

symbolic representations of death or death-related rituals. Chimpanzees show self-awareness [8], empathy [9] and cultural variations in many behaviors [10]. Are humans uniquely aware of mortality? We propose that chimpanzees' awareness of death has been underestimated, as anticipated some 30 years ago on the basis of self-awareness [8]. Although data are likely to accumulate slowly, a thanatology of *Pan* appears both viable and valuable. Finally, such data may have implications for the end-of-life management of captive elderly chimpanzees, an issue of increasing importance as more great apes are retired from research facilities and zoo populations age. In some cases it might be more humane to allow elderly apes to die naturally in their familiar social setting than to attempt to separate them for treatment or euthanasia.

#### Supplemental Information

Supplemental information are available at [http://www.cell.com/current-biology/supplemental/S0960-9822\(10\)00145-4](http://www.cell.com/current-biology/supplemental/S0960-9822(10)00145-4).

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## Chimpanzee mothers at Bossou, Guinea carry the mummified remains of their dead infants

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The forests surrounding Bossou, Guinea, are home to a small, semi-isolated chimpanzee community studied for over three decades [1]. In 1992, Matsuzawa [2] reported the death of a 2.5-year-old chimpanzee (Jokro) at Bossou from a respiratory illness. The infant's mother (Jire) carried the corpse, mummified in the weeks following death, for at least 27 days. She exhibited extensive care of the body, grooming it regularly, sharing her day- and night-nests with it, and showing distress whenever they became separated. The carrying of infants' corpses has been reported from a number of primate species, both in captivity and the wild [3–7] — albeit usually lasting a few days only — suggesting a phylogenetic continuity for a behavior that is poignant testament to the close mother-infant bond which extends across different primate taxa. In this report we recount two further infant deaths at Bossou, observed over a decade after the original episode but with striking similarities.

During the 2003 dry season, a respiratory epidemic broke out at Bossou, claiming the lives of five chimpanzees (reducing their number from 19 to 14) [8]. Among the dead were two infants: 1.2-year-old Jimato and 2.6-year-old Veve (see Supplemental Information available on-line with this issue). The mothers of both infants (Jire and Vuavua) continued to carry their offspring's lifeless bodies for 68 and 19 days after death, respectively (Figure 1A; Table S1). Thus, for the first three weeks of January 2004, Bossou was home to two mothers carrying dead infants.

As in Jokro's case, the bodies of Jimato and Veve underwent complete mummification. Over the days following death, the bodies swelled, then gradually dried out. All hair

was lost, but body parts remained largely intact, encased in dry leathery skin. When it was finally abandoned, Veve's skeleton was still remarkably intact, missing only some teeth in the upper jaw (Figure 1B). Because of the wearing effects of prolonged carrying, by the time Jire abandoned Jimato's body, much of the bony cranial structure had been destroyed, making most facial features unrecognizable. Nevertheless, fingers, toes, and even genitals were preserved within the layer of tough dry skin.

In all three cases, group members' responses to the corpses were highly similar. Mothers carried the bodies during all travel (typically by gripping a limb in hand, foot, or between shoulder and neck), groomed them regularly, and chased away flies that circled the corpses (twice with the aid of a tool; Supplemental Movie S1). These are all behaviours that may have facilitated mummification. Related and unrelated individuals from all age groups and both sexes attempted to touch, poke or handle the bodies, lifted and dropped their limbs, and sniffed them. In later stages, juveniles and infants were occasionally allowed to carry the bodies some distance from the mother in bouts of play (Supplemental Movie S2). With only one exception (Movie S2), we never observed a response that could be interpreted as aversion, despite the bodies' intense smell of decay and highly unusual appearance. Similarly, we observed no aggressive acts towards the infants' corpses during the entire period of carrying. Elsewhere, chimpanzees have been reported to treat violently and even cannibalise the corpses of dead infants after snatching them away from the mother shortly after death (for example [4,5]). No such incidents were recorded in the cases of Veve and Jimato. In general, therefore, all members of the community demonstrated high levels of tolerance towards the corpses.

What factors were responsible for the mothers finally abandoning the corpses? Besides accidental loss of the bodies and subsequent failure to recover, physiological changes in the mothers associated with infant-death may also have played a role. Postpartum amenorrhoea in chimpanzees lasts around four years, but is much shortened after an infant's

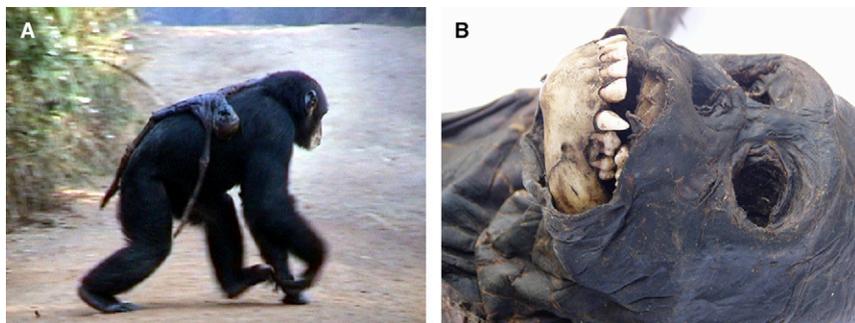


Figure 1. Mummified infant chimpanzees during and after prolonged carrying by their mother. (A) An adult female chimpanzee, Jire, carries the mummified remains of her infant, Jimato, who died in a respiratory disease epidemic at Bossou, Guinea, 17 days earlier. The body is carried dorsally, with Jimato's arm gripped between Jire's shoulder and neck. Jire continued to carry the corpse for a further 51 days, before abandoning it (see also Table S1). (Image by Dora Biro.) (B) Head of an infant chimpanzee's (Veve) mummified remains after being carried for 19 days post-death by the mother (Vuavua). Photo was taken immediately after Vuavua had abandoned (dropped, and did not retrieve within 24 hours) the corpse. (Image by Claudia Sousa.)

death [9]. Because lactation ceased once the infants died, the mothers' reproductive cycle returned; such hormonal changes, which prepare the mother for the arrival of a new infant (normally around weaning), may have contributed to a gradual 'letting go' of the previous infant's remains. Intriguing parallels may exist with physiological and psychological changes experienced by human mothers, in whom the absence or cessation of breastfeeding may cause exaggerated desires to hold their infant [10]. The fact that Jire nonetheless carried her infant for considerably longer than Vuavua may have been rooted in several factors, including Jire's extensive experience as a mother (Jimato was her eighth infant; Veve was Vuavua's first) and Jimato's younger age at death.

An obvious and fascinating question concerns the extent to which Jire and Vuavua "understood" that their offspring were dead. In many ways they treated the corpses as live infants, particularly in the initial phase following death. Nevertheless they may well have been aware that the bodies were inanimate, consequently adopting carrying techniques never normally employed with healthy young (although mothers of handicapped young have also been known to respond appropriately). The fact that all three documented cases of infant deaths at Bossou were followed by extended carrying of the infants' remains suggests that this behaviour may not be a rare occurrence in

this small community, and raises questions about the potential role of observational learning in promoting chimpanzee mothers' prolonged transport of deceased young. Nonetheless we hope that further data from this already threatened community will not be quick in coming.

#### Supplemental Information

Supplemental information are available at [http://www.cell.com/current-biology/supplemental/S0960-9822\(10\)00218-6](http://www.cell.com/current-biology/supplemental/S0960-9822(10)00218-6).

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