0.1 Metabolic and coinfection models

0.1.1 Full coinfection model

$$
\begin{aligned}
\frac{dB}{dt} &= \underbrace{r\big(1-\frac{N}{K}\big)B}_{\text{growth}} - \underbrace{dBP}_{\text{infection}} + \underbrace{sL}_{\text{cure}} \\
\frac{dP}{dt} &= \underbrace{c\mu_p(B,L)I_p}_{\text{burst function}} - \underbrace{dBP}_{\text{Infection}} - \underbrace{dI_nP}_{\text{coinfection}} - \underbrace{mP}_{\text{viral decay}} - \underbrace{\chi dPL}_{\text{lys. immunity}} \\
\frac{dI_n}{dt} &= \underbrace{dBP}_{\text{infection}} - \underbrace{dI_nP}_{\text{coinfection}} - \underbrace{\mu_{ld}(B,L)I_n}_{\text{Infected to }\Phi\text{ prod.}} \\
\frac{dI_p}{dt} &= \underbrace{\mu_{ld}(B,L)I_n}_{\text{Infected to }\Phi\text{ prod.}} - \underbrace{\mu_p(B,L)I_p}_{\text{lysed cells}} + \underbrace{\mu_iL}_{\text{induction}} \\
\frac{dL}{dt} &= \underbrace{r\big(1-\frac{N}{K}\big)L}_{\text{growth}} + \underbrace{dI_nP}_{\text{coinfection}} - \underbrace{\mu_iL}_{\text{induction}} - \underbrace{sL}_{\text{cure}}
\end{aligned}
$$

0.1.2 Basic coinfection model

$$
\begin{aligned}
\frac{dB}{dt} &= \underbrace{r\big(1-\frac{N}{K}\big)B}_{\text{growth}} - \underbrace{dBP}_{\text{infection}} \\
\frac{dP}{dt} &= \underbrace{c\mu_p(B,L)I_p}_{\text{burst function}} - \underbrace{dBP}_{\text{Infection}} - \underbrace{dI_nP}_{\text{coinfection}} - \underbrace{mP}_{\text{viral decay}} \\
\frac{dI_n}{dt} &= \underbrace{dBP}_{\text{infection}} - \underbrace{dI_nP}_{\text{coinfection}} - \underbrace{\mu_{ld}(B,L)I_n}_{\text{Infected to }\Phi\text{ prod.}} \\
\frac{dI_p}{dt} &= \underbrace{\mu_{ld}(B,L)I_n}_{\text{Infected to }\Phi\text{ prod.}} - \underbrace{\mu_p(B,L)I_p}_{\text{lysed cells}} + \underbrace{\mu_iL}_{\text{induction}} \\
\frac{dL}{dt} &= \underbrace{r\big(1-\frac{N}{K}\big)L}_{\text{growth}} + \underbrace{dI_nP}_{\text{coinfection}} - \underbrace{\mu_iL}_{\text{induction}}
\end{aligned}
$$

0.1.3 Metabolic model

$$
\begin{aligned}
\frac{dB}{dt} &= r_{max} H_{O_2} H_{DOC} H_{eDAR} B - dBP \\
\frac{dP}{dt} &= c\mu_p \big[1 - \mathcal{P}(L)\big] I - dBP - mP + c\mu_i L \\
\frac{dI_n}{dt} &= dBP - \big[1 - \mathcal{P}(L)\big] I - \mathcal{P}(L) I \\
\frac{dL}{dt} &= r H_{O_2} H_{DOC} H_{eDAR} L + dI_n P - \mu_i L
\end{aligned}
$$