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Response to Comment on "The Brain of LB1, *Homo floresiensis*"

Weber *et al.* (1) focus on one specimen of 19 microcephalics that they analyzed and provide six indices that, indeed, are essentially identical to those of LB1 (2). Unfortunately, Weber *et al.* failed to provide the length, breadth, height, and frontal breadth measurements used to calculate these indices, and we are unable to derive these values from the indices, which can be reduced to three unique equations with four unknowns (i.e., the model is underspecified). One would expect this microcephalic's endocast to closely resemble that of LB1, but it remains unclear whether any of the images shown in (1) include views of this key specimen. Figure 2 in (1) supposedly provides four views of one modern microcephalic endocast, but the view in figure 2A has a pronounced frontal lobe rostrum ("beak") not seen in the view in figure 2D, and we do not believe these images represent the same individual. We also note another concern: Lateral hemispheres are traditionally oriented so that the line that connects the frontal pole (FP) with the occipital pole (OP) is horizontal, and its length represents that of the endocast (3). From the orientations of the endocast(s) in figure 2 in (1), we suspect that Weber *et al.* did not observe this convention and, further, may have measured endocast length using a non-traditional caudal landmark on the cerebellum rather than the OP on the cerebrum. Fortunately, a clear transverse and sigmoid sinus that separates the cerebrum above from the cerebellum caudally appears on their microcephalic endocast, which resembles our microcephalic in having a flattened, posteriorly placed cerebellum compared with LB1, for which the cerebellum is underneath the occipital lobes (the normal condition for *Homo*) (Fig. 1D).

Weber *et al.* assert that seven of their microcephalic endocasts have a relatively ex-

panded Brodmann's area 10 similar to LB1, but none of the five microcephalic endocasts in their figure 3 reproduce the two distinct, enlarged convolutions seen in the region of area 10 in LB1 (arrows, Fig. 1A). Contrary to Weber *et al.*, normal gyral patterns are believed to be typical of true microcephalics, whereas simple gyrfication typifies some kinds of secondary microcephaly (4, 5). LB1 is estimated to have been an ~30-year-old female, an age by which 78% of female microcephalics have died (6). Brain weight in microcephalics reaches its maximum in early childhood and thereafter reduces throughout adulthood, which results in the brains of elderly microcephalics fitting loosely within their crania (6). To a lesser degree, brains of normal people also shrink with advanced age, which accounts for the relatively poor reproduction of convolutions on their endocasts compared with younger individuals (3), as is typical for other anthropoids (7). For these reasons, one would not expect to obtain a highly convoluted endocast like LB1's from the braincase of a 30-year-old female microcephalic.

We stress that it is important to use similar landmarks when comparing indices obtained by different workers, and we do not believe this was done by Weber *et al.* If one of their specimens is virtually identical to LB1 in shape as they assert, they should provide its absolute measurements, illustrate its various views (in conventional orientations) compared with LB1, and clearly delineate the separation of cerebrum from cerebellum. We have done the best we can to reply to this commentary without this information. Meanwhile, Fig. 1 suggests that Weber *et al.*'s microcephalic endocast(s?) resembles the one we studied, which is markedly different from that of LB1. If this is the best evidence that can be produced from

a sample of 19 microcephalics, we suggest that the authors reconsider their position on the microcephalic hypothesis regarding *Homo floresiensis*.

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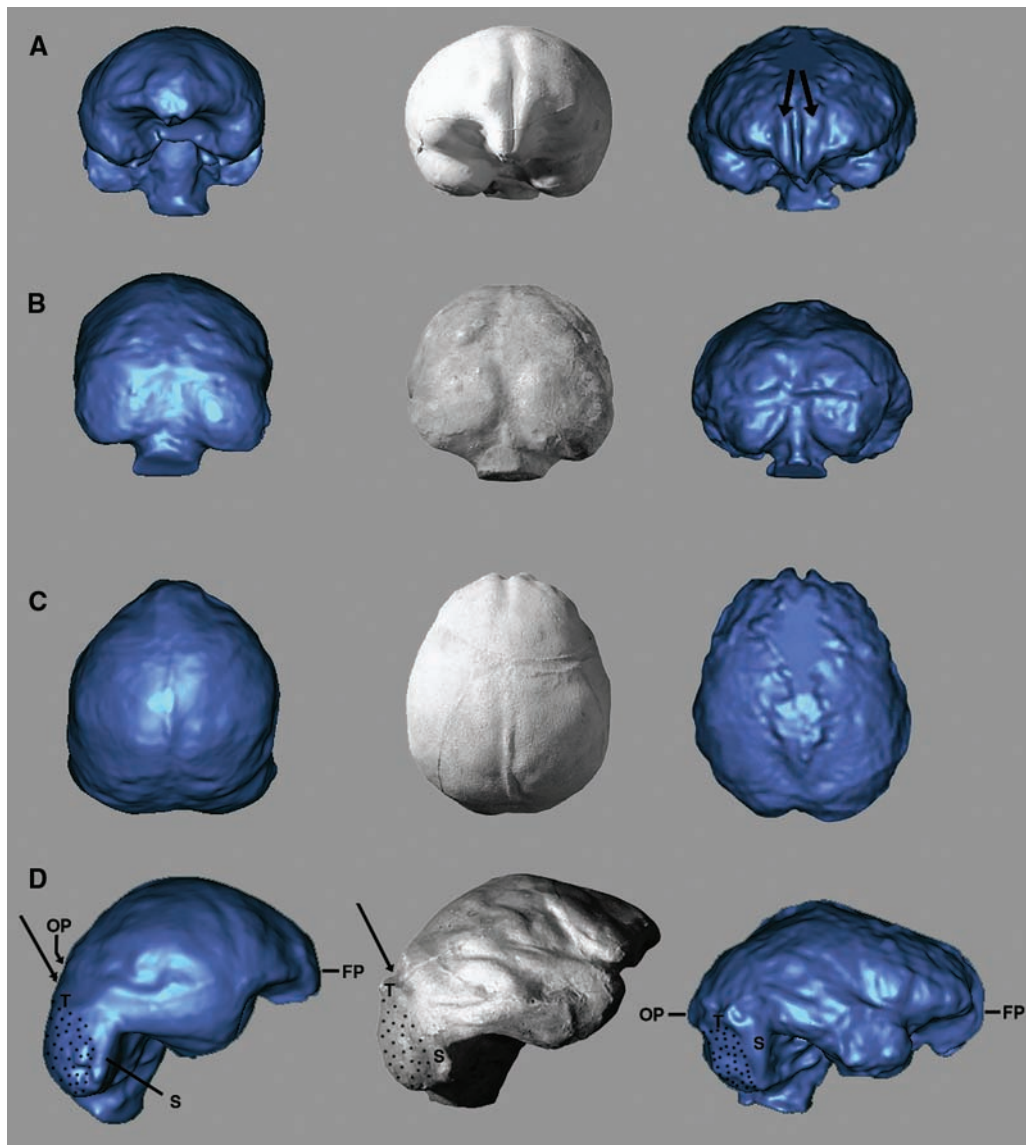


Fig. 1. Endocasts, from left to right, of a microcephalic we described (2), microcephalic(s) described by Weber *et al.* (1), and LB1 (2). Views: (A) frontal; (B) posterior; (C) dorsal; (D) right lateral. Blue images are virtual endocasts (2); images are scaled to approximately the same size to facilitate shape comparison. The brainstem was used to align the lateral views. FP, frontal pole; OP, occipital pole; S, sigmoid sinus; T, transverse sinus. Stippled areas represent the cerebellum. Arrows in top row point to two distinct convolutions on the frontal lobe of LB1 that are not seen on the two microcephalics. The lateral view provided by Weber *et al.* (D, middle) appears truncated on the inferior surface of its frontal lobe, contrary to the frontal view (A, middle), which points down in the region of the olfactory bulbs. The outlines in the frontal and posterior views of our microcephalic's endocast are similar, which is also true for LB1 but not for the Weber *et al.* specimen. We therefore question whether the images in the middle column are from one individual as stated by Weber *et al.* (see their caption for Figure 2). Arrows in the bottom row identify the superior margin of the transverse sinus. The occipital pole of the cerebrum of Weber *et al.*'s microcephalic must be rostral to the arrow (i.e., to its right), as is the case for our microcephalic on the left (2). Contrary to these microcephalics, OP in nonpathologic *Homo* (including LB1 on the right) protrudes farther back than the caudal pole of the cerebellum.