10. Summary and Conclusions

Radionuclides may enter a woman under various circumstances including occupational exposures, medically related administrations, or intake from the general environment. This Report addresses the determination of radiation dose to the embryo/fetus from radionuclides that are present in a woman before her pregnancy or that enter during pregnancy. These doses may be the sum of those attributable to the radionuclides in the maternal system plus those that are transferred into the placenta or other membranes, the embryo/fetus, and the fetoplacental fluids.

The transfer of radioactivity from the pregnant woman to the fetoplacental system, the distribution of the activity, and the developmental effects of the resulting radiation absorbed doses are all affected by gestational stage. For these reasons, the anatomical and physiological development of the embryo/fetus are reviewed and a synopsis of radiation effects is presented for representative periods of prenatal development with emphasis on those effects resulting from internally deposited radionuclides. Because much of the knowledge regarding placental transfer and radiation effects on the human embryo/fetus is based on extrapolation of data from animals, information is provided on the comparative development of species that most commonly have been used in experimental studies.

Calculation of radiation absorbed doses to the embryo/fetus and its individual tissues or organs is complicated by the continuously changing anatomical and physiological characteristics during intrauterine development. These complications also affect the models and calculations of the kinetics of transfer of radioactivity between the maternal and fetoplacental systems. Absorbed doses from alpha and beta particles as well as secondary electrons with photon radiation are affected by the small sizes of structures, organs or tissues of the embryo/fetus, which often have dimensions less than the path length of the particles.

Little or no information is available concerning transfer to the placenta or embryo/fetus for many radioactive compounds that

may enter the maternal system. Much has been learned from experimental studies with animals, but this database also is incomplete and interspecies differences make the validity of extrapolations uncertain. Direct human studies, including evaluation of accidental exposures, should be considered to the extent permitted by legal and ethical considerations.