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Evolutionary Dynamics

Assignment #04s

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1.1 Allometric scaling

We know (from lecture and an article 'Some Dynamic Aspects of HSC') that a number of active HSC follows negative allometry (power law) to mass of mammal with scaling exponent 0.75.

$$N_{sc} \approx M^{0.75}$$

That means that to get to know the number of Active HSC in any mammal we just need to calibrate that power law by experimentally getting to know N_{sc} and M of any mammal. It was done for cats and humans, so for humans $M = 70$ and $N_{SC} = 385$, so

$$N_{sc} = N_{sc_0} \times M^{0.75}$$
$$385 = N_{sc_0} \times 70^{0.75}$$
$$N_{sc_0} = 15.9088$$

Now, we can estimate the number of active HSC in hamster (average M=100gm = 0.1 kg), so

$$N_{sc} = 15.9088 \times 0.1^{0.75} \approx 2.3$$

Same for blue whale (M =100 000 kg, http://www.marinemammalcenter.org), so

$$N_{sc} = 15.9088 \times 100000^{0.75} \approx 89461$$

The range of total number of HSC is the same for all mammals and approximately equal to 11000...22000, so it is the same for hamster and blue whale.

2.1 Hematopoietic multicompartment model

3.1 Treatment of chronic myeloid leukemia

4.1 One-dimensional Fokker-Planck equation

5.1 Diffusion approximation of the Moran process

6.1 Absorption time in the diffusion approximation