Dr. rer. soc. Ute Habel

Professor of Neuropsychological Gender Research, University Clinic for Psychiatry, Psychotherapy, and Psychosomatics, RWTH Aachen University

Could you please explain why women are more prone to depression and anxiety than men?

There is no clear answer to that question, but there are several hypotheses. The higher prevalence of these disorders in females may be a result of artifacts, or biological and psychosocial factors, or a combination and interaction of all of these. The artifact hypothesis assumes that women are more willing to seek help, which accounts for a higher number of registered patients. In addition, females and males may show a different depressive symptomatology and the classical diagnostic categories fail to cover male depression which differs from the female pattern. However, this has not been accepted as a sufficient explanation. Among the biological reasons, the different brain structure of men and women may influence the development of different disorders. Additionally, a higher genetic load has been reported for depression in females than males. Steroid hormones, such as estrogen and progesterone, also act as modulators since the different prevalence rates for depression, for example, emerge after puberty. Consequently, depression and anxiety are more frequent in phases of hormonal changes, such as postpartum and during menopause. But psychosocial factors are also highly relevant, such as poverty, stress, low status, low educational level, and unemployment. Women often experience more psychosocial stressors than men, since they often have multiple role responsibilities. It is likely that a complex interaction of all these factors contributes to a greater proneness of women to these disorders.

Which areas of your research do you consider the most promising in the treatment of depression and anxiety? Which aspects would you like to investigate further?

Most of our psychotherapeutic interventions, which are very effective in the treatment of depression and anxiety, have not been evaluated thoroughly with respect to their neurobiological correlates using neuroimaging. Furthermore, the therapeutic options are constantly increasing and new therapeutic approaches, such as metacognitive therapy, acceptance and commitment therapy, and mindfulness-based therapy have been proposed with promising results and have to be analyzed for their specific effects on brain and behavior. And in addition to these psychotherapeutic approaches, experimental innovative therapies, such as

transcranial direct-current stimulation and neurofeedback, offer valuable methods that have to be tested not only for their potential to reduce symptoms in patients, but also for their short-term and long-term effects. I see one of the most promising pathways for future research in the search of prognostic multidimensional variables that could predict at baseline, before a therapeutic intervention, who will profit most from which therapeutic strategy option. A promising neurobiological candidate for treatment response emerged in the function of the subgenual anterior cingulate region in depression, for example, and we have to follow this path with respect to further variables, such as other regions, hormones, and physiological responses to increase the sensitivity and specificity of our predictions as well as to assess the disorder specificity. It is of upmost importance in all these approaches to acknowledge and analyze possible gender differences, a strongly neglected aspect, as gender is one of the most important influencing factors on human individuality.

To what extent does gender influence the neurobiology of emotions – and why?

The common gender stereotype states that women are more emotional than men. And a number of studies seemed to support this, reporting more intensive emotional experiences and stronger physiological responses in females although the results are quite mixed. Moderating variables are gender role expectations and stereotypes. However, most of our own studies did not reveal behavioral gender differences in emotional experience or in emotion recognition or higher-order social cognitive functions, such as empathy. On a neural level, our results repeatedly demonstrated gender differences, with generally stronger activation of females, during emotion experience and empathy, and especially in subcortical limbic areas, such as the amygdala, a key structure in the emotional network. Furthermore, we were able to show and replicate several times, that sex hormones exert an influence on brain and emotional behavior. During the follicular phase of the cycle, females have greater emotion recognition abilities than during the luteal phase and this is related to the progesterone level. The lower the progesterone, the better the recognition of emotional facial expressions. This indicates that even if gender does not affect the observable behavior it exerts an influence on a neurobiological level, reflecting a differential strategy of both genders to reach the same endpoint.

How do activities during childhood, such as engaging in sports or playing with toys, influence the gender-specific development of the brain?

All learning and training leaves its footprints in the brain's structure and function. Several studies have shown long-lasting cerebral functional and morphological alterations after training of certain competencies, such as cognitive task solving, mental rotation, musical training, or fine motor skills, and many more. If this training focuses on certain functions in one gender while the other gender engages in different games and sports, then this will certainly contribute to gender-specific behavior and functional as well as structural brain differences. Furthermore, certain abilities such as empathy, for example, mostly develop during a certain time period.

The respective preferred activity of the child may hence have a greater influence during certain ‘sensitive periods’ than in others.

On the other hand, it is also important to acknowledge that neurobiological gender differences are already present prenatally and may give rise to different biologically determined interests and preferences.

The most compelling finding supporting this comes from studies investigating female and male rhesus monkeys' preferences for human toys. The baby monkeys revealed similar gender stereotyped toy preferences as humans. The male monkeys preferred wheeled toys over plush toys like boys, while female monkeys, like girls, were less consistent. These striking similarities to humans suggest biologically determined toy preferences and rather support the hypothesis that hormones affect behavior and cognition reflected in gender-specific toy preferences, which are then further shaped by social influences into the sex differences we can observe.

How do female and male brains age differently?

In general, older age is associated with brain atrophy rates independent of gender. In a recent review, Hedman and colleagues (2012) concluded that apart from brain volume increases during childhood and adolescence, a continuous volume decrease of 0.2% per year can be observed, which accelerates to an annual brain volume loss of 0.5% at age 60 and more than 0.5% above the age of 60 years. Thereby, evidence is provided for a volume loss of gray matter and cortical thinning during aging. Regarding neurodegenerative diseases like Alzheimer’s disease, women are disproportionally more affected compared to men. The underlying mechanisms for these differences are still unknown. Studies try to elucidate gender differences regarding brain anatomy, age-related volume-loss, or potential chemical interactions as potential causal factors. In healthy aging, there is evidence for some structural differences between women and men: despite age-related volume reductions, some studies suggest gender-related differences of atrophy rates within specific brain areas. In addition, older women show a greater cortical connectivity and a more efficient underlying organization of cortical networks compared to older men (Gong et al., 2009). But at present, all these results are preliminary. In addition, it is important to bear in mind that brain alterations during aging can be compensated to a large extent and are, therefore, not easily detectable behaviorally in the elderly. They are, however, of high scientific interest. Altogether there is a high variability in gender differences, and aging, and the interaction of both factors on brain structure and function is still not well understood. We have an urgent need for specific research to improve diagnosis, and adapt, and develop trainings and therapeutic approaches to take gender differences in the aging society adequately into account.