A stochastically perturbed mathematical model for avascular tumour growth

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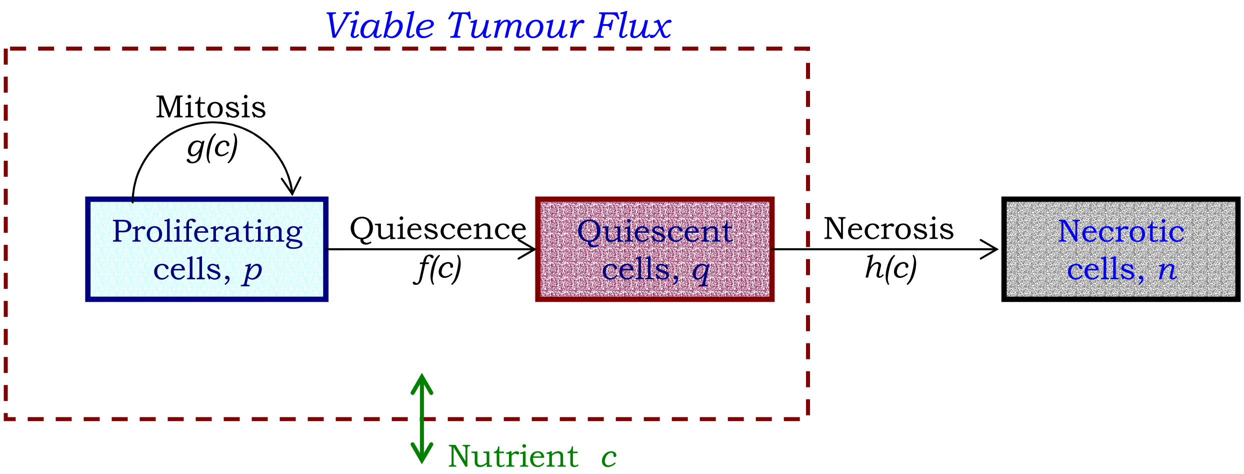
The Model



We will be modifying the following Sheratt-Chaplain model to include stochastic elements in the model.

$$\frac{\partial p}{\partial t} = \frac{\partial}{\partial x}\left(\frac{p}{p+q}\frac{\partial(p+q)}{\partial x}\right) + g(c)p(1-p-q-n) - f(c)p$$

$$\frac{\partial q}{\partial t} = \frac{\partial}{\partial x}\left(\frac{q}{p+q}\frac{\partial(p+q)}{\partial x}\right) + f(c)p - h(c)q$$

$$\frac{\partial n}{\partial t} = h(c)q$$

$$c = \frac{c_0\gamma}{\gamma+p}\left[1-\alpha(p+q+n)\right]$$

Numerical scheme for solution

1. Equations with the associated boundary and initial conditions and parameters will be formulated as Finite Difference equations and solved using standard Finite Difference schemes.
2. Non-deterministic components such as growth inhibiting factors, $I(n)$, and diffusion "white noise" are added to the appropriate equations as stochastic perturbations.
3. A standard Wiener process, over [0,T], at discrete time steps will be used to create the Brownian path needed for the numerical solution of the equations using the Euler-Maruyama method.
4. Numerical results will be compared with published experimental findings to validate the model.