CLAIMS

What is claimed is:

1. A system for controlling a seed train process, comprising:

an expansion chamber for receiving an initial cell stock for expansion into a viable cell culture;

a bioreactor in fluid communication with the expansion chamber for receiving a viable cell culture;

a pump for effecting transfer of a viable cell culture from the expansion chamber to the bioreactor through a fluid communication path between the expansion chamber and the bioreactor;

a Raman spectrometer having at least one probe for monitoring the cell expansion process within the expansion chamber using Raman spectrometry, the Raman spectrometer being adapted to generate Raman spectral data;

a multivariate model that provides predictions of process variables based on Raman spectral data; and

a computer system in signal communication with the Raman spectrometer for receiving Raman spectral data, and in signal communication with the pump for controlling operation of the pump for effecting transfer of a viable cell culture from the expansion chamber to the bioreactor,

wherein the Raman spectrometer is adapted to generate Raman spectral data and a multivariate model that provides predictions of one or more process variables, and the computer system is adapted to compare the process variable measurements to one or more predefined process set points to determine if one or more process variable measurements have satisfied a predefined trigger value, and

wherein the computer system is adapted, upon determining that a process variable measurement in the Raman spectral data has satisfied a predefined trigger value, to control the pump to execute an auto-transfer of a cell culture volume from the expansion chamber to the bioreactor.

2. The system according to claim 1, wherein
the computer system processes Raman spectral data received from the Raman spectrometer to generate a multivariate model of the one or more process variables.

3. The system according to claim 2, wherein
the computer system generates a partial least squares regression model.

4. The system according to claim 3, wherein
the computer system is adapted, when comparing process variable predictions from the multivariate model to one or more predefined process set points, to use process variable measurements from a plurality of predefined isolated regions of the Raman spectral data.

5. The system according to claim 4, wherein
the computer system uses process variable measurements from Raman spectral data in the wavelength regions of 800-850 cm^{-1}; 1260-1470 cm^{-1}; 1650-1840 cm^{-1}; and 2825-3080 cm^{-1}.

6. A method of auto-inoculating a bioreactor using a system according to claim 1, comprising:
expanding a cell stock in the expansion chamber;
generating Raman spectral data, using the Raman spectrometer, to provide data to a multivariate model that predicts one or more process variables of the cell expansion in the expansion chamber;
the computer system comparing process variable predictions from the multivariate model with predefined process set points at the computer system;
the computer system controlling the pump to auto-inoculate the bioreactor with a viable cell culture from the expansion chamber when the computer system determines that one or more process variable predictions from the multivariate model satisfies a predefined trigger value.

7. The method according to claim 6, wherein
the predefined trigger value is a viable cell density value.

8. The method according to claim 7, wherein
the predefined trigger value is set to a viable cell density value that is equal to or within a range of -10% of a predetermined target viable cell density.

9. The method according to claim 6, wherein
the predefined trigger value is a lactate level value.

10. The method according to claim 9, wherein
the predefined trigger value is set to a lactate level value that is equal to or within a range of +10% of a predetermined minimum lactate level.

11. The method according to claim 6, wherein
the predefined trigger value is a model predicted VCD .

12. The method according to claim 11, wherein
the predefined trigger value is set to a model predicted VCD value that is equal to or within a range of -10% of a predetermined maximum cell growth rate.

13. The method according to claim 6, wherein
the computer system stores a first predefined trigger value based on a predetermined viable cell density, and stores a second predefined trigger value based on a predetermined processing variable other than viable cell density, and
the computer system is adapted to control the pump to auto-inoculate the bioreactor with a viable cell culture from the expansion chamber when the computer system determines that a process variable prediction from the multivariate model satisfies either the first or second predetermined trigger value.

14. The method according to claim 6, wherein
the second predetermined trigger value is a lactate level value.

15. The method according to claim 6, wherein
the predefined trigger value is a model predicted VCD value.

16. The method according to claim 6, wherein
the computer system processes Raman spectral data received from the Raman spectrometer to generate a multivariate model of the one or more process variables, and obtains the process variable measurements from the multivariate model for comparison with the predefined trigger values.

17. The method according to claim 16, wherein
the computer system generates a partial least squares regression model.