CHAPTER VII
FUTURE RESEARCH DIRECTIONS

Several previous studies provided convincing evidence that eNOS/NO is involved in all the ovarian functions and plays a crucial role in reproductive processes, even though most studies have been carried out on rats and humans and very little is known about livestock. Future studies should also be aimed at verifying whether ovarian dysfunctions are associated with an altered NO production in order to clarify whether these defects can be corrected by NO. Further research measuring the effects of toxicant exposure on reactive oxygen species (ROS) generation and the modulation of toxicant effects by antioxidant supplementation or depletion in isolated cultured follicles and ovaries would also help in characterizing antral follicle and oocyte sensitivity. In-vivo and in-vitro studies support the view that bovine oocytes are susceptible to thermal stress at various stages of follicular development. Perturbation in the physiology of the follicle-enclosed oocyte during the lengthy period of follicular development could potentially lead to an oocyte with reduced competence for fertilization and subsequent development. Thus, protection of the ovarian oocyte pool from thermal stress through nutritional manipulations, administration of ROS and⁄or other survival factors warrant further investigation. Additionally, most studies have focused on better embryo quality and high IVP success without determining quality of oocytes. However, to the best of our knowledge, there is no study focusing on oocyte quality and IVP with respect to follicular vasculature in ruminants. Therefore, future research should be investigated the expression of eNOS, concentrations of NO, and oocyte quality and success of IVP, with respect to follicular vasculature in ruminants.

Over the past several decades, several therapies have been proposed for manipulating ovarian follicle growth in ruminants. These hormonal manipulations have been successfully used to optimize the reproductive outcomes following the application of various biotechnologies. Various strategies have been proposed to improve the responses to reproductive biotechnologies following TAI (e.g., Ovsynch protocols) and superovulation programmes. Moreover, further research is needed to fully understand the mechanisms by which TAI using Ovsynch, modified Ovsynch, Ovsynch+hCG, and Ovsynch+GnRH increases ovulation and conception rates in lactating dairy cows. Future research challenges to improve reproductive management of lactating dairy cows are to improve embryo survival (e.g., induction of accessory CL, etc.), promptly identify pregnant and non-pregnant animals, and target the non-pregnant cow for a programmed re-synchronization of ovulation for re-insemination.

During TAI protocols, final follicular growth and size of the ovulatory follicle are key factors that may significantly influence oocyte quality, ovulation, and consequently pregnancy outcomes. P4 concentrations during superovulation protocols influence follicular growth, oocyte quality and embryo quality; therefore, several adjustments to superovulation protocols have been proposed depending on the animal category and breed. In addition, control of follicle development has a significant impact on the oocyte quality and IVP outcome. Further research is necessary to the manipulation of ovarian follicular growth and CL function to maximize oocyte quality and improve conception rates following TAI and embryo transfer of in vivo- and in vitro-derived embryos in ruminants.