RHYTHMIC CHANGES IN THE COPULATORY FREQUENCY OF RHESUS MONKEYS (MACACA MULATTA) IN RELATION TO THE MENSTRUAL CYCLE AND A COMPARISON WITH THE HUMAN CYCLE

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Summary. The frequency of ejaculation in thirty-two pairs of rhesus monkeys studied during seventy-five menstrual cycles was significantly higher ($P<0.001$) in the follicular than in the luteal phase of the cycle: this pattern was closely similar to the changes in the incidence of sexual intercourse reported in a human population.

Although many Old World monkeys and apes do not show well-defined periods of oestrus or 'heat', and will copulate throughout the female's menstrual cycle, there are indications that a sexual rhythm persists in higher primates and that increased frequencies of copulation occur near the expected time of ovulation. Laboratory studies on pairs of rhesus monkeys have frequently shown increased numbers of mounts by the male near mid-cycle and a sharp decline in mounting activity early in the luteal phase (Michael, Herbert & Welegalla, 1967; Michael & Welegalla, 1968). The precise pattern of changes observed differed in different pairs and with different cycles and, in some, rhythmic changes were entirely absent. In general, changes in the various indices of sexual behaviour appeared to interact in such a way that copulatory activity was highest during the late follicular phase (Michael, 1968). Because of the marked differences in pairs and cycles, it has not been possible so far to make any generalized statement about rhythmic changes in the rhesus monkey population as a whole. To remedy this deficiency, observations have now been made on the frequency of copulation (ejaculation) during the menstrual cycle in pairs of rhesus monkeys in our colony.

Sixteen adult male (weighing 9.0 to 13.7 kg) and sixteen mature female (weighing 4.0 to 10.0 kg) rhesus monkeys were obtained through dealers directly from the wild. All animals were housed, maintained and tested as previously described (Michael, Herbert & Welegalla, 1966). To prevent conception, the Fallopian tubes of the females were transected, and 1 cm of each tube was removed between double-thread ligatures. Care was taken to avoid any interference with the blood supply to the ovaries and no irregularities of...
menstruation occurred subsequently. Between August 1962 and May 1968, observations were made on pairs of animals of opposite sexes in a quiet, isolated room from behind a one-way vision mirror. Tests were of 60-min duration, and each pair was tested on alternate days; daily inspections were made for the occurrence of menstruation. In our colony, there is a variable period of summer amenorrhea between June and September and data from this season have not been included.

Data from seventy-five menstrual cycles (mean length $28.3 \pm 0.3$ days, range 21 to 34 days) from thirty-two pairs of animals are shown in Text-fig. 1 (solid line). The mean numbers of ejaculations per test were calculated for all the tests available for each day of the cycle, each point being a mean of at least twenty-three, and at most thirty, pairs. There was a maximum incidence of

![Text-fig. 1](image-url)
ejaculation 17 days before the first day of the next menstruation, and a pro-
gressive decline throughout the luteal phase, a low point being reached 2 days
before menstruation. Text-figure 1 (lower part) shows the same data but
smoothed by plotting the means of 2 consecutive days. The mean number of
ejaculations from the 1st to the 12th reverse cycle days was significantly lower
than that from the 13th to the 24th reverse cycle days (t test, \( P < 0.001 \)): the
high and low plateaux of values in the follicular and luteal phases respectively
were separated by an abrupt decline between Days 12 to 13. There was a
further abrupt fall immediately before menstruation. Since the seventy-five
cycles showed wide variations in length, and included many with differing
types of rhythmic changes as well as those without any obvious rhythmicity, the
highly significant differences between follicular and luteal phases in the overall
data were noteworthy.

If the occurrence or otherwise of a full copulation only (i.e. a mounting series
with an ejaculation) was considered, no evidence of rhythmicity was seen
because male rhesus monkeys are highly potent and usually ejaculate at least
once during most tests. When, instead, the mean numbers of ejaculations per
test were used, the copulatory activity showed rhythmic changes in relation to
the menstrual cycles. There was a marked similarity between these changes in
the rhesus monkey and the incidence of sexual intercourse reported by Udry &
Morris (1968) in a human population. These latter data (Text-fig. 1, broken
line) show the percentage of women mating on each day of the cycle. When the
species differences in potency and in the frequency of mating were allowed for
by the two ways of representing the monkey and human data, there was a
remarkable similarity in the rhythms of copulation in the two species. This
points to the possibility that similar underlying neuro-endocrine mechanisms
may be responsible for the behavioural changes of the two species, and indicates
that the rhesus monkey may provide a useful model particularly relevant to
man.

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