CYCLICAL CHANGES IN UTERO-OVIDUCAL MOTILITY IN THE RABBIT

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The phasic activities of utero-oviducal musculature are co-ordinated to accomplish successful gamete transport. In untreated rabbits, the oviducal musculature shows dramatic daily changes in contractility (Salomy & Harper, 1971). In oestrogen-treated rabbits, contractions are characterized by high frequency, small amplitude and irregular pattern (Mattos & Coutinho, 1971). This oestrogen-dominated pattern is observed with either high or moderate doses of the steroid (Greenwald, 1963). During the luteal phase, the oviducal musculature becomes increasingly active (Boling, 1971) in response to increasing progestagen concentrations. Maximal contractility of the myometrium occurs during the preovulatory phase, and a 'myometrial block' (Csapo, 1970) is established during the luteal phase.

A chronological study of the characteristic motility patterns may provide a further understanding of their physiological implications. The purpose of this investigation was to study cyclical changes in the activity of musculature of the oviduct and uterus in the rabbit during the transport of gametes.

Balloon-ended, fluid-filled, polyethylene catheters were inserted in the lumen of the ampulla and the uterus of fourteen adult New Zealand rabbits in oestrus. Pressure fluctuations were transmitted and recorded using pressure transducers, a carrier preamplifier and a polygraph. Motility patterns were recorded during oestrus and for the first 5 days *post coitum* (*p.c.*). Does were mated to fertile bucks 48 hr after the insertion of catheters.

During oestrus, the oviducal contractions were characterized by high frequency, low amplitude, and a slight change in tonus, as indicated by the instability of the resting pressure (Text-fig. 1A); in three rabbits, however, this pattern was not observed and the contractions were irregular and variable (Table 1). Following copulation, a progressive increase in activity was noted and, by 6 hr *p.c.*, the active oviducal motility was characterized by high frequency and amplitude of contractions and regularly repeated outbursts of increased tonus (Text-fig. 1B). The activity was reduced at 24 hr *p.c.* (Text-fig. 1C) and, at 60 hr *p.c.*, an alternating rhythm was associated with rapid and slow sets of contractions (Text-fig. 1D). Rapid sets of contractions were abolished 72 hr *p.c.* (Text-fig. 1E). The relatively infrequent contractions were predominant. A progressive slowing down in frequency and an increase in the

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amplitude was observed daily (Text-fig. 1F). In two rabbits, an active motility pattern was established 1 hr *p.c.*, but it changed suddenly, bypassing the gradual change typically recorded at 24 and 48 hr *p.c.* (Table 1).

During oestrus, three different uterine motility patterns were frequently observed: rhythmic, arrhythmic, and combined (Text-fig. 1A). Rhythmic contractions were characterized by large amplitude, short duration and low frequency. Arrhythmic contractions were characterized by small amplitude, prolonged duration and high frequency. The third type was a combination of

TEXT-FIG. 1. Cyclical variations in utero-oviducal motility in rabbits. A: oestrus; B: 1 to 6 hr *p.c.*; C: 24 hr *p.c.*; D: 60 hr *p.c.*; E: 72 hr *p.c.*; F: 96 hr *p.c.* Each graph represented 25 min of simultaneous, continuous recording. Maximal activity of both uterine and oviducal musculature was exhibited 1 to 6 hr *p.c.* At 72 and 96 hr *p.c.*, intensive oviducal activity was contrasted with blocked myometrial activity.

these two patterns. An initial rapid increase in uterine activity 1 to 6 hr after copulation (Text-fig. 1B) was followed by a gradual, progressive decline in contractility (Text-figs 1C and D). At 72 hr *p.c.* (Text-fig. 1E), uterine activity was blocked in six rabbits and depressed in five others (Table 2). At 96 hr *p.c.*

Table 1. Typical and atypical patterns of oviducal motility in the rabbit

Hours post coitum	No. of rabbits tested	Typical oviducal motility		No. of rabbits showing atypical motility
		Pattern	Resting pressure	
Oestrus*	10	Active, high frequency and low amplitude	Slightly variable	3
1	11	Very active, high frequency and high amplitude	Markedly variable with outburst of increasing tonus	3
3	11	Very active, high frequency and high amplitude	Markedly variable with outburst of increasing tonus	1
6	11	Very active, high frequency and high amplitude	Markedly variable with outburst of increasing tonus	0
24	10	Active, low frequency, higher amplitude and prolonged duration	Variable	2
60	9	Alternating successive rapid and slow sets of intense contractions	Stable	2
72	8	Slow intense sustained contractions	Stable	0
96	3	Progressive slowing down associated with increase in the contraction amplitude and duration	Stable	0
120	3	Progressive slowing down associated with increase in the contraction amplitude and duration	Stable	0

* An oestrous pattern of motility was maintained for 2 successive days before copulation was allowed.

Table 2. Rabbit uterine activity *post coitum*

Hours post coitum	No. of rabbits in which uterine activity:			
	Increased	Remained unchanged	Decreased	Was blocked
1	10	3	1	0
24	0	12	2	0
60	0	3	7	4
72	0	2	5	6
96	0	0	2	11
120	0	0	0	13

(Text-fig. 1E), uterine activity was blocked in eleven rabbits and depressed in two others.

The *p.c.* changes have physiological significance in ova picked up by the fimbriae and ova retained at the ampullary-isthmic junction. On the other hand, the dramatic *p.c.* changes in the myometrial activity play a major rôle in sperm migration to the ampulla, transport of ova through the uterotubal junction, and spacing the implanting blastocyst along the uterine wall. In the rabbit, the pacemaker of oviducal muscular activity is located at a discrete area around the ampullary-isthmic junction (Talo & Brundin, 1971), and its activity may be influenced by its adrenergic nerves densely located at the same area (Owman & Sjöberg, 1966). Adrenergic α -constricting receptors are activated by noradrenaline, while both α - and β -dilating receptors are activated by adrenaline (Seitchik, Goldberg, Goldsmith & Pauerstein, 1968; Coutinho, 1970). Ovarian steroids modify the activity of these receptors since they increase the noradrenaline content of the isthmus (Bodkhe & Harper, 1972a, b). In goats, pronounced electrical activity and groups of positive pulses occur during oestrus, and sets of negative pulses dominate during dioestrus (Larks, Larks, Hoffer & Charlson, 1972). In women, local release of adrenergic amines may evoke outbursts of increased oviducal muscular activity (Coutinho & Maia, 1969).

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