

# Massive Open On-line Courses in Open Educational Resources for Toxicology Learning. Drugs and Persistent Organic Pollutants as Xenobiotics

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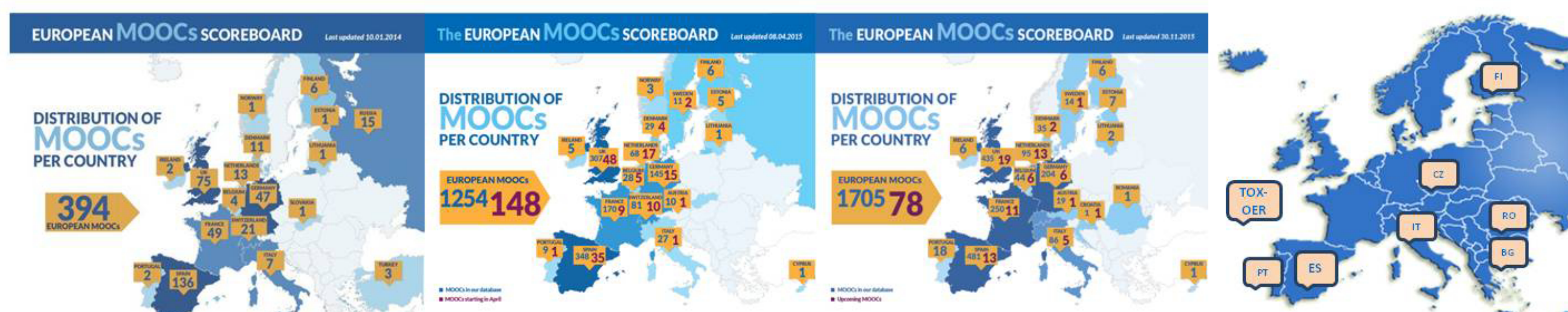
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## 1. Motivation and study aim

! **lack of** European Massive Open On-line Courses (MOOCs) in the field of the Toxicology

! **major differences** in teaching and learning of this important subject within various European biologically oriented faculties



Source: <https://www.openeducationeuropa.eu/en/category/freetags/scoreboard#main-content>

Source: MOOC-Maker Building Management Capacity for MOOCs in Higher Education (561533-EPP-1-2015-1-ES-EPPKA2-CBHE-JP)



### ✓ Learning Toxicology through Open Educational Resources (TOX-OER)

Erasmus+ Strategic Partnership project

✓ **TOX-OER** aims to develop and share toxicology-related knowledge and skills among partners of 7 countries:

- ✓ project coordinator – **Universidad de Salamanca (Spain, USAL)**
- ✓ partners: **Università di Bologna (Italy, UniBo)**, **Universidade do Porto (Portugal, UPorto)**, **South-Eastern Finland University of Applied Sciences (Finland, XAMK)**, **Univerzita Karlova V Praze (Czech Republic, CUNI)**, **Universitatea Transilvania din Brasov (Romania, UTBv)** and **Space Research and Technology Institute (Bulgaria, SRTI-BAS)**.

✓ **Study aim** – to present part of the **TOX-OER** outcomes developed by the project partnership, especially the modules related to the drugs and persistent organic pollutants, as principal groups of xenobiotics.

## 2. Methodology

**TOX-OER** will develop a scientific and pedagogical joint between research in the field of toxicology and MOOC pedagogical design, consisting in guidelines to support:

- creation of accessible Open Educational Resources (OER)
- course & modules management
- implementation, monitoring and evaluation of individual and social learning activities.

### Who needs TOX-OER???



Students (Bachelor, Master or PhD)	Students (vocational training)	Professionals in toxicology related fields
<ul style="list-style-type: none"> <li>– Pharmacy</li> <li>– Medicine, nursing, veterinary medicine</li> <li>– Biology, biochemistry, chemistry, agronomy</li> <li>– Environmental engineering</li> <li>– Forensic sciences</li> </ul>	<ul style="list-style-type: none"> <li>– Pharmacy assistant</li> <li>– Nursing assistant</li> <li>– Veterinary assistant</li> <li>– Hygienist</li> <li>– Laboratory technicians</li> </ul>	<ul style="list-style-type: none"> <li>– Pharmacists</li> <li>– Occupational medicine professionals</li> <li>– Forensics, police forces</li> <li>– Supervisory bodies</li> <li>– Authorities in energy and environmental sector</li> <li>– Power plants, industry and agricultural operators</li> </ul>

## 3. Results – modules developed for Toxicology OER

TOX-OER Modules / topics	ECTS	Partners
<b>M1: General Concepts</b>	1	UPorto
<b>M2: Pharmaco-Toxicokinetics</b> - 2.1. ADMET, Membrane and Transport Mechanisms; 2.2. ABC Transporters, BBB Barrier; 2.3. Absorption, Distribution, Excretion; 2.4. Xenobiotic Metabolism	6	UPorto
<b>M3: Principal Groups of Xenobiotics</b> - 3.1. Prescription Drugs; 3.2. Drugs of Abuse	4	UniBo
<b>M4: Environmental Pollutants</b> - 4.1. Gaseous Pollutants; 4.2. Heavy Metals; 4.3. Persistent Organic Pollutants; 4.4. Pesticides I; 4.5. Pesticides II	7	UTBv, CUNI, SRTI-BAS
<b>M5: Target Organ Toxicity and Biomarkers</b> - 5.1. Cardiovascular; 5.2. Pulmonary; 5.3. Renal; 5.4. Liver; 5.5. Nervous System	8	CUNI, USAL, UPorto
<b>M6: Environmental Toxicology</b> - 6.1. European Union and National Regulations Related to Environmental Quality; 6.2. Control of Emissions from Anthropogenic Activities and Safety; 6.3. Introduction to the Environmental Quality Monitoring System; 6.4. Monitoring the Environmental Quality - Air, Water, Soil	7	UTBv, XAMK
<b>M7: Patents and Patent Application</b> - 7.1. European legislation, Patentability, Structure of patents, Forensic applications of patents	2	UniBo

**Module 3** – describes the main toxicological features of prescription and drugs of abuse, and their differences from legal and scientific points of view.

Analytical methods for their qualitative and quantitative determination in different biological and non-biological matrices will be described and discussed.

The most important aspects of regulations in the pharmaceutical sector will be provided and explained.

**Module 4** – describes the impact of some pollutants (gaseous pollutants, heavy metals, persistent organic pollutants and pesticides) on human health, as well as on the environment.

### 4.3 - Persistent Organic Pollutants (1 ECTS)

- Persistent Organic Pollutants – Introduction
- Short-chain chlorinated paraffins (SCCPs)
- Pentachlorophenol (PCP)
- Hexachlorocyclohexanes (HCHs)
- Polycyclic aromatic hydrocarbons (PAHs)
- Polychlorinated biphenyls (PCBs)
- Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/PCDF)

## 4. Conclusions

§ **TOX-OER** develops modules/topics/units for **Toxicology OER**.

§ **TOX-OER** manages a virtual space on which the **MOOC** platform will be installed, where all the OER will be available.

§ **TOX-OER** creates the conditions for the **recognition** and **certification** (ECTS) of learning achievements, among the partners.

**Knowledge has no boundaries.**  
We are the very first European MOOC on Toxicology.



Learning Toxicology  
through Open  
Educational Resources  
Welcome to TOX-OER

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