UCLouvain

lbio1283

2020

Statistical principles and biological data analysis

Due to the COVID-19 crisis, the information below is subject to change, in particular that concerning the teaching mode (presential, distance or in a comodal or hybrid format).

4 credits	30.0 h + 40.0 h	Q2

Teacher(s)	Schtickzelle Nicolas ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	*The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.*
Main themes	This course lays the foundation for the probabilities and statistics necessary for the analysis of biological data. The topics covered are: random variables (nature, distributions and probability calculus), principles of statistical inference (sampling, null and alternative hypothesis, hypothesis testing and confidence interval), and basic statistical inference methods (t-test, analysis of variance, correlation and regression, Xhi²). The practical work will allow practical application using the R software. By the end of this course, students will be able to design the experimental and sampling design to answer a simple biological question, analyze the data, and interpret the results with an awareness of possible limitations to inference posed by the data and/or compliance with the conditions for statistical analysis.
Aims	1 At the end of this training, the student will be able to : **concerning statistics** -Calculate and interpret the most common indicators of descriptive statistics (mean, standard deviation, quantiles, ...) -Calculate and interpret a graph of observed / cumulated frequencies, a boxplot (boxplot); interpret a quantile-quantile graph (QQ-plot) -Choosing the right theoretical distribution to model a random variable -Demonstrate an understanding of the concept of random variable and the principles of statistical inference (population vs. sample, estimator, hypothesis testing, p-value...) -Formulate a hypothesis test in terms of null hypothesis and alternative hypothesis, perform a hypothesis test and draw conclusions in French -Apply a basic inference method (t-test, analysis of variance, correlation and regression, Xhi²) **concerning the use of R** From a detailed list of solved functions and/or examples : - Calculate and interpret the most common indicators of descriptive statistics (mean, standard deviation, quantiles, ...) - Realize and interpret a mustache box (boxplot), a quantile-quantile graph (QQ-plot) - Calculate and interpret correlation and regression - Perform a t-test, an analysis of variance, an Xhi² test and interpret the results Translated with www.DeepL.com/Translator (free version) - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Open book written exam consisting of multiple choice questions, open questions and practical solution of exercises with R software on a computer. The exam is carried out on Moodle, in a computer room on campus, unless health regulations require that the exam be taken at a distance. The final marks having to be rounded to the unit, this rounding is done towards the higher unit if the student has obtained at least 50% of the possible points for the part "questions of theoretical comprehension" and 50% of the possible points for the part "practical resolution of exercises", and towards the lower unit if this is not the case.

Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Audience course and practical work in a computer room. The student is encouraged to interactivity for all these activities. In the event that health regulations do not allow full face-to-face teaching, the course will be broadcast live via Microsoft Teams, either for all students or for a part (while the other part follows the face-to-face course). The course will be as interactive as possible with the possibility for each student to ask their questions live.
Content	With this course, the student acquires the basic notions and principles of probabilities and statistical inference necessary for the scientific process. At the end of the learning phase, they are able to determine the important characteristics of an experimental design, to select and carry out the appropriate statistical analysis for the analysis of the data, and to interpret the results and possible limitations to the conclusions to be drawn. The course begins with the basics of probability theory. It then details the principles of statistical inference (population vs sample, variables and distributions, sources of variations in the data, hypothesis testing, p-value and type I and II error, confidence interval ...). The main types of basic statistical analysis are detailed and illustrated: t test, ANOVA (1, 2 and 3), correlation and simple linear regression, count data (X^2). The principles of permutation tests are also discussed. The course is complemented by practical work on computer using the software R, which allow the student to carry out in practice all the statistical analyzes discussed.
Inline resources	The course slides and practical work support material are available on Moodle. Introductory tutorial videos are also available. If the health rules require that certain courses be given live with Microsoft Teams, these will be recorded and made available to students.
Other infos	A basic knowledge of the R software is required: the student is expected to be able to create and modify R-data sets independently. The course LBIO1282 aims specifically to give the student this knowledge; if he has not followed it beforehand, the student must be trained autonomously in these skills, eg by means of the many resources available online for free.
Faculty or entity in charge	BIOL

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Bachelor in Biology	BIOL1BA	4	LMAT1101 AND LMAT1102	
Minor in Biology	MINBIOL	4	LBIO1282	
Bachelor in Geography : General	GEOG1BA	4	LMAT1101 AND LMAT1102	