PHARMACY EDUCATION BY USING OPEN EDUCATIONAL RESOURCES PRODUCED IN COLLABORATIVE ERASMUS+ PROJECTS

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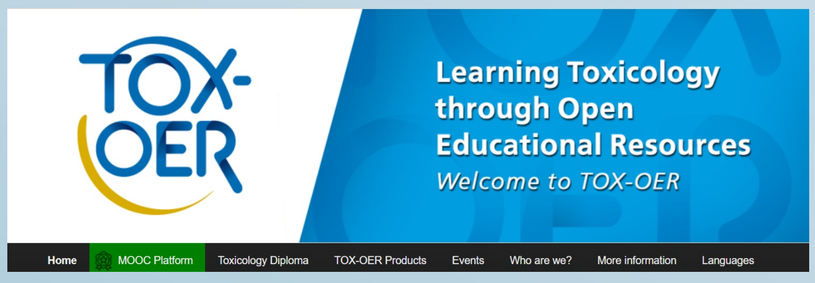
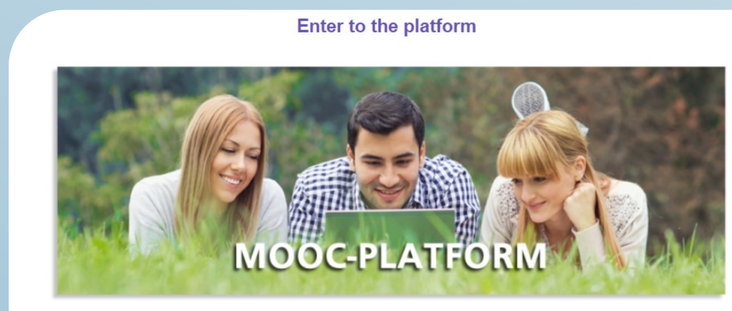
Introduction

The "Open Educational Resources" (OER) labels teaching, learning and research materials in any medium (digital or not), which is available, released under an open license that permits free access or use (Martin *et al*, 2018). In this presentation, it will be described the use of the OER produced in Faculty of Pharmacy of U.Porto in two collaborative Erasmus+ projects: TOX-OER (Learning Toxicology through Open Educational Resources), finished in 2018 and OEMONOM (Open access Educational Materials on Naturally Occurring Molecules – sources, biological activity and use), in course. Both projects' targets at preparation of comprehensible, free and easily available materials for teachers, professionals, students of biomedicinal disciplines as well as lay persons in areas included in Pharmaceutical Sciences.



| MOOC Structure

https://toxoer.com/



TOX-OER MOOC (Massive Open Online Courses) is a pedagogical platform to develop and share knowledge and skills related to the toxicology field by seven European countries. Our objective is to improve the access of learning in toxicology, the active learning, the virtual and blended mobility.

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- Module 1. General Concepts
- Module 2. Pharmaco-Toxicokinetics
- Module 3. Principals Groups of Xenobiotics
- Module 4. Environmental Pollutants
- Module 5. Target Organ Toxicity and Biomarkers
- Module 6. Environmental Toxicology
- Module 7. Patents and Patent Application

Module structures (Topics)

2.1 ADMET, Membrane and Transport Mechanisms (1 ECTS)

- Main concepts: Absorption, distribution, metabolism, excretion and transport (ADMET)
- Chemical and Physical Membrane characteristics
- Xenobiotic transport mechanisms
- Passive transport
- Active transport
- Phase 0 and 3 in cellular influx and efflux of xenobiotics
- Xenobiotic interactions at transport level
- Biological and genetic variability in ADMET

2.2 ABC Transporters, BBB Barrier (2 ECTS)

- ADMET and Membrane Transporters
- Transporters at Blood-Brain-Barrier (BBB) and other tissues
- Xenobiotic interactions at transport level, Transporters variability and biological consequences

2.3 Absorption, Distribution, Excretion of xenobiotics (2 ECTS)

- Toxicokinetics and main routes of xenobiotics absorption, distribution and excretion
- Factors that modulate the distribution of xenobiotics (protein-binding, tissue accumulation)
- Main barriers concerning distribution (Blood-Brain-barrier and Placenta)

2.4 Xenobiotic Metabolism (2 ECTS)

Phase 1 reactions

- Oxidations, reductions and hydrolysis
- Microsomal reactions (Cytochrome P450)
- Non-microsomal reactions (Alcohol and Aldehyde dehydrogenase, Epoxide Hydrolase and Esterases)

Phase 2 reactions

- Glucuronidation, sulfonation, acetylation, methylation and conjugation with glutathione, amino-acids and CoA
- Detoxification/bioactivation pathways (e.g. paracetamol, salicylates, benzo(a)pyrene, aflatoxin B1)

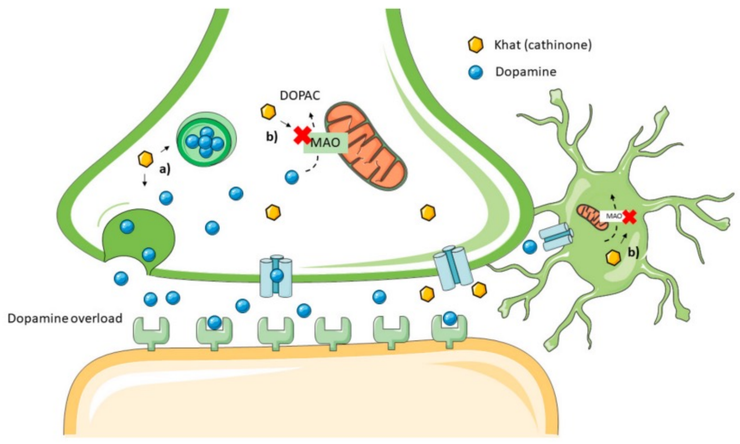
https://portal.faf.cuni.cz/OEMONOM/EN/Home/

Open Access Review

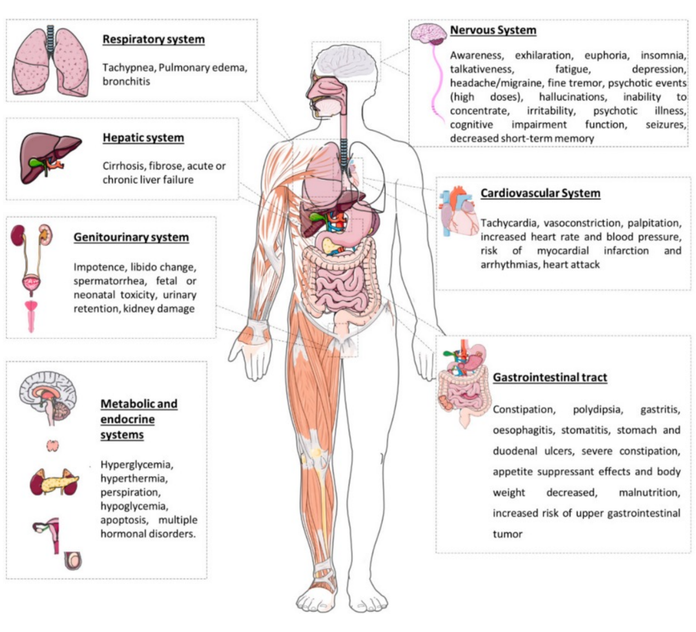
Khat, a Cultural Chewing Drug: A Toxicokinetic and Toxicodynamic Summary

by Bárbara Silva [1,2,*], Jorge Soares [1,2], Carolina Rocha-Pereira [1,2,3], Přemysl Mladěnka [4], Fernando Remião [1,2,*] and on behalf of The OEMONOM Researchers †

Toxins **2022**, *14*(2), 71; https://doi.org/10.3390/toxins14020071



Mechanism of toxicity of cathinone on the central nervous system. (a) Dopamine release induction; (b) MAO inhibition in neurons and astrocytes



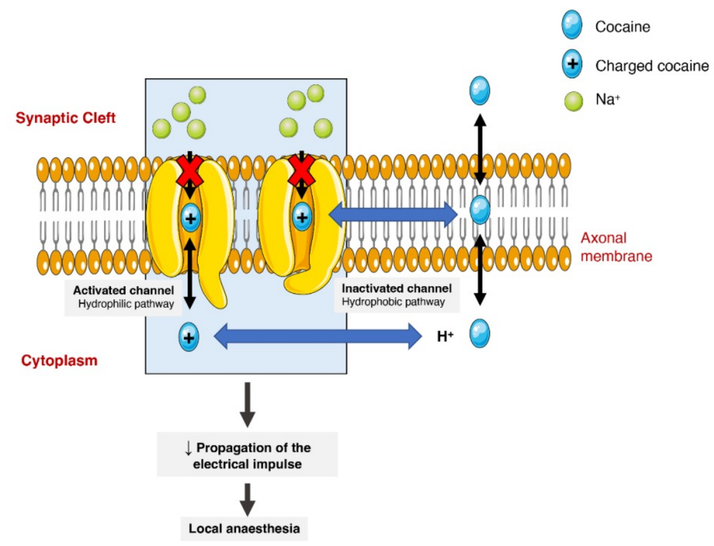
Common **adverse effects** of khat abuse

Open Access Review

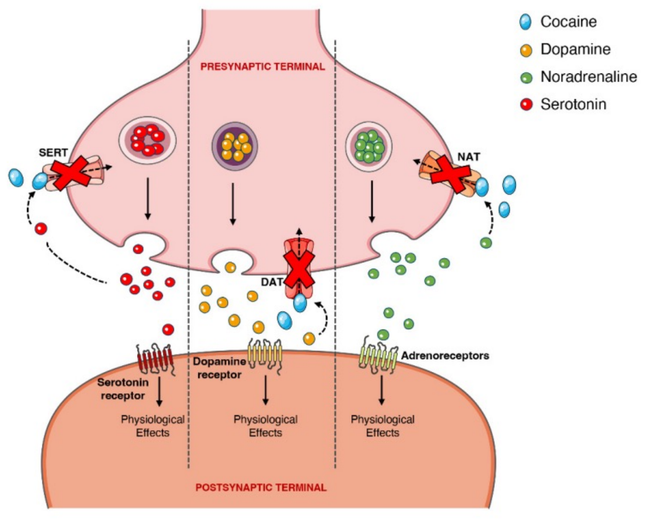
Cocaine: An Updated Overview on Chemistry, Detection, Biokinetics, and Pharmacotoxicological Aspects including Abuse Pattern

by Rita Roque Bravo [1,2,†], Ana Carolina Faria [1,2,†], Andreia Machado Brito-da-Costa [1,2,3], Helena Carmo [1,2], Přemysl Mladěnka [4], Diana Dias da Silva [1,2,3,*], Fernando Remião [1,2,*] and on behalf of The OEMONOM Researchers ‡

Toxins **2022**, *14*(4), 278; https://doi.org/10.3390/toxins14040278



Cocaine's interaction with **voltage-gated sodium channels**



Cocaine's **pharmacodynamics** at the noradrenergic, serotonergic or dopaminergic synapse. Cocaine acts by blocking the presynaptic transporters of dopamine

Conclusions

This presentation demonstrates the potential of using OER in Pharmacy Education, namely in Toxicology field.

References

Martín AIM, Vicente MP, Garriel MP, Vicente L, Remião F, Girotti S, et al. Challenges in Open Educational Resources: The Case of TOX-OER MOOC. Editorial Amarante; 2018.

Acknowledgements

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