METABOLISM & SCALING

"The Reader may please to observe, that in the last Article for the Recovery of my Liberty the Emperor stipulates to allow me a Quantity of Meat and Drink sufficient for the support of 1728 *Lilliputians*. Some time after, asking a Friend at Court how they came to fix on that determinate Number; he told me that his Majesty's Mathematicians, having taken the Height of my body by the help of a *Quadrant*, and finding it to exceed theirs in the Proportion of Twelve to One, they concluded from the Similarity of their Bodies, that mine must contain at least 1728 of theirs, and consequently would require as much Food as was necessary to support that number of *Lilliputians*. By which the Reader may conceive an Idea of the Ingenuity of that People, as well as the prudent and exact Oeconomy of so great a Prince."

Gulliver's Travels (Ch. III), Swift

METABOLISM & $S \propto M$?

Meeh 1879, Brody & Elting 1926, Voit 1930

$S = k_S M^{2/3}$

Rubner 1880

dogs; E / S constant

$S \propto M^{0.67}$

Stahl 1967

rats-humans

$S \propto M^{0.65}$

METABOLISM

Kleiber 1932

0.15-679 kg

$P_{met} = 73.3\ M^{0.74}$

Brody et al. 1934

mouse-elephant

$P_{met} \propto M^{0.734}$

Hemmingsen 1960

$P_{met} \propto M^{0.75}$

3 / 4 EXPONENT 1

Kleiber 1961

$P_{met} = 70\ M^{0.75}$

Hemmingsen 1960; Smith 1976, 1978

$P_{met} \propto M$ & $P_{met} \propto S$

McMahon 1973

$E \propto \sigma A_x \Delta L$

$P_{met} = E / \Delta t \propto \sigma A_x (\Delta L / \Delta t)$

$P_{met} \propto A_x = \pi D^2 / 4$

$P_{met} \propto D^2 \propto M^{3/4}$

3 / 4 EXPONENT 2

Bartels 1982

small mammal outliers

Heusner 1982

statistical artifact; $b_{intraspecific} = 0.67$

Feldman & McMahon 1983

$b_{interspecific} = 0.75$

Martin 1981

relative brain size $M_{brain} \propto M^{0.75}$, $M^{0.56}$

3 / 4 EXPONENT 3

fractals ...