The results indicate that although these are long lasting irreversible inhibitors of monoamine oxidase, they can influence precursory steps in the anabolism of 5-hydroxytryptamine. This is especially true for the non-hydrazine inhibitors tested in these experiments. It is also evident from these results that the time period after use of inhibitors is very important—the shorter the time period the greater the chance for interference on systems other than monoamine oxidase.

Summary. Two hydrazine (β-phenylisopropylhydrazine and iproniazid) and 2 non-hydrazine (*trans*-2-phenylcyclopropylamine and pargyline) monoamine oxidase inhibitors were tested for their influence on the conversion of tryptophan and 5-hydroxytryptophan to 5-hydroxytryptamine. It was found that the conversion of 5-hydroxytryptophan was influenced by both types of monoamine oxidase inhibitors but the non-hydrazine inhibitors were most effective. There was an increase in the amount of 5-hydroxytryptamine formed, especially during the first few hours after the inhibitors were administered. Tryptophan conversion to 5-hydroxytryptamine was not significantly influenced by the monoamine oxidase inhibitors. Excitatory responses seen with monoamine oxidase inhibitors and 5-hydroxytryptamine precursors were also observed and appeared to be related to the degree of enzyme inhibition more than to the amount of 5-hydroxytryptamine.

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Effect of Increased Tissue Traction Upon Tensile Strength of Cutaneous Incisions in Rats.* (31396)

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There are many biological situations in which mechanical factors seem to direct organization and growth of connective tissue. Histological study of tendon indicates that collagen aligns in a direction parallel to the lines of stress, and of bone show that the trabeculae therein align (and are capable of re-aligning) in such a manner as to afford the greatest possible structural stability. The urinary bladder, the uterus and the body's arterioles all become hyperplastic in response to increased pressure on their luminal surfaces. Thus, teleologically speaking, connective tissue is able to organize itself in a manner best suited for function in response to the existing stresses upon that tissue. The response of morphology to stress in the musculoskeletal system has been discussed by Hirsch as the "stress stimuli" principle(5).

The literature has been inconclusive re-

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garding the role of extrinsic tension in the alignment of newly formed collagen fibers. One report shows that decreasing tension may be deleterious to the development of tensile strength(7), while another states that increasing the extrinsic tension results in a weaker scar(3). However, these studies measured essentially only breaking strength of the scar and not true tensile strength(6).

Materials and methods. Methods for handling rats and measurement of breaking strength and skin thickness were indentical to those used in previous studies(8). In this study animals were operated upon in pairs, and in each animal of the pair a 6 cm dorsal transverse incision was made equidistant between the sacrum and the occiput. Skin and panniculus carnosus were incised down to the level of the fascia covering the dorsal musculature. The wound in one member of each pair was then closed with 4-0 Tevdek (courtesy of John Deknatel and Sons, Queens Village, N. Y.) using a continuous mattress suture. In the other member, a second incision was made 2 cm posterior to the first incision and running parallel to it. Both of the incisions in this animal were then extended to a point 1-1.5 cm laterally to a point intermediate between the 2 incisions in the longitudinal plane. The piece of tissue thus delineated by the 2 incisions (Fig. 1) was then excised from underlying fascia with scissors and the edges of skin bordering the excised area was approximated using a continuous mattress suture of 4-0 Tevdek. This latter procedure had the effect of creating a linear incision with increased traction perpendicular to the long axis of that incision without compromising the blood supply to the area of healing.

All animals were sacrificed on the 14th postoperative day and the healing wounds were measured for breaking strength and thickness, using an Instron tensiometer as previously described‡(8) (Fig. 2).

Results and discussion. Grossly the wounds appeared similar. Their histological structure seemed similar, but the width of the wound in microscopic cross-section was directly related

‡ Instron Co., Canton, Mass.

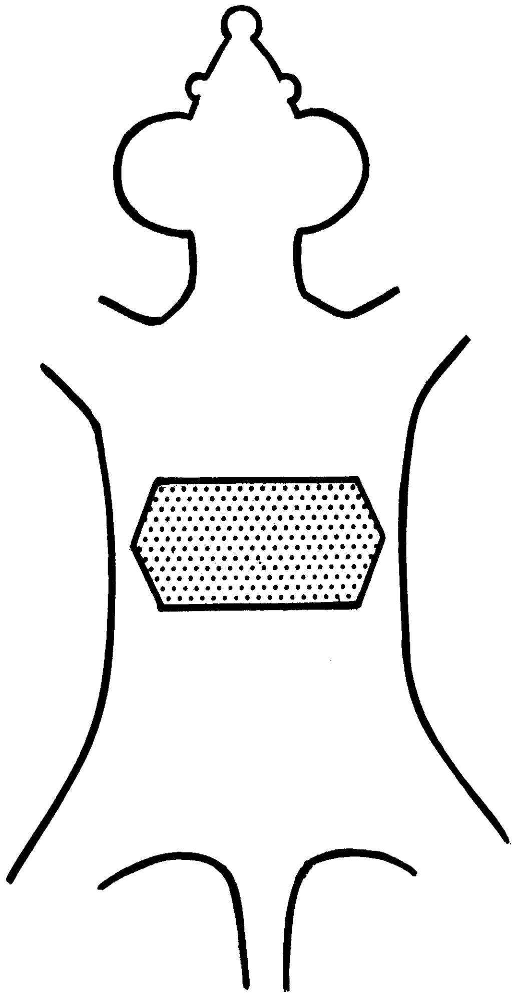

FIG. 1. A wound was made as outlined above so that when the opposing edges were sutured together, the effect was analogous to a linear incision with increased perpendicular to its long axis.

to its tensile strength. In all cases the major collagen bundles traversed the defect when viewed in microscopic cross-section.

Although the difference between the breaking strength was not significant ($t = 1.55$) the wounds which healed under conditions of increased extrinsic stress attained a significantly ($t = 2.37$) greater tensile strength after a period of 14 days (Table I). The tensile strength of a wound is felt by Milch to be "directly related to the number of effective network chains per unit volume, not to the total number of chains"(6). Thus tensile strength reflects the functional capacity of a

TABLE I.

Type of wound	No. of animals	Breaking strength (g)	Thickness (mm)	Tensile strength (g/mm^2)
Normal incision	19	487 ± 19	$1.246 \pm .026$	65.6 ± 3.2
Incision with increased tension	14	534 ± 30.2	$1.139 \pm .031$	80.3 ± 5.3
t value		1.55	2.67	2.37

All values $\pm$ 1 S.E. of mean.

wound and depends not only on quantity of collagen present, but also on the structural arrangement of that collagen both on the molecular and histologic level.

Berard *et al*(2) have observed that wrinkle lines on the dorsum of a rat are oriented in a transverse direction and that major collagen bundles in the skin paralleled these wrinkle lines. When lines of skin tension were mapped out on the dorsum of a guinea pig (which is referable to the rat) by the method of Langer, they were found to be oriented in a transverse direction thereby paralleling the arrangement of the bundles of collagen(9).

If tissue tension does align collagen fibers in a healing wound, then one would expect that collagen fibers which are laid down in an incision which cuts across wrinkle lines (longitudinal incision) would be aligned by 2 parallel forces. The first is the tendency of any incision to gape (due to weight of tissue and other factors) and the second is that tension which is inherent in the intact skin in that area. In this longitudinal incision both forces tend to align the newly formed collagen fibers in such a manner as to smooth bridge the defect and to parallel pre-existing fibers in the normal skin bordering the incision. In an incision paralleling wrinkle lines (transverse incision) however, the weak forces of the gaping wound which orient the fibers in such a fashion to bridge the defect are accompanied by the natural lines of tension which in this incision run parallel to the long axis of the wound. The result would then be two perpendicular lines of force along which the collagen must orient itself, resulting in a haphazard arrangement of fibers and a scar of poor structural stability (Fig 3).

It has, in fact, been demonstrated that wounds in rats cutting across wrinkle lines (longitudinal incisions) are twice as strong as those where the incision was made paralleling wrinkle lines (transverse incisions) during the period extending from 2 weeks(2) up to 6 months(1) after wounding. Furthermore, these investigators reported that in the junctional area between pre-existing col-

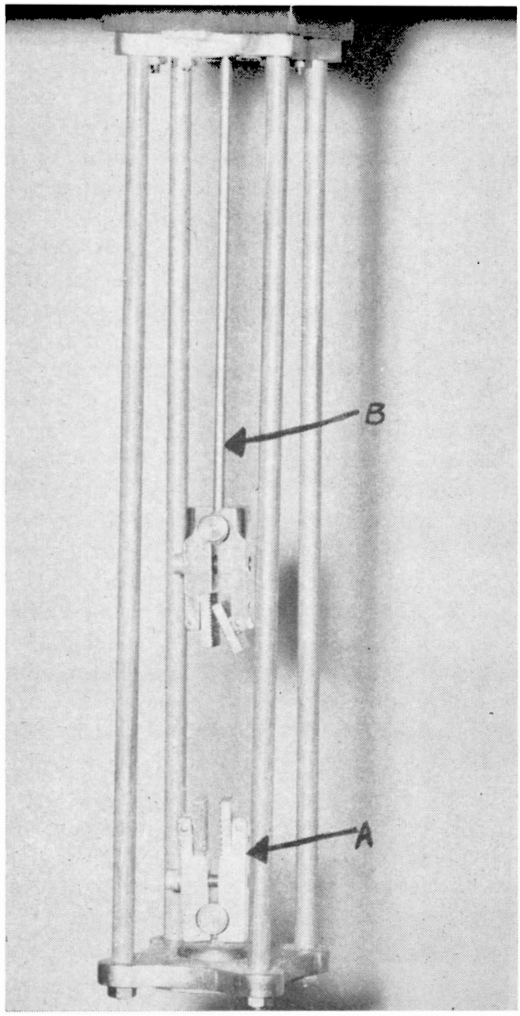

FIG. 2. Moving parts of Instron tensiometer. Tissue is clamped m jaws, x lower jaw v carriage (A) move downward @ set rate of speed. Upper jaw is fixed to a strain gauge by the central bar, (B) from which recordings are made.

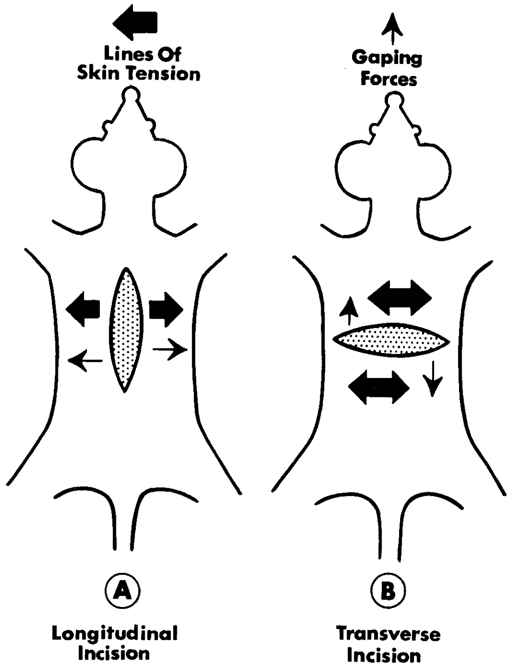

FIG. 3. Schematic representation of alignment forces of tension acting upon longitudinal and transverse incisions.

lagen fibers and newly laid down collagen in the wound the transition was relatively smooth and uninterrupted in the wounds which cut across wrinkle lines, while in the wounds parallel to wrinkle lines (and therefore collagen fiber bundles) the junctional area was marked by many whorl-like depositions of collagen(2).

This present study then affords an explanation for the results observed by Berard, Levenson *et al*(1,2,4) concerning the differential healing of transverse and longitudinal wounds, and substantiates the hypothesis that there is a direct relationship between the tensile strength of a wound in the early period of wound healing and the amount of tissue traction being exerted upon that healing wound during that time.

Summary. The tensile strength of simple skin incisions and those healing under increased tension was measured after 14 days of healing. The incisions which healed under increased tissue tension attained a significantly greater tensile strength as measured with an Instron tensiometer. This effect was used to explain previously observed differences in the rate of gain of tensile strength of transverse and longitudinal incisions.

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