TWINS AND LATE EMBRYONIC MONSTROSITIES IN PIGEONS

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Plates 6 and 7

THE material here reported on was obtained, with one exception, during the summer of 1938 at the Palmetto Pigeon Plant, of Sumter, South Carolina. The exception was a set of double-yolk egg twins found the previous year.

It was desired to ascertain the positions within the egg of twins arriving at the hatching stage. Such eggs were therefore partially opened and then immersed in ten per cent formalin. After about two days the embryos were sufficiently hardened to be removed for examination. For photographing, the twins were separated slightly, but their original relations were maintained. Embryos not too far decomposed were later sexed at the University of Wisconsin, with the assistance of Mr. Ray D. Owen. The entire collection is at present housed at the Palmetto Pigeon Plant.

DOUBLE-YOLK EGG TWINS

Approximately three dozen double-yolk eggs were examined during the summer; probably others escaped attention. All such eggs were very large; generally a normal-sized egg accompanied each in the clutch, though occasionally both eggs of the clutch possessed two yolks. A few were infertile, but the majority showed two fairly normal separate embryos. Death occurred usually during the first week of incubation. In one case an embryo died at the end of the first week, but the other survived to term (17 days) and was decidedly over-sized.

Five large eggs developed both twins to hatching stage. Several broke the shell, but none actually emerged. All were dead when placed in formalin. It was found that each embryo had its own yolk-sac, and was in no way attached to its twin.

Case A (Plate 6, 1. A).—Lower member curled normally (head to right, beak under right wing); had broken the shell. Upper twin in reverse position, beak between legs. Both male.

Case B (Plate 6, 1. B).—Upper twin curled normally, had not broken shell. Lower twin in reverse position, head between legs. Upper, female; lower decomposed somewhat, probably also female.

Case C (Plate 6, 1. C).—Both twins curled normally, had pipped the shell on the same side near the ends. Upper female, lower male.

Case D (Plate 6, 1. D).—Both twins curled normally, but lying side by side. Both had pipped the shell at opposite sides near the middle. Both female.

Case E (Plate 6, 1. E).—Lower member curled normally, had pipped the shell near the end. Upper twin with head between the legs. Upper male, lower female.

An interesting fact about these twins is that no two sets show the same relative positions. Apparently position is largely determined by chance. Since three of the ten embryos were unable to bring the beak in contact with the shell, crowding is probably a factor of considerable importance in preventing normal hatching.

The sex distribution in the four sets whose sex is certainly known is in perfect agreement with the theoretical expectation on the basis of chance, namely, one set of males, one set of females, and two mixed sets.

SINGLE-YOLK EGG TWINS

In two eggs of normal size, twins were found attached to the same yolk-sac. The first case (Plate 6, fig. 2) was too far decomposed to determine position or sex.

The second case (Plate 6, fig. 3) is of great significance. The embryos are well preserved, and their pedigree is known. They lie side by side, head to tail; the yolk-sac extends directly from one navel to the other. The twins are both female. It was at first supposed that they might be 'identical,' but it will be observed that they differ markedly in the length of the down filaments.

As great care was taken to preserve these twins in perfect condition, the difference in down length cannot be laid to extrinsic factors. Furthermore, the twins are of the same size and well past the age at which the down becomes fully developed, so that differential age at death is not responsible. The most probable explanation is a genetic one: the twins, being female, received sex-linked factors only from the father; the father was heterozygous for the sex-linked 'dilution' factor, which is responsible for shortness of down (Cole and Kelley, 1919). On this basis, the twins are the product of not one but two spermatozoa, and presumably also two blastodiscs.

It may be possible that a single blastoderm gave rise to these twins, as Riddle (1918, 1921) contended for several sets of twins attached to single yolk-sacs which he examined. However, the genetic basis for the difference in down length would be extremely difficult to

harmonize with such an origin. More probably we are dealing with the type I twins of Newman (1923)—a single yolk bearing two blastoderms. The use of the term 'identical' in referring to twins attached to the same yolk-sac seems inadvisable unless more evidence is available.

MONSTROSITIES

The following embryos were not fixed until after removal from the shell, so that their positions are not necessarily quite natural.

Only one example of true partial anterior duplication was discovered (Plate 7, fig. 1). This embryo, a female, died several days before hatching age. The eyes on each side of the head are normal; a double eye occupies the forehead region. There are two beaks, both nearly normal. The brain is dorsally exposed.

Exposed brain also characterizes two other embryos with head deformities. One of these, a female (Plate 7, fig. 2), has a stunted upper beak. The other (Plate 7, fig. 3), a male, is cyclopic, the single eye being located just above a trough-like lower beak,—no upper beak exists; however, just above the right ear another lower beak with a stunted upper beak arises. If the ears are considered suitable points of reference, this second beak is decidedly out of position. There is no evidence that this specimen is a case of partial anterior duplication.

Extremely short neck is the only definite abnormality in another case (Plate 7, fig. 4). The sex and the anatomical basis of the embryo's peculiarity were not ascertained.

The female specimen figured in Plate 7, fig. 5, shows only rudiments of tongue and lower beak, though the upper beak is quite normal.

The sixth case of embryonic abnormality is shown in Plate 7, fig. 6. No sternum was developed, and the heart, liver, and digestive tract were largely exposed. In addition there is apparently a deficiency of ribs on the left side, as the body is sharply bent in this region.

ACKNOWLEDGMENT

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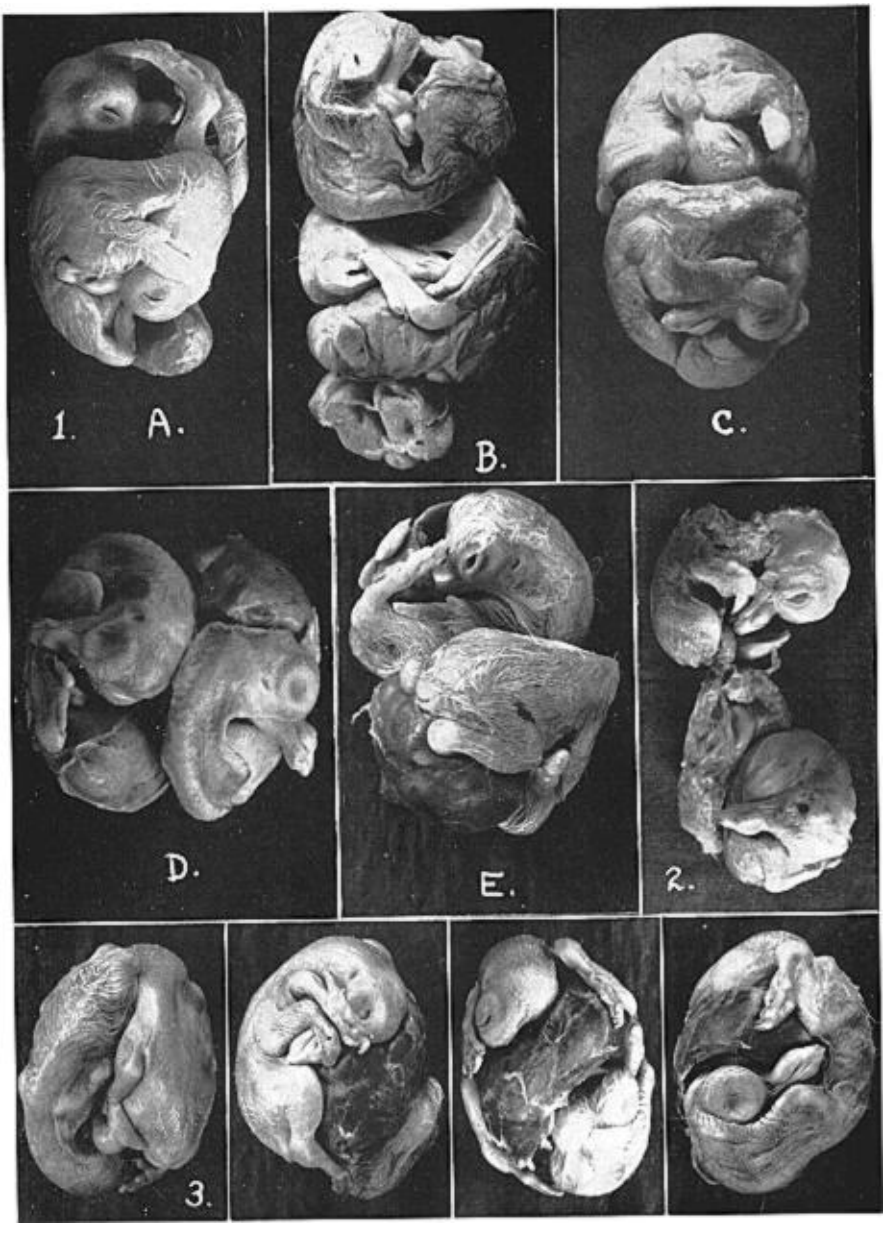
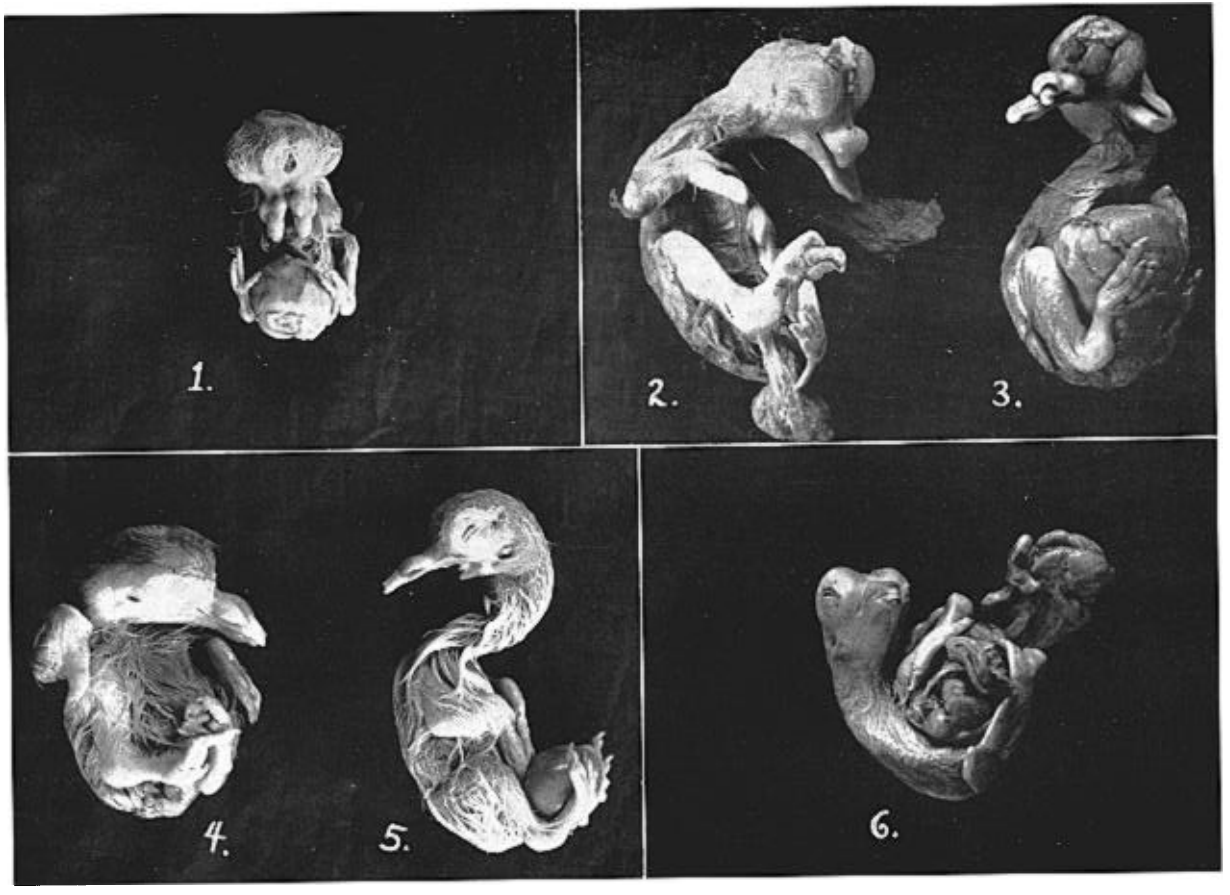
SUMMARY

Descriptions and sexes are presented for five sets of separate twins reaching the age of hatching. No two sets show the same relative positions. In three sets, one twin was unable to break the shell because of abnormal position. It is inferred that crowding is a major



TWIN EMBRYOS OF PIGEONS



ABNORMAL PIGEON EMBRYOS

factor in preventing hatching. Sex distribution agrees closely with expectations on the basis of chance.

Two sets of twins from eggs of normal size and attached to single yolk-sacs are described. For one of these the pedigree was known, and the twins were both females. Genetic evidence based on marked difference in length of down indicates that the twins did not arise from a single blastoderm.

Six abnormal embryos are described which lived to about the age of hatching. Four show abnormal head features, one very short neck, and one lack of sternum.

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EXPLANATION OF PLATES

PLATE 6

Fig. 1.—A, B, C, D, E: five sets of separate twins from large eggs.
Fig. 2.—First set of twins attached to one yolk-sac, in egg of normal size.
Fig. 3.—Second set of twins attached to one yolk-sac, in egg of normal size; four views. Note difference in length of down filaments.

PLATE 7

Fig. 1.—Embryo with partial anterior duplication.
Fig. 2.—Embryo with exposed brain and short upper beak.
Fig. 3.—Embryo with exposed brain, cyclopia, and extra beak.
Fig. 4.—Embryo with very short neck.
Fig. 5.—Embryo with rudimentary lower jaw and tongue.
Fig. 6.—Embryo lacking sternum.

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