Appendix

Scatchard analysis

For the reaction: Cell + Ab ⇔ Ab-Cell

$K_a = [Ab\text{-}Cell]/([Ab][Cell])$

Or

$[Ab\text{-}Cell]/[Ab] = K_a\,[Cell]$

in addition:

$[Cell]_{total} = [Cell] + [Ab\text{-}Cell]$

So

$[Ab\text{-}Cell]/[Ab] = K_a\,[Cell]_{total} - K_a\,[Ab\text{-}Cell]$

If this is differentiated as a function of [Ab-Cell]:

$[Ab\text{-}Cell]/[Ab]'([Ab\text{-}Cell]) = -K_a$

Because the volume and the amount of cells are constant
Furthermore, the extrapolation of the curve to [Ab-Cell]/[Ab] = 0 gives a value for the amount of bindingsites.

Dissociation

Reaction: $Ab_{bound} \rightarrow Ab_{Free}$ (first order kinitics)

$d[Ab_{bound}]/dt = - k\,[Ab_{bound}]$

$d[Ab_{bound}]/[A] = - k\,dt$

Integration gives:

$\ln([Ab_{bound}]_0/[Ab_{bound}] = k\,t$

Half-life is calculated from

$\ln(1/\{1/2\}) = k\,t_{1/2}$

$t_{1/2} = \ln(2)/k = 0.693/k$

Lindmo

Reaction: Cell + Ab ⇔ Ab-Cell

K_a = [Ab-Cell]/([Ab][Cell])

$[Ab_{Total}]$ = [Ab] + [Ab-Cell]

so…

Ka = [Ab-Cell]/{([Ab_{Total}] – [Ab-Cell])[Cell]}

With r:= Active fraction

Ka = [Ab-Cell]/{(r[Ab_{Total}] – [Ab-Cell])[Cell]}

Or

Ka[Cell](r[Ab_{Total}] – [Ab-Cell]) = [Ab-Cell]

Or

Ka[Cell]r[Ab_{Total}] / [Ab-Cell] – ka[Cell] = 1

Or

[Ab_{Total}]/[Ab-Cell] = 1/r + 1/(ka[Cell]r)

Thus plotting the left side of the equation against the inverse cell concentration should yield a straight trendline, and the interception with the ordinate equals 1/r, whereby the immunoreactive fraction can be found.