Docket #: S21-307

Valency Controlled Receptor Systems for Cell Engineering and Therapy

Stanford Reference: 21-307 & 20-066

Cell therapy is revolutionizing the way we treat disease. Reprogramming natural and complex cell functionalities toward new targets opens an enormous space of possible therapeutic modalities that were previously unavailable. The success of engineered cell therapies relies on rewiring natural immune activation pathways to novel disease relevant targets through genetic manipulation. Adoptive cell therapies, such as CAR-T cell therapies, relies on engineered T cells to target and destroy malignant tumors. However, there is a lack of molecular methods and tools that can be used to successfully engineer novel features onto immune cells and engineer cells to modulate diverse signaling pathways. The Qi lab at Stanford invented a molecular tool and methodology to convert natural or synthetic transmembrane receptors, that can transmit an extramembrane signal input across the cell membrane to activate intramembrane signal pathways, into a custom input-based valency controllable receptor system. The core of the invention is a synthetic transmembrane receptor that can receive diverse forms of biophysiochemical inputs and activate downstream signals for pathway and functional control. Integrating the synthetic receptor into cells allows for controlled modulation of cellular pathways. The valency controllable receptors can potentially be combined with other receptors including but not limited to CAR and TCR to modulate cell activity. The system is inducible and druggable which provides a customizable tool to advance the therapies to target infectious diseases, regenerative medicine, and cancer.

Applications

- Next-generation cell therapies (e.g. to target cancer, viral infections, bacterial infections, wound healing, autoimmunity, etc)
- Modulating immune and other cells via cellular engineering

- CAR-T Therapies

Advantages

- Secondary control of cellular response and precise target engagement to enhance safety and efficacy
- Invention adaptable to different costimulatory domains
- Programmable to activate native cellular pathways
- Recognize both surface bound and soluble factors in an AND/OR gated format

Patents

- Published Application: WO2023087024
- Published Application: 20250017960

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