Drugs 101: Behavioral Pharmacology

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Drug Facts

- Drug effects are dose-dependent
- Drugs effects are time-dependent
- Drugs are toxic at high enough doses
- Drugs have multiple effects

Pharmacology

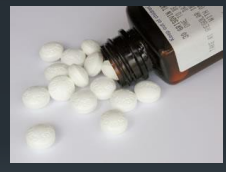
- Drugs – chemicals that affect living tissue
- Drug naming conventions
  - Trade name – Ritalin, Risperdal, Mellaril, Thorazine
  - Generic name – methylphenidate, risperidone, thioridazine, chlorpromazine
  - Chemical name - $C_{23}\ H_{27}\ FN_4O_2$
  - Manufacturer code - Ro15-4513

Pharmacology

- Drug Classification Schemes
  - Therapeutic usage – antipsychotics, antianxiety, anticonvulsants
  - Behavioral effects – stimulants, sedatives, sleep aids
  - Chemical classes – Benzodiazepines such as Valium, Librium, Xanax

Fate of a Drug

- Administration/Absorption:
  - Oral (PO)
  - Intravenous (IV)
  - Intramuscular (IM)
  - Intraperitoneal (IP)
  - Subcutaneous (SC)
  - Inhalation
  - Topical



Drug effects are time-dependent and depend on route of admin

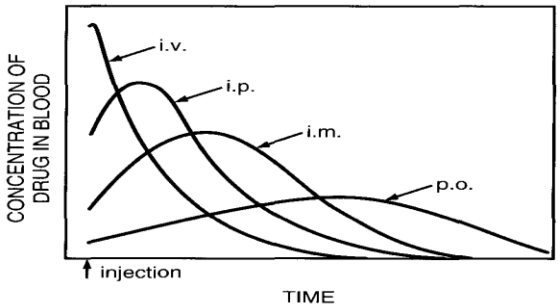
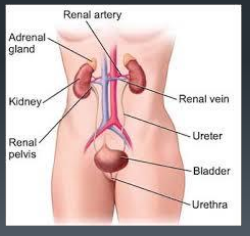


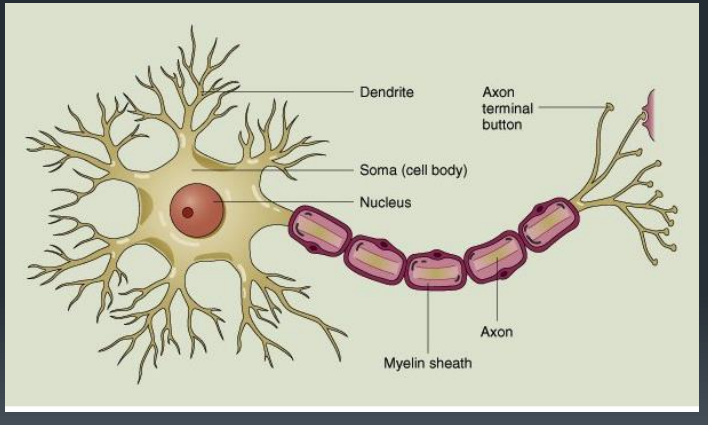
Figure 1-11 The time courses for blood levels of a drug given by different routes of administration.

Fate of a Drug

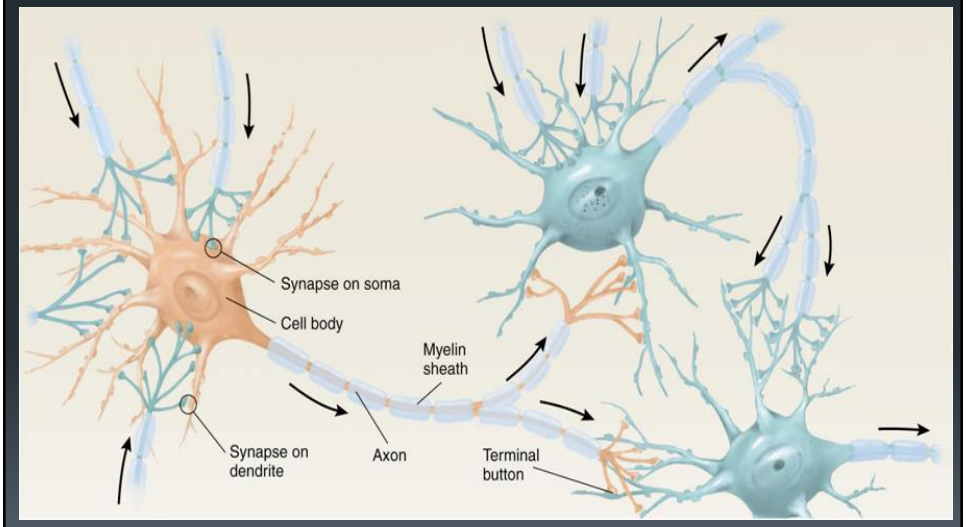
- Distribution to site of action
  - Bloodstream → capillaries → intracellular fluids → neuron receptors in brain/spinal cord/periphery
  - Some to bone and fat cells
- Biotransformation
  - Liver
  - GI Tract
- Excretion
  - Kidneys
  - Lungs



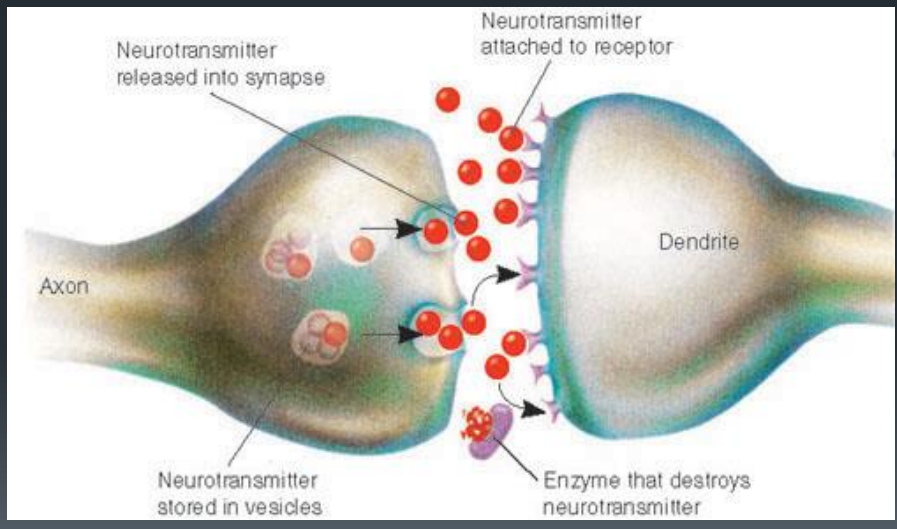
Site of action: Neuron



Site of action: Neuron



Site of action: Synapse

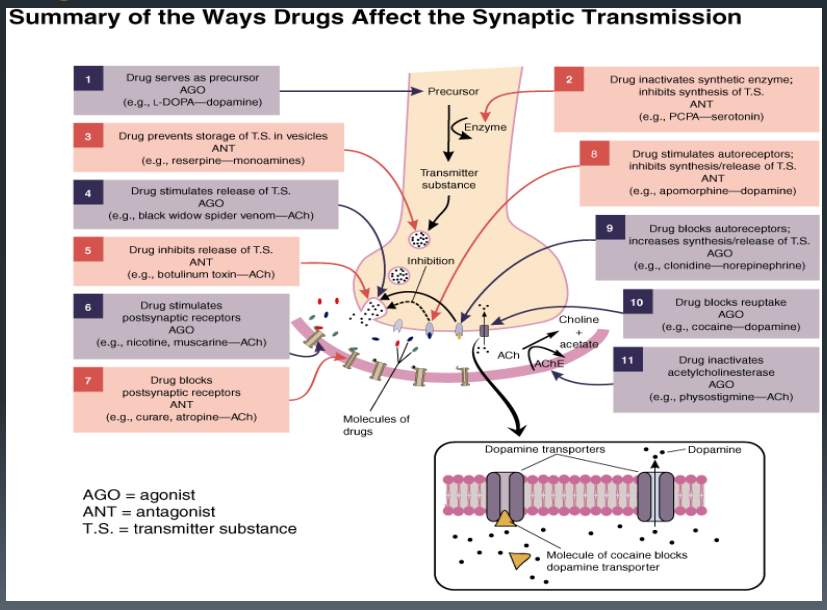


Neurotransmitters

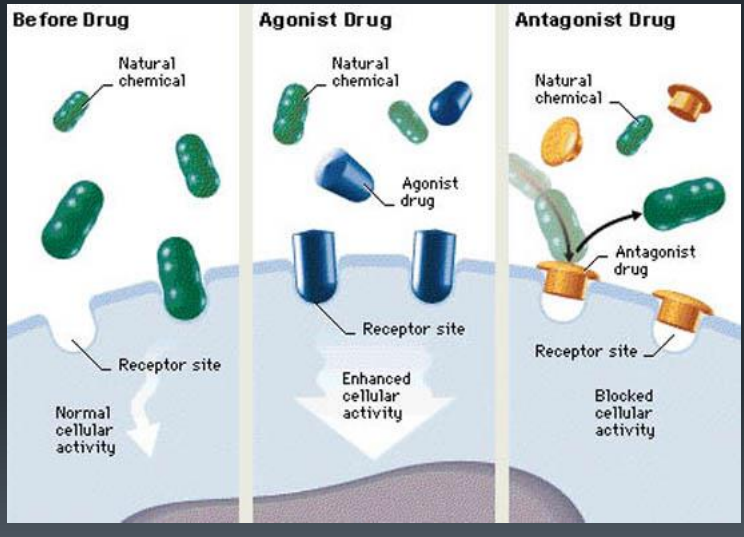
- Dopamine (DA)
  - Mediates reinforcers
  - Movement
  - Psychosis
- Serotonin (SE & 5-HTP)
  - Depression

- Norepinephrine (NE)
  - Arousal
- GABA
  - Inhibition
- Acetylcholine (ACh)
  - Movement

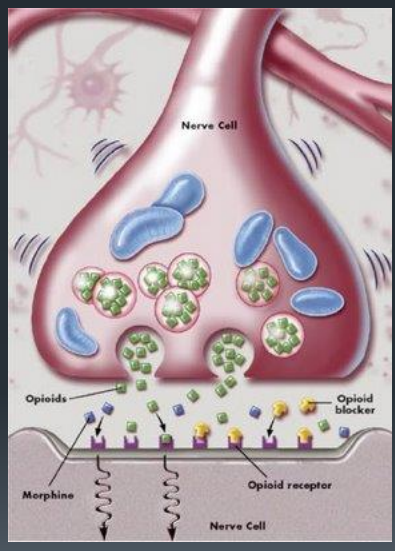
Drug effects on NT actions



Drug effects on NT actions



Drug effects on NT actions



Drug Processes

- Tolerance -decrease effect over repeated admin
  - Metabolic –
    - Alcohol produces enzymes that breaks it down
  - Cellular –
    - Cells become less responsive to drug
  - Behavioral –
    - Organism learns to respond while under the influence of drug
  - Cross Tolerance

Drug Processes

- Sensitization
  - Drug effects increase with repeated administrations
    - High dose
    - Liver problems

Drug Processes

- Withdrawal syndrome

Caffeine

Effects	W/D
Increase HR	Decrease HR
Increase alertness	Decrease alertness
Decrease sleep	Increase sleep
Decrease headache	Headaches!

Drug Processes

- Withdrawal syndrome
  - Physiological changes after termination of drug administrations or decrease in dose.

Morphine

Effects	W/D
Analgesia	Pain sensitivity
HR decrease	HR increase
Euphoria	Depression
Resp decrease	Resp increase
Constipation	Explosive diarrhea

Drug Processes

- Physical Dependence
  - A condition in which termination of drug will produce withdrawal syndrome.
  - Is a function of reinforcing value of drug, dose, time of exposure
- Psychological Dependence
  - A condition in which termination of drug will evoke drug seeking, cravings, etc
  - Is a function of reinforcing value of drug, dose, time of exposure

Drug Processes

- Potency
  - To get a given effect, which drug (Drug A or Drug B) requires less MG?
    - Risperdal requires 6 mg
    - Thorazine requires 800 mg
- Peak efficacy
  - What is the maximum effect of Drug A vs Drug B
    - Risperdal decreases aggression by 50%
    - Thorazine decreases aggression by 50%

Drug Processes

- Metabolic Factors
  - 0-Order Kinetics (non-linear)
    - Fixed mg of drug is metabolized per time period
    - Alcohol: 10 ml/hour
  - 1st Order Kinetics (linear)
    - Fixed % of drug is metabolized per time period
    - Expressed in T ½
    - T ½ of 6 hours = ½ of drug is metabolized every 6 hours
    - Drug is eliminated in 5-6 half lives

Drug Processes

0 Order Kinetics: 10mg/hour

Injestion	4 hours	8 hours	12 hours
800 mg	760 mg	720 mg	680 mg

1st Order Kinetics: T ½ = 4 hours

Injestion	4 hours	8 hours	12 hours
800 mg	400 mg	200 mg	100 mg

Drug Class Profile Antipsychotics

- Classes
  - Typical (older drugs with more side effects)
    - Thorazine, Mellaril
  - Atypical (new drugs with fewer side effects)
    - Risperdal, Zyprexa, Seroquel

Antipsychotics

- Fate
  - Administration/Absorption
    - Oral – GI → bloodstream
    - IM – muscles → bloodstream
  - Distribution
    - Brain and entire body
    - Collects in fat cells

Antipsychotics

- Fate
  - Metabolism
    - Drug metabolized in liver
    - Almost all molecules are transformed
  - Excretion
    - Kidneys
    - T ½ = 11 – 58 hours

Antipsychotics

- Effects
  - Prescribed for schizophrenia and bipolar disorder
  - Decreases psychotic behavior
  - Decreases disruptive/dangerous behavior

Antipsychotics

- Side effects: Extrapyramidal symptoms
  - Tardive dyskinesia (TD)→ Video
  - Dystonia → Video
  - Parkinson-like symptoms → Video
  - Akathesia → Video
  - Neuroleptic Malignant Syndrome
    - Low grade fever
    - Rigidity of limbs
    - Unstable BP
    - Stupor
- Side effects: Diabetes

Antipsychotics

- Mechanism of Action
  - Dopamine antagonist
  - Blocks D receptors but does not operate
  - Antagonist
- Withdrawal?
  - None
  - Drug resides in fat cells and is slowly released over time after termination
- Reinforcer?
  - No
- EO? – yes, for food

Antidepressants

Class	Names	Admin	T/1/2	Side Effects
1st generation	1. MAOI: Parnate 2. Tricyclics: Tofranil, Elavil	Oral	1. 3 hours 2. 24 hours	1. Decrease HR, orthostatic hypotension 2. Dry mouth, constipation, increase appetite, sexual impairment
2nd generation	SSRI: Prozac, Luvox, Zoloft, Paxil	Oral	15-20 hours	Nausea, headache, insomnia, weight gain, Serotonin syndrome

Antianxiety and sleep aids

Class	Names	Admin	T/1/2	Side Effects
Antianxiety	Valium, Librium, Xanax, Ativan	Oral, IV, IM	11-48 hrs	Decrease anxiety, decrease muscle tension, driving impairment, decrease in effects of aversive stimuli, decrease seizures
Sleep	1. Halcion, Restoril 2. Z drugs: Ambien, Lunesta	Oral	1. 3.5-8 hrs 2. 1-3 hrs	Increase sleep, memory loss

ADHD

Class	Names	Admin	T/1/2	Side Effects
Stimulants	Ritalin, Concerta, Focalin, Adderal	Oral,	3-6 hours	Decrease sleep & appetite, small increase in HR/BP
Non-stimulants	Tenex, Catapres	Oral	12-17 hrs	Dry mouth, sleep, fatigue, constipation

Pharmacology

Drug classes:
Therapeutic Use

Behavioral Functions of Drugs

- Drugs as reinforcers
  - Anti-pyschotics
  - Anti-depressants
  - ADHD drugs
  - Anti-convulsants
- Drugs as EOs/Aos
  - Anti-pyschotics
  - Anti-depressants
  - ADHD drugs
  - Anti-convulsants

Interfacing with Psychiatry

- Psychiatry role
- BCBA role
  - Learn from psych
  - Collect data on main and side effect
  - Influence when appropriate
- Developing professional relationship
  - Behavioral view
  - Pairing
  - Positive reinforcement
  - Shaping

Prescribing Drugs

- Prescribing drugs to special populations in need of protection should involve safeguards.
  - Goals are clear with specific targets and in P interests
  - Tx decisions made on basis of drug effects
  - Flexible and integrated with beh Tx.

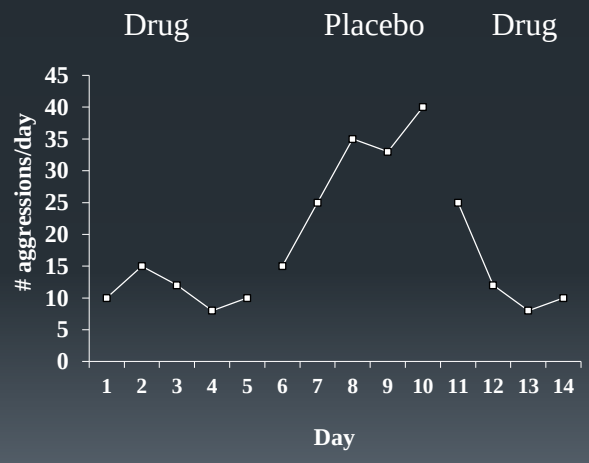
Prescribing Drugs

- Manage the psychiatrist!
  - Attend appointments
  - Collect data
  - Report side effects
  - Learn about drugs!

Drug Evals

- Essential features of a drug evaluation?
  - Objective measure of behavior
  - Meds given according to protocol
  - Design
  - Data analysis must be adequate
  - Placebo controll
  - Blind study?
    - Single
    - Double
    - Triple
  - Informed consent

Effects of Drug on Aggression



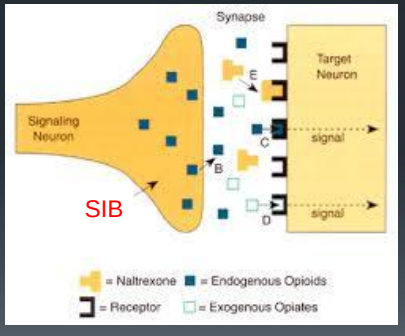
Drug Tx of SIB

- Hypothesis: SIB causes body to release endorphins
  - Endorphins: Body's natural reaction to pain
  - "Endogenous morphine-like substance"
  - Effects: reduced pain + effects that mimic "runners high"

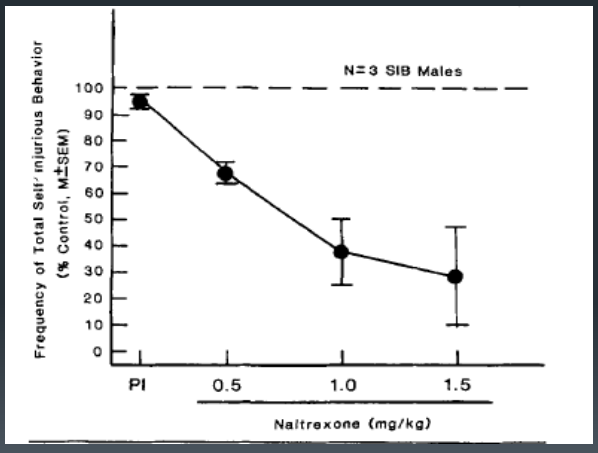
Special Topics

Drug Tx of SIB

- Mechanism
  - If SIB releases endorphins, then we need a way to block this
  - Morphine antagonist = Naltrexone



SIB – Naltrexone effects



Drug Abuse Theories

- Drug taking is sinful
  - Should be punished
  - Was a factor in passage of 18th Prohibition Amendment
- Drug taking is a disease
  - Person is sick
  - Needs treatment
  - A factor in AA

Drug Abuse Theories

- Behavioral view
  - Drugs are reinforcers
  - Drug taking produces social reinforcers
  - Drug taking produces escape/avoidance of withdrawal

Phase	Years	Population	Purpose	Success Rate
PreClinical	3.5	Lab and animals	Safety and bio activity	5000 tested
Phase 1	1	20-80 Healthy Volunteers	Safety and dose	5 enter
Phase 2	2	100-300 patient volunteers	Efficacy and side effects	5 enter
Phase 3	3	1000-3000	Efficacy & adverse reactions to longer term use	5 enter
FDA	2.5	Review and approval		1 approved
Phase 4	Additional post marketing study required by FDA			