10th World Congress: Alternatives and animal use in the life sciences
Seattle, WA, USA, August 2017

Mechanistic modeling of developmental defects through computational embryology. Knudsen[1] TB, Hunter[1] ES III, Baker[2] NC, Spencer[2] R, Glazier JA[3], Daston[4] GP and Piersma[5] AH. [1]USEPA, ORD, RTP, NC; [2]Leidos, RTP, NC, [3]Indiana University, Bloomington IN, [4]Procter & Gamble Co., [5]RIVM, Netherlands.

An important consideration for 3Rs is to identify developmental hazards utilizing mechanism-based *in vitro* assays (e.g., ToxCast) and *in silico* predictive models. Steady progress has been made with agent-based models that recapitulate morphogenetic drivers for angiogenesis, somitogenesis, urethrogenesis, and palatogenesis. Additional models are underway for the neurovascular unit, endocardial cushions, and neural tube closure. The models offer a heuristic approach to reconstruct tissue dynamics from the bottom-up, cell-by-cell and interaction-by-interaction. Individually, they can simulate emergent phenotypes and predict adverse outcomes or 'cybermorphs' to essentially bring an AOP to life utilizing computational dynamics. Collectively, their compilation into an integrated array or 'virtual embryo' motivates the construction of novel ontology systems to integrate molecular pathways, cellular behaviors, and *in vitro* data on chemical-biological interactions with extant knowledge of embryology. *This abstract does not reflect US EPA policy*.