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Further observations on the delivery behaviour of the common marmoset (*Callithrix jacchus*)

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Introduction

In a recent paper the delivery behaviour of the common marmoset (*C. jacchus*) has been discussed in detail (ROTHE 1973). However, due to several methodological inadequacies, such as observation by light, several questions concerning the parturition process had to remain unanswered. Recently, we had the opportunity to attend two more deliveries; the results obtained allow for conclusions about at least four main questions: 1. Does the pregnant ♀ leave the other group members before parturition? 2. Which aspect of the behaviour of the pregnant ♀ could be taken to indicate imminent parturition? 3. Do group members take any notice of the birth; if so, how do they react to labour, to the parturition process itself, and to the newborn infant(s)? 4. Does the mother bite the umbilical cord before eating the placenta?

We are aware of some flaws in both our observations and the interpretations of the results. We therefore hope for more information on the delivery process in Callithricidae by other workers.

Material and methods

Both ♀♀ (No. 11 and No. 12) came to our laboratories in 1968; they were already full-grown and had been recently caught in Brazil. Since then, each of them has given birth to more than 20 young (♀ No. 11 : 10 births; ♀ No. 12 : 9 births); in all, 30 of the young were brought up by their respective mothers. They remained with their parents in the two family groups of which No. 11 and No. 12, respectively, are the highest ranking females. Further details on the history of the two mothers and on the special rank-order relations in *C. jacchus* groups are given elsewhere (ROTHE 1973).

On the basis of more than 30 previous pregnancies of five breeding females we were able to determine the day of an expected birth more or less accurately.

We started our observations at 08h00 in the morning, each female being checked every hour; from 18h00 on, observations were continuous. Street lighting from the windows was sufficient to guarantee exact observation; with ♀ No. 11, no extra light was turned on during the whole night; with ♀ No. 12, the light was switched on with the beginning expulsion of the fetuses.

Results

Month and hour of birth; inter birth interval; gestation period

Both deliveries took place in February at night; that is between 01h00 and 04h00 (♀ No. 11) and between 19h00 and 22h30 (♀ No. 12). The interbirth intervals were 155 and 156 days, respectively. We could not exactly determine the gestation period of ♀ No. 12 since this female was not observed during its postpartum estrus following the foregoing birth (August 30, 1972). Therefore, the day of conception is unknown. The pregnancy of ♀ No. 11 can be taken to have lasted 146 days, if we assume that the day of the previous postpartum estrus, when the first successful copulation (intromission and ejaculation) was noted, can be considered as the conception date (see also ROTHE, in press.). No clear behavioural and bodily changes could be seen during

the pregnancy of ♀ No. 11. ♀ No. 12, however, with the beginning of the 3rd month of gestation, became very quiet and almost apathic and its abdomen enlarged enormously (see also LORENZ and HEINEMANN 1967 for *Callimico goeldii*) (Fig. 1). Yet, as had already been observed during more than 30 other pregnancies, the degree of abdominal enlargement does not allow for definite conclusions as to the stage of pregnancy.



Fig. 1. Pregnant ♀ No. 12; one hour before the onset of the dilatation period

Preparation for birth

According to NAAKTGEBOREN and SLIJPER (1970), the "preparation period" is characterized by a decrease in the animal's endocrine stability. Restlessness, nest-building behaviour, and the search for an adequate place to give birth are said to be among the detectable behavioural expressions prior to the onset of the first stage of labour. However, we have found that nest-building behaviour does not seem to be an element of

the behavioural repertoire of pregnant *C. jacchus* females. Only one reference to nest-building in *C. jacchus* has been found in the literature (MARIK 1931).

♀ No. 11 left the common sleeping box 38 min, ♀ No. 12 1h14 min before the beginning of the dilatation period. None of the other members of their families paid attention to the females; they remained asleep in their boxes. Both females were extraordinarily restless; several times they fed, drank and defecated.

Dilatation period

According to NAAKTGEBOREN and SLIJPER (1970) this period can be defined as the time span between the onset of the first stage of labour and the beginning of the expulsive pains. Yet, as we have already stated with other deliveries we observed, the beginning and the end of the dilatation period are very difficult to determine. In both females the first clearly detectable signs of the beginning of dilatation were: freezing of locomotion, lifting of the abdomen and of the tail, ruffling of the hair, closing of the eyes, heavy breathing, and adduction of the flanks (Fig. 2). This posture resembles the one the marmosets assume when constipated. We consider its first appearance as marking the beginning of the first stage of labour, as from this time on the labour pains could be detected by the observer.

The end of the dilatation period was marked by increased intensity of labour. Both females assumed a squatting posture (Fig. 3), typical for the pains of the expulsive stage of parturition. On the basis of the definition given above, the dilatation period lasted 37 min in ♀ No. 11 and 91 min in ♀ No. 12. During the whole dilatation period both females were extraordinarily restless. Very frequently they scratched and licked their genital regions. ♀ No. 12 evidenced some vaginal secretion, and towards the end of the dilatation stage she vomited a few times.

In the first third of the dilatation period, ♀ No. 12 experienced ten labour contractions, occurring in almost regular intervals of 3 min. In the second third, we counted two pains, and in the last we noted another ten, also occurring in intervals of about 3 min. The mean duration of the labour contractions was 2 s (range: 1.2–3.4 s). There is no significant difference as to the duration of labour in the first and second half of the dilatation period. With ♀ No. 11 we noted six labour pains which were spread regularly over the whole dilatation period. They lasted for about 2 s (range: 1.5–2.7 s) each.

Expulsive stage

The expulsive stage ranges from the onset of the expulsive pains to the complete expulsion of the fetuses (NAAKTGEBOREN and SLIJPER 1970). The assuming of a squatting posture when in labour and the uttering of groans have been considered to indicate the beginning expulsion of the fetus(es).

1. *Duration of expulsion; frequency of expulsive pains; presentation and number of offsprings:* ♀ No. 11 gave birth to a single fetus; the expulsive stage lasted for 21 min. We counted nine expulsive pains of 5 s to 8 s duration each. The pains followed one another in almost regular intervals of about 1.3 min. After the fetus' head had been born, only one contraction of the uterus was necessary to expel the rest of the body; the infant was presented in vertex position, occiput posterior.

♀ No. 12 gave birth to triplets. The expulsion of all three fetuses required 46 min. There were 34 expulsive pains (see Table). With the first two infants (I 1, 12), the body (except for the head) was expelled by a single contraction of the uterus; I 1 was presented in vertex position, occiput anterior, and I 2 in vertex position, occiput posteriors. I 3 was born in breech position (Fig. 4); the expulsion of its body (up to

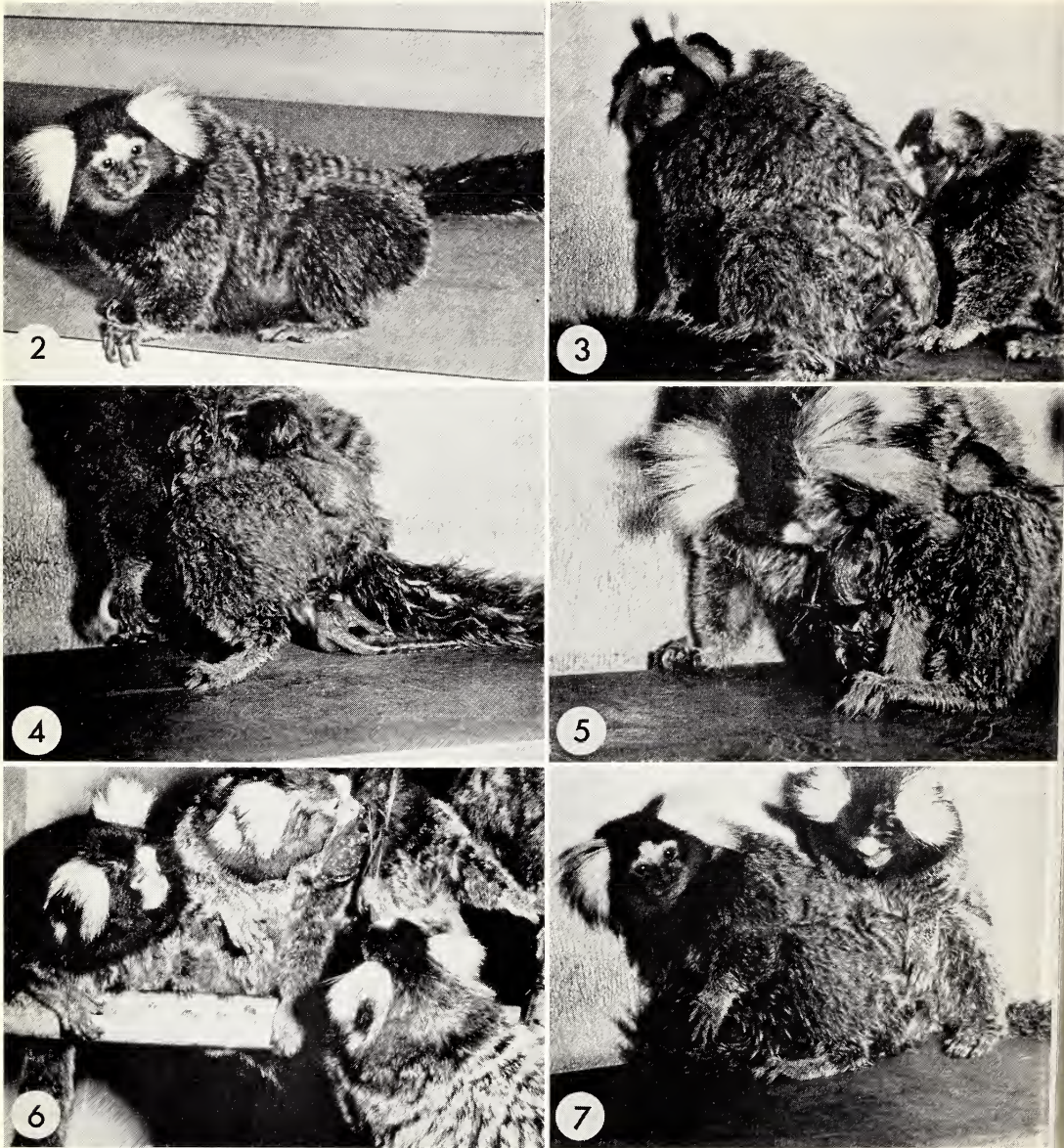


Fig. 2. Pregnant ♀ No. 12; beginning of the dilatation period — Fig. 3. ♀ No. 12 labouring in a squatting-posture during the expulsion of I2; I1 is clinging at the mother's fur; a ♂ at the right — Fig. 4. Expulsion of I3; breech presentation; I1 and I2 are clinging at the mother's fur — Fig. 5. Mother (♀ No. 12) licks the head of I2 immediately after its expulsion; I1 is clinging at the mother's left nipple — Fig. 6. Group members eat the placenta — Fig. 7. Father tries to take the first-born infant (I1)

the shoulders) required five expulsive pains, the infant's head following after another three contractions.

The expulsive pains lasted from 5.5 s to 9.4 s; the interval between pains was about 1.2 min. Vaginal outflow of blood occurred along with the expulsion of the placenta

(♀ No. 11) and shortly after the birth of I2 (♀ No. 12), respectively. Both females licked their genitalia after each labour.

2. *Behaviour of mother and offspring immediately after birth:* The mothers' care for their infants shortly after birth was confined to frequent licking (Fig. 5). With the exception of I3 (♀ No. 12), the neonates at one gripped the fur (grasping reflex of their hands and feet) of their mothers (Fig. 3). They reached the nipples unaided after 19 min (singleton of ♀ No. 11), 35 min (I1 of ♀ No. 12), and after 21 min (I2 of ♀ No. 12).

Table

Summary of data from two births in *Callithrix jacchus*

(Occ. ant. = occiput anterior; occ. post. = occiput posterior; sacr. post. = sacrum posterior)

	♀ No. 11	♀ No. 12
Foregoing deliveries	10	9
Month of birth	February	February
Hour of withdrawal from group members	01h16	19h03
Onset of dilatation period	02h30	19h41
Duration of dilatation period (min)	37	91
Number of contractions during dilatation period	6	22
Duration of expulsive stage (min) (I1/I2/I3)	21	16/20/10
Number of contractions during expulsive stage (I1/I2/I3)	9	16/8/10
Expulsion interval I1/I2, I2/I3	---	22,1
Number of offsprings	1	3
Presentation of I1	vertex, occ. post.	vertex, occ. ant.
I2	—	vertex, occ. post.
I3	—	breech, sacr. post.?
Duration of placental stage (min)	14	1
Duration of delivery (min)	98	161
Nipple contact after min (I1/I2)	19	35/21
Gestation period (days)	146	?
Interbirth intervall (days)	155	156

The last born fetus was not able to grip its mother's fur. It lay quite motionless between or next to her hindlegs. The infant breathed only sporadically. The mother licked I3 carelessly and paid no further attention to it. I3 did not survive.

Very often the mothers licked and scratched their genitalia. Both females ignored the umbilical cord(s) of their infant(s) which remained untouched until the eating of the placenta.

Placental stage; placentophagia

The placental stage is defined as the time which elapses from the complete expulsion of the fetus(es) to the complete expulsion of the placenta (NAAKTGEBOREN and SLIJPER 1970). With ♀ No. 11, the placental stage lasted 14 min; the placenta was expelled by a single uterus contraction. The female licked its genital region and then started to eat the placenta and the newborn's umbilical cord of which only a short piece remained close to its body. Placentophagia and cleaning the perch from blood lasted 26 min. The infant remained motionless at the mother's right nipple.

With ♀ No. 12, the placental stage lasted less than 1 min; one weak contraction

expelled the placenta. The mother was very exhausted; at first, she paid no attention to the placenta even though she did not allow any other group member to touch or lick it. However, after 4 min one of her eldest daughters managed to seize the placenta and ran away with it so that the umbilical cords tore close to the infants' bodies. I3 was dragged a short distance along the shelf and then fell to floor; it vocalized faintly, but was not approached by any of the group members. The placenta was eaten quite greedily by some of the eldest sons and daughters (Fig. 6). A few times ♀ No. 12 tried to get a piece of it but did not succeed.

Behaviour of group members during parturition

♀ No. 11 was alone during the whole delivery process. The other group members stayed in their sleeping boxes (about 2.5 m away from the birth place) and did not even react to the relatively loud groans of the labouring female. They did not notice the newborn infant until the morning at 06h00 when we switched on the lights (see also HOPF 1967 for *Saimiri sciureus*).

No attention was paid to ♀ No. 12 by the family until the light in the housing-room was switched on. Four minutes later, the eldest son approached his mother, licked some amnion-fluid from the sitting-board, and tried to sniff and to touch the mother's genital region. Within 2 min the α -♂ (= father) came to ♀ No. 12, sniffed at the amnion fluid at the base of the mother's tail, and at once started to copulate. She threatened and struck at him. The father stayed with No. 12 and later on tried to lick, to touch, and eventually to take the newborn infants (Fig. 7). Gradually, all other members of the family came to their parents and looked at the infant(s) with extreme curiosity (see also ROTHE 1973). At first, the mother tried to keep father, sons and daughters away but later allowed them to sniff and touch the infants. Obviously the mother was too exhausted to keep off the family during the delivery process. We did not see any group member assist the mother during parturition (see LANGFORD 1963).

Early postpartum period

♀ No. 12 was rather exhausted after parturition. She rested for another 18 min at the birth place and several times licked and scratched both her genitalia and the babies; only two of her eldest daughters were with her. Afterwards, she climbed to the feeding-board, drank eagerly, and then (22h54) fell asleep on one of the sleeping boxes; at this time she was alone again. The family members had disappeared into the sleeping boxes and continued sleeping after we switched off the lights. At 0h12 ♀ No. 12 awoke suddenly, stretched, and then fell asleep again until we switched on the lights at 06h00. During the whole night the babies rested at the mother's nipples. At 06h37 she tried to get rid of them. In the meantime, all family members had approached the mother and had touched and sniffed at the babies. Of all group members, the father was the least interested (see also ROTHE 1973). It was the eldest son who took up the babies at 06h37. He carried them till 07h26. Then the mother took them back. At once they climbed to her nipples.

♀ No. 11 was in fairly good condition after birth. After she had lapped up all the blood from the perch and from her hands, she went to the feeding-board, drank, climbed to a sitting-shelf, and fell asleep (04h33). She awoke at 05h43. At 06h00, the highest ranking male of the group (= father) approached her; after an intense greeting ceremony, he tried to get the baby. At first the mother did not allow him to take the newborn infant but when she made efforts to get rid of it, it was he who got it. As in the other family, all group members showed great curiosity in the babies. In both families no aggressive behaviour towards the infants was observed.

Further development of the newborn *C. jacchus* and child transport by family members will be described elsewhere (ROTHE and DRENHAUS, in prep.).

Conclusions

The results referred to in this paper allow for a more or less full answer to our introductory questions. However, we have to keep in mind that further observations are necessary for a better understanding and interpretation of the delivery behaviour of the common marmoset.

1. The pregnant females withdraw from their family members about one hour before the onset of the dilatation period. None of the group members follows the female, nor do they — as long as the housing room is kept dark — pay any attention to it. Even vocalization of the labouring female and the smell of amnion fluid do not provoke the approach of any member of the family. The females gave birth to their offspring without any help from their group members, and they did not return into the common sleeping box after parturition. In our previous paper we have interpreted this behaviour, in accordance with BOWDEN et al. (1967) (*S. sciureus*), as a protective reaction of the female against obtrusive group members who could endanger the mother and the neonates (consider for example the tearing of the umbilical cords by other animals when grasping the placenta). Our present data strongly suggest that the presence of other family members seems to be caused by an inadequate observation method (by full light).

2. Again it was difficult to determine the beginning and the end of the dilatation period. But the postures described above ("defecation" — and squatting-posture) of the females seem to us to be rather good criteria for the establishment of the dilatation period. However, further observations will have to prove or disprove this assumption.

3. The mother does not pay attention to the umbilical cord before the expulsion, viz. eating of the placenta. With undisturbed parturition (e. g. no observation by turned on lights) the mother is considered to always eat the placenta by herself.

4. Group members show great curiosity in the babies, on noticing them for the first time.

5. Again it became obvious that the mother's care for her young is limited to licking; she offers no help during the infant's way to her nipples shortly after expulsion. Therefore, weakly born infants do not have a fair chance to survive.

Summary

One single and one triple birth by two pluriparous *Callithrix jacchus* females living in family groups are described. Both deliveries took place at night between 19h00 and 22h30 and 01h00 and 04h00 respectively. The housing rooms were kept dark until the end of the parturition in the first case, and, in the second, until the beginning of the expulsion period. About one hour before the onset of the dilatation period, the pregnant females left the common sleeping box unnoticed by their group members. One female was alone during the whole delivery; her group members did not notice the baby before the morning (06h00). With the other delivery, the family members approached the mother after we had switched on the lights at the beginning of the expulsion period. They showed great interest in the babies but did not actually interfere with the delivery. Three infants were presented in vertex position, two of them in occiput posterior, one in occiput anterior. The last-born triplet was presented in breech position. The mother and other group members did not show much concern with the weakest born baby. With exception of this one presented in breech position, all other babies grasped the mother's fur immediately after their expulsion and reached the nipples without help. One female ate the placenta including the umbilical cord herself, the second at first paid no attention to the placenta which was then seized and eaten by other family members.

Zusammenfassung

Weitere Beobachtungen zum Geburtsverhalten des Weißbüscheläffchens (Callithrix jacchus)

Eine Einlings- und eine Drillingsgeburt zweier im Familienverband lebender pluriparer *Callithrix jacchus* ♀♀ werden beschrieben. Beide Geburten fanden während der Nacht zwischen 19h00 und 22h30 bzw. zwischen 01h00 und 04h00 statt. Solange die Beobachtungsräume nicht beleuchtet waren, wurde das gebärende ♀ bzw. die Neugeborenen von den übrigen Gruppenmitgliedern nicht bemerkt. Ungefähr eine Stunde vor dem Beginn der Eröffnungsphase sonderten sich die beiden ♀♀ von der Gruppe ab. Sie verließen den Schlafkasten, ohne von anderen Gruppenmitgliedern bemerkt zu werden. Ein ♀ war während der gesamten Geburt allein. Die Gruppe bemerkte das Neugeborene erst am Morgen. Dem anderen ♀ näherten sich die Familienmitglieder erst, nachdem wir die Raumbelichtung eingeschaltet hatten. Sie zeigten sich an den Neugeborenen interessiert, halfen aber bei der Geburt nicht mit. Drei Jungtiere wurden in Scheitellage, zwei von ihnen in occiput posterior, eines in occiput anterior geboren. Der letztgeborene Drilling war eine Steißgeburt. Die Mutter und die übrigen Familienmitglieder kümmerten sich nicht um ihn. Bis auf den letztgeborenen Drilling klammerten sich alle Neonaten sofort nach ihrer Austreibung am Fell der Mutter fest und krabbelten selbständig zu deren Zitzen. Ein ♀ fraß die Plazenta einschließlich des Nabelstranges selbst auf. Dem anderen ♀ wurde die Nachgeburt von Gruppenmitgliedern entrissen und verzehrt.

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