Accordingly, during the summer of 1881, I endeavoured to procure L. truncatulus in order to put my strong suspicion to the test of experiment. But I was unfortunately unable to find any, even in the localities where I had found it during the previous year. In my search I had on many occasions the skilled assistance of my friend and colleague Mr. W. Hatchett Jackson, but we never found any other trace of this species than the empty shells. The localities for the snail mentioned by Whiteave in his paper on the mollusca inhabiting the neighbourhood of Oxford were searched, but without success. My friends at a distance were appealed to, but were unable to assist me. There can be little doubt but that the freedom of sheep near Oxford from the liver-rot during last winter was directly connected with the real scarcity of this snail. This year, however, there were floods on the Isis in July, and L. truncatulus was brought down by the water in vast quantities, probably from marshy ground far up the river. So numerous were they that I repeatedly obtained as many as 500 specimens at a single sweep of a small hand-net. The low-lying meadows near the river were covered with the flood waters, and when these subsided the snails were left scattered broadcast over the fields. The snail is almost the smallest species of Limnæus; the variety which I found so abundantly was only a a quarter of an inch long when fully grown. Although it is a water-snail, it lives much out of water. My observations have convinced me that the individuals left by floods on the fields continue to live out of water so long as the ground is moist. Their numbers are recruited by others, which crawl out of neighbouring ditches or streams. If a drought occurs they become dormant; but, unless too long continued, they revive with the first shower of rain.

On discovering these snails I immediately started infection experiments with them, and was at once successful. The adult fluke in the liver of the sheep or other mammalian host produces vast quantities of eggs. So prolific is it that I have estimated the number produced by each fluke to be at least several hundred thousand. The eggs pass with the bile into the intestines, and are distributed over the fields with the manure. If the eggs fall on too wet ground, or are washed into a ditch, development continues, and after a time, the length of which depends upon the temperature, embryos are hatched out of the eggs. For the purpose of my infection experiment, I obtained eggs from the livers of affected sheep, and kept them in water until the embryos were hatched, and then transferred them to vessels containing the snails to be experimented upon.

The embryo of the liver-fluke has the shape of an elongated cone with rounded apex; its average length is .125 mm., or about 2-200 of an inch; its breadth at the anterior end about one-fifth of this. The broader end or base of the cone is always directed forwards, and in the centre of this is a short retractile head papilla. The whole of the surface, with the exception of the head papilla, is covered with very long cilia, by means of which it swims, with head papilla drawn in, swiftly and restlessly through the water. It is exceedingly active; sometimes it goes rapidly forwards, and then rotates on its longitudinal axis, just turning a little from side to side as if searching for something. At other times, by curving its body, it sweeps round in circles, or, curving itself still more strongly, spins round and round without moving from the spot.

When the embryo, in moving through the water, comes in contact with any object, it pauses for a moment, and feels about, as if trying to discover its nature, and if not satisfied, darts off hastily again. But if the object be a Limnæus truncatulus it at once begins to bore. Under ordinary conditions, the head papilla of the embryo is short and blunt, but as soon as the animal begins to bore it becomes longer, conical and pointed. The embryo spins round on its axis, the cilia working vigorously, and pressing the embryo against the surface of the snail. This pressure is increased by the body of the embryo being alternately drawn up and then suddenly extented. As the papilla sinks further into the tissues of the snail it becomes longer and longer, and it reaches five times its original length, and the tissues of the snail are forced apart, as if by a wedge, leaving a gap through which the embryo squeezes its way into the snail.

The embryo will not bore into all snails alike; the only other species which I have found it bore into from without is Limnæus pereger, and even here the specimens have always been such as were still very small. I have found embryos enter certain other snails, such as Planoribus, but only from eggs which had been swallowed by the snail, and had been hatched in the digestive tract. This difference seems to be due to an instinctive choice on the part of the embryo, rather than to a greater softness of the tissues in Limnæus truncatulus. The tissus of Physa fontinalis, for instance, appear to be equally soft, but I have found that if these two species are placed in a small bulk of water with a very large number of embryos, the Limnæi will be found, on dissection, to contain fifty or more embryos, whilst the Physæ will be found entirely free from them.

But although the instinct of the embryo seemingly prompts it to enter the right snail, it does not teach it to discriminate between the different parts of the snail's body, for I have found as many as a dozen embryos within the substance of the foot of a single Limnæus truncatulus. Such a position, of course, is not favourable to further development of the embryos, which, thus gone astray, soon perish.

The natural place for the further development of the embryo appears to be the pulmonary chamber, but they may also be found in the body cavity. Once safely lodged in the suitable locality, the embryo undergoes a metamorphosis. It loses the external layer of ciliated cells, and changes from the conical to an elliptical shape. The eye-spots usually become detached, but they, as well as the head-papilla, persist, showing the identity of the young sporocyst—for so it must now be called—with the embryo of the liver fluke. The active embryo has degenerated into a mere brood sac, in which the next generation is produced. The sporocyst increases rapidly in size, the round, clear cells contained within it increase in number, partly perhaps owing to the division of the germinal cells of the embryo, but also owing to a multiplication and subsequent detachment of the cells lining the inside of the body-wall. As growth proceeds the contents of the sporocyst arrange themselves into round balls of cells, the germs of the second generation. These germs increase in size and assume first an oval and then an oblong shape, whilst a delicate cuticle is formed upon the surface. At one end a number of cells are arranged to form a spherical pharynx, which leads into a blind digestive sac. A little behind the pharynx the surface of the body is raised into a ridge, forming a ring surrounding the anterior end, whilst near the opposite end two short processes grow out. The germ has now become a redia, as the brood sac or nurse form provided with pharynx and intestine is called. The adult sporocyst is sac-shaped, and reaches the length of 0.6 mm.; it usually contains one or two rediæ nearly ready to leave, together with two or three larger and several smaller germs. There is another method of increase during the sporocyst stage, namely, by the division of a sporocyst into two others by a constriction separating the original one into two smaller ones. This method of multiplication, however, does not appear to be frequent in this species.

When the rediae is ready to come forth, it breaks through the wall of the sporocyst, and the wound caused by its forcible exit immediately closes up, and the remaining