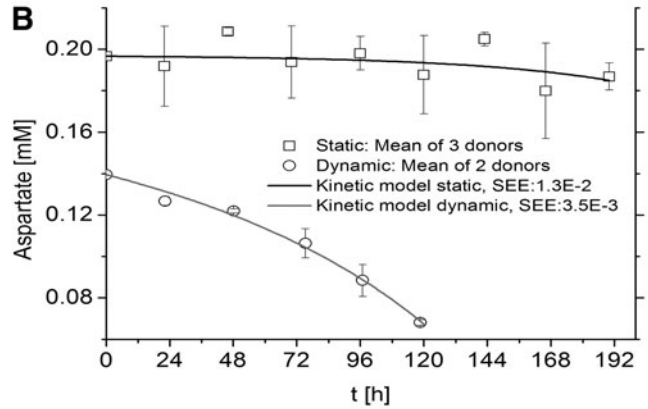
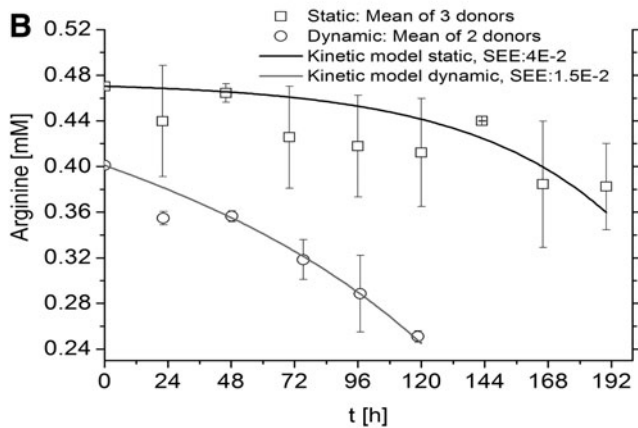
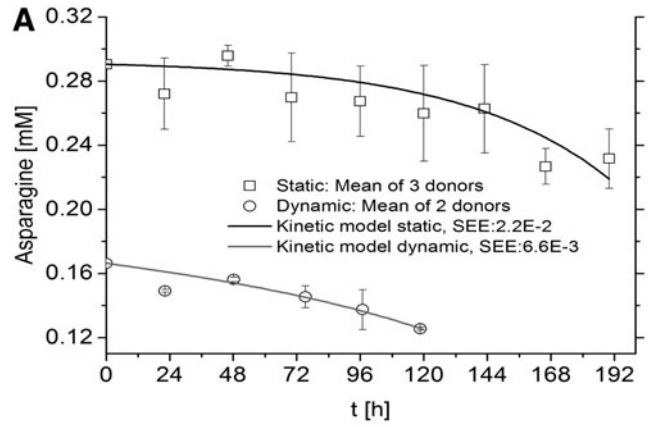
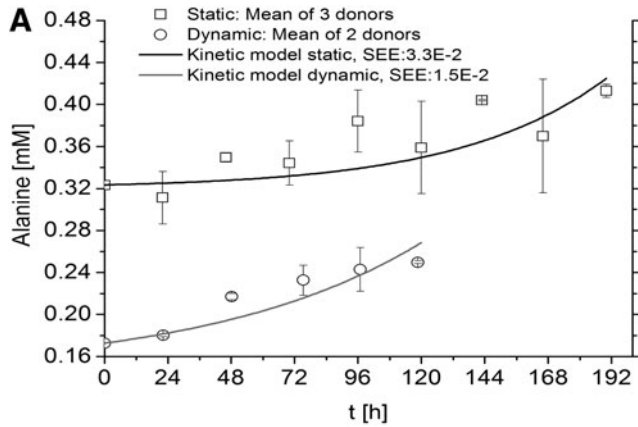
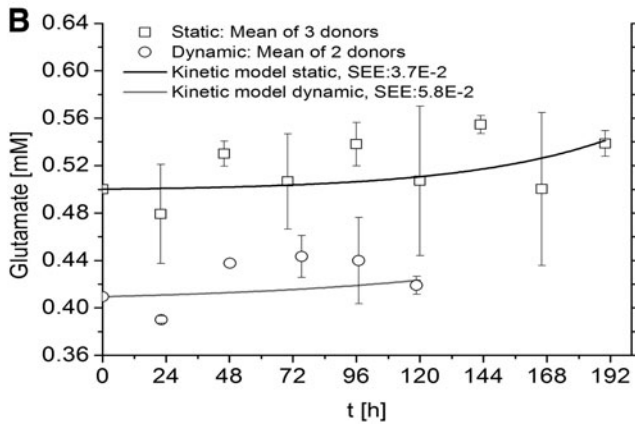
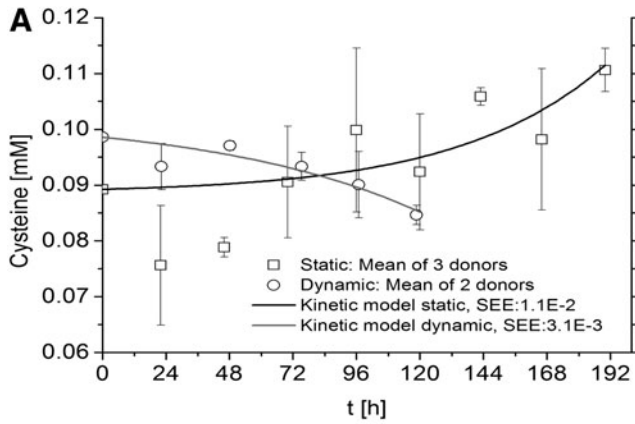


Supplementary Data

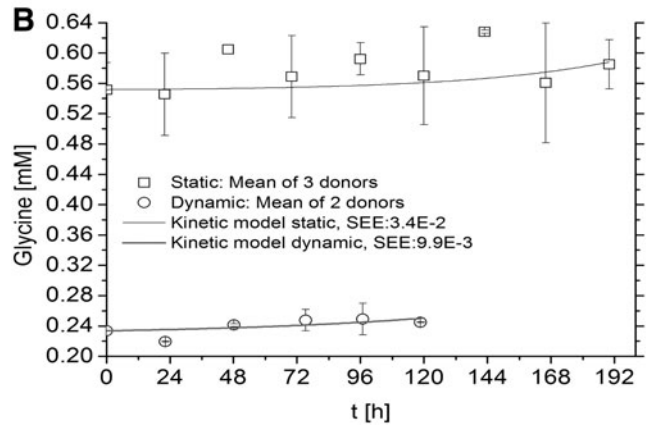
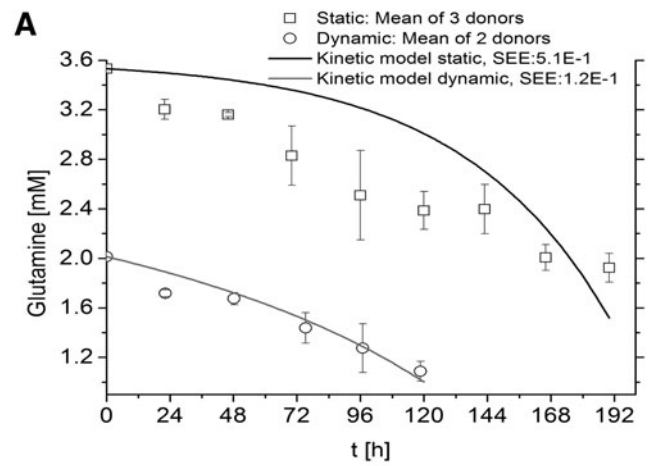


SUPPLEMENTARY FIG. S1. Nonessential amino acids have a distinct metabolism in hMSCs culture. **(A)** Alanine is secreted. **(B)** Arginine is consumed. Experimental concentrations, kinetics model, and standard error of estimates (SEE) are shown. hMSCs, human mesenchymal stem cells.

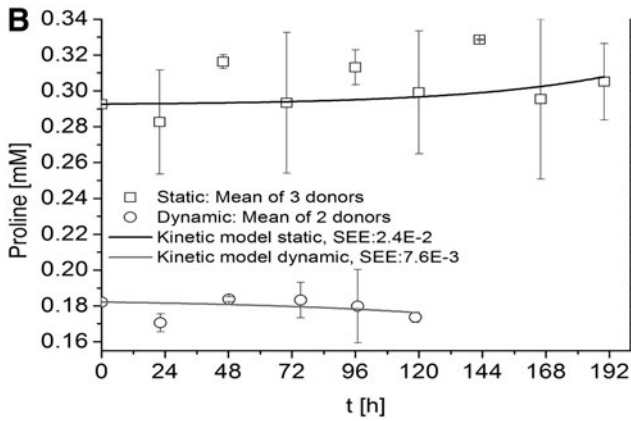
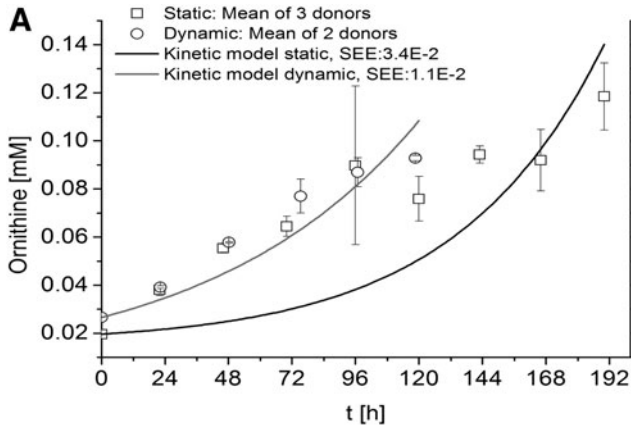
SUPPLEMENTARY FIG. S2. Nonessential amino acids have a distinct metabolism in hMSCs culture. **(A)** Both asparagine and **(B)** aspartate are consumed. Experimental concentrations, kinetics model, and SEE are shown.



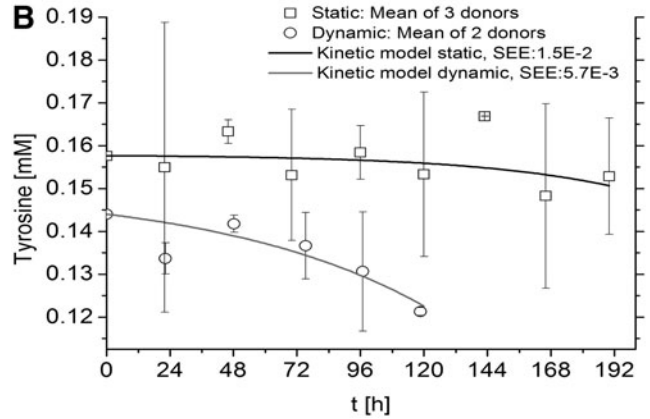
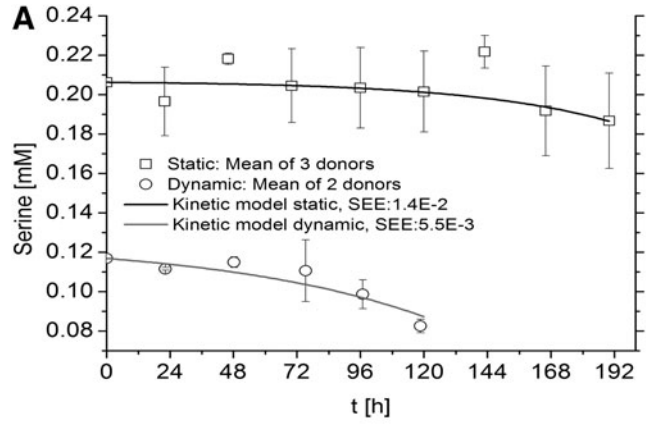
SUPPLEMENTARY FIG. S3. Nonessential amino acids have a distinct metabolism in hMSCs culture. **(A)** Cysteine is secreted in static cultures and consumed in dynamic cultures. **(B)** Glutamate is secreted. Experimental concentrations, kinetics model, and SEE are shown.



SUPPLEMENTARY FIG. S4. Nonessential amino acids have a distinct metabolism in hMSCs culture. **(A)** Glutamine is consumed. **(B)** Glycine is secreted. Experimental concentrations, kinetics model, and SEE are shown.



SUPPLEMENTARY FIG. S5. Nonessential amino acids have a distinct metabolism in hMSCs culture. **(A)** Ornithine is secreted. **(B)** Proline is secreted in static culture and consumed in dynamic cultures. Experimental concentrations, kinetics model, and SEE are shown.



SUPPLEMENTARY FIG. S6. Nonessential amino acids have a distinct metabolism in hMSCs culture. **(A)** Serine and **(B)** tyrosine are both consumed. Experimental concentrations, kinetics model, and SEE are shown.

SUPPLEMENTARY TABLE S1. SPECIFIC GROWTH RATES (μ), GLUCOSE (Q_{GLUC}), LACTATE (Q_{LAC}), AND $Y_{LAC/GLUC}$ WITH STANDARD DEVIATIONS

Donor		Static				Dynamic					
		1	SD	2	SD	3	SD	1	SD	2	SD
Viable Cells	μ [h^{-1}] $\times 10^{-2}$	1.86	0.1	1.85	0.1	1.87	0.06	1.21	0.2	1.29	0.1
Glucose	q_{gluc} [picomoles/cell/h]	-0.4	0.2	-0.9	0.7	-0.9	0.7	-0.6	0.02	-0.62	0.03
Lactate	q_{lac} [picomoles/cell/h]	1.2	0.4	1.1	0.8	2.3	0.7	1.3	0.03	1.2	0.04
$Y_{lac/gluc}$	q_{lac}/q_{gluc} [-]	3.08		1.2		2.6		2.2		1.9	

Static cultures (three donors) and dynamic cultures (two donors).

SUPPLEMENTARY TABLE S2. AMINO ACIDS WITH SIGNIFICANT DEGRADATION RATES IN STATIC AND DYNAMIC CULTURES

	$[h^{-1}]$	Static			Dynamic		
		$\times 10^{-3}$ (n=10)	$SD \times 10^{-3}$	R^2	$\times 10^{-3}$ (n=7)	$SD \times 10^{-3}$	R^2
Arginine	k_r	1.2	0.7	0.80	2.6	1.3	0.83
Aspartate	k_d	1.1	0.7	0.74	2.1	1.0	0.83
Asparagine	k_n	1.3	0.6	0.86	1.8	1.3	0.71
Glutamine	k_q	3.3	0.7	0.96	3.0	1.2	0.86
Ornithine	k_o	5.7	1.8	0.89	7.3	3.6	0.79