MASSIVELY PARALLEL HIGH THROUGHPUT SINGLE-CELL OPTOPORATION

IITM Technology Available for Licensing

Problem Statement

- Single cell intracellular delivery **faces challenges due to cell membrane impermeability**, necessitating disruptive methods.
- **Existing techniques focus on bulk cargo delivery**, resulting in low efficiency and reduced cell viability.
- Collecting data from individual cells is essential, requiring parallel high-throughput delivery methods.
- Cell culture randomness hinders monitoring and organization of single cells for research.
- There is **a need for improved delivery approaches and methods for parallel single-cell therapy and analysis** to advance the field.

Intellectual Property

- IITM IDF Ref. **2005**
- **IN 202041031463**
- **PCT/IN2021/050706 - Published**
- **US18006098**

Technology Category/ Market

Category - Biomedical, Bio-MEMS device
Applications - Personalized medicine and regenerative medicine applications.
Industry- Biomedical, Cellular therapy.

Market-The global Bio-MEMS market size is forecast to reach $15.5 billion by 2027, growing at a **CAGR of 11.68%** from 2022 - 2027.

TRL (Technology Readiness Level)

TRL - 3, Proof of concept stage.

Research Lab

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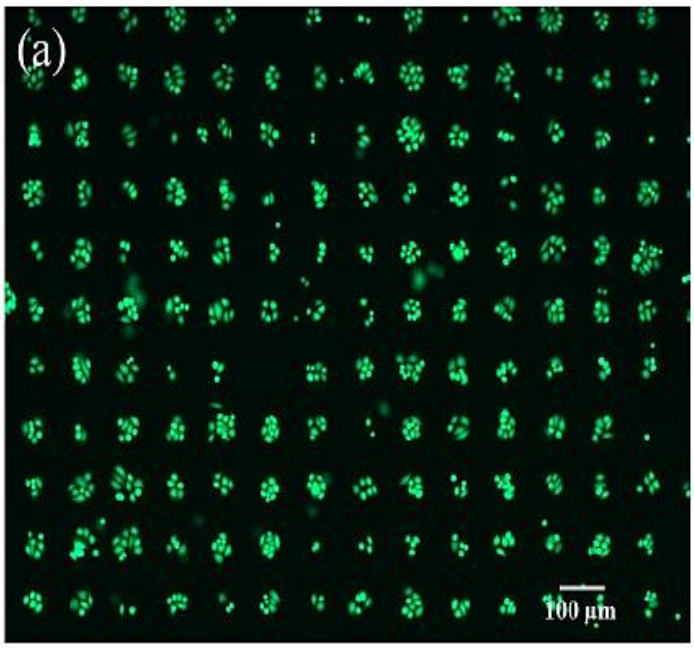

Hole size : 50 µm, Interspace : 100 µm

FIG. 2. illustrate an exemplary graphical representation of single-cells patterning (calcein AM staining) using SU-8 membrane holes using an array of 50 µm hole size and 100 µm interspacing.

Technology

1 .

- The present invention relates to **massively parallel high throughput single cell patterning technology** and intracellular delivery techniques.

2 .

- The method teaches use of **parallel single-cell patterning technique using SU-8 membrane** and nano-second pulsed laser espouse on single-cell with micro-dish pattern device structure (Fig. 1, 2 & 3).

3 .

- The platform is **able to effectively deliver different (small to large) cargo in a different cell type** with high transfection efficiency and high cell viability at parallel single-cell resolution. Fig. 4.

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Key Features / Value Proposition

1. **Massively Parallel Single-Cell Patterning:** The method offers a unique approach to pattern single cells in a massively parallel high-throughput fashion, allowing for precise control and organization of individual cells.
2. **High Transfection Efficiency:** It achieves high transfection efficiency and cell viability, enabling the effective delivery of various cargo sizes to different cell types.
3. **Versatile Cell Patterning:** The platform can accommodate single-cell patterning with varying hole sizes, making it adaptable to different cell types and research needs.

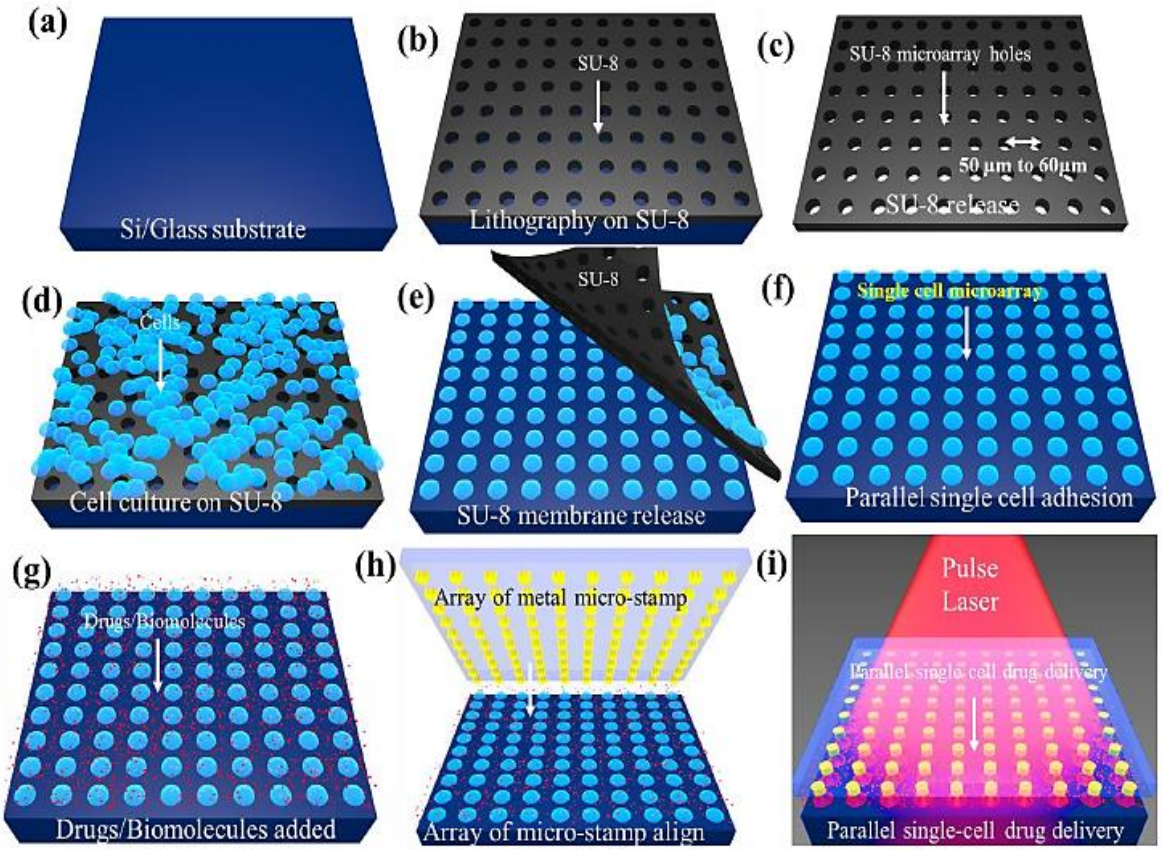

Fig.1. Cleaned glass/silicon substrate (b) SU-8 based array of hole formation using lithographic process (c) membrane release from substrate (d) SU-8 membrane transferred on petri dish/cleaned glass substrate and cultured cells on top of the substrate (e-f) after cell adhere on substrate, SU-8 membrane release and array of single-cell hole formation was achieved (g) cell impermeable biomolecules introduce on top of the single-cell (h) array of metal (Ti/Au) micro-dish align on top of the cell (i) pulse laser exposure and massively parallel high throughput single-cell delivery was achieved.

FIG. 1(a)-1(i) illustrates a schematic view of the cell culturing platform (SU-8 membrane) demonstrating various steps involved in method.

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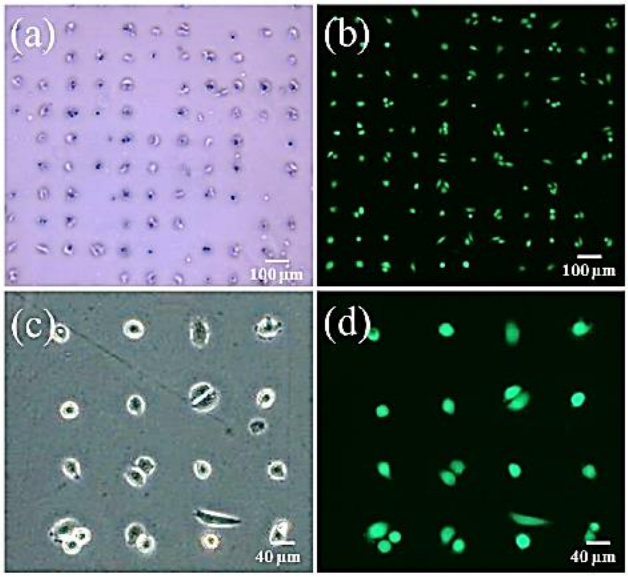

Hole size : 40 µm, Interspace : 100 µm

FIG. 3 illustrates single- cell (SiHa cells) printing using SU-8 membrane holes using an array of 40 µm holes size and 100 µm interspacing.

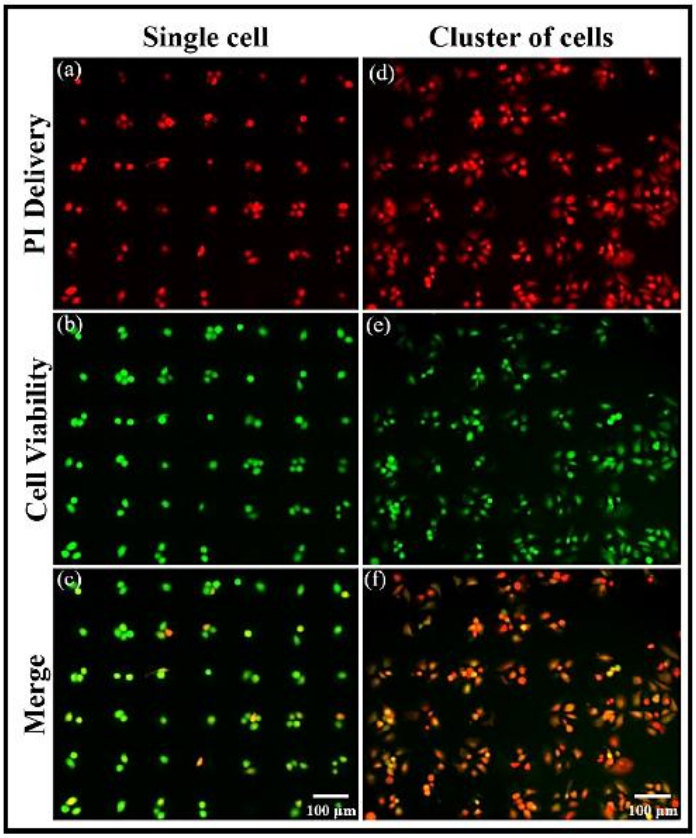

FIG. 4. illustrates fluorescence image of massively parallel high throughput single-cell intracellular delivery to spatially isolated SiHa cells (Cervical cancer).

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