

The choice of statistical methods is quite large. For the evaluation of biotests, you only need very specific ones.

ToxRat has all the tools you need.

And it knows which method is suitable for which data.

## Hypothesis testing

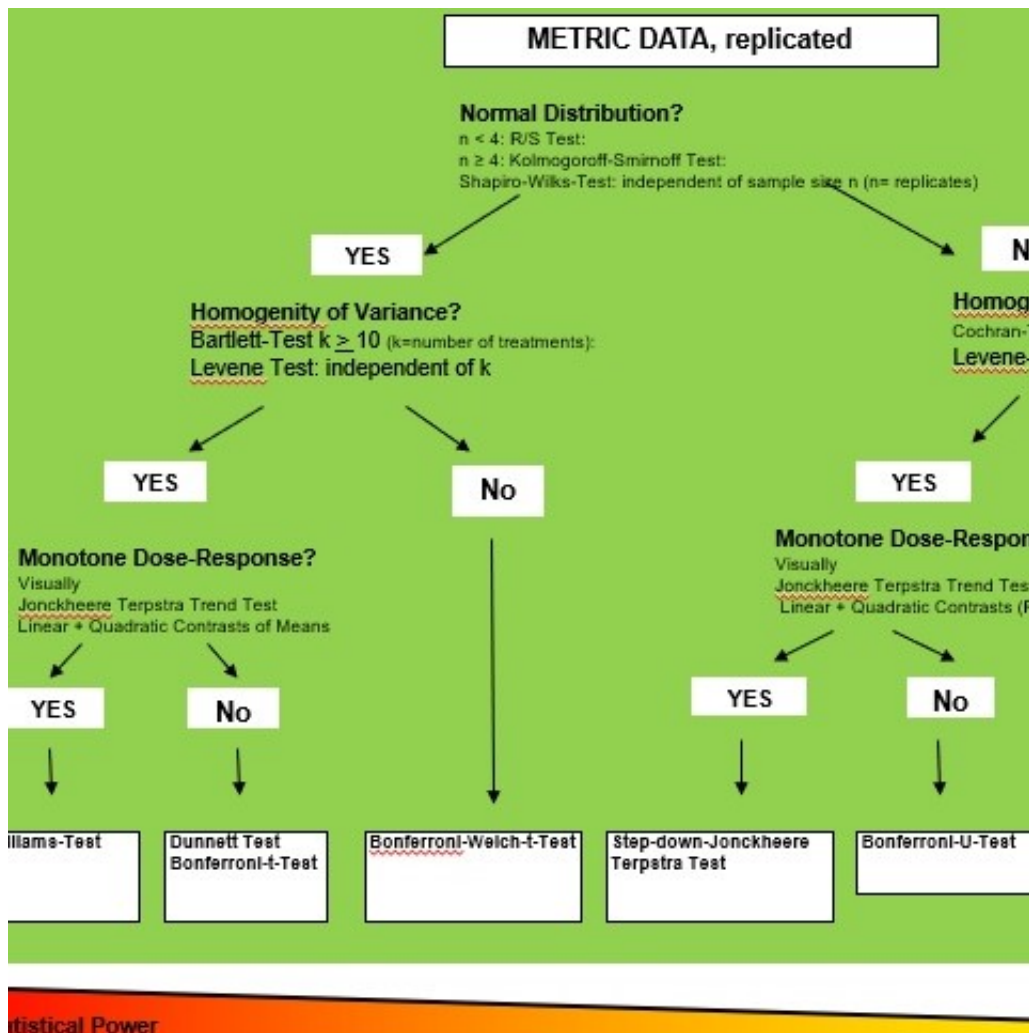
### Simple statistics:

- mean, median, standard deviation, coefficient of variation, confidence interval, minimum and maximum

### Statistical testing

- **Variance analysis** (ANOVA, Kruskal-Wallis Test,  $\chi^2$ - and exact contingency table tests)
- **Analysis of Variance plus Trend** (Jonckheere-Terpstra, Cochran Armitage)
- **Pretests on normal distribution** (R/S-Test, Kolmogorov-Smirnov Test, Shapiro Wilks Test)
- **Pre-tests on homogeneity of variance** (Cochran, Bartlett, Levene, Tarone test for extrabinomial variance)
- **Tests for monotony** (linear + quadratic contrasts, (Rao-Scott-) Cochran Armitage Trend Test, Jonckheere-Terpstra Trend Test)
- **Pairwise (two-sample) comparisons** (Student-t-Test, Welch-t-Test, Mann-Whitney-U-Test, Mediantest, Fisher Exact Binomial Test,  $\chi^2$  Fourfold Table Test)
- **Multiple Comparisons** (t-Test with Bonferroni-Correction, Dunnett Test, Williams Test, Welch-t-Test with Bonferroni-Correction, Step down Jonckheere Terpstra Test, Bonferroni-Median test, Wilcoxon-Mann-Withney-U-Test with Bonferroni Correction, Step down (Rao Scott-) Cochran Armitage Test,  $\chi^2$  - and Fisher Exact Test with Bonferroni Correction)
- **Tests for outliers** (Dixon/Grubbs, Hampel outlier test)

Several **data transformations** available



## Point Estimation - linear regression, interpolation

Dose-Response-Curves / Find effect levels: up to 6 user definable effect levels, 95% Confidence limits

**Linear regression** (metric and quantal variables):

- Functions: Probit, Logit, Weibull
- Fitting algorithms: linear / linear weighted / linear max. likelihood
- Confidence limits: Fieller's Theorem, Normal Approximation, Bootstrap procedure
- Correction of variance for covariance of control
- Abbott Correction
- Parallel Line Assay and Potency Estimation

**Interpolation methods** to determine the EC50 for quantal data:

(Trimmed) Spearman Kärber, Moving Averages, Binomial estimation

Methods Based on Dose/response-Functions

## Linear Regression

Available Functions

☒ Probit, Normit

☐ Logit

☐ Weibull

☐ Linear (straight line)

Algorithm

☐ Linear regression

☐ Weighted linear regression

☒ Linear max. likelihood regression

☒ Use replicates while fitting

ECx-Confidence Limits Based on

☒ Fieller's Theorem

☐ Normal Approximation

☐ Bootstrap (only replicated metric data)

☐ Data Adjustment for Normal Distribution

In case responses are less than 0% or greater than 100%, you may wish to replace those values by ones slightly greater than 0% or smaller than 1 (Pre-set x%: you may enter a value x which replaces those  $\leq 0\%$  ( $>=100\%$ :  $100\% - x$ )).

0,100

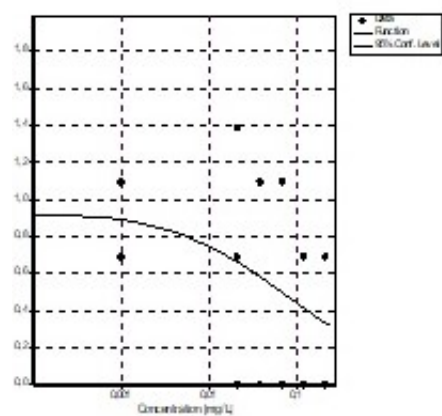
## Point Estimation - non linear regression

### Non-linear regression

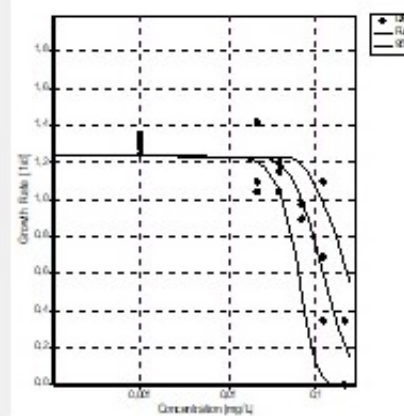
- 2-3-4 parameter Normal, Sigmoid (Bruce-Versteeg)
- 2-3-4 parameter Logistic
- 2-3-4 Parameter Weibull
- Weighting: relative, Poisson, by variability
- Optimization methods: Levenberg-Marquardt, Downhill-Simplex
- Confidence limits: Monte Carlo Simulation, Bootstrap procedure

[top](#)

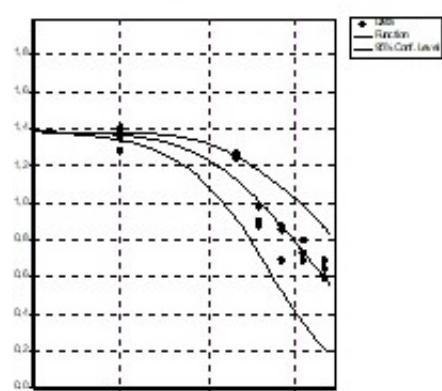
Growth Rate Response Curve 0 - 24 h



Growth Rate Response Curve 0 - 48 h



Growth Rate Response Curve 0 - 72 h



Growth Rate Response Curve 0 - 96 h

