Definition and Synopsis of the Etiology of Adult Gender Identity Disorder and Transsexualism

1.Gender Identity Disorder is defined as an incongruence between the physical phenotype and the gender identity[1], that is, the self identification as male or female. The experience of this incongruence is termed Gender Dysphoria. The most extreme form, in which individuals need to adapt their phenotype with hormones and surgery to make it congruent with their gender identity, is called transsexualism[2], Those individuals experiencing this condition are referred to as trans people, that is, trans men (female to male) and trans women (male to female).

2.Transsexualism can be considered to be a neuro-developmental condition of the brain. Several sexually dimorphic nuclei have been found in the hypothalamic area of the brain (Allen & Gorski, 1990; Swaab *et al*., 2001). Of particular interest is the sexually dimorphic limbic nucleus called the central subdivision of the bed nucleus of the stria terminalis (BSTc) which appears to become fully volumetrically sexually differentiated in the human brain by early adulthood. This nucleus has also been found to be sexually dimorphic in other mammalian and avian species (Miller & Vician, 1989; Grossmann & Jurkevich, 2002). In human males the volume of this nucleus is almost twice as large as in females and its number of neurons is almost double ($P < 0.006$) (Zhou *et al.*, 1995; Kruijver *et al.,* 2000; Chung *et al.,* 2002).

3. The Kruijver *et al.* study, cited above, indicates that in the case of transsexualism this nucleus has a sex-reversed structure. This means that in the case of trans women (n=7), the size of this nucleus and its neuron count was found to be in the same range as that of the female controls (n=13) and, therefore, women in the general population. In the only available brain of a trans man, the volume and structure of this nucleus was found to be in the range of the male controls (n=21) and, therefore, men in the general population. It is hypothesised that this male-like BSTc will be present in other trans men as well. These findings were independent of sexual orientation and of the use of exogenous sex hormones. In the 42 human brains collected for this study, the BSTc was found to have a structure concordant with the psychological identification as male or female. It is inferred that the BSTc is an important part of a sexually dimorphic neural circuit, and that it is involved in the development of gender identity (Kruijver et al., 2000).

4. Sexual differentiation of the mammalian brain starts during fetal development and continues after birth (Kawata, 1995; Swaab *et al.*, 2001). It is hypothesised that in humans, in common with all other mammals studied, hormones significantly influence this dimorphic development although, at present, the exact mechanism is incompletely understood. It is also postulated that these hormonal effects occur at several critical periods of development of the sexual differentiation of the brain during which gender identity is established, initially during the fetal period, then around the time of birth; and also post-natally. Factors which may contribute to an altered hormone environment in the brain at the critical moments in its early development might include genetic influences (Landen, 1999; Coolidge *et al*, 2002) and/or medication, environmental influences (Diamond *et al.*, 1996; Whitten *et al*., 2002), stress or trauma to the mother during pregnancy (Ward *et al.,* 2002*;* Swaab *et al*., 2002).

5. Gender identity usually continues along lines which are consistent with the individual's phenotype, however, a very small number of children experience their gender identity as being incongruent with their phenotype. Adult outcomes in such cases are varied and cannot be predicted with certainty. It is only in a minority of these children that, regardless of phenotypical socialisation and nurture, this incongruence will persist into adulthood and manifest as transsexualism (Green, 1987; Ekins, 1997; Prosser, 1998; Di Ceglie, 2000; Ekins & King, 2001; Bates, 2002).

6. As stated, in trans people, a sex-reversed BSTc has been found. The findings of a specific sex-reversed brain organisation in trans people provides evidence consistent with the concept of a biological element in the etiology of transsexualism. The evidence for an innate biological predisposition is supported by other studies, one example of which, indicates a higher than average correlation with left-handedness (Green & Young, 2001). Where the predisposition for transsexualism exists, psycho-social and other factors may subsequently play a role in the outcome, however, there is no evidence that nurturing and socialisation in contradiction to the phenotype can cause transsexualism, nor that nurture which is entirely consistent with the phenotype can prevent it (Diamond, 1996). There is further clear evidence from the histories of

conditions involving anomalies of genitalia, that gender identity may resolve independently of genital appearance, even when that appearance and the assigned identity are enhanced by medical and social interventions (Imperato-McGinley, 1979; Rosler& Kohn, 1983; Diamond, 1997; Diamond and Sigmundson, 1997; Kipnis & Diamond, 1998; Reiner, 1999; Reiner, 2000). It is not possible to identify one single cause for transsexualism: rather, its causality is highly complex and multifactorial. The condition requires a careful diagnostic process, based largely on self-assessment, facilitated by a specialist professional.

7. In conclusion, transsexualism is a neuro-developmental condition of the brain. (Zhou *et al.*, 1995; Kruijver *et al.*, 2000).[3] The condition cannot be overcome by contrary socialisation, nor by psychological or psychiatric treatments alone (Green, 1999). Individuals may benefit from an approach that includes a programme of hormones and corrective surgery to achieve realignment of the phenotype with the gender identity, accompanied by well-integrated psychosocial interventions to support the individual and to assist in the adaptation to the appropriate social role. Treatments may vary, and should be commensurate with each individual's particular needs and circumstances.

[1] The term 'gender identity' is used, in the UK, to indicate the self-identification as male or female. However, terminology varies around the world, and the term 'sexual identity' is preferred by many in the US. (pace Professor Milton Diamond). See "Sex and Gender are different: Sexual Identity & Gender Identity are Different", (2000) Clinical Psychology & Psychiatry, Vol 7 (3):320-334.
[2] The transsexual condition is also referred to in various ways (Diamond M, 2002 In Press) "What's In a Name? Some terms used in the discussion of Sex and Gender". Transgender Tapestry.
[3]The UK government recognises that transsexualism is not a mental illness. See Lord Chancellor's Department – government policy concerning transsexual people. www.lcd.gov.uk/constitution/transsex/policy.htm

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