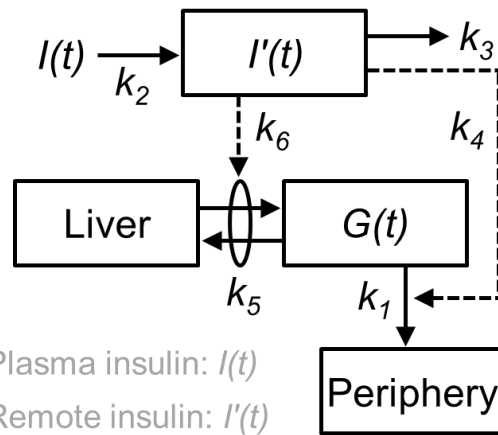


Mechanistic data-driven modelling of organoids-on-a-chip systems

Lee & Sung, In: Roy (ed.): *Chemometrics & Cheminformatics in Aquatic Toxicology* (Wiley, Hoboken, NJ, 2022)

- Organoids-on-a-chip (OoC): Artificially reconstructed multi-organ-mimicking system based on microfluidic devices
- Simulate complex nervous system development and endocrine signalling pathways in a mechanistic & controllable manner

Sung, *Math. Biosci.* **352**, 108900 (2022)



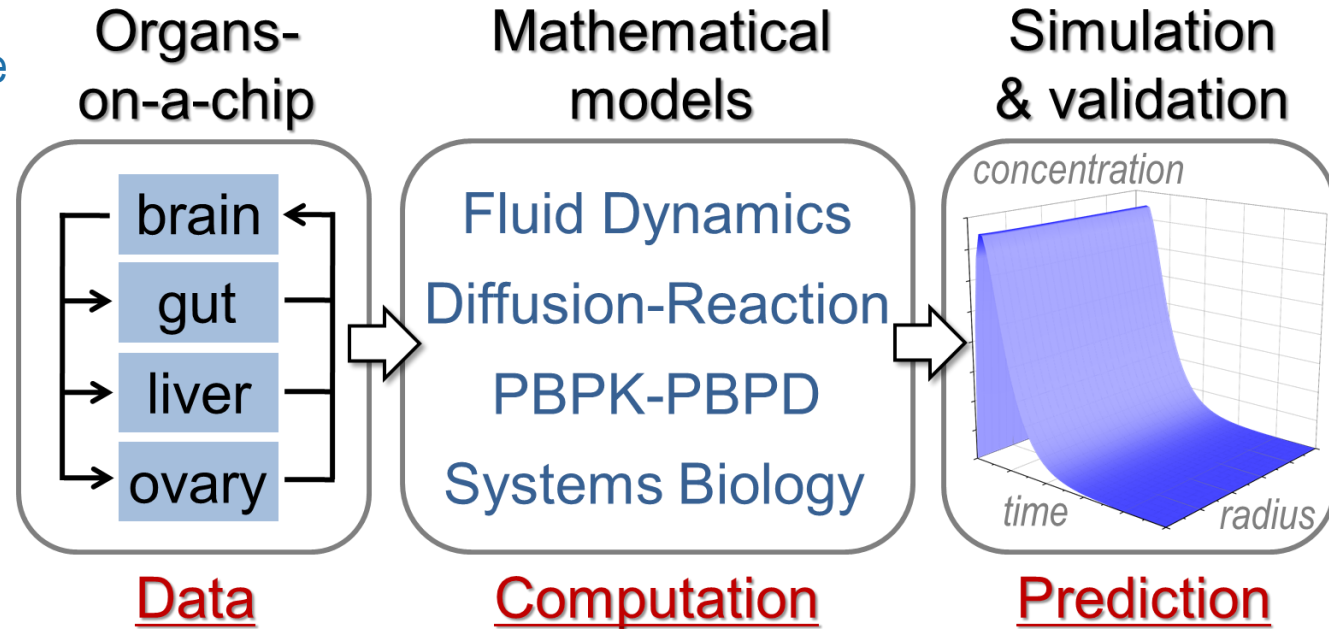
Plasma insulin: $I(t)$
 Remote insulin: $I'(t)$
 Interstitial insulin: $X(t)$
 Plasma glucose: $G(t)$
 Plasma glucose (basal level): B_0

$$X = (k_4 + k_6)I'$$

$$\dot{X} = -k_3X + k_2(k_4 + k_6)I$$

$$\dot{G} = -(k_1 + k_5 + X)G + B_0$$

Endocrine Microphysiology + *In Silico* Modeling



- Data-driven modelling neuroendocrine OoC systems to enable comparative physiological studies across vertebrate species
- Whole chip-level modelling techniques for mechanistically analysing pharmacokinetics & pharmacodynamics in the vertebrates
- Parameter calibration & scaling → *In vitro-in vivo* extrapolations