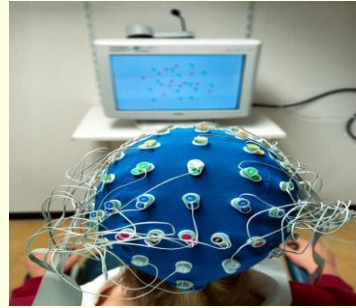


## Sex and the Brain, part 1

### Objectives:

1. Review of brain's control of all things reproductive
  - A) it controls production of sex hormones & gametes
  - B) it controls embryonic sexual development
  - C) controls secondary sexual characteristics at puberty, and on.
  - D) it receives and interprets sexual stimuli
2. Role of limbic system in sex
3. There are more similarities than differences in the brain between the sexes. (This will be covered in part 2)



1

## Sex and the Brain Readings

### Reading Assignments:

1. [Sex & The Brain](#)
2. [New Insights into Gendered Brain Wiring](#)  
(follow-up study to Sex & the Brain)
4. [Brain Scans Find the Penis At Last](#)
5. [Human Sexuality – Pgs 75 – 87](#). (or 2 – 14) The highlighted sections.  
Also, see my comment boxes within.
6. [Menstrual Synchrony in Women](#)
8. [The Call of Pheromones](#)

<https://www.sciencedaily.com/releases/2021/03/210325115316.htm>

2

## 1 A) Brain controls production of sex hormones (Steroidogenesis)

### Review of Reproductive A & P

*Review!*

- Remember that the hypothalamus of the brain secretes **GnRH**.
- This causes the pituitary gland gland to secrete **LH & FSH**.
- LH causes the testes to make testosterone & the ovaries to estrogen, also causes ovulation
- FSH cause the testes to mature sperm maturation & ovaries to mature egg maturation

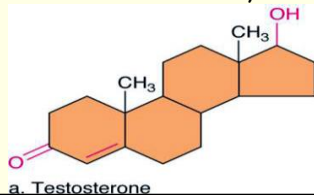
3

## 1 A) Brain controls production of sex hormones

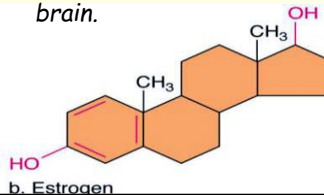
### **Embryonic exposure to sex hormones:**

- Exposure to estrogen or testosterone during embryonic development causes organizational changes  
= changes that, once they occur, cannot be undone (permanent!).

Exposure of fetus to testosterone causes masculinization of body & brain.



Exposure of fetus to estrogen causes feminization of body & brain.



4

## 2 B) Brain controls embryonic development of Primary Sexual Characteristics based on hormones

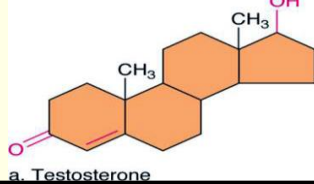
### Embryonic exposure to sex hormones:

*Review!*

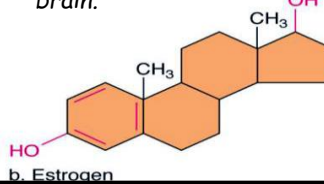
- At 8 weeks gestation genes on male embryo's Y-chromosome activate. *?? Do you remember which genes??* SRY & TDF  
They stimulate testes development. **Brain directs testes to make testosterone (T).**



Exposure of fetus to testosterone causes masculinization of body & brain.



Exposure of fetus to estrogen causes feminization of body & brain.



5

## 2 B) Brain controls embryonic development of Primary Sexual Characteristics based on hormones

### Embryonic exposure to sex hormones:

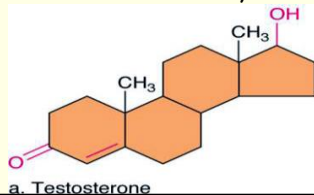
*Review!*

- At 8 weeks gestation genes on male embryo's Y-chromosome activate. They stimulate testes development. **Brain directs testes to make testosterone (T).**

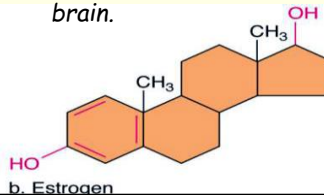
> If no Y-chromosome, no testis formation. **Embryo** develops ovaries. **Brain directs ovaries to produce estrogen (E).**



Exposure of fetus to testosterone causes masculinization of body & brain.



Exposure of fetus to estrogen causes feminization of body & brain.



6

**2 B) Brain controls embryonic development of Primary Sexual Characteristics based on hormones**

**Primary Sexual Characteristics:**

- **Male embryo with testes & testosterone develops:**
  - Penis
  - Scrotum
  - Urethra opens at head of penis (connected to reproductive tract)
  - Seminal vesicles, prostate, & bulbourethral glands
  - Vas deferens, ejaculatory duct
  - **Masculinized brain**
- **Female embryo with ovaries & estrogen develops:**
  - Vagina
  - Uterus, cervix, & fallopian tubes
  - External genitalia (labia, clitoris)
  - Urethra separate from reproductive tract
  - **Feminized brain**

*Review!*

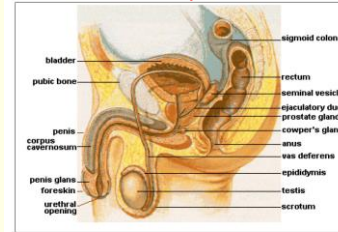
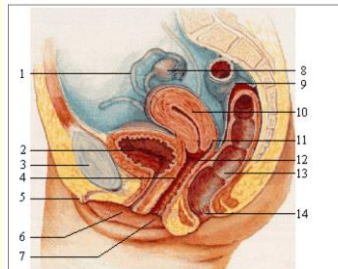


Figure 27.3. Male reproductive system  
[http://commons.wikimedia.org/wiki/File:Male\\_anatomy.png](http://commons.wikimedia.org/wiki/File:Male_anatomy.png)



7

**2 C) Brain controls Secondary Sexual Characteristics at puberty, and on.**

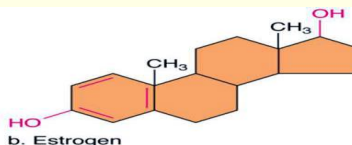
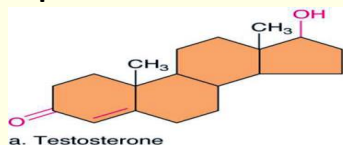
At puberty a **SURGE** of sex hormones causes development of **Secondary Sexual Characteristics:**

**Testosterone surge causes males to develop:**

- Enlarged penis
- Pubic, facial, and body hair
- Thickened more square jaw & heavy brow
- Deepened voice & adam's apple
- Muscularity
- Get taller
- Body odor & acne
- Nocturnal emissions (wet dreams)
- More aggression
- **Sex drive (Libido)**
- **Sperm production**

**Estrogen surge causes females to develop:**

- Enlarged breasts
- Pubic and body hair
- More angular jaw & delicate brow
- Change in body fat distribution (hips)
- Body odor & acne
- **Sex drive (Libido)**
- **Monthly ovulation & menstruation**



8

## Review:

- **1 A) Brain's control of sex hormones and gamete maturation**
  - > hypothalamus GnRH
  - > Pituitary LH & FSH
- **1 B) Embryonic sexual development of primary sexual characteristics based on:**
  - > Genes (Y chromosome)
  - > testes testosterone
  - > ovaries estrogen
- **1 C) Secondary sexual characteristics at puberty due to testosterone or estrogen.** (review of Biology of Beauty lecture)

9

### **1 D) Brain receives & interprets sexual stimuli.**

#### **1. Cerebral Cortex**

- > Thinking part of the brain
- > Where sensory stimuli received & interpreted

#### **2. Limbic System**

- > Emotional part of the brain.

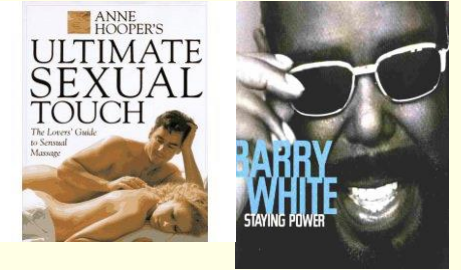
[Human Sexuality – Pgs 75 – 87.](#) (or 2 – 14)

10

**1 D) Brain receives & interprets sexual stimuli.**

**1. Cerebral Cortex**

- A) Thoughts
- B) Touch (tactile stimuli)
- C) Sight
- D) Sounds
- E) Smell
- F) Taste



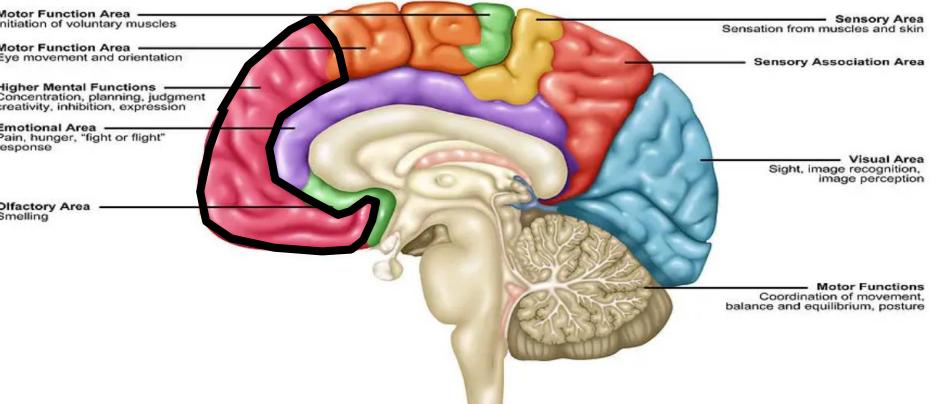
Human Sexuality – Pgs 75 – 87. (or 2 – 14)



11

**1. Cerebral Cortex**

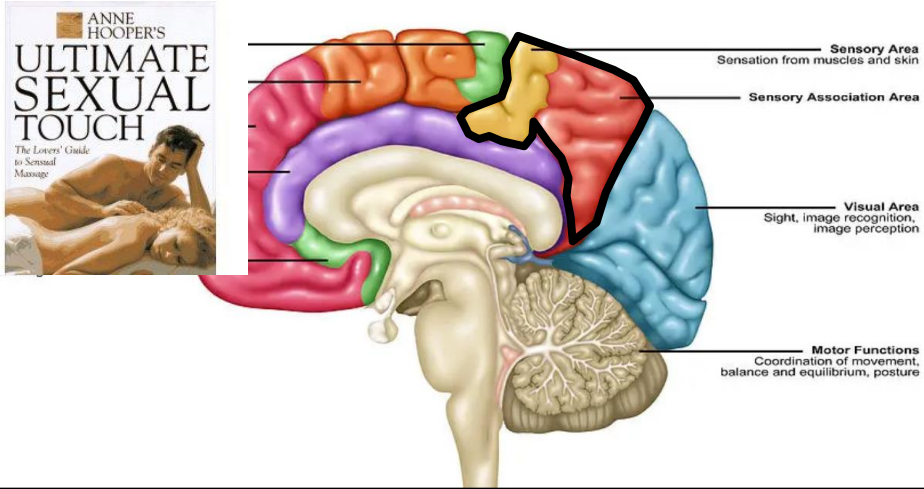
- A) Thoughts – the **prefrontal cortex**
  - > thinking part of the brain
  - > sexual fantasies, desires, thoughts, and images
  - > site of inhibition (or sometimes lack there)



12

# 1. Cerebral Cortex

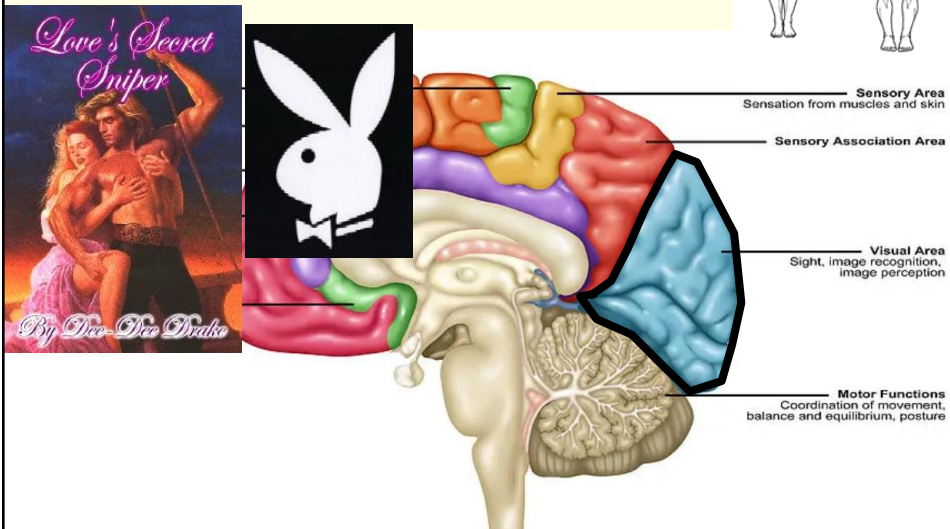
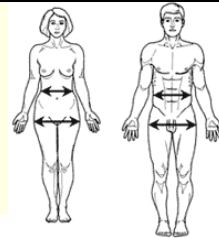
**B) Touch (tactile stimuli) – and the **sensory cortex of cerebrum****  
 > perceive touch, vibration, heat, pain, and pleasure.



13

# 1. Cerebral Cortex

**C) Sight – and the **occipital cortex of cerebrum****

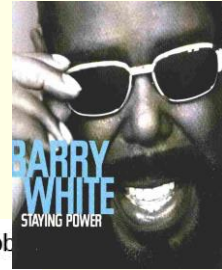
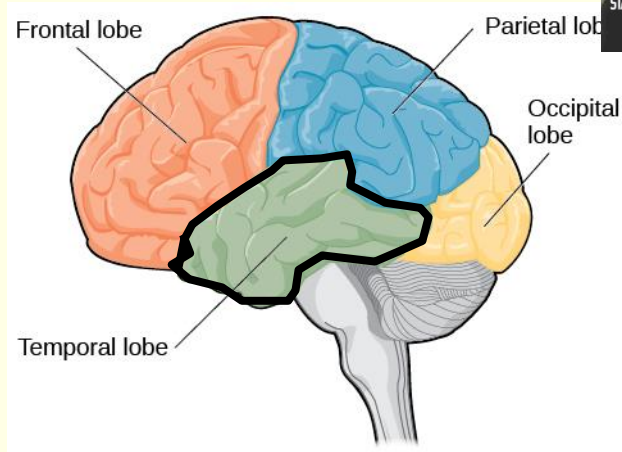


14

## 1. Cerebral Cortex

### D) Sound –the **temporal cortex of cerebrum**

- > music can be arousing
- > someone's voice



15

## 1. Cerebral Cortex

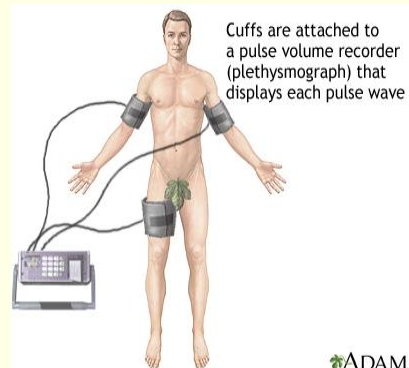
### D) Sound –the **temporal cortex of cerebrum**

- > music can be arousing
- > someone's voice

#### Study by Gaith and Plaud

> Male college students shown erotic videos, with and without audio.

> Saw increased correlation with sexual arousal and sound (using **penile plethysmograph**, which measures blood flow to penis during arousal).

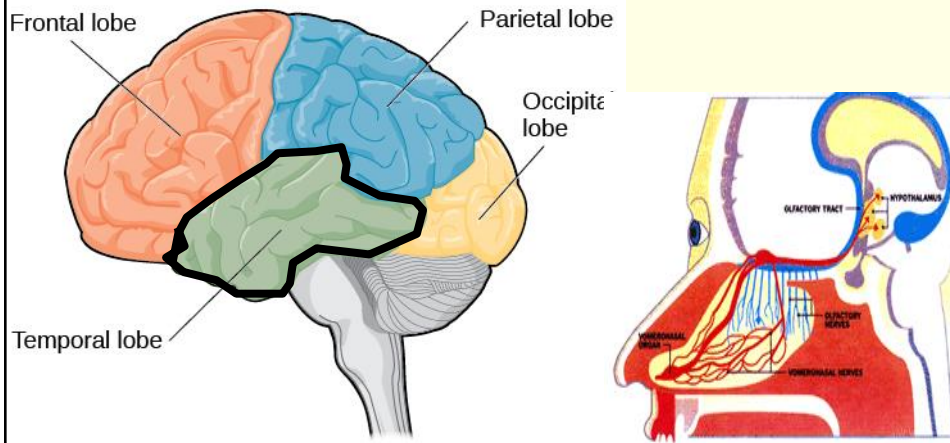


16



## 1. Cerebral Cortex

**E) Smell** – also the **temporal cortex of cerebrum** and the **vomeronasal organ** (= structure in brain that senses pheromones).



17

## 1. Cerebral Cortex

**E) Smell** – also the **temporal cortex of cerebrum** and the **vomeronasal organ** (= structure in brain that senses pheromones).

### Sex Scents

*Olfactory preferences are determined in large part by culture. Women in some societies use their vaginal secretions as a perfume, rubbing some behind the ear or on the neck to attract and arouse sexual partners. Sweat is an almost universal ingredient in love potions throughout the world. In parts of the Balkans and Greece some*

*men carry handkerchiefs in their armpits during festivals and offer these as tokens to women they invite to dance. In contrast, in America, most people think that the smell of a moist vagina or sweaty armpit would not be appealing, and indeed many people regularly use deodorants to conceal these odors from a dating partner.*

18

## 1. Cerebral Cortex

### E) Smell – also the **temporal cortex of cerebrum**

**Pheromones** = secretions from skin, which contain hormones like T & E2, among others, that we don't consciously smell BUT it affects our behavior.



19

## 1. Cerebral Cortex

### E) Smell – also the **temporal cortex of cerebrum**

#### **Study by Cutler (1998)**

> Put synthetic male pheromones into aftershave lotion of college men & Looked at 6 behaviors:

1. Petting
2. Dates (formal)
3. Dates (informal)
4. Sleeping next to romantic partner
5. Sex
6. Masterbation

> Found that men had increased rates of petting, sleeping next to someone, sex, and informal dates.

20

## 1. Cerebral Cortex

### E) Smell – also the **temporal cortex of cerebrum**

#### Ex. 1) The MHC T-Shirt Test (Evolution of sex notes)

> women could smell the MHC complex on men's t-shirts, and they ranked those with the best smell that had MHC most different from their own.

Women can smell genetic differences from themselves!  
Hybrid vigor baby!



21

#### Ex. 2) **Androstenol (Bathroom Stall Study)**

(see reading assign: "[The Call of Pheromones](#)" – work by Gustavson)

- **Androstenol** = male androgen pheromone from armpit sweat.
- Gustavson sprayed random bathroom stalls with it and recorded which stalls people chose. (**Remember ... that is a split-second decision we make!**)
- Results: Men avoided tainted stalls but women selected them!



22

### Ex. 3) Athena pheromone study

Pheromone researcher (**Winnifred Cutler**) studied a proprietary chemical (found in female armpit sweat called "**Athena**")

- Studied men's rating of attractiveness to this odor.
- Results: highly attractive to men
- (*Researcher now trying to market this chemical*)



### Another study examined post-menopausal women using Athena for 6 weeks.

- Women kept diary of sexual activity.
- Result: Women using Athena report greater sexual activity than women not using it.



23

### Ex. 4) "BoarTaint" (**Androstenone**)

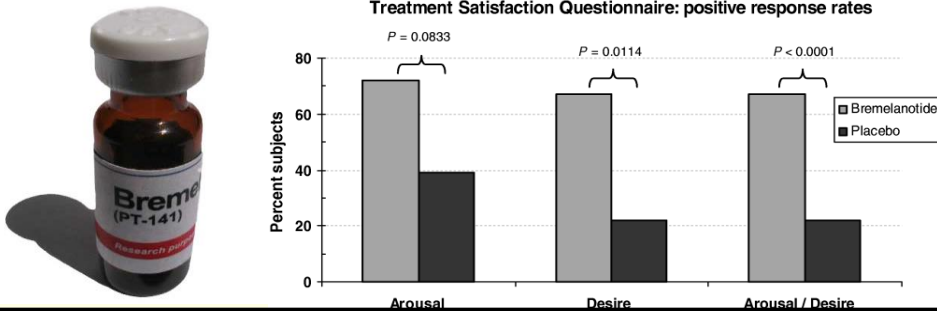
- Don't confuse w/*androstenol*.
- Pheromone in boar (male pig) sweat & urine.
- Someone decided to try it out in humans.
- Found to be ↑ libido in women.



24

### Ex. 5) Bremelanotide

- Another pheromone in armpit sweat.
- Marketed as intra-nasal spray.
- Found to ↑ libido in men and women.



25

### Ex. 6) Menstrual Synchrony in Women (the "McClintock Effect")

(See reading assign: "[Menstrual Synchrony in Women](#)")

- Women release pheromones (like Athena) having effect other women.
- Women who live, work, spend significant time together synchronize their menstrual cycles. (Have period on same week)
- Thought an evolutionary adaptation in social groups, many women having children at same age – have lots of helpers w/child care.
- Also thought to play competitive advantage for males (all females ovulating in same time period levels the fertility playing field).

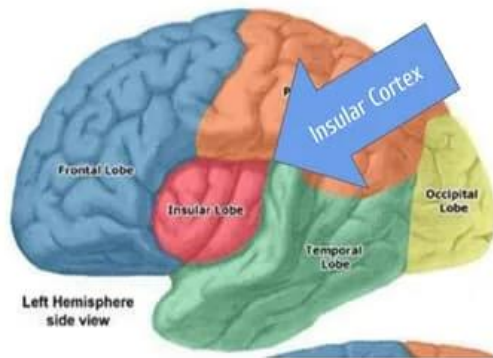


26

## 1. Cerebral Cortex

E) Taste – also the **insula cortex of cerebrum**

# The Insular Cortex



27

## Libido & other chemicals:

### Other things that INCREASE libido – Aphrodisiacs

#### Food & TASTE

- **Oysters** (contain zinc, known to ↑ libido)
  - **Chocolate** contains:
    - [phenylethylamine](#) – stimulates Limbic system (emotional brain)
    - [Cannabinoids](#) – similar to THC (pot)
- Effect of these on brain:
- [serotonin](#) - euphoria
  - [dopamine](#) – addiction center of brain
- **Spanish fly** = powdered emerald green beetle contains [cantharadin](#) – causes inflammation & swelling in urinary tract. Sensation confused with swelling of genitals during arousal.



28

## Aphrodisiacs - Food & TASTE

- **Oysters** (contain zinc, known to ↑ libido)
- **Chocolate** contains:
  - [phenylethylamine](#) – stimulates Limbic system
  - [Cannabinoids](#) – similar to THC (pot)



Effect of these on brain:

- [serotonin](#) - euphoria
- [dopamine](#) – addiction center of brain
- **Spanish fly** = powdered emerald green beetle contains [cantharadin](#) – causes inflammation & swelling in urine. Sensation confused with swelling of genitals during arousal.



29

## Libido & other chemicals:

### Other things that INCREASE libido - Aphrodisiacs

#### Food & TASTE

- **Rhinoceros horn (powder)** – popular in Asia  
[These don't do anything & kills endangered species!]
- **Tiger penis** – popular in Asia  
[This doesn't work either & kills endangered species!]



30

## Libido & other hormones

### Hormones that INCREASE libido:

- Testosterone (for men & women)
- Estrogen (for women)

### Hormones that DECREASE libido:

- **Progesterone** - secreted during menstrual cycle & during pregnancy.
- **Cortisol (stress hormone)** - decreases testosterone & estrogen levels.

31

## 1 D) Brain receives & interprets sexual stimuli.

### 1. Cerebral Cortex

- > Thinking part of the brain
- > Where sensory stimuli received & interpreted

### 2. Limbic System

- > Emotional part of the brain.

[Human Sexuality – Pgs 75 – 87.](#) (or 2 – 14)

32



## 1 D) Brain receives & interprets sexual stimuli.

### 1. Cerebral Cortex

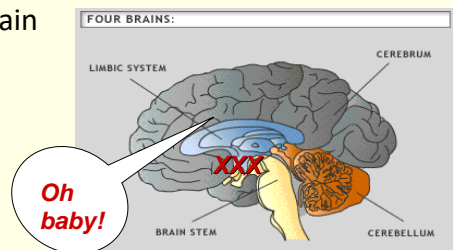
- > Thinking part of the brain
- > Where sensory stimuli received & interpreted

### 2. Limbic System

- > Emotional part of the brain.

limbic system = part of emotional brain that is associated with the 4 F's

- 4 F's =
- 1.
  - 2.
  - 3.
  - 4.



From Evolution of Sex, part 1

33

## 1 D) Brain receives & interprets sexual stimuli.

### 2. Limbic System

- > Emotional part of the brain.

***Faked orgasms don't fool brain scans  
(Evolution of sex, part 1)***



*COPENHAGEN, Denmark (Reuters) -- Women may be able to fool their partners by faking an orgasm but a brain scanner will catch them every time, a conference heard on Monday.*

- **Location of male/female orgasm = Limbic system (includes hypothalamus and amygdala)**
- **In females *amygdala* shuts off during true orgasm, remains active if fake orgasm!**

[http://people.fmarion.edu/tbarbeau/CNN\\_Faking\\_Orgasms\\_Brain.pdf](http://people.fmarion.edu/tbarbeau/CNN_Faking_Orgasms_Brain.pdf)

34

## Review: *slide updated 3/2*

- 1 D) **Brain receives and interprets sexual stimuli**

### **Cerebral Cortex and**

- A) Thoughts
- B) Touch (tactile stimuli)
- C) Sight
- D) Sounds
- E) Smell
- F) Taste

- **Hormones that increase & decrease libido**

- **Limbic System**

- > 4 F's

- > Amygdala and female orgasm