single ambulacrum of an animal like *Helicoplacus*. However, Hyman's summary[4] of sipunculoids as having "less than 10 to numerous" tentacles suggests that it might fit Nichols' theory better to postulate a reduction of rays to the acceptable minimum of five so that the animal expends the minimum of metabolic energy in calcifying them. This reduction would mean further loss of food-gathering power to a lophophore already restricted in flexibility by calcification, which could be overcome by the provision of lateral branches to the rays as outgrowths of the coelomic canal. Nichols deduced such branches, but from analogies with recent crinoids, he considered the branches would be respiratory. Selection might have favoured their development to meet the needs of both feeding and respiration. Whatever the exact details, the hypothetical ancestral echinoderm has now been equipped with pentameral symmetry and can give rise to a variety of primitive echinoderms.

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Fertilisation of sheep ova following their transfer to goats

An interesting feature which has emerged from attempts to hybridise domestic sheep (*Ovis aries*) and goats (*Capra hircus*) is the marked difference in conception rate according to the direction in which the cross is made. In goats inseminated with sheep semen the conception rate is similar to that in goats mated naturally with male goats; whereas in sheep inseminated with goat semen fertilisation is an infrequent occurrence[1–3]. The low fertilisation rate in sheep inseminated with goat semen has been confirmed by Hancock[4] who found that only 5 of 93 (5.4%) sheep eggs were fertilised by goat spermatozoa.

Here I report an experiment undertaken with a view to isolating the factors which may be involved in the infertility of the sheep and goat cross, the approach being to circumvent any incompatibility between spermatozoa and environment by transferring sheep oocytes to the Fallopian tubes of goats which had been mated with fertile male goats. Results showed that most of the sheep eggs subsequently recovered had been fertilised and were undergoing cleavage, indicating that the sheep ovum presents no intrinsic barrier to the entry of the goat spermatozoon.

Eleven Border Leicester × Welsh Mountain ewes were treated with progestagen-impregnated intravaginal sponges (Veramix Plus; Upjohn Ltd) for 13 d, and were each given 1,500 i.u. pregnant mares' serum gonadotrophin (Folligon; Intervet Laboratories Ltd) by subcutaneous injection at the time of sponge removal. The ewes were then tested with a vasectomised ram twice daily for signs of oestrous activity, and were given either 6,000 μg luteinising hormone releasing factor (Roche Products Ltd) or 500 i.u. human chorionic gonadotrophin (Chorulon; Intervet Laboratories Ltd) by intramuscular injection, 18 h after the onset of oestrus. The animals were subjected to laparotomy approximately 24 h later. Six of the ewes were used as egg donors, the technique for recovery of eggs being that described by Hancock and Hovell[5]. The oocytes were transferred in a small volume of Hank's fluid into the ovarian end of the Fallopian tubes of four crossbred goats (G1, G2, G3 and G4) which had been mated with fertile male goats 30–60 min earlier. The remaining five ewes were inseminated with goat semen; the semen was collected with the use of an artificial vagina, and an equivalent of 2.15×10^9 (range 0.9–4.96) spermatozoa was deposited directly into each uterine horn. Goats G1, G3 and G4 and the inseminated sheep were subjected to laparotomy for egg recovery 3 d after the first operation; goat G2 was subjected to laparotomy 2 d after the first operation. A record was made of the number of corpora lutea in the ovaries of the goats at the time of the second operation.

Table 1 The numbers of sheep oocytes transferred to the left (L) and right (R) Fallopian tubes of mated goats, and the numbers of fertilised and unfertilised ova recovered

Goat	Sheep oocytes transferred		Corpora lutea		Ova recovered	
	L	R	L	R	L	R
G1	3	4	1	0	2 (6–8 cell) 1 (1 cell)	1 (5 cell)
G2	0	1	1	0	—	1 (2 cell)
G3	0	4	0	0	—	zona pellucida with spermatozoa
G4	3	2	0	1	2 (6–8 cell) 1 (1 cell)	1 (1 cell)

A total of six cleaved and three uncleaved ova were recovered from three of the goats (G1, G2 and G4). Assuming that, from the number of corpora lutea, one of the cleaved ova from goat G1 and one of the uncleaved ova from goat G4 were 'native' ova (see Table 1), the results indicate that seven of the transferred ova were recovered at the second operation. Five of the seven ova (71.4%) were cleaved. No ova were recovered from goat G4, but an empty zona pellucida showing the presence of embedded spermatozoa was found.

A total of ten ova were recovered from the five sheep in which goat semen had been placed directly into the uterine horns. None of the ova were fertilised, and there were no spermatozoa attached to, or embedded within, the zonae pellucidae.

Although the number of animals used in the experiment was very small, the fertilisation of transferred sheep oocytes in three goats and the presence of spermatozoa in the zona pellucida recovered from the fourth goat, indicate that there is no innate incompatibility between sheep ova and goat spermatozoa. These findings would seem to suggest that the low fertilisation rate in sheep inseminated with goat semen is due to factors affecting the survival, transport or capacitation of the goat spermatozoa in the ewe.

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