244 Developmental Uptake of Radiolabeled 3,3’,4,4’-Tetrachlorobiphenyl (PCB 77) into Japanese Quail Egg Compartments and Embryos

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The avian embryo provides an excellent bioassay for determining early developmental effects of environmental chemicals, particularly for compounds to which embryos are exposed via maternal deposition. To facilitate testing, eggs are usually injected with small volumes of the toxicants early in development. Lethality is generally attributed to the concentrations injected. Treatments are often administered by injection onto the air cell membrane or into the egg contents. However, few experiments are actually able to capture embryo exposure and little is known about the uptake and movement of a toxicant within the egg components or into the embryo subsequent to injection. Fertilized Japanese quail eggs (Coturnix japonica) were injected with 1-5μl volumes of 14C 3,3’,4,4’-tetrachlorobiphenyl (PCB 77) either into the air cell or albumen on embryonic day 0 (ED0), prior to development. Levels of radiolabel were measured on ED 1, 5 and 10 in shell (including membranes), albumen, yolk and embryo. All egg components contained measurable levels of 14C PCB 77, and concentrations changed in each over the course of development. Specifically, concentrations in the shell content decreased; albumen concentrations increased from ED1 to ED 5, then decreased. Concentrations of 14C PCB 77 in both yolk and embryo increased from ED1 to ED10. By ED5 the embryo contained of 1-2% of the injected 14C PCB 77, increasing to 7-10% by ED 10. To put this into perspective, when 3,3’,4,4’,5-pentachlorobiphenyl (PCB126) was injected into Japanese quail eggs on ED0 using the same techniques, mortality of eggs injected with as 0.16μg/g egg show as much as 46% embryo mortality by ED4-7. If we apply uptake rates equivalent to 14C PCB 77 it suggests that as little of 1-5% (16-80ng) of the injected dose may be responsible for mortality in the quail egg. As such, total egg toxicant concentrations measured in environmentally exposed eggs may not be providing a clear story of toxicity as uptake by the embryo or diffusion of toxicants across membranes will vary according to a number of factors. Further, the embryo had relatively low levels of 14C PCB 77 compared to yolk, albumen and shell, suggesting that uptake mirrors embryonic utilization of egg components for nutrition and growth.