INTERRUPTION OF PREGNANCY IN THE MOUSE AND RABBIT BY ADMINISTRATION OF PMS OR HCC

WEN-HSUN YANG,* CHIEN-TIEN HSU,*
HO-SHIANG CHIANG,** and LUNG-LI LIN*

(Received for publication, March 18, 1971)

ABSTRACT

Intravenous injection of 40 IU PMS on Days 1-3 after mating did not affect tubal transport of ova in the mouse, but resulted in the early entry of ova from the tube into the uterus in the rabbit. When 200 IU HCG was given on Days 1-3, tubal transport of ova was markedly accelerated in either the mouse or rabbit. Early cleavage of ova and development of ova to the morula or blastocyst stage was not affected following the administration of gonadotropins on early days of pregnancy. The treatment of 40 IU PMS on Days 1-3, slightly inhibited implantation in both mice and rabbits, but induced severe fetal mortality in both the mouse and rabbit as seen in animals laparatomized on Day 18. When variable doses of PMS from 5 to 40 IU were administered on Days 4-6, the number of implantation sites was slightly reduced in both the mouse and the rabbit, nevertheless live embryos were reduced to between 66% and 39% in the mouse and to between 76% and 0% in the rabbit, respectively of control values. Administration of 800 IU HCG on Days 1-3 had no apparent effect on ovo-implantation but reduced the number of live embryos to 13% of the control value in the mouse. The same treatment in the rabbit had a comparatively mild effect on pre-and post-implantation losses in the rabbit. When variable doses of HCG from 200 to 800 IU were given on Days 4-6, implantation was not markedly affected in either mice or rabbits, but the number of live embryos were reduced to between 42% and 19% in the mouse and to between 89% and 53% in the rabbit, respectively, of the control values. Supplemental treatment with progesterone in the rabbit did not reduce the adverse effect on pregnancy in the PMS-treated females, but was beneficial in the rabbit ovariectomized at the time of blastocyst formation. It thus seems likely that antifertility effects of PMS may have been due to abnormal steroid production in the ovary.

INTRODUCTION

A high degree of embryonic mortality has been shown to occur in the pregnant rat[1,2], mouse[3,4], rabbit[5-7] and sheep[8,9] after superovulation which was brought about by the single injection of pregnant mare's serum (PMS) or pituitary follicular stimulating hormone, or with the addition of human chorionic gonadotropin (HCG) to each of the above. This can be attributed in part to the overcrowding of the embryos in the uterus[10-13] since no inherent inability of development was observed in the superovulated eggs of rabbit[14] or of mouse[15]. Following the administration of gonadotropic hormones after ovulation or implantation in the normally mated rat and hamster, tubal transport or implantation phase of fertilized eggs were also severely affected[16]. This antifertility effect was chiefly induced by the abnormal

* Department of Obstetrics and Gynecology, Taipei Medical College, Taipei, Republic of China
** Department of Veterinary, U. S. Naval Medical Research Unit No. 2, Taipei, Republic of China

function of the ovaries by the stimulation of gonadotropins, for the high embryonic mortality was significantly reduced in those animals following the ovariectomy with substitutional treatment with progesterone. This paper reports the further study of gonadotropic effects on the normal pregnancy of mice and rabbits, when PMS or HCG was administered at various days after mating to examine the proportion of embryos implanted, and the embryonic mortality after implantation.

MATERIALS AND METHODS

Albino mice of NIH-strain from NAMRU-2 (U. S. Naval Medical Research Unit No. 2 at Taipei, Republic of China) weighing 30 to 50 grams were housed 5 per cage and were kept in an air-conditioned room between 23 and 25°C under constant 12-hr artificial light (0500-1700). Proestrous females, selected on the basis of their vaginal smear, were caged with fertile males in the early morning. The presence of sperms in the vagina was verified the same evening about 2 hours after mating and the vaginal plug was examined on the following morning which was designated as Day 1 of pregnancy. New Zealand white rabbits weighing from 2 to 3 Kg were purchased from local breeders. Following isolation of the purchased animals for 3 weeks in their cages, each females was usually mated in the late afternoon with three different fertile males, once with each animals. The following day was also designated as Day 1 of pregnancy.

Various doses of PMS or HCG were injected intravenously in 0.1 ml normal saline solution in the mouse and in 0.2 ml normal saline solution in the rabbit on different days after mating. Daily doses of 40 IU PMS or 200 IU HCG were given to mice or rabbits at 1700 on Days 1, 2 and 3 of pregnancy. The animals were examined for tubal transport and cleavage of eggs at different intervals from Day 2 to Day 4 in the mouse and from 42 to 96 hours after the treatment in the rabbit. Some animals were also examined for implantation of eggs and embryonic development on Day 18. Various doses of PMS from 5 to 40 IU, or of HCG from 200 to 800 IU were also given to mice and rabbits on Days 4, 5 and 6 after the entry of blastocysts into the uterine cavity. These animals were killed on Day 18 for examination of implantation sites and live embryos.

In an attempt to clarify the effect of injected gonadotropins on pregnancy, mated rabbits were ovariectomized on Day 4 between 1700 and 1800 hour. Some of these animals were injected subcutaneously daily with 8 mg progesterone (in 0.4 ml sesame oil), while others were injected with 40 IU PMS for 3 days in addition to the progesterone. The same doses of PMS and progesterone were administered to a group of intact pregnant rabbits as another control. Animals were laparatomized on Day 18 for examination of implantation sites and live embryos. Fetal mortality was calculated on the percentage of implantation sites which failed to give rise to live embryos.

RESULTS

1. Transport and Development of Ova

The results are presented in Table 1 for mice, and Table 2 for rabbits. In the mouse and rabbit, the development of ova following treatment with 40 IU PMS or 200 IU HCG on Days 1, 2 and 3 was similar to that obtained in the controls. Tubal transport of eggs in the mouse was not apparently changed following the treatment with PMS, but markedly accelerated to a day earlier than the control by administration of HCG. In the rabbit, however, the tubal transport of eggs was more effectively accelerated to about 30 hours earlier than the control by administration of either PMS or HCG. Induction of ovulation by such treatments was obvious because newly ovulated ova surrounded by follicular cells

Table 1. Transport and development of ova following intravenous injection of PMS or HCG on Days 1, 2 and 3 in mated mice

Time of examination (Day & hour)	40 IU PMS			200 IU HCG			Controls, 0.1 ml saline		
	No. of mice	Ova recovered from		No. of mice	Ova recovered from		No. of mice	Ova recovered from	
		Tube[1] (stage of ova[2])	Uterus[1] (stage of ova[2])		Tube[1] (stage of ova[2])	Uterus[1] (stage of ova[2])		Tube[1] (stage of ova[2])	Uterus[1] (stage of ova[2])
Day 2									
1700	—	—	—	3	24 [3] (1, d; 21, 2c; 2, 4c)	0	—	—	—
Day 3									
0500	—	—	—	5	26 [5] (2, d; 24, m)	8 [2] (1, d; 7, m)	—	—	—
1700	3	23 [3] (1, d; 22, m)	0	5	7 [2] (7, m)	29 [5] (1, d; 28, m)	—	—	—
Day 4									
0000	3	23 [4] (2, d; 21, m)	0	3	0	21 [3] (1, d; 20, m)	5	35 [5] (2, d; 33, m)	0
0500	4	17 [4] (1, d; 14, m; 2, b)	9 [4] (1, d; 6, m; 2, b)	—	—	—	5	30 [4] (1, d; 27, m; 2, b)	11 [2] (6, m; 5, b)
1100	4	10 [2] (1, m; 9, m)	17 [4] (1, d; 2, m; 14, b)	—	—	—	4	0	24 [4] (1, d; 9, m; 14, b)
1700	4	0	31 [5] (2, d; 29, b)	—	—	—	—	—	—

1) Figures in brackets denote the number of animals that had ova in their tubes or in uteri.

2) d=1-celled or degenerating ova; 2c=2-celled ova; 4c=4-celled ova; m=morula; b=blastocyst.

Table 2. Transport and development of ova following intravenous injection of PMS or HCG on Days 1, 2 and 3 in mated rabbits

Time of examination (hours after mating)	40 IU PMS			200 IU HCG			Control, 1.0 ml Saline		
	No. of mice	Ova recovered from		No. of mice	Ova recovered from		No. of mice	Ova recovered from	
		Tube[1] (stage of ova[2])	Uterus[1] (stage of ova[2])		Tube[1] (stage of ova[2])	Uterus[1] (stage of ova[2])		Tube[1] (stage of ova[2])	Uterus[1] (stage of ova[2])
42	3	20 [3] (2, d; 18, m)	0	—	—	—	—	—	—
48	3	18 [3] (2, d; 16, m)	6 [2] (1, d; 5, m)	4	25 [4] (3, d; 22, m)	0	—	—	—
54	3	18 [3] (8, d; 10, m)	3 [1] (3, m)	4	23 [4] (4, d; 19, m)	3 [1] (1, d; 2, m)	—	—	—
60	3	5 [1] (1, d; 4, m)	12 [3] (2, d; 10, m)	3	16 [3] (1, d; 15, m)	5 [2] (1, d; 4, m)	—	—	—
66	3	0	19 [3] (3, d; 16, m)	3	13 [3] (3, d; 10, m)	9 [3] (1, d; 8, m)	—	—	—
72	—	—	—	4	11 [3] (2, d; 9, m)	16 [4] (1, d; 15, m)	4	22 [4] (3, d; 19, m)	0
78	—	—	—	—	—	—	3	14 [3] (2, d; 6, m; 6, b)	4 [1] (2, m; 2, b)
84	—	—	—	—	—	—	4	8 [3] (1, d; 5, m; 2, b)	16 [4] (2, d; 3, m; 11, b)
96	—	—	—	—	—	—	3	0	17 [3] (2, d; 15, b)

1) Figures in brackets denote the number of animals that had ova in their tubes or in uteri.
2) d=1-celled or degenerating ova; m=8-celled to 32-celled morula; b=blastocyst.

were found near to the proximal portion of Fallopian tubes on Day 2. As the primary ovulated eggs had already been cleaved and situated near to the distal end of Fallopian tubes or uterine horns on Day 2-4, it was not difficult to identify the primary ovulated eggs from the secondarily ovulated ones.

2. Implantation and Embryonic Development

In the mouse, following daily treatment with 40 IU PMS on Days 1, 2 and 3, the number of implantations and live fetuses were markedly reduced to 60.6% and 13.3%, respectively as compared with the control. Following daily treatment with PMS on Days 4, 5 and 6 in the mouse, the average number of implantation sites was not significantly reduced in a series of tests with administration of different doses of PMS around the time of implantation. Nevertheless, following such treatment a proportional decrease in the live embryos was obtained in response to increasing dosages (Table 3). In the rabbit, although a very few implantation sites were seen, no living fetuses were observed following PMS treatment on Days 1, 2 and 3. After administration of PMS on Days 4, 5 and 6 in the rabbit, a more severe effect on fetal mortality was seen in the rabbit than in the mouse. Following such treatment, a proportional decrease in the live embryos was also seen in response to increasing dosages (Table 4). In the controls, no significant increase in embryonic mortality was found following daily treatment with normal saline solution on Days 1, 2 and 3, or on Days 4, 5 and 6 in mice and rabbits (Tables 3 and 4).

Implantation was not inhibited but a clear increase in embryonic mortality was obtained following treatment with 800 IU HCG on Days 1, 2 and 3 in both mice and rabbits. Similarly, following daily administration of HCG on Days 4, 5 and 6 in a series of tests, implantation was not inhibited, but embryonic mortality increased in response to the increased dose of HCG. No significant effect were seen in saline-injected controls (Tables 5 and 6).

3. Fetal Development in the Ovariectomized Animals

Since the inhibitory effect of PMS on fetal development in the intact mouse was rather weak in comparison with that in the intact rabbit. This experiment was performed in the rabbit. In the rabbit, the additional administration of 8 mg progesterone from Day 4 to 17 did not prevent complete fetal mortality induced by PMS treatment alone. Nevertheless, following ovariectomy on Day

Table 3. Effect of intravenous injection of PMS in mated mice (examined on Day 18)

Dose IU/mouse/day	Days of injection	No. of mice			Implantation sites mean±SE (%)[1]	Living fetuses mean±SE (%)[1]	Fetal mortality (%)[2]
		Mated	Having implant. sites	Having living fetuses			
40.0	1-2-3	10	8	2	6.0±7.4 (60.6)	1,2±2.6 (13.3)	80.0
5.0	4-5-6	8	8	6	8.0±2.2 (81.6)	4.3±2.7 (54.4)	49.0
10.0	4-5-6	10	8	6	7.8±1.7 (79.6)	5.2±4.1 (65.8)	33.3
20.0	4-5-6	10	8	6	7.0±2.5 (71.4)	3.0±3.3 (38.0)	57.1
40.0	4-5-6	8	7	6	8.8±2.1 (89.8)	3.1±6.1 (39.2)	67.9
Control, Saline							
0.2 ml	1-2-3	8	8	8	9.9±1.3 (100)	9.0±1.8 (100)	8.9
0.2 ml	4-5-6	10	10	10	9.8±1.7 (100)	7.9±2.2 (100)	19.4

1) The percentage of implantation sites or live fetuses compared with controls.
2) Calculated as the percentage of implantation sites which fail to give rise to live fetuses.

Table 4. Effect of intravenous injection of PMS in mated rabbits (examined on Day 18)

Dose IU/rabbit/day	Days of injection	No. of rabbits			Implantation sites mean±SE (%)[1]	Living fetuses mean±SE (%)[1]	Fetal mortality (%)[2]
		Mated	Having implant. sites	Having living fetuses			
40.0	1-2-3	7	7	0	6.7±2.2 (85.9)	0	100
5.0	4-5-6	6	6	5	7.0±1.7 (97.2)	4.7±3.1 (75.8)	32.9
10.0	4-5-6	11	11	5	6.9±1.2 (95.8)	1.6±2.1 (25.8)	76.8
20.0	4-5-6	6	5	1	6.3±3.1 (87.5)	0.2±0.4 (3.2)	96.7
40.0	4-5-6	8	4	0	5.2±3.3 (72.2)	0	100
Control, Saline							
1.0 ml	1-2-3	7	7	7	7.8±1.1 (100)	7.0±1.3 (100)	10.3
1.0 ml	4-5-6	7	6	6	7.2±1.5 (100)	6.2±2.1 (100)	13.9

1) The percentage of implantation sites or live fetuses compared with controls.
2) Calculated as the percentage of implantation sites which fail to give rise to live fetuses.

Table 5. Effect of intravenous injection of HCG in mated mice (examined on Day 18)

Dose IU/mouse/day	Days of injection	No. of mice			Implantation sites mean±SE (%)[1]	Living fetuses mean±SE (%)[1]	Fetal mortality (%)[2]
		Mated	Having implant. sites	Having living fetuses			
800	1-2-3	10	6	4	5.4±1.4 (54.5)	1.2±2.2 (13.3)	77.8
200	4-5-6	7	7	5	8.6±2.9 (87.8)	3.3±2.7 (41.8)	61.6
400	4-5-6	10	10	2	8.4±2.9 (85.7)	2.2±2.9 (27.8)	73.8
800	4-5-6	10	6	4	7.5±1.4 (76.5)	1.5±2.0 (19.0)	80.0
Control, Saline							
0.2 ml	1-2-3	8	8	8	9.9±1.3 (100)	9.0±1.8 (100)	8.9
0.2 ml	4-5-6	10	10	10	9.8±1.7 (100)	7.9±2.2 (100)	19.4

1) The percentage of implantation sites or live fetuses compared with controls.
2) Calculated as the percentage of implantation sites which fail to give rise to live fetuses.

Table 6. Effect of intravenous injection of HCG in mated rabbits (examined on Day 18)

Dose IU/rabbit/day	Days of injection	No. of rabbits			Implantation sites mean±SE (%)[1]	Living fetuses mean±SE (%)[1]	Fetal mortality (%)[2]
		Mated	Having implant. sites	Having living fetuses			
800	1-2-3	7	6	4	6.8±2.8 (87.2)	3.0±3.5 (42.9)	55.9
200	4-5-6	8	8	7	7.4±1.7(102.8)	5.5±3.6 (88.7)	25.7
400	4-5-6	7	6	5	7.0±1.9 (97.2)	5.1±3.0 (82.3)	27.1
800	4-5-6	9	9	5	7.0±3.1 (97.2)	3.3±3.8 (33.2)	52.9
Control, Saline							
1.0 ml	1-2-3	7	7	7	7.8±1.1 (100)	7.0±1.3 (100)	10.3
1.0 ml	4-5-6	7	6	6	7.2±1.5 (100)	6.2±2.1 (100)	13.9

1) The percentage of implantation sites or live fetuses compared with controls.
2) Calculated as the percentage of implantation sites which fail to give rise to live fetuses.

Table 7. Effect of intravenous injection of PMS on pregnancy in the ovariectomized progesterone-treated rabbit (examined on Day 18)

Days of ovariectomy	Treatment	Days of injection	No. of rabbits			Implantation sites Total (mean±SE)	Living fetuses Total (mean±SE)	Fetal mortality (%)[3]
			Mated	Having implant. sites	Having living fetuses			
Intact	40 IU PMS 8 mg progesterone	4-5-6 4 to 17	8	7	0	37 (4.6±2.3)	0[1]	100
Day 4	40 IU PMS 8 mg progesterone	4-5-6 4 to 17	8	6	4	45 (5.1±2.6)	19 (2.4±3.1)[1,2]	57.8
Day 4	1 ml saline sol. 8 mg progesterone	4-5-6 4 to 17	8	7	3	50 (6.3±2.9)	16 (2.0±2.6)[2]	68.0

1) Significant difference by Chi-square test ($X^2=32$, P 0.01).
2) Significant difference by Chi-squgre test ($X^2=7.4$, P 0.01).
3) Calculated as the percentage of implantation sites which fail to give rise to live fetuses.

4 and substitutional treatment with progesterone, about 42% of implanted eggs developed into live embryos under the influence of PMS treatment (Table 7).

DISCUSSION

By administration of PMS and HCG before mating for superovulation, an accelerated tubal transport of ova was observed in the cow[17] and sheep[9], but the passage of ova through the tube was delayed in the rat[18]. By administration of PMS or HCG after normal mating and ovulation in the previous study[16], the passage of ova into the uterus was more accelerated in the rat (10-48 hr) than in the hamster (2-4 hr). Similar treatment in the present study, however, increased the tubal transport of eggs more rapidly in the rabbit (24-30 hr) than in the mouse (0-24 hr). Estrogen, progesterone and testosterone are all well known to be intimately associated with the mechanism of ova transport, but variable effects are seen in different species and at different dose levels[19-23]. There is no direct evidence in the present study to ascertain an imbalance of estrogen and progesterone as a result of PMS or HCG administration. It has been observed on several occasions that, following early entry of tubal ova into the uterus either by hormonal treatments[24], or by mechanical means such as transfer of ova[24,26], the development of young ova in the uterine environment is inhibited in the mouse, rabbit and rat. In the present experiment, however, the slightly accelerated tubal transport of both PMS and HCG in the rabbit does not affect the development of ova into early blastocysts.

It has been observed that by administration of PMS and HCG before ovulation, superovulated ova of rats, rabbits and mice cleaved and developed rather normally in the genital tract and most of the subsequent embryonic loss occurred during the pre-and particularly the post-implantation stages[1,2,6,7,14,15]. Similar effects to embryonic mortality were also seen by administration of PMS or HCG on Days 1, 2 and 3 of normal pregnancy in the rat and hamster in the previous study[16] and also in the mouse and rabbit in the present experiment. By treatment of gonadotropins at the time of implantation, a much greater incidence of post-implantation embryonic mortality was noted. Since the development of eggs in the tube and uterus was rarely affected, most of the difficulty in the embryonic development occurred at the post-implantation stage, it is very likely that the endometrial disorder induced by the imbalance of hormones must have been responsible for the high embryonic mortality.

In the present study, daily administration of progesterone to the PMS-treated rabbits also failed to maintain pregnancy at a normal level. After ovariectomy, however, the adverse effect of PMS on embryonic development was significantly reduced in the rabbit. It seems reasonable to suppose that the high embryonic mortality in the PMS-treated pregnant animals cannot be explained as being due to a deficiency of the luteal hormone, for supplemental daily treatment of progesterone was also ineffective in maintaining pregnancy. It is suggested that the high embryonic mortality in the PMS-treated animals may have been due to some disturbance of steroidal secretion from the ovary following stimulation by PMS, because removal of the ovaries and substitutional therapy with progesterone were effective in reducing the high rate of embryonic mortality. Although pregnancy can be interrupted by exogenous estrogens[20-23,27-29], whether or not the antifertility effect of PMS or HCG is due to an increase of estrogen in response to gonadotropic stimulation is still to be determined.

ACKNOWLEDGEMENTS: This work was chiefly supported by a grant from the

National Science Council of the Republic of China, and also supported in part by the memorial fund for Mrs. W. W. Hsu. Many thanks are due to the United States Naval Medical Research Unit No. 2 for the contribution of mice.

REFERENCES

(1) EVANS, H. M., and M. E. SIMPSON: Endocrinology **27**; 305, 1940.
(2) COLE, H. M.: Science **91**; 436, 1940.
(3) GATES, A. H.: Nature (London) **177**; 754, 1956.
(4) SMITHBERG, M., and M. H. RUNNER: J. Exp. Zool. **133**; 441, 1956.
(5) PINCUS, G.: Anat. Rec. **77**; 1, 1940.
(6) PARKES, A. S.: J. Endocr. **3**; 268, 1943.
(7) WARWICK, E. J., R. L. MURPHREE, L. E. CASIDA, and R. K. MEYER: Anat. Rec. **87**; 279, 1943.
(8) CASIDA, L. E., E. J. WARWICK. and R. K. MEYER: J. Anim. Sci. **3**; 32, 1944.
(9) ROBINSON, T. J.: J. Agric. Sci. **41**; 6, 6, 1951.
(10) EDWARDS, R. G., and R. E. FOWLER: J. Exp. Zool. **41**; 299, 1959.
(11) MCLAREN, A., and D. MICHIE.: J. Exp. Biol **36**; 281, 1959.
(12) ADAMS, C. E.: J. Reprod. Fertil **1**; 36, 1962.
(13) HARPER, M. J. K.: J. Reprod. Fertil **7**; 185, 1964.
(14) CHANG, M. C.: Nature (London) **161**; 978, 1948.
(15) Runner, M. N., and A. GATES: Nature (London) **174**; 222, 1954.
(16) YANG, W. H., and M. C. CHANG: Endocrinology **83**; 217, 1968.
(17) DOWLING, D. F.: Agric. Sci. **39**; 374, 1949.
(18) AUSTIN, C. R.: J. Endocri. **6**; 293, 1950.
(19) BURDICK, H. O., and R. WHITNEY.: Endocrinology **21**; 637, 1937.
(20) WHITNEY, R. and H. O. BURDICK.: Endocrinology **20**; 643, 1936.
(21) PINCUS, G., and R. KIRSCH.: Amer. J. Physiol **115**; 219, 1936.
(22) GREENWALD, G. S.: Endocrinology **69**; 1968, 1961.
(23) BURDICK, H. O., B. B. EMERSON, and R. WHITNEY.: Endocrinology **26**; 1081, 1940.
(24) WHITNEY, R. and H. O. BURDICK.: Endocrinology **22**; 639, 1938.
(25) CHANG, M. C.: J. Exp. Zool. **114**; 197, 1950.
(26) NOYES, R. W. and Z. DICKMANN: J. Reprod. Fertil. **1**; 186, 1960.
(27) PARKES, A. S., and C. W. BELLERBY.: J. Physiol. (London) **62**; 145, 1926.
(28) SMITH, M. G.: Bull. Hopkins Hosp. **39**: 203, 1926.
(29) CHANG, M. C., and M. J. K. HARPER.: Endocrinology **78**; 860, 1966.

PMS 或 HCG 抑制小白鼠和家兎妊娠之研究

楊文勳* 徐千田* 江合祥# 林隆禮*

(1971年3月18日受理)

在小白鼠交配後第一天至第三天給予 40 IU PMS 的靜脈注射，並不影響其卵管內卵的輸送情形，但是，同樣的處理，在家兎，則加速其卵管內的卵進入子宮。當改用 200 IU HCG 進行同樣的處理，則明顯的加速小白鼠或家兎之卵管內卵的輸送速度。在妊娠早期施行 Gonadotropins 的處理，並不影響動物卵管內卵的早期分割及卵的發育至 Morula 或 Blastocyst。

在交配後第一天至第三天給予 40 IU PMS 的處理，對小白鼠和家兎皆有輕度抑制着床的作用，但於妊娠至第十八天行剖腹檢查的結果發現有造成嚴重死胎的現象；當使用 PMS 自 5 IU 到 40 IU 等不同劑量，於交配後第四天到第六天來處理小白鼠和家兎，結果，雖然只有稍許地減少其着床數目的現象，但是，其形成胎兒與對照羣者相比較，在小白鼠減少到 69% 與 39% 之間，在家兎則減少到 76% 與 0% 之間。

在交配後第一天至第三天給予 800 IU HCG 的處理，對小白鼠卵的着床現象，並無明顯的影響，但對其形成胎兒與對照羣者相比較，則減少到 13%；同樣的處理，對家兎則有比較中等程度的影響着床減少。另一方面，當使用自 200 IU 到 800 IU 的 HCG，不同劑量，注射於交配後第四天至第六天的小白鼠和家兎，則對着床現象皆無顯著的影響，但對其形成胎兒與對照羣者相比較，在小白鼠減少到42% 與 19% 之間，在家兎則減少到 89% 與 53% 之間。

受過 PMS 處理的已妊娠家兎，再給予 Progesterone 的處理，並不減輕 PMS 對妊娠的不利影響，但是，對於在 Blastocyst 已形成時期，再接受卵巢切除後的同樣家兎，再給予同樣的處理，則有利於妊娠，因此，乍看來好像 PMS 的抗生殖作用，可能是因卵巢內有異常的 Steroid 產生之故。

* 臺北醫學院婦產科
# 美國海軍第二醫學研究所獸醫科