week 1 - principles of physiology and respiration

---

what we should be able to do

- Learning outcomes (what you should be able to do by the end of the lecture):
- Define physiology and describe what it encompasses.
- Understand the difference between the external and internal environment, its relation to an organisms complexity and the tendency to adopt homeostasis as complexity increases.
- Describe how basic physical principles (physics) underlie all of physiology and how organisms are constrained by them.
- Explain allometry (laws of scaling), the universality of the 0.7 rule in physiology (physiologies magic number), and Rubner's law and its implications for physiological processes.
- Outline how gas solubility (oxygen & carbon dioxide) and the viscosity of the medium (air versus water) it is carried in, affect the rate at which it can diffuse and be transported.
- Perform calculations using Harvey's equation (the rate at which a gas can diffuse to the centre of a sphere as determined by its diameter) and understand its implications.

---

definitions

conformity = compliance with standards, rules or laws, behaviour in accordance with socially accepted conventions **regulations =** a rule or directive made and maintained by an authority

homeostasis = the tendency towards a relatively stable equilibrium between interdependent elements, especially as maintained by physiological process

allometry = the growth of body parts at different rates, resulting in a change of body proportions

kleiber's constant = observation for that vast majority of animals, an animals metabolic rates scales to the 3/4 power of the animals mass **harvey's equation =** S= Cr^2/6K

body size and temperature: why they matter ?

- metabolic rate depends on body size and temperature, we can estimate the magnitude of many ecological processes from the temperature and size of the organisms that affect them

---

what is physiology, what does it encompass?

- animals physiology = the study of how animals work or the study of the mechanism and evolution of animal function
- comparative physiology = comparing between the physiology of different animals and understanding why they are different

---

why do physics and chemistry underlie all of physiology?

- why are activation energies or enthalpies of charge fixed (we can use enzymes to alter them but only within fixed parameters
- enzyme kinetics ; why does the reaction plateau?
- although we can affect the solubility of compound though temperature, its solubility constant is just that
- why is the total pressure of two ideal gases the sum of their partial pressures?
- bc there are basic physical and chemical laws that all matter (energy) must adhere
- physiology is the sum of molecular interactions/ processes and hence is subject to these laws

---

internal environment

- le milieu interdire = the internal environnent
- the cells within the organism experience their own internal environment different to and distinct from that occupied by the organism, which is the **external environment.**

---

conformity versus regulation

- conformity : internal conditions = external conditions

- regulation : internal conditions remain constant irrespective of external conditions