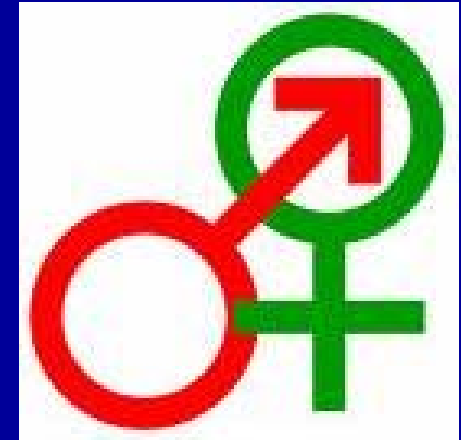


# Sexual Differentiation

Fall 2007

Bios 90/95

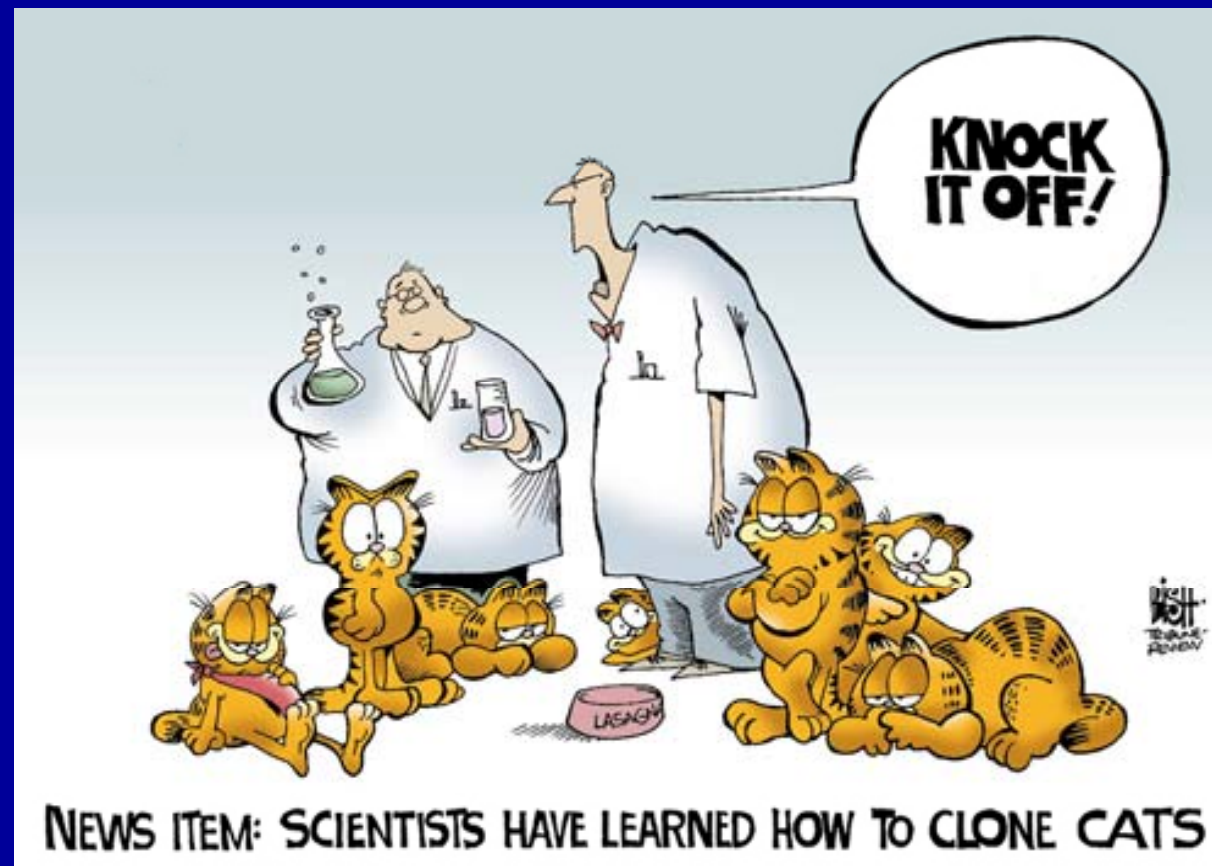


Jennifer Swann, PhD

Dept Biol Sci, Lehigh University



# 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...?

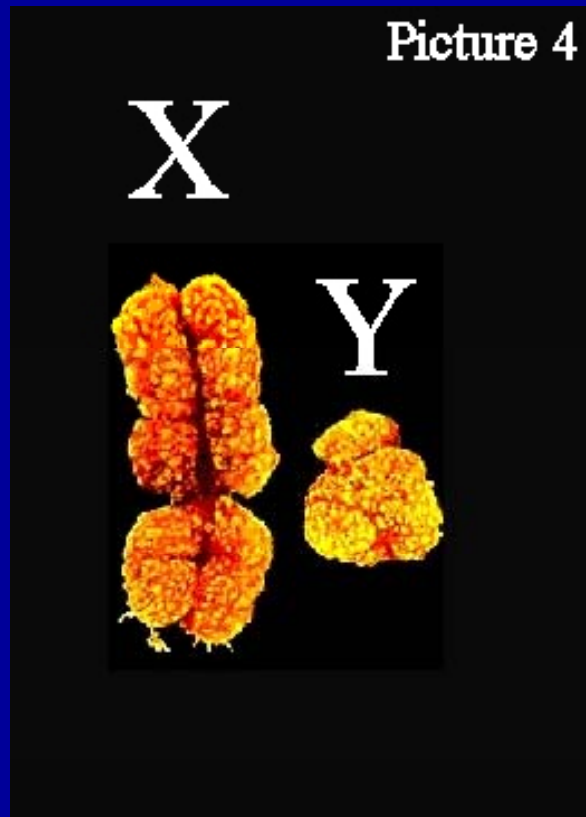
# Or Genotype?



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

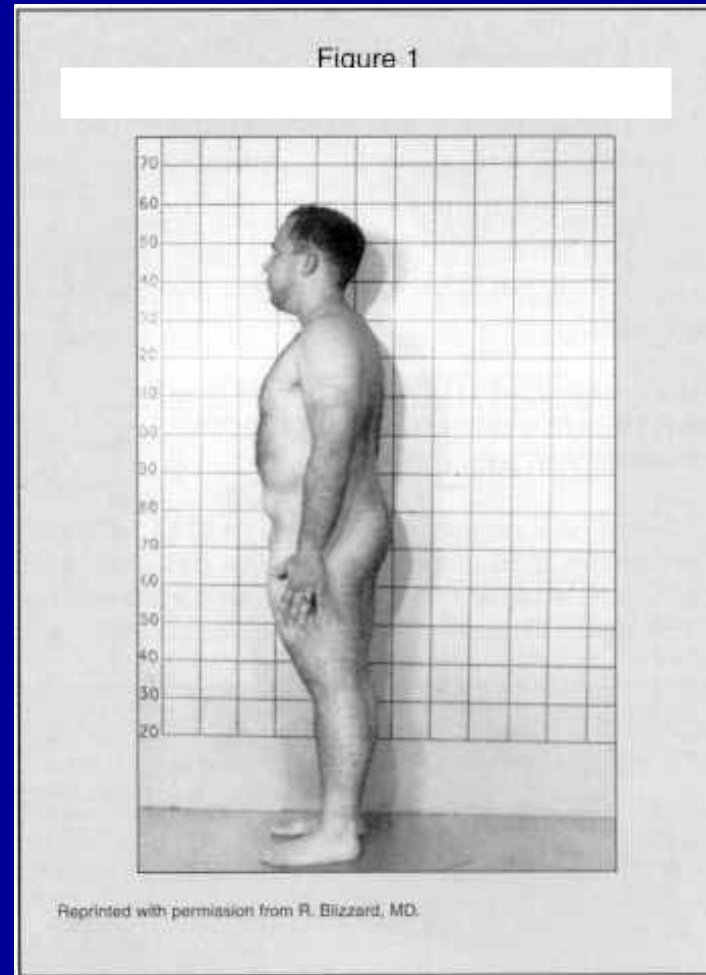


- Women have 2 X
- Men have X and Y
- Men and women differ by about 1% of their genetic make up

# Does Genotype alone confer Phenotype?



Genotype XY



Genotype XX

# Genes regulate hormones: hormones regulate differentiation



XY

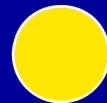


testis

*Testosterone*



XX



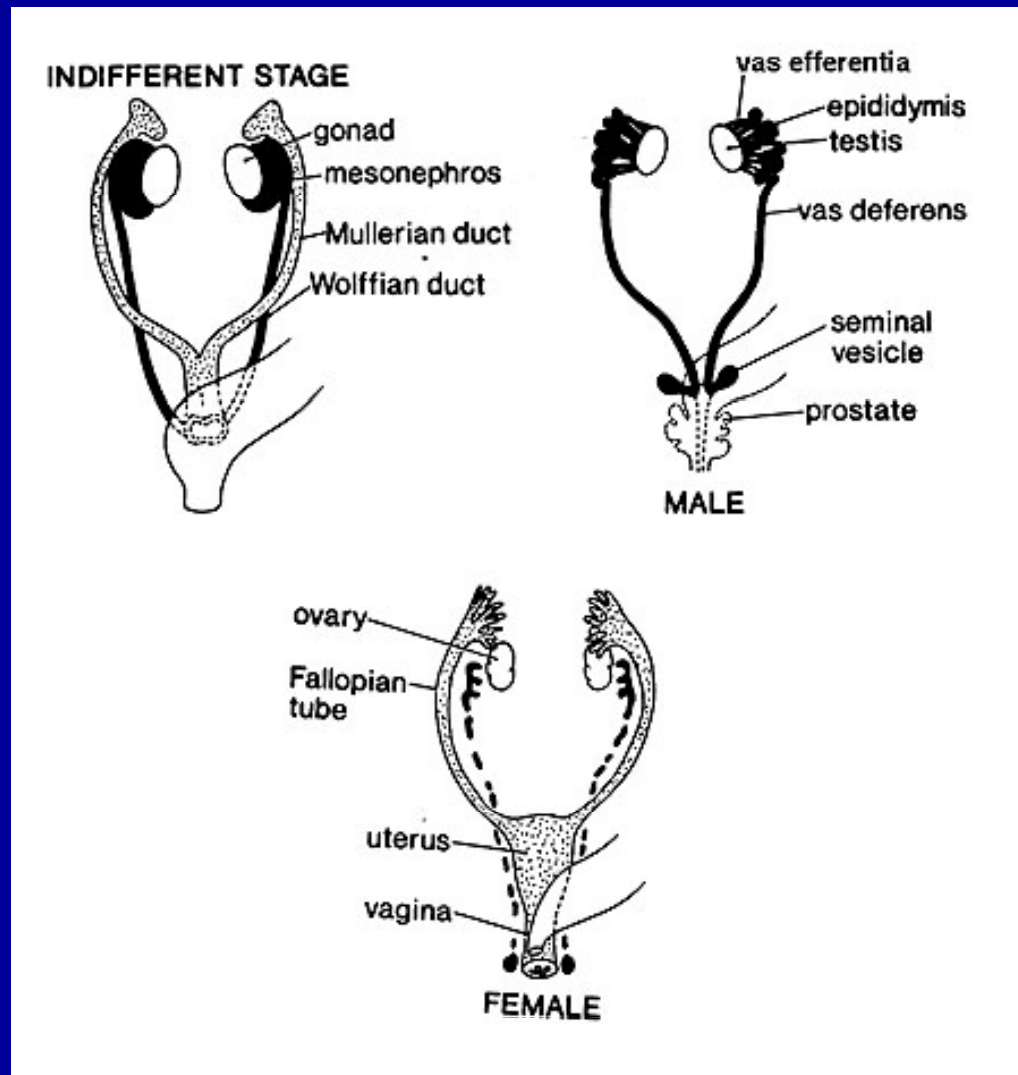
ovary

*no hormones*





# Sexual Differentiation: Internal Organs



## Male

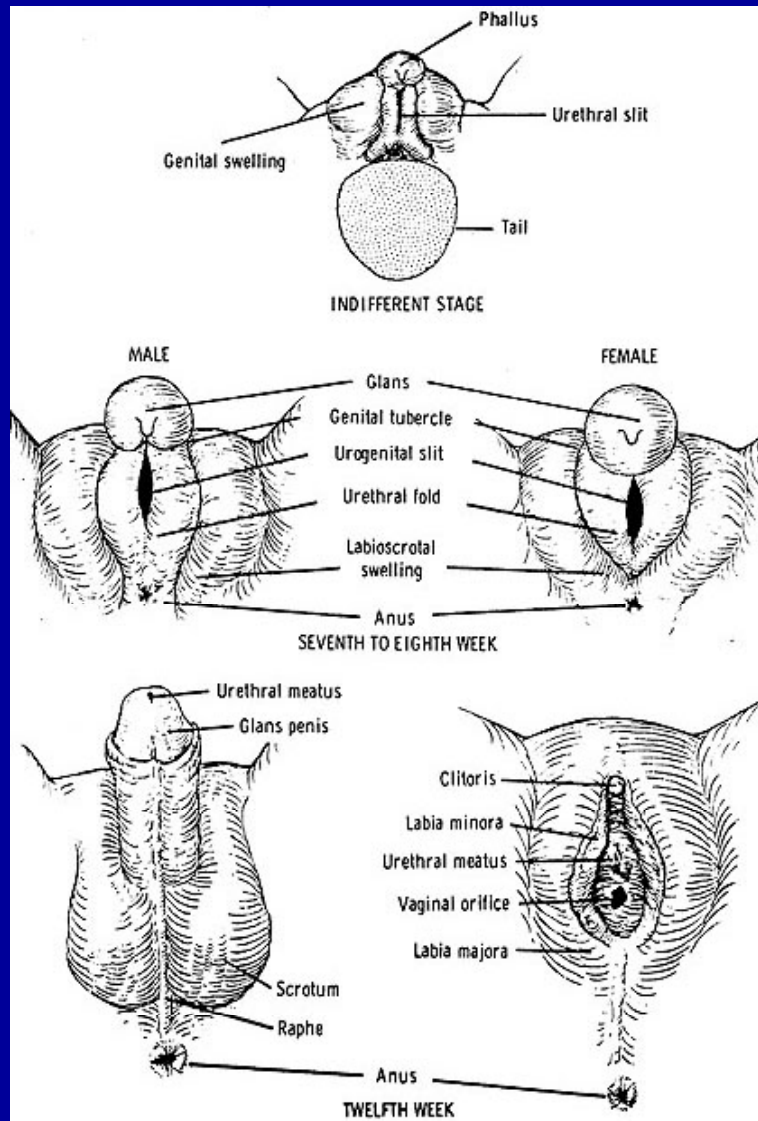
- Testis form at 7 weeks of gestation and secrete testosterone (T) and anti müllerian hormone (AMH).
- In response to T the Wolffian ducts become the vas deferens and the seminal vesicles
- In response to AMH the müllerian ducts degenerate

## Female

- Ovaries form after the 2nd month.
- In the absence of testis:

the Wolffian ducts degenerate and the müllerian ducts form the fallopian tubes uterus and part of the vagina

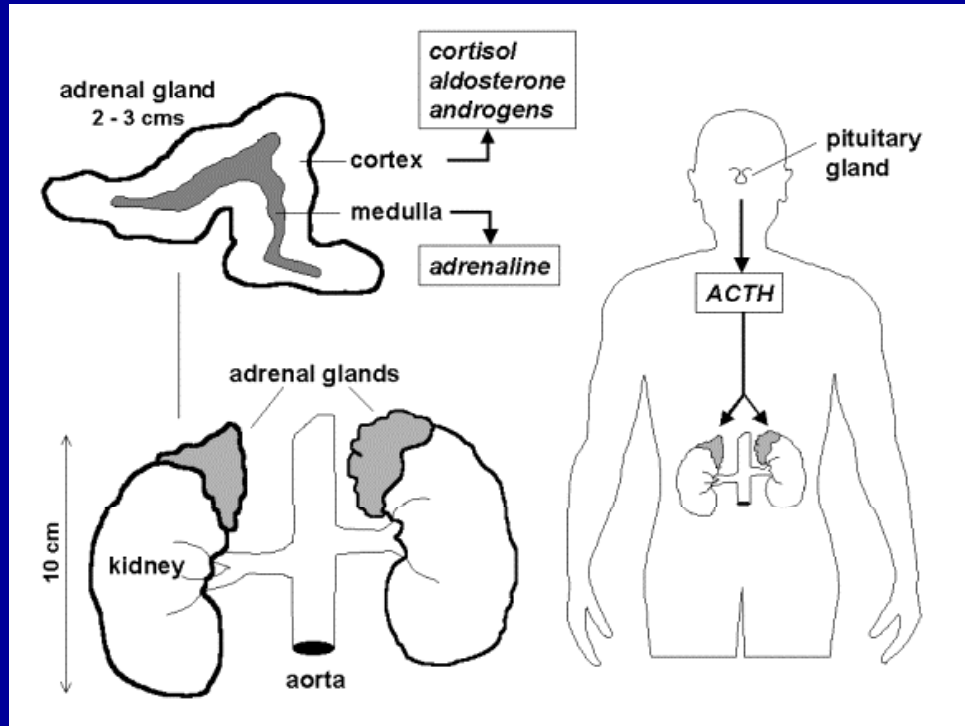
# Sexual Differentiation: External Organs



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

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

# Congenital Adrenal Hyperplasia



- Caused by a genetic deficiency in the enzyme 21-hydroxylase which produces cortisol in the adrenal gland.

- Production begins in the 2nd month of gestation

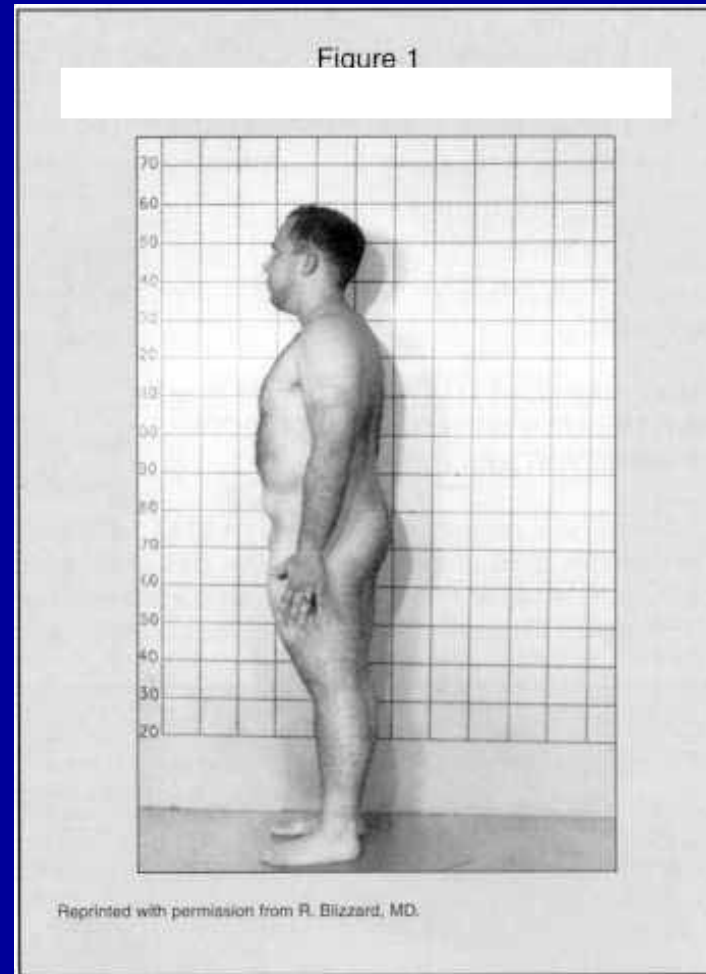
- Decreased cortisol production increases ACTH

- Increased ACTH increases the activity of steroid-producing cells of the adrenal cortex.

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



# Which patient suffers from CAH?





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

Genotype XY

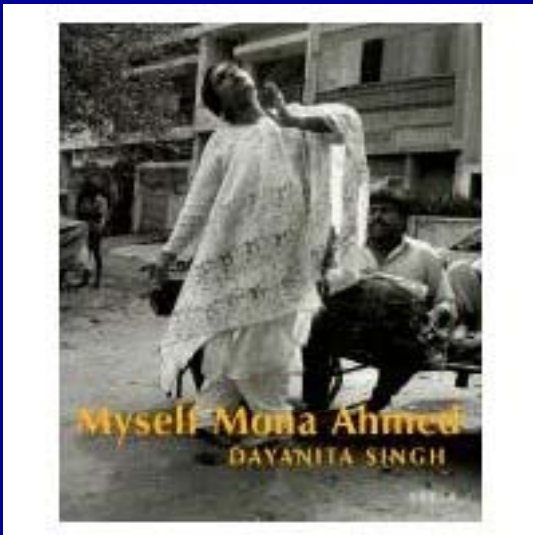
# Testicular feminization (tfm) or Androgen Insensitivity Syndrome

- 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: wikipedi



# 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