

# 2011 中技社科技研究獎學金

## CTCI Science and Technology Research Scholarship

### Dielectrophoresis of Bacteria for Rapid Assessment of Antimicrobial Susceptibility

#### 介電泳法應用於細菌之藥物感受性的快速評估

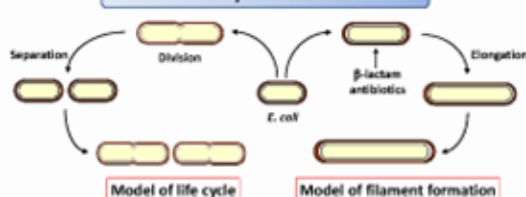
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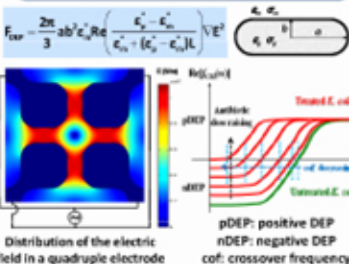
#### Introduction

- We present a **dielectrophoresis-based antimicrobial susceptibility testing (d-AST)** to assess the minimum inhibitory concentration (MIC) and discriminate the drug resistance within two hours.
- The urinary tract infection (UTI) is a bacterial infection that effects any part of the urinary tract. Most UTIs caused by Enterobacteria species that include *Escherichia coli* (*E. coli*, ~80%), *Klebsiella pneumoniae* and *Proteus mirabilis*.
- The cephalosporins (a class of  $\beta$ -lactam antibiotics), which are used to treat UTIs commonly, disrupt the synthesis of the peptidoglycan layer of bacterial cell walls.

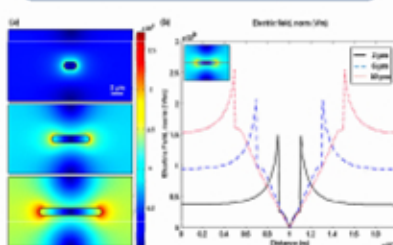
#### Cell cycle of *E. coli*



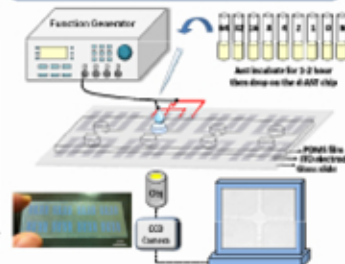
#### Dielectrophoresis (DEP)



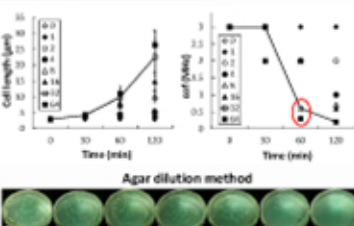
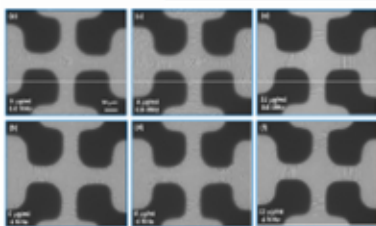
#### Induced electric fields of elongated cells



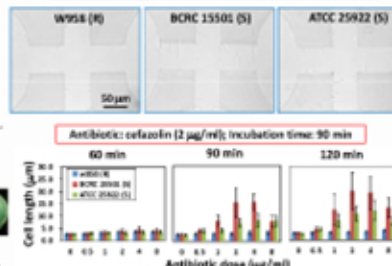
#### Configuration of d-AST system



#### Assessment of antimicrobial susceptibility of *E. coli*



#### Rapid screening of drug resistant *E. coli*



#### Summary

- To compare with the conventional methods (E-test, disk diffusion and broth dilution), the d-AST reduced the detection time from days to hours (1-2 hr).
- The approach can be used for other Gram-negative bacilli, like *Pseudomonas aeruginosa*, *Proteus mirabilis*, and *Klebsiella pneumoniae* that also cause UTIs.
- The bacterial culture and drug delivery can be integrated into the microfluidic chip to achieve the "Lab-on-a-Chip".

#### Throughput

Paper: Cheng-Che Chung, I-Fang Chang, Wen-Hong Yang, Hsien-Chang Chang, Antimicrobial susceptibility test based on the dielectrophoretic behavior of elongated *Escherichia coli* with cephalosporin treatment, *Biomicrofluidics*, 5:021102, 2011.  
 Patent: 鍾政哲、鄭宜昉、楊文宜、張憲彰, 微生物抗藥性與抗生素最小抑制濃度之檢測方法, 中華民國專利, 申請案號 100123735.  
 Honor: 鍾政哲、鄭宜昉、陳慶斌、張憲彰, 快速、簡易的細菌之藥敏分析晶片, 2011年第八屆國家新創獎學生組第一名。