

Biological explanations of gender development, including chromosomes and hormones.

Biological explanations focus on physical characteristics either inherited or within the biochemistry of the body. The genetic argument suggests that chromosomes are responsible for gender development, where males have a chromosome pattern of XY and females XX.

Hormonal explanations focus on the biochemistry from prenatal development into adulthood. Hormones are the body's chemical messengers that travel through the bloodstream and influence many different processes. The same sex hormones exist in both males and females, but they differ in terms of quantity and the effect that they have upon different parts of the body (e.g. testosterone and oestrogen).

Prenatal sex hormones drive the biological blueprint for physical and neurological sex differences long before a baby is born. Physical sex organs are decided around weeks 6 to 12 of pregnancy. The presence of the SRY gene (a specific piece of DNA found on the Y chromosome that acts as the primary switch for triggering male biological development on the Y chromosome) triggers male testes to give out androgens (like testosterone), while their absence leads to female reproductive anatomy.

How Physical Development Works

- **Genetic Trigger:** The SRY gene on the Y chromosome tells embryonic gonads to develop into testes.
- **Androgen Surge:** Between weeks 6 and 12, male gonads release testosterone, dihydrotestosterone (DHT), and androstenedione. This forms the penis, scrotum, and prostate.
- **Default Female Pathway:** Without high levels of androgens, the biological pathway defaults to developing female reproductive organs.

Surges of testosterone in early-to-mid pregnancy (weeks 8 to 24) help shape sex-differentiated brain structures and lay the groundwork for future behavioural traits, attention patterns, and neurological development. At this point in prenatal development the brain can become masculinised (male hormones) or feminised (female hormones). Prenatal hormones influence structural differences in areas like the hypothalamus, hippocampus, and corpus callosum. This developmental influences can be seen in males and females once they start to develop.

Khan (2024) proposes that while male brains tended to be greater in volume than female brains, when adjusted for total brain volume, female infants on average had significantly more grey matter, while male infants on average had significantly more white matter in their brains.

There is ongoing discussion about whether or not these brain differences affect gender development. There is a great debate in literature on the factors related to nature or nurture involved in the sexual differentiation of the brain. However, it is well established that biology plays a major role.

Biological sex shapes small differences in brain structure and early attention starting in the womb, while gender identity and societal experiences interact with these biological foundations over time.

Read the article on **Brain Sex Differences and Gender**.

Is there such as thing as a 'gendered brain'?

Watch this [video](#) from Gina Rippon.

Points to consider;

- Research on brain structures consistently finds some sex differences.
- However, the differences are not dimorphic.
- Like gendered psychological and behavioural attributes, the distributions overlap, and most brains are made up of a mix of female and male features that do not cluster together in a way that creates a clear female-to-male continuum.
- Importantly, sex differences that do exist depend on contextual/environmental factors. For example, research by Reich et al (2009) on rodents suggests that such differences can be reversed under stress conditions.
- Furthermore, Hyde et al (2019) showed that differences can change over time. Thus, showing that brain differences are not 'hardwired' (specification link: brain plasticity).

