Bioassay in the Life Sciences

Teacher: Jens Carl Streibig, UCPH, Denmark (jcs@plen.ku.dk)

Venue: University of Mohaghegh Ardabili, Iran*

http://uma.ac.ir/index.php?gsmp=1-en

https://en.wikipedia.org/wiki/University_of_Mohaghegh_Ardabili

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Synthetic and natural substances are everywhere and in order to assess positive or negative effects upon humans, animals, and the environment. It is difficult to estimate effects of a substance without testing it on living organisms. Chemical and physical properties tell us about the molecules themselves, but living organisms may react in unpredictable ways. Therefore, we use biological assay in short bioassay to estimate effects. It means the design of bioassay experiments and the modelling of the response as a function of the dose is crucial for the classification of chemicals and understand their biological effects. In order to try understanding the principles of bioassay it is imperative to link results with the real world exposure to chemicals. In this course, the group of chemicals to illustrate the bioassay are pesticides; but the principles are the same whatever the chemicals.

The course will be a short introduction to the subject and it will be supported by hands on exercises to solve various research questions based on dose-response curves. This course requires students to use the open source programme **R**

You bring your own PC preferably updated with the **R**-programme (latest version as of now: https://cran.r-project.org/bin/windows/base/R-3.5.2-win.exe) and the **RStudio** (Latest version as of new: https://download1.rstudio.org/RStudio-1.1.463.exe) It is a set of integrated tools designed to help you be more productive with **R**.

We use the add-on package, *drc* and the add-on packages *multcomp*, *sandwich* and *lmtest*.

Date	Time	Activity
one	Before lunch	*Welcome:* Participant and teacher presentation and general course introduction. Short introduction to • Toxicity, • Selectivity and • Potency *General R programing and add-on package installation* Basic functionality and concepts, auxiliary programmes, data management 1) First steps with R: Solving a number of small introductory exercises 2) Arranging own data in a format suitable for import into R Student exercises to summarise data for models
	After Lunch	The use of Markdown in teaching and reporting R output https://rmarkdown.rstudio.com/ https://rmarkdown.rstudio.com/articles_intro.html *Visualisation:* Displaying data by means of plotting functions: scatter plots, bar plots, histograms, Student exercises to summarise data for models Which models to use based on the data?

Date	Time	Activity

Two	Before Lunch	Students get data to plot.
		We discuss which models could be used to describe the data
		• Linear,
		• Polynomial,
		• Splines,
		• Nonlinear,
		    • Apparent nonlinear (linearize data),
		    • Intrinsic nonlinear.
		Students independently choose model on the basis of dataset

	After Lunch	Nonlinear models with asymptotes. The meaning of parameters: • Logistic • Log-logistic • Weibull (asymmetric models) • Exponential • Mechaelis-Mentens • Others The choice of model and the meaning of parameters Student fits models and explain what the parameters mean
Date	**Time**	**Activity**
Three	Before lunch	"All models are wrong, but some are useful" In depth examination of models and the concept of • Stochasticity • Mechanistic Exercises with various dataset and summary of the resulting bioassay models
	After Lunch	The difference between normally distributed quantitative endpoints and binomial distributed end-points in bioassay. • Toxicity, • Selectivity and • Potency After-fitting Exercises with various endpoints
Four	Before Lunch	Expansion to complicated models: *Joint action of biologically active and biologically inert compounds* Exercises with dataset set Which conclusion can you make based on modelling datasets.
	After Lunch	*Joint action of biologically active compounds* Understanding the concept of • Additive action and • Independent action Choice of model should be based upon biology, not mathematics analyse datasets and conclude upon the joint action Conclusion of the workshop

* Travel and visa:
• Fly to Tehran, Fly to Ardabil or By Bus from Tehran.
• Fly to Tabriz, Take a taxi to Ardabil (We can arrange it)
• Participants from border countries can travel via Tabriz, Bilesavar or Astara.
• All participants outside Iran can contact Associate Prof. Dr. Mohammad Taghi Alebrahim, Director of Scientific & International Affairs (m.t.alebrahim@gmail.com). He will be happy to help you with the travel arrangement and visa.