

Baby monkeys receive signals through their mother's breast milk

March 2 2010



A rhesus macaque mother nurses her infant. Credit: Katie Hinde

Among rhesus macaque monkeys, mothers who weigh more and have had previous pregnancies produce more and better breast milk for their babies than mothers who weigh less and are less experienced. Scientists from the Smithsonian Institution and the University of California, Davis are using this natural variation in breast milk quality and quantity to show that a mother's milk sends a reliable signal to infants about their environment. This signal may program the infant's behavior and temperament according to expectations of available resources and discourages temperaments that prove risky when food is scarce. The study was published in the *American Journal of Primatology* Feb. 16.

Researchers used large groups of rhesus macaques living in an outdoor enclosure at the California National Primate Research Center at UC Davis. Researchers collected milk two different times from 59 mothers: once when their [infants](#) were 1 month old and again when the infants were 3 1/2 months old. They recorded the quantity of milk produced by each mother, and the energy value of each one's milk was analyzed for its content of sugars, proteins and fat. These figures were combined to calculate the available milk energy generated by each mother.

Although all of the monkeys in the study were fed the same diet, the researchers found natural variation in the quantity and richness of the milk generated by the 59 mothers. Milk from mothers who weighed more and had had previous pregnancies contained higher available energy when their infants were 1 month old than the milk of lighter, less experienced mothers.

"This is the first study for any mammal that presents evidence that natural variation in available milk energy from the mother is associated with later variation in infant behavior and temperament," said Katie Hinde, the study's lead author and anthropologist at the California National Primate Research Center and the nutrition laboratory at the Smithsonian's National Zoo. "Our results suggest that the milk energy available soon after birth may be a nutritional cue that calibrates the infant's behavior to environmental or maternal conditions."

At 3 to 4 months old, each infant was temporarily separated from its mother and assessed according to its behavior and temperament. The study found that infants whose mothers had higher levels of milk energy soon after their birth coped more effectively (moved around more, explored more, ate and drank) and showed greater confidence (were more playful, curious and active). Infants whose mothers had lower milk energy had lower activity levels and were less confident when separated from their mother. Mothers and infants were reunited immediately after

the experiment.

Rhesus macaques are found throughout mainland Asia: from Afghanistan to India and from Thailand to southern China. A free-ranging colony of rhesus macaques was established in 1938 on Cayo Santiago—a small island off of the east coast of Puerto Rico. The only primates with a broader geographic distribution than [rhesus macaques](#) are humans.

Provided by Smithsonian

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