



SAMPLE CHAPTER ONLY
Full Release Jan 2.



@Neuro_Cloud's

AN INTRODUCTION TO
#NEUROSCIENCE v1.1

table of contents...

1 - Neuro-Cloud Textbook Project Story

1.1 introduction

1.2 quantifying the crowdforce

1.3 moving forward

1.4 other open-knowledge initiatives

1.5 a few of our contributors

2 - Sample Chapter 10: Addiction

10.1 welcome

10.2 drugs of abuse

10.3 molecular mechanisms of dependence

10.4 treatment options

10.5 drugs and society

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Dedicated to my little brother, mark 'Helix' alsberg

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1 - The Neuro-Cloud

Textbook Project Story

Neuro-Cloud was started as a small service to publish neuroscience lab data to open-access servers. We hoped to be able to provide a unique data publishing platform that could be accessed by researchers around the world. We found that several open-access platforms already existed and after a year of publishing, we decided to partner with Next Generation Publishing to produce a brand new type of textbook made by researchers, students, and faculty together, before being peer-reviewed. All of the content in the textbook is open-access, and can be used however, as long as material is attributed where applicable. We want to integrate all of the learning resources available across the web, and provide an academic, narrative-based text to weave facts into the critical thinking applied at the time. We want to teach how scientists have thought about the concrete observations of their times.

The first wave of support was inspiring. Would-be contributors were contacted through various social media platforms, and they began working on the text that would become a chapter. This document contains the first piece of the contributor, crowd-force generated chapter, edited and loaded with open content before being peer reviewed. We believe that we have created a sustainable crowd network for generating new learning content. In order to facilitate these services, we are creating open-source web-apps and toolkits that brings contributor's resources together. We have dubbed these services as the 'Next Generation Textbook Portal' and the 'Next Generation Textbook Platform.' While these service are still in development, we have created an interactive iBook preview for iOS devices. Please note that the iBook preview is meant to serve as a display of the services included in the iOS, Google App Market, Chrome App, and Web App version. iBook, ePub, pdf and print versions will also be available for free(or at cost, in the case of the print copy.)

The Next Generation Textbook Portal is unique because it is a first-of-its kind model for providing free learning content. We believe that the current educational market is flooded with 'Free*' or 'Freemium*' content delivered through in-app purchases and pay-to-remove ad services. We do not believe in releasing a product that is not as complete as possible, without having to download more features. Essentially, we want to provide content that makes students think, "why hasn't this always existed". Further, we want to empower the student to learn in whichever setting they choose. Our material can be

accessed as part of a traditional course, through a web course, or just by someone wanting to learn. The Next Generation Textbook Portal will provide the database hub that allows users to register with a class, battle other classes, or create their own learning tool.

quantifying the crowdforce - how it works

As part of the Neuro-Cloud Textbook Project, we want to follow up and publish the results of our "crowdforce." This will provide anyone who wants to use crowd sourcing with open-access projects real data into what motivates contributors. We have logged all of our social outreach attempts, recorded what worked best, and documented new user engagement techniques. We believe we can generate a crowdforce project best-practices guide that will be backed by real and open data.

Access to open-data is one of the several pillars that supports the next generation publishing inc. model. We also rely on open-source programming, open-knowledge advocates, open-educators and every day citizen-scientists. By providing the general population with accessible open-science materials, we can encourage STEM learning at all levels. The work in this textbook is an example of how students of science, at every level, can come together to provide society with materials that can be used in any setting. While we kept thorough and accurate learning standards, we attempted to present it in a way that could be a joy to all.

moving forward and future needs

The Next Generation Textbook Project was built to scale with the user database it services. Initially, a Google Apps for Education App Engine will serve as our primary web-app server. This will deliver content to the Website, iOS app, Google Market app, Chrome app and interactive iBook version. We would like to transition this service to a private server, so that we can enable as many services as possible. We expect to be able to cover all costs moving forward through personal donations, and are currently not interested in contributions that carry any legal obligation. All of our users content and web-enabled content is available under the CC 3.0 license and can be accessed by anyone. If you would like to make a donation, you can do so by contacting Editor@Neuro-Cloud.Net This includes any future partnership offers or content sponsorship.

Initially, the print copy of the book was going to be a minor perk. We know some people hate reading electronically, and we did not want to exclude them from the project. However, a project created by The Finnish Design Institute of London inspired us to totally recreate the concept of a print textbook. What you now hold in your hands in the first draft of the layout for our paper copy. We have come full-circle and now believe that the print copy will be the very best way to learn, as it is a hybrid journal/textbook. We want students to feel like their textbook is unique to them and a beautiful record of their time spent learning. The ultimate goal for the paper copy is to make an affordable (>\$15), well-crafted, personal book that could be taken anywhere. We hope you find yourself reading ahead, and sharing with your peers how exciting it is to learn about neuroscience.

Neuroscience is not the end, but rather the beginning. Once we have completed one book, we hope to release a full series of free textbooks made with the consumer in mind.

other open-knowledge projects...

Besides textbooks, Next Generation Publishing has been able to engage in a number open-knowledge projects.

#Phones4Africa is an initiative to re-purpose old electronic waste while also putting it to use in open-science. We have partnered with *Mobile-Assay's* Gates Foundation Grant program to use old cell phone cameras as a low-cost agriculture testing platform. We have also been able to partner with open-hardware initiatives seeking to create homemade spectroscopy web-cams.

Additionally, we are working on a project called *Schollit*, which is a build of the open-source website 'Reddit', which incorporates the open academic registry ORCID into the registration process. The result is an indexed, open repository of academic work, submitted by authenticated academics and voted on by their peers. The Reddit commenting system will then facilitate cite-able, informal, micro-reviews for all posted academic content.

We have also been able to be an advocate for academics in the tech sector. This year we have partnered with *Force11* and the *Mozilla Science Labs* in an effort to make open-access resources more accessible. We hope to continue to partner with as many friends as possible as we all try to *#DoSomethingGreat*.

some of our other projects...



www.schollit.com
#schollit



smartPhones4Africa.org

some of our friends...



And countless others....

Chapter 10 - ADDICTION

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Ishita Aggarwal is a fourth year undergraduate student at the University of Toronto in Toronto ON, Canada. Currently completing a double major in Cell and Molecular Biology and Neuroscience, Ishita hopes to pursue a graduate degree in Neuroscience in the near future. In addition to being a dedicated student and a curious research assistant, Ishita is highly committed to her school and local community. As a peer mentor for incoming students, Director of Events for Women in Science and Engineering, and former Co-Editor in Chief of the Journal of Undergraduate Life Sciences, Ishita is eager to gain diverse experiences. Writing for the Neuro-Cloud Next Generation Textbook Project has allowed her to improve her academic knowledge and share her passion for Neuroscience with young scientists worldwide.



Pre-Test



Chapter
10 slides



Ask a
Question

What have you heard about addiction before this chapter?

What would you like to learn about addiction?

digestion. The effect first pass metabolism has depends, not only on the drug, but also the person. The FDA looks at several factors, including general population tolerance when deciding how determine drug dosages.

Some drugs are not impacted by first pass metabolism at all, while others can have up 90% of the drug become totally inactive during first-pass metabolism. This could be legal If a drug is produced with the intention of being taken orally, but is either injected or snorted because the patient would be receiving 10x the normal dose.

Other factors can influence the way rate and efficiency that a drug is metabolized. Digestive enzymes through out are responsible for degrading drugs into metabolites that are no longer active. If these enzymes are increased or decreased, the available drug in the body is inversely affected. For example, there is a class of anti-depressants called ***Monoamine Oxidase Inhibitors (MOI's)*** that cannot be taken with certain medications because they increase the amount of time that the drug is available in the body through a process known as ***enzyme induction***. The opposite can also be true, when an enzyme causes a drug to be degraded more quickly. This process is known as ***enzyme inhibition***.

.....

NOTES

In your own words define...

Pharmacodynamics:

Pharmacokinetics:

Pharmacology:

Bioavailability:

1st Pass Metabolism:

Blood Brain Barrier:

Check your work
&
Review Vocab



10.1 REVIEW

What would you like to learn about drugs and addiction?

Critical Thinking

Another factor that contributes to a drug's pharmacodynamics and pharmacokinetics is when drugs are taken together. Several people drink alcohol when they take drugs, what effects do you think et-OH with the following drugs? Check your answers Online.

$\text{C}-\text{C}-\text{OH}$
+
Cocaine

$\text{C}-\text{C}-\text{OH}$
+
THC

$\text{C}-\text{C}-\text{OH}$
+
Xanax

WHAT DO YOU THINK?

Did you know you writing your thoughts by hand helps your brain remember them better? If you don't believe us, then give it a shot. Make this book yours.

How would you define the term 'drug'?

Major factors leading to addiction

Genetics - New evidence shows that some people may be born with a predisposition to addiction based on their genes.

Psychology - Sometimes, a traumatic incident in life can increase the likelihood of addiction

Co-morbidity - Someone who is diagnosed with a separate mental condition can have a higher chance of developing addiction or dependence.

What are some other factors that could lead to addiction or dependence?

10.2 Drugs of Abuse

Drugs can be wonderful things, after all, they make us feel better when we are sick. Sometimes, people use drugs to achieve an effect different than it's intended use, or they use more than they should, the drug is considered abused. The chemical structure of the drug contributes to it's likelihood to be abused. While science does not know everything about every drug, we have learned how some addictive drugs behave in the brain. We will divide drugs of abuse into 2 major categories, stimulants and depressants, although there are several other classes and subclasses of drugs.

Stimulants

Stimulants generally increase the physiological or neuronal activity in the body.

Cocaine

Cocaine is a powerful CNS stimulant. The drug comes in three forms: hydrochloride salt (injected into the body or snorted), free base (smoked), and crack (smoked). The three different routes of ingestion (injecting, snorting, and smoking) produce different onsets in the brain. Although cocaine can be used as a local anesthetic, it is commonly used (and abused) as a recreational drug.

Cocaine acts on the "cocaine receptor site" in the brain. The "cocaine receptor site" is a **dopamine transporter (DAT)** that is blocked by cocaine. Blocking the DAT causes an increase in levels of dopamine in the synapse, cause neuronal firing. Prolonged cocaine use damages nerve cells, depleting their DA supply. As a result, the user experiences a "crash," consisting of long periods of sleep, depressive symptoms, drug seeking, and an inability to experience pleasure. Hence, the drug user experiences a withdrawal syndrome.

Cocaine does not produce chemical dependence in all users.

NOTES

In your own words define...

Drugs of Abuse:

DAT

Stimulants:

Depressants:

Other types of drugs

Inhalants

While widely used across the world, inhalants are one of the most dangerous classes of drugs. These drugs are inhaled by a user containing the gas that he or she wishes to abuse, and breathing it deeply. Inhalants often contain cleaning products and substances that are toxic to the human body. Because Inhalants directly inhibit your repository system, fatalities are not uncommon. The high that inhalants produce are often relatively short, and cause symptoms of confusion, nausea, euphoria and difficulty breathing.

Hallucinogenics

Hallucinogenics come in several different forms. Some are naturally produced, like mushrooms or toad venom, while others like **LSD** are artificially synthesized in a lab. Not to much is known about how these drugs produce both auditory and visual hallucinations, however it appears that the brain's natural sensory filter is disabled. Some drugs like ecstasy also target the 5-HT system in the brain, causing increased feelings of pleasure. 'Bad-trips' refer to drug hallucinations are negative. When a drug user is having a 'bad-trip', they can be risk to themselves or others.

If you or a loved one suffers from drug addiction, reach out to your local helpline, this book is not meant to be a guide for treatment or medical advice.

Draw out the molecular structure of one of the drugs, how does it's structure contribute to it's function?



10.2 REVIEW

Mechanism's of action

Briefly describe how the following drugs work

Caffeine:

Amphetamines:

Benzodiazepines:

Your turn, research a drug not given in this chapter and write about how it works in the brain.

by anxiety and stress preceding a compulsive repetitive behavior and a release of stress by performing the compulsive act.

According to Koob, the transition of an impulsive disorder to a compulsive disorder is marked by a shift from positive reinforcement (results that produce satisfaction) to negative reinforcement (a result that stops painful or unsatisfying stimuli) to drive a behavior. Koob uses three stages of addiction to describe an addict's progression from impulsivity to compulsivity: preoccupation / anticipation, binge / intoxication, and withdrawal / negative affect.

The concept of allostasis, defined as the process of achieving stability through change, was originally proposed to account for the mechanisms of stress and anxiety, and alcohol and chemical dependence. The term allostatic state may be used to explain how movement of physiological parameters out of homeostasis can cause drug and alcohol dependence through the establishment of a new set point.

In a 2003 paper, Koob hypothesized that levels of DA, 5HT, and endorphins decrease during physiological withdrawal, driving the transition from drug use to drug dependence. These changes take place in the circuitry of the basal forebrain macrostructure of the extended amygdala.

In summary, the allostasis theory is based on strong experimental evidence, lays a foundation for the DSM-IV diagnostic criteria, and explains neurobiological changes that occur in the MDS and in the extended amygdala. The allostasis theory is criticized for relying heavily on withdrawal mechanisms as an explanation. Furthermore, it fails to explain why allostasis occurs in some drug users and not in others.

The Pathology of Motivation and Choice Theory

Kalivas and Volkow described three temporally sequenced stages of addiction: acute drug effects involving DA circuits, a transition from recreational use to repetitive use, and end-stage addiction, characterized by an overwhelming desire to use the drug and a diminished ability to control drug-seeking behavior. They found that repeated drug exposure involves the prefrontal cortex and its GLU connections to the NAcc. This theory emphasizes that these GLU projections make up the final common pathway for drug-seeking behavior.

An advantage of the theory is that DA and GLU dysregulation has been confirmed in numerous studies. However, the model does not

In previous chapters we have gone over several of the neurotransmitters that are involved in addiction, for each NT, give an example of another neural system the transmitter involved in.

Dopamine (DA):

Serotonin (5HT):

Endorphins:

What are your top 3 theories?

Theory	Areas of the brain involved	Neurotransmitters involved

Drug Courts

In 2011 the popular radio program 'This American Life' reported on one drug court where a state judge was given too much power while working with addicts. The story brought national attention to drug court programs across the country and how our courts approach drugs and crime.

Research indicates that the majority of drug crimes are nonviolent, and the prosecuted addicts may be more likely to become violent criminals after going through the traditional judicial system. It is important for governments to hold their citizens accountable for their actions if those actions impact others, regardless of circumstances, however, there are several programs that are working on ensuring that addicts get the help they need before resorting to traditional sentencing. For example, someone may be arrested for possession of cocaine, and be charged with felony possession that would make them lose their job, license and more. It may be more effective if we could get first-time offenders into rehabilitation programs before removing them from society. There may always be cases where jail is right choice for a first time offender, but judges want the freedom to decide how to handle each instance.

Drugs and Public Policy: Syringe Exchange

One example of harm-reduction ideology is syringe exchange programs. While traditional logic may believe helping drug addicts use drugs will only make the problem worse, results show that they may provide addicts with a resource for quitting. Further, syringe exchange has been shown to lower rates of HIV and hepatitis in drug communities. Police and EMT's also have a lower rate of contracting diseases during pat downs and arrests.

THC and Legality

Recently, two states in America voted to have recreational pot legalized. Colorado already has an extensive medical marijuana program which has generated epidemiological data that will provide insights into new policy moving forward. One study, conducted at the University of Colorado at Denver Medical Hospital examined cases of children



430: This American Life - Very Tough Love
MAR 25, 2011

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NOTES



Harm Reduction Coalition - Syringe Access

Syringe Exchange Programs. Good or Bad?

Circle one: **Good** **Bad**

Chapter 10 - Review



More Vocab



Flashcards



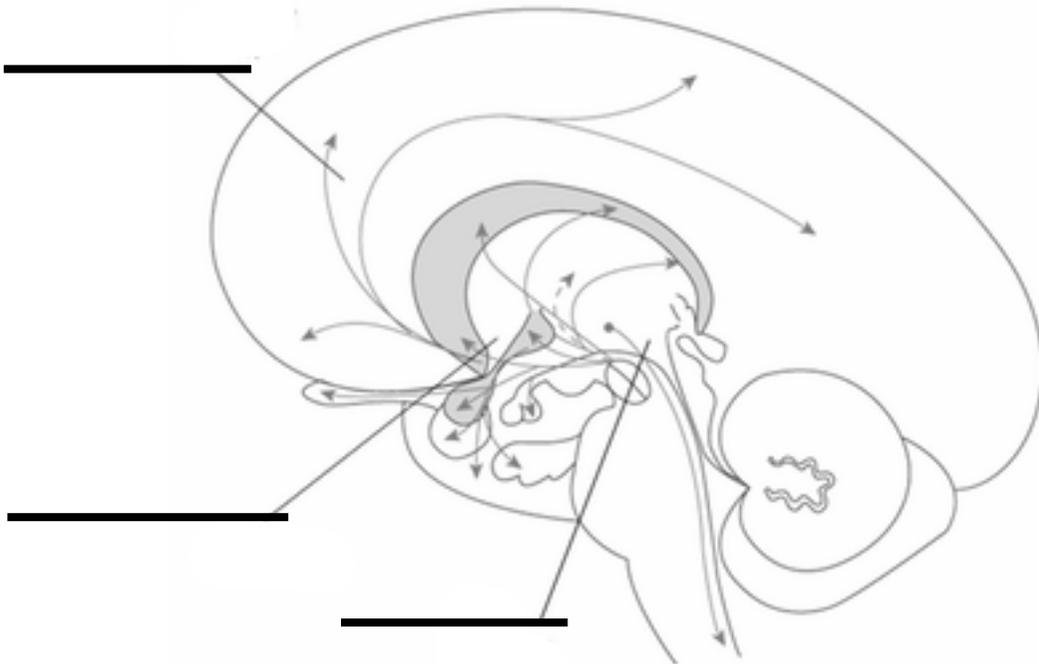
Practice Test



Questions?

Label the 3 major parts of the mesolimbic dopamine system.
Label 3 more regions of the brain NOT covered in this chapter.
What are 2 roles that the mesolimbic dopamine system plays in the brain?

1. _____
2. _____



VOCAB

For each of the following terms, give a brief definition. When you are done, check your answers at the bottom.

12-Step Program

Benzodiazapines

DAT

Drug

First Pass Metabolism

Psychological Dependence

Routes of Entry

Pharmacodynamics

Depressants

Co-morbidity

Pharmacokinetics

Your turn: Now it is your turn, write a quiz question and share it with one of your friends.

1. _____

_____?

Now try to stump us! Tweet it to @Neuro_Cloud #BrainBuster