A dose-response dataset is a collection of dosages \( d_i \) for \( i = 0, \ldots, N \) that satisfy \( 0 = d_0 < d_1 < \ldots < d_N \). Population density data at some defined time \( T \), taken here to be 18h, is held in an \( N \times M \) matrix \( \mathcal{D} := (D_{ij}) \), representing data taken from a microtitre plate-reading device. These are determined empirically for \( j = 1, \ldots, M \), \( M \) being the number of replicates of each bacterial culture at each dose.

An inhibition coefficient, or \( IC_x \), is a value of the dose that reduces population density by \( x\% \) relative to drug-free growth. Other growth measures could be used, for example, an estimate of exponential growth rate.

To approximate \( IC_x \) the following is done. First, the mean density of the zero-drug control is determined, \( \overline{D_0} := \frac{1}{M} \sum_{j=1}^{M} D_{0j} \), one then chooses a putative model \( F(\cdot) \) of the data. This must be a function such that the approximation \( D_{ij} \approx F(d_j) \) is possible with respect to some metric (and below we require that the regression coefficient \( R^2 > 0.99 \) for this). A standard choice for \( F \) is a Hill function, whereby

\[
F(d) = \frac{\Delta}{d^n + K^n}.
\]

This has many of the properties desired by a dose-response in the sense that it is a monotone decreasing function that satisfies \( F(d) > 0, F(0) = \Delta > 0 \) and \( \lim_{d \to \infty} F(d) = 0 \). Other choices are possible, but a Hill function approach is common. Then, given that \( x \) is expressed as a percentage, solve for \( d \) in \( F(d) = (x\overline{D_0})/100 \), it follows that \( IC_x \approx d \). In other words,

\[
F(IC_x) = (x\overline{D_0})/100.
\]

When this solution exists, it is unique because \( F \) is a decreasing function.

Given \( \alpha \), using nonlinear regression we then estimate 100 \( \cdot (1 - \alpha) \)-percent confidence intervals that estimate upper and lower envelopes, \( F^-(d) \) and \( F^+(d) \) of the predicted dose-response at each dose. In general, these are non-monotone functions that satisfy \( F^-(d) < F(d) < F^+(d) \). An estimate of the confidence interval of \( IC_x \) is then given by the interval \((d_-, d_+)\) where

\[
(F^-)^{-1}(d_-) = (x\overline{D_0})/100 = (F^+)^{-1}(d_+).
\]

This procedure was implemented in Matlab using the \texttt{NonLinearModel} class from the Statistics Toolbox, and the results are presented in Figure S5.