Supplementary information

Figure S1 Correlation matrices and dendrograms for independent and dependent variables in models

**Nucleated cells (NC)**

![Correlation matrix](image)

**Dendrogram of nucleated cell data**

1 logID, 2 [IL-3], 3 [IL-6], 4 [G-CSF], 5 [SCGF], 6 [HGF], 7 [IL-11], 8 [GM-CSF], 9 [EPO], 10 [SCF], 11 [FL], 12 [MGDF], 13 [bFGF], 14 [LIF], 15 [TPO], 16 Cell-type-1=MNC-2=cd34+, 17 Serum-1=Y-0=N, 18 Feeder-1=Y-0=N, 19 T-flask, 20 6-well-plate, 21 24-well-plate, 22 Spinner-flask, 23 RVW, 24 Stirred-rotating-reactor, 25 culture-day

**CD34+**

![Correlation matrix](image)

**Dendrogram of CD34+ data**

1 logID, 2 [IL-3], 3 [IL-6], 4 [G-CSF], 5 [SCGF], 6 [HGF], 7 [IL-11], 8 [GM-CSF], 9 [EPO], 10 [SCF], 11 [FL], 12 [bFGF], 13 [LIF], 14 [TPO], 15 Cell-type-1=MNC-2=cd34+, 16 Serum-1=Y-0=N, 17 Feeder-1=Y-0=N, 18 T-flask, 19 6-well-plate, 20 24-well-plate, 21 48-well-plate, 22 culture-day
CFC

1 logID, 2 [IL-3], 3 [IL-6], 4 [G-CSF], 5 [GM-CSF], 6 [EPO], 7 [SCF], 8 [PL], 9 [TPO], 10 Cell-type-1=MNC-2=cd34+, 11 Serum-1=Y-0=N, 12 Feeder-1=Y-0=N, 13 T-flask, 14 24-well-plate, 15 48-well-plate, 16 96-well-plate, 17 culture-day

CFU-GM

1 logID, 2 [IL-3], 3 [IL-6], 4 [G-CSF], 5 [GM-CSF], 6 [EPO], 7 [SCF], 8 [PL], 9 [TPO], 10 Cell-type-1=MNC-2=cd34+, 11 Serum-1=Y-0=N, 12 Feeder-1=Y-0=N, 13 T-flask, 14 24-well-plate, 15 Spinner-flask, 16 culture-day
**BFU-E**

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1 logID, 2 [IL-3], 3 [IL-6], 4 [G-CSF], 5 [GM-CSF], 6 [EPO], 7 [SCF], 8 [FL], 9 [TPO], 10 Cell-type-1=MNC-
2=cd34+, 11 Serum-1=Y-0=N, 12 Feeder-1=Y-0=N, 13 T-flask, 14 Spinner-flask, 15 culture-day

**LTC-IC**

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1 logID, 2 [IL-3], 3 [GM-CSF], 4 [SCF], 5 [FL], 6 [TPO], 7 Cell-type-1=MNC-2=cd34+, 8 Serum-1=Y-0=N, 9 Feeder-1=Y-0=N, 10 T-flask, 11 24-well-plate, 12 96-well-plate, 13 culture-day
Table S1. Performance of MLR-EM and BRANN bioreactor models ($r^2$ values) with varying numbers of hidden layer nodes in the BRANN models. The number of experiments for each cell type are shown in brackets.

<table>
<thead>
<tr>
<th>Cell type</th>
<th>Data set</th>
<th>MLR</th>
<th>BRANN 1 node</th>
<th>BRANN 2 nodes</th>
<th>BRANN 3 nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC</td>
<td>Training (80%)</td>
<td>0.62</td>
<td>0.59</td>
<td>0.81</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>Test (20%)</td>
<td>0.59</td>
<td>0.52</td>
<td>0.75</td>
<td>0.78</td>
</tr>
<tr>
<td>CD34+</td>
<td>Training (80%)</td>
<td>0.56</td>
<td>0.48</td>
<td>0.49</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>Test (20%)</td>
<td>0.59</td>
<td>0.50</td>
<td>0.51</td>
<td>0.51</td>
</tr>
<tr>
<td>CFC</td>
<td>Training (80%)</td>
<td>0.66</td>
<td>0.61</td>
<td>0.61</td>
<td>0.71</td>
</tr>
<tr>
<td></td>
<td>Test (20%)</td>
<td>0.70</td>
<td>0.61</td>
<td>0.60</td>
<td>0.62</td>
</tr>
<tr>
<td>CFU-GM</td>
<td>Training (80%)</td>
<td>0.79</td>
<td>0.69</td>
<td>0.70</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>Test (20%)</td>
<td>0.92</td>
<td>0.89</td>
<td>0.89</td>
<td>0.89</td>
</tr>
<tr>
<td>BFU-E</td>
<td>Training (80%)</td>
<td>0.91</td>
<td>0.79</td>
<td>0.81</td>
<td>0.89</td>
</tr>
<tr>
<td></td>
<td>Test (20%)</td>
<td>0.94</td>
<td>0.80</td>
<td>0.84</td>
<td>0.83</td>
</tr>
<tr>
<td>LTC-IC</td>
<td>Training (80%)</td>
<td>0.73</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Test (20%)</td>
<td>0.76</td>
<td>0.71</td>
<td>0.73</td>
<td>0.73</td>
</tr>
</tbody>
</table>

Table S2. Performance of MLR-EM and BRANNLP bioreactor models ($r^2$ values) with varying degrees of sparsity imposed. The number of parameters in each model is shown in brackets. BRANNLP with no imposed sparsity may still prune less relevant parameters resulting in fewer than the maximum number in the model.

<table>
<thead>
<tr>
<th>Cell type</th>
<th>Sparsity index</th>
<th>MLR-EM</th>
<th>BRANN 1 node</th>
<th>BRANN 2 nodes</th>
<th>BRANN 3 nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC</td>
<td>0</td>
<td>0.62</td>
<td>0.61 (21)</td>
<td>0.80 (25)</td>
<td>0.82 (25)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0.60</td>
<td>0.61 (14)</td>
<td>0.71 (13)</td>
<td>0.84 (17)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.57</td>
<td>0.50 (9)</td>
<td>0.49 (9)</td>
<td>0.66 (12)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.50</td>
<td>0.44 (7)</td>
<td>0.44 (6)</td>
<td>0.59 (10)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.41</td>
<td>0.52 (11)</td>
<td>0.48 (5)</td>
<td>0.48 (7)</td>
</tr>
<tr>
<td>CD34+</td>
<td>0</td>
<td>0.56</td>
<td>0.50 (18)</td>
<td>0.50 (18)</td>
<td>0.51 (17)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0.53</td>
<td>0.52 (6)</td>
<td>0.44 (6)</td>
<td>0.59 (10)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.44</td>
<td>0.62 (13)</td>
<td>0.62 (13)</td>
<td>0.62 (9)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.44</td>
<td>0.63 (7)</td>
<td>0.63 (8)</td>
<td>0.63 (7)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.37</td>
<td>0.63 (11)</td>
<td>0.74 (10)</td>
<td>0.74 (9)</td>
</tr>
<tr>
<td>CFC</td>
<td>0</td>
<td>0.79</td>
<td>0.74 (11)</td>
<td>0.74 (10)</td>
<td>0.74 (9)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0.75</td>
<td>0.75 (7)</td>
<td>0.75 (6)</td>
<td>0.75 (7)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.69</td>
<td>0.72 (4)</td>
<td>0.72 (4)</td>
<td>0.74 (4)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.45</td>
<td>0.62 (4)</td>
<td>0.80 (5)</td>
<td>0.84 (5)</td>
</tr>
<tr>
<td>BFU-E</td>
<td>0</td>
<td>0.91</td>
<td>0.85 (10)</td>
<td>0.85 (10)</td>
<td>0.84 (11)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0.78</td>
<td>0.86 (7)</td>
<td>0.84 (6)</td>
<td>0.84 (5)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.73</td>
<td>0.62 (4)</td>
<td>0.80 (5)</td>
<td>0.75 (4)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.45</td>
<td>0.48 (1)</td>
<td>0.48 (1)</td>
<td>0.48 (1)</td>
</tr>
<tr>
<td>LTC-IC</td>
<td>0</td>
<td>0.73</td>
<td>0.68 (8)</td>
<td>0.68 (6)</td>
<td>0.58 (4)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0.70</td>
<td>0.65 (4)</td>
<td>0.65 (4)</td>
<td>0.65 (4)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0.68</td>
<td>0.65 (4)</td>
<td>0.65 (4)</td>
<td>0.65 (4)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0.58</td>
<td>0.48 (1)</td>
<td>0.48 (1)</td>
<td>0.48 (1)</td>
</tr>
</tbody>
</table>