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Sexual Climax in Female *Macaca mulatta*

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Introduction

The view that female infra-human primates do not achieve orgasm is widespread [e.g. FORD and BEACH, 1952; MORRIS, 1967]. It has been assumed that this aspect of sexual behaviour is qualitatively different in man.

While there has been much experimentation in the neurophysiology and endocrinology of sexual behaviour in infra-human primates over the past 30-40 years, the assumption that female monkeys do not achieve orgasm has never been tested.

The purpose of this report is to relate research begun on the question of whether or not female monkeys have orgasms and to discuss some of the theoretical questions related to this research, I would like to emphasize here that the research accomplished is only preliminary in terms of the research design employed, and that the results therefore are considered tentative.

Definition

The criterion for orgasm is the phenomenon as it has been observed in female humans, particularly through the extensive researches conducted by MASTERS and Johnson [1966]. It is manifest when it occurs, as a consequence of excitation during the (1) excitement phase, and directly subsequent to the (2) plateau phase. The (3) orgasmic phase is announced by colour changes, particularly of the labia minora, which engorge to twice their normal size, and which deepen from bright pink to deeper scarlet red in the nulliparous. The darkening, according to MASTERS and JOHNSON [1966], invariably occurs in association with orgasm.

Methodology

The Specimens. Three adult female *Macaca mulatta* were used in this study. Two of these animals were wild-born and, as they arrived in Toronto as sub-adults in 1968, had assumedly experienced a normal socialization through their earlier maturational stages. The 3rd animal was born at the Hospital for Sick Children, Toronto, in April, 1966, and was received at the University as a full adult in January, 1970. She was removed from her mother at the age of 3 months, and kept in semi-isolation. She was occasionally let out of her single cage, petted and played with and allowed to climb around the room. This animal displayed a behavioural syndrome akin to the pattern described by Harlow et. al. in a series of articles [1962] on isolation-reared macaques. That is, her behaviours were either anomalous or socially retarded. Of smaller size than the other 2 animals, when gang-caged with them she exhibited an inability to groom, although the other animals solicited grooming from her, and her manual dexterity in manipulation and locomotion were normal. Her vocalizations and grimaces were infantile [HINDE and ROWELL, 1962] although whether this represents a neurotic adaptation to avoid attack from the other 2, or retardation in behaviour is uncertain. When first gang-caged she responded incorrectly to the mild threat and open-faced grimace and postures of the others. By not adopting submissive postures and facial expressions, she was subject to attack. Of the 2 wild-born animals, 1 was so intractable and eventually dangerous that experimentation with her was terminated.

The Experimental Apparatus. A metal framework was constructed of angle-iron on a wooden counter top to which ropes with toggles were attached. The animal was placed in dog harnesses, at the fore- and hindquarters, and cat collars were affixed to the carpus and tarsus regions. The toggles were hooked to the harnesses and collars so that movement was restricted though not completely impeded. At first injections of 0.05 mi Sernylan were given to get the animal from the holding cage to the apparatus. But due to the interference of the drug with behaviour, acceleration of heartbeat and long time recovery period, it was soon abandoned and no other tranquilizing drug was employed. Heartbeat was monitored by means of a Fritzheilige EK 100 EKG machine. It was assumed on the basis of similar studies on human subjects Masters and JOHNSON, 19661, that a differential in heartbeat would be the best criterion of orgasmic plateau. The back of each animal was shaved in order to affix the electrodes. During the experiment, heartbeat was monitored whenever the animal was assumed to be in a high state of excitement. Criteria were: behaviour, perineal coloration, clitoral tumescence, and vaginal secretion. Resting state heartbeats were taken with the animal in a BRS-Foringer maximum restraining unit.

In order to quiet the animal, it was fed and groomed. Grooming so tranquilizes a monkey as it sits with its eyes partially or fully closed that the heartbeat record taken at this time may be sub-normal. This almost-asleep heartbeat rate, however, would still afford a comparison with excitation state heartbeat rates. Without telemetric equipment, resting state heartbeat could not be taken in the holding cage as the animal would pull off the electrodes.

A penis-simulator was constructed on a plastic base on which a silicon replica was moulded, whose dimensions were 4 cm long and 0.8 cm wide, the mean vaginal dimensions of the subjects. The simulator was introduced into the animal's vagina with vaseline as lubricant, and moved at between 2 to 5 thrusts/sec. CARPENTER [1942] reports between 2-8 thrusts/intromission for the rhesus at Cayo Santiago, although the duration of an intromission is not given. SOUTHWICK et al. [1965] record 'several' thrusts/intromission in 3-4 sec, for rhesus in India.

The Experiment

The animal was removed from the holding cage, harnessed and groomed till her heartbeat went down to close to the resting-state. Each animal was tested from only the 4 days prior to her putative ovulation to 2 days into the follicular phase of her cycle to maximize her responsiveness [BALL and HARTMANN, 1935; BEACH, 1947; CONAWAY and SADE, 1965; CARPENTER, 1942; VAN WAGENEN, 19661. The experiment was conducted between February and April of 1970. The cage-born and 1 of the wild-born females were ultimately tested 7 times each, but the other wild-born female, due to her intractability, was only tested 4 times.

The protocol for the experiment was 3 min of grooming of the sacral area to induce the animal to present, 5 min of clitoral stimulation followed by 5 min of vaginal stimulation with a 4 min rest and then 5 more min of vaginal stimulation. While arbitrary, these time units were chosen to well exceed the duration of an episode of actual stimulation and intromission in a copulatory series in the natural state (see table I). According to CARPENTER [1942], a 'true' copulation is comprised of a series of intromissions, each comprising 2-8 pelvic thrusts with the number of thrusts increasing as the male approaches ejaculation. There may be anywhere from 3 to 100 intromissions per ejaculation, with intervals between them. One such copulation described by CARPENTER [1942[involved 14 min of intervals between intromissions, the whole episode lasting 40 min. Unfortunately no mention was made of how long each mounting was, or how many there were, but if there had been as few as 10, each one would not have lasted more than 2 min 36 sec. SOUTHWICK [1965] gives the

Duration for an intromission as between 3 and 4 sec with 5 to 25 introMissions ejaculation and total copulation time, including intervals, as Between 10 and 20 min (see table I).

Table I. Copulation data by species

Species	**Source**	**No. pelvic thrusts intromission**	**Time**	**Introm. Per Ejac.**	**Copulation time**
M. mulatta	Carpenter [1942]	2-8 (except when ejac. occurs) Arm reflex Male vocalization	No data	3-100	No data
	Southwick [1965]	‘several’ No arm reflex Male vocalization	3-4 sec	5-25	10-20min
M. radiata	Simonds [1965]	5-10 1 female; 3 males copulated with her in 4 min	No data	1	
M. speciosa	Bertrand [1969]	No data	No data	1 May be several Ejac. in Short time	No data
E. patas	Hall [1968]	No data	No data	No data	½ min in captivity
P. anubis	Hall and Devore [1965]	5-10	10-15 sec	No data	Copulation at 2 min intervals Example: 1 female In 7 h received 21 copulations with intervals

Results

Several generalizations can be made regarding the 3 subjects, although Much of the behaviouar was naturally very individualistic. All 3 animals Tended to react negatively during at least one of the trials, and this behaviour was independent of phase of cycle. For example, 1 wild-born female, with estral puffiness and coloration covering her perineum and extending down to her knees, reacted negatively on March 27th, but not on March 25th, when she was slightly less coloured. As BEACH [1947] has suggested, many factors other than hormonal level effect response. The reaction ranged from a continuous attempt to get out of the harness and away from the experimenter, to repeated attempts to attack. In a positive trial, all 3 animals would respond to sacral grooming by presenting-ranging from merely lifting the tail, to assuming a full lordosis posture with the head down, as described in the wild by CARPENTER [1942]. For all 3 animals heartbeat rates fluctuated throughout the experiment, with no relation to the state of excitation. While not consistent either as to animal or time of cycle, fidgeting often occurred at irregular moments during the experiment. That is, attempts to pick at objects or undo cuffs, etc., occurred whether or not the animal was tumescent or secreting, but did not occur when lordosis was assumed. All 3 animals frequently responded to clitoral and/or vaginal stimulation by urinating and defecating. When the animal urinated, it was -minimally within 2 min, and maximally within 16 min of the beginning of experimentation. When defecation occurred, it was usually at the same time, or maximally with a 4 min lag after urination. This did not appear to be a fear response as it was associated, in each case, with a heartbeat that was close to the resting state.

The animals clearly exhibited 3 of MASTERS and JOHNSON'S [1966] 4 copulatory phases: excitement, plateau and resolution.

I. *Excitement Phase*. In response to sacral grooming, the animal presents. As clitoral stimulation begins, the vaginal opening dilates, a mucous secretion emanates from the vagina, the labia engorge and the perineal region deepens in colour (the degree of colour change is individual).

2. *Plateau Phase.* The clitoris may tumesce. With vaginal stimulation, the vaginal barrel widens and deepens. The animal may at this point reach back with one hand to the experimenter, clutching at the experimenter's hand, or towards her own genitals. She may look back at the experimenter and she may utter a low grunting sound. This reaching, looking and vocalizing has been described for wild female monkeys by CARPENTER [1942] as occurring when the male is close to ejaculation.

3. *Resolution Phase*. The clitoris, if it has been tumescent, detumesces. Coloration recedes. The animal may bend her hindquarters away from the experimenter, fidget and try to get out of the harness.

The question of whether or not *M. mulatta* females reach orgasm is at this point not absolutely clear. Two behavioural phenomena of obvious importance did occur, however. One of the wild-born animals exhibited what CARPENTER [1942] calls the 'spasmodic arm reflex' in which one arm jerks, a reflex which he felt manifested intense sexual excitement. In this animal, the jerking involved the arm first, and on 2 occasions the entire body. The captive-born female, at the height of the Plateau Phase had a series of intense vaginal spasms, to a maximum of 5 contractions which also involved the anus on 4 occasions. The female who had the arm reflex also had vaginal contractions, but this occurred only twice, and was never as intense as it was in the captive animal. The heartbeat monitored at the moment of constriction ranged from 168 beats/min, close to resting state, to 190 beats/min, close to the agitated state.

It is significant that vaginal and anal spasming is found in the human female only during the orgasmic phase and is usually associated with auto-stimulation [MASTERS and JOHNSON, 19651. MASTERS and JOHNSON [1965] report vaginal contractions at approximately 1 sec intervals which can range from a minimum of 3 to 4 up to a maximum of 10. This reaction they term the 'penile grasping reaction'. 'This spasmodic contraction of the outer third of the vagina is the only significant physical response reaction which is purely confined to the orgasmic phase' [p. 81]. In very intense orgasm,'... particularly of the orgasm elicited by automanipulation' the anal sphincter may also contract [p. 81]. The similarity between the behaviour of the experimental animals and the behaviour of MASTERS and JOHNSON'S subjects does not prove that indeed female macaques experience orgasm. The similarity does suggest, however, that further experimentation is warranted.

Earlier researchers [FORD and BEACH, 1952] suggested that infra-human female primates do not experience orgasm because the dorso-ventral position does not permit clitoral contact. MASTERS and JOHNSON [1966] have shown that it is not direct stimulation of the clitoral glands, but the pulling back of the clitoral hood that culminates in orgasm. Indeed, their experimentation showed that orgasm could be achieved without a clitoris as long as the labia minora were intact. Intromission from any position permits in the human, and should permit in the infra-human primate, the proper stimulation to occur. MASTERS and JOHNSON [1966] further note that the clitoris in humans appears to serve no other function than that of excitation. The evolutionary grade at which this single function evolved is hard to determine although the only infra-human primates to have a clitoris which encompasses the urethral opening are represented in the Tupaiidae. On the basis of the experiment reported here, it would seem that the time factor, and not anatomy, is critical, as the frequency of intervals within a copulatory series, and the time of individual copulations probably do not permit sufficient stimulation for achievement of orgasm.

Discussion and Conclusion

The impetus for an anthropologist to study the question of infra-human sexual behaviour stems from the problem of the origin of, and nature of the human social bond. ZUCKERMAN's [1932a, b] early hypothesis, based largely on captive populations, that year-round sexuality would suffice as a cause for uniting the emerging hominid group was abandoned in the light of subsequent data reviewed by LANCASTER and LEE [1965], which demonstrated the periodicity of infra-human reproductive matings in wild living groups. Yearly birth seasons confirm these cyclic reproductive matings.

Several scholars [e. g. SAHLINS, 1960] have seen the hominid social bond developing from more purely social causes, such as the division of labour, the recognition of kinship, marriage, etc. Yet a body of data from, in particular, animal behaviourists has given ample evidence to the contrary, that the processes involved in the creation of social bonds may be more biological. The now classic experiments of LORENZ [1937] and HESS [1959] indicate that, for example, the mother-infant bond forms at a species-specific critical period (depending on maturation rate). The process of imprinting, which may depend on any one of the communicatory modalities, seems a universal phenomenon; at least among mammals and birds. SCOTT [1958] has illustrated with his studies on sheep how this dyadic bond: continues throughout the life of the: dam. Her daughters, reciprocally imprinting with! their offspring, loin the group so that a nock may be multigenerational. Primatologists [particularly SADE, 1965] have provided sufficient data to affirm the process for infra-human primates. As the infant matures, it reciprocates through the same modalities to the same end. The interdependence of the two which has a biological origin, develops social overtones and is maintained throughout the lives of the individuals. As both males and females are imprinted to their darns, a neMork of relationships develops and one may posit kinship roles laterally and Lineally through the female line. The male stays with the group largely, no doubt, as a function of having been imprinted into it. Habit, which may be interpreted as conditioning, serves to further fix him - as it does the female - to the group. He learns the individuals of his society, and develops the ability to predict them in terms of experience with them. It may be that the nature of primate sexuality in Anthropoidea as ZUCKERMAN [1932a, b] supposed, enhances these bonds, for although a reproductive mating season is a yearly occurrence, mating is not restricted to it. BEACH 11947] notes that sexual behaviour in infra-human primates is a complex activity. It is not merely a function of hormonal levels, nor of hormonal interaction with the central nervous system, 'The relationship between ovarian condition and sexual behaviour is clear-cut in females of lower mammalian species, but the female monkey shows some willingness to receive the male at times when the ovaries do not contain ripe follicies.. .' [P. 292]. This has been confirmed by field data of infra-human primate societies which have shown that the frequency of copulation increases in the reproductive mating season, but is not restricted to it.

Two aspects of primate sexuality seem of particular importance to the development of social bonds: the ability to copulate in the ventral-ventral position (which is infrequent in pongids and non-existent in cercopithecoids) and the possibility of the female experiencing orgasm. FORD and BEACH [1952] review the phylogenetic progression of these, citing the anatomical, endocrinal and neurophysiological evolution permitting them. The social significance of the ventral-ventral posture has been discussed by CAMPBELL [1966]. He suggests that the intimacy derived from face to face contact functioned to enhance the social bond. The second special aspect of human sexuality may have had an even greater role. SAWYER and his colleagues have emphasized over the past decade the interreaction between hormones. and the central nervous system. The double feed-back mechanism, involving particularly hypophyseal, hypothalamic and gonadal secretions, acts on the reticular-hypothalamic system and on the limbic-hypothalamic system which are also interconnected to each other [SAWYER, 1966, 1967].

GESCHWIND [1964] has suggested that the evolution of human speech has involved the development of associative centres in the brain between the limbic or emotional system and the system governing speech. Perhaps in the measure that there has indeed been an evolution of the 'sentimental system' as HOLLOWAY [1967] proposes, an evolution which derives from a reorganization in and of the brain, orgasm may have had a significant role in reinforcing social ties through an intensification and development of the intricate feed-back circuit described by SAWYER and his colleagues.

The affect or emotional release associated with female orgasm would serve to intensify social links - whether or not mating was with one or a series of partners - just as grooming, whether with one or a series of partners, serves to strengthen and even form the basis for social ties, for the emotion would be associated with the agent almost as in positive reinforcement conditioning.

Two of the experimental animals experienced vaginal spasming largely as a function of stimulation prolonged beyond ordinary copulation time. Orgasm may therefore be, phylogenetically speaking, a continuum phenomenon - as most of hominid evolution has proven to be. As the strengthening of social bonds was adaptive to hominids, cultural values may have selected for biological ability to give and/or achieve orgasm, by the male sustaining intromission for a longer time, and/or the female reaching critical threshold earlier.

Future Work

Neurophysiological researches clearly implicate part of the hypothalamus, and regions of the amygdala of the forebrain in mediating sexual behaviour in mammals [e. g. SAWYER, 1967]. A more sophisticated attack on the problem of the presence or absence of orgasm in female cercopithecines will include telemetric implants of as small a size as possible in these areas of the brain.

Further implants, subcutaneous or subcostal in the region of the heart for monitoring with an EKG machine might help to clarify the random pattern previously described. The EEG and EKG norms will be taken for each animal in the resting state in the holding cage. The experiment will include a large sample of wild and captive-born females. A wild-born, fully socialized male will be introduced to each of these females as they come into the ovulatory phase of their cycles. The factor of position and body contact other than just genital contact can be analyzed. It is assumed that the copulatory position with the male's entire body contacting the female is influential in increasing sexual response. Their behaviour can be observed and monitored from behind a one-way mirror. As the natural behaviour will not permit direct observation of the female genitalia, artificial trials will be made specifically to observe these differences and to establish a correlation with the EEG, and above all to control for the length of time of intromission.

Summary

While earlier researchers believed that female monkeys are not capable of orgasm, the preliminary results of experimentation at the University of Toronto reported here, indicate the contrary. Utilizing MASTERS AND JOHNSON'S [1966] criteria of sexual response, 3 adult female *Macaca mulatta* were artificially stimulated and their responses monitored by means of an EKG and observations. Two of the subjects manifested vaginal spasming after prolonged stimulation, which has been clinically shown by MASTERS and JOHNSON [1966] to occur in human females only in the orgasmic phase of the sexual cycle. Although assumedly capable of orgasm, the short duration of a copulatory series in the wild suggests that this behaviour does not occur in the natural state. The significance of orgasm in terms of the origin of the human social bond is discussed in the light of recent neurophysiological data which indicates complicated feed-back circuitry between the hormonal and central nervous systems, and with reference to previous theories of the social bond.

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