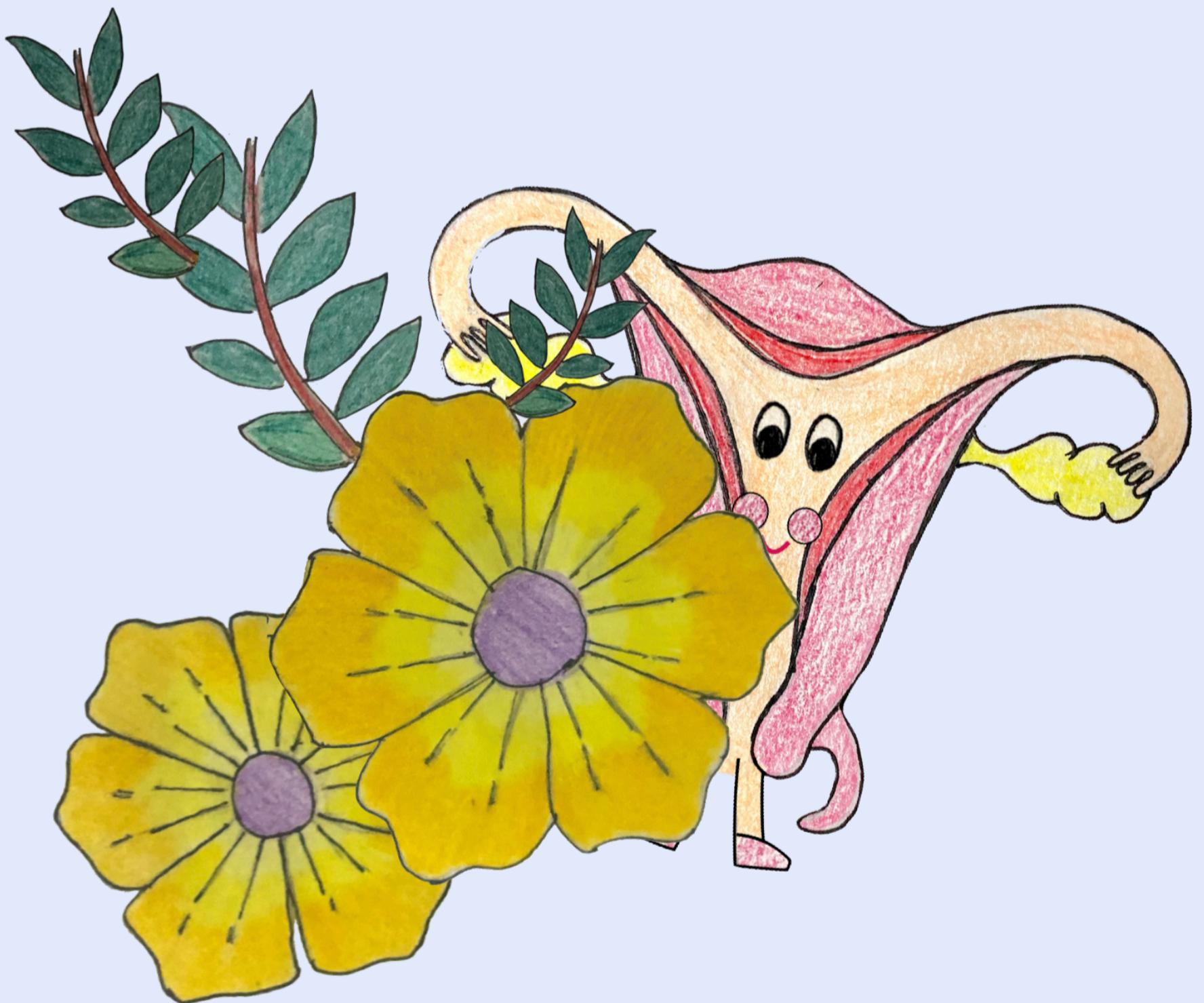


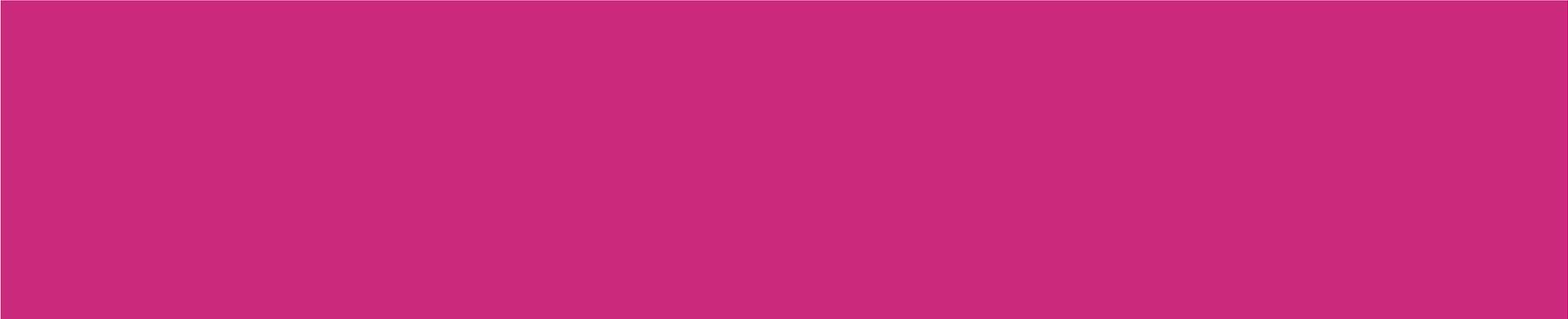
MYS-INFORMATION



Conceptualised, illustrated and written by Anukasha Sisodia, under the guidance of Dr. Fiona Diaz Miranda

Published by Seeds of Awareness





Shame, silence and taboo surround sexual health in India. Cultural myths perpetuated with gender socialisation guide choices of society as well as young people in this backdrop. There is a lack of safe spaces to seek reliable and age appropriate information.

MYS-INFORMATION provides information about the human reproductive system in a fun way to bust myths and know about human sexuality without feeling awkward.

In this edition we will look at the detailed processes of human reproduction, genetics and hormones to bust some popular myths related to gender expression, gender roles, body image and sexual and reproductive health.

In another version, we will discuss the myths in a simpler, less technical manner, to reach a wider audience.

Coming up is a second edition that will bust popular myths about the gender binary, sexual orientations and intersex

Mts-information will soon be available in Hindi and other regional languages.



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1. Reproduction
2. Genetics
3. Hormones

Myths

2. Women are physically weak and delicate
2. Boys are strong, women are weak
3. Only fair and thin is beautiful/handsome
4. Only men have sexual desires, women do not
5. Women are responsible for the sex of the child
6. Women are responsible for the inability to have a child
7. Women are nurturers, men are breadwinners

IT'S TABOO TO TALK ABOUT SEX

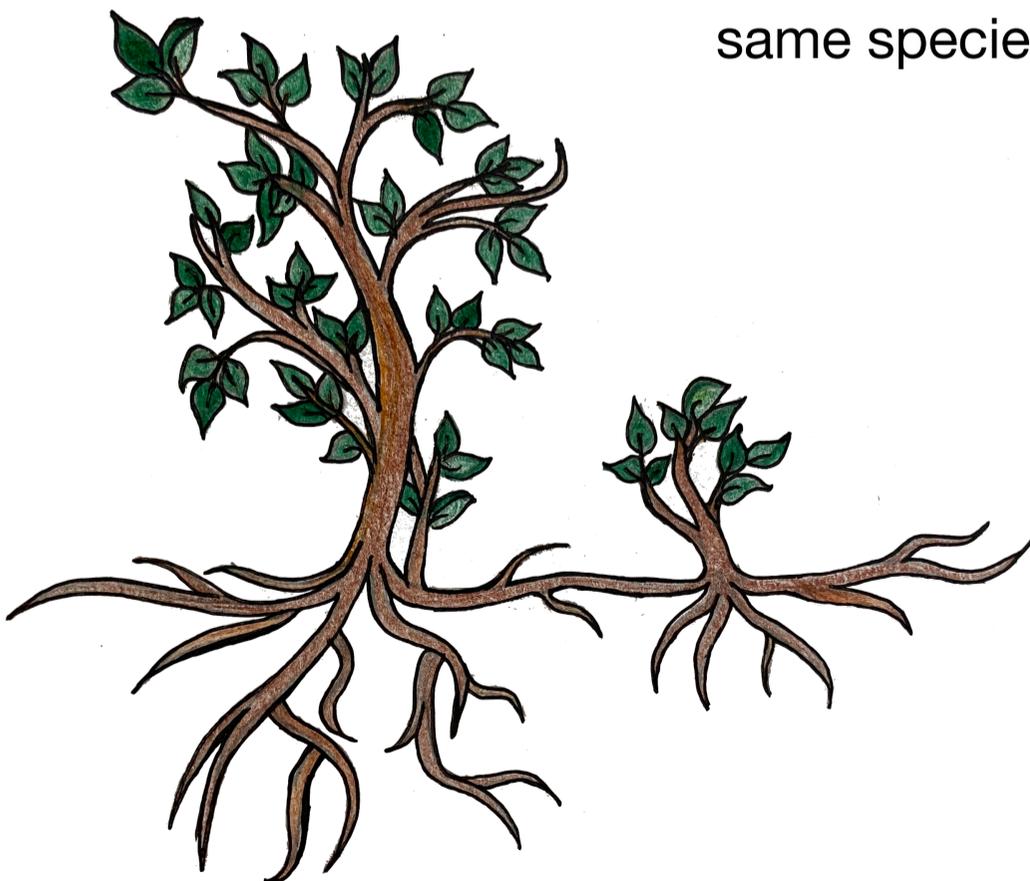
So let's talk about it!

- According to evolutionary purposes, sexual intercourse is a means of reproduction, to ensure the human species does not go extinct
- However, sex is not only a means of reproduction, people can engage in sexual activity for various other reasons as well such as pleasure.

What is reproduction?

In humans, reproduction is the ability of producing children through a sexual process

- Its the ability to produce offspring of the same species



Let's focus on reproduction in humans

First, we have to understand some part of genetics

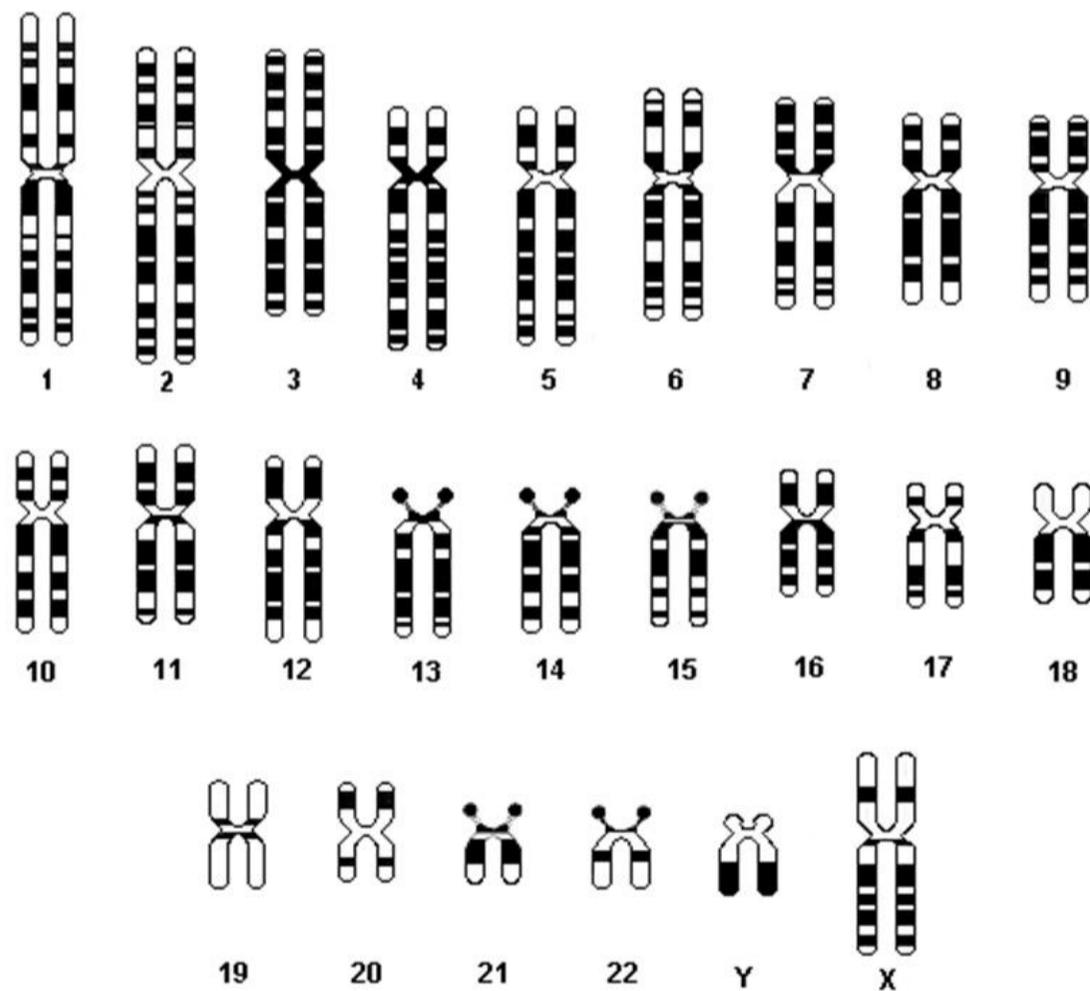
- Humans have 46 chromosomes
- Chromosomes are made up of DNA

Genetic information that is passed on from generation to generation

We have 2 copies of each chromosome

∴ there are 23 types of chromosomes in the human body

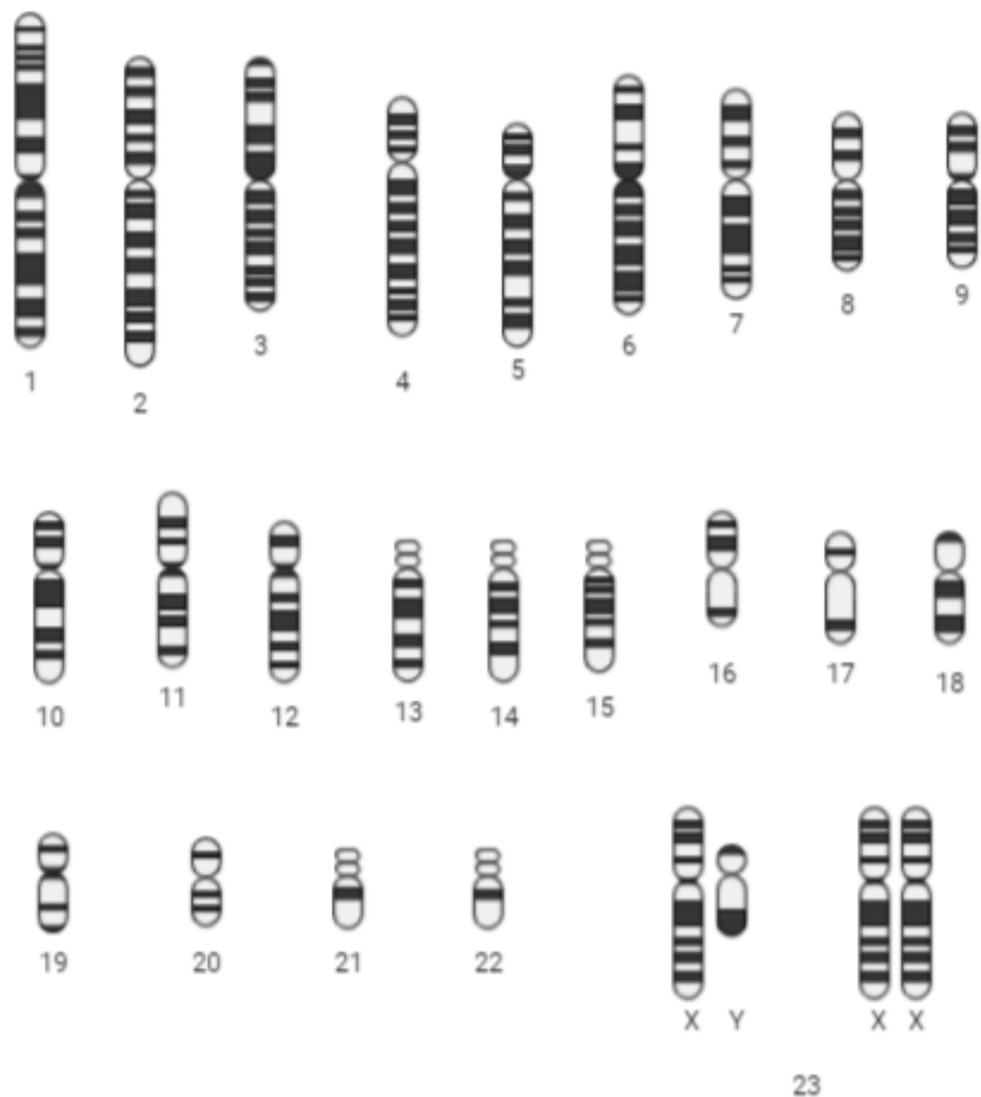
23 chromosomes make one complete set of genetic information



Every cell in our body has 46 chromosomes (2 sets of genetic information)

EXCEPT sex cells

Sex cells have only one set of chromosomes

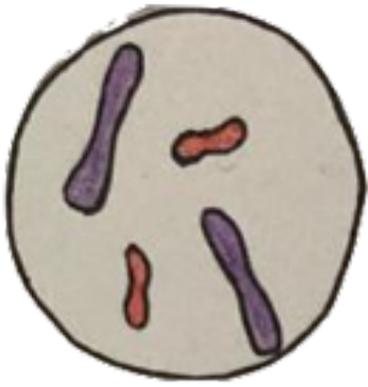


For sex cells to be produced, meiosis must occur

Meiosis is the process of cell division

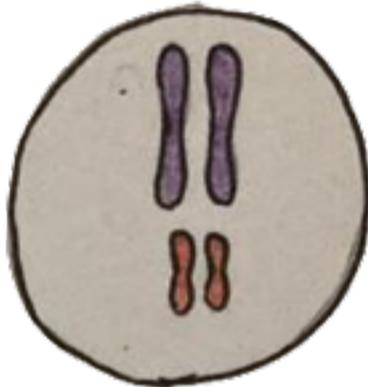
One cell with 46 chromosomes (2 sets of genetic information) produces four cells, with 23 chromosomes each (one set of genetic information)

1.



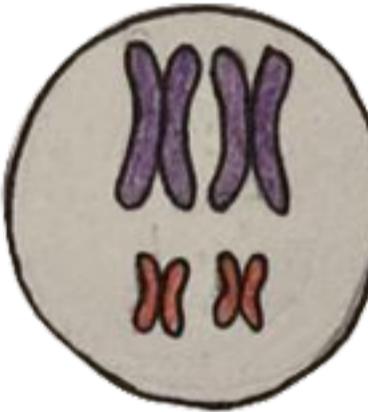
We are going to draw only 2 pairs (4 chromosomes) in the cell to simplify it

2.



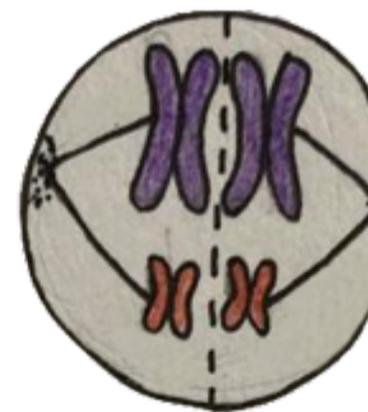
The 46 chromosomes pair up into their 23 pairs

3.



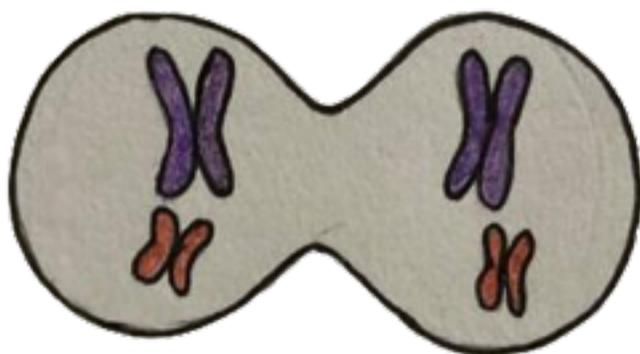
Each chromosome makes a copy of itself, called sister chromatids

4.



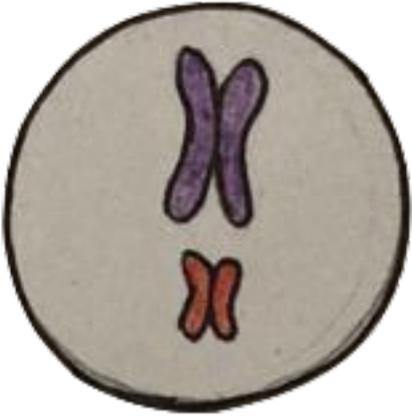
The 23 pairs of chromosomes separate, and the cell divides in the centre

5.



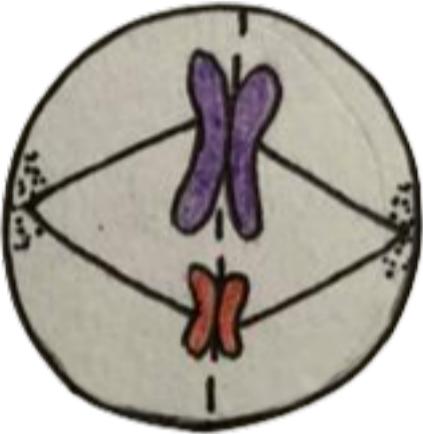
This process produces 2 cells, each with only 23 chromosomes that each have a sister chromatid

6.



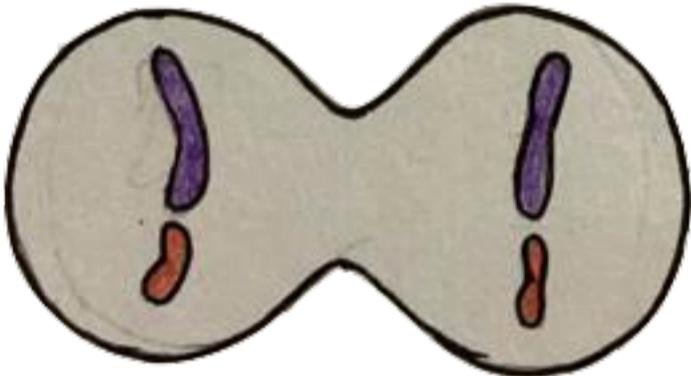
Next the sister chromatids separate in both cells

7.



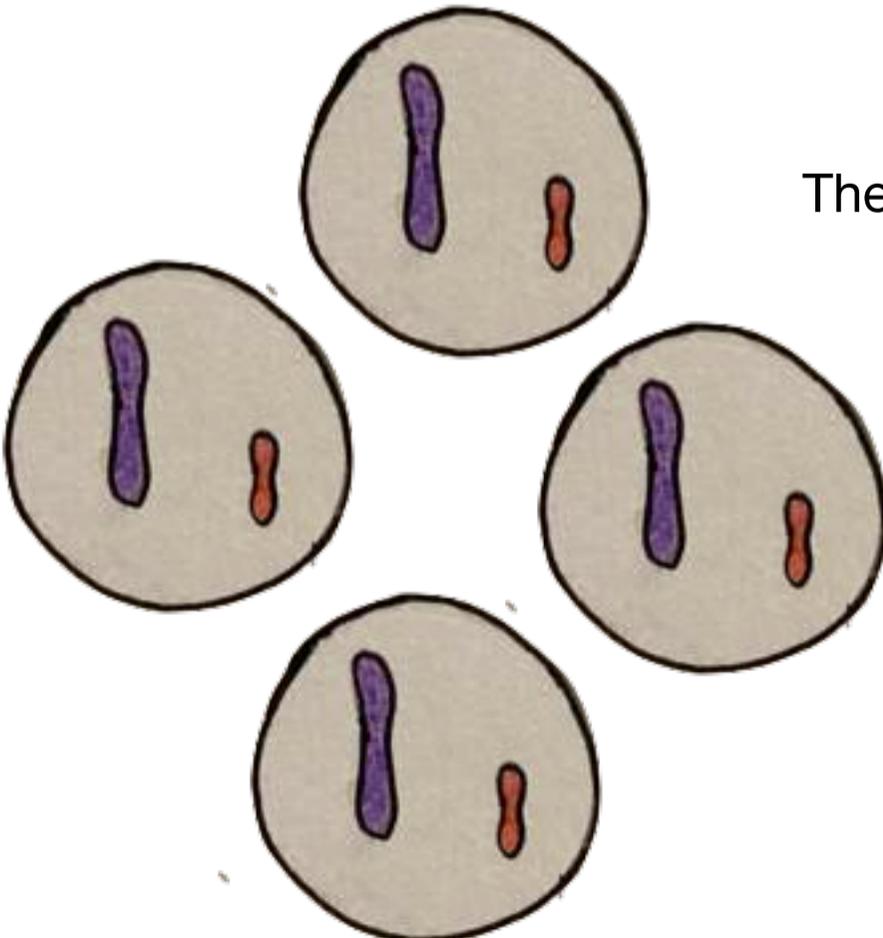
The cells divide in the centre again

8.



Each cell produces two cells

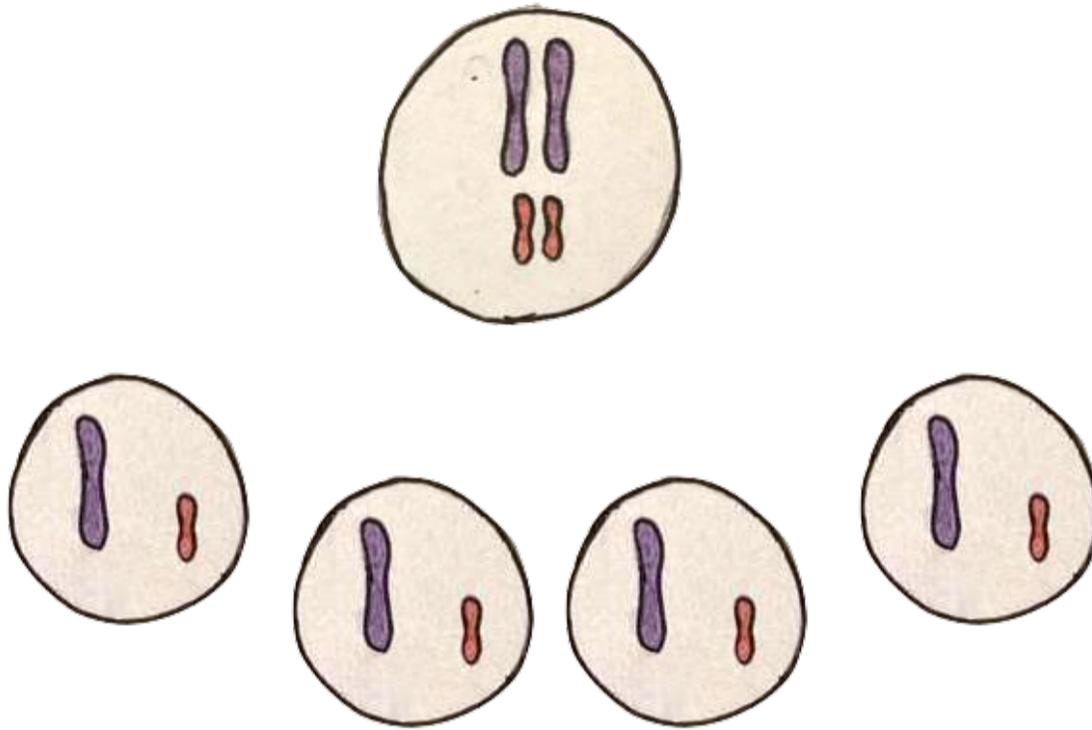
9.



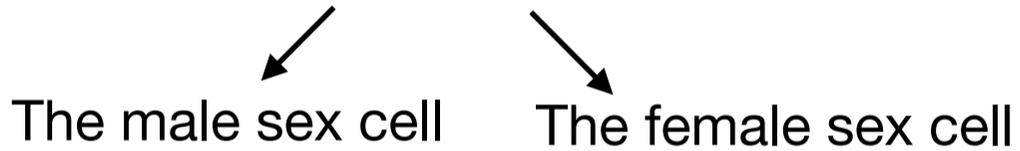
The result of meiosis is four gametes

New cells that are produced through cell division are known as daughter cells or gametes

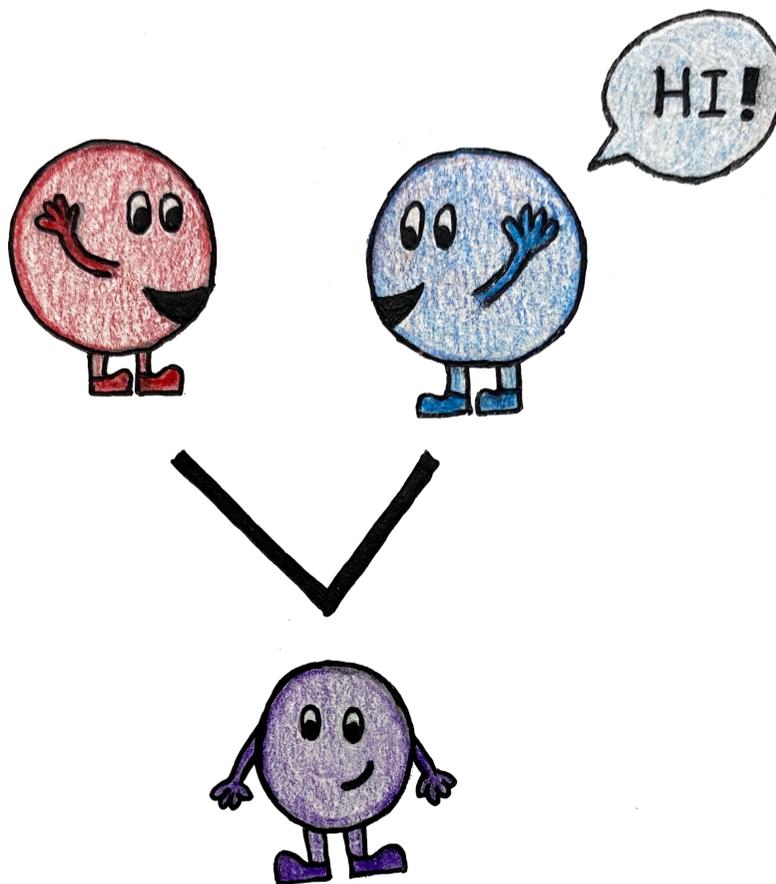
MEIOSIS



There are two types of sex cells

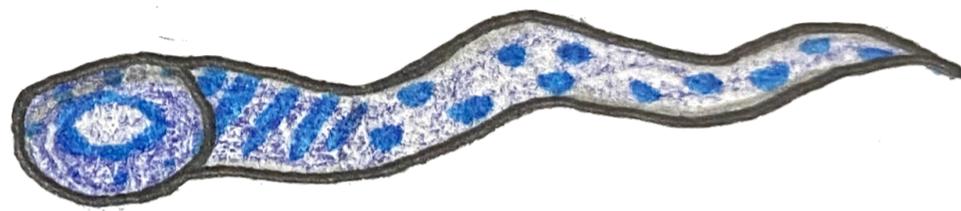


To produce an offspring, the male and female sex cells must fuse to produce a zygote (a single cell, the beginning of a new life)



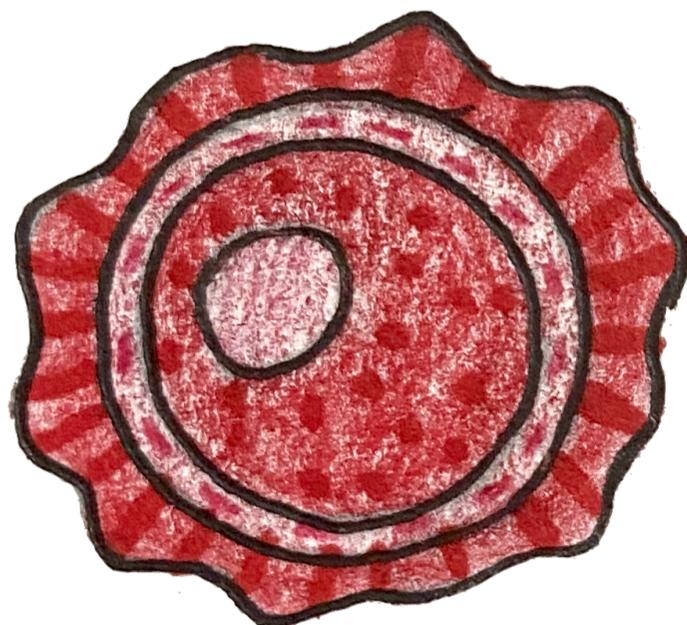
The sex cells in a male are called sperms

A sperm carries 23 chromosomes from the male to be passed on to the next generation

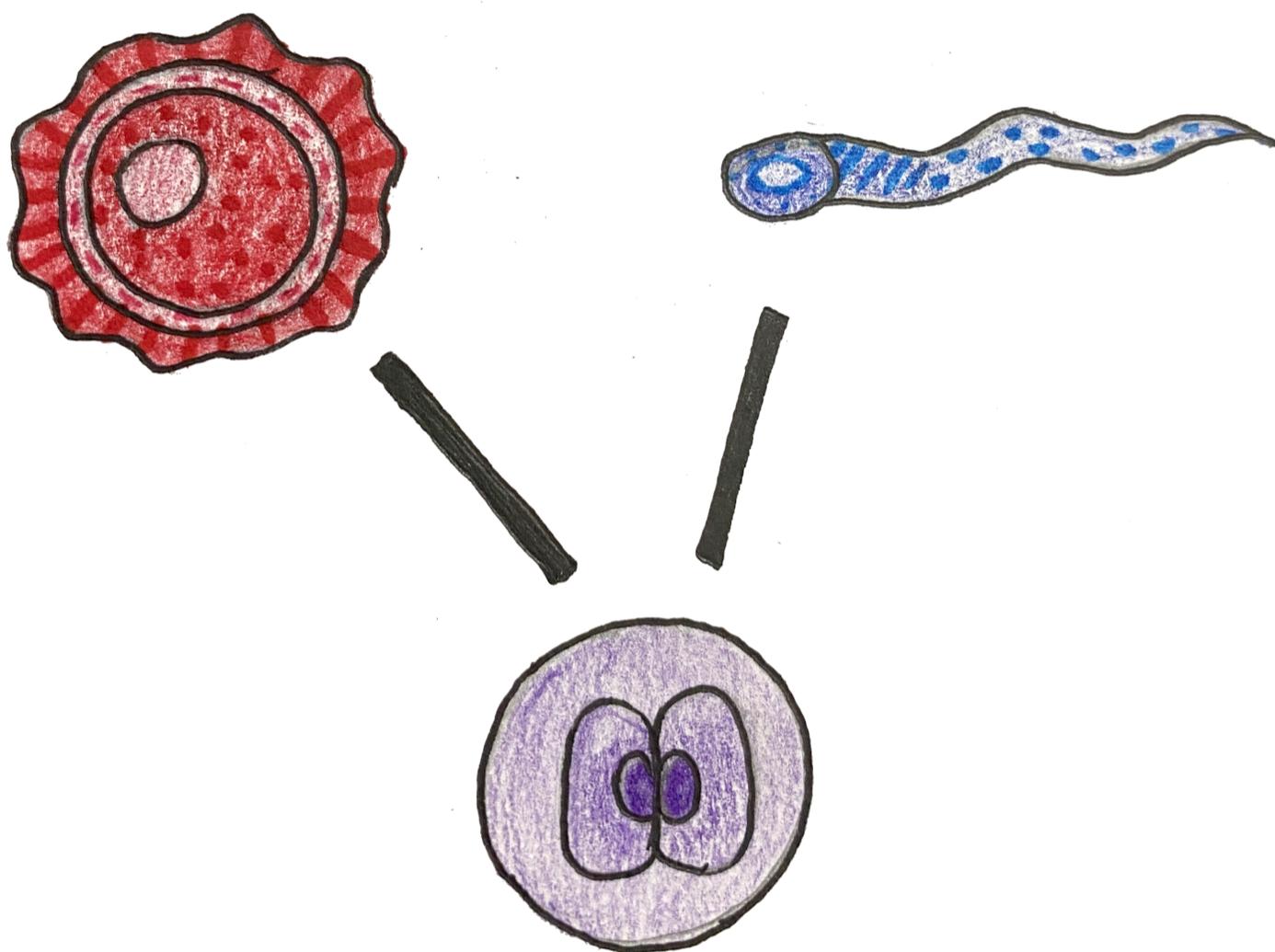


The sex cells in a female are called eggs

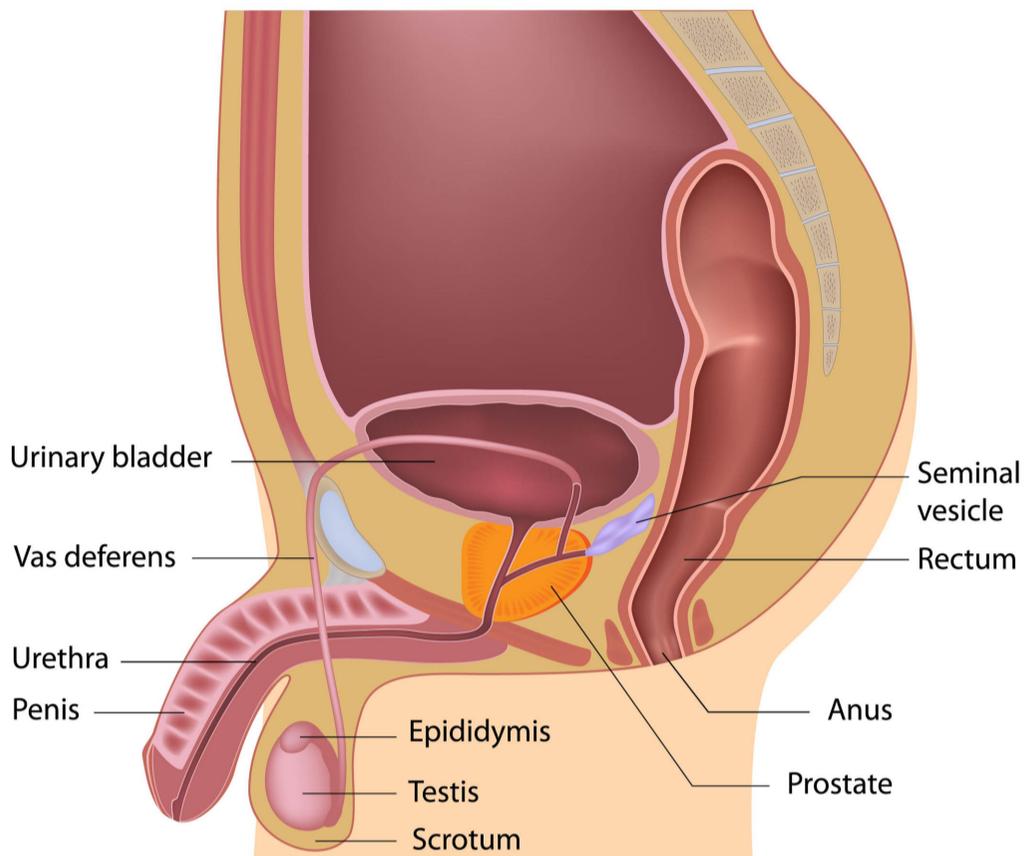
An egg carries 23 chromosomes from the female to be passed on to the next generation



An egg and a sperm fuse to create a zygote



Male body:

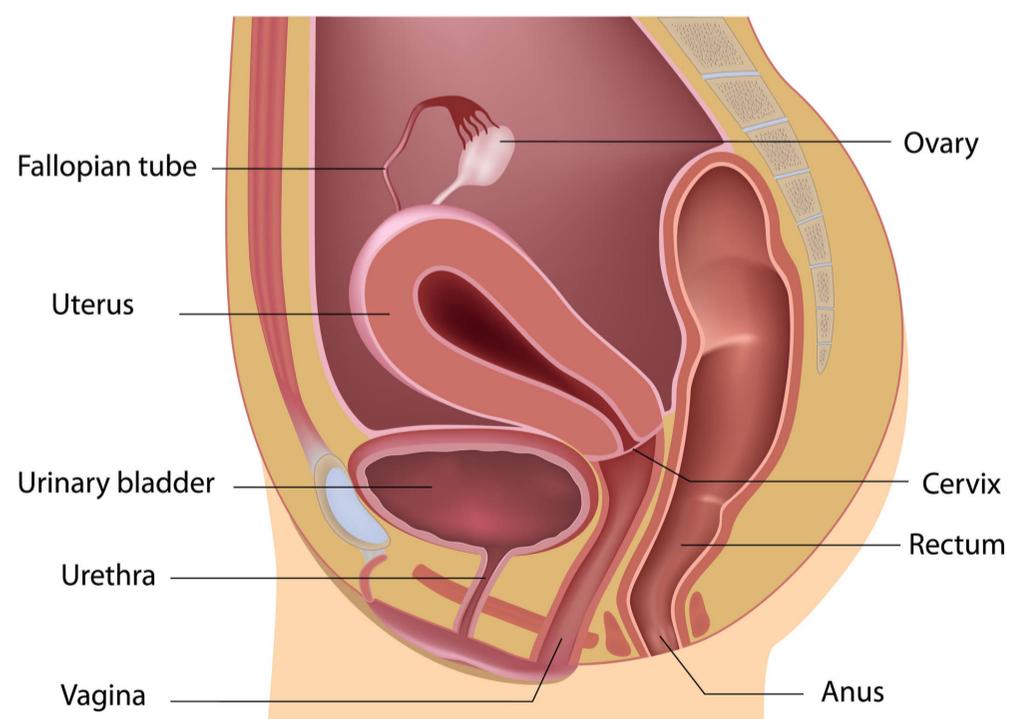


- The main sex organs are the testes and the penis
- Sperms are produced in the testes
- The penis carries sperms to be transported to the egg

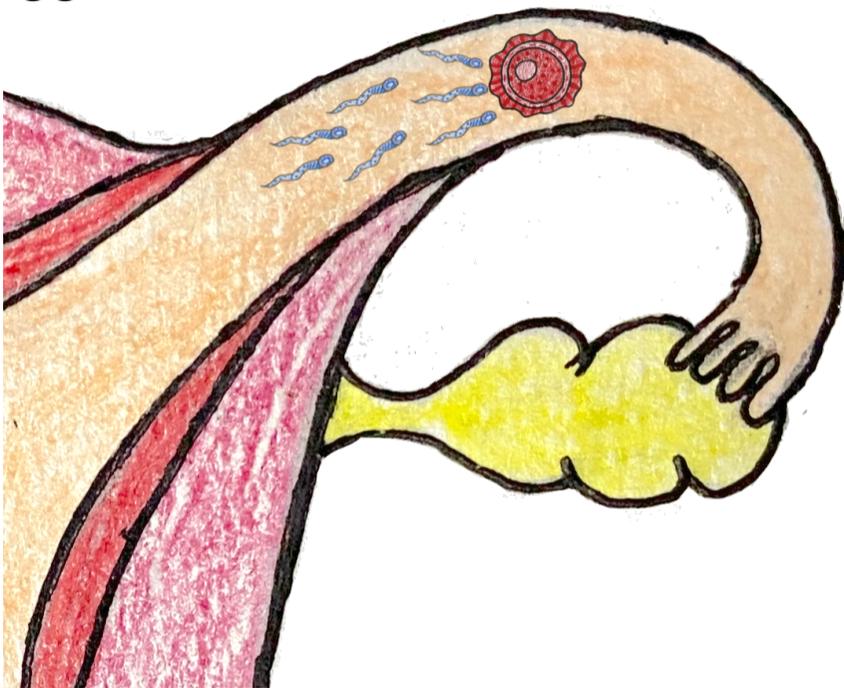
The penis also carries urine to be excreted

Female body:

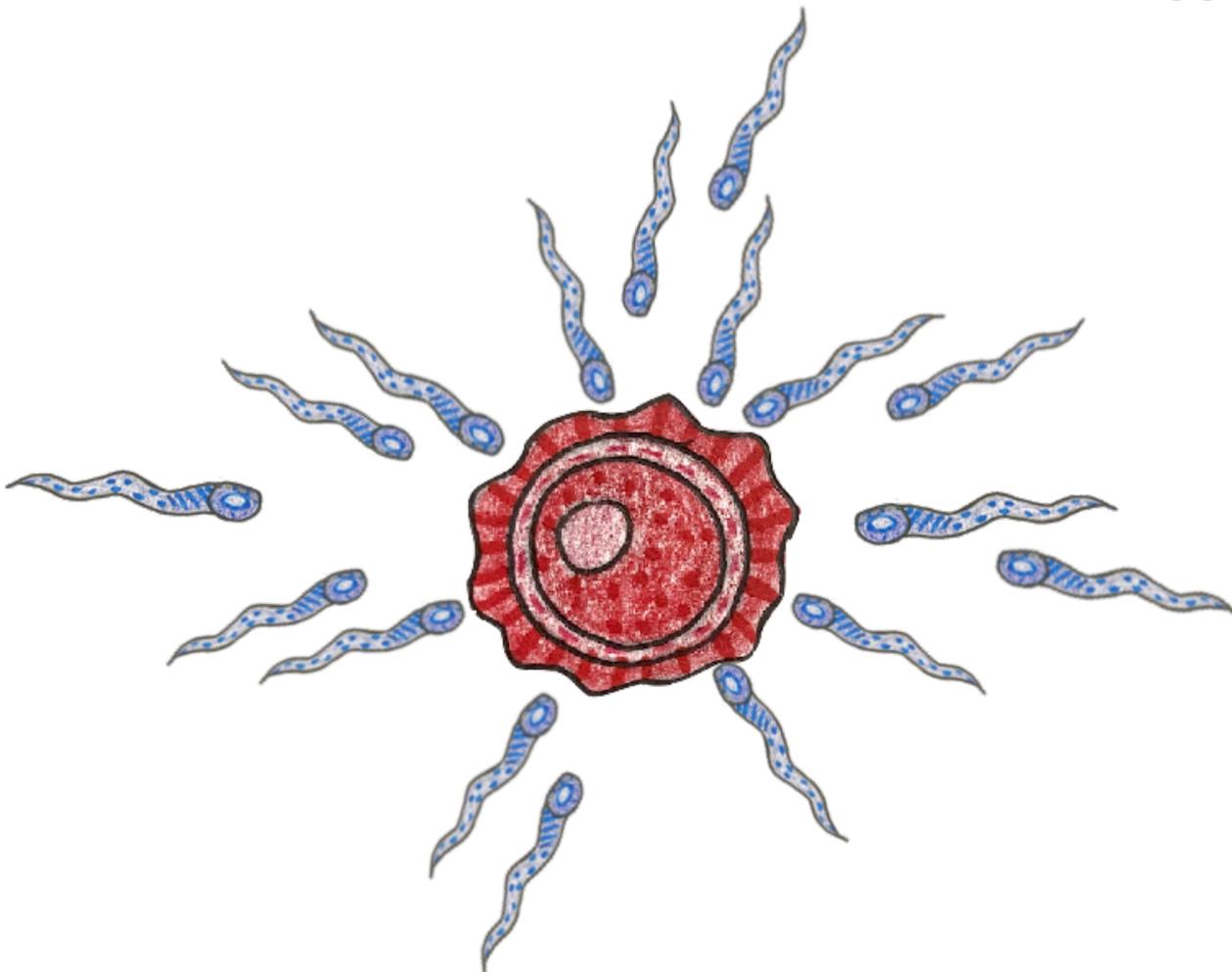
- Eggs are released by the ovaries
- The oviduct - is a tube through which the egg is transported to the uterus
- The egg attached itself to the uterus once fertilised, which also nourishes the foetus
- The vagina - is the point of entry for sperms and the exit point for menstrual blood



- During vaginal sex, the penis is inserted into the vagina.
- The testes produce semen which is a fluid that contains the sperm
- The semen flows through the penis and into the vagina
- The sperm travel to the oviduct where they meet the egg

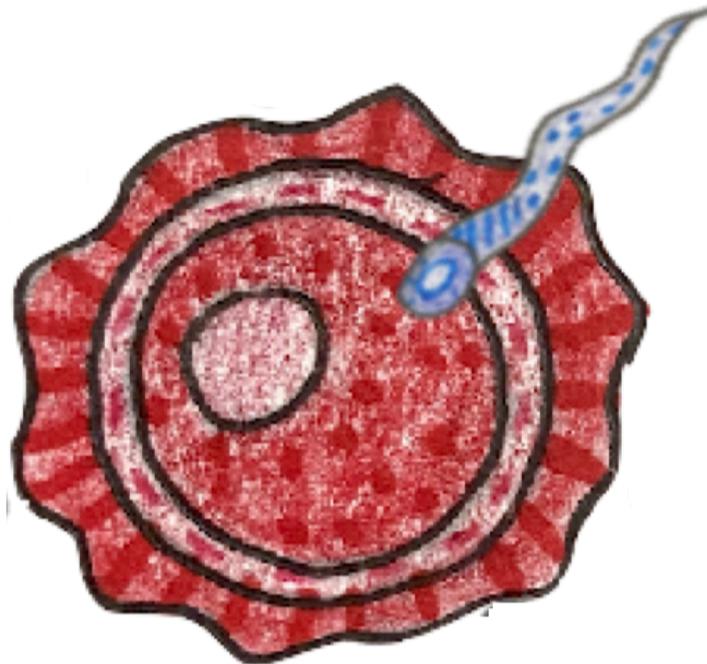


The sperms attempt to break the barriers of the egg to fertilise it



Only one sperm penetrates the barrier of the egg and fertilises it

- The nuclei of the sperm and egg fuse
- The other sperms don't survive



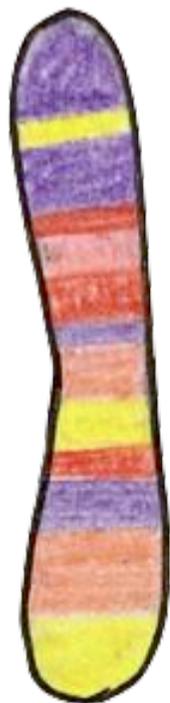
- The fertilised egg implants itself to the walls of the uterus that was prepared for pregnancy
- This begins the process of pregnancy
- Over 9 months:
 - The fertilised egg grows into a foetus
 - It develops organs and bodily functions
 - It is then ready for birth

Let's look more into genetics and the characteristics it determines in an offspring

As we saw before, the 46 chromosomes pair up into their 23 pairs

- We get one set of chromosomes (23 chromosomes) from our mother
- We get the other set of chromosomes (23 chromosomes) from our father
 - These pairs are known as homologous pairs of chromosomes
 - Homologous chromosomes have the same types of genes present on them in the same sequence

For example, let's call one type of chromosome, chromosome A and another type, chromosome B



Chromosome A



Chromosome B

The two chromosomes above will each have a homologous chromosome, another chromosome A and another chromosome B



Chromosome A

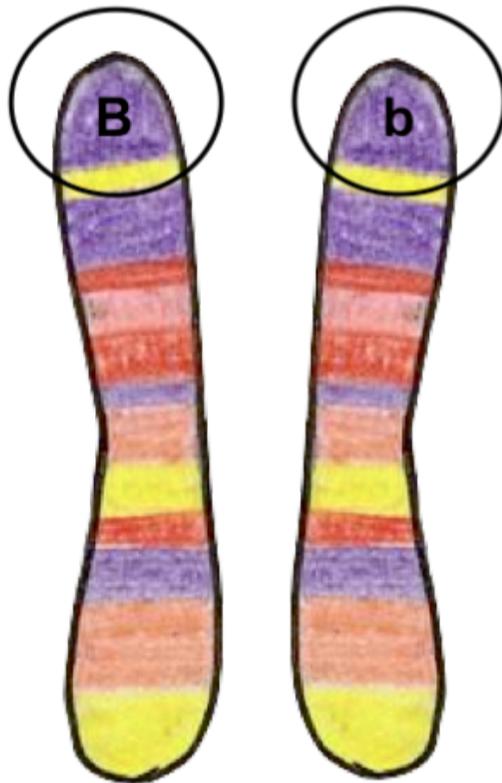


Chromosome B

- Next, we have alleles
- An allele is a variant form of a type of gene
- Let's take the same example of chromosome A
- The chromosome has different types of genes present on it
- Each type of gene will be in the same position on both chromosomes

The specific position of a gene on a chromosome is called a locus - Each type of gene has a specific locus - Each type of gene will be in the same position on both chromosomes

- Let's say the first gene starting from the top of the chromosome is the eye color gene
- We know that there are many different eye colours
- These different eye colours come from different alleles



- Continuing with the example of chromosome A, we know that it exists in a pair
- Chromosome A that we receive from our mother pairs with chromosome A that we receive from our father
- Chromosome A will have the same types of genes present on it, however there could be different alleles for each gene
- Therefore, all of us have two alleles for the same gene
- Sometimes we could have two of the same type of alleles and sometimes we could have two different alleles
- The dominant allele will express itself in the individual when the sperm and egg fuse to form a zygote with two sets of genetic material (46 chromosomes)

HORMONES

- Hormones play a big role in reproduction
- Hormones are chemical messengers secreted by our bodies that enable organs to carry out their functions



- They are secreted by endocrine glands present in our body
- Hormones travel through our blood
- The hormones convey messages from the brain to their target organ
- They bind to receptor cells on that particular organ to ensure the right hormone reaches the right organ

- The target organ acts as a factory for substances required by our body, the hormone signals for it to either increase or decrease production



- There are several different types of hormones, including sex hormones
- We will focus on sex hormones

The primary functions of the sex hormones lie in sexual and reproductive processes.

SEX HORMONES



Oestrogen and progesterone are the female sex hormones

Testosterone is the male sex hormone

We will look at oestrogen and testosterone



OESTROGEN



TESTOSTERONE

- Oestrogen is primarily produced in ovaries
- Testosterone is primarily produced in the testes

However males have a small amount of oestrogen and females have a small amount of testosterone as well

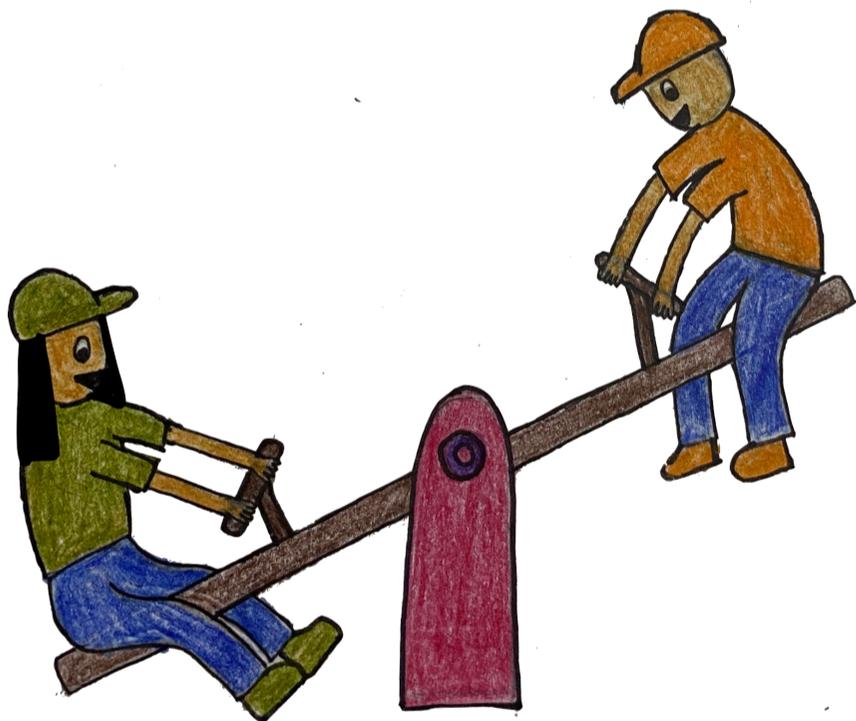
Sex hormones in a female

Higher level of oestrogen



Sex hormones in a male

Higher level of testosterone



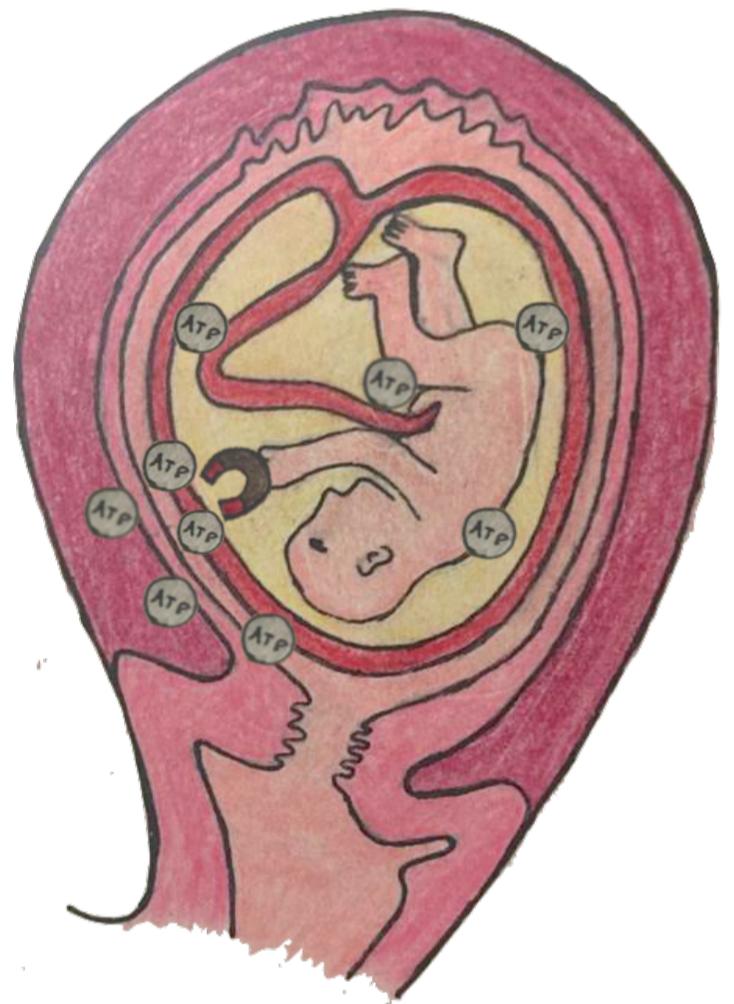
They both also affect muscle strength and mass

***Keeping all this in mind, let's visit
some of the popular myths that
surround gender and sexuality and
factually bust them!***

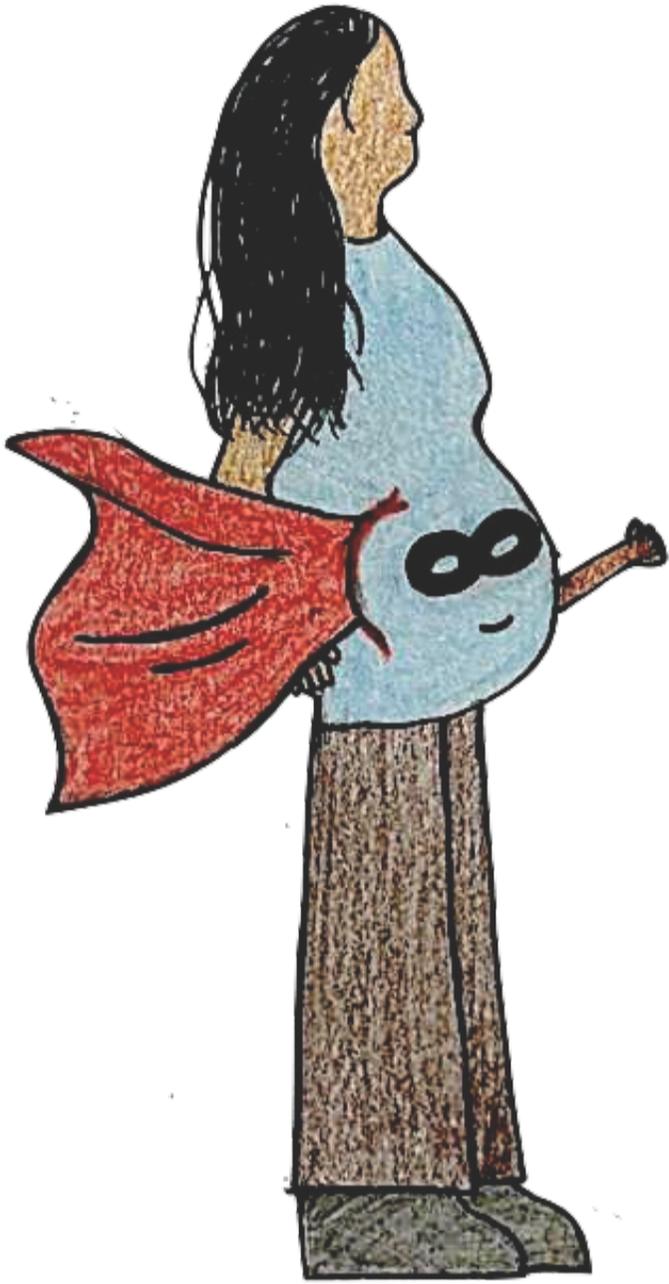
***MYTH: WOMEN ARE
PHYSICALLY WEAK AND
DELICATE***

- Let us revisit reproduction
- Pregnancy and childbirth require large amounts of energy
 - Metabolic rates rise when we exert ourselves
 - Metabolism consists of all the chemical processes that take place in our body

- During the third month of pregnancy, metabolic rates in females may double
- By the time of labor they will increase by 10%
- Energy in the form of nitrogen is needed for the growth of the foetus, the uterus and other tissues

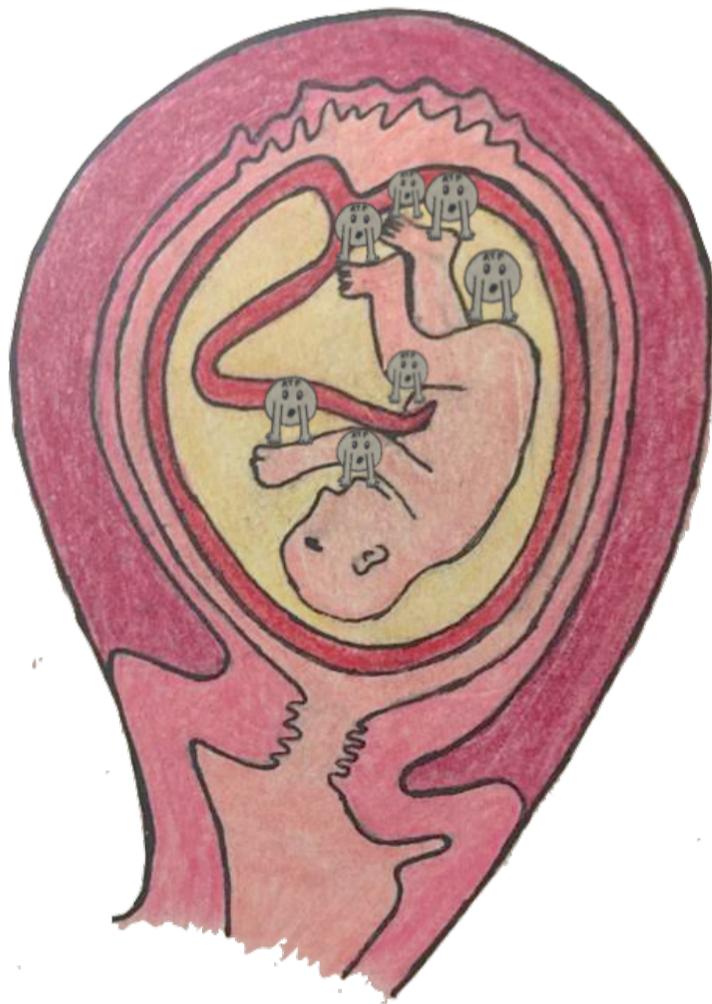


- Thus we see that pregnancy requires large amounts of energy and endurance
- Women would be unable to go through with pregnancies without the physical strength and capability to do so



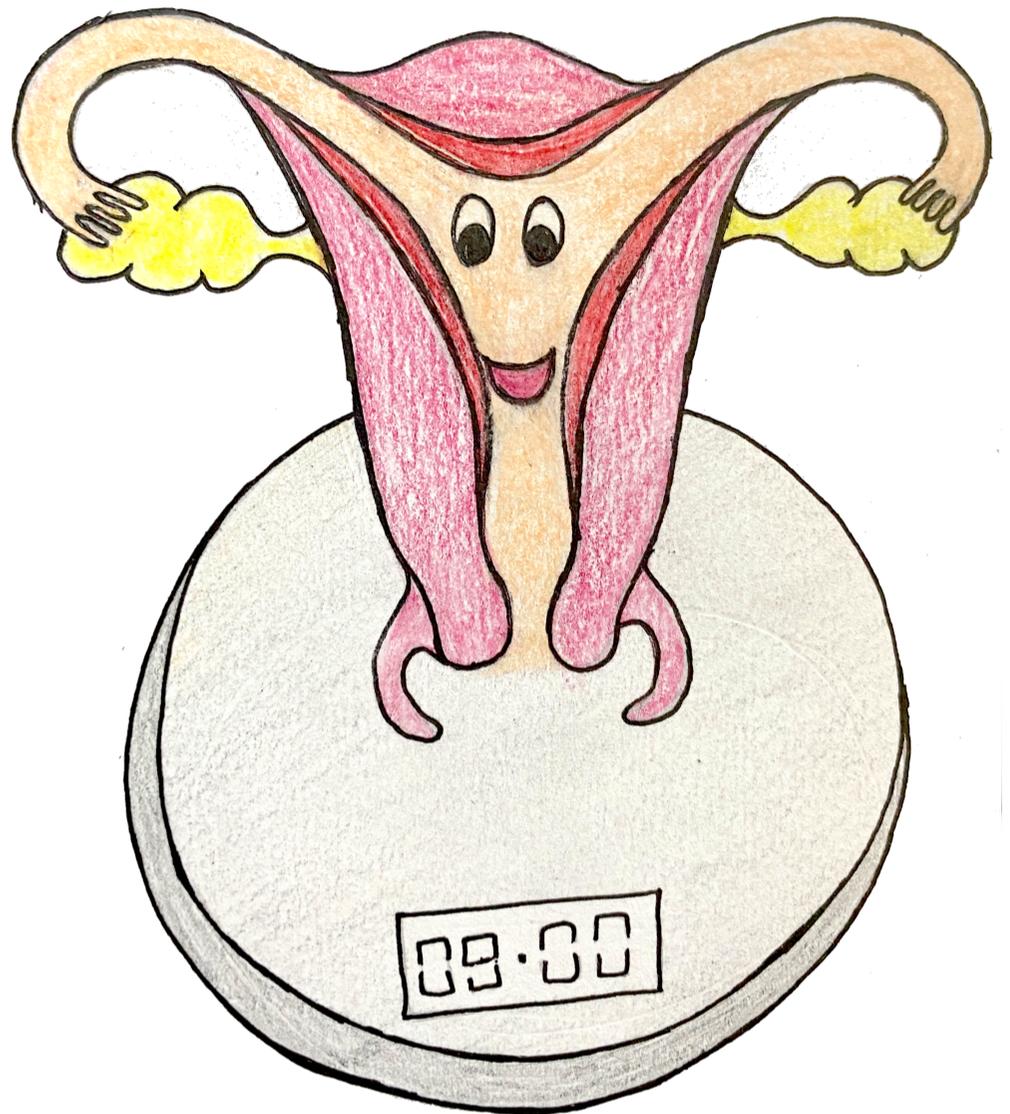
- When a female goes into labor, the doctor can determine whether she can have a vaginal birth
- During vaginal birth, the uterine muscles contract to push the baby out
- During labor, a very large amount of energy is required to push the baby out

Along with pregnancy, a woman would not be able to go through childbirth without the physical strength and capability to do so



Here's some fun facts about the strength of the uterus:

- The uterus creates about 7 kgs or about 15.5 pounds of force on average during natural childbirth
- By weight, the uterus is the strongest muscle in the human body, compared to all other muscles present in all sexes
- The uterus is made up of vertical and horizontal muscle fibres that intertwine to create a powerful muscle force
- The pressure and power that is employed by the uterus during labor is the strongest force exerted by any muscle in



Do you still think women should be classified as weak?

***MYTH: MEN ARE
STRONG, WOMEN ARE
WEAK***

Lets refer to sex hormones

Testosterone is often associated with strength

- It increases neurotransmitters in the nervous system

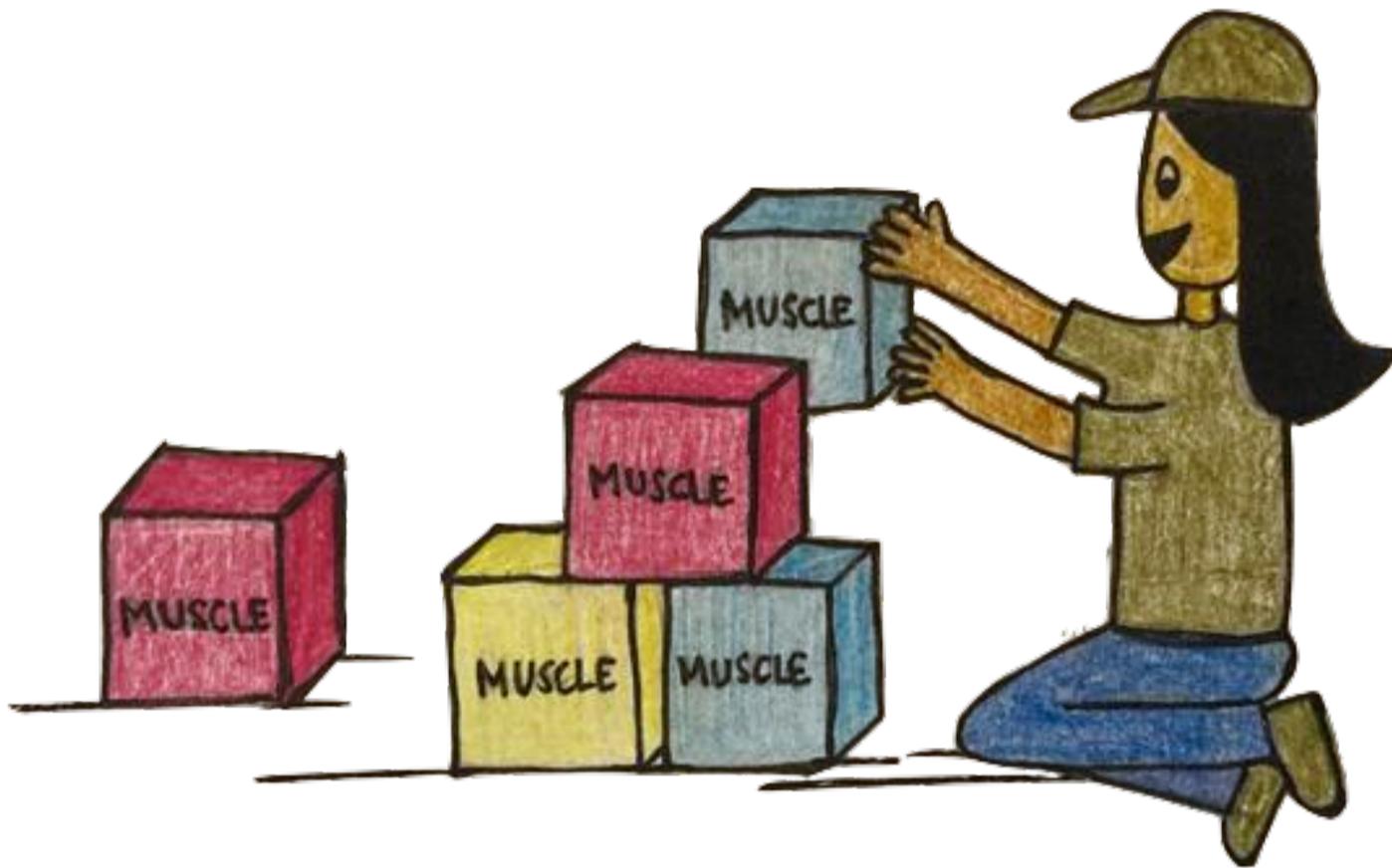
Neurotransmitters act as the body's
chemical messengers

- This enhances muscle size
- Testosterone also contributes to protein synthesis (process of creating protein molecules)
- Proteins are required for energy and muscle growth as well
- Since males have a larger amount of testosterone, they appear physically stronger, thus males are considered stronger

However, oestrogen, also performs similar functions

- Oestrogen also increases the collagen content of connective tissues
- Collagen is a protein that is responsible for healthy joints and stretchiness in the skin

OESTROGEN



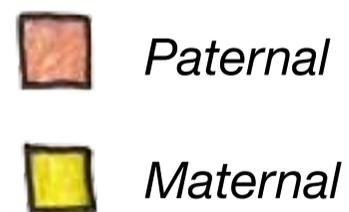
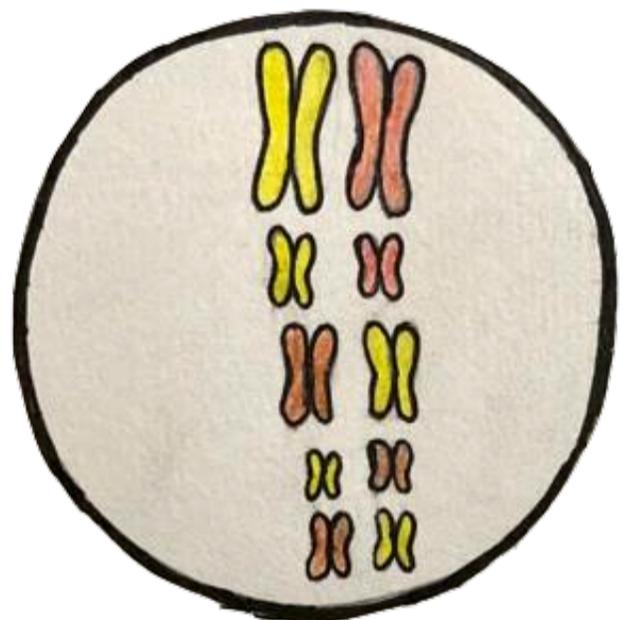
- As we now know, both males and females have the necessary hormones to ensure physical strength
- Both sexes also have other hormones to regulate growth and strength
 - Growth hormone (GH)
 - Cortisol (which increases blood glucose levels)
 - Other hormones involved in protein synthesis and growth

***MYTH: ONLY FAIR AND
THIN IS BEAUTIFUL/
HANDSOME***

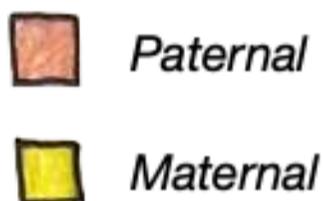
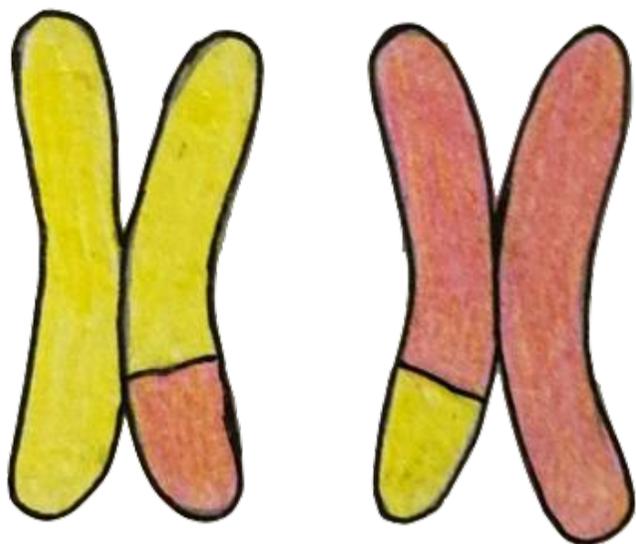
- Referring to meiosis and alleles we can understand variation in humans
- Alleles on a gene determine characteristics of an individual, this leads to variation
- There are three main sources of variation in humans
 - Random Orientation
 - Crossing over
 - Random fertilisation

Random orientation:

- In meiosis, one cell splits up into four gametes
- Before splitting up, the homologous chromosomes pair up
- When pairing up the maternal and paternal chromosomes align themselves to the right and left of the cell randomly
- Therefore, when the cell splits in the centre, some maternal chromosomes may go to the right while others may go to the left
- Thus the gametes produced will have a mixture of maternal and paternal chromosomes (one set of genetic material)



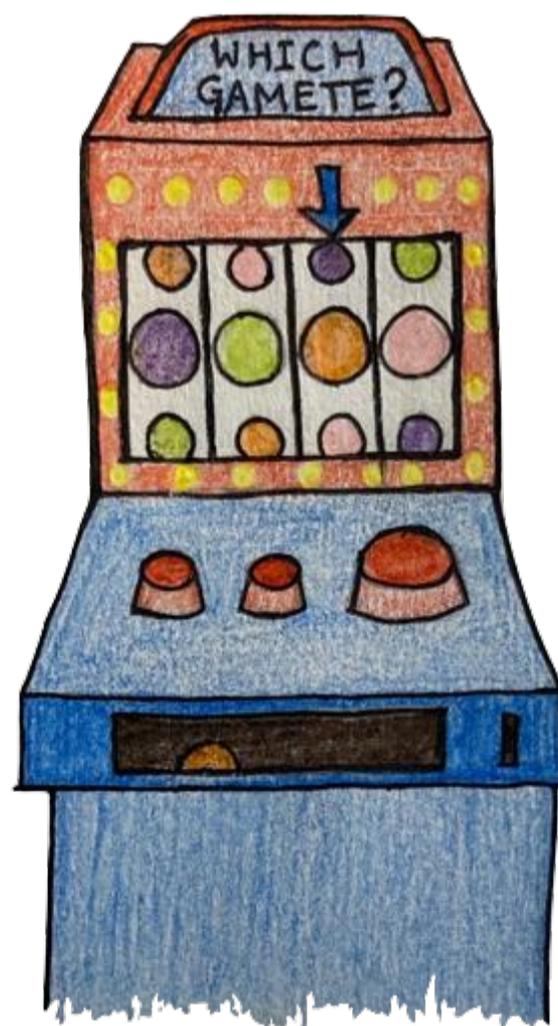
Crossing over:



- Before the chromosomes split up into daughter cells (gametes), a segment of homologous chromosomes cross over (interchange)
- Due to this some alleles of the maternal chromosome are now on the paternal one and some chromosomes of the alleles from the paternal chromosome are on the maternal ones
- Since each type of gene has a specific position (locus) on each chromosome, the crossing over, takes place between the same types of genes

Random fertilisation:

- One of the four gametes from the mother, will fuse with one of the four gametes from the father
- Any of the gametes can fuse with each other, therefore we can say fertilisation is a random event

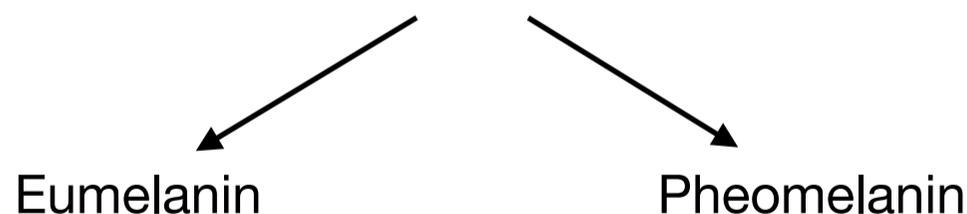


- It is a known fact that our genes majorly affect our appearance
- There are many different alleles for these traits
- With so much variation, do you think we should still blame one for their body shape, size or anything else?

Let's look at skin color

- Along with exposure to sun, a large part of the color of our skin is determined by genetics
- You may have heard of melanin, it is the pigment that gives our skin, hair and eyes their color
- Melanin is produced by specialised cells in our body called melanocytes
- On the surface of melanocytes, there are certain receptor cells present
- These receptor cells are called the melanocortin 1 receptor
- This receptor controls which type of melanin is produced by the melanocytes
- We will look at the types of melanin
- Melanocytes make two types of melanin

The type of melanin produced is determined by the genetic makeup



- | | |
|---|---|
| <ul style="list-style-type: none"> • Causes darker skin that tans easily • Protects skin from ultraviolet radiation (UV rays) from sunlight | <ul style="list-style-type: none"> • Causes lighter skin that tans poorly and may cause freckles • Does not protect the skin from ultraviolet radiation (UV rays) |
|---|---|

- Individuals in places with more exposure to sunlight usually have eumelanin receptors
- Individuals in colder places, with less exposure to sunlight usually have pheomelanin receptors

This happens due to natural selection



Over generations natural processes have caused adaptations, so human genes are best suited to their environment

Imagine a world where everyone looked identical

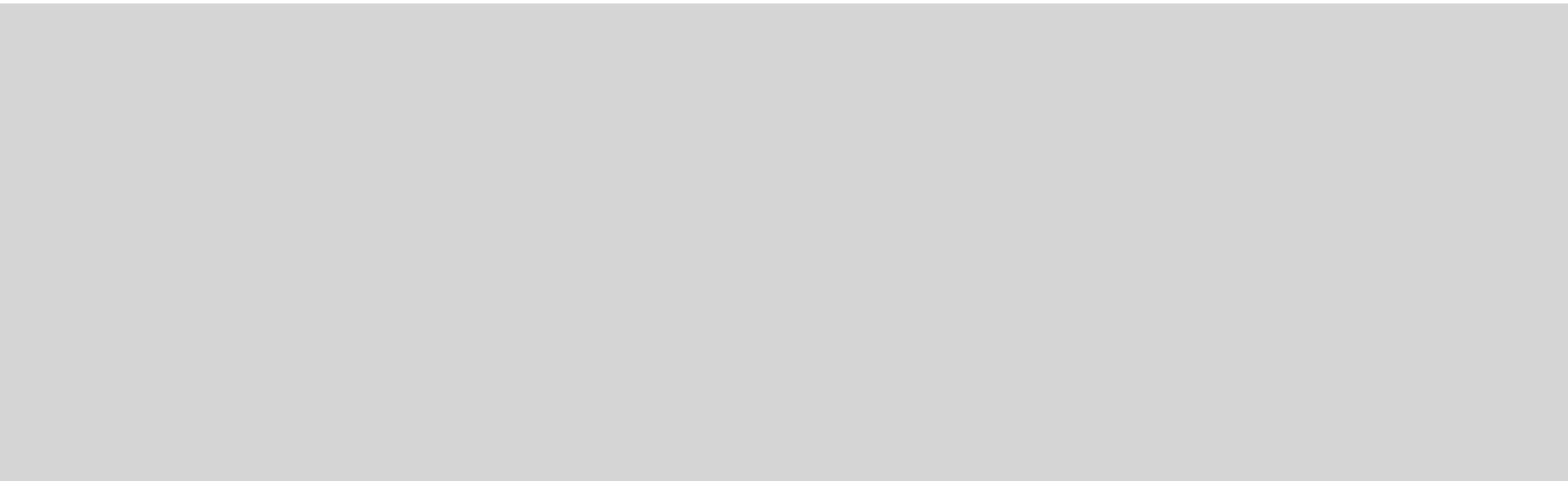
Isn't it interesting that every individual looks different?

We should appreciate our bodies

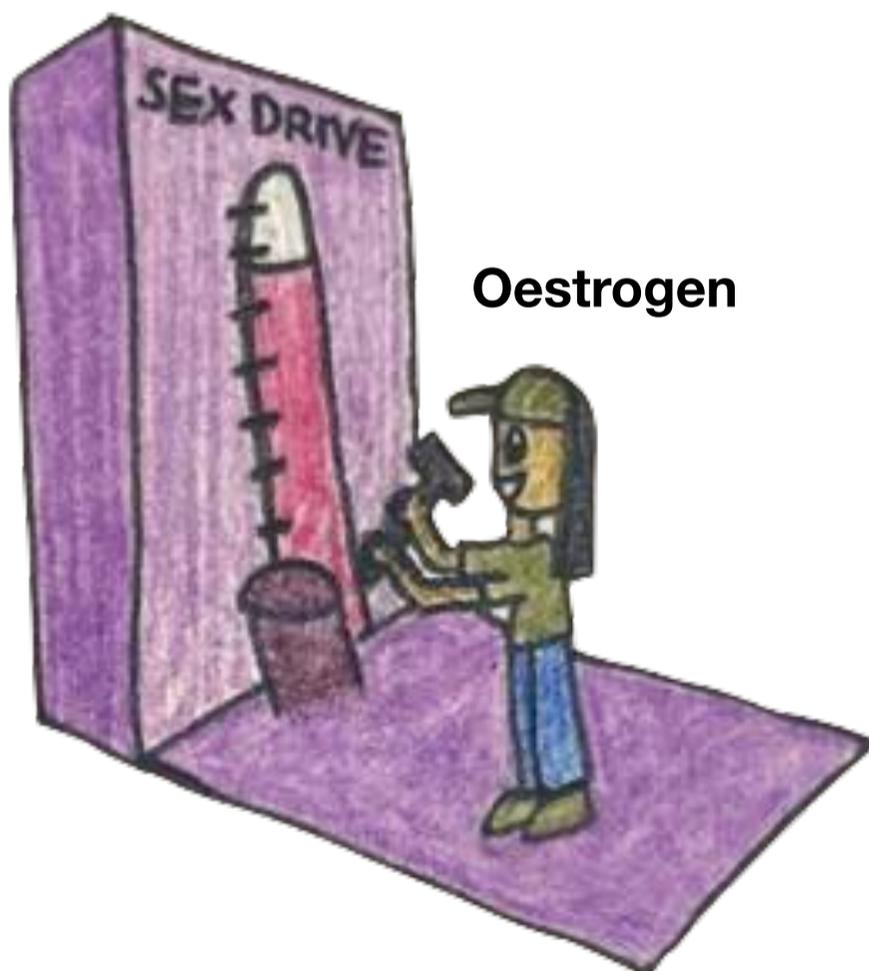




***MYTH: ONLY MEN HAVE
SEXUAL DESIRES,
WOMEN DO NOT***



- The function sex hormones play in sexual desire is fascinating
- Sex hormones contribute to a person's libido
- Libido is a person's conscious or unconscious sexual drive or desire
- In males, testosterone regulates libido
- In females, estrogen regulates libido
- Regardless of being male and female, these sex hormones will cause sexual drive
- A woman also has sexual desires



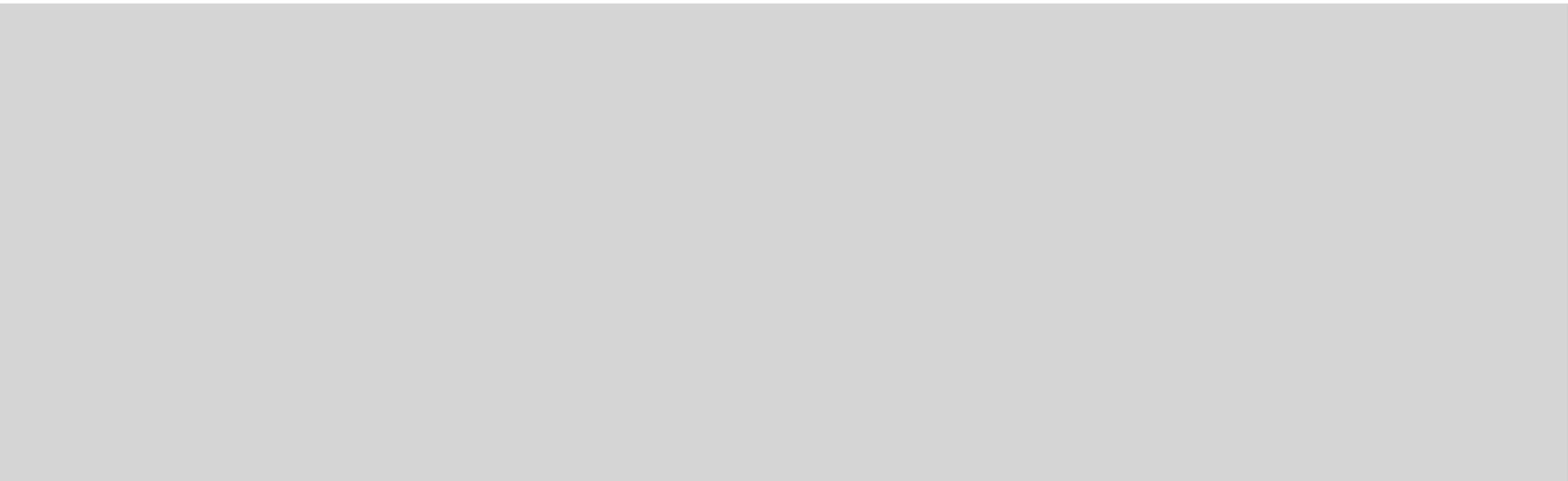
- Since the level of sex hormones vary throughout the month, the sexual drive varies at these times as well
- When oestrogen is produced in high levels by the body, sexual desire increases
- The hormone progesterone can reduce sexual desire

We all have these hormones that cause sexual desire.

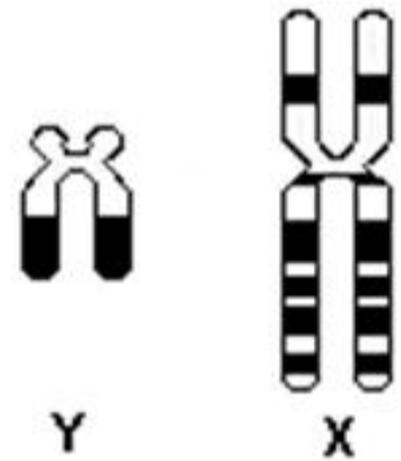
How can we assume women do not?



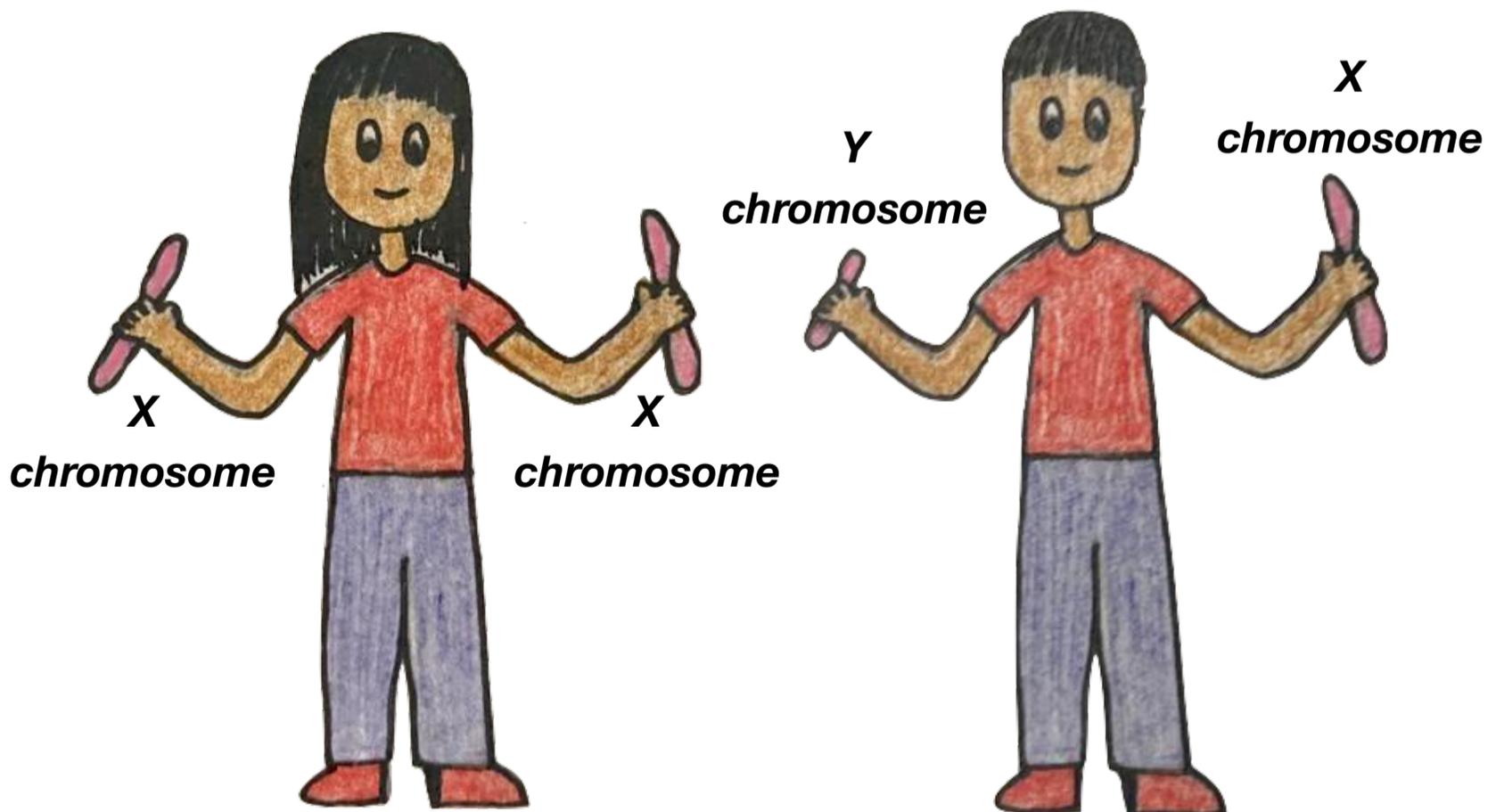
***MYTH: WOMEN ARE
RESPONSIBLE FOR THE
SEX OF THE CHILD***



- Referring to genetics, we can understand the sex of the child
- Of the 23 pairs of chromosomes that each cell has, only one pair determines the sex of the individual
- The 23rd chromosome pair are the sex chromosomes
- In males, the chromosome pair is XY
- In females the chromosome pair is XX
- When an individual has two X chromosomes, their sex is female
- When they have one X and one Y chromosome, their sex is male

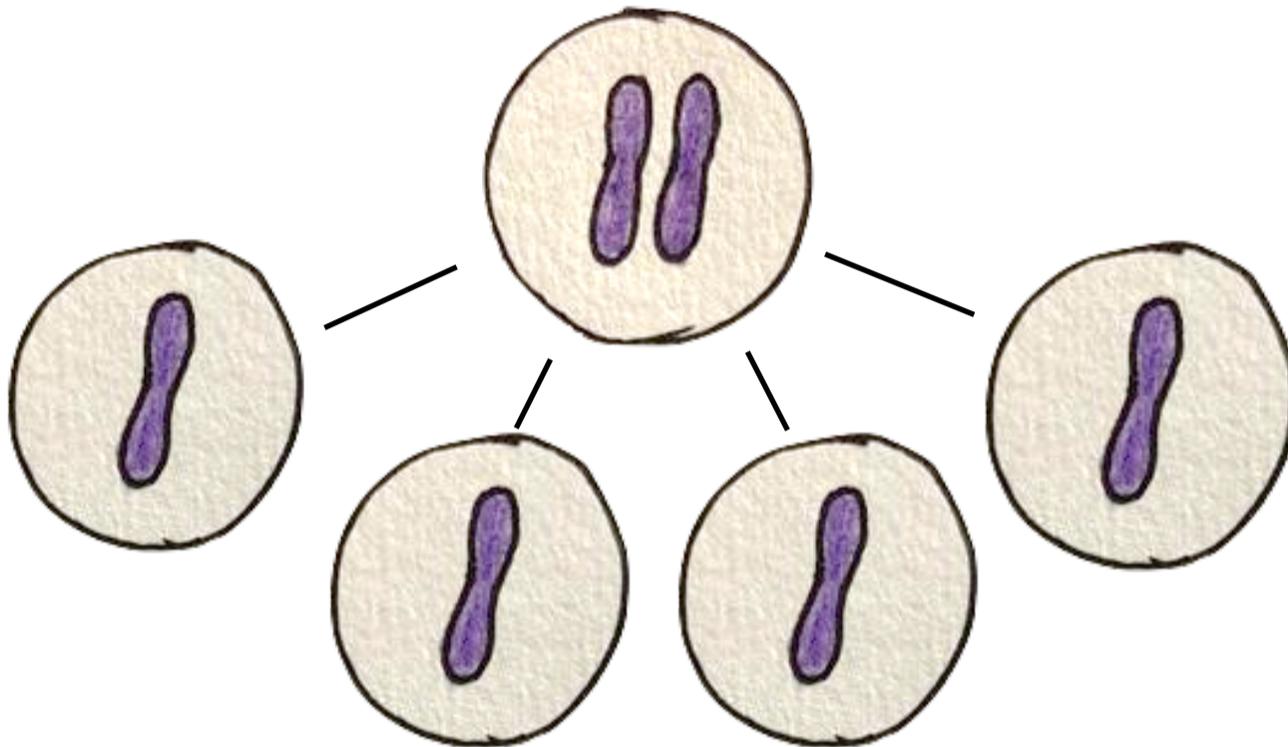


Sex chromosomes



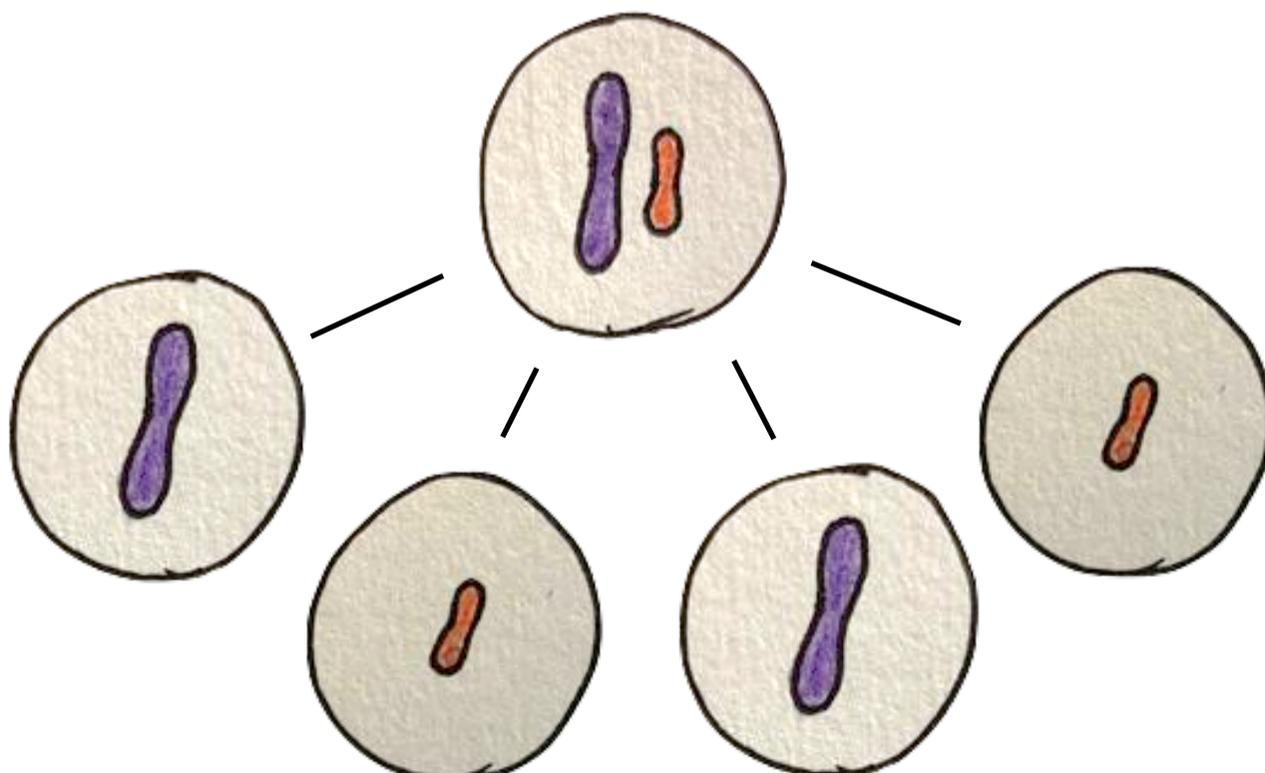
- Meiosis in females:

- o Both chromosomes in the 23rd pair are X chromosomes
- o Therefore the resulting four gametes will each have one X chromosome



- Meiosis in males:

- o One chromosome in the 23rd pair is the X chromosome and one is the Y chromosome
- o Therefore of the four resulting gametes, two will have X chromosomes and the other two will have Y chromosomes.



One of the gametes from both parents then fuse

- The gametes produced by the mother will always have an X chromosome
- The gametes produced by the father will either have an X chromosome or a Y chromosome
- Let's look at the different possible outcomes of the gametes fusing
- To ensure we look at all possible combination we will make a table

This is called a Punnett Square, it is used to predict possible genetic traits that an offspring may have

Lets predict the possible sex of an offspring

- A sperm cell can have either chromosome X or chromosome Y
- So we label one column as chromosome X and one column as chromosome Y

	X	Y

	X	Y
X		
X		

- An egg cell can have only chromosome X
- So we make label both rows and chromosome X

Now we cross each row and column, with the possible chromosome pairs

	X	Y
X	XX	XY
X	XX	XY

POSSIBLE OUTCOMES: XX OR XY

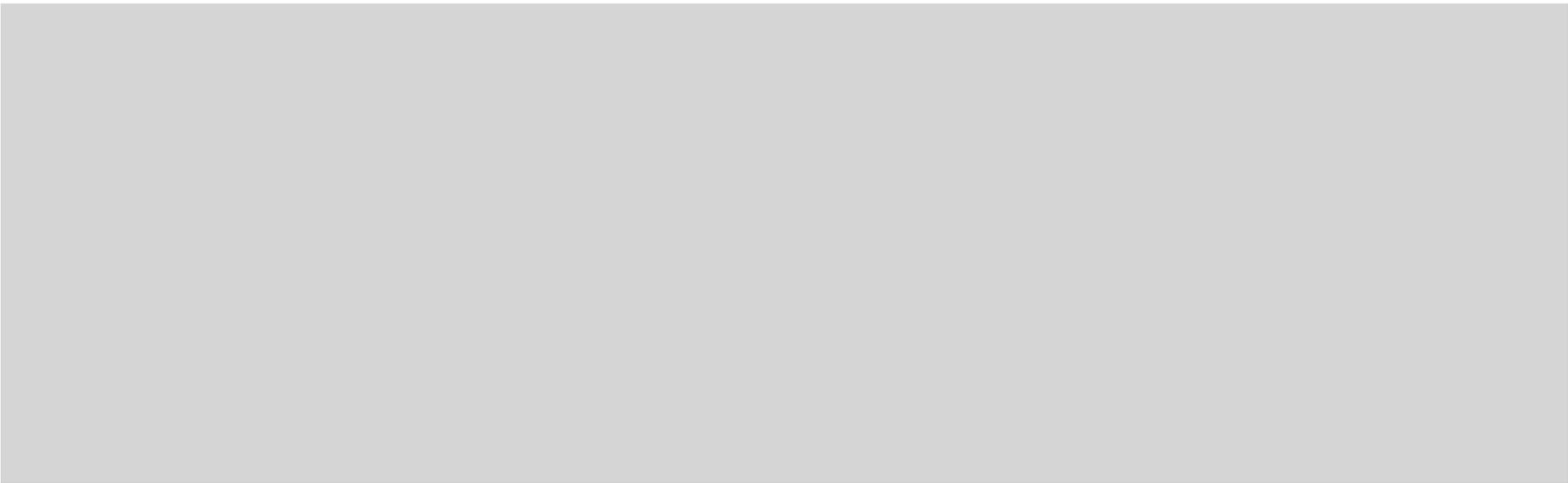
As can be seen, there are two possible outcomes

- The resulting zygote can have the chromosome pair XX or the chromosome pair XY
- This shows a 50% chance of the offspring being female and a 50% of the offspring being male
- As we saw, the female provides the X chromosome for the zygote, whereas the male provides the variation of either X or Y
- Therefore, the woman is not responsible for the sex of the child
- The sex chromosome of the male gamete determine the sex of the child
- Neither the mother or the father choose which of their eggs and sperm are going to be fertilised, thus none of them are responsible for determining the sex

How can we hold an individual responsible for something they can't control?



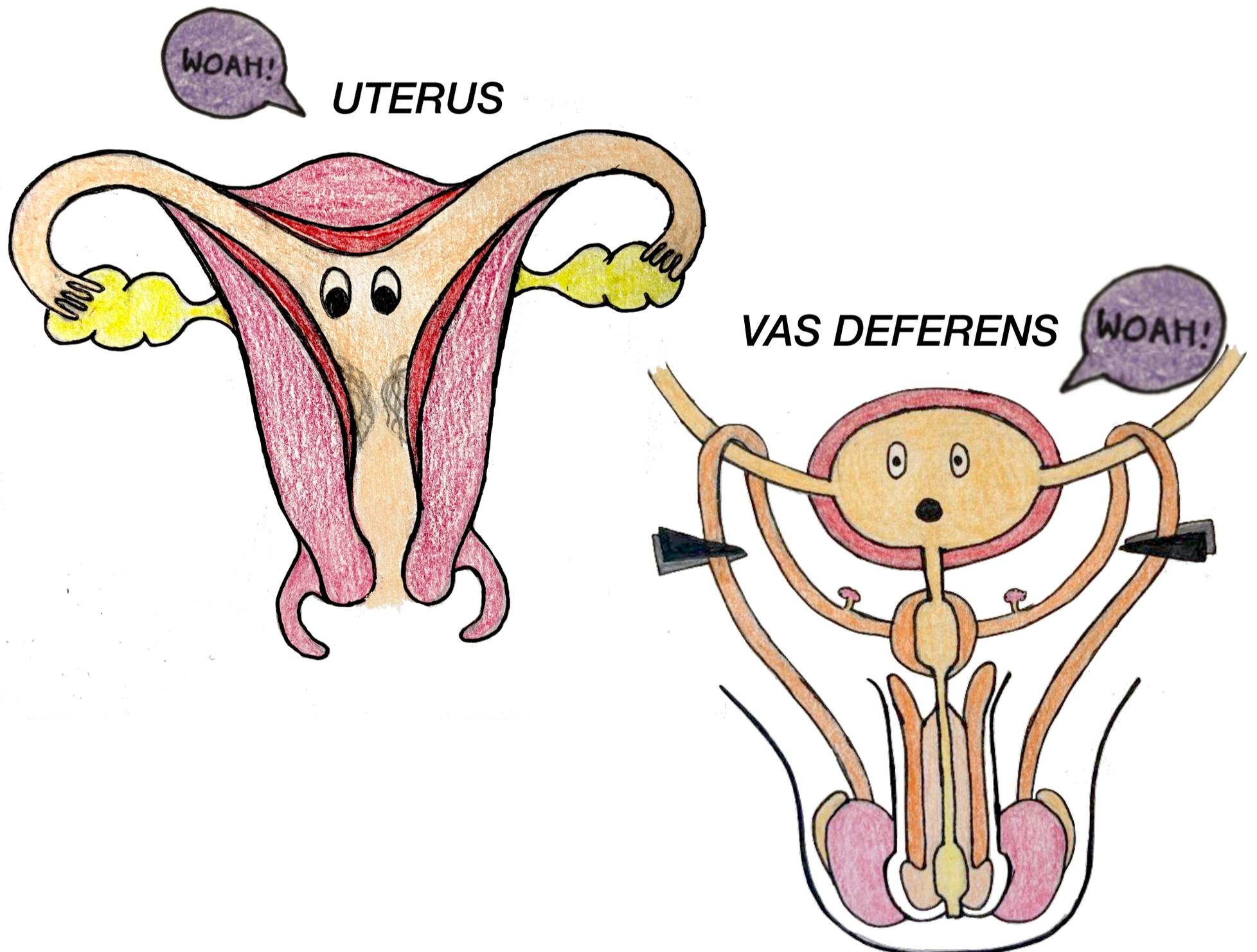
***MYTH: WOMEN ARE
HELD RESPONSIBLE FOR
THE INABILITY TO HAVE A
CHILD***



Referring to the process of reproduction, we can understand fertility

- If one is struggling to have a baby, the woman is often blamed
- However, it can be either the male or the female whose body is infertile

Infertility is the inability of a person to reproduce by natural means
Infertility has various medical causes which result in the abnormal functioning of the reproductive system



Both males and females could be infertile

Females

- Infertility in females can have a lot of causes
- A few of them include:
 - o Ovulation disorders - the inability of the ovaries to produce a mature egg
 - o Damage to fallopian tubes (another name for oviduct) - when there is a blockage in tubes that lead the egg to the uterus
 - o Narrowing of the cervix (the cervix is the lower, narrower end of the uterus)
- Sometimes the cause can also remain unknown

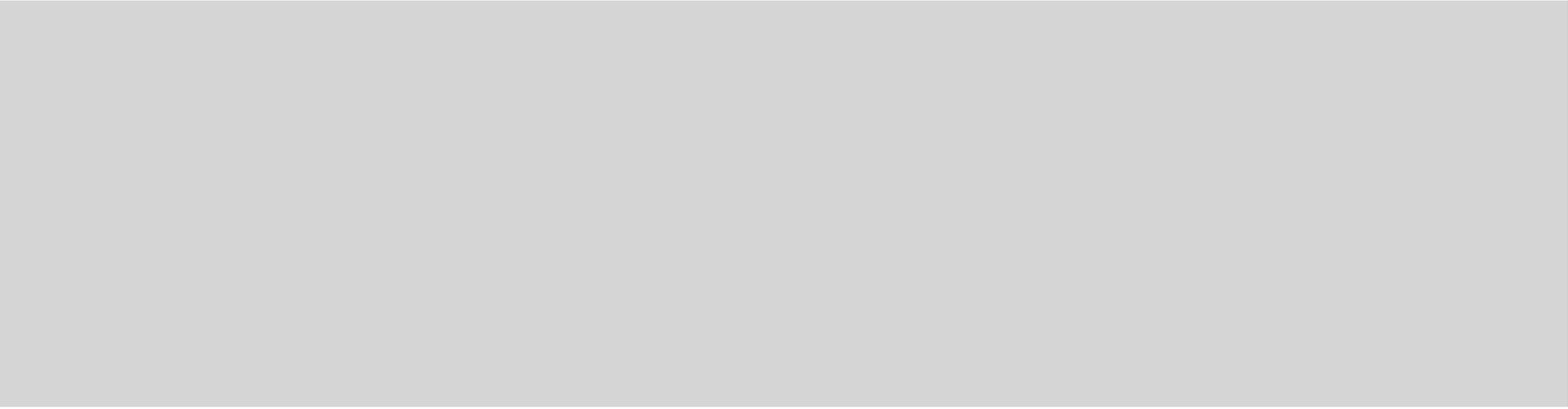
Males too can be infertile

- There can be multiple causes for this infertility
- A few of them include:
 - o Infection – some infections can interfere with sperm production or sperm health
 - o Ejaculation issues
 - (inability of semen to be expelled from the body)
 - retrograde ejaculation occurs when semen enters the bladder (organ that stores urine) instead of emerging out the penis
- Blockage of tubules that carry sperm - the tubes that transport sperm may be blocked due to different causes

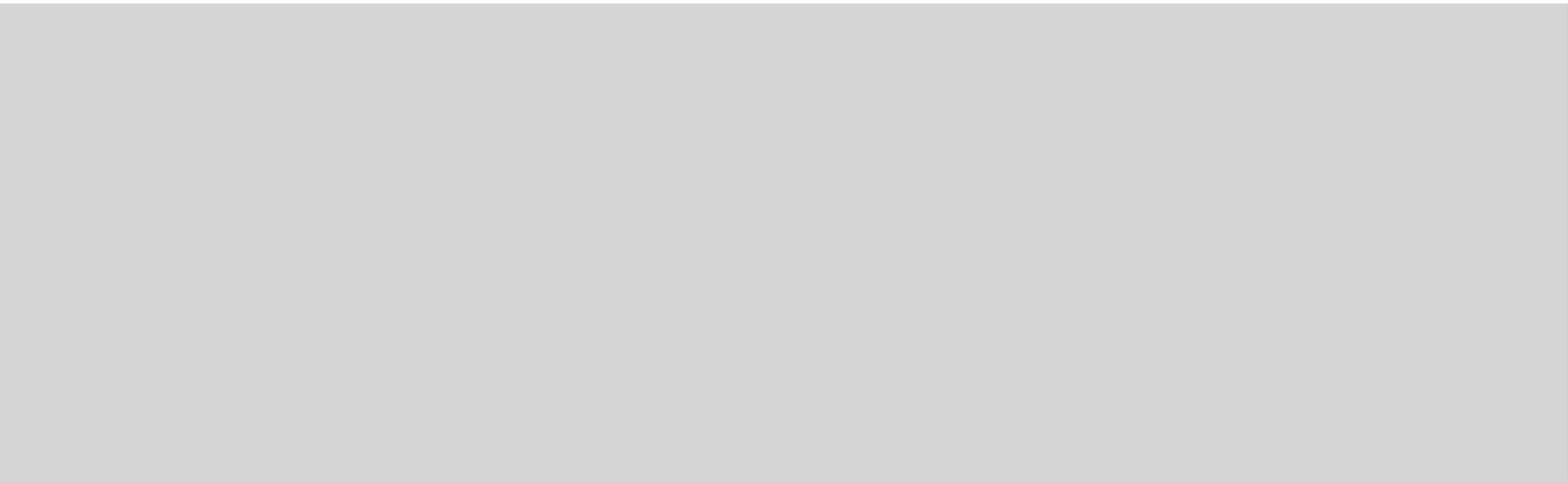
Therefore, the male or the female could be infertile

Neither can be held responsible for their infertility

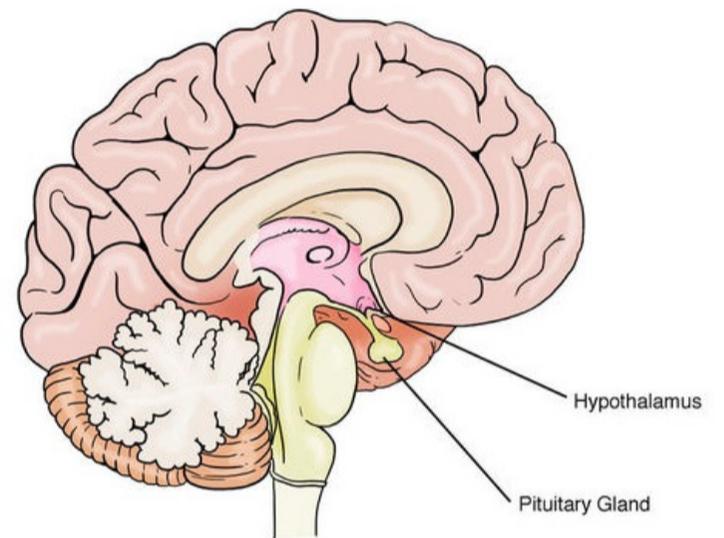




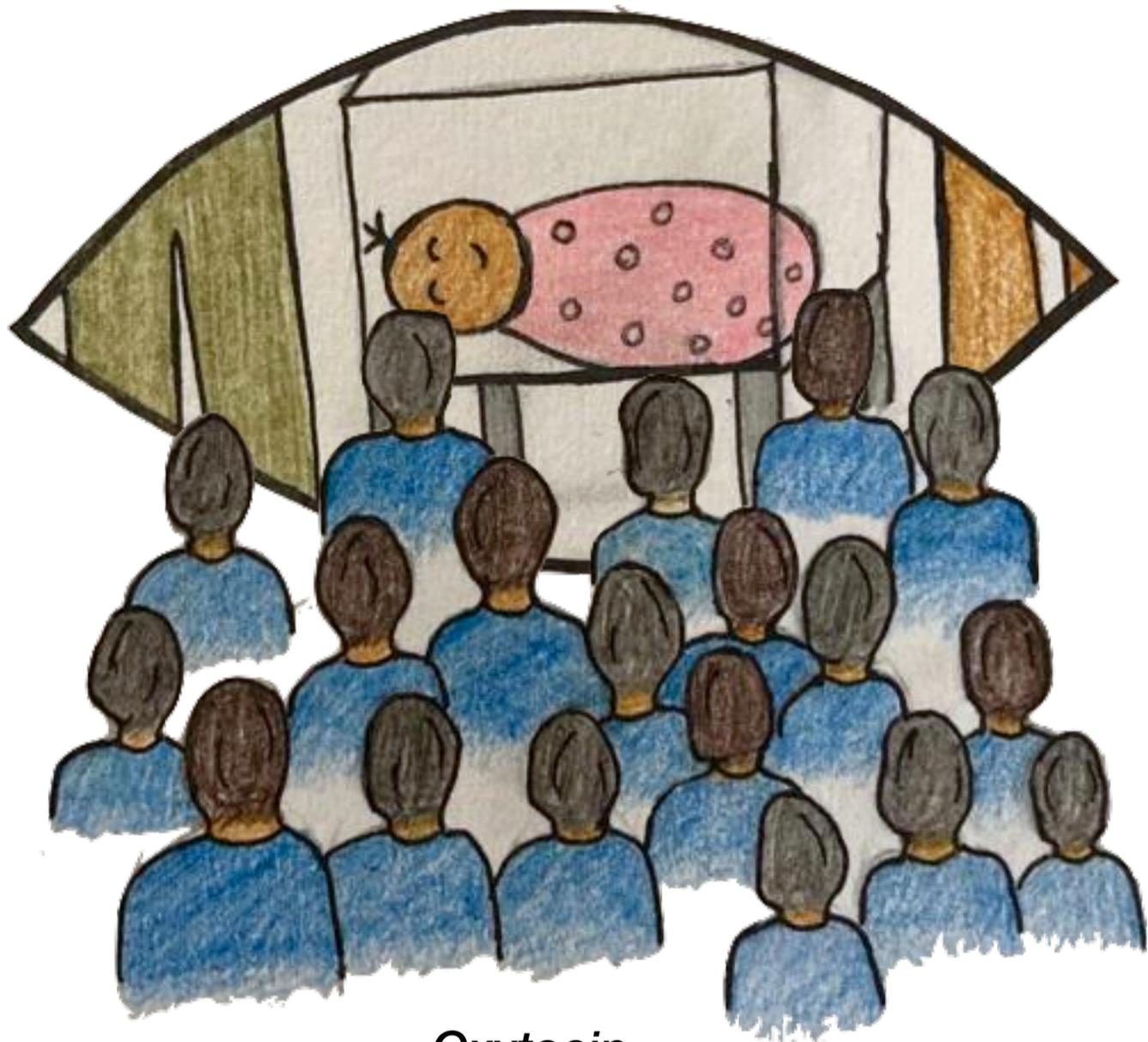
***MYTH: WOMEN ARE
NURTURERS, MEN ARE
BREADWINNERS***



- There are many more hormones in the human body apart from the sex hormones
- Each of these is responsible for different functions
- Let us look at the hormone, oxytocin
- Oxytocin is produced in the hypothalamus (part of the brain)
- It is then secreted into the bloodstream by the posterior pituitary gland (gland that secretes hormones produced by the hypothalamus)

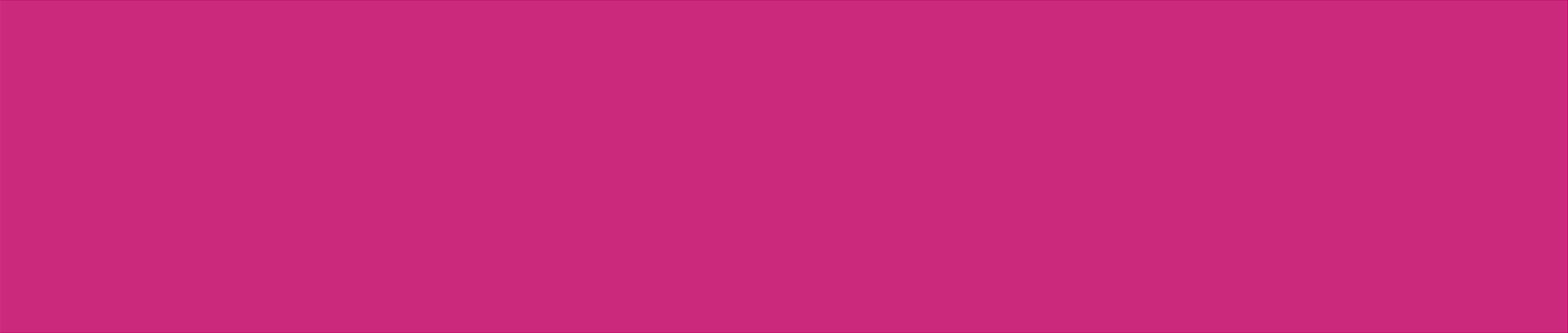


- Oxytocin is the hormone associated with childbirth and breastfeeding
- However, it is also associated with empathy, social behavior and nurturing as well
- In females, oxytocin is produced in large amounts during labor and stimulates mother-infant bonding
- However, oxytocin is also produced in males
- Brain scans conducted during a study at Emory university showed an increase in oxytocin levels in the brain areas that are associated with reward and empathy when they were viewing photos of their toddlers



Oxytocin

- As we have now seen, oxytocin, which is a hormone associated with nurturing is produced by both males and females
- Males too have the ability to be nurturers



These are some cultural myths that influence the choices people make.

The body's make up and functions are so organised and precise thus awareness of this important information helps bust myths that are made due to lack of knowledge.

Hope this scientific information motivates you to learn more about the human body and it's functioning.

Stay tuned for the next edition that will bust myths regarding the gender binary, sexual orientation and intersex.



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