SIMPLE CURVE FITTING instead of EXPENSIVE EQUIPMENT

Development of RRM, a method created for concentration estimation in biological samples

PROBLEM DESCRIPTION

There are several methods to measure concentration of biologically active substances in living tissues. However, these procedures require either homogenization of the sample (that veils concentration differences among the various tissue compartments) or expensive equipment. Many biologically active substances are agonists that exert their effect by binding to a specialized molecular system called receptor. RRM (receptorial responsiveness method) is a procedure to estimate an acute increase in the concentration of an agonist in the microenvironment of binding sites of its receptors, a tissue compartment difficult to access in a living organ.

CHALLENGES AND GOALS

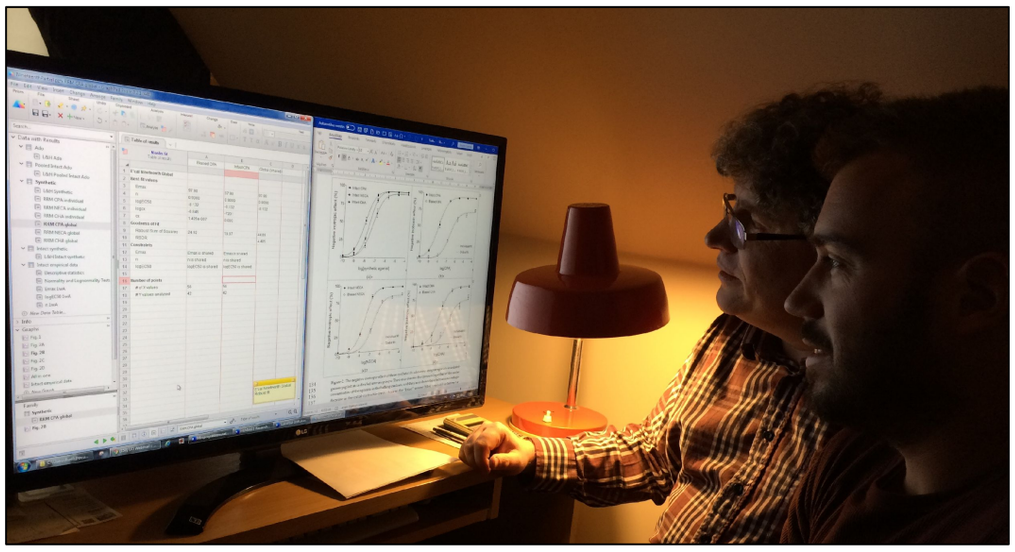
To find the best manner of curve fitting for RRM

CHALLENGES: Health, demographic change and wellbeing

PRODUCTIVE SECTOR: Biomedicine and Health Care

MATHEMATICAL AND COMPUTATIONAL METHODS

RRM was implemented by combining different fitting approaches and setting options: individual vs. global fitting, ordinary vs. robust fitting, and three weighting options (no weighting vs. weighting by $1/Y^2$ vs. weighting by $1/SD^2$). During the testing, RRM was used to estimate known concentrations of three stable synthetic A_1 adenosine receptor agonists (CPA, NECA, CHA) in isolated, paced guinea pig left atria. The estimates were then compared to the known agonist concentrations (to assess the accuracy of RRM), furthermore the 95% confidence limits of the best-fit values were also considered (to evaluate the precision of RRM).



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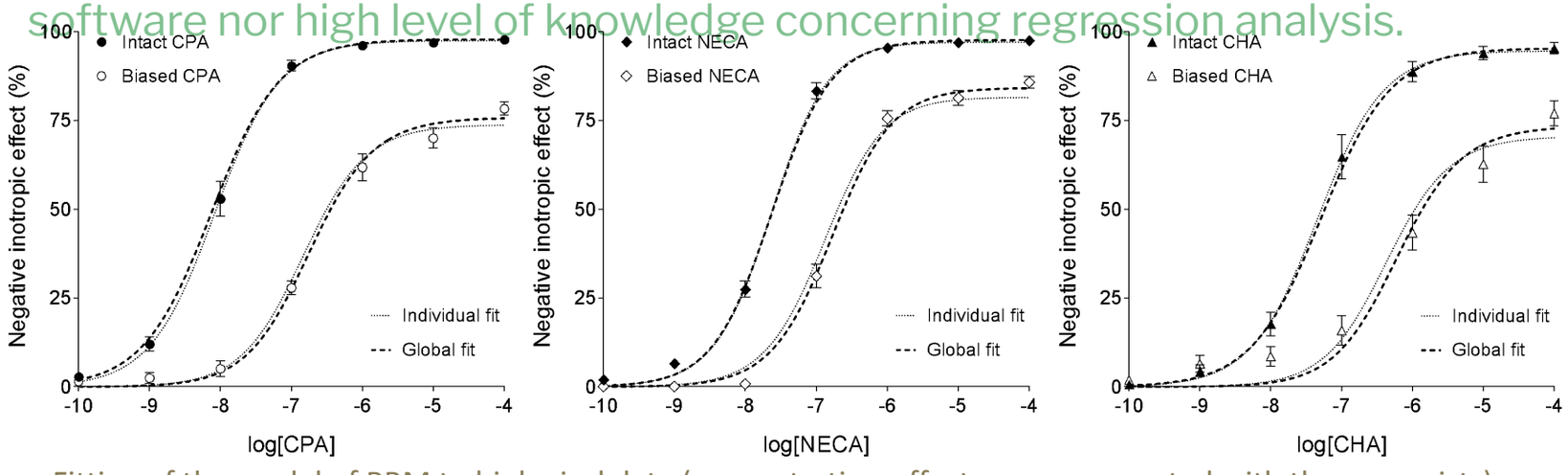
Results and Benefits

The best estimates of RRM could be obtained via individual fitting without any weighting, almost irrespectively of the fact whether ordinary (assuming Gaussian distribution) or robust (assuming Lorentzian distribution) regression was chosen. Thus, the well-established approach (assuming normality and homoscedasticity) is useful for the assessment with RRM as well. However, it was unexpected that the conventional individual regression was a more accurate and precise way to carry out RRM than the global regression. In general, RRM proved to be a relatively easy-to-use procedure that requires neither a heavy-duty curve fitting software nor high level of knowledge concerning regression analysis.

Improvement of RRM, a method for concentration estimation *via* curve fitting



Fitting of the model of RRM to biological data (concentration-effect curves generated with three agonists)

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