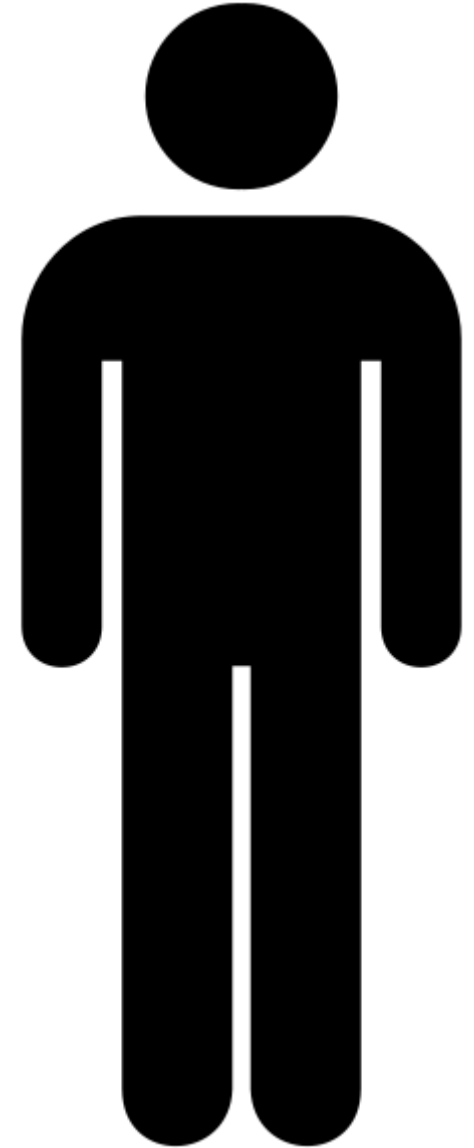


Lecture 6



Sex
Determination

These are the core content for the whole week (you already have these in your course book, and on LEARN).

Lecture 6

WEEK 2 – From conception to birth

Describe the formation and structure of human gametes and the process of fertilization.

Describe the main methods of assisted conception.

Describe the processes of normal human development *in utero*, including, cleavage, compaction, blastula formation, implantation, gastrulation, neurulation and early organogenesis.

Describe the mechanisms that give rise to unusual features or abnormalities of human development, including twinning (incl. conjoined and transfusion syndrome), axis duplications, spina bifida, anencephaly, fetus in fetu, cleft palate, phocomelia and intersex phenotypes.

The embryos of males and females begin developing the same way, making the foundations for both sexes.

By the time they start making gonads, they have to decide.

Your gonads developed in the trunk of your body, about half way between shoulder and pelvis (whichever sex you are).

This makes sense if you consider where they still are in a fish

testis

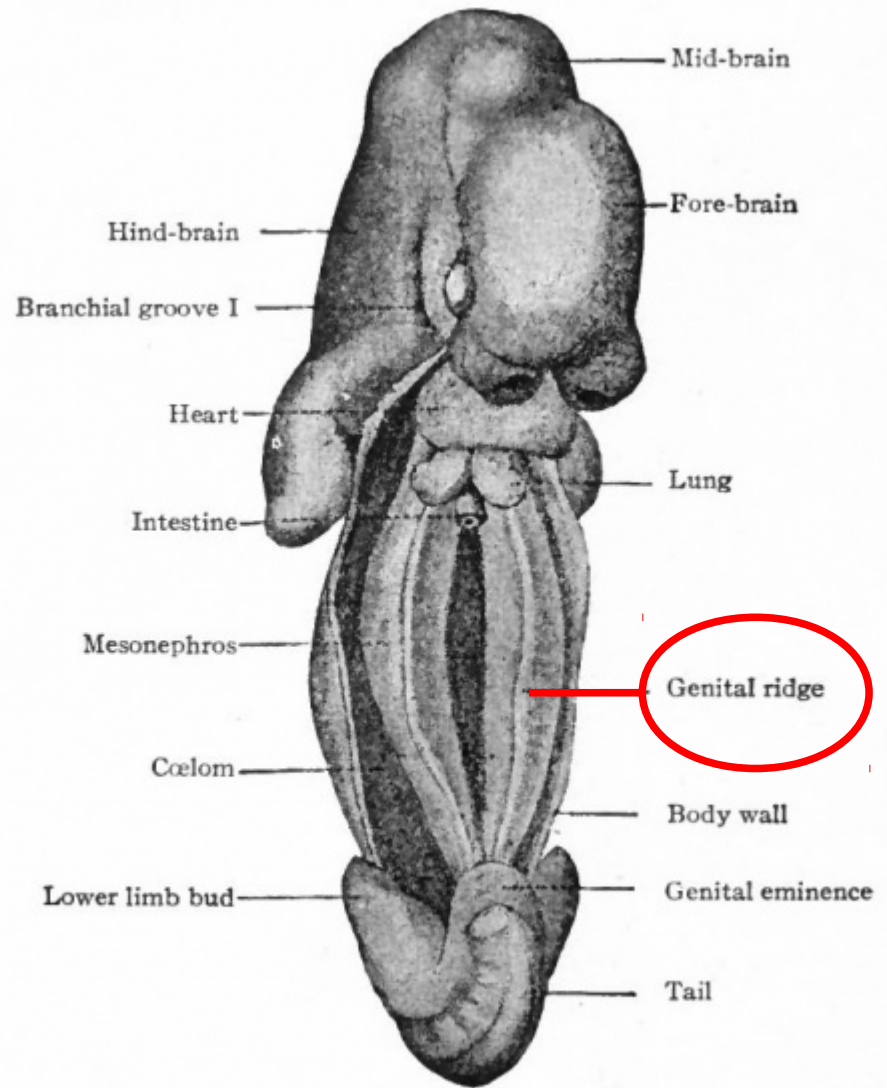
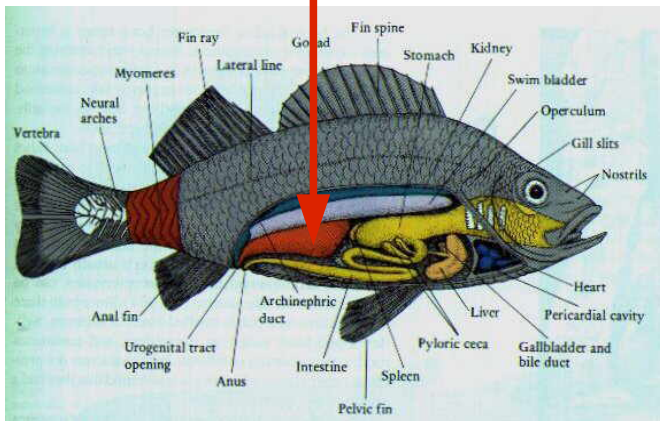
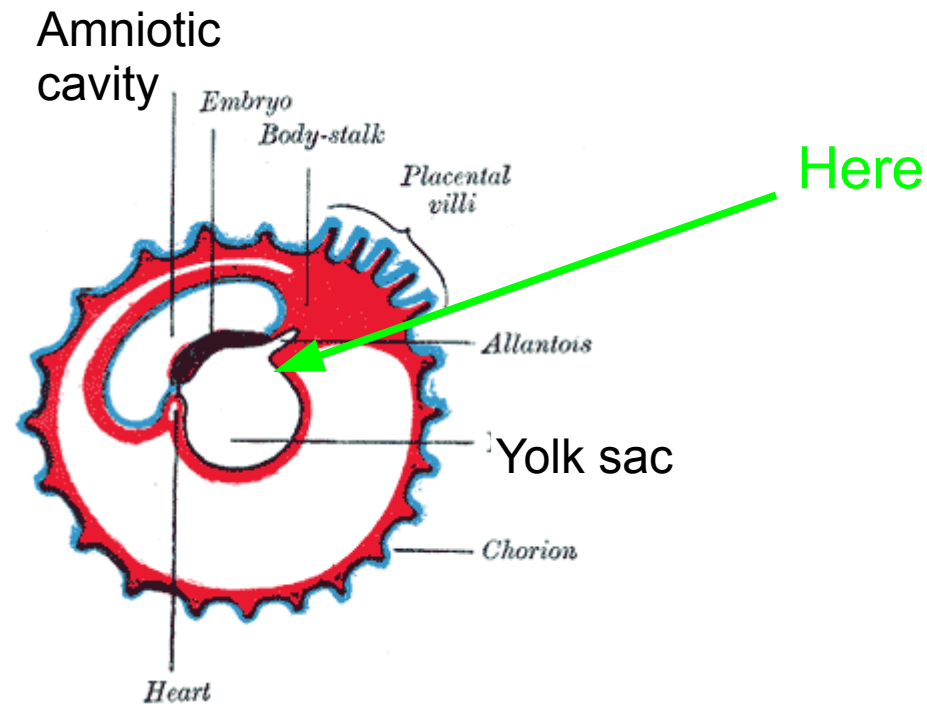
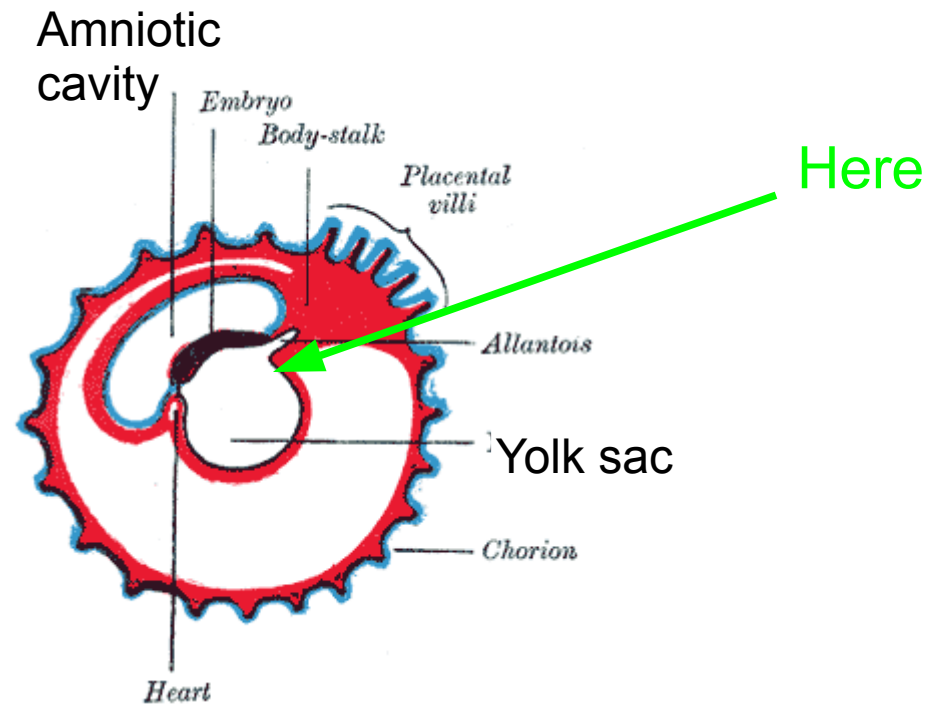


FIG. 308.—Human embryo of 5 weeks. The ventral body wall has been removed to disclose the mesonephroi. *Kollmann.*

The germ line comes from epiblast cells that were
NOT INCLUDED in gastrulation.
It therefore ends up outside the body, in the yolk sac.



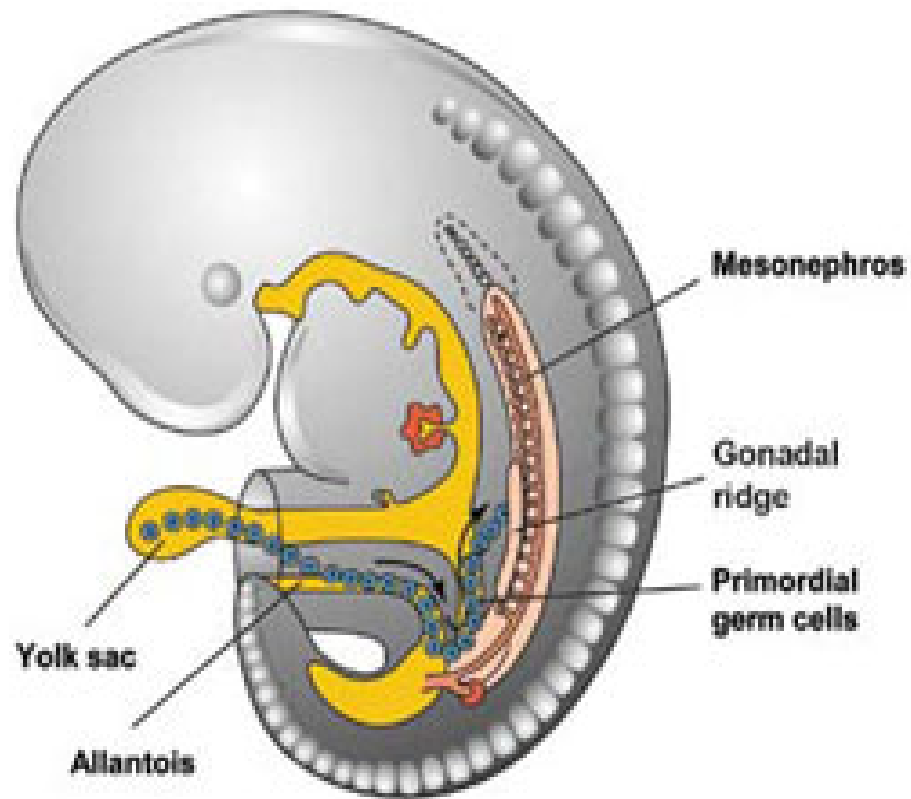
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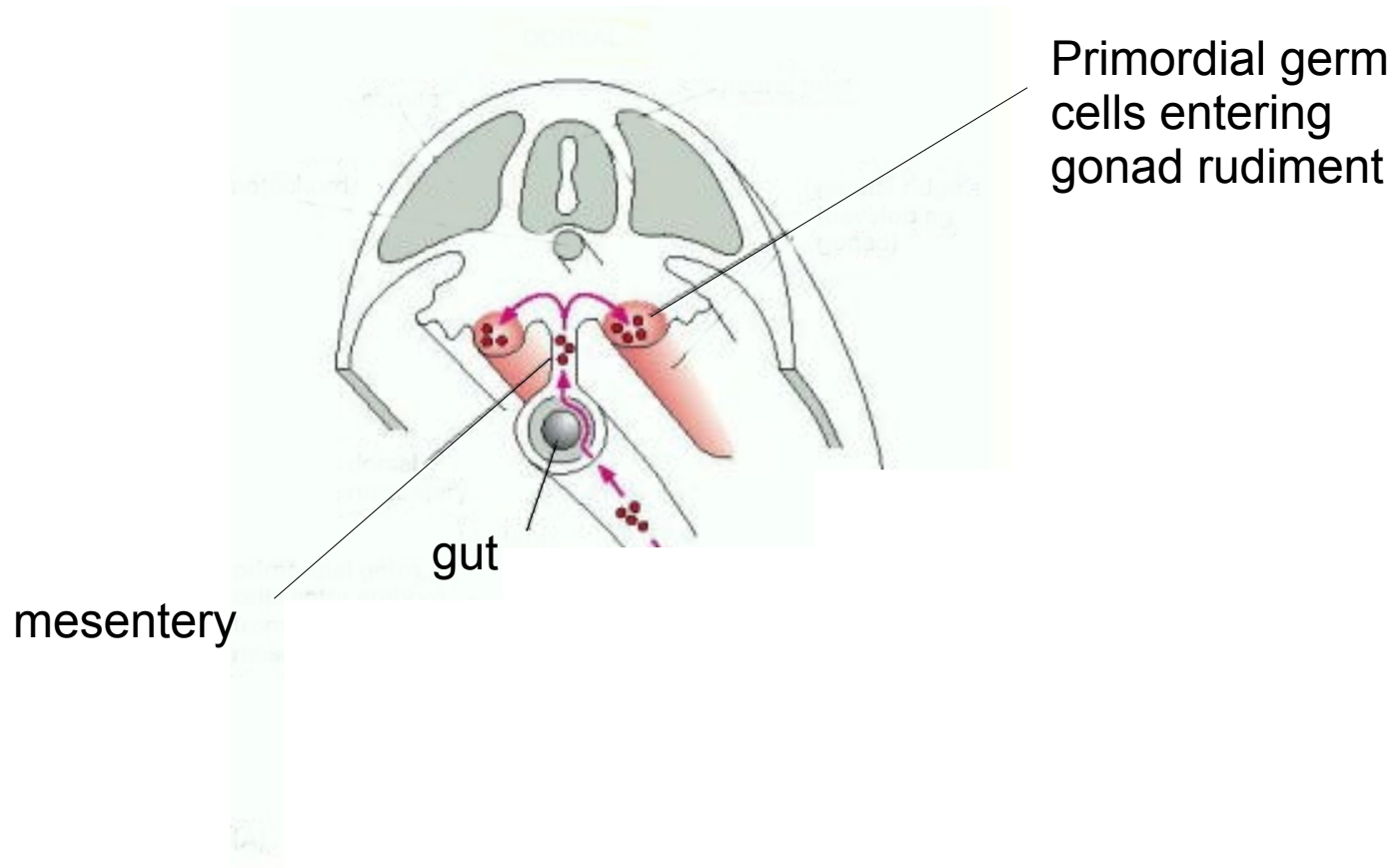
This is a problem, because obviously the germ line needs to be in the gonads.

The primordial germ cells use this connection, and the gut and its mesentery, as a way to invade the body;

(the sheet-like connection between gut and the rest of the body)

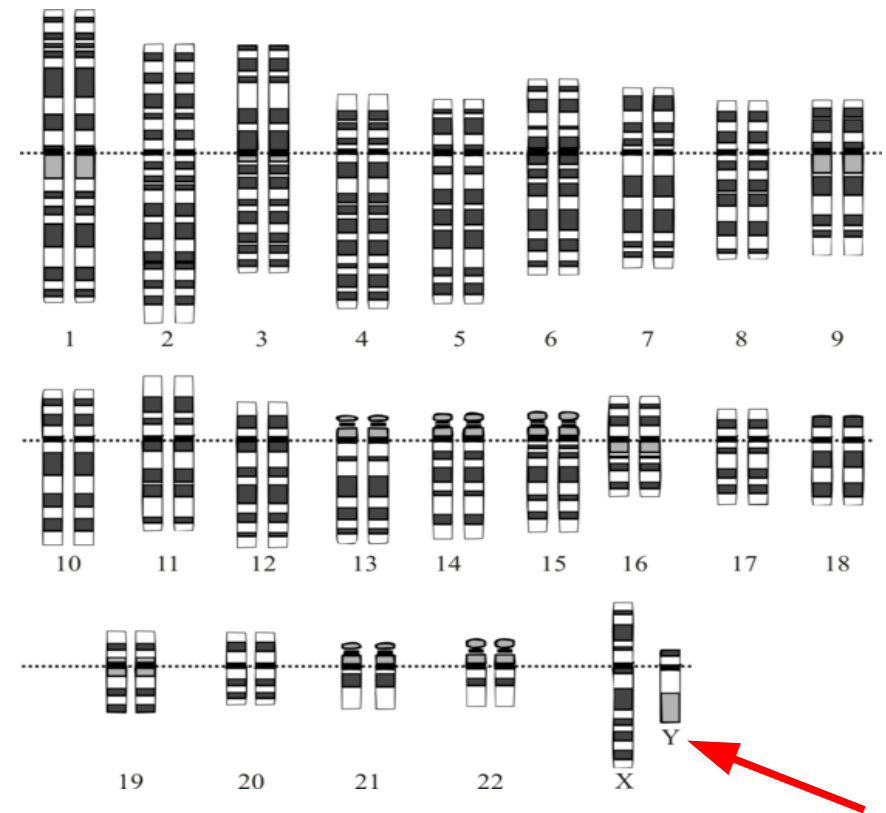
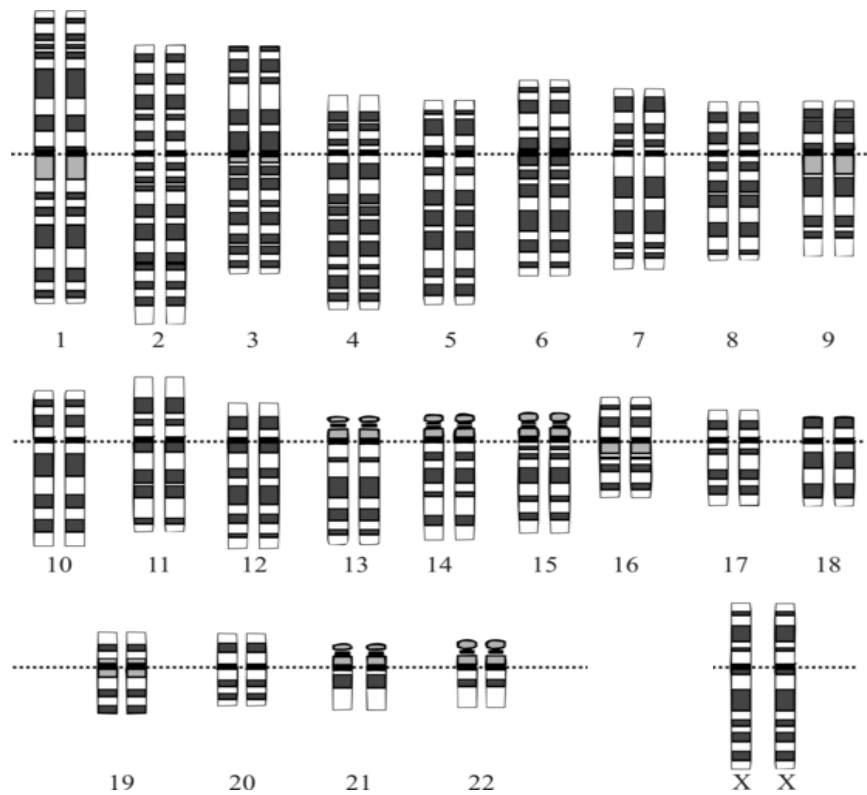


When they reach the level of the developing gonads, they move up the mesentery and then move across to enter the gonads themselves:



Around this time, the gonad has to make a decision about whether to develop into a testis or an ovary

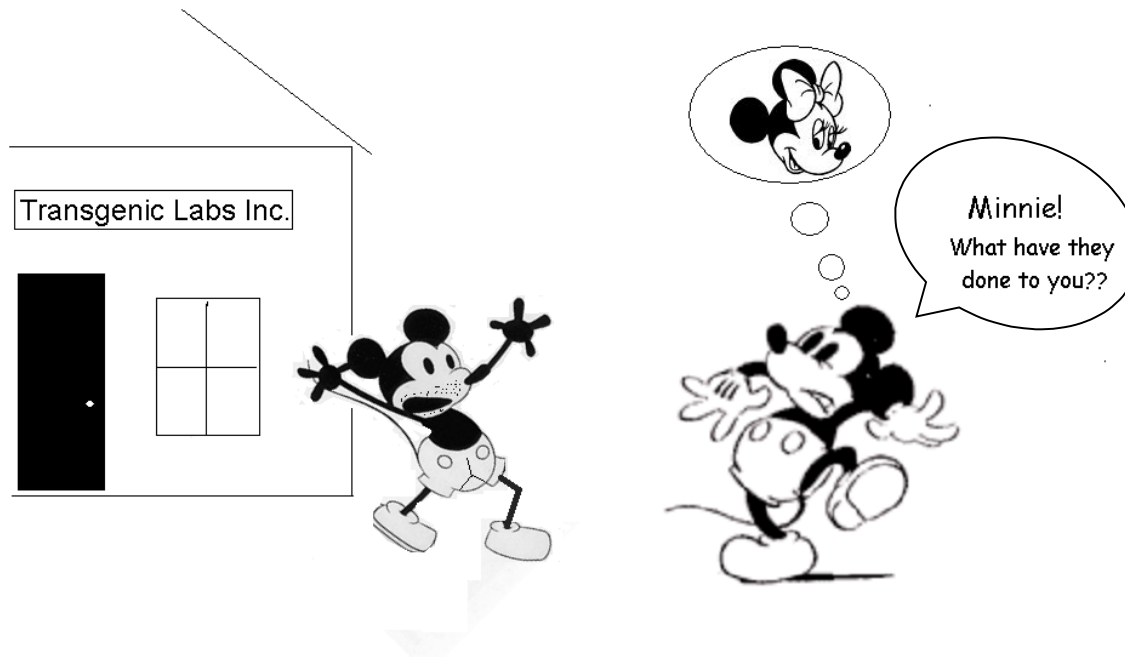
Males and females have a different chromosome constitution;



A gene on the Y chromosome (SRY) determines sex;

If you force an XX mouse to express SRY, by genetic
engineering....

....a male mouse develops



How does SRY act?

- Primitive gonads consist of somatic cells and germ line cells
- *Somatic* cells express SRY (if it is present)
- SRY forces somatic cells to develop into testis cells (otherwise they form ovary cells).

In Eutherian Mammals*, the rest of the body pays no attention at all to whether it has a Y chromosome.

It has to take its cue from the testis

The testis communicates with the rest of the body by excreting androgenic hormones.

* in many other animal types, even birds, body cells make their own decisions about male-female according to their chromosomes. In yet other types (Alligators), everything is decided by environmental temperature.

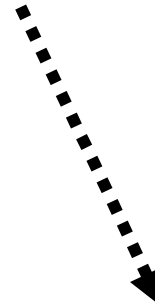
'Indifferent'
Gonad



Testosterone +
AMH production



Indifferent soma



Female

Male

“default” / “natural” state
(see feedback exercise)

Image from *The Creation of Adam*
(Michelangelo)

The most obvious somatic differences are in the reproductive system itself:

Mullerian ducts make oviducts, uterus, cervix uteri and upper vagina

Wolffian ducts disappear

Cloaca makes lower vagina (see year 2)

Phallus develops into clitoris

Labioscrotal folds remain separate and develop into labia

Gonads remain internal

Mullerian ducts disappear (AMH = anti-Mullerian hormone)

Wolffian ducts become vas deferens

Cloaca does not become vagina

Phallus develops into penis

Labioscrotal folds fuse to become scrotum

Gonads descend into scrotum

You do not need to know the details of genital formation until year 2: I just mention the above so that you can see how many differences there are.

Sexual dimorphism in humans:

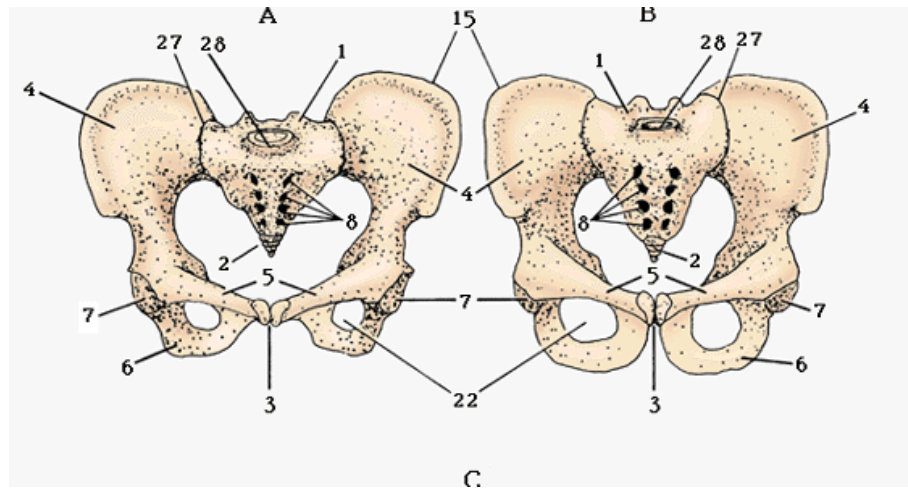
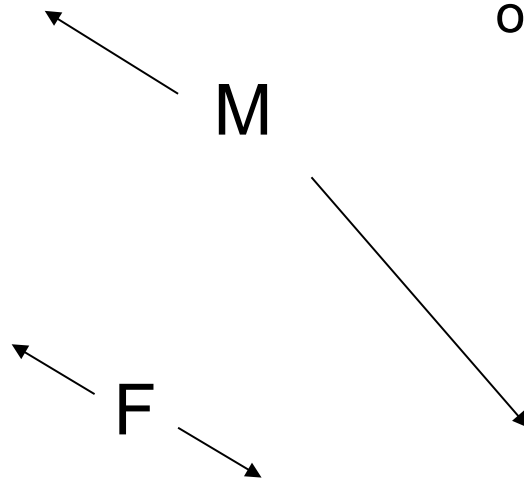


Externally obvious differences in:

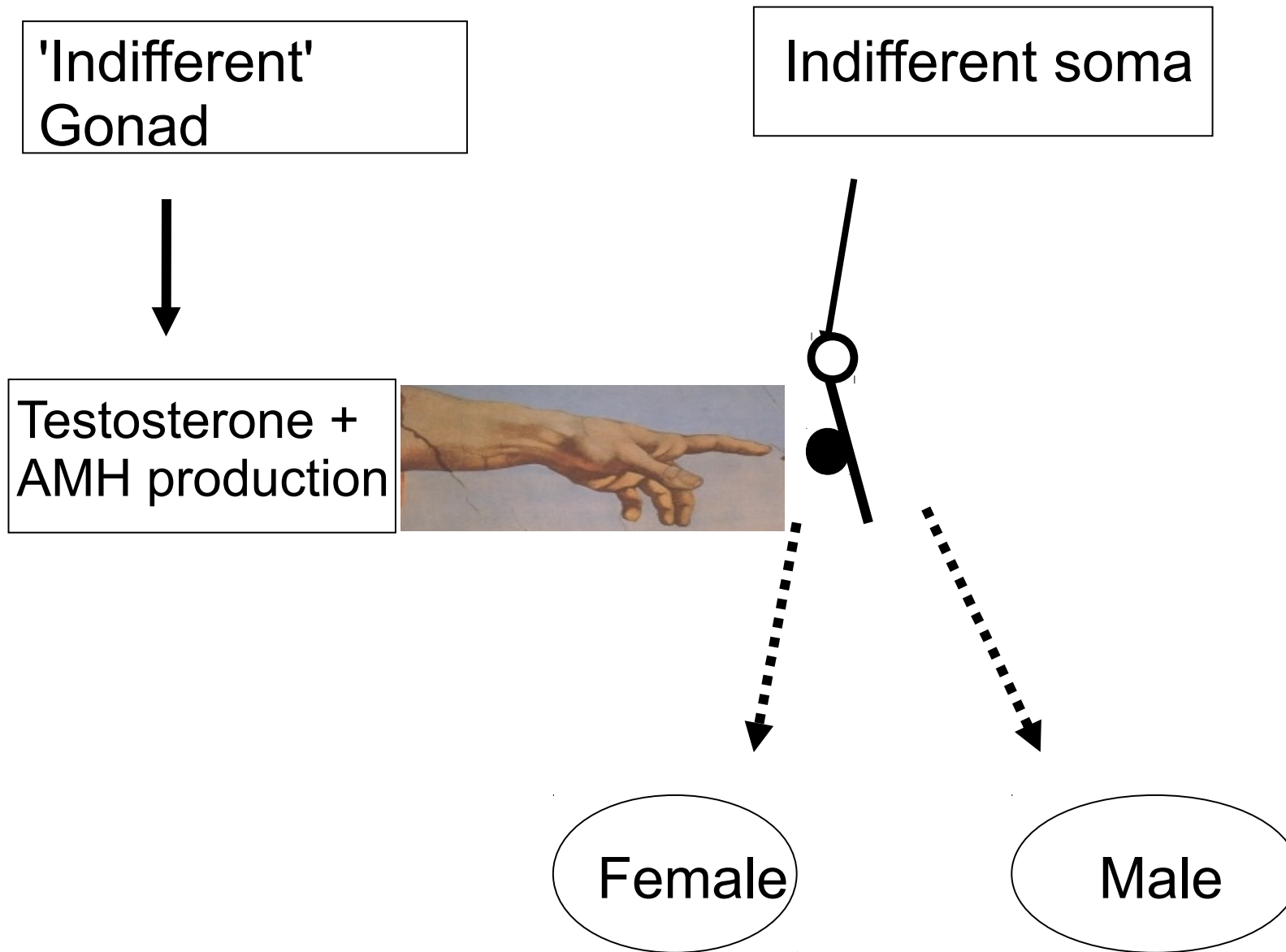
- * *average* height & mass
- * body shape
- * development of external genitalia
- * development of mammary glands
- * body hair pattern (extent varies with race)

Sexual dimorphism in humans:

Also brain, although it is difficult to research this without attracting masses of protest from some group or other.



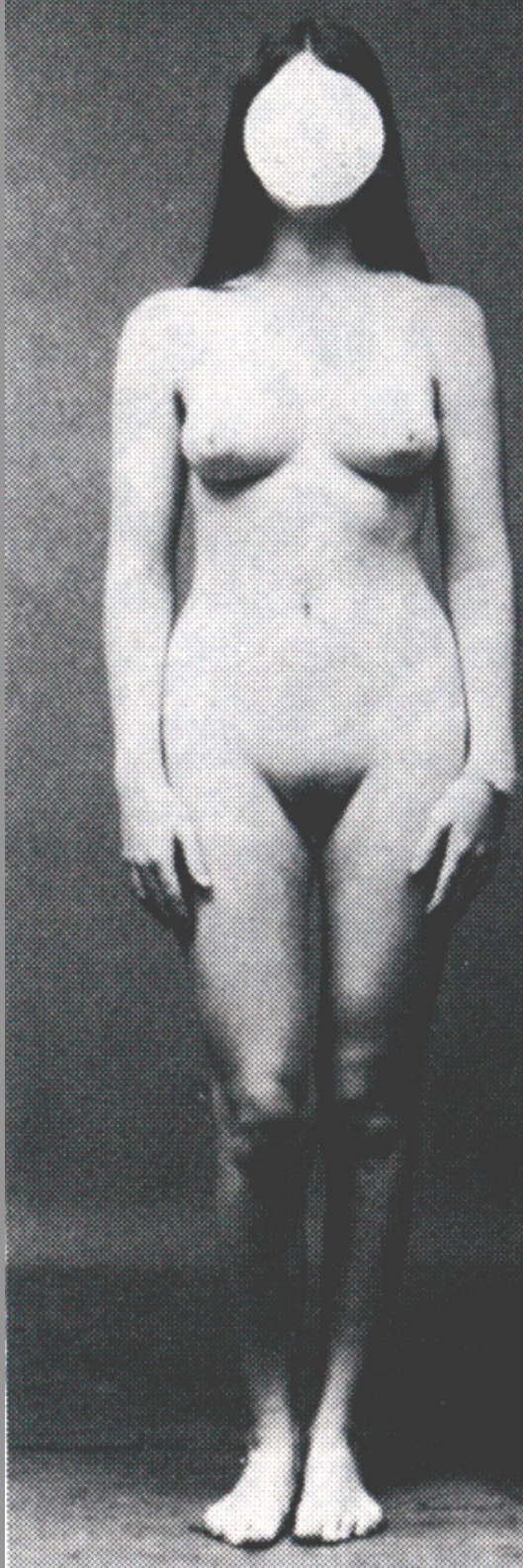
What if this system does not work properly?



“default” / “natural” state
(see feedback exercise)

Image from *The Creation of Adam*
(Michelangelo)

**Complete
Androgen
insensitivity –
this person is
XY.**



*{Face is normal, but
hidden for reasons of
patient privacy}*

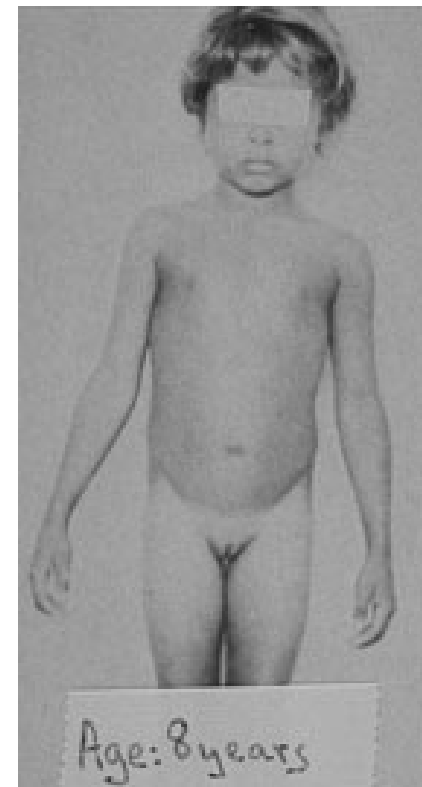


“Women with AIS... who want AIS to be represented by real, proud people instead of stigmatizing pictures where the face has been removed”

Testosterone itself is a relatively weak androgen

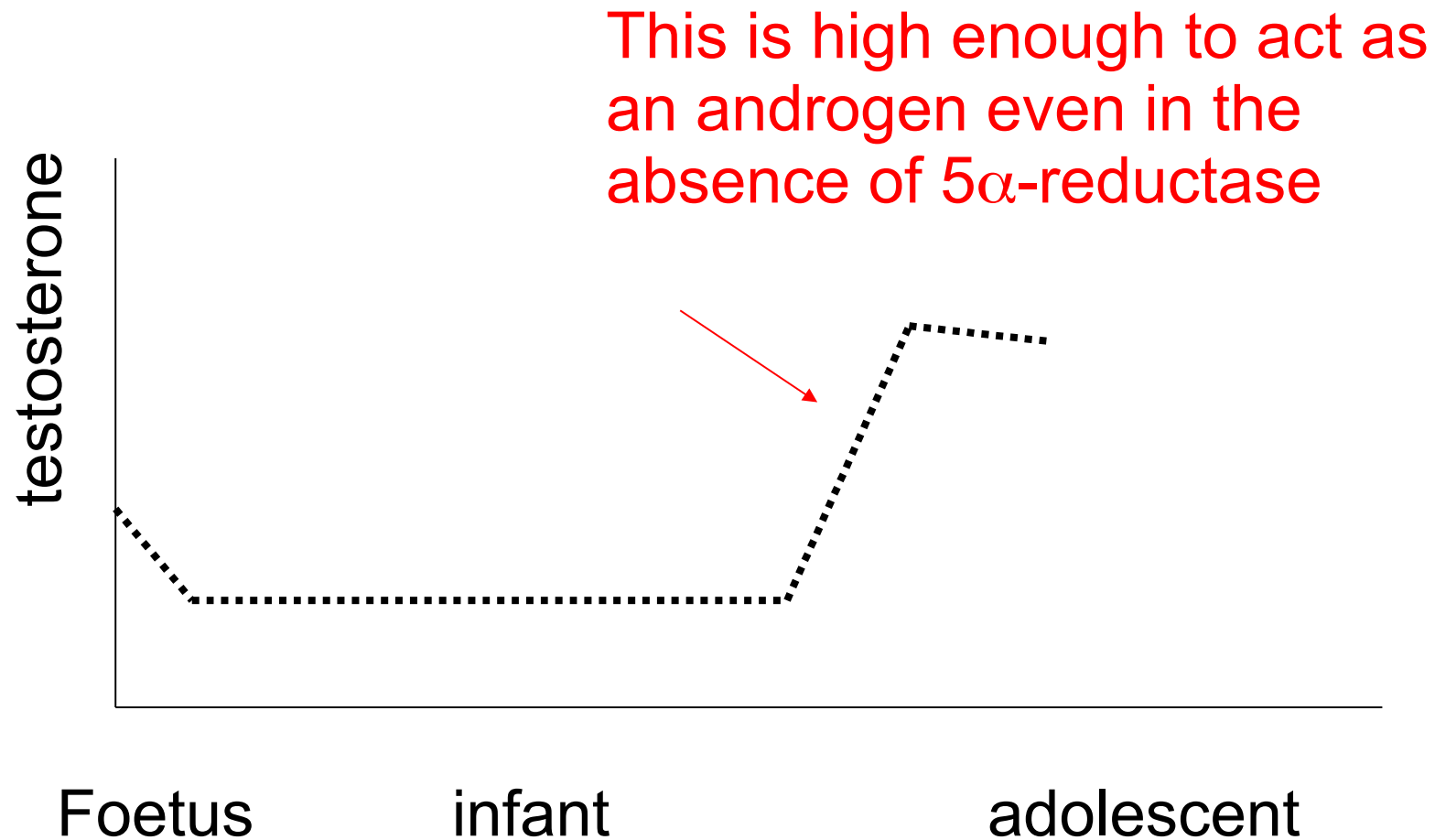
- Testes secrete testosterone. This stimulates androgen receptors only weakly
- Tissues - 5α -reductase converts it to 5α -dihydrotestosterone
- 5α -dihydrotestosterone stimulates androgen receptors strongly

XY children with deficient 5α -reductase ('guevedoces') therefore make female bodies:



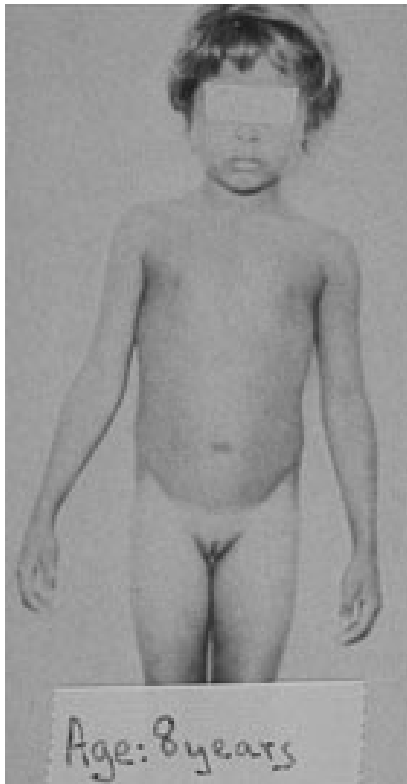
XY – 8 yrs old

Testosterone rises at puberty



Guevedoces:

↑ ↑
'eggs at twelve'



8 years old



19 years old

There is also a vast range of intersex phenotypes

Generally, children born with them are 'corrected' so that they conform with the expectation of belonging clearly to one sex or another.

.... is this ethical?

Slide for LEARN, not in live lecture, and for background only, not for examinable LOs.

There are also people who feel themselves to be a gender other than the one they appear anatomically to be, and some of these people choose to live as the gender they wish to be ('transgender'), with body modifications ranging from none at all, to partial (e.g. hormonally-driven mammary gland development in an XY individual), to as-full-as-is-surgically-possible.

You will meet this whole issue later in your course but, if you want to connect to 'HES' aspects of gender now, you may be interested in a 2014 interview conducted for a San Francisco cable station between the television interviewer, blogger and body freedom activist Gypsy Taub, and a transgender interviewee, Ambrosia. You may find the interview especially informative because;

- 1) Ambrosia is being interviewed primarily because of her involvement in political protests, not because she is transgender, so she is there as an activist not a self-selected 'representative' of the transgender community. She is a 'real person', not the supermodel-type of transgender individual whom the media usually use in interviews (she is also not an experienced interviewee so you will need to be patient with sometimes stumbling language).
- 2) Ambrosia's anatomical gender features are obvious because Gypsy always conducts interviews with everyone naked, herself included, whatever the topic (part of her campaigning strategy against US laws that require people to be clothed in public and against the cultural idea that only some bodies are acceptable).
- 3) Much of what Ambrosia says may surprise you and go against pre-conceptions you may have about the lives of transgender people, their motives, their sexuality, and how they are seen and treated.

You can find the video at <https://archive.org/details/betv-16620ambrosia>. Obviously this features (non-pornographic) nudity so be sensible about where you view it. The questions about being transgender **start at 07:18** and you may want to skip straight to them (the earlier material is about her political activism).

When I mentioned to Gypsy that I wanted to use this interview as background for our MBChB course, I assured her I was confident that you would view it maturely and not abuse the courage of the interviewee by using the video for prurient amusement of your non-medical friends. Please live up to my high opinion of you. In the note she sent back giving her permission for me to draw your attention to the video, she added this message:

..... my very best wishes to your students. Big naked hugs to you all! Gypsy

And the end of all our exploring

Will be to arrive where we started

And know the place for the first time.

TS Elliot, 1942

