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United States Patent [19][11] **Patent Number:** **5,955,353****Amiot**[45] **Date of Patent:** **Sep. 21, 1999**

- [54] **HOLLOW FIBER BIOREACTOR WITH AN EXTRAFILAMENT FLOW PLUG**
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- [52] U.S. Cl. **435/297.4; 435/370; 435/400; 604/4; 210/321.81**
- [58] **Field of Search** **435/366, 370, 435/400, 401, 297.2, 297.4, 299.1; 210/321.8, 321.81, 321.89, 321.9; 604/4, 5**

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[57] **ABSTRACT**

A bioreactor containing living animal cells at a density approaching that of normal animal tissue is described. High cell loading is achieved by providing a flow restrictor which controls fluid flow through the bioreactor during cell loading. Methods for making and using the bioreactor are also described.

42 Claims, 9 Drawing Sheets