Brain Chemistry
Stuff you probably already know

- If neurons receive enough input, they “fire”
- Electrical impulses control the firing of neurons
How do neurotransmitters work?
Serotonin

- Affects appetite, sleep, learning
- Elevates mood
- Reduces aggression
- Makes you resistant to depression and anxiety
- Makes people think more positively of intimacy and romance
- Levels are lower during winter months
Serotonin

- Antidepressants (SSRIs)
- Health supplement 5-HTP
- Foods with **tryptophan**
  - Turkey!, soy beans, tuna, salmon, rye, nuts, eggs, avocado, flax, olives, fish oil....
Endogenous Opioids

- Pain relief
- Includes endorphins
- Reduces stress
- Create a sense of well being, even euphoria
- Affects sexual behaviour, appetite, body temperature
- Involved in reward and addictive behaviour
Endogenous Opioids

- Strenuous exercise
- Sex
- Opium
- Codeine
- Morphine
- Heroin
Dopamine

- **Pleasurable reward:**
  - released during pleasurable situations
  - causes you to seek out rewards

- **Role in addiction**
- Affects motivation, **arousal**, decision making
- Improves focus and attention
- Sexual gratification
- Increases **sociability**
Dopamine

- Food
- Sex
- Rock n Roll?

- Cocaine
- Methamphetamines
- Alcohol

- World of Warcraft
  - and other addictive video games
Dopamine

● Having too much makes you crazy
  ○ *Schizophrenia* has been linked to high levels of dopamine

● Having too little makes you shake
  ○ *Parkinson’s Disease* is due to Dopamine deficiency
  ○ Taking anti-psychotics for long periods can cause *Dystonia - drug induced Parkinsonism*
  ○ Deficiency may cause *ADHD* and *Restless Legs Syndrome*
Gamma Amunobutyric Acid (GABA)

- Promotes relaxation
- Relieves anxiety
- Improves mood
- Can induce sleep
- Can release sex hormones
- Inhibitory neurotransmitter - sedative
  - sluggish movements
  - slurred speech
Gamma Amunobutyric Acid (GABA)

- Alcohol
- Valium
Oxytocin

- Actually a hormone
- Sometimes called the “love” chemical
  - involved in pair **bonding**, **trust**, intimacy, attachment, **maternal love**, sex, **empathy**, generosity, **social recognition**, social memories
- Also promotes **ethnocentric** behaviour
  - trust and empathy with in-group, but
  - suspicion and rejection of outsiders
- Autistic people have less
Oxytocin

● Physical contact with another person
  ○ hugs, even handshakes

● Eye contact

● Give birth

● Have sex
  ○ stronger effect in women?
Cortisol

- Increases blood sugar
  - Fuel to brain increases

- Heightened working memory… temporarily

- Suppresses immune system
  - reduces inflammation

- Muscle aches, insomnia, fatigue, weight gain in abdomen, anxiety, decreased libido

- decreased muscle mass and bone formation
Cortisol

- STRESS!

- Corticosteroids (Cortisol)
Adenosine

- Involved in many biological processes

- Adenosine Triphosphate = ATP

- Inhibitory neurotransmitter
  - relaxes breathing
  - suppresses neuron excitability and firing rate
  - puts you to sleep
  - suppresses arousal
Adenosine

- caffeine!
  - binds to same receptors as Adenosine and inhibits its effects
Acetylcholine

- Most common neurotransmitter
- First to be discovered
- Basic transmission of nerve impulses:
  - Activates muscles
  - Increases neuron excitability
- Improves attention, reaction time
Acetylcholine

- **Nicotine!**
  - There are actually **nicotinic** receptors for ACh in your brain!

- Certain foods: liver, egg yolk, cheese, nuts, oatmeal, soybeans

- Nerve gas - causes neuromuscular paralysis by inhibiting effects of Acetylcholine
Conclusions

● Method through which all substances act on the brain

● Neurotransmitters are poorly understood
  ○ Notice how nearly all of them affect sleep, sex, mood, appetite…?

● Huge effects on behaviour

● Behaviour also affects neurotransmitter levels
http://sciencenordic.com/hormone-removes-pleasure-smoking

nicotine, epinephrine, estrogen, progesterone
ACETYLCHOLINE
Epinephrine (Adrenaline)

- Fight or flight response
- Increased heart rate
- Knee shaking

- Negative emotions & memories
- Enhances long-term memory formation
Epinephrine (Adrenaline)

- Danger!
- Fear