Victoria
September 7th 2017

Class 5 the neurotransmitters (drugs)

**Psychopharmacology:** study of the effects of a drug on behavior

**Pharmacokinetics:** study of the ‘fate’/ ‘movement’ of substances administered to the body

1. Administration
2. Absorption
   - entering the body, or a body compartment (e.g. brain)
3. Distribution
   - being carried to specific target organs
4. Metabolism
   - being broken down by enzymes
5. Excretion

**Routes of Administration**

- **Intravenous:** fast precise, direct access to brain
  e.g. drug of abuse, adrenaline

- **Intraperitoneal:** fast, indirection access to brain
  e.g. chemotherapy (cancer)

- **Intramuscular:** slower (capillaries) direct access
  e.g. vaccines, antibiotics

- **Subcutaneous:** slow absorption (fat tissue), indirect
  e.g. insulin

- **Oral:** easy, delayed, (has to go through stomach/ intestines and liver)
  e.g. aspirin

- **Sublingual:** easy (for humans) bypass digestive system. capillaries of the tongue
  e.g. steroids, cardiovascular (hypertension, vasodilator)

- **Intrarectal:** slow, bypass the stomach
  e.g. suppositories

- **Inhalation:** fast, easy, requires volatile substances
  e.g. nasal decongestant, asthma

- **Topical Administration:** fast, local (skin, mucous)
  e.g. nasal, eye, (ear drops)
- **intracerebral**: bypass the BBB, local (specific brain area) mostly research

- **Intra(cerebral)ventricular**: bypass the BBB, global effect, emergency

-FDA considers 111 routes of administrations as valid

epidural, intracardiac, transdermal

**Kinetics of absorption**

*study of the effects on some specific brain areas (movement through the BBB)*

-Lipid- soluble (e.g. heroine) substances pass the BBB. Water soluble substances (e.g. morphine) do not.

**effectiveness: dose response curve**

-if the effect was proportional to the amount of drugs: linear curve

effectiveness- affinity

**different sites of action**
morphine:
  - analgesic-inhibits pain perception neurons
Aspirin:
  - analgesic- suppress “chemical signal” from damages cells to the nervous system

different affinity- drugs bind to receptors

**affinity= strength of the binding**

**margin of safety**

*drugs have multiple effects at different concentrations: morphine*
therapeutic index
TI- measure of drug safety

LD- LETHAL DOSE for 50% of the animals
ED- effective dose for 50% of the animals

example- (valium) tranquilizer, anxiety reducer: TI = 100

LOW TI- dangerous
HIGH TI- safe

Drug misuse/abuse

what kinds of long term effects do drugs have?

-effect decreases with repeated (prolonged) use:
  tolerance: need more drugs, compensatory mechanism counteracting the effect of the drug

withdrawal symptoms: compensatory mechanism alone. opposite behavioral/ emotional effects

example: euphoria< > depression
-effect increases with repeated (prolonged) use: sensitization
e.g. antidepressants: need time to be effective

effect can be psychological: **placebo effect**
used mainly in research
e.g. control for anxiety (human)
control for the effect of drug administration (animals)

  -drug reinforcing effect depends on the environment: nicotine and cues

**how do drugs work? agonist, antagonists**

-an agonist has the same postsynaptic effects as a particular neurotransmitter (i.e. it opens receptors) increased the effect of a drug

-antagonist- opposite effect. receptor is closed
two ways of doing this- competitive and non competitive
drugs can interfere with re-uptake and degradation

**neurotransmitters**
goal of neurotransmitter release: postsynaptic potential (EPSP/IPSP)

Transmitter ID card
- synthesis and destruction
- pathway of release
- receptors
- disease+ action of prescription drugs

**the main families of neurotransmitters**
amino acids >>>>>>> Glutamine, GABA, Glycine

Acetylcholine (Ach)

Monoamines

Neuropeptides

Other (lipids, nucleosides, soluble gases)

**amino acids**

*glutamate (glutamic acid)*
synthesis- from pro tines in food
found where? everywhere in the CNS

GABA
-synthesis: from glutamate
found where? everywhere in the CNS
-psychopharmacology:
-controls spread of excitation (epilepsy, seizures)

Glycine
-synthesis:
- found in sugar cane
- endogenous production unknown. Non essential (can be synthesized by the body, no need for external source)
-found where? mainly, the spinal cord
-receptors:
- always inhibitory

What if you had a quiz?
- agonists are drugs that bind to receptors and open them (T/F)
  answer: true

-the margin of safety is measure…
  answer: as the distance between two dose response curves

-a competitive agonist is..
  answer: a drug that binds to a receptor at the same site as a neurotransmitter and opens it

-Intravenous drug administration has slow and diffuse effects (T/F)
  answer: false