Psychopharmacology

Instructor Manual

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The Noba Therapies unit contains two modules: Therapeutic orientations and Psychopharmacology.

Psychopharmacology provides an overview of drug treatments and how they work and interact with our nervous system. This module also briefly touches upon some controversial subjects in the field of psychopharmacology, such as the addictive nature of some drugs.

Learning Objectives

- Relevant APA Learning Objectives (Version 2.0)
    - Describe key concepts, principles, and overarching themes in psychology (1.1)
    - Describe applications of psychology (1.3)
    - Apply ethical standards to evaluate psychological science and practice (3.1)
    - Apply psychological content and skills to career goals (5.1)

- Content-Specific Learning Objectives: Psychopharmacology
    - How do the majority of psychoactive drugs work in the brain?
    - How does the route of administration affect how rewarding a drug might be?
    - Why is grapefruit dangerous to consume with many psychotropic medications?

- Why might individualized drug doses based on genetic screening be helpful for treating conditions like depression?
- Why is there controversy regarding pharmacotherapy for children, adolescents, and the elderly?

Abstract

Psychopharmacology is the study of how drugs affect behavior. If a drug changes your perception, or the way you feel or think, the drug exerts effects on your brain and nervous system. We call drugs that change the way you think or feel psychoactive or psychotropic drugs, and almost everyone has used a psychoactive drug at some point (yes, caffeine counts). Understanding some of the basics about psychopharmacology can help us better understand a wide range of things that interest psychologists and others. For example, the pharmacological treatment of certain neurodegenerative diseases such as Parkinson's disease tells us something about the disease itself. The pharmacological treatments used to treat psychiatric conditions such as schizophrenia or depression have undergone amazing development since the 1950s, and the drugs used to treat these disorders tell us something about what is happening in the brain of individuals with these conditions. Finally, understanding something about the actions of drugs of abuse and their routes of administration can help us understand why some psychoactive drugs are so addictive. In this module, we will provide an overview of some of these topics as well as discuss some current controversial areas in the field of psychopharmacology.

Class Design Recommendations

Although many courses fold pharmacological techniques into a lecture with other treatments, this form of therapy is perhaps one of the most used. Correspondingly, assigning a whole class period to this module better reflects the ubiquity of this treatment.

Please also refer to the Noba PowerPoint slides that complement this outline.

First class period (50-75 min)

- Briefly introduce of how drugs affect behavior

- Discuss pharmacokinetics
- Describe drug Administration and metabolism
- Talk about individualized Therapy, metabolic differences, and potential prescribing approaches for the future
- Special topic: Drugs vs. therapy
- Educate students on controversial issues
    - Special topic: The link between antidepressants and suicide, violence, and mania
- Are drugs more effective than psychological therapies?
- Optional 7-day activity: Medication adherence – Easy as can be…right?

Module Outline

Introduction

- Psychopharmacology is the study of how drugs affect brain and behavior. All **psychoactive drugs** interfere or alter how neurons communicate with each other. Neurons communicate with each other by releasing a chemical called a **neurotransmitter** across a tiny space between the neurons, known as the **synapse**. Some of the most important neurotransmitters in terms of psychopharmacological use are: acetylcholine, dopamine, norepinephrine, serotonin, glutamate, GABA, and endogenous opioids. Psychoactive drugs can either increase neurotransmission activity at the synapse **(agonists**) or reduce it (**antagonists**). Drugs accomplish these results by different mechanisms. While drugs target specific neurotransmitters in their primary mechanisms, drugs often do not work exactly where intended. This contributes to side effects. Commonly, individuals prescribed **psychotropic drugs**take additional drugs to counteract the side effects of the initial drug.

Pharmacokinetics: What Is It – Why Is It Important?

- **Pharmacokinetics**refers to how our body handles the drugs we take. The acronym ADME stands for absorption (how the drug gets into the bloodstream), distribution (how the drug reaches the brain), metabolism (how the drug is broken down), and excretion (how the

drug leaves the body).

Drug Administration

- The way we take drugs impacts how quickly they reach the brain. Oral administration, the most common, is relatively slow. Drugs enter the stomach and are absorbed in the small intestine. The rate of absorption can be affected by, among other factors, the type and quantity of food in your stomach. The fastest methods of administration, however, are inhalation and intravenous.
- The more quickly a drug reaches the brain and activates the reward center, the higher the risk for abuse and addiction (i.e. smoking). The cues associated with such drugs can be equally intense, amplifying the addiction.

Drug Metabolism

- Metabolism, or the breakdown of drugs, occurs primarily in the liver. The liver produces **enzymes,**proteins that speed up chemical reactions involved in the breakdown of psychoactive drugs. Enzymes exist in families and the same family of enzymes breaks down many psychoactive drugs: the cytochrome P450 superfamily.
- Tolerance to drugs can occur through repeated exposure. This is particularly true of sedative drugs like opiate-based painkillers or alcohol. Some drugs (like alcohol) cause **enzyme induction**, an increase in the number of enzymes produced by the liver. For example, chronic alcohol consumption can lead to alcohol being broken down more quickly, requiring more drinks to reach the same affect.

Recent Issues Related to Psychotropic Drugs and Metabolism

- *Grapefruit Juice and Metabolism*.Certain foods can alter the rate of drug metabolism. Grapefruit juice, for example, suppresses cytochrome p450 enzymes in the liver, and these enzymes are responsible for the breakdown of many drugs. If the enzymes are suppressed, drugs can potentially reach toxic levels.

Individualized Therapy, Metabolic Differences, and Potential Prescribing Approaches for the Future

- Mental illnesses contribute to more disability in western countries than all other illnesses. One-in-four adults is estimated to experience a mental health issue in any given year. Although there is no "magic bullet", pharmacotherapy combined with psychological therapy

may be the most effective treatment for psychiatric conditions. Nevertheless, individuals differ in their response to particular drug interventions. Understanding the reasons behind these differences will improve our ability to treat those in need.

- For this reason, the individualized treatment approach has garnered significant interest within the scientific community. For example, we know that individuals vary genetically with respect to the cytochrome p450 enzymes and their ability to break down drugs. The general population falls into four categories ranging from ultra-extensive metabolizers to poor metabolizers. If a doctor could pre-determine the type of metabolizer his patient is, he could then make a more informed and individualized decision about the drug dosage.

Other Controversial Issues

- *Juveniles and Psychopharmacology.*A recent Center for Disease Control study has suggested that as many as 1 in 5 children between the ages of 5 and 17 may have some type of mental disorder. The incidence of bipolar disorder and autism among adolescents and children is also on the rise. While there is no definitive answer as to why these changes are occurring, some believe the change is a result of increased awareness. Others suggest the change is a result of the criterion used for diagnosis, while others point to environmental factors.
- Questions remain as to how children and adolescents should be treated for these disorders, particularly since most psychotropic drugs have been tested for safety and efficacy on adults, not children. The scientific community is concerned about drugs that alter neuronal activity in a developing brain as they could have significant unintended consequences. As such, there is need for clinical trials on children and adolescents; however, these trials will give rise to important ethical considerations.

- *The Elderly and Psychopharmacology*.The elderly are estimated to reach 20% of the population by 2030, consuming 40% of the prescribed medication. However, they too have not typically been included in clinical trials of psychotropic drugs. **Polypharmacy**, which is the use of multiple drugs, is a common occurrence among the elderly. There are many issues that make the elderly unique with respect to taking prescribed drugs, such as slower metabolism of drugs, risk factors like falling and breaking bones, and the impact of the psychotropic drugs on bone density.

Difficult Terms

- Agonists
- Antagonists

- Enzymes
- Enzyme induction
- Neurotransmitter
- Pharmacokinetics
- Polypharmacy
- Psychoactive drugs
- Psychotropic drugs
- Synapse

Lecture Frameworks

Overview

The module *Psychopharmacology* provides information on how drugs affect the brain and behavior, how they are administered and metabolized. The content also reviews how drugs affect people in various ways and delves into some controversial issues. There is quite a bit of content to cover – we suggest generating interest with our special topics and the optional activity. In addition to the videos listed at the end of the module in the Discover Psychology text, we have provided links to a few videos you might consider showing the class. There is also some difficult vocabulary and you may be asked to clarify or explain key terms.

First Class Period:

- Lecture – Refer to slides for the following:
    - To introduce how drugs affect behavior.
    - To describe pharmacokinetics.
    - To talk about drug administration and metabolism. The example discusses the effect of grapefruit juice on metabolism.
    - To describe individualized therapy, metabolic differences and potential prescribing approaches for the future.

- Special Topic: Drugs vs. Therapy
    - At this point, the students will have some idea that depression is one of the most prevalent psychological disorders in North America. It is likely that the students have either experienced depression themselves or known someone else with this diagnosis.
    - *Discussion*: After this introduction, you could ask the students what they think works better at treating depression – medication or some of the therapies that were covered in the previous module.
    - *Video*: This is a three-minute video from the American Psychological Association that would be appropriate to show at this time: **https://www.youtube.com/watch?v=Ery8RHHEfIM**
    - The video discusses why drugs alone may not be enough to treat various disorders. Keep in mind the video only briefly touches upon mental illnesses (i.e., major depressive disorder); the bulk of the video focuses on drugs and HIV/AIDS. However, it still briefly mentions the arguments made by DeRubeis, Siegle, and Hollon (2008; see evidence-based teaching section).
    - After showing the students this brief clip, you might briefly discuss the research presented by DeRubeis et al. (2008) as they note that in many instances therapy is as effective as medication. In fact, as compared to drugs, the beneficial effects of therapy last longer (even after treatment is complete). This topic is a great segue into some controversial issues related to drug therapies.
- Lecture – Refer to slides for the following:
    - To talk about juveniles and psychopharmacology
    - To discuss issues about the elderly and drug therapies
- **Special Topic: The Link between New SSRIs and Suicidality, Violence and Mania**
    - In keeping with the previous slides on controversial issues, this topic illustrates some worrisome side effects of serotonin reuptake inhibitors (SSRIs), also known as antidepressants.
    - Breggin (2002; see Evidenced-Based Teaching section) discusses the newer wave of SSRIs (e.g., Prozac), and the harmful side effects they can cause to an individual's emotional and mental well-being.
    - SSRIs have been linked to increased incidence of mania, depression, and obsessive thoughts, which in turn leads to increased rates of suicide, violent behavior, and misdiagnoses of the side effects as psychological disorders.

- The lesson you want to impart to your students is: drugs are not always better treatment options. It's important to be able to talk to medical health professionals about all the available treatment options.

- Discussion

  - A fun way to end the class will be assigning the activity below. Use this discussion to highlight the significance of the activity. In the first module of this unit, you may have described stigma as a barrier to seeking psychological treatment. Ask the students to think about what could serve as barriers to drug therapies? If one of them does not suggest it, then you should highlight adherence as an important issue.

- Activity: Medication Adherence – Easy As Can Be…Right?

  - In order to explain this activity, you will need to give some information to students about adherence. Non-adherence refers to not taking medication exactly as advised by doctors. One of the most commonly cited reasons for non-adherence is simply forgetting. Others include patients not realizing how incredibly important it is to take medication exactly as prescribed.
  - According to a report by the National Community Pharmacists Association (2013), non-adherence to medication can harm a patient's health and add increased cost to our healthcare system. Ask students if they have any guesses on how much and allow 2-3 students to shout out a few numbers. They are not likely to guess that non-medication adherence can add up to 290 billion dollars of cost to our healthcare system…annually! Be as dramatic as possible with this last fact. Then, ask students how they feel about that. Be patient as many are likely to express outrage or strong opinions about this.
  - Now introduce the activity below. This is a 7-day activity that students must complete on their own, but it requires very little time on their part. Tell students that although they will not be externally penalized (just as doctors can't punish their patients for not following their advice), you expect everyone to complete this assignment. For detailed instructions on the activity, refer to the Activities and Demonstrations section below.

Activities & Demonstrations

Medication Adherence: In-Class Activity

Time: 7-day assignment, but should take no more than 1-15-minutes per day.

Materials: Kool-Aid, Tic-Tacs, copies of each medication protocol (3 protocols in total), copies of data recording sheet (3 recording sheets in total).

Directions:Give your students the following prelude.

- HIV (human immunodeficiency virus) is a chronic condition. Although HIV is not a psychological disorder, the same principles could apply to someone taking drugs to treat schizophrenia. No treatment can remove this virus from the body. If treated, HIV is not lethal. However, if left untreated, HIV can degrade the immune system to the point non-functionality. When this happens, we refer to patients as having Acquired Immune Deficiency Syndrome (AIDS) and various other harmful infections can just as easily occur.
- There is a treatment solution: HIV Antiretroviral drug therapy can subdue HIV and delay the onset of AIDS for a long time. Here's the catch (or two).
    - HIV has a high mutation rate - what this means is that one drug is usually not effective and the body can become resistant. As a result, multiple medications are usually assigned, so if the body becomes resistant to one type of drug, there will be other drugs to make up for it.
    - In this type of therapy, adherence to the medication is very important. Not being consistent will lead to the development of drug resistant strains. In other words, non-adherence can essentially be worse than not being treated at all.
- Each student is to imagine that they are a person living with HIV. Everyone will be assigned one of three treatment regimens exactly as prescribed, but instead of actual drugs, we will use Kool-Aid packets and tic-tac mints.
- Then, randomly assign each student to one of three protocols, each with varying difficulty. Remind them that it is important to be consistent and follow the instructions as provided! Failure to do so could have very damaging consequences as explained earlier.
- Students will also be given a recording data sheet, on which they will record the time and the date each time they take their "dose". Instruct them to be as honest as they can on their recording sheets. This is not a contest to see who's the absolute best at treatment adherence and they will not be penalized for noting down when they did not take their medication.

- As a class, you can also come up with hypotheses. For example, students with the simplest treatment protocol will have the best adherence. Alternatively, you can choose to refrain from coming up with any hypotheses at all and just highlight general results of the data you receive from the students' activity sheets.
- Note: Remind the students that they do not have to ingest the Kool-Aid or Tic-Tacs if they don't want to, especially if they have any dietary restrictions. If anyone wishes to not actually take anything, all they have to do is follow the instructions leading up to ingestion, dispose of the dose instead of ingesting it, and write down the time/date as if they actually took the "medicine".

Protocols:

#1)

- Fuzeon (Kool-Aid): Mix a packet with 8 oz of water, let stand for 10 minutes, and then drink it. Take it every 12 hours.
- Kaletra (spearmints tic tac): Take one tablet every 12 hours.
- Combivir (cinnamon tic tac): Take one tablet every 12 hours.
- If you forget to take a dose at the scheduled time, take it as soon as you remember, unless you are scheduled to take your next dose in 6 hours or less. If so, skip the dose, and record it as missed. In either case, take the next scheduled dose at its regular time.

#2)

- Truvada (citrus twist tic tac): T ake one tablet once a day with or without food.
- Reyataz (orange tic tac): Take two tablets once a day with food.
- Norvir (wintergreen tic tac): Take one tablet once a day with Reyataz
- If you forget to take a dose at the scheduled time, take it as soon as you remember, unless you are scheduled to take your next dose in 12 hours or less. If so, skip the dose, and record it as missed. In either case, take the next scheduled dose at its regular time.

#3)

- Atripla (orange tic tac): Take at bedtime once a day on an empty stomach.
- If you miss taking the dose at bedtime, record it as missed. Then take the next scheduled dose at its regular time.

To download the recording sheets for each protocol, go the following website:

http://www.hhmi.org/biointeractive/classroom-activities-drug-adherence-activity

Here are two changes to remind students to note in terms of the recording sheets:

- Where it says to indicate school name, the students should note down the course name and section.
- This activity is only for 7 days, so they are only to record until day 7.

Adaptation for large classes:

- To save time and money: if you have a large class of students, ask your class for 30 volunteers (10 for each of the three protocols) to do this 7-day activity and then present their results to the class.

This activity is adapted from:

http://www.hhmi.org/biointeractive/classroom-activities-drug-adherence-activity

Videos:

- Psychiatric Drugs: http://education-portal.com/academy/lesson/psychiatric-drugs.html#lesson
    - Time: 5:30 minutes
    - This video introduces how psychiatric medications were discovered
    - It covers three different classes of psychiatric drugs and how they work: antidepressants to treat major depression; antipsychotics to treat schizophrenia; and lithium to treat bipolar disorders.

- "This Is Psychology" Episode 9: Drugs and therapy – American Psychological Association: https://www.youtube.com/watch?v=Ery8RHHEfIM
    - Time: 4 minutes
    - This video talks about behavioral therapy, drug therapy, and the importance of combining the two when treating disorders and chronic diseases.

Outside Resources

Video: Neurotransmission
http://www.youtube.com/watch?v=FR4S1BqdFG4

Web: Description of how some drugs work and the brain areas involved - 1
http://www.drugabuse.gov/news-events/nida-notes/2007/10/impacts-drugs-neurotransmission

Web: Description of how some drugs work and the brain areas involved - 2
http://learn.genetics.utah.edu/content/addiction/drugs/mouse.html

Web: Information about how neurons communicate and the reward pathways
http://learn.genetics.utah.edu/ontent/addiction/reward/neurontalk.html

Web: National Institute of Alcohol Abuse and Alcoholism
http://www.niaaa.nih.gov/

Web: National Institute of Drug Abuse
http://www.drugabuse.gov/

Web: National Institute of Mental Health
http://www.nimh.nih.gov/index.shtml

Web: Neurotransmission
http://science.education.nih.gov/supplements/nih2/addiction/activities/lesson2_neurotransmission.htm

Web: Report of the Working Group on Psychotropic Medications for Children and Adolescents: Psychopharmacological, Psychosocial, and Combined Interventions for Childhood Disorders: Evidence Base, Contextual Factors, and Future Directions (2008):
http://www.apa.org/pi/families/resources/child-medications.pdf.

Web: Ways drugs can alter neurotransmission
http://bioserv.fiu.edu/~waltercm/b/addicitions/dopamine.htm

Evidence-Based Teaching

Beidel, D. C., Turner, S. M., Sallee, F. R., Ammerman, R. T., Crosby, L. A., & Pathak, S. (2007).

SET-C versus fluoxetine in the treatment of childhood social phobia. *Journal of the American Academy of Child and Adolescent Psychiatry, 46*(12), 1622–1632.

Part of the module on psychopharmacology covers how psychological disorders and treatments might affect children. Beidel et al.'s article compares the effects of behavioral therapy and medication (i.e., Prozac) in treating social phobias among children. The findings of this report indicated that more children responded to the behavioral therapy than the medication. Unlike the medication, the behavioral therapy resulted in improved general functioning and social skills in addition to reducing social distress, suggesting that behavioral therapy may be more effective in treating social phobias among children overall.

Breggin, P. R. (2002). Suicidality, violence, and mania caused by selective serotonin reuptake inhibitors: a review and analysis. *Ethical Human Sciences and Services*, *5*(3), 225–246.

In this review, Dr. Breggin informs us that there is substantial evidence demonstrating the dangers of newer serotonin reuptake inhibitors (SSRIs) (e.g., Prozac, Zoloft, Praxil, etc.). Notably, these antidepressants can lead to a multitude of unwanted side effects, including manic psychoses, depression, and obsessive thoughts. In turn, these side effects can have a detrimental influence on a person's mental health, leading to increased rates of suicide, violent behavior, and misdiagnoses of additional psychological disorders. Over the years, numerous studies, epidemiological reports, and clinical trial results have corroborated these findings, suggesting the need for more stringent regulations around the use of SSRIs.

DeRubeis, R. J., Siegle, G. J., & Hollon, S. D. (2008). Cognitive therapy vs. medications for depression: Treatment outcomes and neural mechanisms. *Nature Reviews Neuroscience*, *9*(10), 788–796.

Given that depression is one of the most common psychological disorders and can cause severe disruptions to daily activities of life, it is important to evaluate which therapies are most effective in treating it. This review demonstrates that cognitive therapy (CT) is as just as effective as antidepressant medications in treating depression. Additionally, CT effects are long-lasting and decrease chances of relapse even after therapy has been completed. Learning more about the distinctions in utility of these two different forms of treatment will enable medical professionals to better prescribe appropriate treatment.

Links to ToPIX Materials

Activities, demonstrations, handouts, etc.:
http://topix.teachpsych.org/w/page/19981032/Psychological%20Disorders%20in%20the%20Classroom

Books & Films:
http://topix.teachpsych.org/w/page/39234720/Disorders

In the News:
http://topix.teachpsych.org/w/page/26711727/Psychological%20Disorders%20in%20the%20News

Video/Audio:
http://topix.teachpsych.org/w/page/19981031/Psychological%20Disorders%20Video

Teaching Topics

Teaching The Most Important Course
http://nobaproject.com/documents/1_Teaching_The_Most_Important_Course.pdf

Content Coverage
http://nobaproject.com/documents/2_Content_Coverage.pdf

Motivating Students
http://nobaproject.com/documents/3_Motivating_Students_Tips.pdf

Engaging Large Classes
http://nobaproject.com/documents/4_Engaging_Large_Classes.pdf

Assessment Learning
http://nobaproject.com/documents/5_Assessment_Learning.pdf

Teaching Biological Psychology
http://nobaproject.com/documents/6_Teaching_Bio_Psych.pdf

PowerPoint Presentation

This module has an associated PowerPoint presentation. Download it at http://nobaproject.com//images/shared/supplement_editions/000/000/131/Psychopharmacology.ppt?1416603049.

About Noba

The Diener Education Fund (DEF) is a non-profit organization founded with the mission of re-inventing higher education to serve the changing needs of students and professors. The initial focus of the DEF is on making information, especially of the type found in textbooks, widely available to people of all backgrounds. This mission is embodied in the Noba project.

Noba is an open and free online platform that provides high-quality, flexibly structured textbooks and educational materials. The goals of Noba are three-fold:

- To reduce financial burden on students by providing access to free educational content
- To provide instructors with a platform to customize educational content to better suit their curriculum
- To present material written by a collection of experts and authorities in the field

The Diener Education Fund is co-founded by Drs. Ed and Carol Diener. Ed is the Joseph Smiley Distinguished Professor of Psychology (Emeritus) at the University of Illinois. Carol Diener is the former director of the Mental Health Worker and the Juvenile Justice Programs at the University of Illinois. Both Ed and Carol are award- winning university teachers.

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