Lecture 9: Motivation

Today
Regulation of
  Temperature
  Thirst
  Hunger

Homeostasis
The ability of an organism to keep __________________________ constant
Example
  Internal temperature
  __________________________ degrees
  If you’re hotter than that, your body tries to cool you down

Homeostasis
Regulatory systems have “________________________” to try and keep constant
How are these “set points” __________________________?

Motivation
A process that __________________________ behavior
A change from a “set point” causes an __________________________
Unpleasant states lead to __________________________ towards a set point
This motivation is specific to the area of the __________________________
  ie. If you’re thirsty, you drink something, not eat something

Regulating Body Temperature
________________________ (amphibians, reptiles and fish) rely on external factors, such as sunlight, in order to maintain body temperature.
________________________ (mammals and birds) have the ability to maintain body temperature through internal activity.
Although they use different control methods, ectotherms and endotherms maintain similar __________________________.

Temperature
________________________ matters
________________________: size of the surface
________________________: thickness
As an organism gets bigger, volume increases faster than surface area

Body Temperature and Surface-to-Volume Ratios
More surface area = more __________________________
More volume = more __________________________
Since smaller animals have a larger proportion of surface area to volume, it is much harder for them to keep warm
How have animals adapted to a climate?
Three ways:

Evolutionary factors
Amount of fur varies depending on the ______________________

Behavioral Responses to Temperature
Change location
Change ______________________
Change color or weight of fur or clothing
These are the primary ways for ______________________ to mediate their body temperature
Endotherms can use these as well

Endothermic Biological Responses to Cold
________________________: produces heat
Release of ______________________: increases metabolism, which warms the body
Blood vessels constrict: keeps blood away from skin, where heat loss occurs

Endothermic Biological Responses to Heat
________________________: evaporation cools the skin
In species that do not perspire, animals may ______________________ their fur
Blood vessels dilate: allows blood near the skin, to allow more heat loss

Examples of Disturbances in Human Core Temperature
Hot flashes associated with ______________________
Possibly due to low estrogen levels in the hypothalamus
The hypothalamus believes the body is burning up, so the body responds accordingly
________________________ represents a controlled increase in the temperature set point
Caused by bacteria

More examples of Human Core Temperature Changes
________________________ (aka heat stroke) represents a failure in mechanisms designed to cope with high core temperatures
The coping mechanisms eventually stop trying to cope
________________________ body temperature may lead to fainting
May lead to death
Korey Stringer- 108 degree body temperature when he arrived at hospital

Hypothermia.....
Hypothermia occurs when sufficient heat cannot be maintained
Body temperature drops below ______________________
Extremely painful
At ________________________, consciousness is lost

Two areas of the hypothalamus participate in temperature regulation
Anterior hypothalamus

Posterior hypothalamus

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Receives input from skin receptors and monitors ____________________________ as well
   Injecting warm water around the hypothalamus causes it to behave as if the body
temperature has increased

The Hypothalamus and Temperature
______________ that cause fever target receptors in the hypothalamus
Manages temperature changes of as little as ____________________________
Other areas monitor larger changes in temperature

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Spinal cord

Temperature Regulation in Infancy
Infants are ________________________ to regulate temperature
   High surface-to-volume ratio
   Immature __________________________
   Low body fat stores
________________________ infants are even more vulnerable
Litter species show social responses to temperature

Thirst
Maintenance of appropriate fluid levels in the body
Fluid levels are primarily driven by concentrations of chemicals within the fluids

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Osmosis
Movement of water in response to ____________________________
   Refers to a solution that is lower in concentration than a reference solution
   Refers to a solution that is higher in concentration than a reference solution

Side note: drowning
Drowning in freshwater and in salt water cause two different body responses
   In freshwater, the incoming (lake) water is less concentrated (hypotonic) than the
   concentration of the fluid within the cells
      Osmosis causes this new water to ____________________________
May ________________________ the cell membranes

**Side note: drowning**
What about salt water?
The incoming (sea) water is more concentrated (hypertonic) than the concentration of the fluid within the cells
Osmosis causes the cellular fluid to move _______________________
Causes ________________________ of the cells, and the ________________ of cells

**How do we lose water?**
Humans consume considerably more salt and water each day than needed
The ________________________ filter out what we don’t need
________________________ does this for patients with kidney failure

**How do we gain water?**
We lose ________________________ of water each day
Source of the “drink 8 cups of water a day” saying
Should we really drink that much water?

**What happens when we lose water?**
Two things

________________________ of current fluids
kidneys

**Two different thirst processes occur**
________________________ thirst
Response to cellular dehydration

________________________ thirst
Response to a drop in blood volume

**Osmotic Thirst**
Cellular dehydration
Occurs after ________________________
Increases in sodium levels outside of the cell leads to water moving out of the cell
Leads to a thirst
Detected by ________________________ in the brain
Possibly located in one of the ventricles

**Hypovolemic Thirst**
Drop in ________________________
After bleeding of some sort
________________________ in the heart measure blood pressure
Lower blood volume = lower blood pressure
What do the receptors do?
Osmoreceptors and baroreceptors stimulate the release of ________________________ (ADH) by the pituitary gland.

What does ADH do?
ADH signals the ________________ to reduce urine production
To release ________________________
Turns into angiotensin II
Constricts blood vessels, which increases
________________________
Activates receptors in the brain that signal the medulla to initiate drinking behavior.

How do we stop drinking?
Receptors along the ________________________ signal when water is consumed
Overdrinking
Not really a problem
________________________ in urine
Extreme overdrinking may result in ________________________
Nausea
Cramps
Disorientation

Hunger
Digestion
________________________
Either used for immediate energy or stored
________________________
Muscle growth and upkeep
________________________
Sole energy source for the brain
Extra is stored as glycogen

The Pancreas
__________________________ to manage glucose levels
________________________
Converts stored glycogen into glucose
________________________
Stores unused glucose as glycogen
Aids in the absorption of glucose into the body tissues

Diabetes
Type I
Diagnosed in ________________________ or young adulthood
Insulin producing cells in the pancreas are destroyed by the ____________________________

Without insulin, glucose circulates in the blood and is not absorbed properly
Cells are literally starving for nutrients

**Diabetes**

Type II
People produce insulin, but not enough
Leads to ____________________________
Pancreas begins to produce less insulin
Symptoms are the same as in Type I
______________________________ is a common risk factor

**Initiating of Hunger**

External cues
______________________________
______________________________ of food
Social settings
Internal cues
______________________________ in the brainstem

**Brain mechanisms for hunger**

Lateral hypothalamus
Lesion leads to a ____________________________

Neurochemicals
______________________________ : secreted by fat cells
When levels are low, the hypothalamus stimulates the parasympathetic nervous system to initiate eating activity

**Satiety**

Internal cues
Fullness of ____________________________
When food reaches the intestines, CCK is released
______________________________ the release of insulin
Functions as a NT in the brain for satiety

**Brain mechanisms for satiety**

______________________________ hypothalamus

Lesions produce ____________________________
If the food contains a bitter substance and does not taste good, rats will eat significantly less than normal rats do
If the food is good, these rats will eat considerably more than normal rats
Lesions also produce ____________________________
Leads to feelings of hunger

**Body Weight**
How do we define normal body weight?
Weindruch (1986)
Two groups
1. Mice that were only allowed to consume __________________________________ they normally consume
2. Mice that were allowed to consume the normal number of calories
Mice that ate fewer calories ______________________
Eating may accelerate the aging process(!!!???)

Body Mass Index
BMI is currently used to identify proper levels of body weight
Seems to be accurate, but not perfect
BMIs between 19 and 22 lead to longer ______________________
Does not account for __________________________________________ more than fat
Weight isn’t really an ideal measure for health

Obesity
Why does it happen?
Multifactored
______________________________________ to metabolism
Genetic influences to set points
______________________________________
Activity levels
Types of food eaten
______________________________________ eaten
Viral infections

Once obesity occurs…
The body actually defends the weight increase
______________________________________ increases
Can’t get rid of them nonsurgically
Liposuction gets rid of fat cells
BUT with fewer fat cells, less leptin is secreted, which leads to an increased appetite
______________________________________ increases
Dieting reduces their size

Chemical changes
Liu et al (2000) found that ______________________ are delayed in obese participants
May lead to increases in eating even though the obese participants are already full
______________________________________ may be available to treat obesity

Treatments
Leptin injections may work.

Eating disorders

- Loss of appetite
- Maintain ________________________ of normal body weight
- Disturbed body image
- Can be fatal, if not treated (up to 10% fatality rate)
- More than ________________________
  1% of the population

Eating disorders

- Binging and purging
  3% of the population

Causes of eating disorders

Environmental
  Fiji islands: valued “robust, well-muscled body”
  Introduction of ________________________ in the Fiji islands in 1995
  After this, ________________________ girls viewed themselves as too big or too fat

Treatments of eating disorders

___________ therapy

Treatment of depression