THE NEED FOR ALTERNATIVE DRUG DELIVERY STRATEGIES

- Repetitive admin.
- Large drug doses
- Adverse side effects
- Poor compliance

✓ Sustained release
✓ Minimization of drug dose
✓ Reduced side effects
✓ Assure compliance

✓ Bio-responsive
✓ Ad hoc delivery
SUSTAINED DRUG DELIVERY SYSTEMS

- Reservoir-based polymeric Implants
- Biodegradable polymeric rods
- Long-acting depots

- Osmotic pumps
- Wearable external pumps
- MicroCHIP devices
NANOFLUIDICS

Concentration-driven transport

Electrokinetic transport

Free → Exponential (Fick’s Law)

Constrained → Constant

5.5 nm

No pumps
No valves

Cumulative Release (μg)

0 20 40 60 80 100 120

Time (Days)

0 0.5 1 1.5 2

A B A B A
NANOCHANNEL MEMBRANE
Ferrati et al. *J. Controlled Release*, 2013
HIV STATISTICS

Number of new HIV infections in 2016 and change since 2010

- 1.8 million people newly infected in 2016 globally
- Decrease in number of new infections across the global population each year since 2010
- 16% decrease

- 190,000 E. Europe and Central Asia (60%)
- 270,000 Asia Pacific (13%)
- 18,000 Middle East and N. Africa (9%)
- 790,000 East and Southern Africa (29%)
- 370,000 Western and Central Africa (5%)
- 72,000 W. and C. Europe and N. America (4%)
- 115,000 Latin America and Caribbean (9%)

AVERT.org
Source: UNAIDS Data 2017
**HIV PrEP FACTS**

**PrEP Works...If You Take It**

<table>
<thead>
<tr>
<th>Trial</th>
<th>Efficacy</th>
<th>Adherence</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPRISA 004⁶</td>
<td>1% tenofovir gel: 39%</td>
<td>51%</td>
</tr>
<tr>
<td>iPrEx⁷</td>
<td>Oral daily Truvada: 42%</td>
<td>51%</td>
</tr>
<tr>
<td>Partners PrEP⁸</td>
<td>Oral daily tenofovir: 67%</td>
<td>83%</td>
</tr>
<tr>
<td></td>
<td>Oral daily Truvada: 75%</td>
<td>81%</td>
</tr>
<tr>
<td>TDF2⁹</td>
<td>Oral daily Truvada: 62%</td>
<td>81%</td>
</tr>
</tbody>
</table>

**TRUVADA (Gilead) = TDF + FTC**

TDF = Tenofovir Disoproxil Fumarate (nucleoside reverse transcriptase inhibitor)
FTC = Emtricitabine (NRTI)
TAF = Tenofovir Alafenamide Fumarate (nucleotide reverse transcriptase inhibitor)

NANOFLOWIDIC IMPLANT FOR HIV PREVENTION
NANOFUIDIC IMPLANT FOR HIV PREVENTION TAF+FTC

Chua et al. JCR, Accepted, 2018
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