MHC social signaling affects reproductive strategies of stallions and mares

D. Burger*[a], E. Marti [b], E. Jeannerat [a], R. Kaeser [a], H. Sieme [c], C. Wedekind [d]

[a] Swiss Institute of Equine Medicine ISME, University of Berne and Agroscope, Avenches, Switzerland
[b] Department of Clinical Research, Vetsuisse Faculty, University of Berne, Switzerland
[c] Unit for Reproductive Medicine – Clinic for Horses, University of Veterinary Medicine Hannover, Germany
[d] Department of Ecology and Evolution, Biophore, University of Lausanne, Lausanne, Switzerland

The major histocompatibility complex (MHC) plays an important role in the immune system of vertebrates and has repeatedly been found to influence social signaling in the context of mate preferences, cryptic female choice, and kin recognition. Evidence for MHC social signaling has been reported in more than 20 vertebrate species so far, including humans. In the context of mate preferences, MHC-dissimilar mating partners tend to be preferred over MHC-similar ones, either to avoid inbreeding or to increase heterozygosity among the offspring. We recently demonstrated in domesticated horses that mares prefer contact with MHC-dissimilar stallions over contact with MHC-similar ones. In addition, we found that stallions exhibit higher mean testosterone levels and higher sperm numbers per ejaculate after short or long exposure to MHC-dissimilar mares than when exposed to MHC-similar mares. Horses have a long gestation and invest much into individual offspring. We therefore also expected maternal differential investment to be important, and we examined whether MHC matching between stallions and mares affects fertility of the mares. We investigated the potential influence of the presence of a stallion on the fertility of mares around the time of insemination. In total 191 females were hCG treated to induce ovulation. They were inseminated 24 and 40 hours later with semen from one of 106 donor breeding stallions. For a period of 62 hours, starting from induction of ovulation, each mare was individually stabled and in contact with one of ten other “stimulus” stallions that was either MHC-similar or -dissimilar, respectively. Pregnancy was ultra-sonographically diagnosed 14 to 17 days after ovulation and was not affected by semen type used (fresh or frozen; $p = 0.26$), nor by mare age ($p = 0.35$). We found a pregnancy rate per cycle of 55.5% when mares had been in contact with a MHC-dissimilar stimulus stallion vs. 35.8% when they had been exposed to a MHC-similar stimulus stallion (effect of MHC sharing to stimulus: $p = 0.019$). The overall genetic distance between mares and stimulus stallions, as determined from microsatellite markers on 20 chromosomes, played no significant role here. We conclude that MHC linked social signaling affects maternal decisions about the maintenance of a pregnancy. The differential investment that we discovered in both stallions and mares, may also be relevant to the equine industry. On the one hand, introducing social signaling around the time of semen collection can increase mean ejaculate quality. On the other hand, introducing social signaling around the time of insemination can influence cryptic female choice and therefore be used to increase success rates and hence the efficiency of breeding programs.