SHORT COMMUNICATIONS

CHANGING PRO-OESTROUS SURGES OF LUTEINIZING HORMONE
IN AGEING 5-DAY CYCLIC RATS

P. VAN DER SCHOOT

Department of Endocrinology, Growth and Reproduction, Erasmus University,
Medical Faculty, P.O. Box 1738, Rotterdam, The Netherlands

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Normal cyclic ovarian activity stops in old female rats: cyclicity may be replaced by absence of ovulation and persistent vaginal cornification (Everett, 1939; Aschheim, 1964/5). In the present study, factors were examined which could contribute to the change from cyclicity to absence of ovulation. Vaginal cyclicity, ovarian microscopy, and the pro-oestrous surge of luteinizing hormone (LH) were compared between old and young rats. Locally bred (R x U)F₁ hybrid females were kept under standard lighting conditions (lights on at 05.00 h; off at 19.00 h). Three- to 5-month-old rats were all cyclic and showed predominantly 5-day cycles. From 7 months onwards a rapid increase occurred in the number of animals with persistent vaginal cornification; cyclic animals kept 5-day cycles (Table 1).

In the first experiment sodium pentobarbitone (Nembutal) was injected (37 mg/kg body weight, i.p.) at various times of pro-oestrus; blood was obtained from the ophthalmic venous plexus within 5 min after the injection for determination of LH concentration by radioimmunoassay (Welschen, Osman, Dullaart, de Greef, Uilenbroek & de Jong, 1975). In the second experiment left ovaries were removed at 18.00 h of pro-oestrus to study oocyte microscopy in preovulatory follicles (Vermeiden & Zeilmaker, 1974). All animals were autopsied on the subsequent day to establish whether (1) ovulation had been blocked by Nembutal or (2) had occurred in animals of the second experiment. Also, the presence of large corpora lutea (CL) formed during the previous cycle was examined.

Table 1. Characteristics of ovarian activity of RU-female rats at various ages

<table>
<thead>
<tr>
<th>Age at examination (months)</th>
<th>No. of animals</th>
<th>% with persistent oestrus</th>
<th>Duration of cycles</th>
<th>Meiotic stage at 18.00 h of pro-oestrus*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>4 5 6</td>
<td>GV CI D</td>
</tr>
<tr>
<td>3 – 5</td>
<td>120</td>
<td>0</td>
<td>1 86 12</td>
<td>12.3 ± 0.3 12.8 ± 0.5 1 4 5</td>
</tr>
<tr>
<td>8 – 10</td>
<td>44</td>
<td>30 – 60</td>
<td>3 88 9</td>
<td>16.9 ± 0.4 12.1 ± 0.3 2 5 1</td>
</tr>
<tr>
<td>12</td>
<td>25</td>
<td>88</td>
<td>0 100 0</td>
<td>– – –</td>
</tr>
</tbody>
</table>

Persistent oestrus, animals showing continued follicular maturation and atresia but no ovulation.

*The meiotic stage indicated is the predominant stage of meiosis found in the preovulatory oocytes of a sample of animals (8 or 10) from the group. GV, germinant vesicle; CI, chromatin mass-I; D, diakinesis: these three stages are observed with increasing time after the onset of the ovulatory LH surge (Vermeiden & Zeilmaker, 1974).

†Means ± S.E.M.

-, not determined.

Nembutal blocked ovulation in young rats when it was injected before 15.30 h; in old rats, blockade still occurred after injection at 16.30 h. Increased LH concentrations occurred earlier in young than in old rats. One hour after the start of the LH surge in old rats LH concentrations...
were significantly lower than those 30 min after the start in young rats (Table 2). Meiotic division in preovulatory oocytes was more advanced in young rats (Table 1). No significant differences were found in the number of ruptured follicles or corpora lutea between the two groups (Table 1). In four old rats, however, ovarian histology revealed the absence of large CL: besides a crop of large unruptured follicles there was a crop of large atretic follicles which, according to the histological appearance (Everett, 1967) had been preovulatory during the previous cycle.

It is concluded that in old rats the start of the LH surge is delayed and the steepness reduced. The changes in the LH surge are not reflected immediately in ovarian activity as cyclic animals continue to show 5-day cycles. The changes, however, indicate a decrease in function of the LH surge mechanism preceding its ultimate cessation with resulting absence of ovulation. The old rats with atretic follicles and no CL may represent an intermediate stage between animals which still ovulate regularly and those which have stopped. Possibly rhythmic follicular growth can continue for some time without rhythmic CL formation. Indeed, such 'anovulatory cycles' have been described previously (Wolfe, Burack & Wright, 1940) and were observed also in ageing, neonatally castrated rats bearing an ovarian graft (van der Schoot, 1973).

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REFERENCES