



**Next:** [Reduction to a Single](#) **Up:** [The Logistic Model](#) **Previous:** [The Logistic Model](#)

## Conservation and Per-Capita Growth

The most basic model of the interaction between yeast and sugar must account for two facts: sugar must be used for the yeast population to grow, and the rate of population growth is proportional to the size of the population. The first of these two facts basically means that for every increase of the yeast population there is a corresponding decrease in the sugar concentration, which may be written mathematically as

$$\dot{Y} = -a\dot{S}. \tag{1}$$

(Recall that  $\dot{Y}$  is the same as  $\frac{dY}{dt}$ ). Here  $a$  is the amount of sugar required to produce a fuzzy baby yeast. The second effect can be written

$$\dot{Y} = g(S)Y,$$

where  $g(S)$  is the per-capita growth rate of the yeast population, which pretty obviously must depend on the sugar concentration. After all, if there is no sugar there will be no growth. The simplest form of a function  $g$  which captures the effect of sugar on per-capita growth rate is

$$g = bS,$$

and substituting this in gives a second equation for rate of population growth,

$$\dot{Y} = bSY. \tag{2}$$

The parameter  $b$  can be interpreted as the rate of growth per sugar concentration.



**Next:** [Reduction to a Single](#) **Up:** [The Logistic Model](#) **Previous:** [The Logistic Model](#)

*James Powell*

*2000-07-31*