



Support from NSF 0227700-Dr. Mary Poets



# NON-THERMAL PLASMA BIO-PRINTER WITH NANO-SCALE PRECISION

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## Targeted Deposition

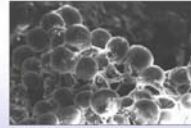


- **Idea** is to design a system for targeted bioactive substance deposition, or "printing".
- **Issues** to be addressed:
  - Micro and sub-micrometer precision
  - Operating at room temperature and pressure
  - Varying liquid chemical compositions
  - Minimal mechanical strain

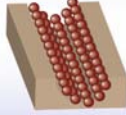
## Applications



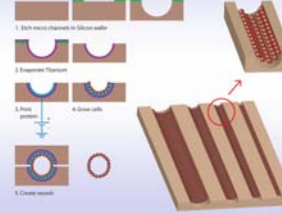
- **Tissue Engineering:** control adhesion of cells and tissue assembly



Development of an etched well being on the lateral surface of microwells.



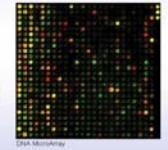
## Tissue Engineering



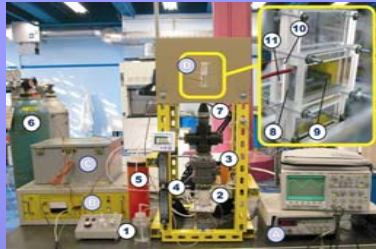
## Applications



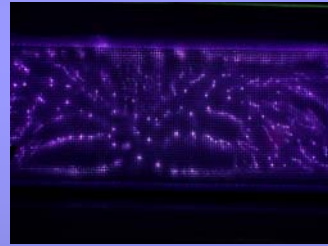
- Improved BioChip manufacturing process



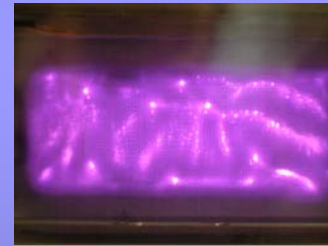
DNA Microarray



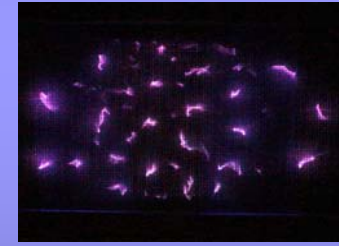
### Working Model



### Dry Helium Plasma



### Dry Argon Plasma



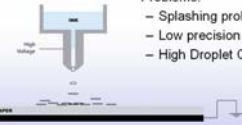
### Wet Argon Plasma

## Electro-Spray



Existing State-of-the-art technology

- In electro-spray, droplets are "ripped" off the nozzle by high electric fields
- **Problems:**
  - Splashing problems
  - Low precision / high droplet speed
  - High Droplet Charge

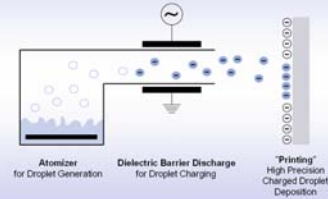


## Plasma BioPrinter



- Use liquid droplets as media carriers
- Charge Droplets in DBD Plasma in inert gases (Ar, He)
- Print using electric field
- **Advantages:**
  - Independent of chemical composition of the solvent
  - Non-contact printing
  - Gentle charging
  - High precision

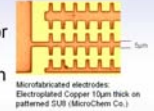
## Plasma BioPrinter



## Current Tasks



- Bio-active materials printing & survival tests for various proteins
- Microfabricated deposition electrodes for increased precision
- Microfabricated plasma electrodes for plasma uniformity



Microfabricated electrodes: Electroplated Copper 10µm thick on patterned SU-8 (MicroChem Co.)