

Sexual Differentiation

Fall 2008

Bios 90

Jennifer Swann, Professor

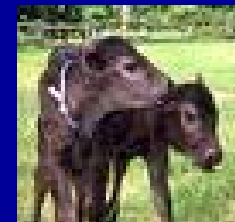
Dept Biol Sci,

Lehigh University

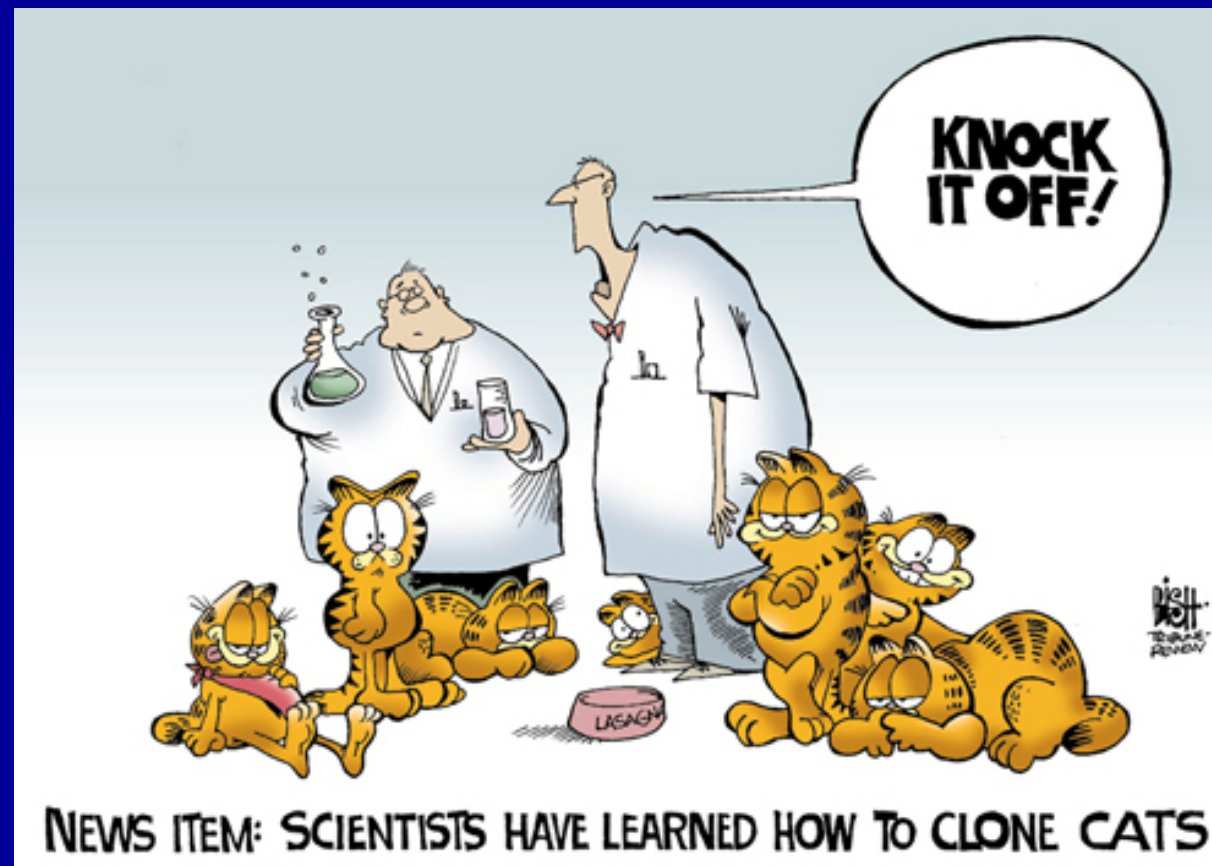


Asexual reproduction

- **Budding : offspring develop as a growth on the body of the parent**
 - jellyfishes , echinoderms, corals, tapeworms
- **Parthenogenesis- egg develops without fertilization**
 - Some fishes, several kinds of insects, and a few species of lizards.
- **Cloning-artificial reproduction of animals form non germ cells**
 - Mice, sheep, cats, donkey.....



Why have sexes?



What determines sex?

- Environment
- Genetics
- Hormones

What causes these differences?

The true story of
JOHN/JOAN

By John Colapinto
The Rolling Stone, December 11,
1997. Pages 54-97

After suffering the complete loss of his penis to a botched circumcision when he was 8 months old a sex-change operation was performed that involved clinical castration, genital surgery and a 12-year program of social, mental and hormonal conditioning.



Environment...?

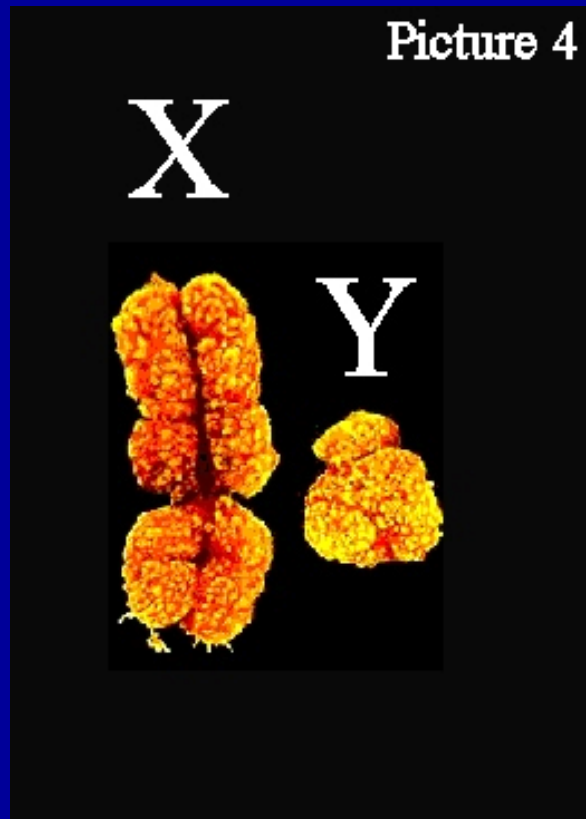
Or Genotype?



Men and women are similar in genetic make up except for 1 chromosome....

Professor Victor Axiak
Forget The Budget! - WHAT ABOUT SEX?
Dossier Science 27 November 2002
<http://www.maltastar.com/pages/msDossierDetailN.asp?id=6918&po=2>

The X and Y chromosome

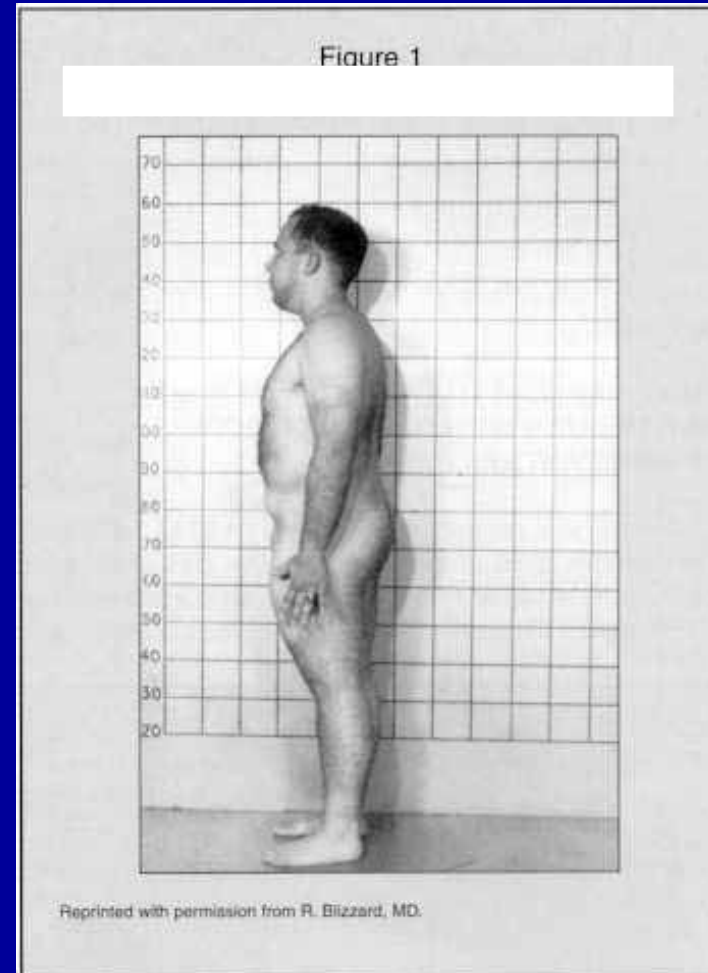


- Women have 2 X
- Men have X and Y
- Men and women differ by about 1% of their genetic make up

Does Genotype alone confer Phenotype?



Genotype XY



Genotype XX

Genes regulate hormones: hormones regulate differentiation



XY

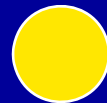


testis

Testosterone



XX

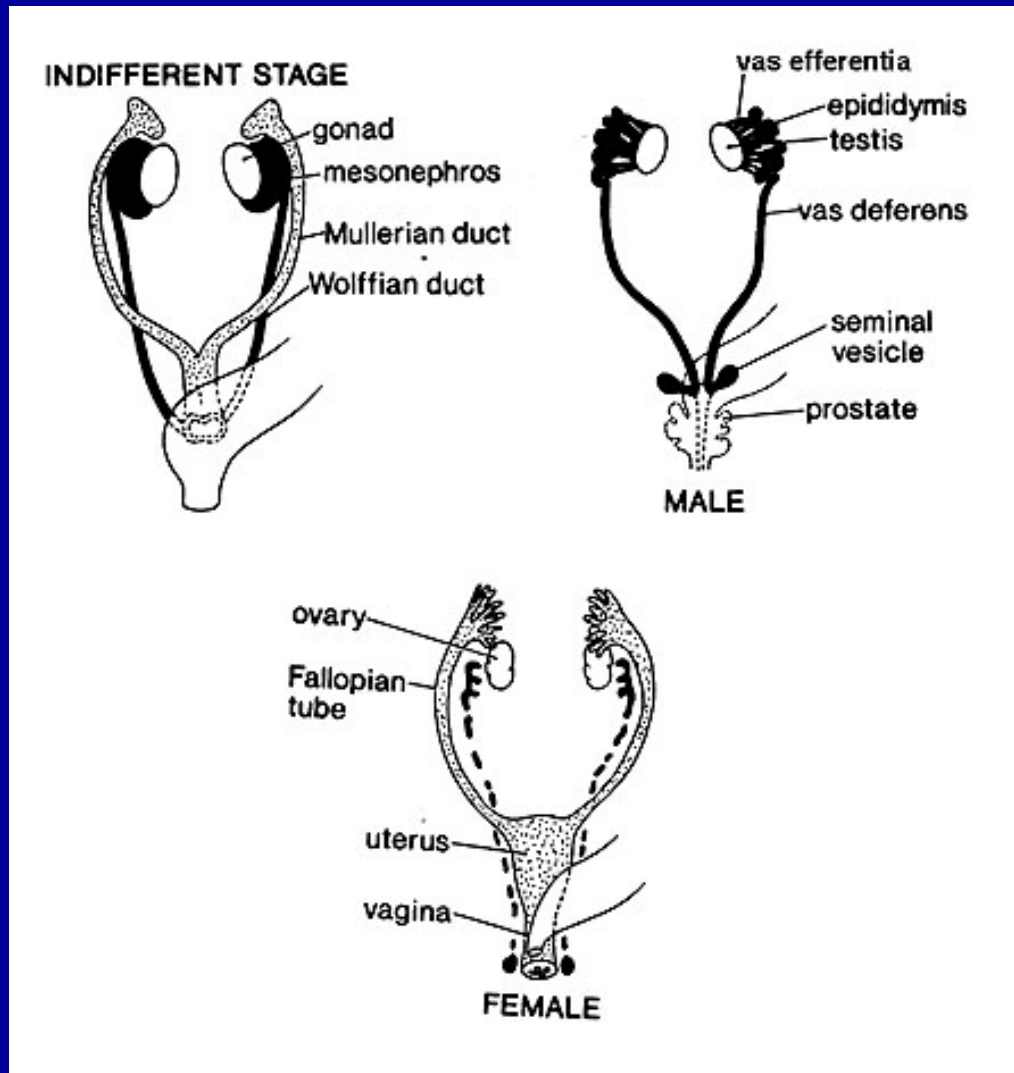


ovary

no hormones



Sexual Differentiation: Internal Organs



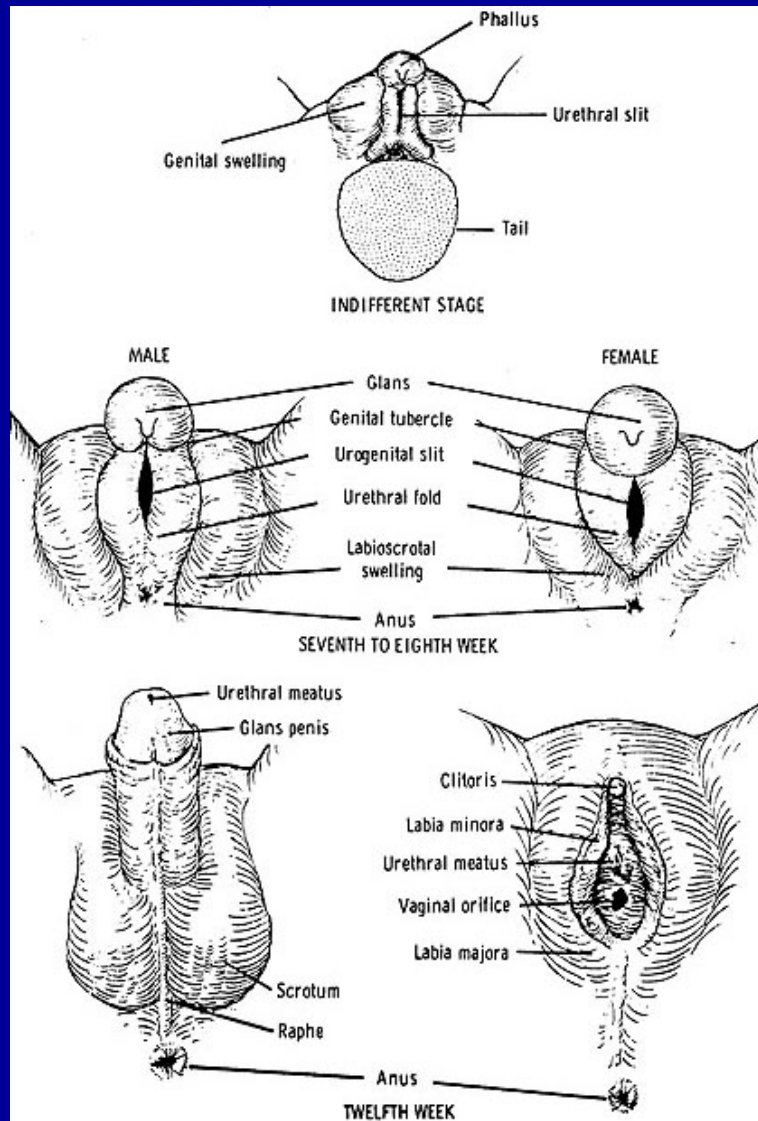
Male

- Testis form at 7 weeks of gestation and secrete:
 - testosterone (T)
 - anti müllerian hormone (AMH).
- Testosterone changes the Wolffian ducts to the vas deferens and the seminal vesicles
- AMH causes Müllerian ducts to degenerate

Female

- Ovaries form after the 2nd month.
- Without T:
 - Wolffian ducts degenerate
 - Müllerian ducts form fallopian tubes, uterus and part of the vagina

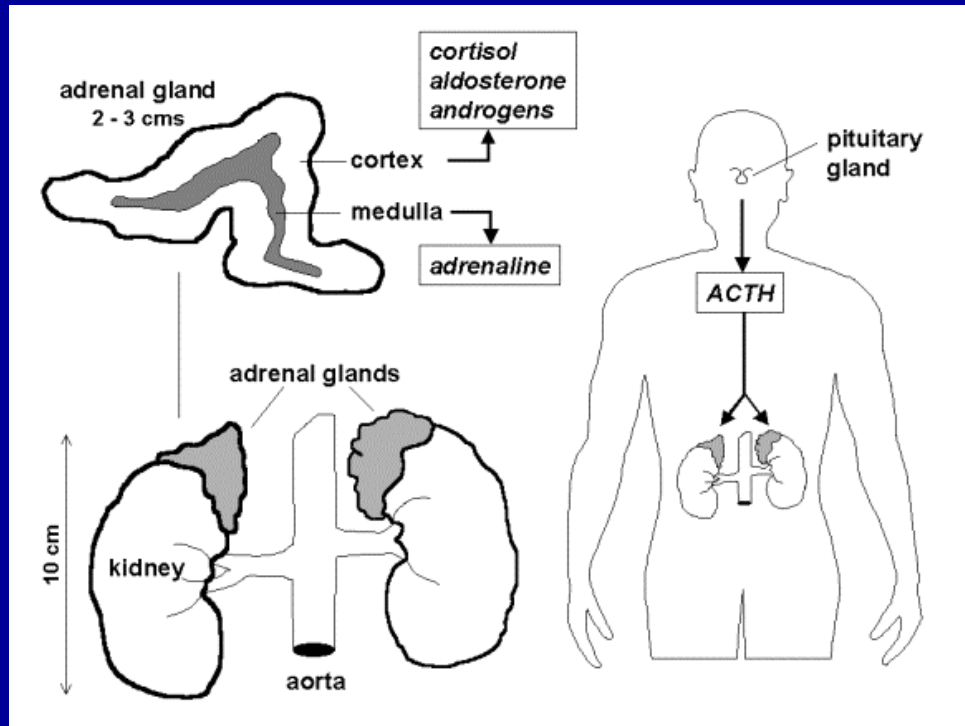
Sexual Differentiation: External Organs



Male:
Dihydrotestosterone, a metabolite of Testosterone causes the fusion of the genital folds forming the penis.

Female:
In the absence of Testosterone genital folds develop into the labial lips and vaginal opening

Congenital Adrenal Hyperplasia

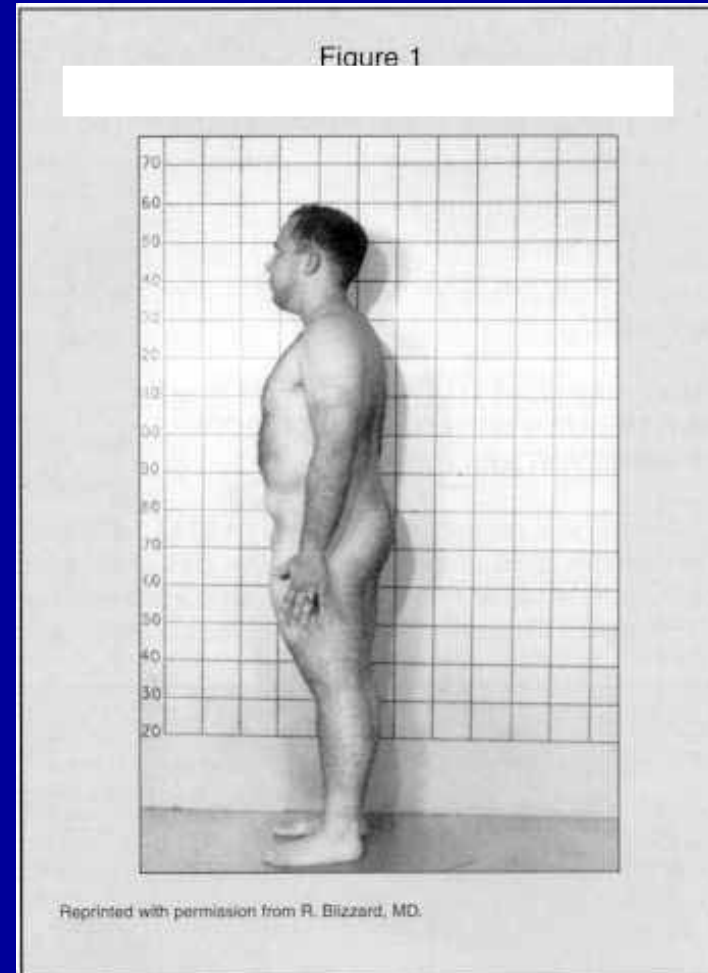


ACTH $\xrightarrow{+}$ Cortisol, (aldosterone, androgens)



- Genetic deficiency in the enzyme 21-hydroxylase decreases cortisol production in the adrenal gland.
- Decreased cortisol production increases ACTH
- Increased ACTH increases the activity of steroid-producing cells of the adrenal cortex.

Which patient suffers from CAH?





Testicular
feminization (tfm)
or androgen
insensitivity
syndrome (AIS)

Genotype XY

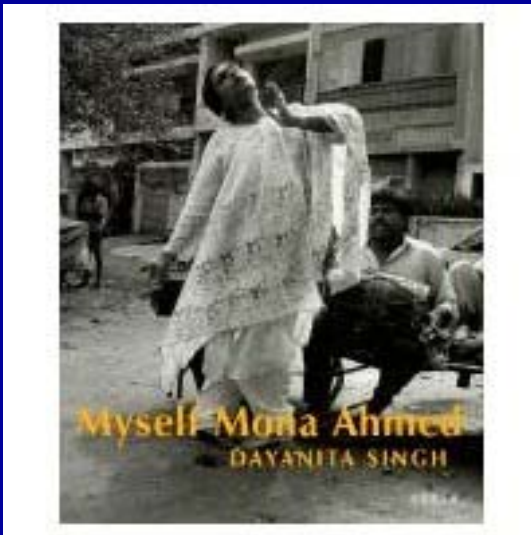
Testicular feminization (tfm) or Androgen Insensitivity Syndrome

- Genetic defects in the androgen receptor
- X-linked trait
- Phenotypic female
- Internal organs:
 - Testis often undescended
 - No seminal vesicles or vas deferens
 - No uterus, fallopian tubes or ovaries.

5 Alpha reductase deficiency

- Genetic deficiency in 5- alpha reductase
- 5- alpha reductase reduces testosterone to dihydrotetosterone
- Phenotype: Internal genitalia - male
External genitalia - female

Third sex



"I am the third sex, not a man trying to be a woman. It is your society's problem that you only recognize two sexes." (Hijra Mona Ahmed to author Dayanita Singh)

Source: wikipedia

How do we know who we are?

QuickTime™ and a
decompressor
are needed to see this picture.

- Anatomical differences occur in every lobe of male and female brains. Jill M. Goldstein of Harvard Medical School and co-workers found that many regions are proportionally larger in females (pink) than in males but that other areas are larger in males (blue).
- Whether the anatomical divergence results in differences in cognitive ability is unknown.

Are sex specific behaviors innate?

Vervet monkeys displayed toy preferences that fit the stereotypes of human boys and girls:

QuickTime™ and a decompressor are needed to see this picture.

- the males (*top photograph*) spent more time in contact with trucks, for example,

- the females (*bottom photograph*) engaged more with dolls (*graphs*).

QuickTime™ and a decompressor are needed to see this picture.

“Such patterns imply that the choices made by human children may stem in part from their neural wiring and not strictly from their upbringing.”

Gender assignment

“Gender identity development is the result of a complex interaction between genes and environment. It is impossible to predict with complete confidence what gender any child will eventually come to identify with. Like all other children, children with DSDs are given an initial gender assignment as boys or girls. But team members should be aware—and advise parents in relevant instances—that children with certain DSDs are more likely than the general population to feel that the gender assignment given to them at birth was incorrect.”

CLINICAL GUIDELINES FOR THE MANAGEMENT OF
DISORDERS OF SEX DEVELOPMENT IN CHILDHOOD
Consortium on the Management of Disorders of Sex Development