Title: Integrated Smart Biomanufacturing Platform for Immune Cell Expansion and Plasma Protein Fractionation with AI-Driven Adaptive Logic

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Abstract

This provisional patent application discloses two modular, independently patentable inventions: (1) an immune cell therapy manufacturing system and (2) a plasma protein fractionation platform. Both are designed for GMP-compliant operation and may optionally share a cloud-based control engine and AI optimization layer. The immune cell system includes closed-loop bioreactor tubing, cytokine scheduling via AI, phenotype-based dosing adjustments, and SOP-based batch release interlocks. The plasma fractionation system includes real-time buffer control, RFID-tagged cartridge validation, per-protein adaptive logic, and regulatory-ready execution control. Each system may operate as a standalone product or together within an integrated infrastructure.