

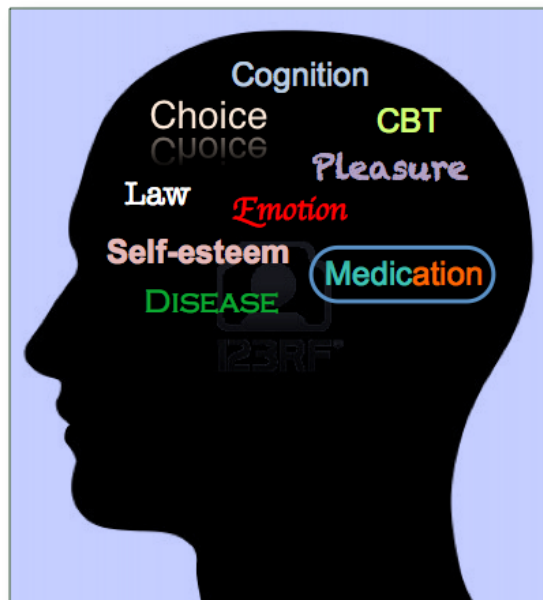


University of Sussex

School of Psychology – M.Sc. in Cognitive Neuroscience  
2013-2014

# Drug Addiction and its Treatment

(Module 918C8)



Module Convenor: Professor Aldo Badiani

**NOTE:** Most of the questions you need answers to about this Module are in this handbook. Please read it fully and carefully before your first seminar.

**NOTE:** This document concerns the structure and content of the Module. If you have questions about procedures, please consult the School of Psychology Administration Office in Pev1 2A13 or via [psychology@sussex.ac.uk](mailto:psychology@sussex.ac.uk).

## **Module content**

The module will cover the following topics: Basic pharmacology of addictive drugs; History of recreational drug use; Drug-induced neuroplasticity; Major theories of drug reward and drug addiction; Drug harm; Treatment of drug addiction. Thus, the scope of the module will range from basic pharmacology to clinical intervention. Particular emphasis will be placed on real-life aspects of drug abuse and drug addiction.

## **Module objectives**

By the end of the module successful students should be able to:

- 1) Understand the mechanisms of action of addictive drugs;
- 2) Understand how addictive drugs can induce enduring changes in brain and behaviour;
- 3) Critically discuss and analyse major concepts and theoretical models of drug addiction;
- 4) Critically discuss and analyse the concept of drug harm and harm reduction;
- 5) Discuss the therapeutic options for the treatment of drug abuse and addiction.

## **Module Contact Information**

Convenor: Prof. Aldo Badiani  
Location: Pevensey I, Room 2B19  
E-mail: [aldo.badiani@sussex.ac.uk](mailto:aldo.badiani@sussex.ac.uk)  
Office hours: Thursdays, 13:00-15:00, or by appointment (via email).

## Seminars & Workshops

### Seminars

The 12 seminars will last 2 hours each, with a short break in the middle. Each seminar will include a formal presentation (lecture) but there will be plenty of time to discuss key articles from the literature and for students to present additional material.

### Workshops (location: FUL-104)

The 4 workshops will last 1 hour each.

## Reading material

No single text covers all topics relevant to this module. The most important course material is represented by the journal articles listed in the next sections.

However, the following textbook is required:

- ◆ **Meyer JS, Quenzer LF (2013) *Psychopharmacology*. Sunderland, MA: Sinauer Associates. (ISBN 978-0-87893-510-9).**

Also required is one of the following texts:

- ◆ Gossop M (2003) *Drug Addiction and its Treatment*. Oxford, UK: Oxford University Press. (ISBN 978-0-19-852608-7). Note: selected chapters from this book will be made available to the students by the end of Wk4.
- ◆ Ruiz P, Strain E (2011) *Lowinson and Ruiz's Substance Abuse: A Comprehensive Textbook, 5th edition*. Philadelphia, PA: Lippincott Williams and Wilkins. (ISBN 978-1605472775). Note: this text is recommended only to students who have a strong interest in the clinical aspects of drug addiction.
- ◆ Galanter M, Kleber HD (2008) *Textbook of Substance Abuse Treatment, 4th edition*. Washington DC: American Psychiatric Publishing. (ISBN 978-1585622764). Note: this text is recommended only to students who have a strong interest in the clinical aspects of drug addiction.

## Assessment

### Literature Review (due: Wk 12)

A 3000-word literature review concerning a topic to be chosen from those that will be made available at the end of Wk 2. The review is due at the end of the term and will be worth 30% of your final mark. More information about this assignment will be provided in class and/or via Study Direct.

### Unseen Examination (date: Summer)

The unseen examination will consist of multiple choice questions and short-answer questions, and will be worth 70% of your final mark. More information about this assignment will be provided in class and/or via Study Direct.

## Submission deadlines, late penalties, and misconduct

**Important note:** Appropriately completing and submitting formally assessed work is your responsibility. Definitive guidelines on this are provided in the 'Handbook for Candidates' available on the web or via departmental offices. If you are in any doubt about the rules concerning submissions check with the departmental office.

The exact deadline for the literature review will be published on Sussex direct. Two copies of your review must be submitted to the Psychology Departmental office, Pevensey 1, Room 2A13 before the deadline. Up to 24 hours late there will be a penalty of 5%. Up to one week late there will be a penalty of 10%.

V&E students should ensure that they discuss with the module convenor any alternative assessment submission deadlines.

Assessment policy and procedures regarding late submission and mitigating evidence are provided at: <http://www.sussex.ac.uk/studentlifecentre/mitigation>



**Regulations concerning plagiarism and collusion can be found at:**  
<http://http://www.sussex.ac.uk/academicoffice/resources/misconduct>.

## Seminars and workshops schedule

### Seminars (location: A103; time: 11:00-13:00)

Wk 1 – <i>Thu, Jan 23</i>	S01: Naturally occurring psychoactive substances
Wk 2 – <i>Thu, Jan 30</i>	S02: Basic pharmacology I
Wk 3 – <i>Thu, Feb 6</i>	S03: Basic pharmacology II
Wk 4 – <i>Thu, Feb 13</i>	S04; Drug-induced changes in brain and behaviour
Wk 5 – <i>Thu, Feb 20</i>	S05: Biopsychology of reward and motivation
Wk 6 – <i>Thu, Feb 27</i>	S06: History of recreational drug use
Wk 7 – <i>Thu, Mar 6</i>	S07: Recreational drug use versus drug addiction
Wk 8 – <i>Thu, Mar 13</i>	S08: Theories of drug addiction
Wk 9 – <i>Thu, Mar 20</i>	S09: Drug Harm I
Wk 10 – <i>Thu, Mar 27</i>	S10: Drug Harm II
Wk 11 – <i>Thu, Apr 3</i>	S11: Treatment of drug addiction I
Wk 12 – <i>Thu, Apr 10</i>	S12: Treatment of drug addiction II

### Workshops (location: FUL-104; time: 17:00-18:00)

Wk 1 – <i>Fri, Jan 24</i>	W01: Drug, Set, and Setting
Wk 2 – <i>Fri, Jan 31</i>	W02: Why do humans use drugs?
Wk 3 – <i>Fri, Feb 7</i>	W03: Again, why do humans use drugs?
Wk 4 – <i>Fri, Feb 14</i>	W04: Drug addiction: choice or disease?

## **Seminar 1 – Naturally occurring psychoactive substances**

Virtually all psychoactive substances are produced by plants or are chemical analogs of substances contained in plants. Many of them (including caffeine, nicotine, delta-9-tetrahydrocannabinol, cocaine, and morphine) are neurotoxins. The rewarding effects of neurotoxins represent an evolutionary paradox.

### Readings

- 1) Meyer JS, Quenzer LF (2013) Psychopharmacology: Drugs, the Brain and Behavior. Sunderland, MA: Sinauer Associates. (ISBN 978-0-87893-510-9). [Chapter 1, 10, 11, 12, 13]
- 2) Sullivan RJ, Hagen EH, Hammerstein P (2008) Revealing the paradox of drug reward in human evolution. *Proc Biol Sci* 275(1640):1231-41.
- 3) Hagen EH, Sullivan RJ, Schmidt R, Morris G, Kempter R, Hammerstein P (2009) Ecology and neurobiology of toxin avoidance and the paradox of drug reward. *Neuroscience* 160(1):69-84.
- 4) Laux-Biehlmann A, Mouheiche J, Vérièpe J, Goumon Y (2013) Endogenous morphine and its metabolites in mammals: history, synthesis, localization and perspectives. *Neuroscience* 233:95-117.
- 5) Ziegler J, Facchini PJ, Geissler R, Schmidt J, Ammer C, Kramell R, Voigtländer S, Gesell A, Pienkny S, Brandt W (2009) Evolution of morphine biosynthesis in opium poppy. *Phytochemistry* 70(15-16):1696-707.
- 6) Goldstein RA, DesLauriers C, Burda AM (2009) Cocaine: history, social implications, and toxicity: a review. *Dis Mon* 55(1):6-38.

## **Seminar 2 – Basic pharmacology of addictive drugs I**

### **Pharmacodynamics**

#### Readings

- 1) Meyer JS, Quenzer LF (2013) Psychopharmacology: Drugs, the Brain and Behavior. Sunderland, MA: Sinauer Associates. (ISBN 978-0-87893-510-9). [Chapters 1, 3, 10, 11, 12, 13]

## **Seminar 3 – Basic pharmacology of addictive drugs II**

### **Pharmacokinetics**

#### Readings

- 1) Meyer JS, Quenzer LF (2013) Psychopharmacology: Drugs, the Brain and Behavior. Sunderland, MA: Sinauer Associates. (ISBN 978-0-87893-510-9). [Chapter 1, 10, 11, 12, 13]
- 2) Higuchi S, Matsushita S, Murayama M, Takagi S, Hayashida M (1995) Alcohol and aldehyde dehydrogenase polymorphisms and the risk for alcoholism. *Am J Psychiatry* 152:1219-1221.
- 3) Sullivan RJ, Hagen EH, Hammerstein P (2008) Revealing the paradox of drug reward in human evolution. *Proc Biol Sci* 275(1640):1231-41.

## **Seminar 4 – Drug-induced neuroplasticity**

It is thought that repeated exposure to addictive drugs produces both short-lived and long-lasting changes in neural connectivity as well changes in cognitive functions and behaviour. The exact nature of these alterations and their role in drug addiction is the subject of scholarly dispute.

### Readings

- 1) Meyer JS, Quenzer LF (2013) *Psychopharmacology: Drugs, the Brain and Behavior*. Sunderland, MA: Sinauer Associates. (ISBN 978-0-87893-510-9). [Chapters 2, 3, 8].
- 2) Stewart J, Badiani A (1993) Tolerance and sensitization to the behavioral effects of drugs. *Behav Pharmacol* 4(4):289-312.
- 3) Badiani A, Robinson TE (2004) Drug-induced neurobehavioral plasticity: the role of environmental context. *Behav Pharmacol* 15(5-6):327-339.
- 4) Robinson TE, Kolb B (2004) Structural plasticity associated with exposure to drugs of abuse. *Neuropharmacology* 47 Suppl 1:33-46.
- 5) Robison AJ, Nestler EJ (2011) Transcriptional and epigenetic mechanisms of addiction. *Nat Rev Neurosci* 12(11):623-637.
- 6) Kalivas PW, Volkow ND (2011) New medications for drug addiction hiding in glutamatergic neuroplasticity. *Mol Psychiatry* 16(10):974-86.
- 7) Pickens CL, Airavaara M, Theberge F, Fanous S, Hope BT, Shaham Y (2011) Neurobiology of the incubation of drug craving. *Trends Neurosci* 34(8):411-420.
- 8) Mandyam CD, Koob GF (2012) The addicted brain craves new neurons: putative role for adult-born progenitors in promoting recovery. *Trends Neurosci* 35(4):250-260.



## **Seminar 5 – Biopsychology of reward and motivation**

The motivation to take drugs is thought to depend on their ability to modulate directly or indirectly the reward systems of the brain.

### Readings

- 1) Solomon RL, Corbit JD (1973) An opponent-process theory of motivation. II. Cigarette addiction. *J Abnorm Psychol* 81(2):158-171.
- 2) Kelley AE, Berridge KC (2002) The neuroscience of natural rewards: relevance to addictive drugs. *J Neurosci* 22(9):3306-3311.
- 3) Berridge KC, Robinson TE (2003) Parsing reward. *Trends Neurosci* 26(9): 507-513.
- 4) Wise RA (2004) Dopamine, learning and motivation. *Nat Rev Neurosci* 5: 483-494.
- 5) Berridge KC (2012) From prediction error to incentive salience: mesolimbic computation of reward motivation. *Eur J Neurosci* 35(7):1124-1143.
- 6) Salamone JD, Correa M (2012) The mysterious motivational functions of mesolimbic dopamine. *Neuron* 76(3):470-485.

## **Seminar 6 – History of recreational drug use**

It is often assumed that the recreational use of psychoactive substances is in a simple relationship with their primary mechanism of action. For example, it is often stated that the recreational use of opiates originated over 3-4000 BCE. However, the history of recreational drug use is much more interesting and complex than that.

### Readings

- 1) Courtwright DT (2001) *Forces of Habit: Drugs and the Making of the Modern World*. Cambridge, MA: Harvard University Press. (ISBN 978-0674010031)
- 2) Davenport-Hines R (2004) *The Pursuit of Oblivion: A Global History of Narcotics*. New York, NY: Norton. (ISBN 978-0-393-05189-6 )
- 3) Goldstein RA, DesLauriers C, Burda AM (2009) Cocaine: history, social implications, and toxicity: a review. *Dis Mon* 55(1):6-38.

## Seminar 7 – Theories of drug addiction

A unified view is at the core of current theories of drug addiction. These unified theories have led to many important discoveries, some of which are described below, but they have also diverted investigators' attention away from psychological and neurobiological processes that characterize specific types of addiction.

### Readings

- 1) Wise RA, Bozarth MA (1987) A psychomotor stimulant theory of addiction. *Psychol Rev* 94:469–492.
- 2) Robinson TE, Berridge KC (1993) The neural basis of drug craving: an incentive-sensitization theory of addiction. *Brain Res Rev* 18:247–291.
- 3) Koob GF, Le Moal M (2001) Drug addiction, dysregulation of reward, and allostasis. *Neuropsychopharmacology* 24:97–129.
- 4) Robinson TE, Berridge KC. Review (2008) The incentive sensitization theory of addiction: some current issues. *Philos Trans R Soc Lond B Biol Sci* 363(1507):3137-3146.
- 5) Volkow, ND, Fowler JS (2000) Addiction, a disease of compulsion and drive: involvement of the orbitofrontal cortex. *Cereb Cortex* 10:318–325.
- 6) Everitt BJ, Robbins TW (2005) Neural systems of reinforcement for drug addiction: from actions to habits to compulsion. *Nat Neurosci* 8(11): 1481-1489.
- 7) Kalivas PW, Volkow N, Seamans J (2005) Unmanageable motivation in addiction: a pathology in prefrontal-accumbens glutamate transmission. *Neuron* 45:647–650.
- 8) West R (2001) Theories of addiction. *Addiction* 96(1):3-13.

## Seminar 8 – Recreational drug use and drug addiction

Drug addiction is not an automatic outcome of drug use. Only approximately 20% of people who use drugs such as cocaine or heroin will switch from controlled to compulsive use. Thus, one of the aims of addiction research is to identify the mechanisms that are responsible for the transition from one stage of the disorder to the next: from initial drug use to chronic drug use and then to compulsive, relapsing drug abuse.

### Readings

- 1) Meyer JS, Quenzer LF (2013) *Psychopharmacology: Drugs, the Brain and Behavior*. Sunderland, MA: Sinauer Associates. (ISBN 978-0-87893-510-9). [Chapter 9]
- 2) Gossop M (2003) *Drug Addiction and its Treatment*. Oxford, UK: Oxford University Press. (ISBN 978-0-19-852608-7). [Chapters 1-3]
- 3) American Psychiatric Association (2013) *Diagnostic and Statistical Manual of Mental Disorders, 5<sup>th</sup> edition (DSM-5)*. Washington, DC: American Psychiatric Publishing. (ISBN 978-0890425558 )
- 4) Ruiz P, Strain E (2013) *Lowinson and Ruiz's Substance Abuse: A Comprehensive Textbook, 5<sup>th</sup> ed.* Hagerstown, MD: Lippincott Williams & Wilkins. (ISBN 978-1605472775). [Section 3]

## Seminar 9 – Drug Harm I

### Substance-specific harms

#### Readings

- 1) Nutt DJ, King LA, Phillips LD, Independent Scientific Committee on Drugs (2013) Drug harms in the UK: a multicriteria decision analysis. *Lancet* 376(9752):1558-65.
- 2) Doll R, Peto R, Boreham J, Sutherland I (2005) Mortality in relation to alcohol consumption: a prospective study among male British doctors. *Int J Epidemiol* 34(1):199-204.
- 3) Thun MJ, Peto R, Lopez AD, Monaco JH, Henley SJ, Heath CW Jr, Doll R (1997) Alcohol consumption and mortality among middle-aged and elderly U.S. adults. *N Engl J Med* 337(24):1705-1714
- 4) Renaud S, Lanzmann-Petithory D, Gueguen R, Conard P (2004) Alcohol and mortality from all causes. *Biol Res* 37(2):183-187
- 5) Barkus E, Murray RM (2010) Substance use in adolescence and psychosis: clarifying the relationship. *Annu Rev Clin Psychol* 6:365-389.
- 6) Large M, Sharma S, Compton MT, Slade T, Nielssen O (2011) Cannabis use and earlier onset of psychosis: a systematic meta-analysis. *Arch Gen Psychiatry* 68(6):555-561.
- 7) McLaren JA, Silins E, Hutchinson D, Mattick RP, Hall W (2010) Assessing evidence for a causal link between cannabis and psychosis: a review of cohort studies. *Int J Drug Policy* 21(1):10-19.
- 8) Moore TH, Zammit S, Lingford-Hughes A, Barnes TR, Jones PB, Burke M, Lewis G (2007) Cannabis use and risk of psychotic or affective mental health outcomes: a systematic review. *Lancet* 370(9584):319-328.
- 9) Rathbone J, Variend H, Mehta H (2008) Cannabis and schizophrenia. *Cochrane Database Syst Rev*. 2008 Jul 16;(3):CD004837.

## Seminar 10 – Drug Harm II

### Harm reduction

#### Readings

- 1) Nutt DJ, King LA, Phillips LD, Independent Scientific Committee on Drugs (2013) Drug harms in the UK: a multicriteria decision analysis. *Lancet* 376(9752):1558-65.
- 2) Nutt DJ (2012) *Drugs, without the Hot Air*. Cambridge, UK: UIT. (978-1906860165).
- 3) Gossop M (2003) *Drug Addiction and its Treatment*. Oxford, UK: Oxford University Press. (ISBN 978-0-19-852608-7).  
[Chapters 4, 6]
- 4) Ruiz P, Strain E (2013) Lowinson and Ruiz's Substance Abuse: A Comprehensive Textbook, 5<sup>th</sup> ed. Hagerstown, MD: Lippincott Williams & Wilkins. (ISBN 978-1605472775).  
[Chapter 55]

## **Seminar 11 – Treatment of drug abuse I**

### **Opiate addiction**

#### Readings

- 1) Gossop M (2003) *Drug Addiction and its Treatment*. Oxford, UK: Oxford University Press. (ISBN 978-0-19-852608-7).  
[Chapters 5-11]
- 2) Ruiz P, Strain E (2013) Lowinson and Ruiz's Substance Abuse: A Comprehensive Textbook, 5<sup>th</sup> ed. Hagerstown, MD: Lippincott Williams & Wilkins. (ISBN 978-1605472775).  
[Section 6, with particular attention to chapters 28-30, 34, 37]

## **Seminar 12 – Treatment of drug abuse II**

### **Other types of drug addiction**

#### Readings

- 1) Gossop M (2003) *Drug Addiction and its Treatment*. Oxford, UK: Oxford University Press. (ISBN 978-0-19-852608-7).  
[Chapters 5-9, 11]
- 2) Ruiz P, Strain E (2013) Lowinson and Ruiz's Substance Abuse: A Comprehensive Textbook, 5<sup>th</sup> ed. Hagerstown, MD: Lippincott Williams & Wilkins. (ISBN 978-1605472775).  
[Section 6, with particular attention to chapters 31, 33, 35, 44]

## **Workshop 1 – Drug, Set, and Setting**

Vulnerability to addiction seems to be influenced not only by genes but also by environmental factors, including adverse life experiences, acute exposure to stressors, drug-associated contextual and discrete cues, and other, more subtle aspects of the environment. Thus, the behavioural and subjective effects of addictive drugs should be seen as the result of complex interactions among the drug, the user's physiological and mental state (set), and the circumstances of drug taking (setting).

### References

- 1) Harding WM, Zinberg NE (1984) Controlling intoxicant use. *J Psychoactive Drugs* 16:101–106.
- 2) Badiani A, Robinson TE (2004) Drug-induced neurobehavioral plasticity: the role of environmental context. *Behav Pharmacol* 15(5-6):327-339.
- 3) Kendler KS, Jacobson KC, Prescott CA, Neale MC (2003) Specificity of genetic and environmental risk factors for use and abuse/dependence of cannabis, cocaine, hallucinogens, sedatives, stimulants, and opiates in male twins. *Am J Psychiatry* 160(4):687-95.
- 4) Caprioli D, Celentano M, Paolone G, Badiani A (2007) Modeling the role of environment in addiction. *Prog Neuropsychopharmacol Biol Psychiatry* 31(8): 1639-1653.
- 5) Crombag HS, Bossert JM, Koya E, Shaham Y (2008) Context-induced relapse to drug seeking: a review. *Philos Trans R Soc Lond B Biol Sci* 363(1507):3233-3243.
- 6) Badiani A. Substance-specific environmental influences on drug use and drug preference in animals and humans. *Curr Opin Neurobiol.* 2013 Aug;23(4): 588-96.



## Workshop 2 – Why do humans use drugs?

### Evolutionary aspects of drug use

#### References

- 1) Nesse RM, Berridge KC (1997) Psychoactive drug use in evolutionary perspective. *Science* 278(5335):63-66.
  - 2) Sullivan RJ, Hagen EH, Hammerstein P (2008) Revealing the paradox of drug reward in human evolution. *Proc Biol Sci* 275(1640):1231-41.
  - 3) Hagen EH, Sullivan RJ, Schmidt R, Morris G, Kempter R, Hammerstein P (2009) Ecology and neurobiology of toxin avoidance and the paradox of drug reward. *Neuroscience* 160(1):69-84.
- 3) *Addiction*, volume 97(4), 2002: Special issue on Evolutionary Psychobiological approaches to addiction.
- Chick J (2002) Evolutionary psychobiology: any relevance for therapy? *Addiction* 97(4):473-4.
  - Hall W (2002) Taking Darwin seriously: more than telling just so stories. *Addiction* 97(4):472-3.
  - Nesse RM (2002) Evolution and addiction. *Addiction*. 2002 Apr;97(4):470-1.
  - Panksepp J, Knutson B, Burgdorf J (2002) The role of brain emotional systems in addictions: a neuro-evolutionary perspective and new 'self-report' animal model. *Addiction* 97(4):459-69.
  - Lende DH, Smith EO (2002) Evolution meets biopsychosociality: an analysis of addictive behavior. *Addiction* 97(4):447-58.
  - Gerald MS, Higley JD (2002) Evolutionary underpinnings of excessive alcohol consumption. *Addiction* 97(4):415-25.
  - Hill EM, Chow K (2002) Life-history theory and risky drinking. *Addiction* 97(4):401-13.
  - Sullivan RJ, Hagen EH (2002) Psychotropic substance-seeking: evolutionary pathology or adaptation? *Addiction* 97(4):389-400.
  - Dudley R (2002) Fermenting fruit and the historical ecology of ethanol ingestion: is alcoholism in modern humans an evolutionary hangover? *Addiction* 97(4):381-8.
  - Hill EM, Newlin DB (2002) Evolutionary approaches to addiction: introduction. *Addiction* 97(4):375-9.

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## **Workshop 3 – Again, why do humans use drugs?**

Readings

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## **Workshop 4 – Drug addiction: choice or disease?**

References

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