

## Public Abstract

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Graduation Term: Winter

Graduation Year: 2006

Title: The effects of elevated temperature on preimplantation-stage porcine embryos

It has been estimated that the United States animal agriculture industries incur annual economic losses of approximately \$2 billion due to the effects of heat stress. A substantial proportion of those losses can be attributed to heat stress-induced reproductive inefficiency. Historically, the bulk of the research being done to investigate this phenomenon has focused on the effects of elevated temperatures on various reproductive parameters in the mother. Only recently has there been a concerted effort to determine whether gametes (sperm and egg) and/or early embryos are directly impacted by exposure to elevated temperature. These experiments were designed to assess the effects of elevated temperature on in vitro-produced pig embryo development. Specifically, the response of embryos to heat stress during the first week of development was evaluated. In vitro fertilized (IVF) embryos were produced by coincubating sperm and eggs in vitro. Parthenogenetic (PA) embryos were generated by artificially "activating" eggs to elicit embryo development without fertilization by spermatozoa. The IVF embryos were shown to be highly susceptible to elevated temperatures applied during the late one-cell stage of development. Interestingly, PA embryos were seemingly unaffected by a similarly-applied heat stress. Very surprisingly, it was shown that both IVF and PA embryos that were exposed to heat stress conditions immediately after fertilization or egg activation progressed through the initial stages of embryo development much more quickly than did their non heat-stressed counterparts, and were, one week later, either moderately more successful (IVF) or much more successful (PA) in developing to the blastocyst stage – the benchmark of success for in vitro embryo development. This enhancement of developmental potential was shown to be correlated with altered dynamics of the mitogen-activated protein kinase signaling cascade, which is a biochemical pathway that is intimately involved in the maturation of mammalian eggs and in the initiation of embryo development. These experiments provide insight into the basic biochemistry and physiology of early embryo development, and valuable information as to the nature of the interactions of early cleavage-stage embryos with the environment. This information may ultimately lead to more efficient in vitro embryo production techniques, and might eventually result in genetic, pharmacologic, or other manipulations that might render gametes and early embryos less susceptible to the effects of elevated temperatures.