A rare anatomical variation newly identifies the brains of C.F. Gauss and C.H. Fuchs in a collection at the University of Göttingen

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Sir, Recently, Falk et al. (2013) analysed original photographs of the brain of Albert Einstein in an article published in Brain. The authors state that

‘…we also hope that our identifications will be useful for workers interested in comparing Einstein’s brain with preserved brains from other gifted individuals, such as the German mathematician Carl Friedrich Gauss (1777–1855)…’.

Since 1855 the brain of Carl Friedrich Gauss has been kept as part of a small collection of preserved (elite) brains at the University of Göttingen, currently (since 1995) in the Institute of Ethics and History of Medicine. Shortly after Gauss’s death in 1855, his brain was dissected—with authorization and under the restriction to be only used for scientific studies—by a group of experts led by Rudolf Wagner, a friend of Gauss and physiologist at the University of Göttingen. Wagner published two scientific studies, in which he described a variety of brains using different metrics, such as total brain weight or volume (Wagner, 1860, 1862). In the 1860 work he specifically focused on the convolutions of the cortex of ‘intelligent men’ considering this a novel and promising approach to assess differences between individual brains, rather than the somewhat crude measures of brain weight and volume. The descriptions of both studies are complemented by a set of copper engravings (Wagner, 1860) and lithographs (Wagner, 1862) made by H. Loedel, depicting the studied brains with great precision and naturalistic accuracy.

In 1998, in parallel with a necessary renewal of the fixative used to preserve the brain in a glass jar labelled ‘C.F. G__ss’, structural MRI was conducted by our group for documentary reasons. A detailed account of the procedures as well as an MRI reconstruction of the cortical surface was reported (Haenicke et al., 1999; Wittmann et al., 1999). In a letter to Science, Frewer and Hanefeld (2000) referred to these MRI results in relation to findings from the brain of Albert Einstein, stating that the Gauss brain does not share the lack of the parietal operculum.

Recent high-resolution functional MRI studies of the primary somatosensory cortex in our laboratory (Schweizer et al., 2008) have brought the rare condition of a divided central sulcus to our attention (Alkadhi and Kollia, 2004). It is caused by an elevated pli de passage fronto-parietal moyen (Broca, 1888), which normally represents a deep convolution in the fundus of the central sulcus connecting the pre- and postcentral gyrus. In some rare cases this deep convolution extends to the surface of the brain, presenting itself as a connective structure between the two gyri. This infrequent anatomical variation of a divided central sulcus can clearly be seen in the MRI surface reconstruction of the left hemisphere of the brain in our earlier publications (Haenicke et al., 1999; Wittmann et al., 1999).

The historical first description of ‘bridges connecting the two central convolutions’ was indeed made by Rudolph Wagner (1862). Although these bridges are virtually identical to the divided central sulcus seen in our MRI surface reconstructions of the believed-to-be Gauss brain, Wagner’s description was unambiguously assigned to the brain of the famous physician Conrad Heinrich Fuchs (1803–1855), who died in the same year as Gauss (Wagner, 1862).

Subsequent inquiries at the University of Göttingen revealed a glass jar labelled ‘C.H. F__s’ similar to the glass jar in which the
brain of C.F. Gauss is kept, both most likely originally labelled by Rudolf Wagner. Meticulous comparison of the two brains in these jars with the original copper engravings and lithographs of Wagner (1860, 1862) have now demonstrated that the brain in the jar labelled ‘C.F. G__ss’ is identical to the brain of C.H. Fuchs as shown in the lithographs of Wagner (1862) (Fig. 1). Moreover, the brain in the jar labelled ‘C.H. Fuchs’ is identical to the brain of C.F. Gauss as documented in the copper engravings of Wagner (1860). These observations prove that the brains have been stored in the wrong jars, and that, consequently, our MRI data recorded in 1998 (Haenicke et al., 1999; Wittmann et al., 1999) do not show the brain of C.F. Gauss, but rather the brain of C.H. Fuchs.

At this stage, it is still unclear when and under which circumstances the brains were placed in the wrong jars. Circumstantial evidence points to a mistake very early in history. In particular, the son of Wagner, Hermann Wagner, studying mathematics, published his doctoral thesis (Wagner, 1864) about a new approach to determine the dimension of the cortical brain. The data for his thesis were gathered from the brains of C.F. Gauss, C.H. Fuchs, a woman, and a craftsman. This situation would certainly favour an accidental mix-up of the two brains.

Our serendipitous finding now allows for a proper identification of the two brains in agreement with the detailed copper engravings of the brain of C.F. Gauss in Wagner (1860) and the detailed lithograph of the brain of C.H. Fuchs in Wagner (1862). Both of our earlier publications (Haenicke et al., 1999; Wittmann et al., 1999) will need to be corrected, in the sense that the investigated brain was not the brain of C.F. Gauss but that of C.H. Fuchs. The ‘rediscovery’ of the brain of C.H. Fuchs also provides the opportunity to conduct a more detailed investigation of the historical first description of a divided central sulcus (Schweizer et al., in preparation).

References