alcohol which inhibited peristalsis by direct action on the muscle cell. The same results as with atropin were obtained in this cat. In the case of pilocarpin, the increased absorption is to be explained by more violent peristaltic movement of the intestinal muscles which knead the intestinal contents more vigorously and in that way promote more rapid absorption of the dissolved substances. When a large dose of pilocarpin was injected, for example, 1mgm. or more per kilo, the intestines went into a tonic spasm and this clamping down of the intestinal muscles decreased absorption to below the normal. Further studies are in progress, especially in regard to the relation of blood circulation to absorption from intestines. This communication is in the nature of a preliminary report and it is hoped that further work may be continued on the subject.

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Effects of repeated transplantation of whole suprarenals into young doves.

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In much of the literature on the suparenal glands one or another relation of these organs to sex and to reproduction is more or less clearly indicated. In a study of these relationships only slight success has been obtained from efforts to transplant suprarenal tissue. [1,2] The present study was chiefly an attempt to obtain functional grafts of whole suprarenals in young doves and pigeons; or, if persistent transplants were not obtained, to repeat the transplantations at intevals during growth so that some of this tissue would be either functioning or in course of resorption during a considerable part of the period of immaturity; and then to examine several aspects of sex and of reproduction in the treated animals.

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1 Poll H., *Arch. f. mikr. Andt.*, 1899, liv, 440.

2 Schmeiden, F., *Zeitschr, f. Chirugie*, 1903, lxx, 453.

We have failed in our attempts to obtain permanent grafts. A number of eggs were obtained from each of the transplanted doves and offspring of these birds were reared. Records were made for both the parents (transplanted) and offspring during a period of 30 months and data obtained for various reproductive capacities and characteristics (age of maturity, fertility, viability, rate of egg production, number and kind of various abnormalities). An examination of these data indicates that none of these characteristics in the offspring can be associated with the transplantations made upon their parents; and that most of these reproductive characteristics were also unaffected in the transplanted birds themselves. This considerable amount of data comprising negative results need not be further considered and is left with the above brief statement. It is thought, however, that two or three by-products of these transplantation tests are of sufficient interest to record, though the data are too meagre to warrant conclusions.

Fifteen ring doves and five common pigeon young received the first transplants at 5 to 10 days after hatching (age was therefore 19-24 days). Additional transplants were made in several cases at about 25, 50, 75 and 100 days later. Pairs of suprarenals taken from related young birds—often from brother or sister—were used in each graft. In the first and second grafts upon each bird one whole gland was placed subcutaneously in the axilla and another on the featherless area of the breast, where the very thin and quite transparent skin permitted easy and frequent observation on the condition of the graft. Birds grafted a third, fourth and fifth time received both glands at slightly separated points on the breast area. Although several of these grafts plainly obtained a blood supply, and gave the *appearance* of remaining essentially intact for periods up to 10 days, our superficial observations together with the three grafts removed at various intervals for sectioning indicates a practical failure of the grafts. A temporary or partial functioning of the grafts cannot of course be excluded; their resorption may be looked upon as in some respects equivalent to the injection of macerated suprarenal tissue.

Omitting all reference to the smaller group of common pigeon young thus transplanted we have summarized in table I certain data obtained from the ring doves. Only 11 of the 15 grafted

birds were healthy when killed for examination at 7 to 12 months old, and only healthy birds are usable in the comparisons made in this table. The tabulation indicates that the size of the suprarenals of the grafted birds (10.2 mgms. for females; 9.8 for males) was not measurably different from that of the control (10.3 for females; 10.6 for males). The body weight of the transplanted birds was somewhat smaller, for both males and females, than was that of the control. The significance of this difference is questionable; the data can be of value only in connection with further results obtained on other animals.

The data obtained for the age of maturity and for gonad size in the birds receiving the transplants are of greater interest on account of their bearing on the view of Varaldo,[1] Krabbe,[2] and others, concerning an antagonism between the suparenal cortex and the sexual glands of the female. The few data of table I indicate that the ovaries of the transplanted birds were smaller than the ovaries of the control (169 mgms. and 237 mgms.), while the testes of transplanted birds seem larger than those of the control (1070 and 706 mgms.). It must be said, however, that the variability is great, that the individual differences show no relation to the number of grafts made, and that our data standing alone are quite inadequate. In fact our complete data indicate that the transplanted males probably did not develop *functional* sperm as early as the transplanted females produced eggs—nearly all of the earliest eggs produced being infertile, though the operated males and females were kept constantly together. Even this latter observation is further complicated by the fact that this group of females showed a strong tendency to mate with *females,* and with the further fact that their eggs were produced at a very early age.

The early maturity of the transplanted females is perhaps the point of greatest interest in the data of table I. These birds produced their first eggs at an average age of less than 157 days. Less than 157 because one of four birds (Nos. 1, 3, 6 or 7) produced a single egg at an earlier age than that given in the table. The mothers of these birds produced their first eggs at an average age of 204 days; but this comparison with their daughters is not entirely fair since these mothers were not killed at early

[1] Varaldo, F. R., *Zentralb Gynakol.,* 1913, xxxvii, 1350.

[2] Krabbe, K. H., *New York Med. Jour.,* 1921, cxiv, 4.

age and the unhealthy individuals eliminated from the list as was done for the daughters. Other factors recognized by us are also involved; but we know from much other work that although there is a wide individual variation the normal age of maturity for groups of these doves lies above 160 days. It is almost certain that the transplants did not retard the period of sexual maturity in the females; and, if the extreme tameness which developed from the repeated handling of these birds could be eliminated as a factor (which we can not now do) it would be come highly probable that the repeated transplantations accelerated the attainment of sexual maturity in the females.

The data of table 2 indicate that, as administered by us, four injections of fresh suprarenal tissue of the ox into young ring doves did not give results comparable with those from the above transplantation tests. After these injections the growth curve was normal or nearly normal for both males and females. The three surviving males attained and maintained body weights of 166-192 grams (ave., 177); the four females, 151-173 grams (ave., 158). All of the four tested females matured perhaps later than is normal, the earliest at 208 days and the group at an average of 260 days.

A water soluble extract of ox cortex is reported by van Herwerden[1] to have shown favorable effects on health and growth of Daphnia, Limnea and tadpoles. Our four injections of this tissue into doves during a 10-day period would not adequately test its effect on growth; but that such administration of ox suprarenal does not produce the same results on the age or time of female sexual maturity as does transplantation of the suprarenals of closely related individuals, is indicated by the data obtained by us. Obviously there were differences in both the source and the quantity of the tissue absorbed; and an extreme difference in the rate of absorption of the injected and grafted tissues. If, however, the transplanted tissue functioned during several days it may have exercised much the greater action.

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[1] v. Herwerden, M. A., *Biol. Zentralb.*, 1922, xlii, 109.

TABLE 2.

Data from young ring doves given four subcutaneous injections (40 to 100 mgms. each) of fresh ox suprarenal tissue within a 10-day period.

Bird			
No.	Sex	Age (mo.) at first injection	Remarks
			Injections of fresh suprarenal cortex
25	♂	3.8	Killed at 12.1 mo.; tuberculous; normal growth and behavior.
26	♀	3.6	Died at fourth injection; reproductive organs unaffected.
27	♀	3.0	Killed 4 days after fourth injection; reproductive organs unaffected.
28	♀	3.0	Killed 4 days after fourth injection; reproductive organs unaffected.
29	♀	1.8	First egg laid at 244 days; mother's first egg at 212 days.
30	♀	1.7	First egg laid at 282 days; mother's first egg at 299 days.
31	♀	1.3	No egg laid at 307 days; mother's first egg at 299 days.
			Injections of fresh whole suprarenal
32	♂	3.1	Alive at 12.0 mo.; normal growth and behavior.
33	♂	1.8	Dead at 9.4 mo.; tuberculous; growth normal.
34	♀	2.7	Died of first injection.
35	♀	2.5	Killed 4 days after fourth injection; reproductive organs unaffected.
36	♀	1.2	First egg laid at 208 days; mother's first egg at 158 days.

TABLE 1.

Special data concerning young ring doves into which suprarenals from related doves were repeatedly transplanted.

Sex	No. of Bird	No of pairs suprarenals transplanted		Age (days) at beginning reproduction		Weight		
		Before maturity	After maturity	Treated bird	Mother of treated bird	Body grams	Suprarenals (mgms.)	Gonads (mgms.)
TRANSPLANTED SERIES								
Female	1	1	2	160	251	163	10.4	
Female	2	1	2	136	147	162	9.5	
Female	3	2		169	267	143	8.0	153
Female	4	4		141	204	139	10.1	95
Female	5	4		155	173	169	13.2	295
Female	6	5		183	251	124	11.2	132
Female	7	5	2	153	239	157	9.2	
Female	Average			157	204	151	10.2	169
Male	8	1	1		190	152	8.7	902
Male	9	2			239	149	7.6	1108
Male	10	3			190	154	10.2	1013
Male	11	5			173	168	12.7	1257
Male	Average				198	156	9.8	1070
CONTROL SERIES								
Female	12			213	357	162	10.7	
Female	13			180+*	380	179	13.1	
Female	14			183	153	161	9.7	
Female	15			199	181	144	6.3	
Female	16			132+*	239	132	11.0	
Female	17			159	275	156	12.5	262
Female	18			146	215	170	8.6	160
Female	19			131	235	168		
Female	20			165	173	166	10.8	290
Female	Average			168+	245	160	10.3	237
Male	21				215	149	9.7	691
Male	22				357	154	8.5	128
Male	23				156	161	12.2	886
Male	24				165	180	12.0	1117
Male	Average				223	161	10.6	706

* Killed at this age and before having produced an egg.