"Experimental Chimeras' Removal of Reproductive Barrier Between Sheep and Goat" (1984), by Sabine Meinecke-Tillmann and Burkhard Meinecke [1]

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In 1984 Sabine Meinecke-Tillmann [5] and Burkhard Meinecke [6] published their article “Experimental Chimeras — Removal of Reproductive Barrier Between Sheep and Goat” in *Nature*. Their study conquered the reproductive barrier between sheep [7] and goats through embryo manipulation. Their article appeared in *Nature* on the same day that a similar experiment, conducted by Carole Fehilly [8], Steen Willadsen [9], and Elizabeth Tucker [10] was published regarding reproductive barriers between sheep [7] and goats. In previous experiments involving the transplantation of sheep [7] embryos into recipient goats or vice versa, the embryos did not survive past the initial weeks of pregnancy [11]. Hybridization experiments had also failed between the species. Although scientists were unsure of the reasons that hybrid eggs from donor sheep [7] did not survive, they attributed the death of the hybrid eggs from donor goats to immunological responses. Meinecke-Tillmann and Meinecke created interspecific chimeric embryos in order to address the reproductive obstacles between the species. These embryos were transferred to sheep [7], and a sheep [7] successfully brought a goat [12] kid to term.

In their study Meinecke-Tillmann and Meinecke worked with sheep [7] and goat [12] embryos to create interspecific chimeric embryos. After the estrus cycles of both species were coordinated and breeding occurred, they collected embryos. Goat embryos and sheep [7] embryos differed in age by twenty-four hours. Meinecke-Tillmann and Meinecke created interspecific chimeric embryos two different ways: by joining single blastomeres from 4-cell sheep [7] embryos with two blastomeres from 8-cell goat [12] embryos or by joining two blastomeres from early 8-cell sheep [7] embryos with two blastomeres of late 8-cell goat [12] embryos in a pig [13] *zona pellucida* [14]. In order to protect the cells, the slit in the *zona pellucida* [14], or outer membrane, was covered by another *zona pellucida* [14] that surrounded the entire aggregated embryo. They retrieved the embryos after blastulation was thought to occur and then transplanted the embryos that entered into the blastocyst [15] stage into recipient sheep [7].

During the experiment Meinecke-Tillman and Meinecke obtained fifteen interspecific chimeric embryos of which nine formed common blastocysts. Four embryos reached the blastocyst [15] stage, one of them failing to fully cleave, and a couple developed into a combination of two small blastocysts in a common *zona pellucida* [14]. There were fifteen sheep [7] recipients, eight of which became pregnant. Three surrogate [16] mothers gave birth to two sheep [7] lambs—one live and one stillborn—and one goat [12] lamb. One sheep [7] lamb was stillborn as a result of postponed birth. It was created from two sheep [7] and two goat [12] blastomeres, but one goat [12] blastomere [17] was not incorporated in the commonblastocyst [15]. The other sheep [7] lamb was created from two blastocysts in a *zona pellucida* [14]. The goat [12] lamb developed from the combination of oneblastomere [17] from a 4-cell sheep [7] embryo and two blastomeres from an 8-cell goat [12] embryo. Meinecke-Tillmann and Meinecke performed several tests including blood tests, cytogenetic analysis [18], and breeding experiments and concluded that the animals created did not provide any signs suggesting that they were interspecific chimeras [19].

Meinecke-Tillmann and Meinecke developed a method to overcome reproductive barriers between sheep [7] and goats. This was accomplished by surrounding the foreign embryo by a protective barrier containing only cells from the same species as the recipient. In their paper they emphasized the significance of creating the embryos with such a barrier in order to protect the foreign embryo from the surrogate [16] mother’s immunological response systems. They stated that the sheep [7] elements, which were at an earlier stage, helped protect the goat [12] elements of the embryo. Meinecke-Tillmann and Meinecke suggested that their method could be valuable for saving endangered species.