

The Virtual Embryo Project (v-Embryo™)

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The v-Embryo™ is a far reaching new research program at the US EPA to develop a working computer model of a mammalian embryo that can be used to better understand the prenatal risks posed by environmental chemicals and to eventually predict a chemical's potential developmental toxicity *in silico*. The basic concept is a public portal, knowledgebase, and computational infrastructure for modeling genetic-cellular networks and developmental toxicity pathways. The v-Embryo™ research platform addresses the hypothesis that critical effects of environmental agents on developmental toxicity pathways may be encoded as computer simulations of morphogenetic processes that draw from knowledge regarding the flow of molecular regulatory information in rudimentary tissues, the cell-autonomous responses to genetic and environmental signals, and the emergent morphogenetic properties associated with collective cellular behavior in any given system. Computational techniques to dissect the relative contributions of genetic variation, stage vulnerability, dose-response patterns, chemical mechanisms, fetal (epigenetic) programming, and maternal-fetal interactions to developmental defects are being built to investigate systematically interactions between these complex variables. Through these resources we can ultimately hope to predict lever-points for toxicity pathways and cellular networks that perturb development. The v-Embryo™ (<http://www.epa.gov/ncct/v-Embryo/>) is piloting a Wiki-space for information sharing (<http://v-embryo.wikispaces.com/>) and aligns with other high-throughput screening assays and systems biology research initiatives at the National Center for Computational Toxicology (NCCT) including ACToR, ToxCast™, and the Virtual Liver. *[This work has been reviewed by EPA and approved for publication but does not necessarily reflect official Agency policy].*