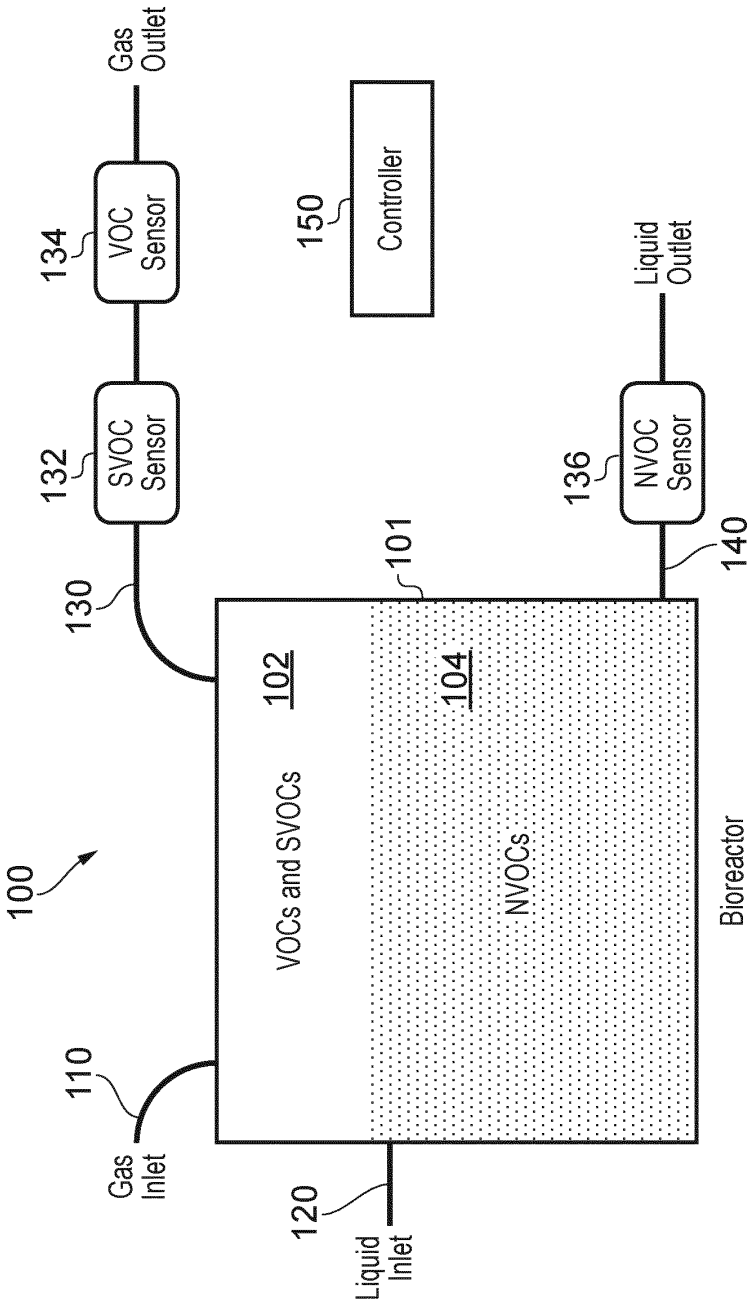

Gas Outlet
134
VOC Sensor
150
Controller
Liquid Outlet
132
SVOC Sensor
136
NVOC Sensor
101
140
130
102
104
100
VOCs and SVOCs
NVOCs
Bioreactor
110
Gas Inlet
120
Liquid Inlet

FIG. 1a

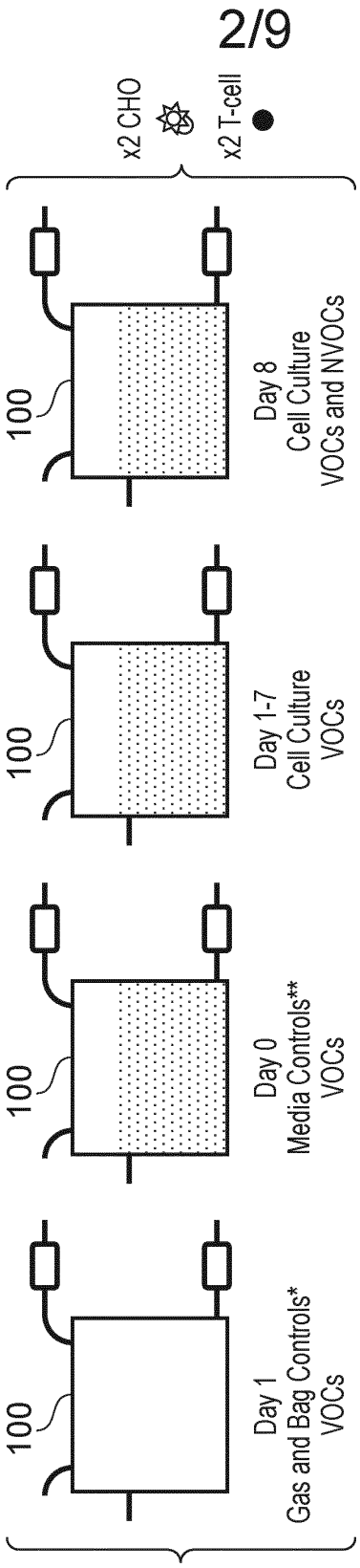


FIG. 1e

FIG. 1d

FIG. 1c

FIG. 1b

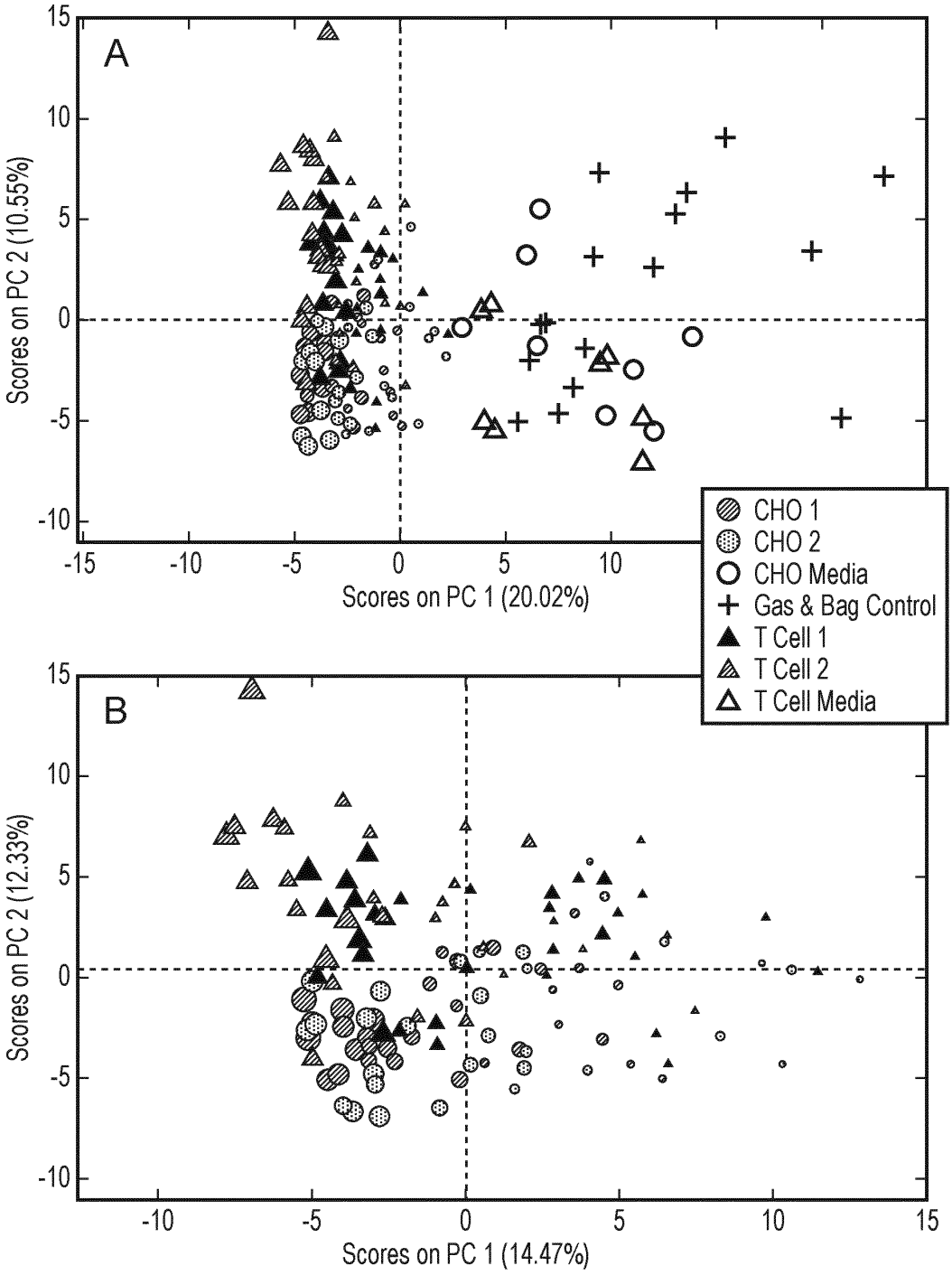

A
B
Scores on PC 2 (10.55%)
Scores on PC 1 (20.02%)
Scores on PC 2 (12.33%)
Scores on PC 1 (14.47%)
CHO 1
CHO 2
CHO Media
Gas & Bag Control
T Cell 1
T Cell 2
T Cell Media

FIG. 2

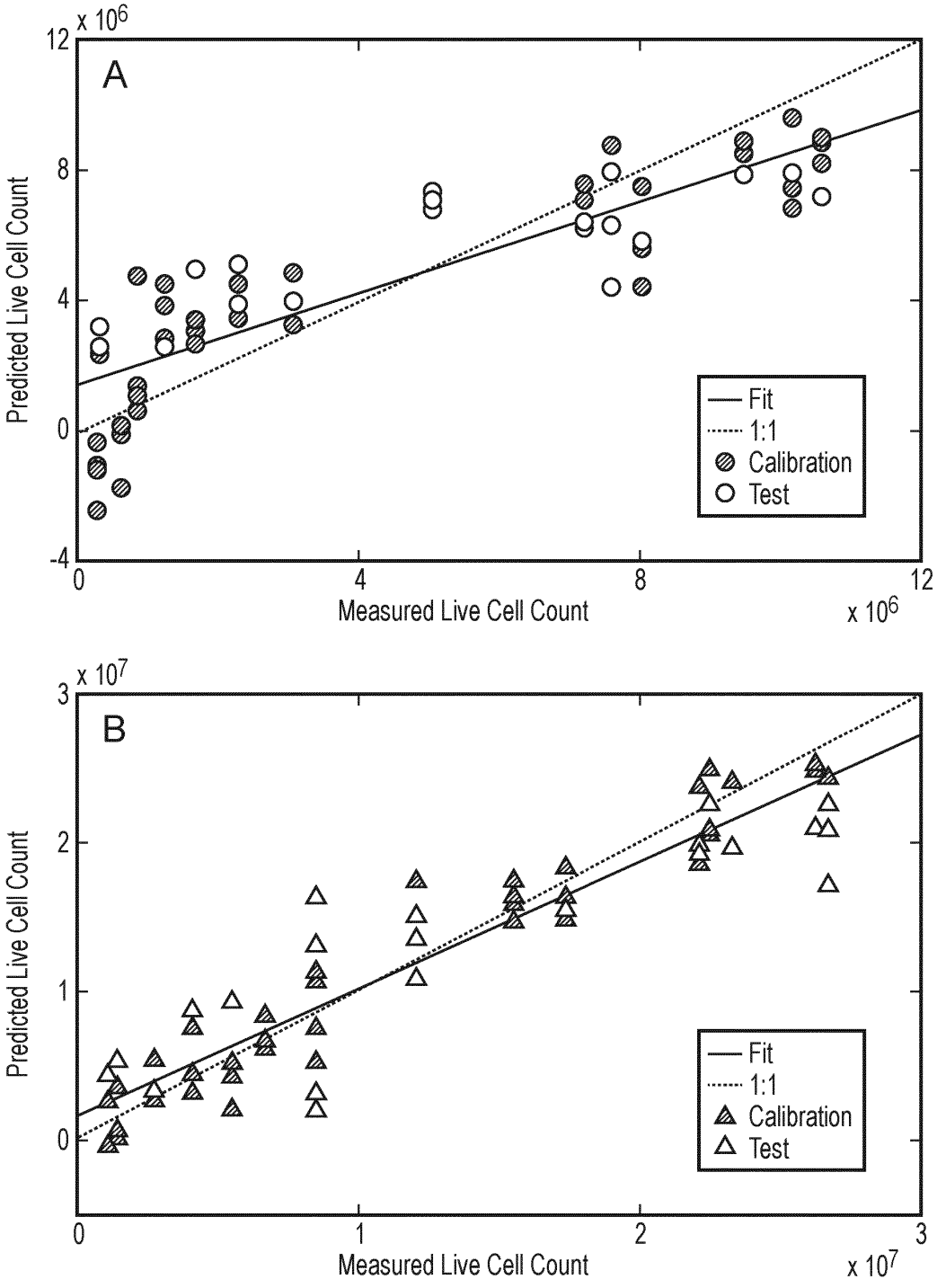

x 10^6
12
8
4
0
-4
A
Predicted Live Cell Count
Fit
1:1
Calibration
Test
0
4
8
12
Measured Live Cell Count
x 10^6
x 10^7
3
2
1
0
B
Predicted Live Cell Count
Fit
1:1
Calibration
Test
0
1
2
3
Measured Live Cell Count
x 10^7

FIG. 3

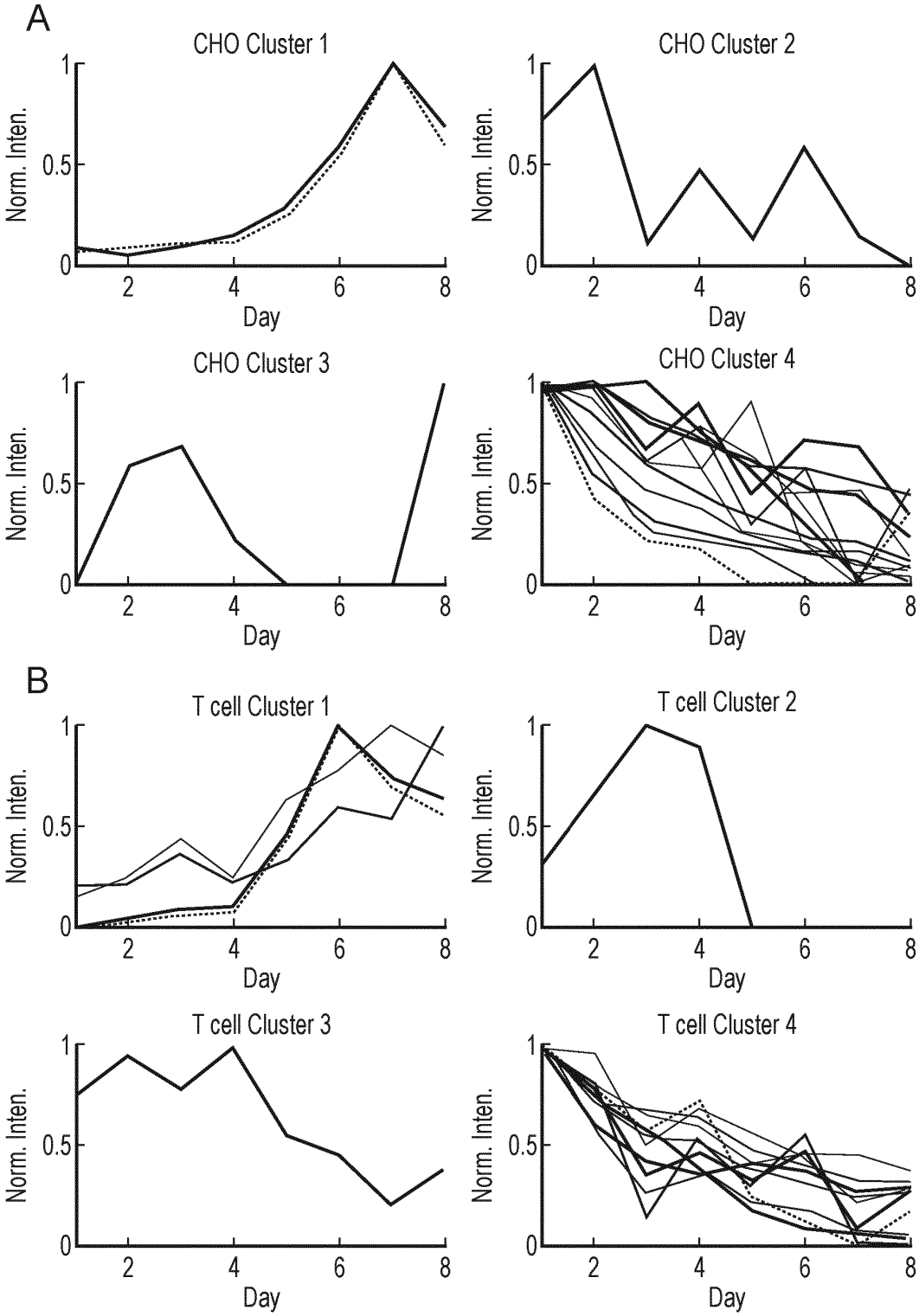

A
CHO Cluster 1
CHO Cluster 2
CHO Cluster 3
CHO Cluster 4
B
T cell Cluster 1
T cell Cluster 2
T cell Cluster 3
T cell Cluster 4
Norm. Inten.
Day
0
0.5
1
2
4
6
8

FIG. 4

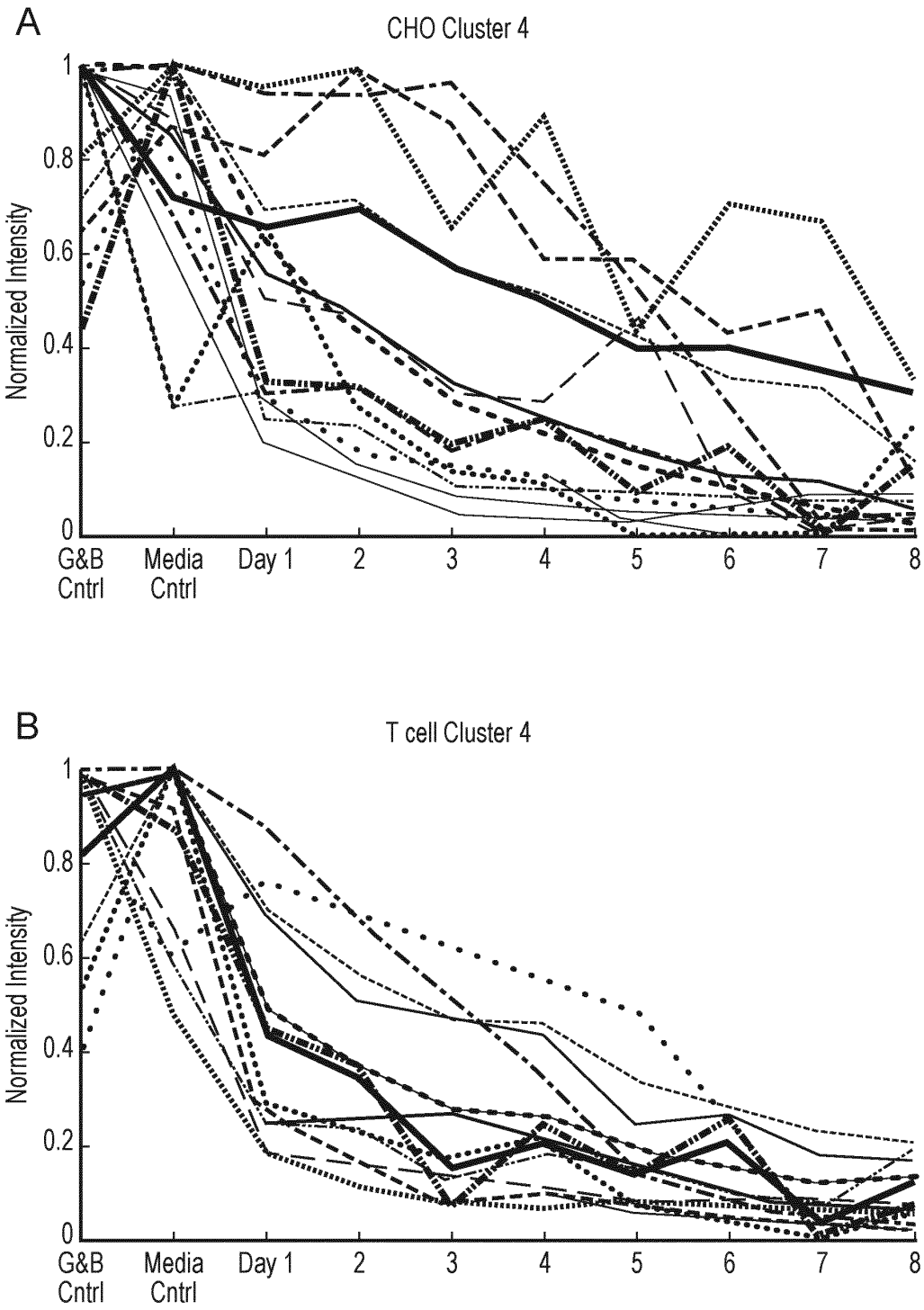

A
CHO Cluster 4
Normalized Intensity
1
0.8
0.6
0.4
0.2
0
G&B Cntrl
Media Cntrl
Day 1
2
3
4
5
6
7
8
B
T cell Cluster 4
Normalized Intensity
1
0.8
0.6
0.4
0.2
0
G&B Cntrl
Media Cntrl
Day 1
2
3
4
5
6
7
8

FIG. 5

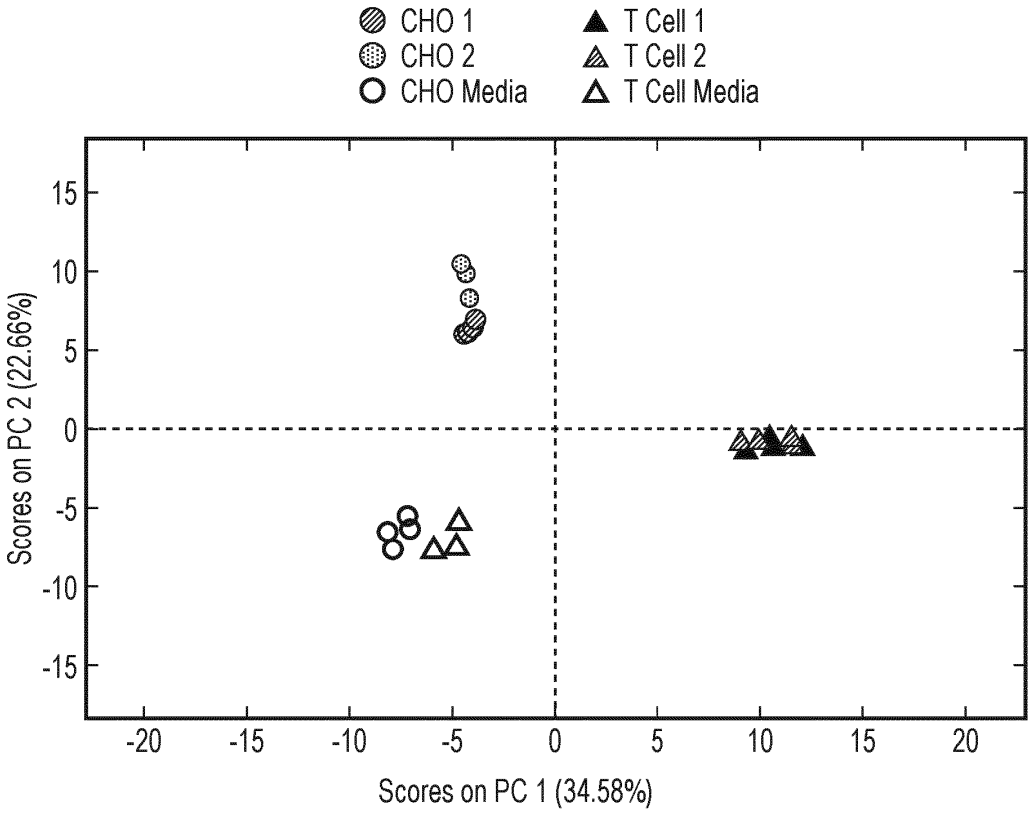

CHO 1
CHO 2
CHO Media
T Cell 1
T Cell 2
T Cell Media
Scores on PC 2 (22.66%)
Scores on PC 1 (34.58%)
15
10
5
0
-5
-10
-15
-20
-15
-10
-5
0
5
10
15
20

FIG. 6

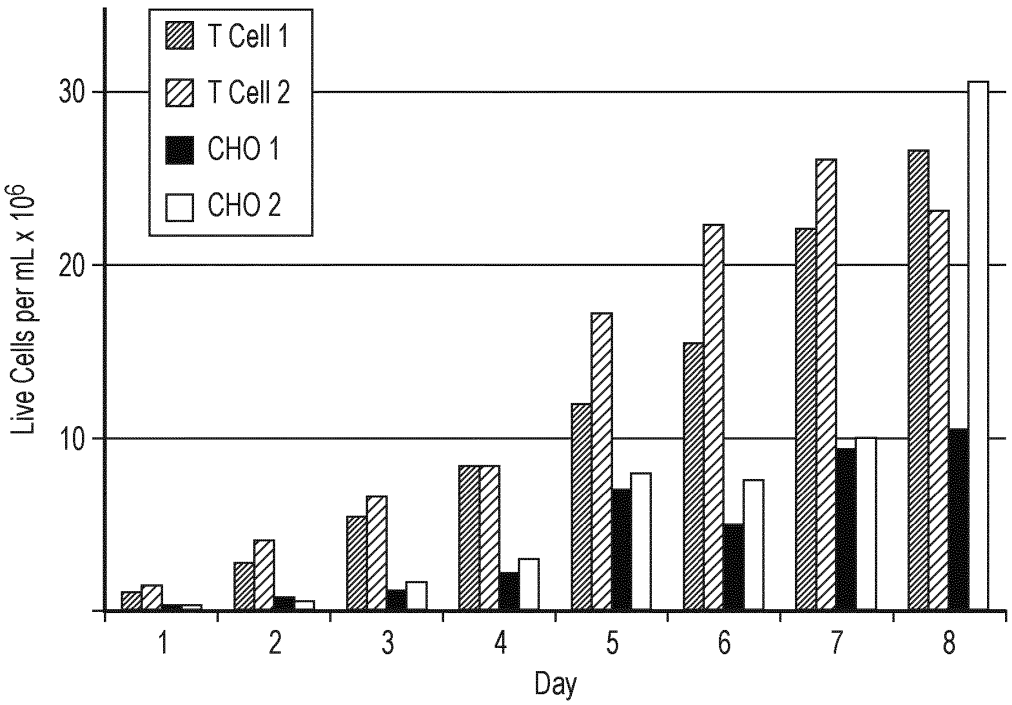

T Cell 1
T Cell 2
CHO 1
CHO 2
30
20
10
Live Cells per mL x 10^6
1
2
3
4
5
6
7
8
Day

FIG. 7

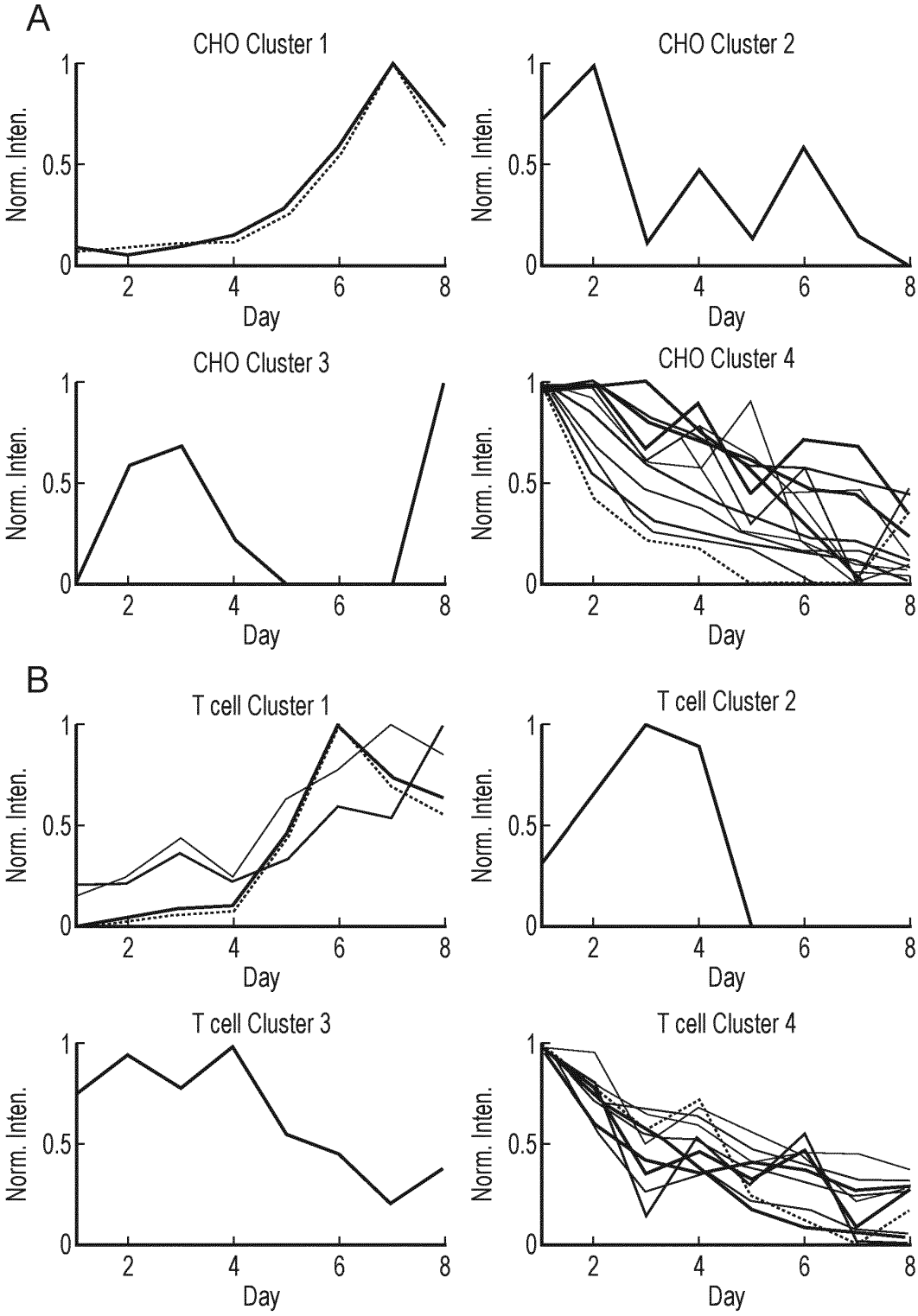

A
CHO Cluster 1
CHO Cluster 2
CHO Cluster 3
CHO Cluster 4
B
T cell Cluster 1
T cell Cluster 2
T cell Cluster 3
T cell Cluster 4
Norm. Inten.
Day
0
0.5
1
2
4
6
8

FIG. 8