

## F. Summary

The study is concerned with the social development of the crab-eating macaque (*Macaca fascicularis*) in the first three months of life. It primarily focuses on the morphological development relevant to socialisation, mother-infant relationships and social play behaviour. Moreover the proximate and ultimate causation of early social behaviour is examined. The subjects of the study were 29 infants within a large zoo group whose composition in terms of age, sex and kinship relations of the individuals is fully known (see appendix).

### 1. *Development of morphology*

The characteristic appearance of the newborn crab-eating macaque changes considerably during the first months of life. The pink skin on the head, extremities and dorsal aspect of the body becomes paler during the first month then darkens from exposure to the sun. From the 10th week on the ischial callosities turn from pink to blue. By 18 weeks the colour change is completed.

On average the fur begins to change from black to brown or grey in the 9th week, ranging from the 7th – 10th week. The variance is small as opposed to that observed at the end of the colour change (median: 22nd week; range: 18th – 34th week) (tab. 2).

In the literature the hypothesis is held that infantile colouration influences group members, especially with regard to aggressive and solicitous behaviour, in favour of the infant. However, the present study provides evidence of negative effects of infantile features on solicitous behaviour of conspecifics other than the mother. It would appear then that the colour change represents a compromise between positive and negative selection pressures.

In four hand-reared infants, first incisors emerged approximately on day 15 and second incisors in the 5th week. Canines and first molars were observed during the 12th week. The deciduous dentition is completed by 20 weeks (tab. 3).

### 2. *Development of mother-infant relationships*

This chapter documents several aspects of the mother-infant relationship, a) transport of the infant, b) nipple contact, c) grooming and manipulation of the infant by the mother, d) development of independence, and e) recognition of the mother, while examining the behavioural development of the infant, age-specific changes in mother-infant relationships as well as the role of mother and infant in the development of age-changes and differences between mother-infant pairs.

From birth on, infants are carried on their mothers' body, mainly on the belly. With increasing age they cling more and more to the sides of the body and the back.

The behaviour of mother and infant in maintaining body contact as well as situations which release these behaviours are described. Cradling influences the infant's activity and contributes to its appeasement. Transport of the infant is described in greater detail and an analysis is made of age-specific changes in the amount of maternal support given (fig. 2) and the forms of transport adopted (figs 1 and 3). Differences between mother-infant pairs (figs 4 and 5) are mainly due to differences in maternal behaviour.

In the ventral-ventral attitude, infants frequently hold a nipple in their mouths and invariably have nipple contact when asleep. Oral contact with the nipple serves not only to obtain milk but is also an essential component of body contact with the mother and an aid to appeasement. Remarkably enough, after a stressful separation from the mother, infants refused nipple contact for up to 30 minutes in spite of being constantly on her belly.

From the third week on infants significantly prefer one nipple (fig. 7). Development of nipple preference (see figs 8 and 9) is essentially due to a differentiation in the infant's behaviour.

The time spent on grooming infants is little compared with that spent on social grooming by the mothers (fig. 10, tab. 5). The great differences in grooming and genital manipulation observed between mother-infant pairs (fig. 11, tabs 6 and 7) are not associated with the sex of the infant but with the temperament of the mother.

After a short presentation of the sensori-motor development (see tab. 8), the increase in independence is described. At an average age of 7 days, infants are first seen standing on the ground (fig. 12a). On day 15 they are separated from the mother by a distance of half a metre (fig. 12c). Distances between her and the infant of more than two meters were not recorded before the end of the first and the beginning of the second month (figs 12e - 12g).

During the first seven weeks, infants spend most of their time in ventral-ventral contact (figs 13 and 14). With increasing age they extend their range, initially maintaining body contact with the mothers (fig. 15) then gradually moving away from them (fig. 16).

During the first three months it is mainly the infant that initiates moves to widen the distance between itself and the mother (fig. 17). Most approaches, in early infancy, are made by the mother. From the 6th - 7th week on, however, maintenance of proximity with the mother rests increasingly with the infant (figs 18 - 24). At the same time her

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rejecting behaviour occurs more and more often, reaching a maximum in the 10th week (figs 25 and 26).

These age-specific changes in the mother-infant relationship do not result from a fundamental change of behaviour in one partner but rather from behavioural changes in both individuals. During the first three months rejecting behaviour tends to have a negative effect on the development of independence (tab. 11).

The striking differences between the individual mother-infant pairs are partly related to the sex of the infant and the experience of the mother, her rank apparently being of minor importance (tabs 12 and 13). In general they are derived from differences in maternal behaviour (tab. 14).

According to observations made during this study, infants in natural choice situations recognize their mothers in proximity at the earliest towards the end of the second week, and at the latest in the 4th week. Long-range recognition of the mother seems possible only from the 7th week on. Infants will, indeed, express fear during non-aggressive encounters with conspecifics from the second week on (fig. 27), but there is ample evidence to preclude unfamiliarity as the cause of their response.

This finding suggests that chiefly the mothers have to be responsible for maintaining proximity with infants during the first six or seven weeks. Not only the mothers, however, but also group members behave in a manner which maintains the contact between mother and infant by withdrawing from approaching infants, refusing them access to their bellies and only interacting with them when they are keyed to their mothers. Since the coat colour change begins shortly after long-range recognition of the mother is accomplished, the characteristic appearance of the infant seems to be important in influencing maternal care as well as avoidance by group members.

### 3. *Social play in infants*

Rough and tumble play or playfighting was first seen in the second week (day 10). From day 28 on playchasing was observed. Playful return to the mother and playful displays occurred from the 7th week on.

Male infants playfight much more than female infants. The sex difference is significant as early as from the 5th week on (fig. 28). Males initiate significantly more rough and tumble play (tabs 15 and 16) and also react much more playfully to play initiators than do females (tab. 17). Furthermore rough and tumble play among males is more intensive and of longer duration than among females (tab. 20).

The influence of the mother-infant relationship on play behaviour is

slight (tab. 21). There is a slightly negative correlation between the rank of the mother and the amount of playfighting indulged in by the infant (tab. 22).

Infants play mainly with conspecifics of the same age and sex. The older the group members are the less they play with infants. Playfighting with adult males rarely occurs (tabs 23 and 24). In the few cases observed, adult males clearly preferred male infants as play partners.

Rough and tumble play with relatives is more frequent than with non-relatives. The difference is significant where adult females and male infants are involved as play partners of male infants (tab. 26). In general, infants of subordinate mothers play more with juveniles as compared to infants of dominant mothers. There is a significant difference for one year-old individuals as play partners of male infants (tab. 27). Dominant juveniles play more with infants as compared to subordinate ones (tab. 28).

My own observations confirm the hypothesis that rough and tumble play has the main function of developing fighting skills. The early occurrence of play fighting is evident from the fact that infants will already start fighting seriously at the age of eight weeks.

Playfighting also contributes to the socialisation of the infants. Of special importance is the development of social bonds between play partners. Assumedly the formation of male subgroups is essentially a result of playful interactions.

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