

Learning Scenario 1. Alternative methods in toxicology (module)

Summary

“Alternative Methods in Toxicology” is a mandatory module within the Master of Veterinary Biotechnology Sciences at the Università degli Studi di Milano. The module results in four credits, and takes 30 hours, inclusive of 18 hours of lectures and 12 hours of practice. The theoretical part provides the description of methodologies and Three Rs application in toxicological research, with particular interest aimed at new perspectives, thanks to the intervention of experts in the field, also through videoconferencing.

The practical part includes demonstrations with *in vitro* models for replacement, and examples of *Integrated Testing Strategies*. A specific lesson is reserved for the illustration of *in silico* models, provided in *ad hoc* facilities. A dictionary with an up-dated nomenclature is also provided to the students. At the end of the course suggestions from students are collected through a questionnaire, on the possible implementation of Three Rs in toxicology in relation to the areas of application, the specific methodologies and priorities.

Subject	Alternative methods in toxicology
Author/owner/ possible copyright issues	https://www.unimi.it/ Prof Francesca Caloni, Università degli Studi di Milano: francesca.caloni@unimi.it
Topics	Three Rs (Replace, Reduce, Refine), Alternative methods in toxicology, Stand-alone methods, Integrated Testing Strategy, Validation.
Eligible student level	Students must have a Bachelor degree in sciences.
Teaching time	30 hours- 3 hours per week during the second semester from March to May.
Examples of online teaching material	Social media to connect with experts, Videos (Jove), link to suggested website.
Examples of offline teaching material	Papers, textbook, discussion groups, meeting with experts, power point presentations. Students are also visited by Italian Reference Centre for Alternative Methods, Welfare and Care of Laboratory Animals.
Helpful resources	https://www.unimi.it/ https://www.unimi.it/it/ugov/person/francesca-caloni Slides and presentations on institutional repository ARIEL https://fcalonimat.ariel.ctu.unimi.it/v5/home/Default.aspx
Licenses, certification or accreditation	Università degli Studi di Milano, Veterinary Biotechnology Sciences (Class LM9), first year, second semester, 4 credits.
Integration in curriculum	This module “Alternative Methods in Toxicology” is integrated in the curriculum of the Master Degree in Veterinary Biotechnology Sciences, Università degli Studi di Milano. It is a mandatory course, first year, second semester. It can also be followed as a stand-alone course.
Examination	Written exam with open questions.
Aims and learning objectives / outcomes	Learn about the Three Rs - Replace, Reduce, Refine: importance and vision. Learn about existing alternative methods and applications in toxicology. Understand the concept of a stand-alone methods. Learn <i>in vitro</i> and <i>in silico</i> approaches.

	<p>Understand the key-steps of an Integrated Testing Strategy.</p> <p>Understand the importance of the development of new alternative methods.</p> <p>Create a new mentality, a way of thinking to be familiar with alternatives.</p>
Activities/ programme	<p><u>Lectures</u></p> <p>Toxicology, Alternative Methods and Three Rs: Replace, Refine, Reduce (2 hours).</p> <p>Alternative Methods and Validation (2 hours).</p> <p>Replacement: validated <i>in vitro</i> test (4 hours).</p> <p>Integrated Testing Strategy (1 hour).</p> <p>Skin sensitisation (2 hours).</p> <p>Endocrine disruptors and alternative methods (1 hour).</p> <p>Carcinogenesis (2 hours).</p> <p>Reproductive Toxicology and Alternative methods (2 hours).</p> <p>Botulin Toxin and Three Rs (1 hour).</p> <p><u>Practical</u></p> <p><i>In vitro</i> markers in toxicity testing (4 hours).</p> <p><i>In silico</i> methods (4 hours).</p> <p>ITS, Integrated Testing Strategy examples (2 hours).</p> <p>Bioreactors (2 hours).</p>
Assignment	<p>Self-study: Prepare, by reading the provided documents and teaching materials.</p>
Student and teacher feedback	<p>Mandatory Institutional Questionnaire filled in by the students.</p> <p>Compulsory Institutional Questionnaire filled in by the teachers.</p> <p>Optional Questionnaire created by the teacher for the students to improve the quality of the course.</p> <p>Published abstract presented in EUSAAT or World Congress on Alternative methods in collaboration with the students.</p>
Helpful Resources	<p>F. Caloni, V. Alberizzi, A. Costa, M. Loiacono, M.G. Morselli, A. Pasotti, C. Cortinovis. Master students' feedback on Three Rs education approach. 8th World Congress on Alternatives and Animal Use in the Life Science, 21-25 August 2011, Montreal, Canada. In: ALTEX ALTERNATIVES TO ANIMAL EXPERIMENTATION, vol.28, p. 210, 2011</p> <p>F. Caloni. Course on alternative methods to animal use in toxicology in the veterinary faculty of Milan. 8th World Congress on Alternatives and Animal Use in the Life Sciences, 21-25 August 2011, Montreal, Canada. In: ALTEX, ALTERNATIVES TO ANIMAL EXPERIMENTATION, vol. 28 (Spec. Issue), p. 214, 2011</p> <p>F. Caloni Teaching alternative methods in Toxicology in Veterinary Science. 19th European Congress on Alternatives to Animal Testing, Linz, Austria, 20-23 September 2015; 16th Annual Congress of EUSAAT. In: ALTEX proceedings. 4 (2), pp. 285-285, 2015</p> <p>F. Caloni 4-year experience teaching alternative methods to animal use in toxicology, 9th World Congress on Alternatives and Animal Use in the life Science, 24-28 August 2014, Prague, Czech Republic. In: ALTEX Proceedings, 3 (1), p 157, 2014</p>

Some students also had training in the lab on alternative methods in toxicology (100 hours), and graduated with a thesis on alternative methods in toxicology.