Life style and Infertility: Myth or reality?

Cigarettes, promiscuity, sport, coffee, stress..

- Biotechnologies of Human Reproduction

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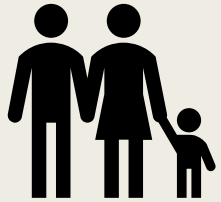
SIENA 12/12/2019

What is Infertility?



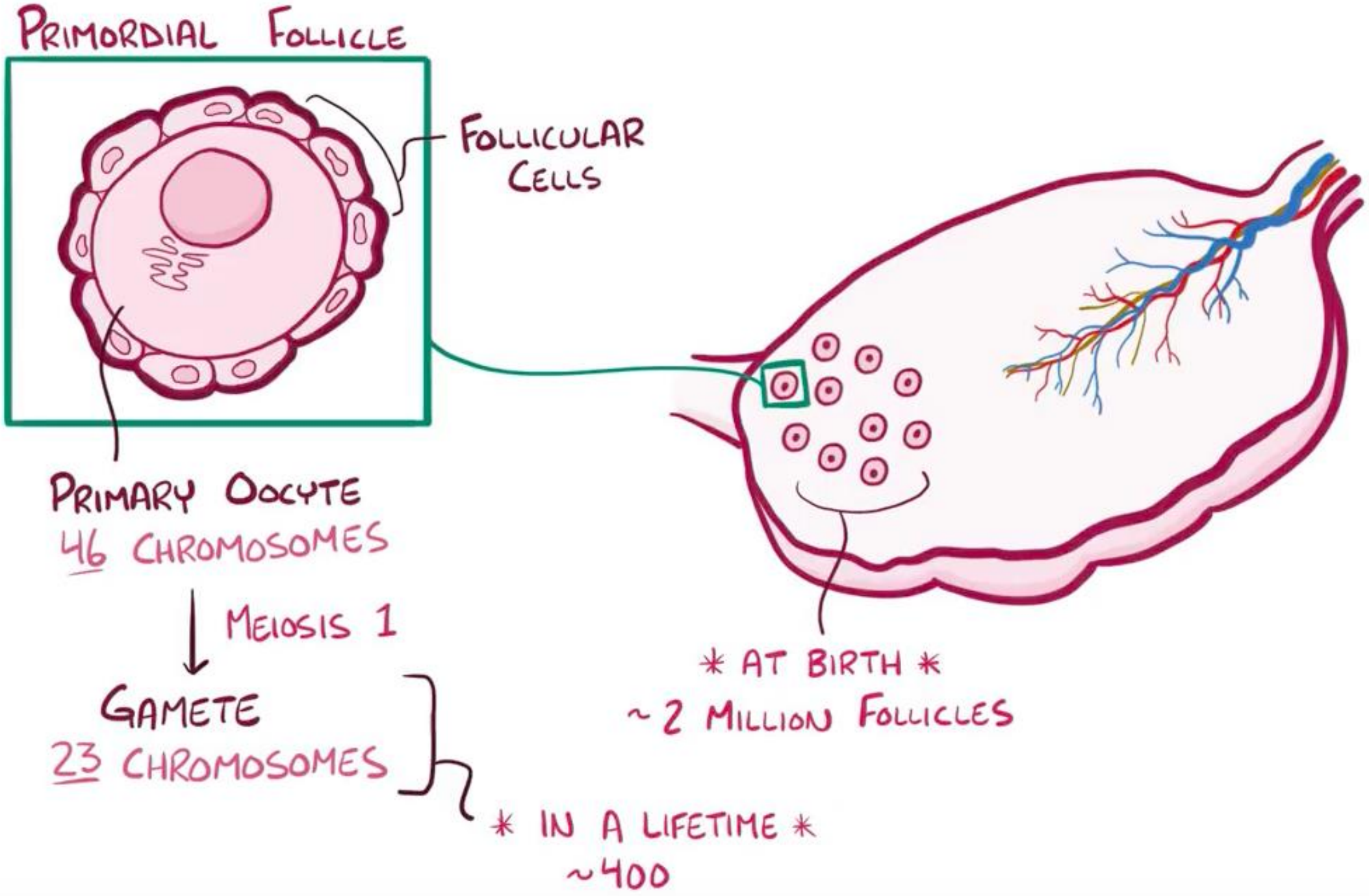
- *Infertility is the failure to conceive after 1 year of unprotected intercourse*
- *10 to 15% of couples are impacted by infertility.*
- *the pivotal role that lifestyle factors play in the development of infertility has generated a considerable amount of interest*

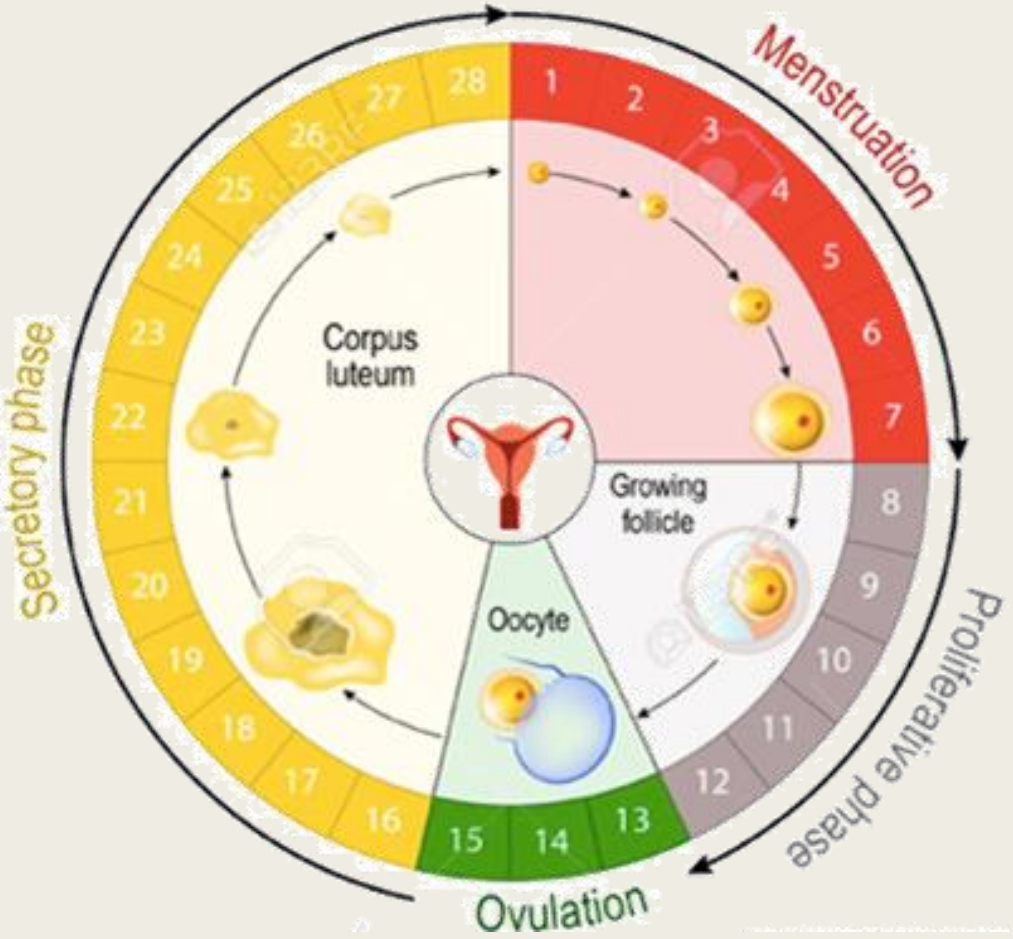
While many aspects of life are not modifiable lifestyles may be changed.

She

The female reproductive system provides several functions.

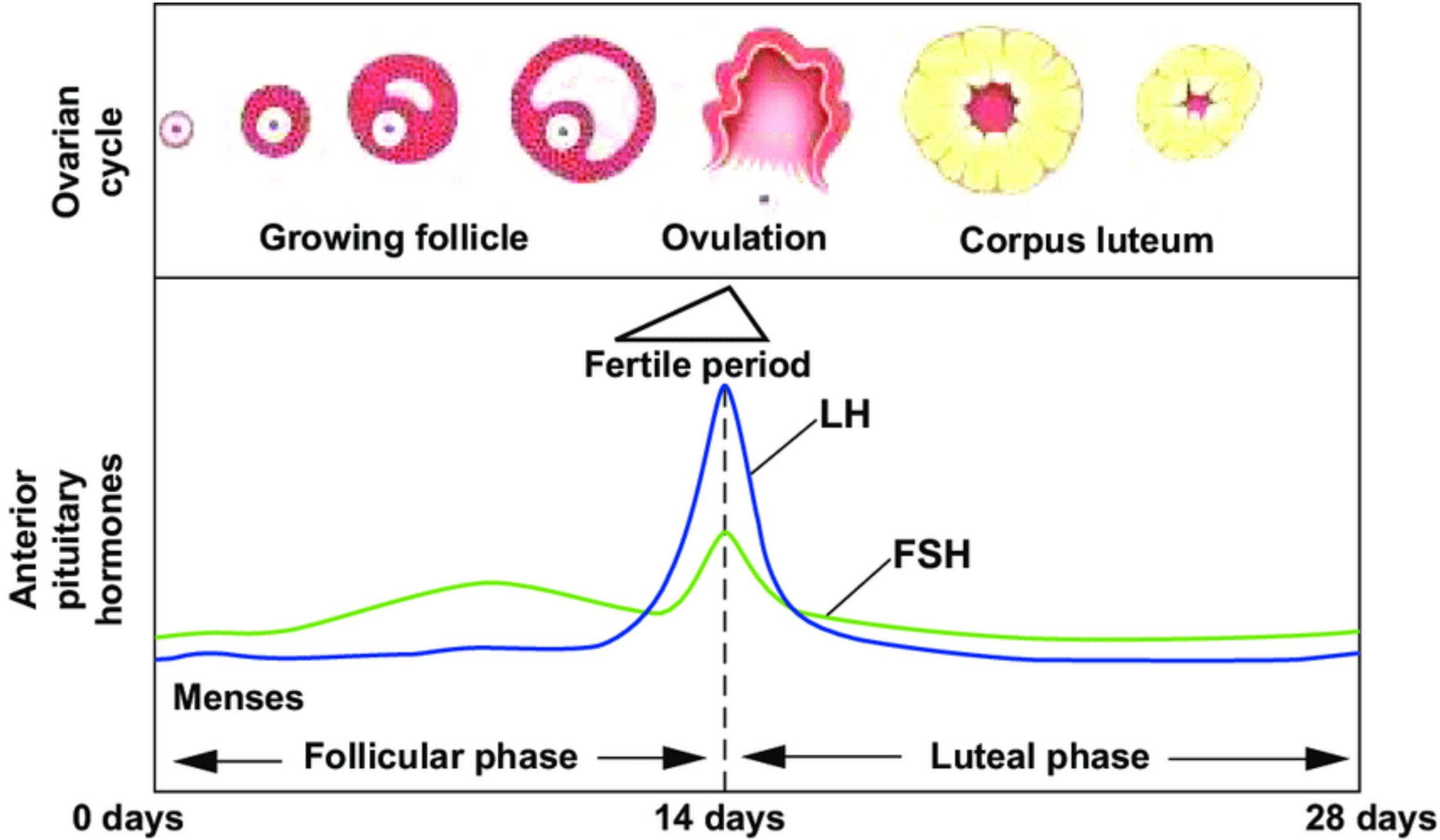
1. The ovaries produce oocytes and hormones
2. The oocytes are then transported to the fallopian tube where fertilization may occur.
3. The fertilized egg then moves to the uterus, where the uterine lining has thickened in response to the normal hormones of the reproductive cycle. Once in the uterus, the fertilized egg can implant and continue to develop.
4. If implantation does not take place, the uterine lining is shed as menstrual flow.


PRIMORDIAL FOLLICLE
FOLLICULAR CELLS
PRIMARY OOCYTE
46 CHROMOSOMES
MEIOSIS 1
GAMETE
23 CHROMOSOMES
* IN A LIFETIME *
~400
* AT BIRTH *
~2 MILLION FOLLICLES

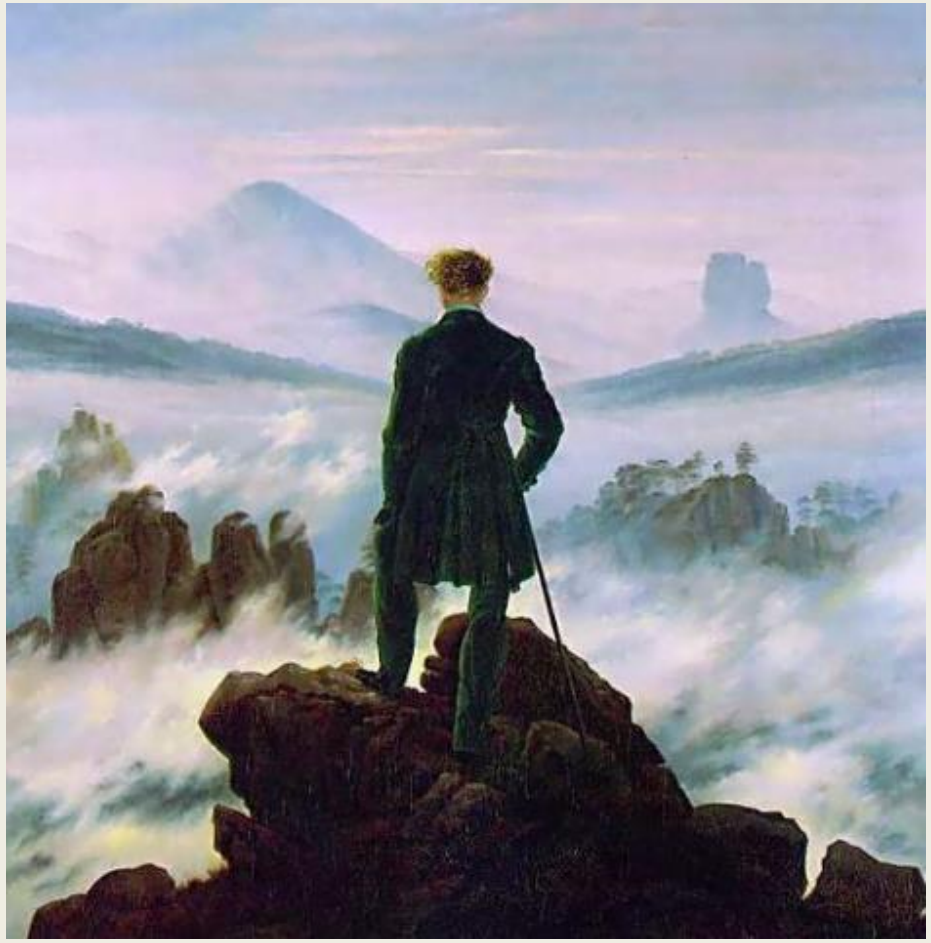


What's the menstrual cycle?

The menstrual cycle is the **monthly series of changes** a woman's body goes through in preparation for the possibility of pregnancy. Each month, one of the ovaries releases an oocyte. At the same time, **hormonal changes** prepare the uterus for pregnancy.

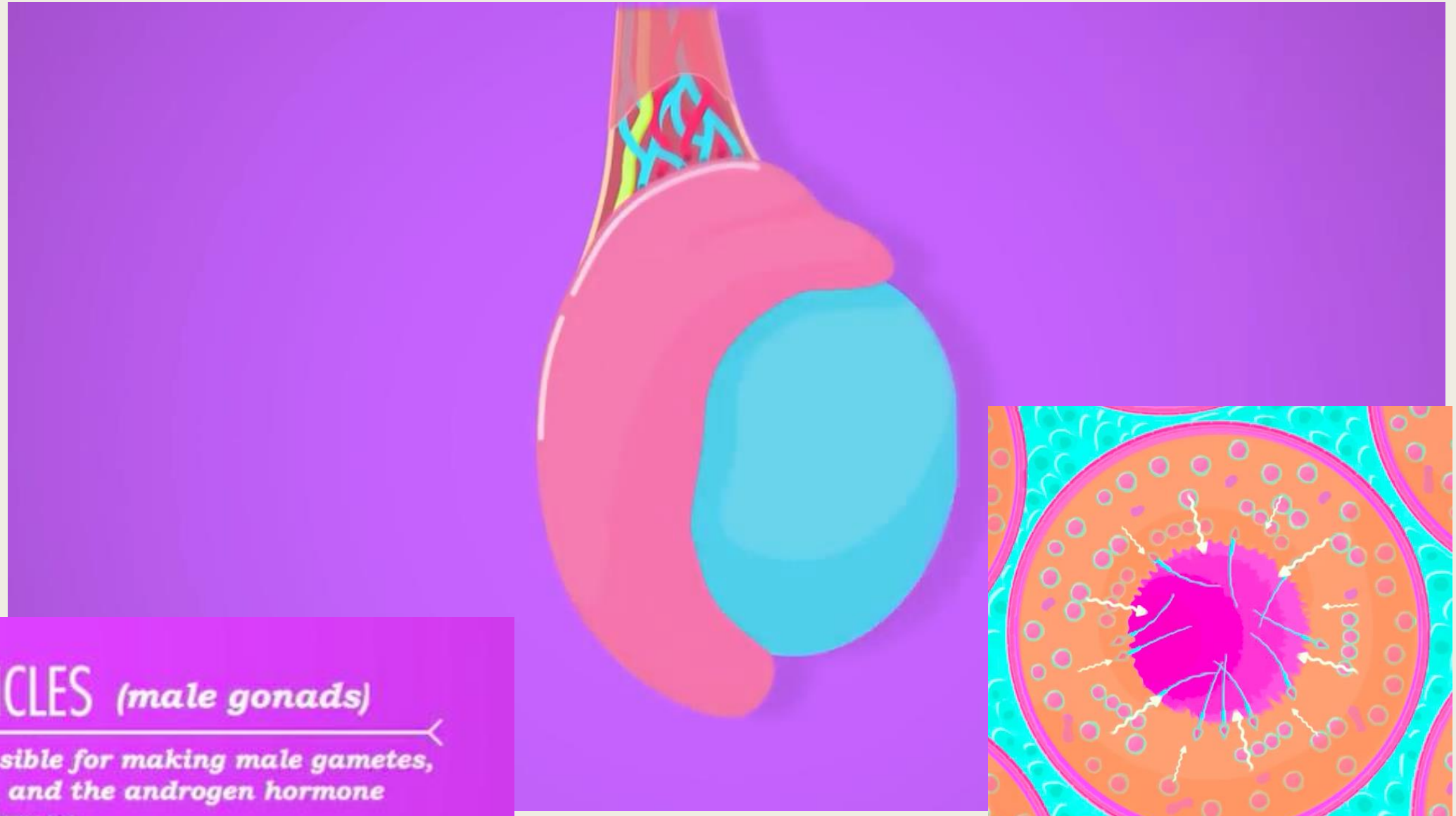

Ovarian cycle
Growing follicle
Ovulation
Corpus luteum
Anterior pituitary hormones
Fertile period
LH
FSH
Menses
Follicular phase
Luteal phase
0 days
14 days
28 days

He



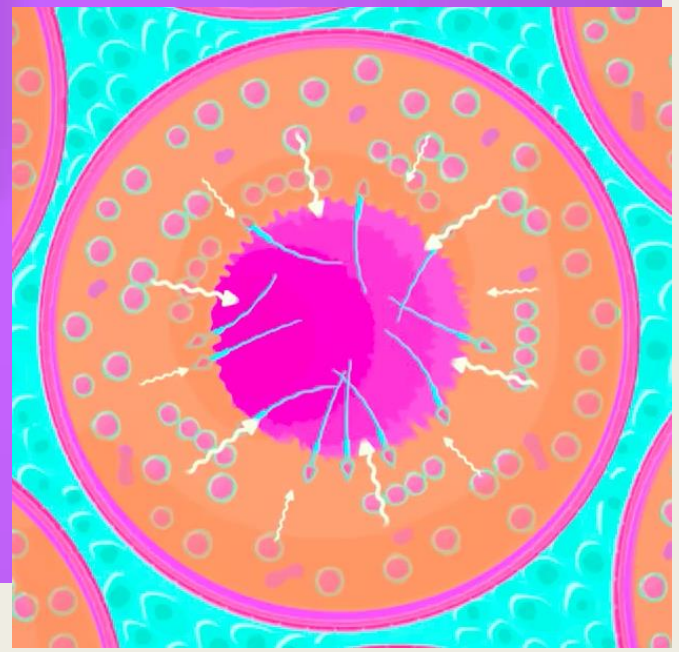
The purpose of the organs of the male reproductive system is to perform the following functions:

1. *To produce, maintain, and transport sperm (the male reproductive cells) and protective fluid (semen)*
2. *To discharge sperm within the female reproductive tract during sex*
3. *To produce and secrete male sex hormones responsible for maintaining the male reproductive system*

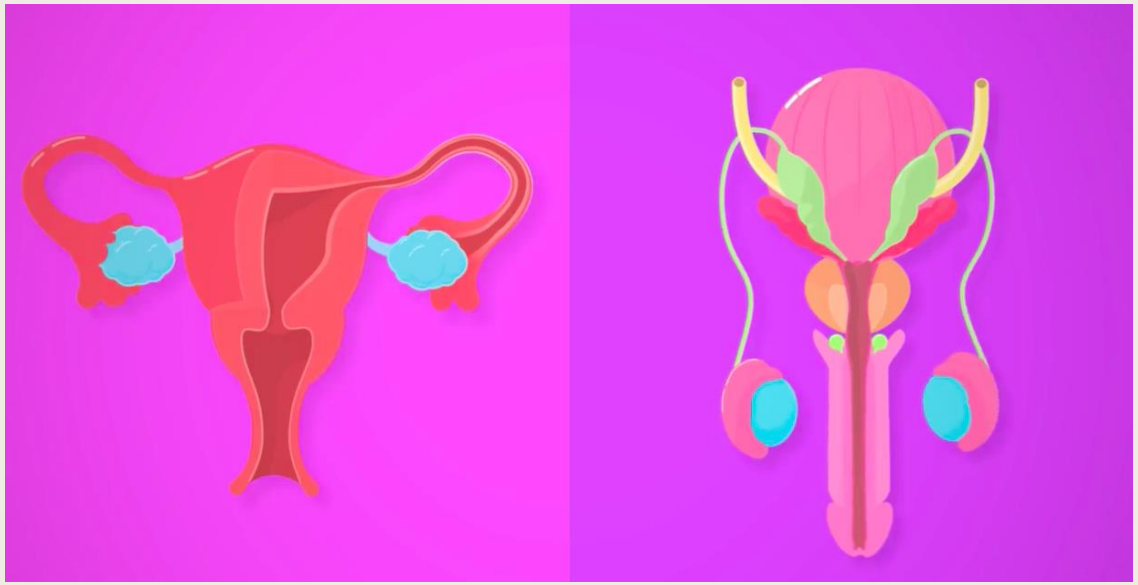


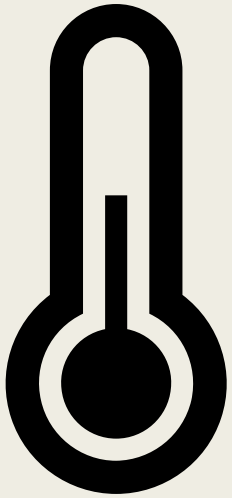
TESTICLES *(male gonads)*

responsible for making male gametes, sperm, and the androgen hormone testosterone



Sperm Production isn't so '**cool**' at a core body temperature of 37 degrees celsius. Luckily the avarage scrotal temperature is about ***3 degrees cooler***, and thus much more sperm-freindly.





The scrotum acts as a "climate control system" for the testes. For normal sperm development, the testes must be at a temperature slightly cooler than body temperature. Special muscles in the wall of the scrotum allow it to contract and relax, moving the testicles closer to the body for warmth or farther away from the body to cool the temperature.

IMPACT OF SEVERAL FACTORS ON FERTILITY

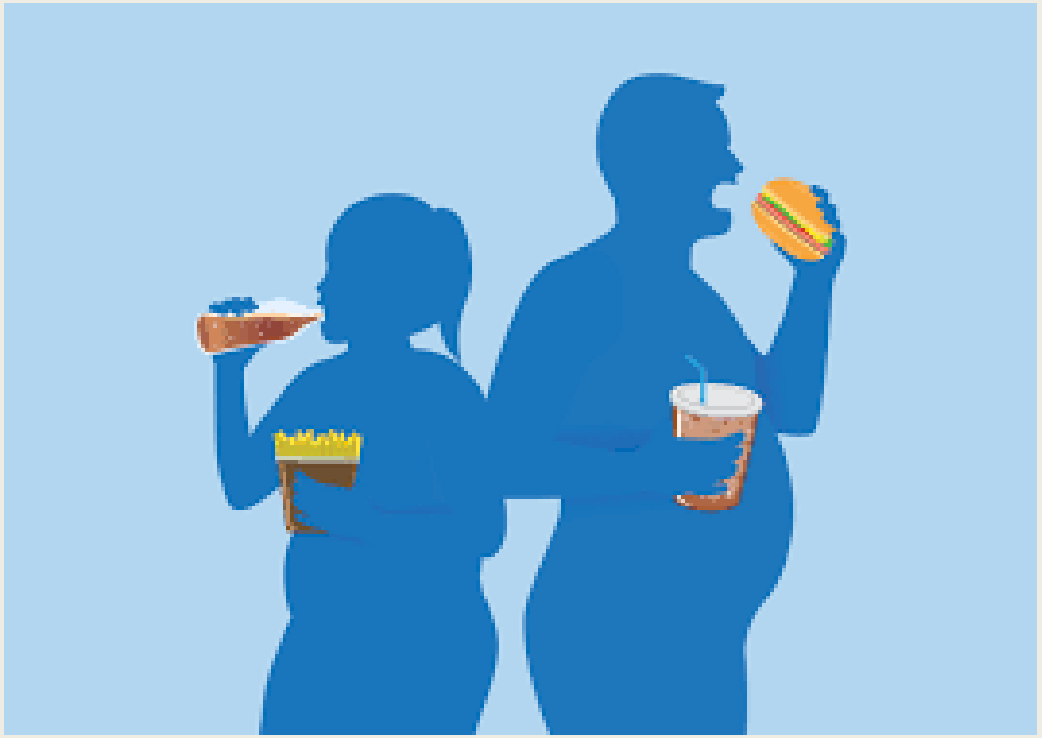
IMPACTS OF DIET AND EXERCISE

Weight

An individual's weight is often associated with his or her eating habits and amount of activity. Body mass index (BMI) is reported as a number. If it is below 18.5 it is considered underweight, between 18.5 and 24.9 is normal, above 25 is overweight, and over 30 is considered obese. Body weight can have significant effects on health, including cardiovascular disease, diabetes, and infertility.

Obesity

Adult obesity increased to 35.7% in 2010. The rising number of obese individuals may be due in part to an energy-rich diet as well as insufficient physical. In addition to other potential health risks, obesity can have a significant impact on male and female fertility.



FEMALE

In 2010, 35.8% of ***women*** in the U.S. over the age of 20 were considered obese. Women with a **BMI over 30** have **longer time to pregnancy** than women who have a BMI between 20 and 25.

Obese women had a **higher rate of recurrent, early miscarriage** compared to non-obese women.

There is a **negative correlation** between **increasing BMI** and **implantation**. A decreased ongoing pregnancy rate of 38.3% per cycle was found in women who were overweight in comparison to the 45.5% in non overweight women .

The negative effects of obesity on fertility in women may be reversible. After losing an average of 10.2 kg, 90% of obese previously anovulatory women began ovulating .

MALE

Obese ***men*** are three times more likely to exhibit a reduction in semen quality than men of a normal weight.

An increase in BMI is correlated with a decrease in sperm concentration, and a decrease in motility.

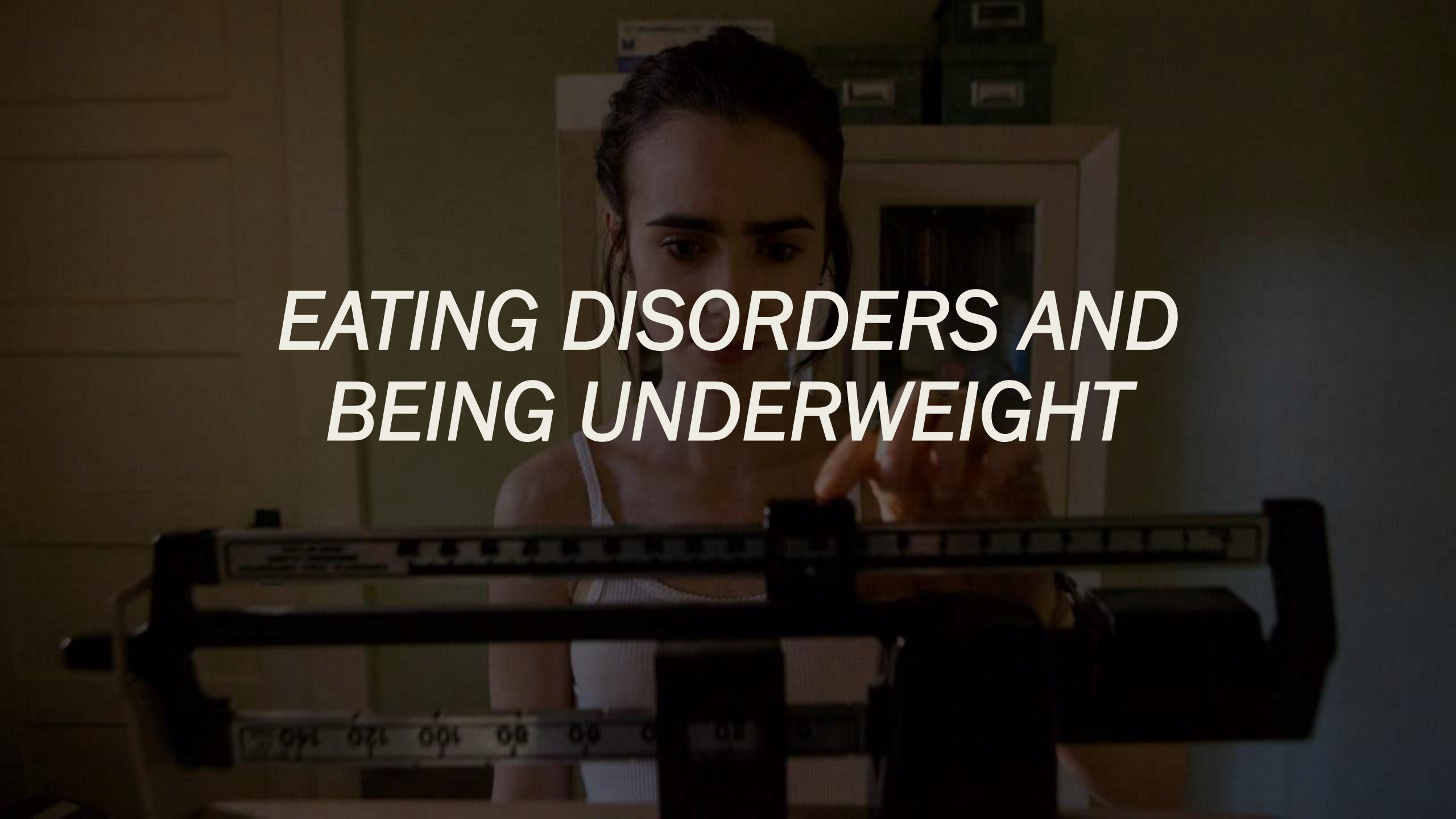
Overweight men have also been found to have increased DNA damage in sperm .

A relationship also exists between obesity and erectile dysfunction (ED). 96.5% of men with metabolic syndrome presented with ED.

Metabolic syndrome (MS) is a constellation of metabolic abnormalities including obesity, hypertension, hypertriglyceridemia..

Hypogonadism, which may be caused by MS, can lead to ED through altered testosterone:estrogen levels.

Severe hypogonadism in men usually results in loss of libido and potency, which can be restored by androgen administration.



EATING DISORDERS AND BEING UNDERWEIGHT

Obesity is not the only way in which weight can impact fertility.

- ***Men*** who are underweight tend to have lower sperm concentrations than those who are at a normal BMI.

- For ***women***, being underweight and having extremely low amounts of body fat are associated with ovarian dysfunction and infertility . Additionally, the risk of ovulatory infertility increases in women with a BMI below 17.

Underweight women had an increased risk of pre-term birth. The lifetime prevalence of anorexia nervosa in women is 0.9%, with the average age of onset being 19 years old.

Eating disorders can negatively affect menstruation, fertility, and maternal and fetal well-being.

20.7% of infertile women seeking intra uterine insemination (IUI) had been diagnosed with an eating disorder, suggesting that women with history of eating disorders may be at a higher risk for infertility.

FEMALE "FERTILITY DIET”

A woman's diet may ultimately affect her fertility, particularly ovulation. ***"fertility diet"***

1. Replacing carbohydrates with vegetable protein **demonstrated** a protective effect. **Replacing carbohydrates** with animal protein was demonstrated to be detrimental to ovulatory fertility. Adding just **one serving of meat** was correlated with a **32% higher chance** of developing ovulatory **infertility**.

2. Choosing monounsatureted fat: trans fats in the diet instead of monounsaturated fats has been demonstrated to drastically increase the risk of ovulatory infertility.

3. **decreased the glycemic load** **is** good for women's fertility and can also decreased ovulation disorders.

4. The use of multivitamins and supplements has an effect. Women who take multivitamins and iron may be less likely to experience ovulatory infertility; women who take six or more tablets had the lowest relative risk for infertility followed by women who took three to five and two or less.

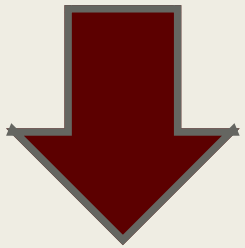
CAN MALE'S DIET IMPACT FERTILITY?

Aspects of a male's diet may have an impact on his fertility.

1. Consuming a diet **rich** in **carbohydrates, fiber, folate**,and **lycopene** as well as consuming **fruit** and **vegetables** correlates with <u>improved semen quality</u>.

2. Consuming **lower** amounts of both **proteins and fats** were more beneficial for fertility.

WHAT ARE WE TALKING ABOUT?

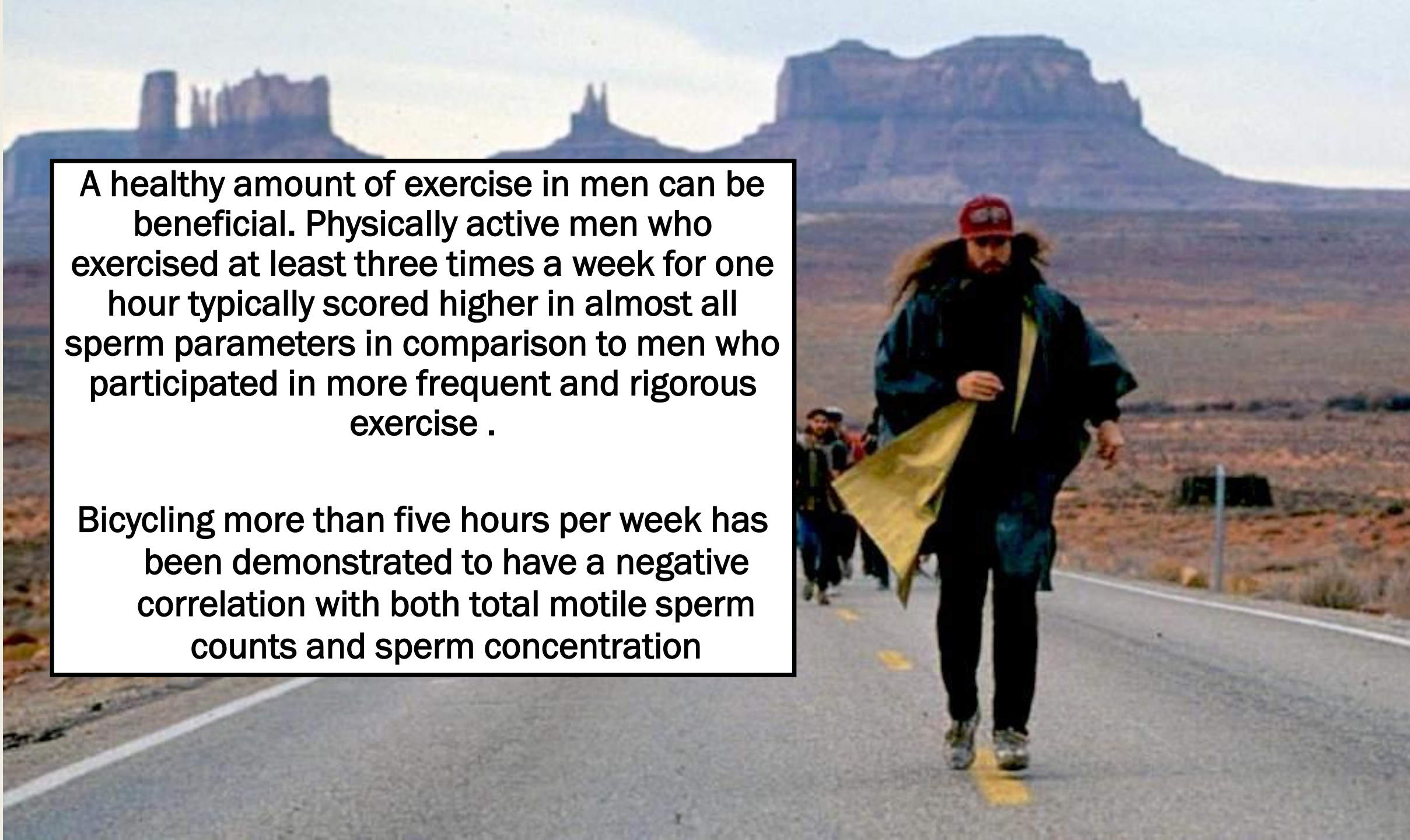


ROS

Reactive oxygen species or ROS are a collection of free radicals and non-radical derivatives of oxygen. These are by-products of cellular respiration that are necessary for certain cellular activity, including sperm capacitation;

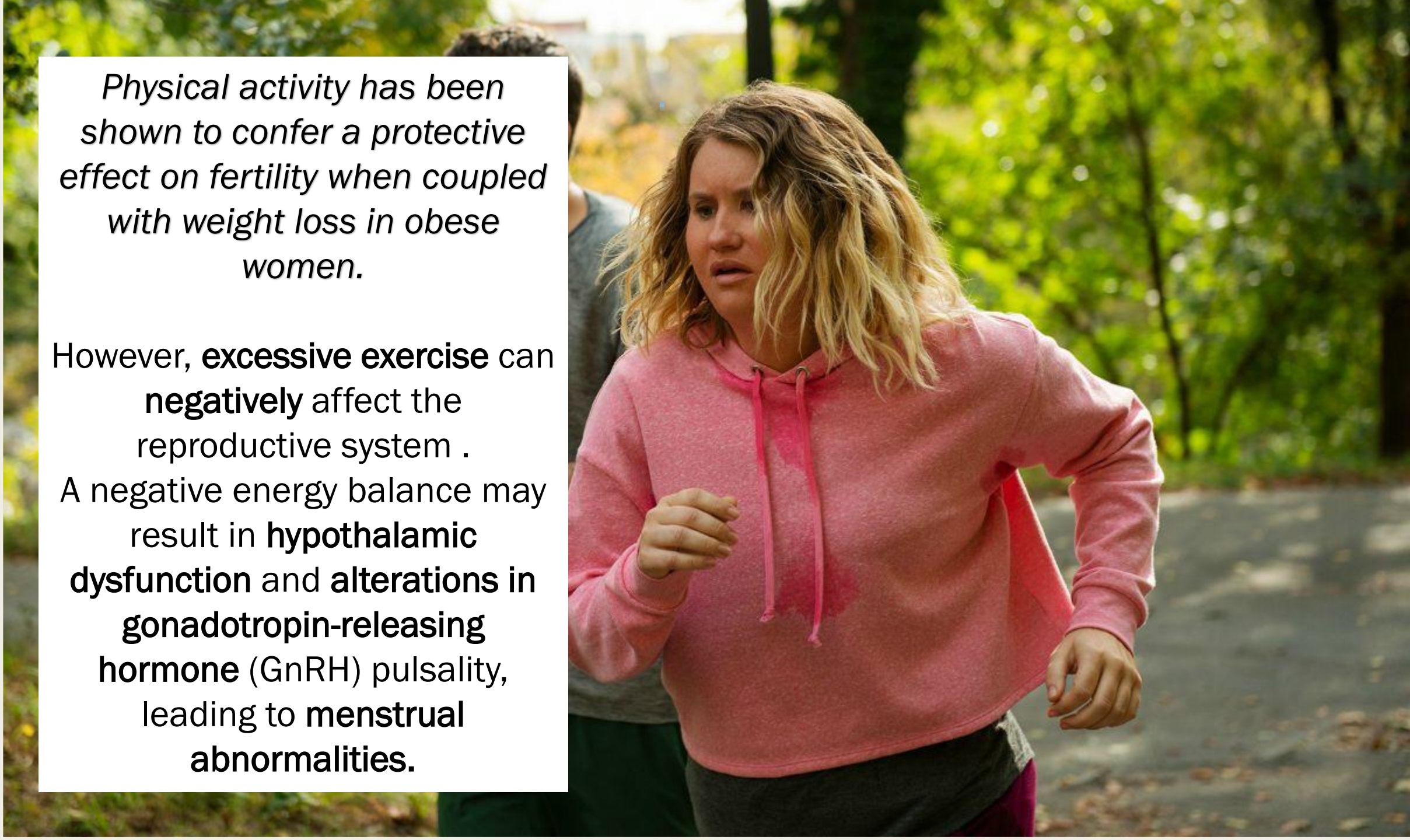
However, an ***overabundance of ROS may compromise sperm function***, including sperm motility, altering DNA and decreasing membrane integrity.


EXERCISE



A healthy amount of exercise in men can be beneficial. Physically active men who exercised at least three times a week for one hour typically scored higher in almost all sperm parameters in comparison to men who participated in more frequent and rigorous exercise .

Bicycling more than five hours per week has been demonstrated to have a negative correlation with both total motile sperm counts and sperm concentration



Physical activity has been shown to confer a protective effect on fertility when coupled with weight loss in obese women.

However, **excessive exercise** can **negatively** affect the reproductive system .
A negative energy balance may result in **hypothalamic dysfunction** and **alterations in gonadotropin-releasing hormone** (GnRH) pulsality, leading to **menstrual abnormalities.**

Recreational and prescription substances

CIGARETTES SMOCKING

Men

It is estimated that 35% of reproductive-aged ***males*** smoke.

Men who smoke before or during attempts to conceive risk decreasing their fertility in comparison to non-smokers.
Men who smoke tend to have a decrease in total sperm count, density motility , normal morphology, semen volume, and fertilizing capacity.

Men

Both moderate and heavy smokers experienced astheno-, oligo-, and teratozoospermia simultaneously.

Smoking can for sure

1. Impact the DNA integrity of the sperm,
2. reduce the mitochondrial activity in spermatozoa,
3. lead to a decreased fertilization capacity .

Women

Among ***women*** who are of reproductive age, 30% are smokers.

Women who smoked had a significantly **higher odds ratio of infertility**, in comparison to non-smokers.
The reductions in fertility among female smokers may be due to decreases in ovarian function and a reduced ovarian reserve.

Smoking

Reduced ovarian reserve was significantly higher in women who smoked than in age matched non-smokers.

This suggests **that ovarian reserve may be the primary mechanism by which smoking affects fertility in women.** Disruption of hormone levels may also be a possible mechanism.

→women who smoked 20 or more cigarettes per day had lower luteal-phase levels of progesterone.

Alcohol

Many studies have been conducted on the effects of alcohol and aspects of health, including fertility.

While there are studies that demonstrate the link between alcohol and infertility, it is not entirely clear what amount relates to an increased risk.

Men

In ***men***, alcohol consumption has been linked with **many negative** side **effects** such as **testicular atrophy, decreased libido, and decreased sperm count.**

Very few men who are classified as alcoholics were normozoospermic with only 12% of men.

Most alcoholics were found to be teratozoospermic, with 73% of heavy drinkers and 63% moderate drinkers falling in this category.

Alcohol seems to have a large impact on both sperm morphology and sperm motility . Oxidative stress has been found to systemically increase with alcohol consumption, but there is not yet a clear link between spermoxidative stress and alcohol.

Alcohol

The amount of alcohol consumed does matter.

Alcohol can have various effects including increasing the time to pregnancy, decreasing probability of conception rate by over 50% and decreasing implantation rate, increasing both the risk of spontaneous abortion and of fetal death, and causing anovulation, luteal phase dysfunction, and abnormal blastocyst development.

Researchers believe that these effects may be due to **hormonal fluctuations** including increases in estrogen levels, which reduce FSH and suppress both folliculogenesis and ovulation, but many mechanisms are still unknown.

Illicit drugs

Men

Cannabis: marijuana, is the **most abused** illicit drug globally and has predominantly male users. Regular marijuana smoking (more than once weekly within the last 3 months) was found to **lower sperm concentration, reduce testosterone released from Leydig cells and total sperm count** amongst young men.

Cocaine: Both acute and chronic exposure to cocaine disrupted **spermatogenesis** and **damaged the testicular ultrastructure**. These changes could have been brought about by cocaine-induced apoptosis

Testosterone and its derivatives :comprise a family of hormones called Steroids, that are used by professional athletes in order to increase their mass.

Anabolic steroid-induced hypogonadism was the most common cause of hypogonadism. Increased levels of exogenous testosterone exert a negative feedback on the HPG axis causing reversible suppression of spermatogenesis, testicular atrophy, and infertility

Sex

Cannabis: who use marijuana are at an **increased risk of primary infertility** in comparison to non-users.
Use of marijuana can **negatively impact hormonal regulation**;

Marijuana and its cannabinoids have been reported to negatively impact movement through the oviducts, placental and fetal development,and may even cause stillbirth.

Cocaine: While less is known about cocaine's effects on ***females***, impaired ovarian responsiveness to gonadotropins and placental abruption have both been reported.

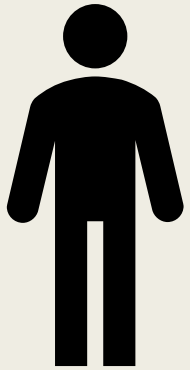
Caffeine

Caffeine has been reported to have ***negative effects on female fertility***.

Caffeine has been associated with an **increase** in the **time to pregnancy**, particularly if the amount is over **500 mg per day.**

The negative effects that are emphasized are miscarriage, spontaneous abortion, fetal death and still birth.
The karyotypes of those spontaneously aborted fetuses were normal indicating that spontaneous abortions may not be due to genetic defects, but perhaps an **unknown mechanism triggered by caffeine**.

Caffeine consumption during the first trimester is related to both miscarriage and still birth.



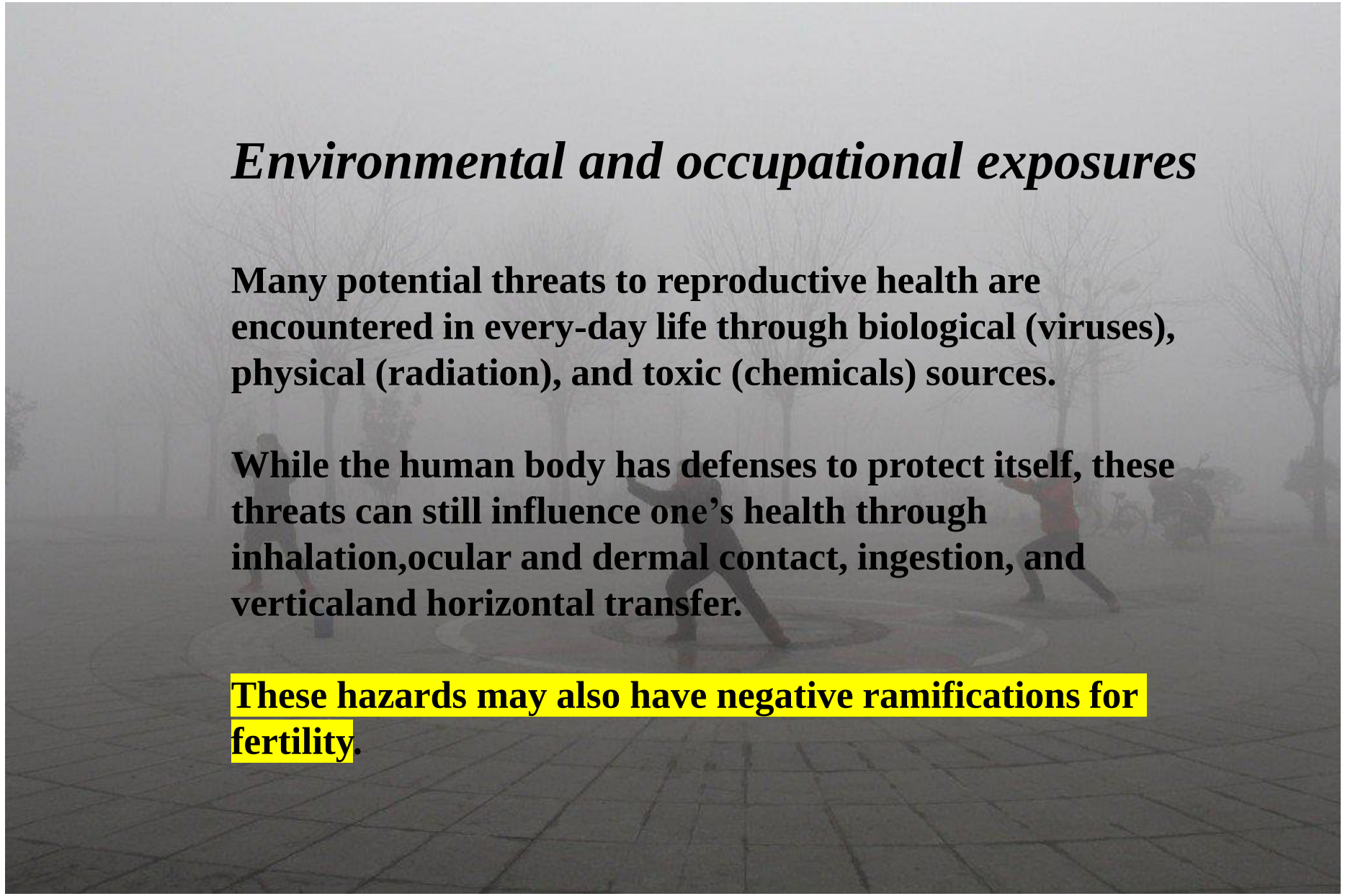
Most studies have **not found an association between moderate caffeine intake and male fertility.**

Semen parameters (semen volume, count and concentration) were **affected by cola-containing beverages and caffeine-containing soft drinks,** but not by caffeine intake from mainly coffee, tea, and cocoa drinks.

More studies are needed in order to investigate in a more deeper way the correlation between caffeine and male infertility

Psychological effects

Stress is a prominent part of any society, whether it is physical, social, or psychological. Infertility itself is stressful, due to the societal pressures, testing, diagnosis, treatments, failures, unfulfilled desires, and even fiscal costs with which it is associated.



Environmental and occupational exposures

Many potential threats to reproductive health are encountered in every-day life through biological (viruses), physical (radiation), and toxic (chemicals) sources.

While the human body has defenses to protect itself, these threats can still influence one's health through inhalation,ocular and dermal contact, ingestion, and verticaland horizontal transfer.

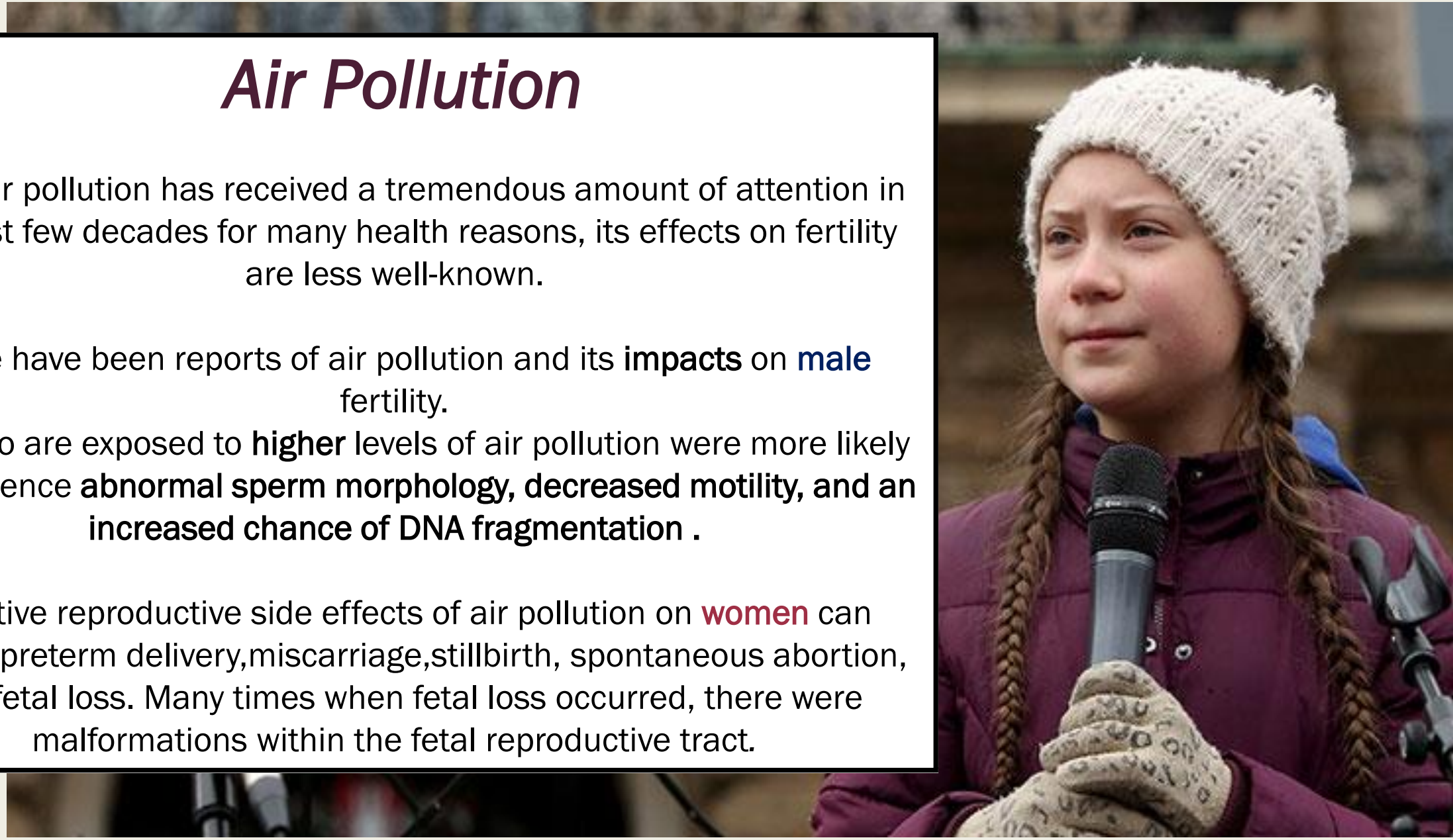
These hazards may also have negative ramifications for fertility.

Air Pollution

While air pollution has received a tremendous amount of attention in the past few decades for many health reasons, its effects on fertility are less well-known.

There have been reports of air pollution and its **impacts** on male fertility.
Men who are exposed to **higher** levels of air pollution were more likely to experience **abnormal sperm morphology, decreased motility, and an increased chance of DNA fragmentation .**

Negative reproductive side effects of air pollution on women can include preterm delivery,miscarriage,stillbirth, spontaneous abortion, and fetal loss. Many times when fetal loss occurred, there were malformations within the fetal reproductive tract.



SEXUAL TRASMITTED DISORDERS

What Are STDs?

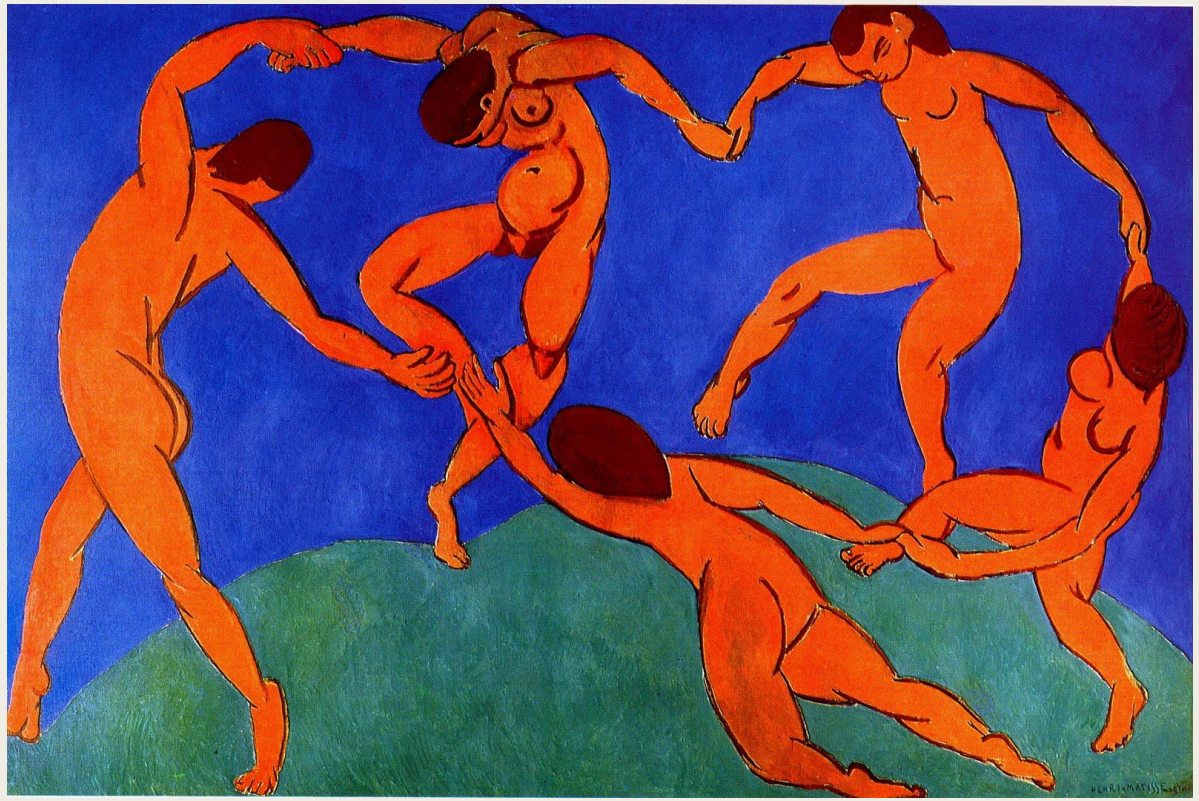
STDs are sexually transmitted diseases. This means they are most often -- but not exclusively -- spread by sexual intercourse. HIV, chlamydia, genital herpes, genital warts, gonorrhea, some forms of hepatitis, syphilis, and trichomoniasis are STDs.

They are among the most common contagious diseases. More than 65 million Americans have an incurable STD. Each year, 20 million new cases are reported; half of these infections are among people ages 15 to 24 and they can have long-term consequences.

STDs are **serious illnesses that require treatment.**
Some STDs, such as HIV, cannot be cured and can be **deadly**. By learning more about STDs, people can learn ways to protect themself.
We can get a STD from vaginal, anal, or oral sex.

You are at high risk if:

- You have more than one sex partner
- You have sex with someone who has had many partners
- You don't use a condom when having sex
- You share needles when injecting intravenous drugs
- You trade sex for money or drugs



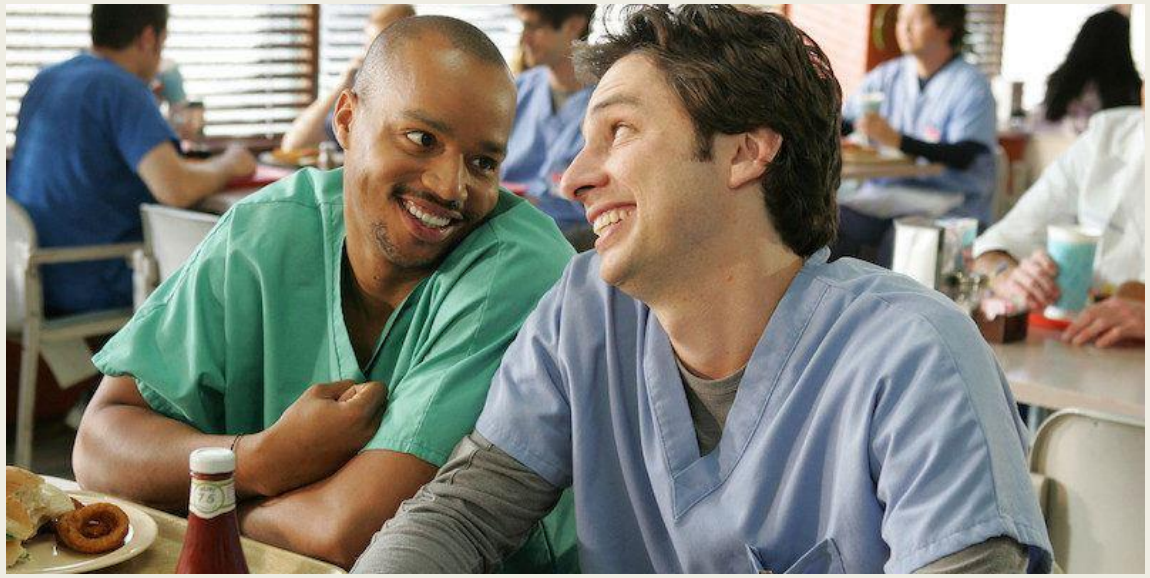
HIV and herpes are chronic conditions that can be managed but not cured.

Hepatitis B also may become chronic but can be managed.

You may not realize you have certain STDs until you have damage to your reproductive organs (rendering you infertile), your vision, your heart, or other organs.

Preventive healthcare (alternatively **preventative healthcare** or **prophylaxis**) consists of measures taken for disease prevention.[1] Disease and disability are affected by environmental factors, genetic predisposition, disease agents, and lifestyle choices and are dynamic processes which begin before individuals realize they are affected.

Preventive care



Taking care of a current fertility problem may provide better fertility in the future. Taking preventative steps such as **visiting your doctor** may help fertility. Making appointments with a doctor for both **preventative measures** and when problems arise may assist in increasing fertility for both men and women.

In addition, using appropriate contraception may have a positive impact on a couple's fertility.

Contraceptive use

Oral contraceptive users had shorter time to conception than those women not using any contraceptives. Oral contraceptives were demonstrated to have ***positive effects on the prevention and management of endometriosis and pelvic inflammatory disease.***

Lifestyle factors and other behaviors are modifiable and may impact fertility.

Eliminating every exposure is **unrealistic**; however, identifying or minimizing even one factor may have significant positive effects on fertility for both men and women.

The lifestyle factors discussed in the present power point ***have the potential to impact fertility***.

It is important to understand the ways in which lifestyle behaviors may benefit or harm fertility in order to **minimize complications** and to **maximize fertility** outcomes.

By understanding the impact of lifestyle on reproductive health, and by actively modifying lifestyle behaviors, **men and women are capable of controlling their own fertility potential.**

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Thanks for your attention!

Any questions?