


The Human Animal



BIO1300 – The Human Animal

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Drugs of Plant Origin



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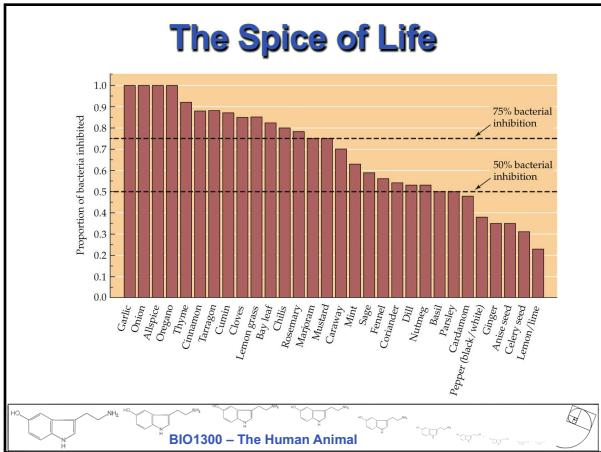
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Plant Secondary Compounds

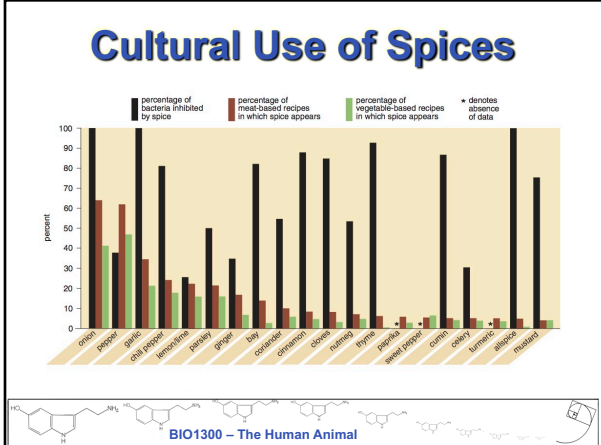


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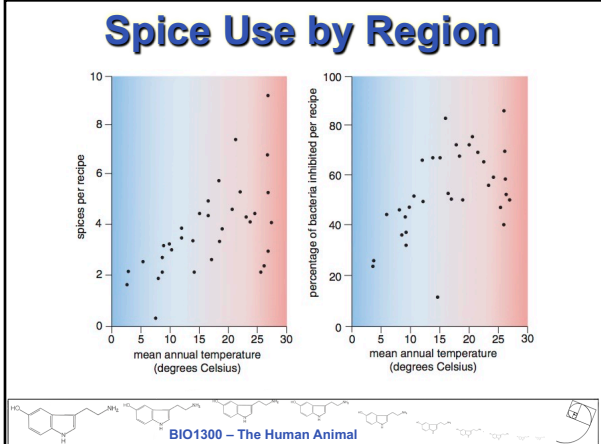
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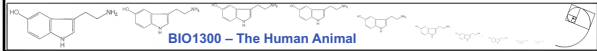
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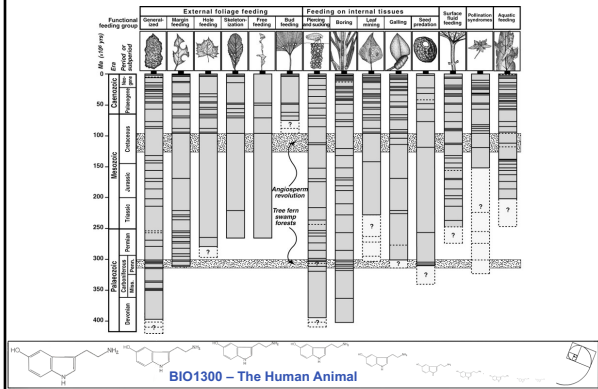
Early Land Plants

- Colonization of land during Ordovician (450MYA)
 - Non-vascular mossy plants on shores
 - First forests were tall ferns and lycopods
- Insects quickly followed



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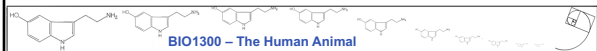
History of Insect Damage



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Plant Defenses

- Large herbivores deterred by physical defenses
- Spines
- Glandular trichomes
- Siliceous spicules

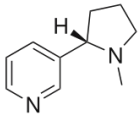


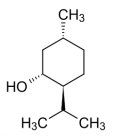
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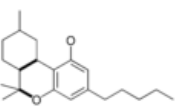
Plant Defenses

- **Alkaloids**
 - Nicotine
 - Caffeine
 - Morphine
 - Cocaine
- **Terpenes**
 - Citronella
 - Menthol
 - camphor

- **Phenolics**
 - Cannabinoids
 - Capsaicin
 - Salicylic acid



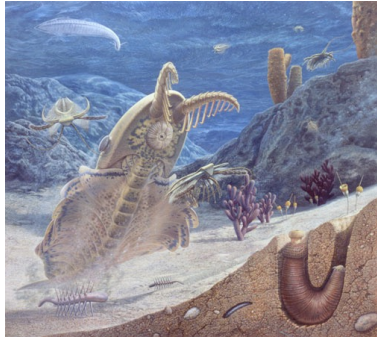




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Monoamine Neurotransmitters



NCCc1ccc(O)c(O)c1
Dopamine

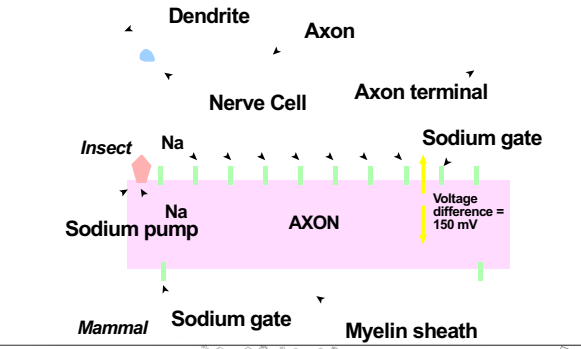
N[C@@H](O)Cc1ccc(O)c(O)c1
Norepinephrine

NCCc1c[nH]c2ccccc12
Serotonin

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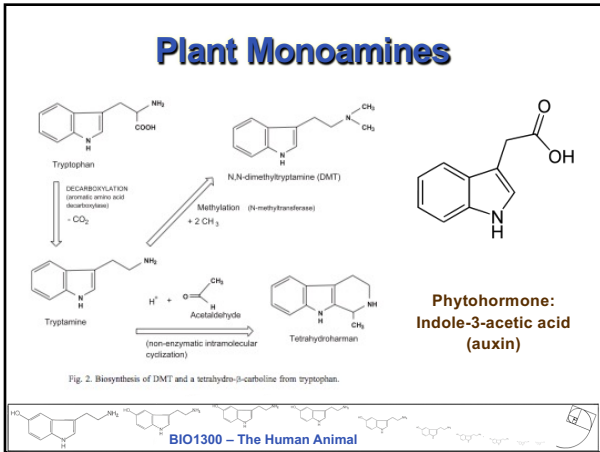
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Non-specific Neurotoxicity



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Addictions

- **Always originate in pain (conscious or unconscious)**
 - Therefore, we should not ask “why the addiction?” but rather “why the pain?”
 - Dr. Gabor Maté, M.D.

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Addiction Definition

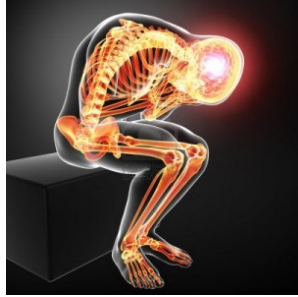
- **Chronic neurobiological disease characterized by behaviours that include craving, compulsive use, continued despite harm**
 - May be narcotic, alcohol or non-substance related

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Do Drugs Cause Addictions?

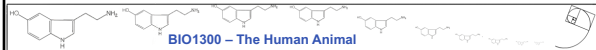
- Can J Medicine study (2006)
- 6000+ patients in chronic pain
- Taking narcotics, morphine
- No risk of addiction



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Crystal Meth in Canada

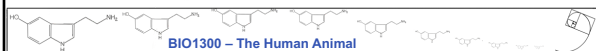
- From surveys
 - 4.6% have tried it
 - 0.5% in past year
- If was highly addictive those figures would be very similar



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Lab Rats

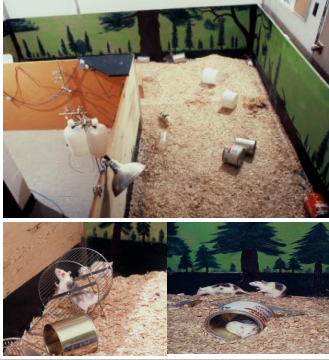
- Will self-administer cocaine and develop addictions
- But they are living in captivity under stressed conditions



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Rat Park

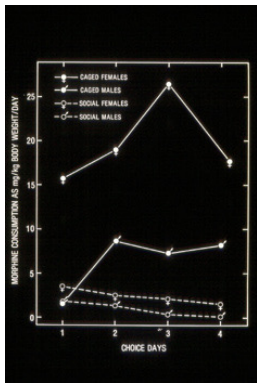
- Dr. Alexander @ SFU in 1980s
- Airy and spacious, scenic and comfortable
- Social environment
- 16-20 rats of both sexes
- 200x bigger than regular cages



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Rat Park Effect

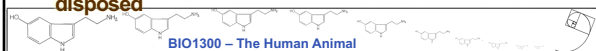
- Rats uninterested in morphine dropper
- Added sugar solution, still uninterested
- Created cohort of addicts then put in 'rat park' and became disinterested in morphine



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Conclusion

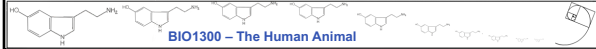
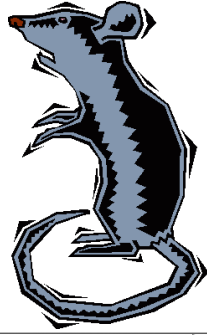
- Drugs have addictive potential
- Animals can develop compulsive cravings
- Happy and healthy animals do not get addicted
 - Access to the drugs are not the source of the addiction
- Addictions are rooted in psychology of emotions, neurobiological systems
 - Stressed individuals are pre-disposed



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Absence of Stable Attachment

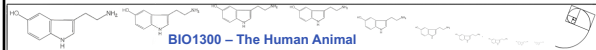
- Rats raised and kept in isolation developed fewer dopamine receptors
- Permanent disruption of incentive-motivation system in brain
- More likely to self-administer cocaine



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Drug Addiction in Humans

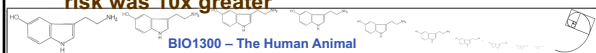
- Very high percentage experienced trauma
 - Physical, sexual and emotional abuse
- Children deprived of safe, nurturing attachment relationship are vulnerable to mood-enhancing drugs to feel 'normal' emotions and lubricants to help them interact socially with others



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Adverse Childhood Experiences

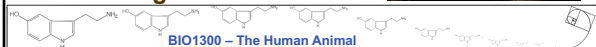
- Center for Disease Control and Prevention study
- Looked at incidence of 10 separate categories of ACE
 - For each ACE, risk of addiction rose by 2-4x
 - Subjects with 5+, risk was 10x greater



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National Inst. on Drug Abuse (2002 review USA)

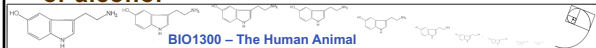
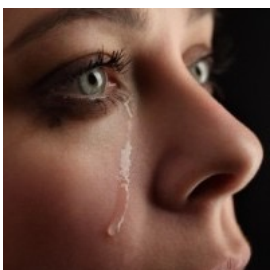
- Up to 100% of women drug abusers were victims of physical or sexual abuse
- Victims of both forms of abuse were 2x as likely to use drugs than those of one or the other
- Populations of substance abusers had met all criteria of suffering from PTSD



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Susceptibility to Addiction

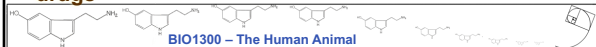
- In humans almost all addicts have experienced a lifetime of pain and trauma
- The less effective our internal chemical happiness system, the more driven we are to compensate with drugs or alcohol



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Trauma and Brain Receptors

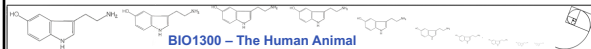
- Life experience that includes abuse, trauma and stress leads to underdevelopment of receptors in limbic system
- Leads to a deficit in stimulation of brain in emotions related to happiness, love, joy, connection
- Can be compensated for by drugs



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Testimonials in 'Hungry Ghosts'

- HIV-infected sex-trade worker summed up effects of opioids and her life history:
 - “the first time I tried heroin, it felt like a warm soft hug”



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Addictions and the Brain

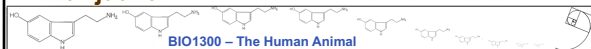
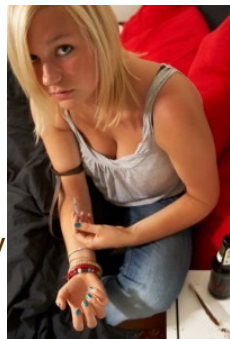
- Involve 4 major systems in the brain
- Opioid apparatus
 - Attachment-reward / endorphins
- Dopaminergic system
 - Incentive-motivation / feel-good chemicals
- Self-regulation mechanisms
 - Pre-frontal and Orbito-frontal cortex
- Body-brain system



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Opiate Abuse

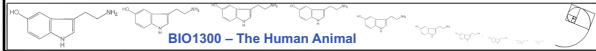
- Heroin and morphine replace most fundamental emotion of human existence
 - Attachment instinct
 - Drive for physical and emotional closeness
 - Euphoria of pleasure and joy
- Endorphins are also triggered by alcohol and marijuana



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Cocaine Abuse

- Increases amount of dopamine available to brain cells
 - Prevents re-uptake into nerve cells
- Addicts start out with fewer receptors
- Cocaine brings dopamine stimulation up to 'normal' level



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Effects on the Brain

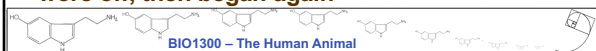
Drug	Inhibits re-uptake	Releases	Neurotrans. Effect
Cocaine	Dopamine		3x amount
Crystal Meth	Dopamine	Dopamine	12x amount
Nicotine		Dopamine	
Alcohol		Dopamine	
Eating		Dopamine	Increase by 50%
Sex		Dopamine	Increase by 100%



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Dopamine Receptors and Addictions

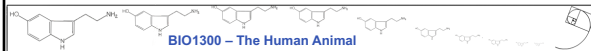
- Rats were bred to be addicted to alcohol
- Were then injected with dopamine directly into nucleus accumbens
- Temporarily had a normal amount of dopamine present in brain
- Effect: they stopped drinking until dopamine wore off, then began again



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Drug Abuse and Tolerance

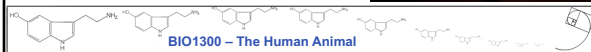
- Brain attempts to maintain homeostasis
- Chronic over-stimulation of receptors by neurotransmitter reduces number of receptors
- User then needs to take more in order to achieve same high
- Explains withdrawl symptoms
 - Brain no longer receiving stimulation due to decreased # of receptors
 - Irritability, depression, fatigue



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Alcohol Abuse

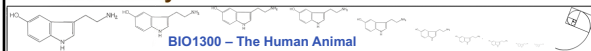
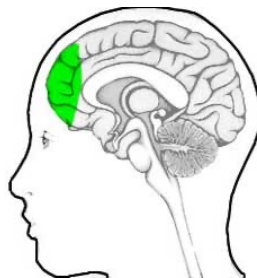
- Early childhood trauma increases likelihood by 2-3x
- Trauma and stress lead to desire to self-regulate negative or painful emotions
- Provides short-term relief from stress and emotional distress



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Trauma and the PFC/OFC

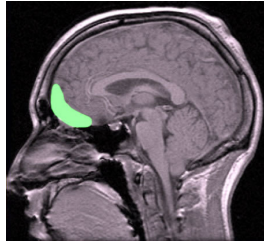
- Underdevelopment of these brain regions in frontal lobe lead to
 - Problems in assessing emotions in others
 - Impairs decision-making ability
 - Imbalance in short vs. long-term consequences
 - Evaluation of risk and uncertainty



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Trauma and the PFC/OFC

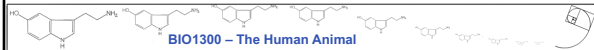
- Creates scenario that reinforces drug use, despite recognized harm
 - Overvaluing drugs and cravings
 - Undervaluing important aspects of life
 - Impairs judgment
 - Failure at inhibiting impulses



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There is Hope

- Brain is highly plastic
- Neurons that fire together wire together
- Solution:
 - not in withdrawing drugs from brain, but removing their need
 - Remove haunting effect of traumas and allow brain to build healthy emotions



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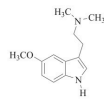
Psychedelics and Serotonin



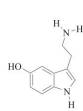
DMT



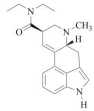
R = H; Psilocin
R = PO₃H₂; Psilocybin



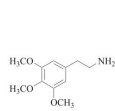
5-Methoxy-DMT



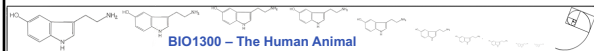
Serotonin; 5-HT



LSD



Mescaline



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The Psychedelic Effect

www.psychonauts.com © Mike Brown 2011

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The Psychedelic Effect

Fixed psychodynamic approach to personality

Id Ego
Superego

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The Psychedelic Effect

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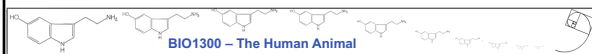
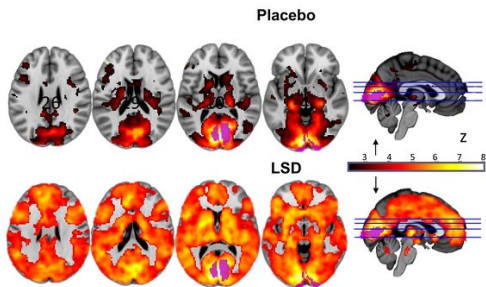
Psychedelics and Therapy

- Used to treat addictions, depression, OCD, PTSD, anxiety



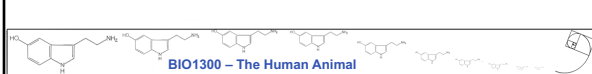
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A Connected Brain on LSD



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Ayahuasca Psychotherapy



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