

eased focus could be assumed as the exciting cause of such an isolyisin formation.

In conclusion, the writer wishes to acknowledge his indebtedness to Dr. J. E. Tuckerman, who collaborated in the research.

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The effect of instilling adrenalin chloride into the mammalian eye.

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Certain writers have concluded that mydriasis cannot be produced by instilling adrenalin into the eye of higher animals except under pathological conditions such as lesions of the pancreas or the removal of the superior cervical ganglion. Perhaps this conclusion results from an oversight of the antagonism existing between the influence of instilled adrenalin and light stimuli when simultaneously acting upon the intact eye. At any rate the conclusion is not supported by more recent experiments and is misleading when used as a basis for diagnosing certain pathological conditions.

I have found that mydriasis can be produced in these animals with relative ease and certainty. In making a comparative study, however, of different degrees of susceptibility to adrenalin, due care must be taken to keep the intensity of light stimuli constant. This is essential, since in the eyes of higher mammals where the light reflex is well developed, strong light may cause the pupil to constrict to such an extent that any antagonism of this process by adrenalin may be lost sight of. For instance, by instilling adrenalin into the normal cat eye for some minutes and then examining the eye in light bright enough to constrict the untreated eye to a small slit-like aperture, no difference in the drugged and undrugged eyes can be detected; but the same eyes examined in a dark corner may show a distinct difference in the pupils, the drugged pupil dilating more than the normal one. Thus the early dilating effect of adrenalin can be detected more easily by reducing the intensity of the light stimuli. In this preliminary com-

munication, however, it is not so much the time of initial dilation as it is the time required for complete antagonism of the light stimuli by adrenalin that is considered. The degree of resistance to this antagonism is perhaps best illustrated by the appended protocols, each taken from a series of experiments. Here it is shown that maximal dilation and loss of light reflex in the guinea pig results within 23 minutes after instilling 6 drops of 1 : 1000 solution of adrenalin chloride. After instilling 2 drops every 2 minutes into the eyes of the following, maximal dilation and loss of light reflex results : In the rabbit, within 56 minutes ; the dog, 96 ; the cat 101 ; whereas in the monkey it requires 148 minutes ; and in normal man even longer.

From the protocols it will be seen that adrenalin not only dilates the pupil of the mammalian eye, but that in each case the stimulating effect of light of moderate intensity can be completely overcome by it. Furthermore the ease with which this antagonism is accomplished seems to depend upon the degree of development attained by the light reflex mechanism, since in animals that have a sensitive light accommodating mechanism most highly developed the period of instillation and amount of solution must be increased to produce mydriasis, whereas in animals with a reflex mechanism less sensitive to light stimuli, mydriasis is relatively easy. In conclusion it seems that these facts must be considered in formulating a theory dealing with the dilator mechanism of the eye or with the value of the adrenalin test for certain pathological conditions.

1. Normal guinea pig. Sept. 5. Park, Davis & Co.'s 1 : 10000 adrenalin chloride.

- 10.30 A. M. Before instillation, diameter of right and left pupil about 5 mm.
- 10.32 " two drops instilled in right eye.
- 10.36 " right pupil 5.8 mm., left pupil 5 mm.
- 10.39 " " " 6 mm., left pupil 5 mm.
- 10.43 " two drops instilled into right eye.
- 10.45 " right pupil 7 mm., left pupil 5 mm.
- 10.50 " " " 7.8 mm., left pupil 5 mm.
- 10.51 " two drops instilled into right eye.
- 10.55 " right pupil 9 mm., left pupil 5 mm.
- 11.11 " " " 9 mm., practically dilated to a maximum.
- 12.32 P. M. " " " about same as at 11.11.
- 1.15 " " " $7\frac{1}{2}$ mm., left about 5 mm.
- 1.24 " " " about same as left.

Maximum dilation brought on by six drops. Time required was about 23 min., at the end of which time the pupil no longer reacted to light.

2. Normal gray rabbit. Sept. 3. Two drops of P., D. & Co.'s adrenalin chloride instilled every 2 minutes.

3.40 P. M. Right pupil 6.6 x 9 mm., left 6.6 x 9.0 mm.

4.02 " " " 11.0 x 12 mm.

4.12 " " " 12.0 x 12.5 mm.

4.38 " " " 13.5 x 14 mm. Last instillation: left 7 x 10.4 mm., pupil scarcely reacted to light.

3. Large adult female cat. Aug. 20. P., D. & Co. 1:1000. Instilled every 2 minutes.

10.30 A. M. Right and left pupils alike; transverse diameter about $1\frac{1}{2}$ mm.

10.34 " first instillation.

11.48 " slight dilation of right eye, $2\frac{1}{2}$ mm., left $1\frac{1}{2}$ mm.

12.45 P. M. maximum dilation 11.2 mm., left $1\frac{1}{2}$ mm., practically no reaction to light after 101 minutes.

4. Young adult female dog. Aug. 21. P., D. & Co.'s 1:1000 sol. of adrenalin chloride; two drops every two minutes.

10.00 A. M. Right and left pupils of same diameter — about 4.2 mm.

10.04 " first instillation.

10.40 " right pupil about 5 mm., left 4.2 mm.

11.00 " " " 6.8 mm., " 4.2 "

11.16 " " " 9 mm., " 4.2 "

11.40 " " " 11 mm., " 4.2 " Last instillation.

4.30 P. M. " " " 2 mm., " 5 "

Maximum dilation was reached after about 96 minutes at which time the pupil ceased to react to fairly bright light from a skylight. By 4.30 the right pupil had not only ceased to dilate, but even in such a light as one might secure in a well-lighted room at 4.30 P. M., the drugged eye constricted much more than did the normal one.

5. Monkey. P., D. & Co.'s adrenalin chloride, 1:1000. Two drops every two minutes.

10.30 A. M. Both pupils of the same diameter, about 2.4 mm.

10.32 " first instillation.

10.46 " right pupil 2.6 mm., left 2.4 mm.

10.49 " " 3.0 mm., " 2.4 "

11.10 " " 3.5 mm., " 2.4 "

11.12 " " 4.0 mm., " 2.4 "

11.35 " " 5.4 mm., " 3.1 "

11.46 " " 6.0 mm., " 3.0 " pupils turned toward bright light.

12.06 P. M. " 6.5 mm., " 2.8 " constricted to about 1 mm.

12.20 " " 7.0 mm., " 2.8 "

12.40 " " 8.4 mm., " 3.2 " When turned toward bright light, the left pupil constricted to less than 1 mm. in diameter while the right constricted but little (8.2 mm.).

1.00 P. M. Last instillation, practically maximum dilation.

5.00 " In dim light, right and left pupils about the same.

Maximum dilation was reached after 148 minutes at the end of which time the pupil no longer responded to bright light. Greater constriction of the right eye than the left was noticed the following morning.

In normal men, the resistance is still greater than in the monkey.