injection of the combined fat emulsion can be accounted for on the basis of an increase in total heat production due to the metabolism of fat plethora. The increased rate of blood sedimentation was believed to be associated with erythrocyte pseudo-agglutination caused by the infused gelatin. The variations in hemoglobin, etc., were related to the dilution effect of the emulsion. The incidence of constitutional reactions compared favorably with reactions encountered after blood transfusions. The sharp rise in the number of chylomicrons followed by the slower fall was indicative of the rate of disappearance of the intravenously injected fat from the blood stream. The appearance of acetone found in an occasional specimen of urine during the infusion phase may be explained on the basis of incomplete oxidation of the fat. In the follow-up we were unable to find any serious toxic effects or late sequelae ascribable to the emulsion.

Summary. The method of preparation of a 10% combined fat emulsion used in the present investigation was described. A combined fat emulsion with a potency of approximately 1300 calories per liter was infused intravenously into 76 human subjects. A variety of laboratory tests and clinical observations provided evidence in favor of its suitability as an intravenous emulsion.

The authors are indebted to the E. F. Drew Co., to the Mead Johnson Co., and to the C. F. Knox Co., for generous supplies of material used for the preparation of the emulsion. The homogenizer was made by the C. W. Logeman Co., New York City.

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Influence of Temperature on the Distensibility of the Pubic Ligament.*

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The studies of Hisaw and his collaborators[1,2] have demonstrated that hormonal changes can profoundly influence the distensibility of an apparently physiologically inert tissue such as the pubic membrane within a relatively short time. In the present study we have attempted to determine the relative influence of changes in the physical environment, *i.e.* load and temperature, on the response of the pubic ligament of the guinea pig.

The experiments to be described subsequently, were performed in both intact preparations of non-gravid and in isolated preparations of gravid and non-gravid guinea pigs. In the former series hormonal influences were controlled by ovariectomy and injection of serum from pregnant rabbits. It was soon found that under our experimental conditions such hormonal factors played a lesser part than did slight variations in the environment, as *e.g.* caused by variations in the distance of a source of heat to the preparation.

The method used in studying the effect of temperature on the stretching of the pubic ligament in the intact animal is illustrated in Fig. 1. The animal was kept under deep nembutal narcosis during the entire experiment. Stretch on the pubic ligament was exerted by a weight which pulled a string loop fastened with one end to the pubis, at the other to the ischium. The other half of the pelvis was similarly fastened with a short loop of string to a fixed point. Recording took place with a third loop, fastened to the side on which the weight pulled; this arrange-

* This investigation was carried out with the aid of a grant from the Harlan Shoemaker Fund for Paralytics, Los Angeles, Calif.

1 Hisaw, F. L., *Anat. Rec.*, 1927, **37**, 126.

2 Abramowitz, A. A., Money, W. L., Zarrow, M. X., Talmadge, R. V. N., Kleinholz, L. H., and Hisaw, F. L., *Endocrinol.*, 1944, **34**, 103.

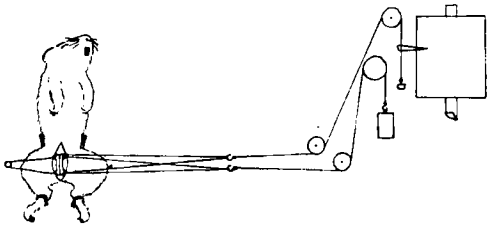

FIG. 1.
Diagram of the arrangement of stretching the pubic ligament of a guinea pig *in vivo*.

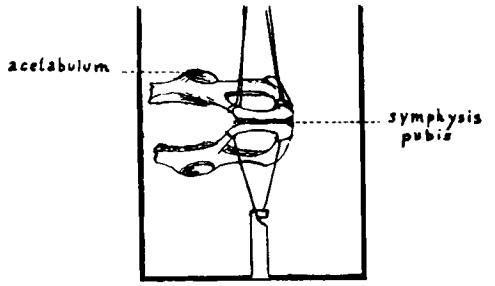

FIG. 2.
Part of the arrangement for the experiments *in vitro*, showing the attachment of the strings to the preparation.

ment made it possible to record more nearly the actual change in the pubic membrane only, without interference of the stretching of the wire by the stretching weight. The animal was held in position between two nails driven just above the hindlegs into the board on which the preparation was mounted and by staples which held the hind legs fastened to the board.

A similar technic was used for the recording of the stretch of the isolated preparation. In this case the pelvis was cut just above the acetabulea. The short single loop on one side was fastened to a hook in the bottom of a cylindrical container, made of brass, which could be submerged in a constant temperature bath. The preparation itself was bathed in mammalian Ringer solution (Fig. 2).

Stretching was recorded on a kymograph and the preparations were subjected to stretch for up to 6 hours in the case of stretching *in situ*, whereas isolated preparations were kept for 12 hours or more. The number of animals in which the ligament was stretched *in vivo* and significant temperature changes were made, was 12. A far larger number, in which the temperature was kept more constant, and in which hormonal factors were varied, served to show that the variations observed with temperature change did not occur without such change. Eight ligaments were stretched *in vitro* under thermostatic conditions.

Results. Table I represents the results obtained when isolated pubic ligaments with the adjacent symphyses, were subjected to a constant load of 100 g at various temperatures for 12 hours. It will be seen that there is no noticeable difference between stretching at 25°C and 30°C. With higher temperatures the rate of stretching increases, and at 38°C is many times that at 25°C. Fig. 3 and 4 represent changes in the rate of stretching within a given preparation when temperature is varied. The stretch at the onset of the experiment is always larger at the same temperature than later, dropping exponentially. By changing temperature this curve can be greatly influenced. Thus from Fig. 3 it is seen that lowering the temperature from 37°C to 34°C almost completely prevents distension from a load of 100 g, but that stretching resumes when the original temperature is reestablished. This experiment was performed on a non-pregnant animal, with the preparation *in situ*. The temperatures measured are those of the Ringer fluid which surrounds the membrane. This fluid also prevents drying of the membrane. The experiment shown is representative of many performed in this way. From these it follows that a greatly increased rate of stretching is caused by a temperature rise between 33 and 36°C. Below this range in the non-pregnant guinea pig there is very little stretching with a load of 100 g, whereas above this range (up to 42°C) the rate further increases, but not so much.

Fig. 4 represents the stretching *in vitro* of

TABLE I.
Change in Distances of Isolated Pubic Membranes After 12 Hours of Stretching by 100 g virgin guinea pigs.

Temp.°C	Stretch in mm*	mm per hr
25	20	1.67
30	20	1.67
35	68	5.08
38	138	11.5

* As recorded on drum; about 4 times actual.

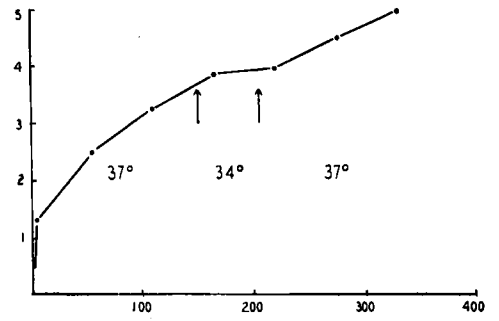

FIG. 3.

Plot of the increase in distance of the membrane, subjected to a stretch of 100 g *in vivo*, of a virgin guinea pig, weight 500 g. Between arrows temperature lowered from 37 to 34 degrees. Length in arbitrary units, each of which corresponds to about ½ mm. Time in units of 100 min.

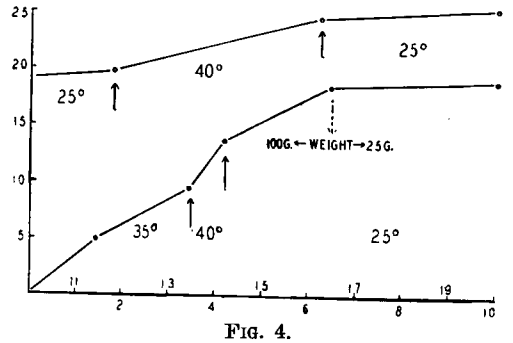

FIG. 4.

Stretching curve obtained from ligament of a pregnant animal *in vitro*, showing the influence of temperature and weight. Notice the much greater stretch than in Fig. 3. Upper curve is continuation of lower curve. Time in hr.

a ligament from an animal almost at term, to which 100 g stretching weight was applied. There is an increase in rate of stretch by changing from 35 to 40°C. In this pregnant animal lowering to 25°C does not prevent a very noticeable stretching. Even decreasing the stretching load to 25 g only reduces the stretching at 25°C to a value comparable to that found in non-pregnant pigs at body temperature. At 40°C the amount of stretching with 25 g load is again considerably increased.

This much greater sensitivity of the membrane of the pregnant animal is completely in accord with the view that the pressures present in the pelvis will be sufficient to push the bones apart. It is difficult to judge, how much pressure might occur under non-pregnant as compared to under pregnant conditions, the much smaller distensibility obviously prevents in most animals any great separation of the bones. Another factor which must be considered in these experiments is the presence of ligaments joining the pelvic girdle to the spinal column. These do possibly participate in the experiments on the membrane *in situ*, but not in the case of the isolated preparations. This may be the main reason, why the stretching curves of the latter were always considerably freer from small irregularities than the former.

It may be pointed out that the great influence of temperature changes between 33 and 37°C on the stretching of the pubic ligament raises interesting questions concerning the behavior of other ligaments in the body, which, by their location might be subject to temperature changes in this range under normal living conditions.

Summary. The effect of temperature on the distensibility of the pubic ligament of the guinea pig was investigated in intact and isolated preparations using a constant load. Both types of preparations exhibited a marked dependence of stretching on temperature between 30 to 40°C with the mode lying in the range 34-35°C under conditions of moderate loading.

Distension at 30°C is negligible, while at temperatures above 34 it is rapid. Preparations from pregnant animals show a lower threshold both for temperature and weight.

The authors want to thank Dr. D. R. Howton and Mr. H. H. Crawford for their assistance during the earlier part of this investigation.