

for

$$O_2(m, n) = \frac{v_o}{a_o + (m + n)(c_1 - \frac{c_1 - c_2}{1 + (\frac{5000}{n})^{10}})} \quad (1)$$

$$D(O_2) = \frac{D_{max}}{1 + (\frac{O_2}{O_{2max} - O_{2thresh}})^5} \quad (2)$$

$$L(O_2) = 1 - \frac{O_{2max} - O_2}{O_{2thresh}} \quad (3)$$

and

$$\begin{aligned} \mu &= \mu_t + \mu_o \\ p_n &= (1 - \mu)^2 \\ p_s &= 2\mu(1 - \mu) \end{aligned}$$

We have

$$\frac{dN}{dt} = v_N N((p_n - p_s) - d_N)(L(O_2)) - D(O_2)N \quad (4)$$

$$\frac{dM}{dt} = (v_M - d_M)M(L(O_2)) + v_N N(2p_s + p_a)(L(O_2)) - D(O_2)M - sIM \quad (5)$$

$$\frac{dI}{dt} = v_I I(1 - \frac{I}{I_H + rIM}) - d_I I \quad (6)$$

Driver Feedbacks to Cancer:

$$d_M = (\frac{d_M}{1 + \frac{\mu_t}{\mu} \alpha_d M}) \quad (7)$$

$$v_M = v_M + v_M \left( \frac{\alpha_v}{1 + \frac{\mu_o}{\mu} M} \right) \quad (8)$$

Driver Feedbacks to Immune system:

$$s = \frac{s}{1 + \left( \frac{M}{\beta_s} \right)^5} \quad (9)$$

$$r = \frac{R}{1 + \left( \frac{M}{\beta_r} \right)^5} \quad (10)$$

$$d_i = \frac{d_{i_{max}}}{1 + \left( \frac{7500}{M} \right)} \quad (11)$$