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**Symposium title:** Progress toward adoption of microphysiological systems in biology and medicine
**Symposium organizer:** John P. Wikswo, Vanderbilt University, john.wikswo@vanderbilt.edu

**Presentation:** Programming microphysiological systems for children's health protection
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**Abstract:** Opportunities exist for the application of organ-on-chip and microscale tissue constructs in the assessment of drug/chemical efficacy and toxicity. Together with computer simulation these *in vitro* systems provide a new direction for research to evaluate complex embryological and reproductive impacts of drug/chemical exposure. Examples include models for reproductive (testis, ovarian axis, mammary gland), embryonic (heart, neural tube, skeleton), and placental systems. Scaling the technologies to higher throughput is an important challenge and drives the necessity of *in silico* models for quantitative prediction of developmental toxicity for informing safety assessments. Cellular agent-based models constructed from extant embryology that simulate critical developmental transitions (and defects) include: VEGF-mediated angiogenesis (angiodysplasia), androgen-mediated urethral closure (hypospadias), TGFb-mediated tissue fusion (cleft palate), and retinoid-mediated limb outgrowth (ectrodactyly). These simulations are proportionally responsive to perturbation, hence amenable to quantitative prediction of effects at various stages of development. Microphysiological systems and computer models that recapitulate the underlying biology and toxicology of critical developmental transitions are emerging tools for developmental effects assessment of drugs/chemicals. (Does not reflect EPA or FDA policy)