Supporting Information for "The dynamics of starvation and recovery"

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Parameter Values and Estimates

Many of the parameter values employed in our model have either been directly measured in previous studies or can be estimated from combining several previous studies. Here we outline previous measurements and simple estimates of the parameters.

Standard synthesis and metabolic parameters Metabolic rate has been often reported to follow an exponent close to 0.75 (e.g. [1, 2] and the supplement of [3]). We make this assumption in the current paper, although alternate exponents, which are know to vary between roughly 0.25 and 1.5 for single species [2], could be easily incorporated into our framework, and this variation is effectively handled by the 20% variations that we consider around all parameter values. It is important to note the exponent, because it defines the value of the metabolic normalization constant, B_0, given a set of data. For mammals the metabolic normalization constant has been reported to vary between 0.018 (W g$^{-0.75}$) and 0.047 (W g$^{-0.75}$) [3, 1], where the former value represents basal metabolic rate and the latter represents the field metabolic rate. We employ the field metabolic rate for our NSM model which is appropriate for active mammals.

The energy to synthesize a unit of biomass, E_m, has been reported to vary between 1800 to 9500 (J g^{-1}) (e.g. [1, 2, 3]) in mammals with a mean value across many taxonomic groups of $5,774$ (J g^{-1}) [2]. The unit energy available during starvation, E', can be considered in several ways. The first is to assume that the total energy stored during ontogeny is returned during starvation which would give a value of 7000 (J g^{-1}) [3]. However, since our model considers the consumption of all body fat as defining the transition to starving, it is more appropriate to consider the energetics of fat metabolism where we would expect $E' = 36,000$ (J g^{-1}) for palmitate[4, 3].

The energy required for maintaining an existing unit of mass is reported to be

Reserved for Publication Footnotes

Table 1: Parameter Values For Various Classes of Organisms

	Mammals
η	3/4 (e.g. [1, 2, 3])
E_m	5774 (J gram^{-1}) [2, 1, 3]
E'_m	$36,000$ [4, 3]
B_0	0.047 (W g$^{-0.75}$) [3]
B_m	0.025 (W gram^{-1})
a	1.78×10^{-6}
b	2.29×10^{-6}
$\eta - 1$	-0.21
λ_0	3.39×10^{-7} (s^{-1} gram$^{1-\eta}$)
γ	1.19
f_0	0.02
ζ	1.01
mm_0	0.32

1. West GB, Brown JH, Enquist BJ (2001) A general model for ontogenetic growth. *Nature* 413:628–631.

2. Moses ME, et al. (2008) Revisiting a Model of Ontogenetic Growth: Estimating Model Parameters from Theory and Data. *http://dx.doi.org.proxy.lib.sfu.ca/10.1086/679735* 171:632–645.

3. Hou C, et al. (2008) Energy Uptake and Allocation During Ontogeny. *Science* 322:736–739.

4. Stryer L (1995) *Biochemistry, Fourth Edition* (W.H. Freeman and Company, New York), pp 608–611.