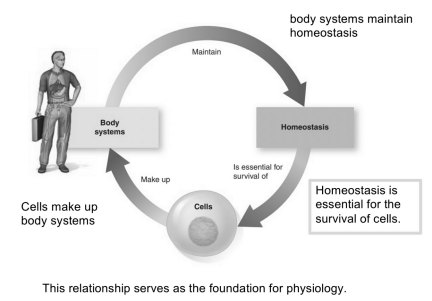
Concept of Homeostasis

Homeostasis Definition:	The maintenance of a dynamic steady state within the internal bodily enviornemnt
Homeostasis Concept:	dynamic mechanisms are the factors that allow for a near-steady state by detecting and responding to deviations from the "set point" through effector responses

Factors in a Homeostatic Control System

Sensor	detects deviations from set point and relays informatory signal to the integrator/control system
Control Center/ Integrator	integrates information input from the sensor to allow for a response system to restore the set point back to normal
Effector	Response system that receives information on adjustments in order to restore the set point back to normal.

Homeostasis Conceptual Summary Figure



Intrinsic Control System

Definition	*LOCAL* control systems built *INTO* a tissue/organ
Example:	Increased CO2 production by exercising skeletal muscle leads to --> relaxation of smooth muscle and dilation of blood vessels; increased blood flow brings more O2

Disruptions in Homeostasis

Pathophysiology	abnormal bodily function associated with disease
Result	homeostatic disruption so severe that death results

Extrinsic Control System

Definition	Systems outside of an organ/-tissue allowing for the co-ord regulation of multiple organs/tissues.
Example 1	The *nervous system* detects *LOW* blood pressure leading to --> Increased Heart rate + constriction of blood vessels
Example 2	The *endocrine system* detects *HIGH* blood glucose leading to --> excretion of hormonal control

Homeostasis Maintenance=Cell communication

***Direct* Intracellular communication**	*Gap Junctions + Transient Direct linkup of Cells surface markers*
***Indirect* Intracellular communication via Extracellular messengers**	Paracrine Secretion + Neurotransmitter secretion

Homeostasis Maintenance=Cell communication (cont)

Endocrine Signaling	Hormonal + neurohormonal secretion

Alterations in Homeostasis

Set points can change

1) In sickness temperature can change --> Fever

2) Throughout Aging --> BMR (basal metabolic rate can change

3) Throughout daily life --> Circadian rhythms can change

Thermoregulation

Shivering -->	when body temp is *LOW*, heat is produced to increase body temp back to normal through shivering
Sweating -->	when body temp is *HIGH*, heat is lost to reduce the body temp back to normal through sweating

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Important Regulatory Systems

Nervous System	brain, spinal cord, nerves, and sense organs
Endocrine System	all hormone-secreting glands

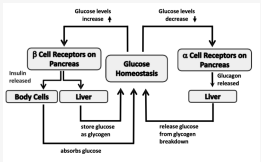
Negative Feedback (NF)

Systems that operate under Negative Feedback	Intrinsic and Extrinsic control systems operate under the principle of negative feedback
Goal	Remediate an unwanted change
Definition	A change in a controlled variable triggers a response that drives the variable in the opposite direction of the initial change, thus opposing the change
Afferent Signal/Path	Send info from Sensor to control center
Efferent Signal/Path	Send info from Control Center to Effectors in order to help restore homeostasis
Example: Temperature Regulation	High body temp sensed by skin cells --> Send info to brain/control center--> send info to Sweat Glands/Effector-->release Sweat --> Response: Lower Body temp back to normal levels

NF Ex: Regulating Glucose Concentration

Set point of glucose concentration of Plasma	~80mg/dL
Beta Cells	Release *INSULIN* from pancreas when glucose concentration *INCREASES*
Alpha Cells	Release *GLUCAGON* from pancreas when glucose concentration *DECREASES*
B-Cells Negative Feedback Mechanism	Beta cells *SENSE* glucose levels in blood (Increase/Decrease) and compare them to the set point glucose concentration; Too high = send info to control center (afferent path) --> Control center sends info to effector (efferent path) --> Response: release INSULIN --> decrease glucose concentration back to set point

NF: Glucose Homeostasis Figure



Nervous system VS Endocrine system

Nervous System	Endocrine System
WIRED; specific structual arrangment between neurons + target cells	*WIRELESS*; widely dispersed endocrine glands that are unrelated to each other + target cells
Chemcial Messenger= Neurotransmitter into --> synaptic cleft	Chemcial Messenger= Hormones released--> blood
SHORT distance (diffusion across synaptic cleft)	*LONG* distances (carried by blood)
RAPID response + *BRIEF* duration	*SLOW* response + *LONG* duration
Function= coords rapid + precise responses	Function= Control long duration activities

Feedforward Mechanisms

Definition:	System that operates without a detector by activating homeostatic mechs + predicting when a change is likely to occur
Potential Mech #1	In response to an anticipated/once in a lifetime (infrequent) event
Ex 1:	The normal anticipatory regulation of heartbeat in advance of actual physical exertion
Potential Mech #2	Through Body Rhythms

Feedforward Mechanisms (cont)

Ex 2:	The rhythms are internally driven but entrained (timing is set) by enviro-nmental cues.

Non-Homeostatic Mech= Positive Feedback

Definiton:	System with no contribution to homeostatis BUT, contributes to specific physiological needs in which the *INITIAL* change is *AMPLIFIED* and moves *AWAY* from set point
Import-ance:	In processes such as childbirth or firing an action potential
Childbirth Example	During labor (stimulus), the the nerve receptors (sensors) detect cervical stretching and signal to the brain (control center) which allows for the release of oxytocin (effector) from the pituitary gland in order to stimulate more stretching and stronger contractions and stimulate the olacenta to further make prostaglandins stimul-ating more oxytocin and more cervical stretch/contractions(-opposite of negative feedback which would end the contracti-ons/stretching).

Homeostatic-ally maintained Factors

1. Nutrients
2. Oxygen + Carbon Dioxide
3. Waste Products
4. pH
5. Water, Salt, other electrolytes
6. Volume + pressure
7. Temperature