

20 cc. of 0.25% solution of ferric chloride produced no demonstrable Prussian blue reaction in the tubercles.

Further experiments are being conducted to substantiate these preliminary results and to determine the effect of the accumulation of iron in tuberculous areas on the course of development of the disease.

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**Complete Atrophy of Kidney in Pigeons Following Section
of the Ureter.**

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In a publication dealing with effects of extirpation of the *bursa Fabricii* in young doves Riddle and Tange¹ showed that this operation sometimes involves the section of one or both ureters. Among 31 operated animals which they reared to maturity 2 individuals were found at autopsy to have each only a single kidney. It was concluded that "the section of the right ureter probably caused the complete disappearance of the right kidney in these 2 animals." The earlier study was carried out on ring doves. More recently Riddle, Krizenecky and Polhemus (unpublished) have bursectomized and thymectomized a series of young common pigeons as part of a study of possible functions of bursa and thymus in relation to sex and reproduction. Incidental to that study 3 additional cases of absent or partially atrophied kidneys have been found. It now seems possible to demonstrate that the section of a ureter in young doves and pigeons is often followed by (a) its occlusion at the point of cutting, (b) the accumulation of pressure in this ureter and in the corresponding kidney, and (c) the partial or complete disappearance of the kidney tissue.

The principal facts are presented in Table I. Cases 1-3 were obtained in ring doves; cases 4-6 in common pigeons. Case 3 is particularly interesting since it indicates the rapidity of the changes in the kidney. Only 20 days after the right ureter was cut this duct was found to be bulbous and much distended throughout its course from the kidney to its blind end, at the point of cutting, near the cloaca; the right kidney had evidently undergone considerable atrophy and

¹ Riddle, O., and Tange, M., *Am. J. Physiol.*, 1928, lxxxvi, 266.

TABLE I.
Partial or Complete Atrophy of Kidney After Section or Tearing of Ureter.

Case	Age (days) at		Description of right or left:	
	Operation	Autopsy	Ureter	Kidneys
1	48	410	R. much distended	R. absent; L. enlarged
2	30	294	R. " "	R. " ; L. "
3	83	103	R. " "	R.=0.238g.; L.=0.618g.
4	57(86)	237	R. bulbous, distended	R.=0.347g.; L.=1.525g.
5	58(89)	369	L. " "	L.=0.032g.; R.=1.818g.
6	59	195	L. sausage-like; dist.	L. absent; R.=1.700g.)

the left kidney had evidently already increased in weight. The expected or normal size of each kidney is 400-500 mgm. in the ring doves, and 700-1000 mgm. in common pigeons.

It is notable that though all of the ureters described in the table were much swollen and distended by fluid this *fluid contained no visible insoluble urates in any instance*. It is practically certain that an earlier accumulation of uric acid had disappeared during the relatively long interval (20-362 days) between operation and autopsy. The following case provides part of the evidence: A common pigeon was bursectomized at 58 days; it died 3 days later, apparently of uremia. Examination showed that both ureters had been cut and that the cut surface had quickly healed and closed the cloacal ends of both ureters; there was no escape of fluid to the body cavity. Both ureters were here markedly distended with fluid and semifluid, plainly containing the usual insoluble excretions of the bird. Both kidneys, at this stage, were plainly enlarged and irritated.

The 3 cases (4-6) of atrophied kidney in common pigeons were obtained from 20 of these animals which were operated (bursectomized) and reared to maturity. On cases 4 and 5 a second or exploratory operation was performed when these birds were 86 or 89 days old. In neither case was any bursa tissue found or removed at the second operation, but it is possible that a ureter was cut or torn at this time, instead of at the first operation. From 51 young birds operated and reared to maturity (case 3, not mature) 5 cases of kidney atrophy were obtained. In 3 of these cases the kidney completely disappeared, leaving not even the trace of a blood vessel in the clean bony case which had been the site of the organ.

Aside from some obvious interest to the pathologist these cases have a bearing on the problem of agenesis of organs. The occasional unexpected absence of an organ, in either embryo or adult, usually raises the question as to whether it is a case of non-formation (agenesis)—a truly developmental or genetic matter—or of disappearance after formation. In the case of the kidney the absence of one of the

normal pair has been repeatedly observed in man and in various animals. We have observed 3 such cases in unoperated pigeons—2 from the genus *Turtur*, and one from *Streptopelia*. In view of the results described in this paper it is certainly possible that some or many of the cases of absent kidneys observed in various animal species are not true cases of agenesis, but of atrophy following the malformation, occlusion, or malfunction of the ureter attached to the missing organ. It seems, in view of observations to be mentioned immediately, that precisely such glandular structures as the kidney would undergo such atrophy more frequently than would other organs. The same series of operations which resulted in the cutting of a few ureters (in surviving birds), resulted also in the section and occlusion of twice as many sperm ducts in the 20 males used; *but in no single instance was there a resulting atrophy of the testis*. In most cases the epididymis was enlarged, it was cystic in 3 cases, but the testes showed no tendency to decrease in size. In the females some oviducts were cut, and though this prevented successful egg-laying, their ovaries were nearly or quite normal. We have earlier reported² 16 cases of birds with complete absence of gonads, and the cause (or history) of these absent organs is of theoretical importance. The present results show that one means of effecting kidney atrophy in these animals is wholly without such action on the gonads.

Summary. Atrophy, partial and complete, of the kidney of dove or pigeon can be obtained by section of one ureter. Pressure develops in the occluded duct and kidney, and insoluble urates later disappear from the contents of the duct. The uninjured kidney readily undergoes functional hypertrophy.

These observations have a bearing on the problem of the agenesis of organs. They indicate that in some cases the absence of a glandular organ which, like the kidney, is functional in the embryo may have been formed (not agenesis) and—through malformation or malfunction of its duct—later undergone complete atrophy. In contrast, section of the genital ducts of these birds was not followed by atrophy of testis or ovary; this evidence therefore indicates that the absence of gonads in birds has a different origin and significance.

² Riddle, O., *Brit. J. Exp. Biol.*, 1925, ii, 211.