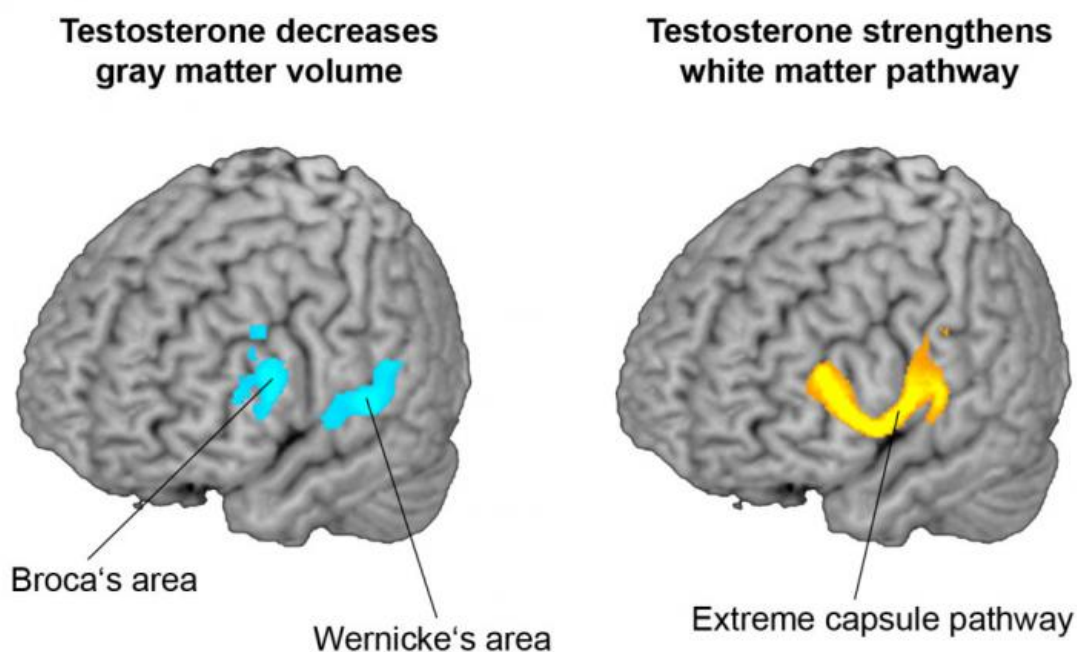


Research shows testosterone changes brain structures in female-to-male transsexuals

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Brain areas affected. Credit: Copyright: NeuroImaging Labs, Dept. Psychiatry and Psychotherapy, Medical University of Vienna, Austria

Brain imaging shows that testosterone therapy given as part of sex reassignment changes the brain structures and the pathway associated with speech and verbal fluency. This result supports research that women in general may deal with speech and interaction differently than men.

The sex hormone [testosterone](#) exerts a substantial influence on human behaviour and cognition. Previous studies have shown that testosterone has a particular influence on verbal fluency. But these investigations (which due to ethical reasons are mostly observational studies or one-off hormone administrations) have been limited in what they can show, as it has been impossible to follow the direct effect of the hormone on the brain structure.

Now a unique study has revealed the changes over time (longitudinal changes) in the brain of female-to-male transsexuals receiving continuous, high-dose hormone therapy as part of their sexual reassignment.

The results show that this therapy induces structural changes in areas of the brain involved in verbal fluency in female-to-male transsexuals. This may have wider implications, for example in the way that men and women handle speech and interaction.

The researchers, from Vienna and Amsterdam, worked with 18 female-to-male subjects (27.6 ± 6.4 years), before and during testosterone treatment. The subjects underwent MRI brain scans before and after 4 weeks of the testosterone administration. The results showed that with testosterone treatment the volume of grey matter decreased in two specific regions of the brain, the Broca's and Wernicke's areas, which are mainly responsible for language processing. At the same time, the neuronal pathway ([white matter](#)) connecting these two regions via the extreme capsule got stronger.

According to researcher Dr Andreas Hahn (Vienna):

"It has been known for some time that higher testosterone is linked to smaller vocabulary in children and that [verbal fluency](#) skills decrease in female-to-male transsexuals after [testosterone treatment](#). This fits in well

with our finding of decreased grey matter volume. However, the strengthening of the white matter in these areas was a surprise. We think that when it comes to certain language skills, the loss of [grey matter](#) outweighs the strengthened white matter connection".

Researcher Prof. Rupert Lanzenberger (Vienna, Austria) continued:

"What we see is a real quantitative difference in brain structure after prolonged exposure to testosterone. This would have been impossible to understand without looking at a transsexual population. In more general terms, these findings may suggest that the genuine difference between the brains of women and men is substantially attributable to the effects of circulating sex hormones. Moreover, the hormonal influence on human brain structure goes beyond early developmental phases and is still present in adulthood".

Commenting for the ECNP Communications Committee, Dr Kamilla Miskowiak, said:

"It is well-known that language development differs between girls and boys and that this is related to gender-related differences in brain maturation. However, this intriguing neuroimaging study of transsexuals before and after their female-to-male gender reassignment suggests that even adult men and women differ in [brain structure](#) within regions involved in language and speech. In particular, female-to-male gender reassignment resulted in local [brain](#) matter decrease within language processing regions, which may explain why verbal abilities are often stronger in women."

Provided by European College of Neuropsychopharmacology

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