Miniaturizing drug sensitivity and resistance test for solid tumors on Droplet Microarray

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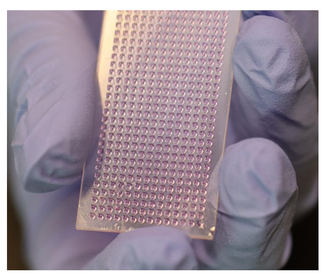
Objectives

- Develop Drug Sensitivity and Resistance Testing (DSRT) on Droplet Microarray (DMA) chip for non-small cell lung carcinoma tumors (NSCLC)
- Establish hydrogel-based culture on DMA.

Introduction

- Functional precision oncology aims to identify the most effective therapy for individual patients.
- DSRT evaluates in vitro how tumor cells respond to different anticancer drugs.
- Challenges include obtaining sufficient amount of cells from solid tumors and high costs of comprehensive drug testing.
- Miniaturized technologies like DMA chip offer solutions by increasing the throughput of assays and preserving the rare and limited samples.
- The aim of current study is to improve applicability of drug sensitivity assays with potential applications in clinics and research.



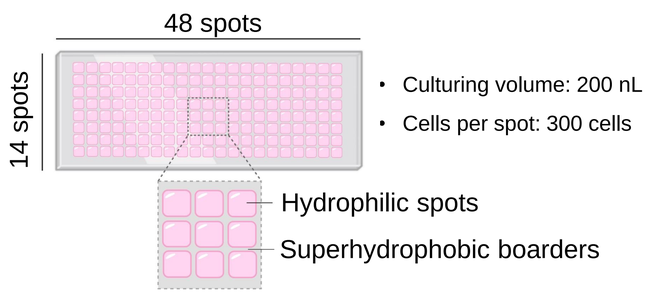
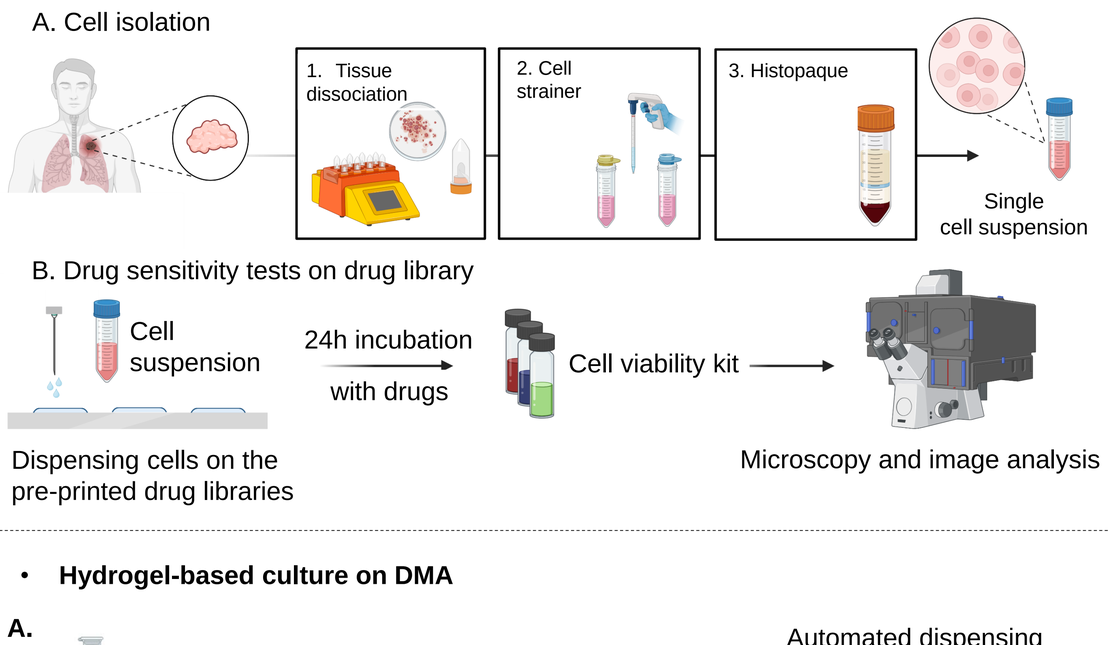


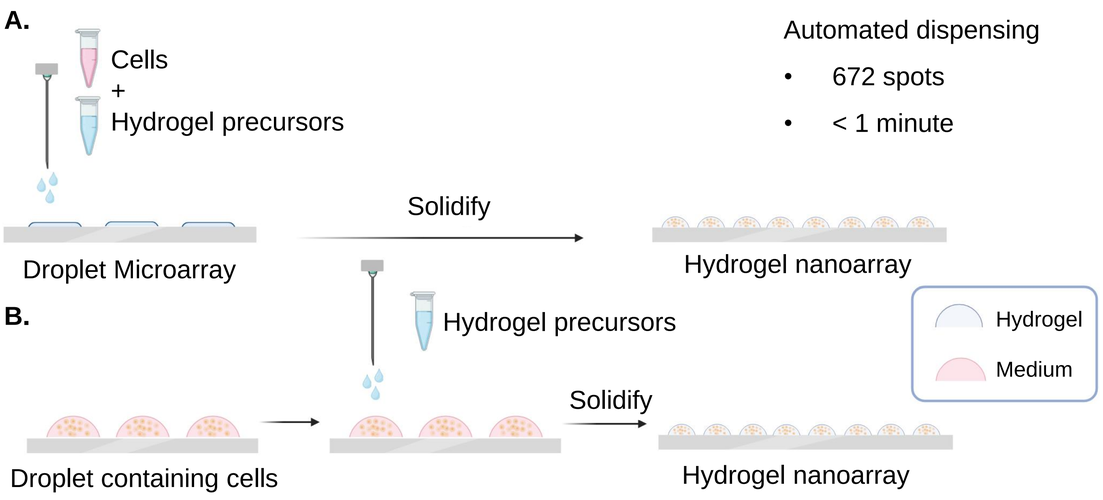
Figure 1. Droplet Microarray platform

Methods

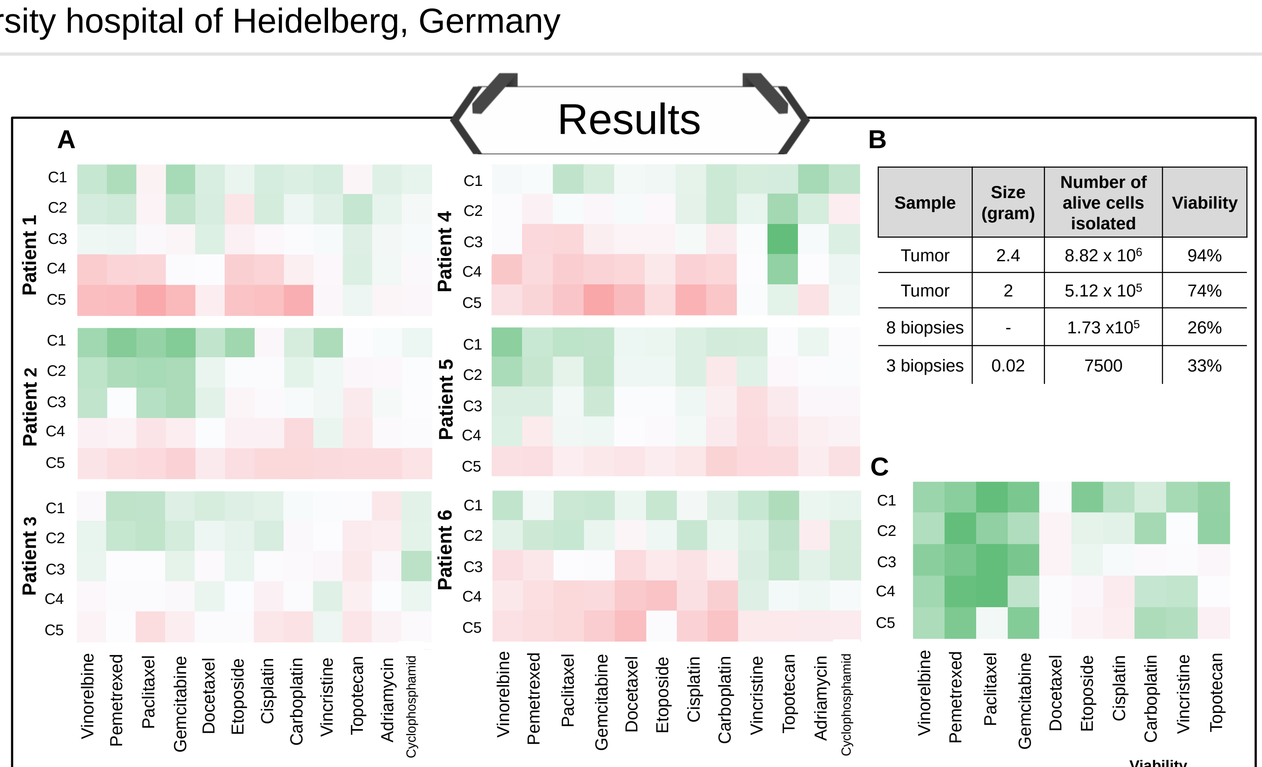
- **DSRT on DMA chip using patient-derived cells**



- **Hydrogel-based culture on DMA**



Results



Sample	Size (gram)	Number of alive cells isolated	Viability
Tumor	2.4	8.82 x 10^6	94%
Tumor	2	5.12 x 10^5	74%
8 biopsies	-	1.73 x10^5	26%
3 biopsies	0.02	7500	33%

Figure 2. The effects of anti-cancer compounds on patient-derived cells cultured on DMA slide. A) C1 shows the lowest and C5 shows the highest concentration of the drugs. B) Comparison between the number of cells isolated from tumor, 8 and 3 needle biopsies. C) The effects of anti-cancer compounds on cells derived from 8 needle biopsies.

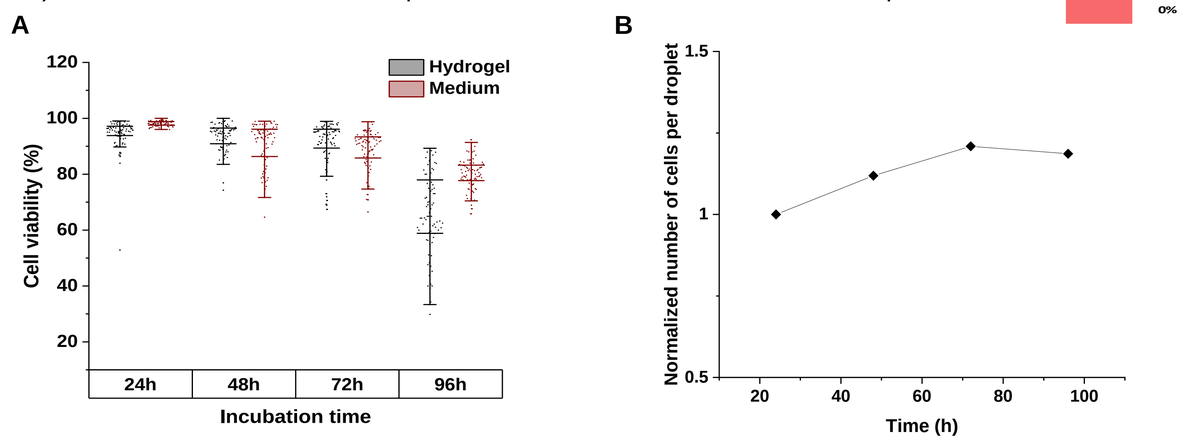


Figure 3. Viability and proliferation of cells cultured in hydrogel. A) Viability of cells cultured in hydrogel and liquid droplets for 24, 48, 72 and 96 hours. B) proliferation of cells cultured in hydrogel from 24 to 96 hours of incubation. The average was taken from 84 repeats.

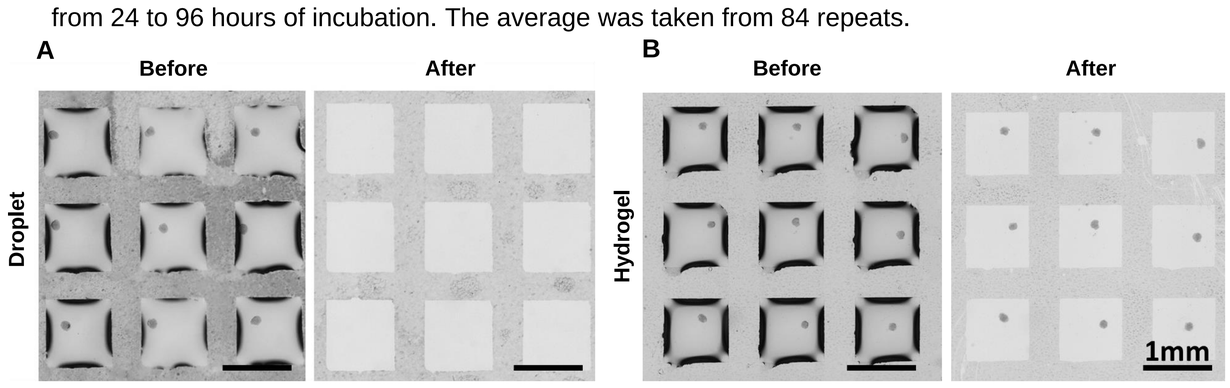


Figure 4. Gelation of single spheroid array on the DMA slide. Microscope images of array of 3 x 3 liquid droplets (A) and hydrogels (B) containing single spheroids before and after immersion in PBS.

Conclusion

Our findings highlight the potential of DMA technology in improving drug sensitivity assays by:

- ✓ minimizing cell and reagent consumption
- ✓ facilitating high-throughput drug screening on patient-derived cells
- ✓ generating a homogeneous array of hydrogels that are stable during washing steps
- ✓ flexibility in experimental design by gelation of droplets at any time point of the study

Acknowledgment

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