Ex: Allometry

$SA \propto M$?

$SA = k \cdot M$?

Relationship between M and V

density, $\rho = \frac{M}{V} \rightarrow V = \frac{1}{\rho} \cdot M$

Relationship between SA and V

$cm^2 = (cm^3)^{2/3}$

$SA \propto V^{2/3}$

dimensional analysis

$\therefore SA \propto V^{2/3} \propto M^{2/3}$

$SA \propto M^{2/3}$

$SA = k \cdot M^{2/3}$

what affects this value?

[List all factors that might affect SA.]

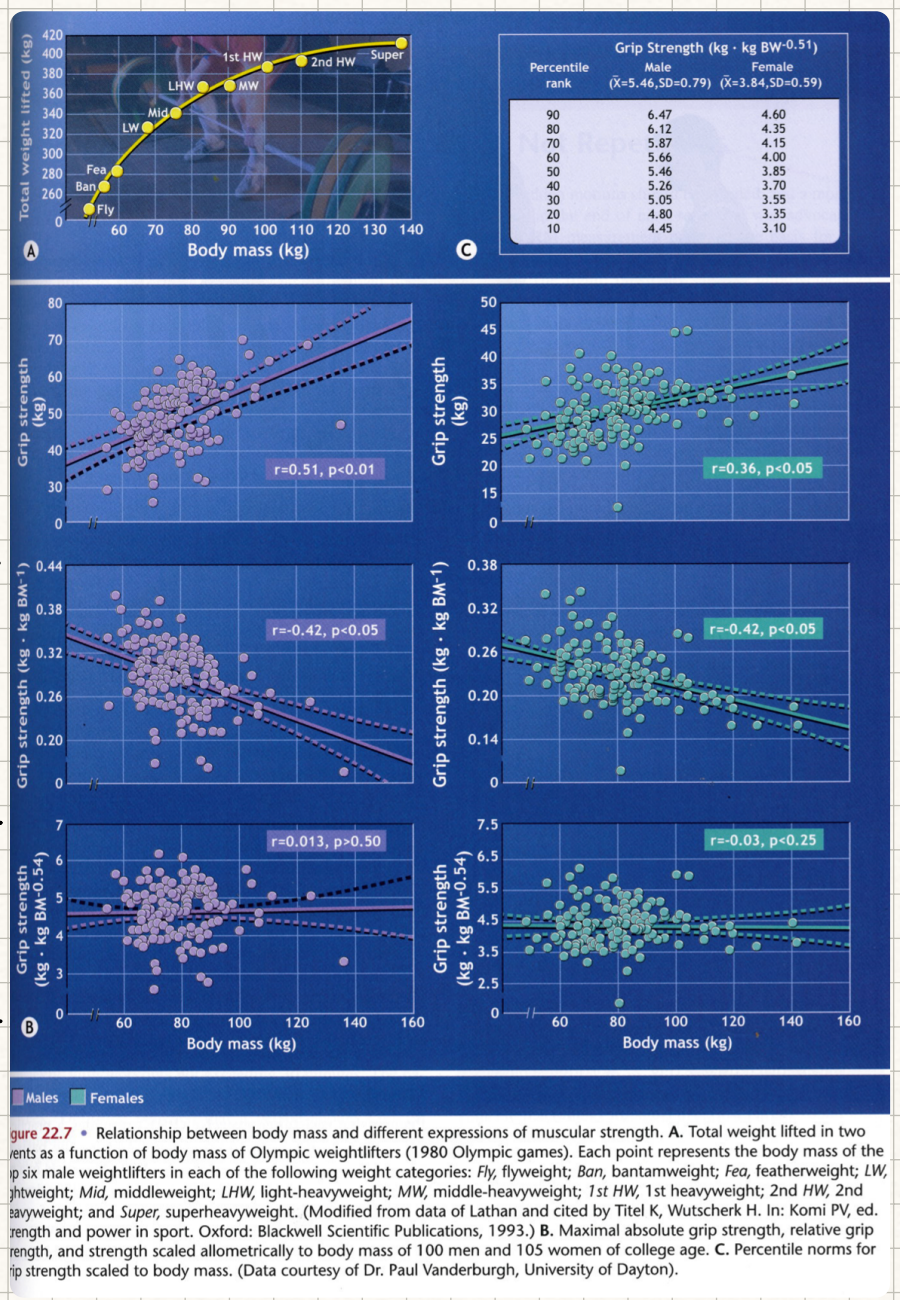
- ~~M~~
- shape
- species
- age
- height

k { • temperature
• pregnancy
• nutrition / diet
• condition (missing limbs)
• sex

M	SA	$k = \frac{SA}{M^{2/3}}$
2.1	1.20427770541849	0.734368065913272
5.2	2.18326648960056	0.727396465643218
3.7	1.74520813842199	0.72953491239041
4.8	2.07112685874293	0.727856686103162

Average is ~~0.726~~ 0.729 = k

Ex: Grip Strength vs. Body Mass



gure 22.7 • Relationship between body mass and different expressions of muscular strength. **A.** Total weight lifted in two vents as a function of body mass of Olympic weightlifters (1980 Olympic games). Each point represents the body mass of the p six male weightlifters in each of the following weight categories: *Fly,* flyweight; *Ban,* bantamweight; *Fea,* featherweight; *LW,* ghtweight; *Mid,* middleweight; *LHW,* light-heavyweight; *MW,* middle-heavyweight; *1st HW,* 1st heavyweight; 2nd *HW,* 2nd eavyweight; and *Super,* superheavyweight. (Modified from data of Lathan and cited by Titel K, Wutscherk H. In: Komi PV, ed. rength and power in sport. Oxford: Blackwell Scientific Publications, 1993.) **B.** Maximal absolute grip strength, relative grip rength, and strength scaled allometrically to body mass of 100 men and 105 women of college age. **C.** Percentile norms for ip strength scaled to body mass. (Data courtesy of Dr. Paul Vanderburgh, University of Dayton).

$GS \cdot BM^{-1}$

$= \frac{GS}{BM}$

BM out-strips GS as BM grows

$GS \cdot BM^{-0.54}$

$= \frac{GS}{BM^{0.54}}$

$Y = 4.6$ is equation of the horizontal line

$\frac{GS}{BM^{0.54}} = 4.6 \longrightarrow GS = 4.6 \cdot BM^{0.54} \longrightarrow GS \propto BM^{0.54}$, maybe $GS \propto \sqrt{BM}$

Linear Functions and Rate of Change

1. **Linear Functions** – y is a linear function of x iff y increases by a constant **amount** for each unit inc. in x.
(The constant amount is called slope.)

$y = \underset{\text{slope}}{m}x + \underset{\text{initial value of y (y-intercept)}}{b}$

m and b are **parameters** (constants).

Assumed Skills –

1. Find the equation of a line given 2 points: $(x,y) = (1,3)$ and $(7,-2)$.
2. Find equation of a line given slope and a point: slope is 2, through $(7,4)$.
3. Find equation of a line given its initial value and rate of inc./dec.: initial value is 3.4 and each unit inc. in x gives a decrease of 4.8 units in y.

Ex: For #1.

$$m = \frac{-2-3}{7-1} = -\frac{5}{6}$$

$$y = -\frac{5}{6}x + b$$

$$3 = -\frac{5}{6}\cdot 1 + b$$

$$3 + \frac{5}{6} = b$$

$$\frac{23}{6} = b$$

$$y = -5/6\,x + 23/6$$

Ex: For #3.

$y = -4.8x + 3.4$

$$-\frac{4.8}{1}$$

Ex: T-Shirts

variable costs

fixed costs (unavoidable)

$$C = 16.37q + 38$$

C: cost of production for q shirts

q: no. of shirts produced

What is the cost of production per shirt?

$$\frac{C}{q} = \frac{16.37q + 38}{q} = \frac{16.37q}{q} + \frac{38}{q}$$

$$= 16.37 + \frac{38}{q} \to 0$$

Notes:

Slope:

- $+$, large
- $+$, small
- 0
- $-$, small
- $-$, large

2. **Rate of Change** –

Ex: Deborah Number (example of fractions being used to compare 2 quantities)

$$D = \frac{T_R}{T_0} = \frac{\text{Time of Relaxation}}{\text{Time of Observation}} =$$

- Large if $T_R \gg T_0$ (Solid)
- Small if $T_R \ll T_0$ (Liquid)