

The Human Animal

BIO1300 – The Human Animal

1

Drugs of Plant Origin

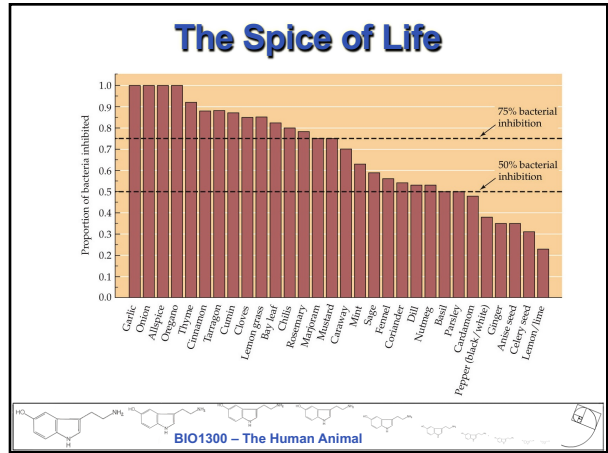
BIO1300 – The Human Animal

2

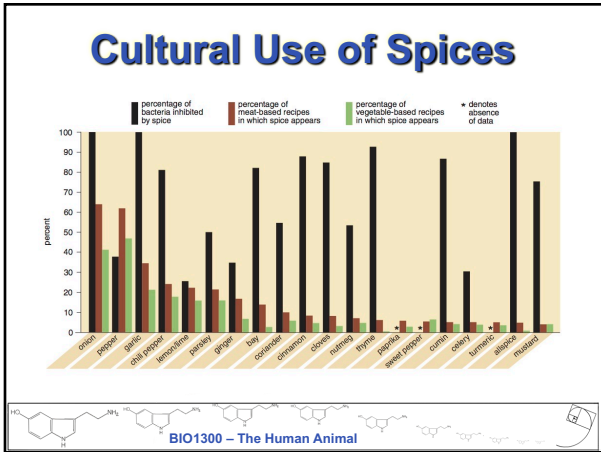
Plant Secondary Compounds

BIO1300 – The Human Animal

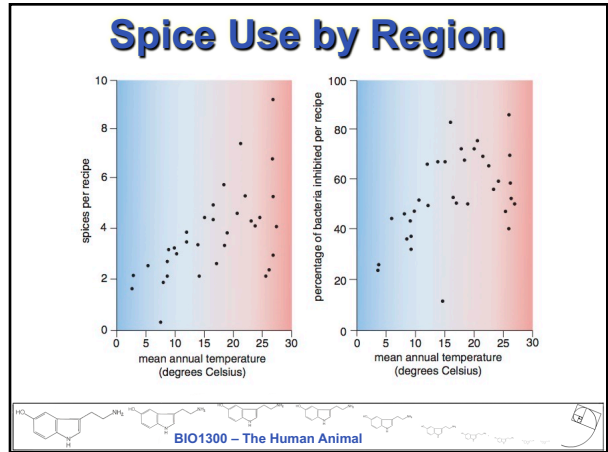
3



4




5



6

Early Land Plants

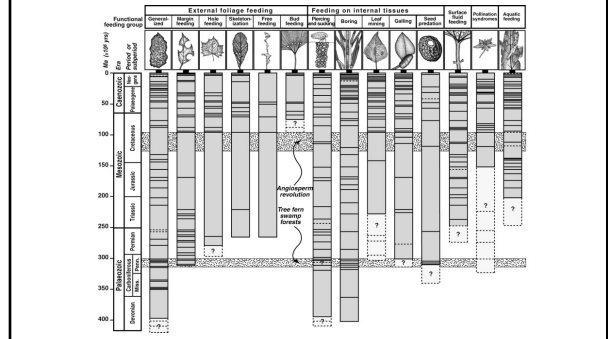
- Colonization of land during Ordovician (450MYA)
 - Non-vascular mossy plants on shores
 - First forests were tall ferns and lycopods
- Insects quickly followed



BIO1300 – The Human Animal

7

History of Insect Damage




BIO1300 – The Human Animal

8

Plant Defenses

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

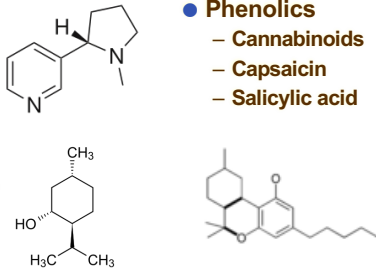


BIO1300 – The Human Animal

9

Plant Defenses

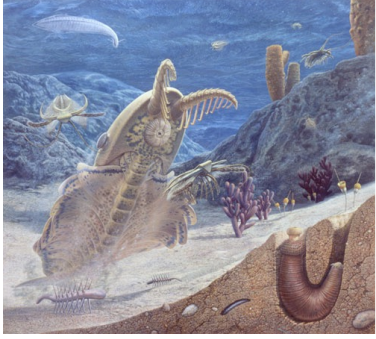
- Alkaloids
 - Nicotine
 - Caffeine
 - Morphine
 - Cocaine
- Terpenes
 - Citronella
 - Menthol
 - camphor
- Phenolics
 - Cannabinoids
 - Capsaicin
 - Salicylic acid



BIO1300 – The Human Animal

10

Monoamine Neurotransmitters



NCC(N)Cc1ccc(O)c(O)c1

Dopamine

NCC(O)Cc1ccc(O)c(O)c1

Norepinephrine

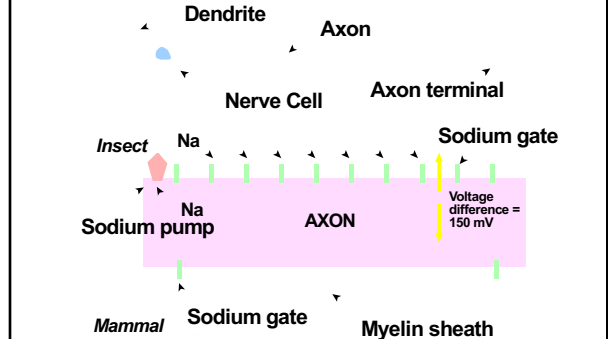
NCC1=CN=C2C=CC=CC12

Serotonin

BIO1300 – The Human Animal

11

Non-specific Neurotoxicity



BIO1300 – The Human Animal

12

Plant Monoamines

Fig. 2. Biosynthesis of DMT and a tetrahydro- β -carboline from tryptophan.

BIO1300 – The Human Animal

13

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.

BIO1300 – The Human Animal

14

Addiction Definition

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

BIO1300 – The Human Animal

15

Do Drugs Cause Addictions?

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

BIO1300 – The Human Animal

16

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

BIO1300 – The Human Animal

17

Lab Rats

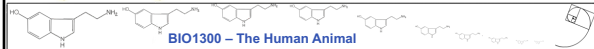
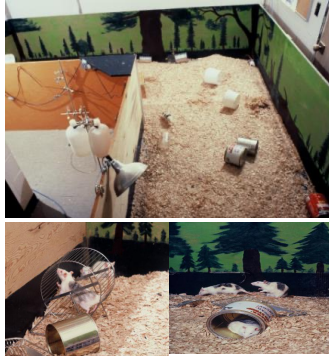
- Will self-administer cocaine and develop addictions
- But they are living in captivity under stressed conditions

BIO1300 – The Human Animal

18

Rat Park

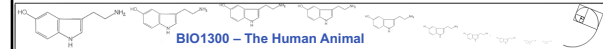
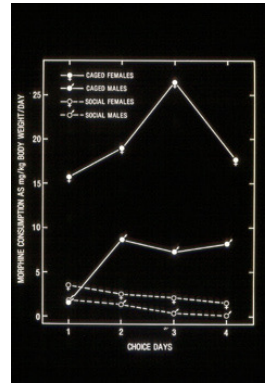
- Dr. Alexander @ SFU in 1980s
- Airy and spacious, scenic and comfortable
- Social environment
- 16-20 rats of both sexes
- 200x bigger than regular cages



19

Rat Park Effect

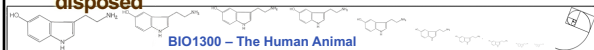
- Rats uninterested in morphine dropper
- Added sugar solution, still uninterested
- Created cohort of addicts then put in 'rat park' and became disinterested in morphine



20

Conclusion

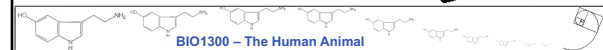
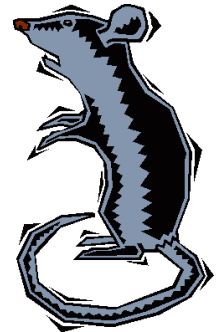
- Drugs have addictive potential
- Animals can develop compulsive cravings
- Happy and healthy animals do not get addicted
 - Access to the drugs are not the source of the addiction
- Addictions are rooted in psychology of emotions, neurobiological systems
 - Stressed individuals are pre-disposed



21

Absence of Stable Attachment

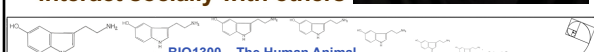
- Rats raised and kept in isolation developed fewer dopamine receptors
- Permanent disruption of incentive-motivation system in brain
- More likely to self-administer cocaine



22

Drug Addiction in Humans

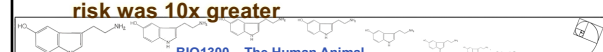
- Very high percentage experienced trauma
 - Physical, sexual and emotional abuse
- Children deprived of safe, nurturing attachment relationship are vulnerable to mood-enhancing drugs to feel 'normal' emotions and lubricants to help them interact socially with others



23

Adverse Childhood Experiences

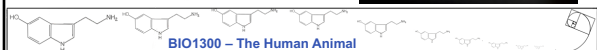
- Center for Disease Control and Prevention study
- Looked at incidence of 10 separate categories of ACE
 - For each ACE, risk of addiction rose by 2-4x
 - Subjects with 5+, risk was 10x greater



24

Cocaine Abuse

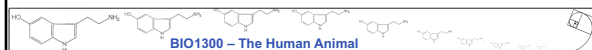
- Increases amount of dopamine available to brain cells
 - Prevents re-uptake into nerve cells
- Addicts start out with fewer receptors
- Cocaine brings dopamine stimulation up to 'normal' level



31

Effects on the Brain

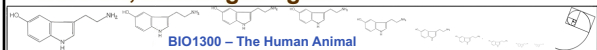
Drug	Inhibits re-uptake	Releases	Neurotrans. Effect
Cocaine	Dopamine		3x amount
Crystal Meth	Dopamine	Dopamine	12x amount
Nicotine		Dopamine	
Alcohol		Dopamine	
Eating		Dopamine	Increase by 50%
Sex		Dopamine	Increase by 100%



32

Dopamine Receptors and Addictions

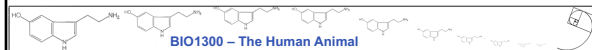
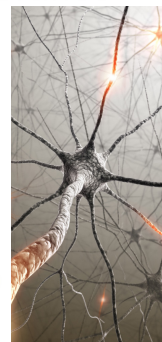
- Rats were bred to be addicted to alcohol
- Were then injected with dopamine directly into nucleus accumbens
- Temporarily had a normal amount of dopamine present in brain
- Effect: they stopped drinking until dopamine wore off, then began again



33

Drug Abuse and Tolerance

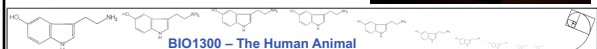
- Brain attempts to maintain homeostasis
- Chronic over-stimulation of receptors by neurotransmitter reduces number of receptors
- User then needs to take more in order to achieve same high
- Explains withdrawal symptoms
 - Brain no longer receiving stimulation due to decreased # of receptors
 - Irritability,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



34

Alcohol Abuse

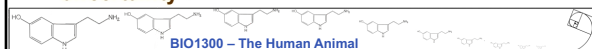
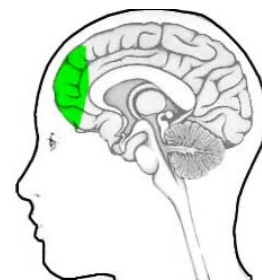
- Early childhood trauma increases likelihood by 2-3x
- Trauma and stress lead to desire to self-regulate negative or painful emotions
- Provides short-term relief from stress and emotional distress



35

Trauma and the PFC/OFC

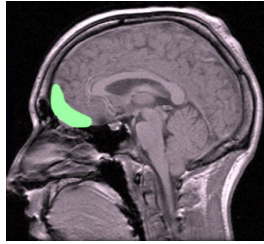
- Underdevelopment of these brain regions in frontal lobe lead to
 - Problems in assessing emotions in others
 - Impairs decision-making ability
 - Imbalance in short vs. long-term consequences
 - Evaluation of risk and uncertainty



36

Trauma and the PFC/OFC

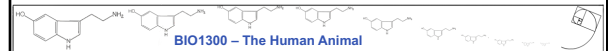
- Creates scenario that reinforces drug use, despite recognized harm
 - Overvaluing drugs and cravings
 - Undervaluing important aspects of life
 - Impairs judgment
 - Failure at inhibiting impulses



37

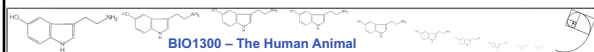
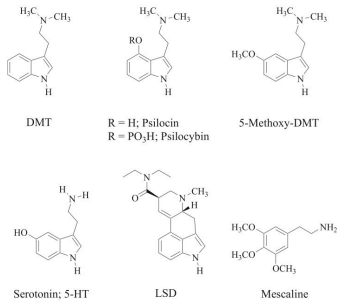
There is Hope

- 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



38

Psychedelics and Serotonin



39

The Psychedelic Effect

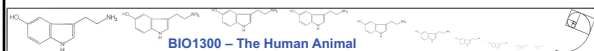


40

The Psychedelic Effect

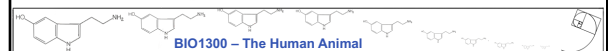
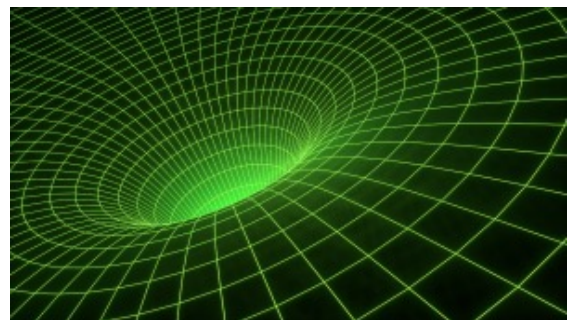


Freud psychodynamic approach to personality



41

The Psychedelic Effect



42

