

# THE EFFECT OF PREGNANCY AND MENSTRUATION ON THE SIZE OF THE SPLEEN.

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THE present research commenced in a somewhat accidental manner. Among the first dogs the spleens of which were exteriorised<sup>(1)</sup> was one which only at first responded well to exercise. Unlike others operated upon at the same time, the spleen after about a month became pale and small, presenting at rest the appearance which it had previously presented after exercise. It was killed by bleeding; the hæmorrhage caused little further contraction of the spleen—again unlike other animals which we had observed. The post-mortem which was performed by Sgt-Major Secker, R.A.M.C., revealed the fact that the animal was in an advanced stage of pregnancy.

Three further experiments have been performed, each of which was along the following lines. Two female dogs were selected of about the same size, one which when she “came on heat” was served with a dog. About half-way through the pregnancy, *i.e.* four to five weeks after the service, the spleens of both animals were exteriorised and the changes in each noted from time to time. As an account of these experiments appears in the *Archivio di Scienze Biologiche* (in the complementary volume to Prof. Bottazzi<sup>(2)</sup>), and as now this may be regarded rather as preliminary, they will only be referred to rather shortly here:

(1) The spleen of each animal, the pregnant and the control, gradually gets smaller as the days pass, but the spleen of the control animal does not shrink nearly so rapidly as that of the pregnant bitch.

(2) This rapid shrinking of the spleen of the pregnant bitch goes on until about the time the pups are born. The third experiment, that in which the technique was most perfect, suggested that minimal shrinkage, and certainly the most obvious pallor of the organ were not coincident with the date of parturition, but took place two or three days earlier.

A record of one of these experiments is shown in Fig. 1, in which the area of the pregnant animal's spleen is shown as a percentage of the area of the spleen of the control animal on the same day. While they were

quite definite as far as they went, they left several points to be desired, both as regards technique and interpretation, of which the following three are the most important:

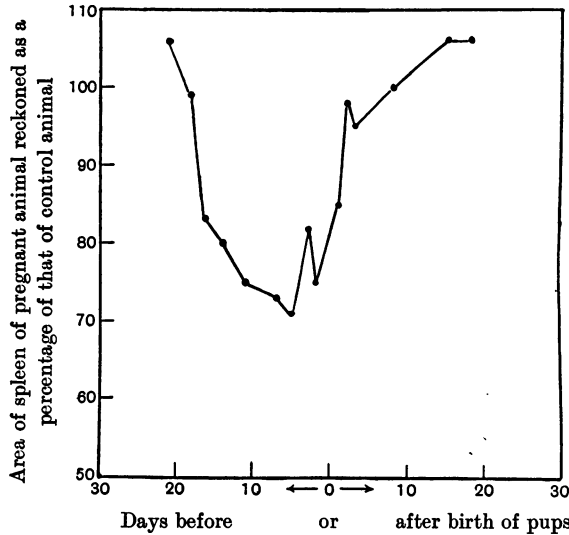


Fig. 1. "The area of the spleen" in pregnant animal expressed as a percentage of that in control animal. The spleens were exteriorised on successive days.

(1) The control spleen was not of uniform size through the experiment, the difference in size between the control and the normal was quantitative only and not qualitative.

(2) The animals all experienced a certain amount of anæmia, and broadly speaking the pregnant animals suffered most from anæmia; might it be that the shrinkage of the spleen was really due to the anæmia?

(3) Further as regards the interpretation, even granting that the contraction of the spleen was caused by a call for blood elsewhere, was that call due to the necessity of producing iron for the blood of the fœtus, or was it due to the enlargement of the capacity of the vascular bed caused by the congestion of blood in the genital organs?

A single experiment went far to settle all the points enumerated above. (This experiment has now been duplicated on another animal in all important respects excepting the hæmoglobin estimations which it seemed unnecessary to repeat.)

A bitch, the spleen of which was exteriorised on June 13th, 1927, was kept under observation, and by September 24th the spleen had ceased

to get smaller; from that date until January 9th, 1928, a period of about fifteen weeks, the spleen had scarcely varied in area and certainly it had not shrunk; the progressive alterations may be followed in Fig. 2.

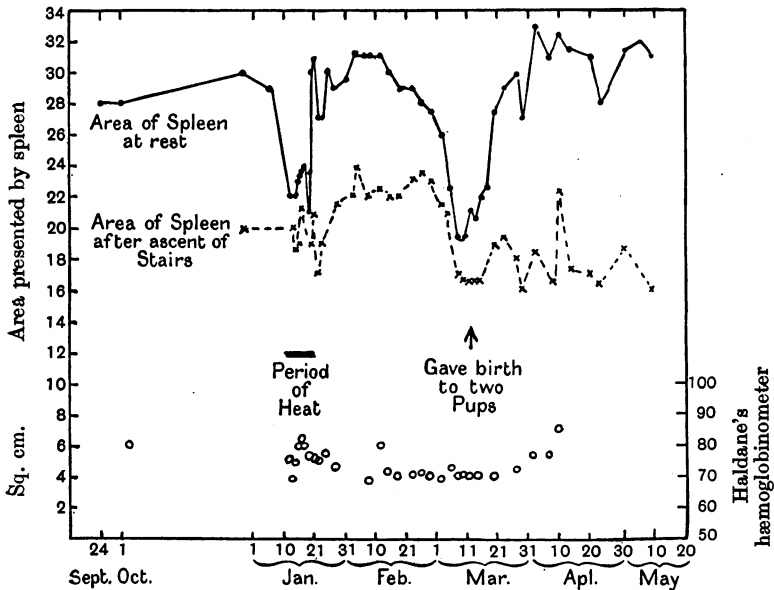


Fig. 2. Alterations in "spleen area" ---, at rest; x---x, after standard exercise; and o o, hæmoglobinometric reading during menstruation and pregnancy.

The animal then came on heat with the result that the spleen contracted suddenly to about three-quarters of its area and remained so during the whole period of heat. Directly that period was over the spleen returned to its former area, or indeed attained a slightly greater one. About the middle of the period of pregnancy (February 12th) the spleen commenced again slowly to contract, reaching its smallest dimensions on March 7th-9th, the pups being born on March 12th. By April 2nd the spleen was larger than it had been at any measurement since August 19th of the previous year. The approximate alterations in volume are shown in Fig. 3, the assumption being that the alterations in volume are proportional to the square in the alteration in "surface" (1).

Applying the results of this experiment to the three points set forth above:

(1) The contraction due to pregnancy was not one which took place in a spleen which would in any case have been contracting, but at a lesser rate. It took place in a spleen which otherwise was of almost

constant size or, if anything, was growing larger. (On June 18th, 1928, it had an area of 37.5 square centimetres.)

(2) The hæmoglobin values were noted right through the experiment (see Fig. 2), and there are no such variations as could be held to account

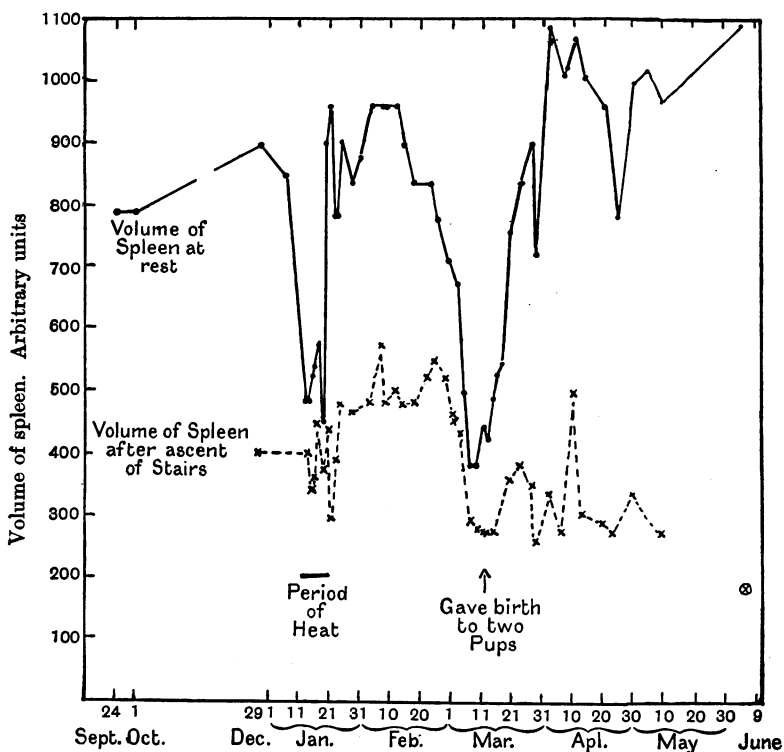


Fig. 3. Computed volume of spleen --- at rest and after standard exercise x---x---x during menstruation and pregnancy. ⊗ after chasing cat along passage. The mass of the spleen in grams is not very different from the figure obtained by dividing the arbitrary units on the ordinate by fifteen.

for the alterations in volume of the spleen. Moreover it has been shown by Shen(3) in work which was being carried on at the same time that anæmia, as opposed to ischæmia, does not cause a shrinkage of the spleen.

(3) There is no question of considerable blood destruction during the period of "heat," therefore as between the rival hypotheses that the contraction of the spleen is directed towards (a) the making good in the circulation of blood destroyed for the purpose of supplying the foetus with iron, and (b) the supply of blood to fill freshly opened vascular areas. The latter in the period of "heat" is the only one that need be considered.

Presumably therefore in pregnancy the enlargement of the vascular bed is the principal cause of the contraction of the spleen. The effort to make good to the circulation any actual loss which may take place by destruction of corpuscles is not ruled out as a concurrent factor.

The response of the spleen to exercise is shown in Figs. 2 and 3 by the dotted line. In each case the exercise taken was once running down and up the laboratory stairs, about 42 feet in height. In every case, there was some response to exercise, but during the menstrual period and again towards the end of pregnancy the response was slight. Even throughout the earlier stages of pregnancy the response though good was as a rule not quite so good as normally, and indeed it seemed to fall off progressively during the pregnancy until March 5th when it was at its worst. A certain amount of caution must be observed in suggesting that the exercise was really constant although the actual ascent made was the same in all cases. From February 24th to May 5th the animal was extremely disinclined to exert itself and only took its exercise in a half-hearted way. That was especially true on March 5th.

#### SUMMARY.

(1) The exteriorised spleen of the dog shrinks to about three-quarters of the surface and about half its volume during the period of "heat" and to a somewhat greater extent towards the end of pregnancy. It probably reaches its smallest size a few days before the birth of the pups.

(2) Reasons are given for attributing the shrinkage in the main to the necessity of supplying blood to meet the increased capacity of the vascular bed, caused by the dilatation of the uterine vessels.

(3) The response of the spleen to exercise is never entirely abolished during "heat" or pregnancy, though it is much reduced at the times when the spleen is shrunken.

(4) The colour of the spleen undergoes remarkable alterations, becoming pale during the periods when the spleen shrinks. If anything, the alteration in colour anticipated the alteration in size both when the spleen is paling and when the red colour is returning.

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#### REFERENCES.

1. Barcroft and Stevens. *This Journ.* 64. p. 1. 1927.
2. Barcroft and Stevens. *Archivio di Scienze Biologiche*, 12. p. 94. 1928.
3. Shen. *This Journ.* 66. p. 74. 1928.