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Studies of Human Placenta: Use of ^{31}P Nuclear Magnetic Resonance Spectroscopy

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STUDIES OF HUMAN PLACENTA: USE OF ^{31}P NUCLEAR MAGNETIC REASONANCE SPECTROSCOPY

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Research completed at the University of Illinois at Urbana-Champaign,
with M. Joan Dawson* and Jyothi Raman*, Dept. of Physiology and
Biophysics.

Nuclear magnetic resonance spectroscopy (NMRS) is a powerful tool for the study of the levels of metabolites in tissues. Phosphorus 31 (^{31}P) is especially suitable for NMRS studies of living systems. Phosphorus compounds present in living systems at sufficient concentrations to be detected by ^{31}P NMRS include ATP, inorganic phosphate, and membrane precursors and degradation products. Therefore, ^{31}P NMRS can be a valuable tool for assessing the energy state and levels of phosphorus metabolites in living tissues.

This project involved an examination of the effectiveness of different buffers in maintaining placental viability throughout superfusion and NMRS study. A comparison was made of the effectiveness of physiological salt solutions to that of enriched cell culture preparations. In the first part of this study, the ability of buffers to prevent sample acidosis was examined. It was concluded that each of the buffers studied is effective in preventing extensive tissue acidosis during NMRS examination. Currently, the buffers are being assessed according to sample ATP stability over time and glucose uptake over time.

Previous studies in our laboratory have indicated that specific changes in ^{31}P NMRS spectra of female reproductive tissues are observed in connection with the normal progression of pregnancy, with disorders of pregnancy, and with gynecologic diseases. This study has shown that physiological salt solutions are as effective as cell culture preparations in minimizing tissue acidosis. Physiological salt solutions have the advantage of being more economical than cell culture preparations. It is hoped that in the future, tissue studies using NMRS could become a cost-effective method of obtaining previously unavailable useful information which would aid the clinician.