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Dobbing J & Sands J. Quantitative growth and development of human brain. *Arch. Dis. Child.* 48:757-67, 1973.
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The paper uses gross measures to describe the quantitative growth of 120 specimens of human brain, ranging from 10 gestational weeks to late childhood. The timing of the human brain growth spurt, major neuronal multiplication in the forebrain, and the comparatively very fast rate of growth of the cerebellum are identified. [The *SCI*® indicates that this paper has been cited in over 295 publications.]

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An interest in the effects of an impoverished environment on the development of human brain and behaviour led us to our proposal that the growing brain may be most vulnerable at the time of the "brain growth spurt." We identified the brain growth spurt in various nonhuman species. Undernutrition at this time produced a permanently reduced growth trajectory for the whole animal and resulted in some permanent deficits and distortions of the brain, with associated behavioural changes. The question arose whether the human also had a brain growth spurt and what was its timing? What were the rules of proper extrapolation of developmental results from one species to another and especially to man?[1]

We next searched the literature for quantitative data on human brain growth. There was surprisingly little; we therefore spent part of the next six years or so collecting 120 brains. We showed that human brain growth in our terms was not in principle different from that of other animals (sometimes an unwelcome conclusion for clinical colleagues, to judge from their frequent prejudice against animal research). There was indeed a brain growth spurt in the human from about mid-gestation until near the second birthday, and the separate growth characteristics of, for example, the human cerebellum, related to *its* differential vulnerability, were identical to those in other species.

An important finding emerged out of the blue. There was a distinct mini-growth spurt in cell multiplication in the forebrain that preceded the main one and occurred from about 10 to 18 weeks' gestation. It almost certainly represented the period when the overwhelming majority of neurons, which is to say their adult number, were produced by multiplication of neuroblasts. Noxious influences at this very early time seemed routinely to produce severe microcephaly.

The great speed of cerebellar growth in humans as in other species and its thereby enhanced vulnerability led to speculation that this may result in what had previously been known as "minimal brain damage," a bad term meaning a degree of clumsiness and other fine-grain signs.

We are gratified by the frequent citation of this paper, the reason for which is clear: it is the only one in the literature with this kind of data; and this in a subject of great potential social, political, and scientific importance. Wherever these three interests are combined, it is to be expected that there will be considerable manipulation and oversimplification of the facts in the interest of raising grants (not to say a certain amount of charlatanry), as well as the usual errors of interpretation, all of which we have tried repeatedly to expose.[2-4]

1. **Dobbing J.** Comparative aspects of the brain growth spurt. *Early Hum. Dev.* 3:79-83, 1979.
2. ————. Vulnerability of developing brain not explained by cell number/cell size hypothesis. *Early Hum. Dev.* 5:227-31, 1981.
3. ————. Infant nutrition and later achievement. *Amer. J. Clin. Nutr.* 41:477-84, 1985.
4. ————. Maternal nutrition in pregnancy and later achievement of offspring: a personal interpretation. *Early Hum. Dev.* 12:1-8, 1985.

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