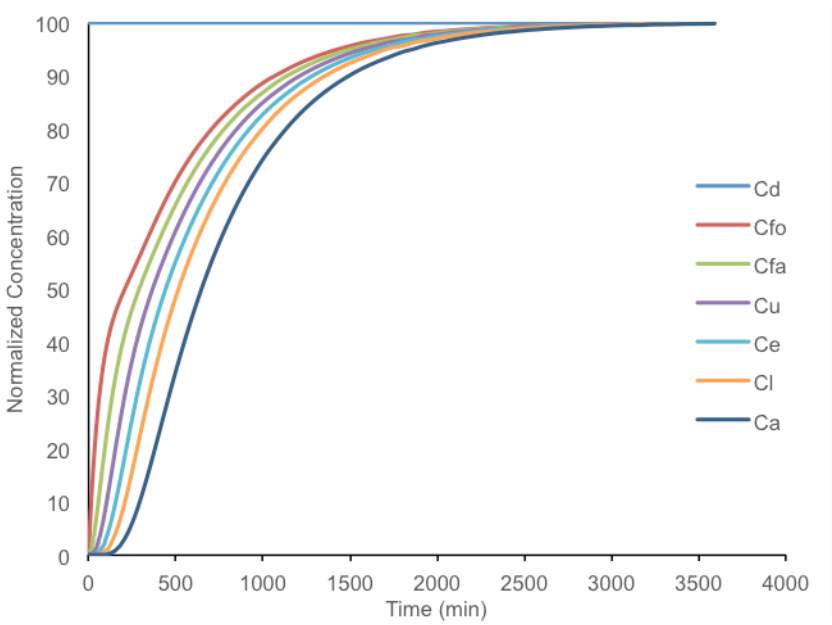
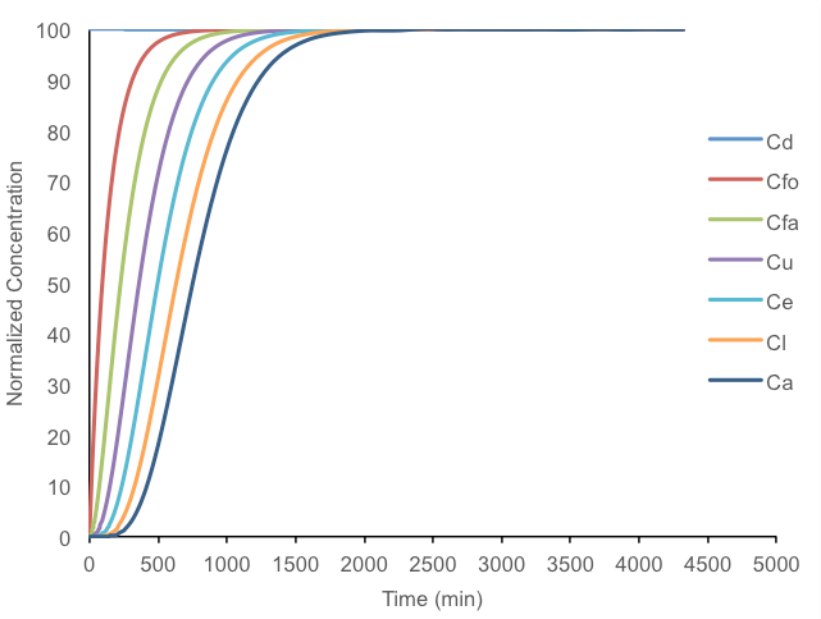
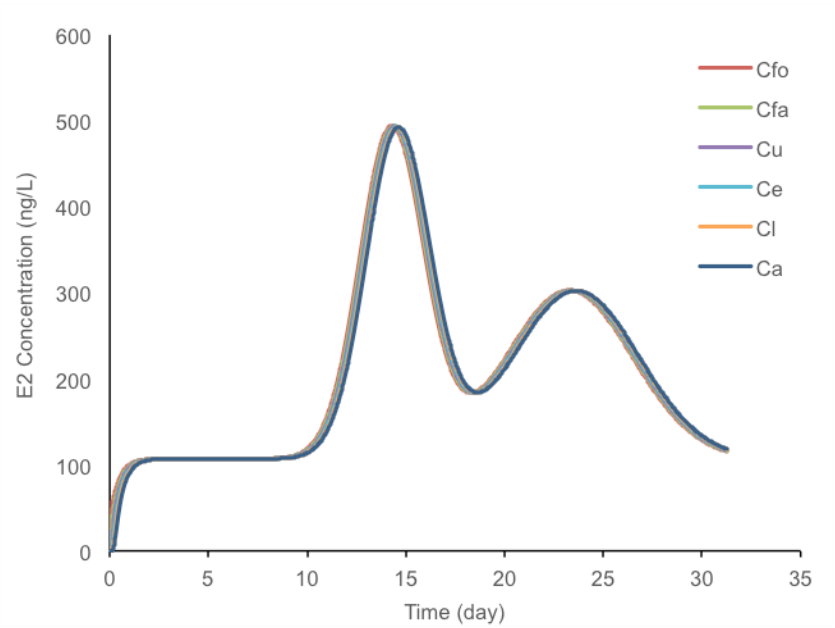
Supplementary Figure 1 showed the response time of the system to a step change in concentration in the Donor module. The simulation assumes $Q_D = Q_R =$ 100 µl/h, organ module volumes are 225 µl, and the sampling port volume is 200 µl. The calculated time required to reach 90% of the steady value in the sampling port is 1.03 Days. Supplementary Figure 2 shows the same system with $Q_R = 0$ µl/h. Note the system response time is slightly faster ($T_{90} = 0.86$ days), but there is a significant lag in concentration between modules. Finally, Supplementary Figure 3 showed the simulated estradiol concentration in each module when the estradiol production rate in the follicle module is set to an approximation of the human female serum estradiol concentration (adapted from dissertation "Modeling Endocrine Regulation of the Menstrual Cycle Using Delay Differential Equations", Leona A. Harris, Department of Mathematics and Statistics, The College of New Jersey, Ewing, NJ 08628).



Supplementary Figure 1. System response profile towards $Q_D = Q_R$ = 100 µl/h. MPS module concentration time profile resulting from a step change in concentration in Donor module from 0 to 100 (normalized concentration), $Q_D = Q_R$ =100 µl/h.



Supplementary Figure 2. System response profile towards Q_D=100 µl/h and Q_R = 0 µl/h. MPS module concentration time profile resulting from a step change in concentration in Donor module from 0 to 100 (normalized concentration), Q_D = 100 µl/h, Q_R = 0 µl/h.



Supplementary Figure 3. System response profile towards dynamic estradiol stimulation. MPS module concentration time profile resulting from an approximation to a human physiologic serum estradiol concentration time profile, $Q_D = Q_R$ = 100 µl/h.

Supplementary Table 1. Nomenclature and description of microfluidic technology and biological cultures.

Microfluidic Platform	Platform characteristics	Tissue Cultured	Biological Nomenclature
Solo-MFP™	Individual tissues Unidirectional (40 µl/h)	Mouse follicles Mouse ovaries Human fallopian tubes Human uterus Human Cervix Human Liver	FemKube OviKube TubeKube UteroKube CerviKube LiverKube
Duet- MFP™	Two Interacting tissues Unidirectional (40 µl/h)	Ovary Ovary + Fallopian Ovary + Uterus Ovary + Cervix	
Quintet-MFP™	Five Interacting tissues Recirculating (100 µl/h)	All tissues above	EVATAR