms.
D. 300 to 600 milligrams.
E. 0 to 300 milligrams.

Bloom’s Taxonomy: Know

15-8. The half-life of LSD in humans is approximately
A. 20 minutes.
B. 45 minutes.
C. 60 minutes.
D. 75 minutes.
E. 110 minutes.

Bloom’s Taxonomy: Know

15-9. In the CNS, LSD appears to be a selective agonist for which of the following receptors?
A. dopamine D₃ receptors.
B. norepinephrine α₁ receptors.
C. acetylcholine nicotinic receptors.
D. serotonin 5-HT₂A receptors.
E. glutamate NMDA receptors.

Bloom’s Taxonomy: Understand

15-10. Which of the following brain regions appear to be involved in the subjective effects of LSD and similar monoamine-like drugs?
A. ventral tegmental area and amygdala.
B. nucleus accumbens and hippocampus.
C. locus coeruleus and cortex.
D. cerebellum and basal ganglia.
E. all of the above.

Bloom’s Taxonomy: Understand

15-11. Which of the following is NOT a geometric pattern normally reported during mescaline-induced hallucinations?
A. grating or lattice.
B. tunnel, funnel, or cone.
C. cobweb.
D. spiral.
E. rectangle.

Bloom’s Taxonomy: Know
15-12. Morning glory seeds contain which of the following?
   A. LSD.
   B. lysergic acid amide.
   C. psilocin.
   D. ibotenic acid.
   E. muscarine.
Bloom’s Taxonomy: Know

15-13. Which of the following is an ingredient in magic mushrooms?
   A. LSD.
   B. mescaline.
   C. harmine.
   D. psilocybin.
   E. lysergic acid amide.
Bloom’s Taxonomy: Know

15-14. Which of the following may occur naturally in animal tissues such as the backs of some toads?
   A. DMT.
   B. ergot alkaloids.
   C. bufotenine.
   D. ibogamine.
   E. psilocybin.
Bloom’s Taxonomy: Know

15-15. The active ingredient in peyote is
   A. mescaline.
   B. lysergic acid amide.
   C. harmine.
   D. scopolamine.
   E. DMT.
Bloom’s Taxonomy: Know

15-16. What is the potency of mescaline compared to that of LSD?
   A. 200 times less potent.
   B. 2000 times less potent.
   C. it has the same potency.
   D. 200 times more potent.
   E. 2000 times more potent.
Bloom’s Taxonomy: Know

15-17. Phencyclidine (PCP) and ketamine are called dissociative anesthetics because
   A. they cause a trance-like state that seems to separate people from sensory experience.
   B. they cause hallucinations.
   C. they work as analgesics and anesthetics.
D. PCP and ketamine have opposite effects.
E. none of the above.

Bloom’s Taxonomy: Apply

15-18. Which of the following is similar to PCP?
A. mescaline.
B. ketamine.
C. THC.
D. psilocybin.
E. scopolamine.

Bloom’s Taxonomy: Know

15-19. The conclusion of the research by Ronald Siegel on hallucinations was that
A. hallucinations are unique to each individual.
B. different types of hallucinogens cause different types of hallucinations.
C. culture determines the form and the content of hallucinations.
D. hallucinations all have a strong emotional and religious content.
E. the nature of hallucinations is determined by the structure of the visual system and the brain, not by the drug.

Bloom’s Taxonomy: Apply

15-20. The use of LSD
A. improves the acuity of both vision and hearing.
B. causes participants to be more attentive to the tasks being performed.
C. increases motivation.
D. all of the above.
E. none of the above.

Bloom’s Taxonomy: Understand

15-21. Which of the following describes the pattern of responding during LSD self-administration in nonhumans?
A. regular, evenly spaced responding.
B. high rates of responding followed by irregularly spaced gaps of abstinence.
C. high rates of responding followed by periods of abstinence on a regular cycle.
D. high rates of responding followed by periods of abstinence during which withdrawal seizures are observed.
E. none of the above. LSD is not self-administered.

Bloom’s Taxonomy: Know

15-22. Tolerance to LSD usually disappears
A. within a day.
B. within a week.
C. within a month.
D. within six months.
E. within a year.

Bloom’s Taxonomy: Know
15-23. Withdrawal symptoms of LSD and other monoamine-like hallucinogens and phantasticants
   A. include vocalizations, grinding of the teeth, and constipation.
   B. include depression, sleepiness, and tremors.
   C. are not found in humans.
   D. include respiratory depression, convulsions and coma.
   E. can result in death if not treated.
Bloom’s Taxonomy: Know

15-24. The sensation of objects appearing to move in a jerky, discontinuous fashion as though illuminated by a stroboscopic light is called
   A. a flashback.
   B. a hypnotic experience.
   C. a psychedelic experience.
   D. trailing phenomenon.
   E. a psychotomimetic experience.
Bloom’s Taxonomy: Know

15-25. For most people who use LSD, drug taking
   A. begins in young adulthood and becomes more frequent as the individual gets older.
   B. is frequent, often occurring daily, for months at a time.
   C. has shown a steady decrease in prevalence from 1990 to 2009.
   D. is motivated by fear and avoidance of the symptoms of LSD withdrawal.
   E. does not decrease with time.
Bloom’s Taxonomy: Know

15-26. The commonly-used name for 3,4-methylenedioxymethamphetamine is
   A. methamphetamine.
   B. crack cocaine.
   C. Ritalin.
   D. heroin.
   E. ecstasy.
Bloom’s Taxonomy: Know

15-27. For the most part, designer drugs like ecstasy are
   A. more potent and more toxic than mescaline.
   B. more likely to cause unpleasant side effects.
   C. are not screened for adverse effects before they are distributed.
   D. all of the above.
   E. none of the above.
Bloom’s Taxonomy: Understand

15-28. Which of the following is NOT a subjective effect of ecstasy?
   A. paranoia.
   B. sharpened sensory experience.
C. increase in wakefulness.
D. increased endurance.
E. all of the above are subjective effects of ecstasy.

Bloom’s Taxonomy: Know

15-29. Which of the following is NOT a physiological effect of ecstasy?
   A. bruxism.
   B. increased muscular tension.
   C. increased body temperature.
   D. pupil dilation.
   E. all of the above are physiological effects of ecstasy.

Bloom’s Taxonomy: Know

15-30. Increased activity of which of the following neurotransmitter systems is important for the subjective effects of mescaline and mescaline-like drugs?
   A. serotonin.
   B. dopamine.
   C. norepinephrine.
   D. acetylcholine.
   E. glutamate.

Bloom’s Taxonomy: Understand

15-31. Chronic use of ecstasy results in
   A. a depletion in brain serotonin.
   B. an increased amount of brain serotonin.
   C. a permanent depletion in brain dopamine.
   D. a temporary depletion in brain dopamine.
   E. a permanent increase in brain serotonin and dopamine activity.

Bloom’s Taxonomy: Know

15-32. Which of the following symptoms of chronic ecstasy use may persist despite years of abstinence from the drug?
   A. memory impairment.
   B. disturbances in body temperature regulation.
   C. decreased attentiveness.
   D. anxiety and hostility.
   E. all of the above symptoms may persist for many years following ecstasy abstinence.

Bloom’s Taxonomy: Know

15-33. What is the therapeutic index of ecstasy?
   A. 5.
   B. 10.
   C. 15.
   D. 20.
   E. 25.

Bloom’s Taxonomy: Know
15-34. Salvinorin A is suggested to bind to
   A. D₂ receptor
   B. κ-opioid receptor
   C. 5-HT₂A receptor
   D. Ach receptor
   E. NE receptor
Bloom’s Taxonomy: Understand

15-35. The subjective effects of Salvia are
   A. different from LSD and last longer than 2 hours.
   B. similar to amphetamine and last longer than 2 hours.
   C. similar to LSD and last less than 30 minutes.
   D. similar to amphetamine and last less than 30 minutes.
   E. None of the above.
Bloom’s Taxonomy: Know

15-36. A normal dose of ketamine contains 75 to 125 mg and is referred to as a
   A.  bump.
   B.  gel tab.
   C.  window pane.
   D. microdot.
   E.  dip.
Bloom’s Taxonomy: Know

15-37. The reinforcing effects of the dissociative anesthetics, such as PCP and ketamine, are likely due to the ability of these drugs to
   A.  increase dopamine transmission.
   B.  block dopamine D₁ receptors.
   C.  increase glutamate transmission.
   D.  block glutamate NMDA receptors.
   E.  increase serotonin transmission.
Bloom’s Taxonomy: Understand

15-38. Nonhumans trained to discriminate PCP and ketamine generalize this response to which of the following drugs?
   A.  alcohol.
   B.  barbiturates.
   C.  opioids.
   D.  stimulants.
   E.  none of the above.  Dissociate anesthetics appear to have unique stimulus properties.
Bloom’s Taxonomy: Apply

15-39. In nonhumans, withdrawal from PCP is marked by
   A.  grinding of the teeth.
   B.  difficulty staying awake.
15-40. Patterns of PCP use are most similar to which of the following drugs?
   A. alcohol.
   B. cannabis.
   C. caffeine.
   D. methamphetamine.
   E. LSD.
Bloom’s Taxonomy: Know

15-41. In 2004, what percentage of high school students in the United States reported having used PCP within the past 30 days?
   A. less than 1 percent.
   B. 5 percent.
   C. 7 percent.
   D. 10 percent.
   E. 15 percent.
Bloom’s Taxonomy: Know

15-42. Which of the following statements is true?
   A. PCP causes people to commit uncontrolled, violent acts.
   B. PCP reduces violence and aggression in humans.
   C. PCP causes laboratory animals to act aggressively.
   D. PCP exerts a taming effect on normally-aggressive laboratory animals.
   E. PCP has no effect on aggression in humans or in laboratory animals.
Bloom’s Taxonomy: Know

15-43. The lethal effects of PCP and ketamine
   A. are increased in long-term users.
   B. are decreased in long-term users.
   C. are potentiated by the presence of alcohol in the body.
   D. are decreased by the presence of alcohol in the body.
   E. are non-existent. PCP and ketamine are never lethal.
Bloom’s Taxonomy: Know

15-44. The cough medicine Robitussin contains which of the following opiate-like drugs?
   A. codeine.
   B. dextromethorphan.
   C. diacetylmorphine.
   D. pethidine.
   E. pentazocine.
Bloom’s Taxonomy: Know
15-45. Dextromethorphan binds with which of the following receptors?
   A. mu opiate receptors.
   B. delta opiate receptors.
   C. dopamine D<sub>1</sub>-like receptors.
   D. glutamate NMDA receptors.
   E. serotonin 5-HT<sub>2</sub> receptors.
Bloom’s Taxonomy: Understand

15-46. Which of the following best describes the effects of dextromethorphan and dextrophan on locomotor activity of laboratory animals?
   A. dextromethorphan and dextrophan cause similar increases in locomotor activity.
   B. dextromethorphan and dextrophan cause similar decreases in locomotor activity.
   C. dextromethorphan causes a decrease in locomotor activity whereas dextrophan causes an increase in locomotor activity.
   D. dextromethorphan causes an increase in locomotor activity whereas dextrophan causes a decrease in locomotor activity.
   E. dextromethorphan and dextrophan have no effect on locomotor activity.
Bloom’s Taxonomy: Apply

15-47. GHB occurs naturally in the body as a metabolite of
   A. glutamate.
   B. GABA.
   C. glycine.
   D. aspartate.
   E. acetylcholine.
Bloom’s Taxonomy: Know

15-48. At high levels, GHB binds to which of the following receptors?
   A. GABA receptors.
   B. GHB receptors.
   C. glutamate receptors.
   D. both A. and B.
   E. both B. and C.
Bloom’s Taxonomy: Understand

15-49. Testing in nonhumans suggests that GHB is different from other dissociative anesthetics in which of the following ways?
   A. it causes more of a cataleptic state than an analgesic state.
   B. it produces seizure-like brain activity.
   C. at high doses, it produces physical signs of seizure such as body jerks.
   D. all of the above.
   E. none of the above. The effects of GHB are similar to those of other dissociative anesthetics.
Bloom’s Taxonomy: Know

15-50. GHB has been used medically as a treatment for which of the following conditions?
A. epilepsy.
B. Parkinson’s disease.
C. sexual impotence.
D. depression.
E. narcolepsy.

Bloom’s Taxonomy: Know

15-51. Which of the following describes the pattern of responding during GHB self-administration in nonhumans?
    A. regular, evenly spaced responding.
    B. high rates of responding followed by irregularly spaced gaps of abstinence.
    C. high rates of responding followed by periods of abstinence on a regular cycle.
    D. high rates of responding followed by periods of abstinence during which withdrawal seizures are observed.
    E. none of the above. There is no convincing evidence that GHB is reliably self-administered.

Bloom’s Taxonomy: Know

15-52. Administration of GHB will alleviate the withdrawal symptoms of which of the following drugs?
    A. barbiturates.
    B. alcohol.
    C. stimulants.
    D. nicotine.
    E. caffeine.

Bloom’s Taxonomy: Know

**Short Answers**

1. Describe what it means that a drug is hallucinogenic.
   Bloom’s Taxonomy: Understand

2. Describe LSD trip and hallucinations caused by LSD.
   Bloom’s Taxonomy: Understand

3. Describe the differences between indoleamine-like drugs and catecholamine-like drugs.
   Bloom’s Taxonomy: Understand

4. Describe the history of LSD use in North-America.
   Bloom’s Taxonomy: Understand

5. Compare the abuse potential of MDMA and LSD.
   Bloom’s Taxonomy: Apply

6. What are the effects of MDMA on the body and the brain?
   Bloom’s Taxonomy: Apply
7. What are the effects of PCP on the body and the brain?
Bloom’s Taxonomy: Apply

8. Compare dextromethorphan and GHB neurophysiology and effects.
Bloom’s Taxonomy: Apply

9. What is Salvia?
Bloom’s Taxonomy: Apply

10. What is mephedrone?
Bloom’s Taxonomy: Analyze

11. Why is LSD suggested to be a useful drug in psychotherapy?
Bloom’s Taxonomy: Analyze

12. Which one is more harmful, LSD or ecstasy?
Bloom’s Taxonomy: Analyze

13. Compare the subjective effects of LSD and MDMA.
Bloom’s Taxonomy: Analyze

14. What are the harmful effects of LSD?
Bloom’s Taxonomy: Evaluate

15. Which of the club drugs discussed in Chapter 15 is the safest to use, and why?
Bloom’s Taxonomy: Evaluate

**Essays**

1. Compare the neurophysiology of LSD and MDMA.
Bloom’s Taxonomy: Apply

2. Describe the various subjective effects of LSD.
Bloom’s Taxonomy: Apply

3. Compare the subjective effects of LSD, PCP, Salvia and MDMA.
Bloom’s Taxonomy: Analyze

4. Which of the club drugs discussed in Chapter 15 is the most harmful, and why?
Bloom’s Taxonomy: Evaluate

5. In your opinion is it justified to use LSD or MDMA in clinical trials to study treatments for mental illnesses?
Bloom’s Taxonomy: Hypothesize