Statistical analysis for *in-vivo* scientists' online course

Course description: This 9-hour intensive workshop is intended for Bioscience researchers at any stage of their research career who wish to be able to choose the most appropriate method of statistical analysis for their experimental design. Participants will gain the theoretical and practical knowledge necessary to analyse *in vivo* experiments and report them in a robust and reproducible way.

This course is for beginners but assumes some prior knowledge of good experimental design.

In summary:

Course title	Statistical analysis for *in vivo* and *in vitro* scientists
Who for	Bioscience researchers at any stage of their research career who are actively analysing data from *in-vivo* experiments.
Length	3x3-hour online sessions (Monday-Wednesday, 9:30-12:30) including a minimum of 1x15 minute coffee breaks.
Format	Interactive mix of presentations, group discussions, demonstrations, activities plus Q&A time.
Overall Purpose	To give participants the theoretical and practical knowledge necessary to select the most appropriate method of statistical analysis for their chosen experimental design and report their data in accordance with best practice.
Key content	**Session 1: Basics of visualisation and hypothesis testing**. a. Understanding, identifying, minimising variation and its impact. b. How the scientific question and experimental design influence the choice of statistical analysis method. c. What summary statistics are available and when to use them. d. Why and how to transform your data, plus strategies for dealing with outliers. e. The structure of a significance test using a two-sample t-test as an example. **Session 2: Estimation & Precision, Significance tests and Basics of ANOVA** f. What measures of precision should be used and when, including SD Vs SEM plus confidence interval. g. Non-parametric statistical tests and other simple tests to compare more complex data sets. h. Basics of ANOVA and why it should often be used instead of multiple t-tests. **Session 3: Extending ANOVA and reporting results**.

	i. What experimental designs and data features require an extension to statistical analysis methods such as ANOVA and how to incorporate them. j. ANOVA for randomised block designs and factorial treatment structures k. Analysis of Covariance, ANCOVA Vs Change from Baseline. l. Assumptions of ANOVA and ANCOVA.
Learning outcomes	By the end of this course participants will understand, appreciate or know: • About sources of variation, how to minimise it the impact it can have. • how a scientific question maps to statistical questions and together with the experimental design influences the choice of statistical analysis methods. • the benefits of visualising your data and how to make the most appropriate choice of plot to explore your data, including an introduction to box and whisker plots. • what summaries are available for location and dispersion, and what features of data influence the choice of appropriate summary statistics. • data transformation methods, why they may be necessary, and which are the most useful. • strategies for identifying and dealing with outliers. • how to compare two groups of data and assess significance using a t-test, plus understand p-values. • an introduction to ANOVA, including the design features that require extensions to ANOVA and how they can be incorporated. • Why ANCOVA is preferable to ANOVA on change from baseline and how to perform ANCOVA • other statistical tests including non-parametric tests and other simple statistical tests for more complex data types. • measures of precision – what should be used and when, including standard error of means/differences and confidence intervals. • the importance of linking the results of statistical analysis to the study purpose when reporting your research and using confidence intervals to better inform decision making.
Pre-requisites/pre-work	None
Course provider ***Course Tutor***	Responsible Research in Practice Katrina Gore
Max no. of attendees	20
Specifications	This workshop can be tailored to specific institutional requirements.