Lecture Notes for October 23rd

Which of the following are evidence in support of the hypothesis that specific anatomical structures are controlled by shape homeostasis?

a) Constant dynamic turnover of bone.

b) Strengthening of bone in response to physical pressure?

c) Osteoporosis in astronauts?

d) What other evidence? For, or against?

Which of these support shape homeostasis?

e) Muscles also get stronger in response to weight lifting?

f) Muscles get stronger in tennis players…

g) but only in the arm they serve with?

h) Which would you expect to stimulate more strengthening of muscles and bones?
? Holding up a weight for a long time?
? Repeatedly lifting and putting down a weight?

i) Salamanders regenerate cut off legs?

j) Salamander legs regenerate faster you cut them off at the elbow, as compared to when you cut them off at the wrist.

The same total time needed for complete regeneration when you amputate at the elbow as when you at the wrist.

The more you cut off, the faster it grows back!

k) Capillaries constantly elongate and retract.

l) People and animals that live at higher altitudes develop more capillaries per cubic volume of tissue than develop in animals at sea level?

m) The smooth muscles of artery walls get thicker and stronger in response to higher blood pressure?

n) Artery walls become more strongly contractile when more blood flows through them.

o) If you radioactively label (just) the cartilage cells of a salamander leg, and then cut off the leg through the radioactively labeled cartilage, then the regenerated skeleton will be made entirely of radioactively labeled cells.
(a true fact) What is your interpretation?

p) Invent as many possible reasons as you can why mammals can't regenerate their legs but salamanders can regenerate them.

q) For each of your possible reasons, suggest a method for enabling regeneration of mammal legs.

r) Is it a kind of regeneration when a broken leg heals itself?

s) What about when an implanted bypass vein changes into an artery-like vessel (wrapped with thick layers of smooth muscle cells)

Which of the following are prerequisites for achieving any kind of homeostasis?

Whether it is homeostasis of body temperature,
Homeostasis of blood pressure,
Homeostasis of blood acidity,
Homeostasis of cylindrical shape (of blood vessels)
Homeostatic regulation of numbers of capillaries

Homeostatic regulation of any variable property at all?

At least one force that is able to **change whatever variable** is being regulated.

The **strength of this force** needs to be **able to change** as some **function of whatever variable** is to be held constant.

In other words, a negative feed-back cycle.

Practical applications of this way of thinking?

Evidence that could confirm that any given variable is being actively controlled by negative feed-back?

Evidence that could **convince a doubting critic**?

How a system **responds to externally imposed** distortion?

Explain some paradox that previously had not made sense?

What if there are two or more different forces (whose strengths vary as functions)

When some properties gravitate back to the same end result by means of two or three or mode different pathways becoming a hollow tube either be bending and fusing a sheet, or by hollowing out a solid rod?

Also, if engulfment of one mass of cells by another?

Multiple alternate pathways is evidence supporting what explanation

Thermodynamic minimization of free energy?

Negative feed-back?