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What is the evolutionary basis for colic?

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Abstract: An evolutionary model of crying requires consideration of nonhuman primate data. Chimpanzees do not have colic. Although they have a peak of fussiness at 6 weeks with a decline by 12 weeks whether raised by biological mothers or in a human nursery, their crying is always consolable. Colic may be a by-product of delayed rates of brain development; that is, neoteny.

Excessive early crying, or *colic*, occurs in Western cultures but does not occur in cultures that engage in high amounts of cradling contact (e.g., !Kung, Efe, Nso). In all cultures studied, there is a peak in crying frequency at approximately 6 weeks of life, and a substantial decline in crying frequency by 12 weeks. In chimpanzees it is also true that there is a peak in crying frequency at approximately 6 weeks of life, and a substantial decline in crying frequency by 12 weeks. The duration of crying is what seems to vary as a result of cultural context; excessive crying does not occur in cultures that value and engage in high amounts of cradling contact (Barr et al. 1991; Keller et al., in press). Following this logic, then it seems that the lessening of cradling contact might contribute to excessive crying. When we look at chimpanzees, whose evolutionary history is closest to ours, we see the same biologically based peak of crying, and the same effect of cradling contact (with shorter bouts of crying with 100% cradling contact in mother-raised infants compared with longer bouts of crying/fussing with the 25% cradling contact in a nursery setting). But even in settings with relatively little cradling contact, like in a human-rearing nursery, chimpanzees do not exhibit colic.

Colic in human settings ranged from 2% to 40% (depending on the definition of colic), so we would expect that among the 55 chimpanzees infants studied, somewhere between one and 22 ought to show excessive crying. In fact, not a single infant within the first 3 months of life exhibited inconsolable, excessive crying (Bard 1994a; 2000; 2002). Unusual circumstances, such as inadequate maternal care, resulted in excessive crying in chimpanzees during the first 2 months of life. However, the crying ceased immediately upon resumption of cradling contact, or cessation of overgrooming (Bard 2000). We see, therefore, that chimpanzees are capable of crying for extended periods of time, day after day. However, they do not exhibit inconsolable crying. Even in these extreme circumstances, when crying extends over an hour-long period, when the mother picks up the infant, the infant chimpanzee stops crying.

Chimpanzees are within the same range of helpless behavior as are human infants, with only some small differences distinguishing neonatal neurobehavioral integrity between the species (Bard 1994b; 2004; Bard et al. 1992; 2001). Neurobehavioral integrity during the first 30 days of life is assessed by cluster scores (Lester 1984), reflecting organized functioning in different realms such as motor performance and attention. Statistical comparisons of these cluster scores suggests that there are no clear-cut species differences in neonatal neurobehavioral integrity (Bard 2004). Rather, neurobehavioral integrity in human and chimpanzee neonates is clearly a function of genetic programs interacting with specific social-ecologies. Chimpanzees, however, appear to differ in some aspects of behavioral state, most noticeably in arousal, arousability, and in regulation of state, that is, coping with arousal. There was one item, consolability, which was rarely scored for the nursery-reared chimpanzees (2 of 38 subjects), either because they did not reach a crying state, or because they did not remain in a crying state for 15 seconds, that is, they self-calmed. All the human babies (42 of 42) received a score on this item at 2 days of age, but only 35 received a score at day 30, suggesting that maintaining a self-calmed state was a developing ability in human newborns, but an existing ability in 30-day-old chimpanzees. Additionally, chimpanzees at 2 days of age were more responsive to being cuddled by the examiner, compared with three groups of human babies. It seems that these items might reflect important species differences in regulation of behavioral state.

Another example is visual development: In the first month of life, human newborns see best in the range of around 25 cm, whereas chimpanzee newborns see as well at 60 cm as at 25 cm (Bard et al. 1995). The developmental rate of the visual system in chimpanzees is slightly faster than that of humans, but much slower than that of rhesus monkeys (Gibson 1985). Rate of maturation of the visual system, for example, differs in a ratio of 1 to 4 between rhesus and humans (rhesus monkeys' visual acuity at 1 month is equivalent to that of human infants at 4–5 months), and that of chimpanzees is more similar to humans than to rhesus monkeys (Bard et al. 1995). This ratio of 1 to 4 of rhesus monkeys to humans in visual development parallels rates of myelination throughout the brain (brain stem and cortex) (Gibson 1985). Therefore, one can speculate that it is myelination rates that might distinguish the excessive developmental delays found in humans, even compared with chimpanzees. In vision, as in many other systems, humans have the most delayed developmental rate of all primates (e.g., Gould 1977).

An important biobehavioral shift occurs around 2.5 months in humans, when human babies are clearly socially engaged with their caregivers (exhibiting mutual gaze and social smiling), there is a decreased frequency and duration of crying, and infant sleep/wake patterns begin to synchronize with those of adults. These behavioral changes coincide with developing subcortical-cortical connections, with increased cortical control of subcortical activity, and myelination of neural pathways (reviewed in Cole & Cole 2001). Chimpanzees also exhibit these behavioral changes of social engagement with caregivers (Bard 1998; submitted; Bard et al., in press; Myowa 1996), and changes in crying/fussing (Bard 2000) around 2 months of age. Chimpanzees, however, seem to have fewer difficulties in establishing sleep/wake regularities than do human infants (Bard 2004; Balzamo et al. 1972). Recent studies comparing human infants with colic with those without colic only find differences in extended disruption of sleep/wake cycles in babies with colic (White et al. 2000). The comparison of chimpanzee and humans is important, therefore, because they share so many characteristics in infancy and share a long evolutionary history; and yet humans in some cultures get colic, and chimpanzees, regardless of the setting, do not exhibit colic (Bard 2000). The evidence suggests that the existence of colic in the human species may be the result of extraordinarily delayed development, a by-product of neoteny (Gould 1977).

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