Silicon Nanowire for Sensing

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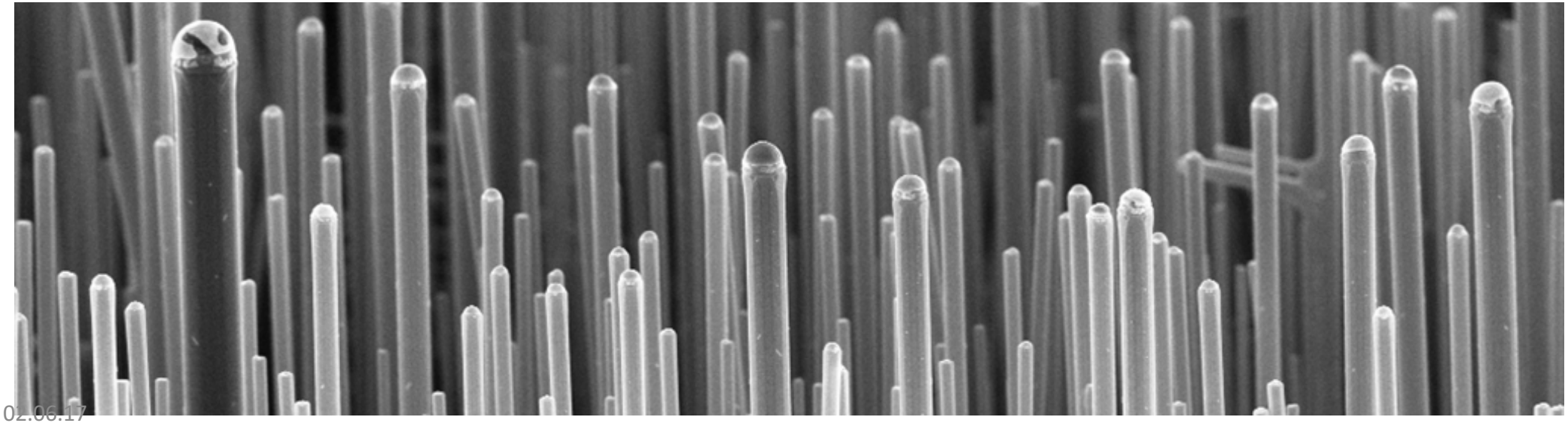
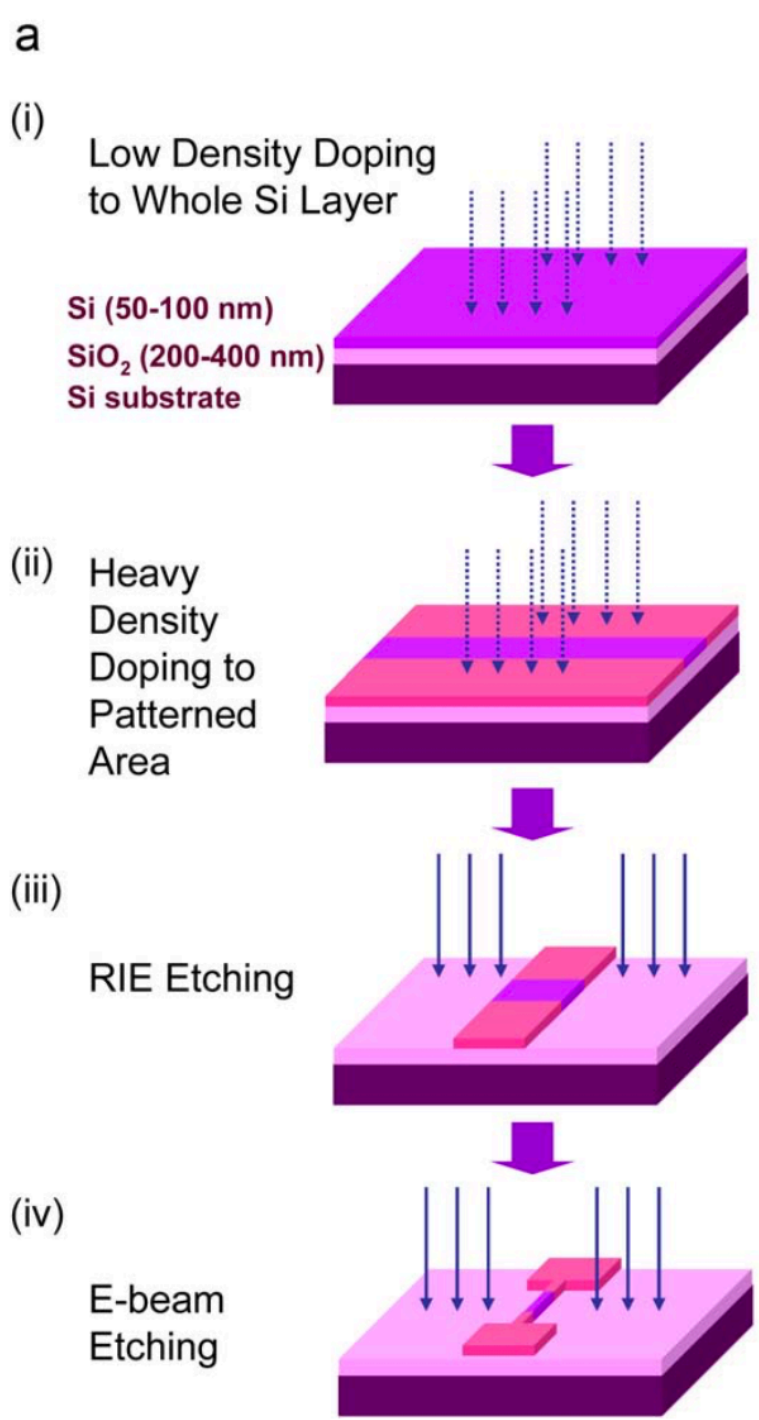
Silicon Nanowire

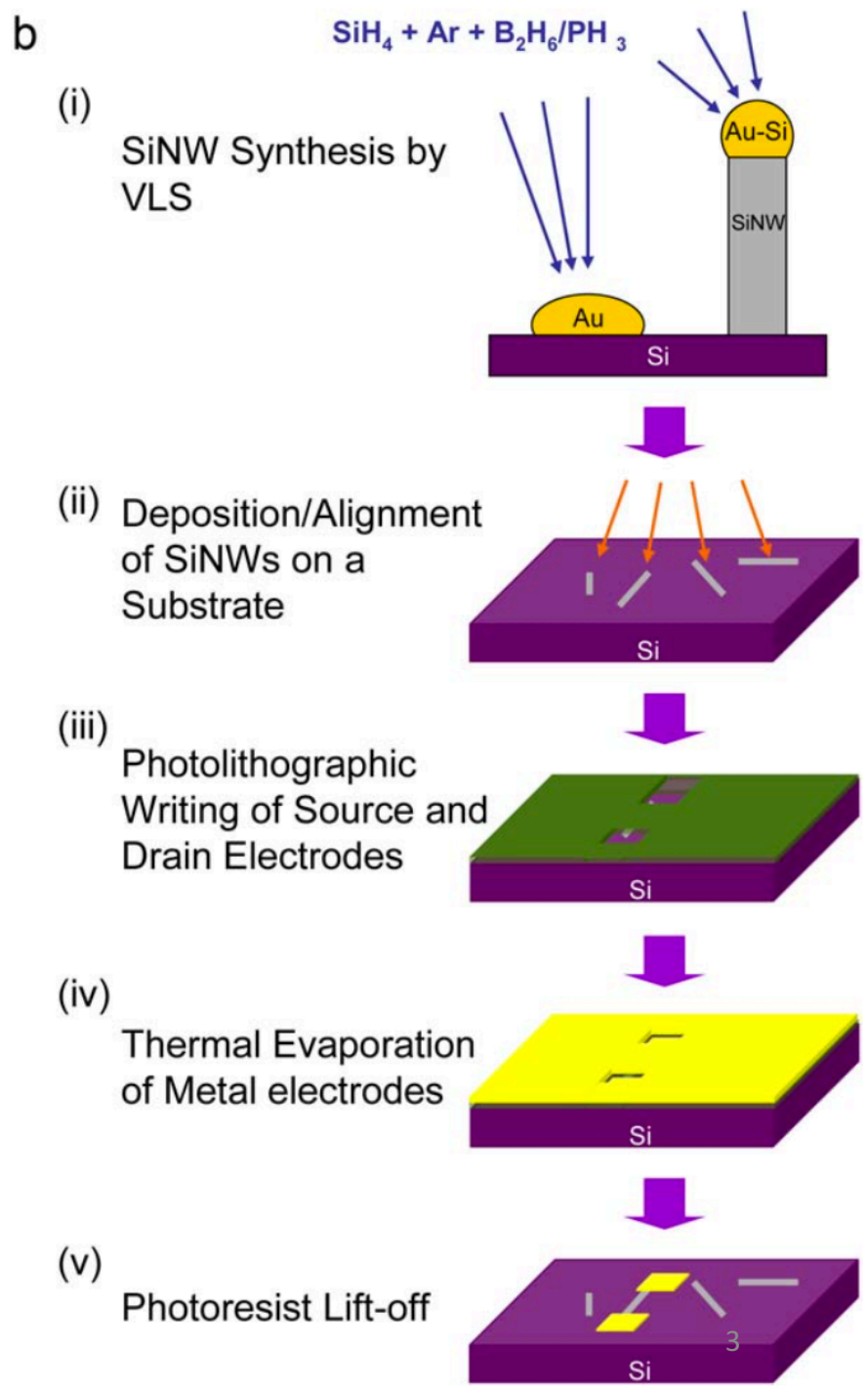
- 1-D nanomaterial, single crystalline
- Introduced 2001
- Sensing of ions, small molecules, nucleic acids or proteins
- Ultra sensitive



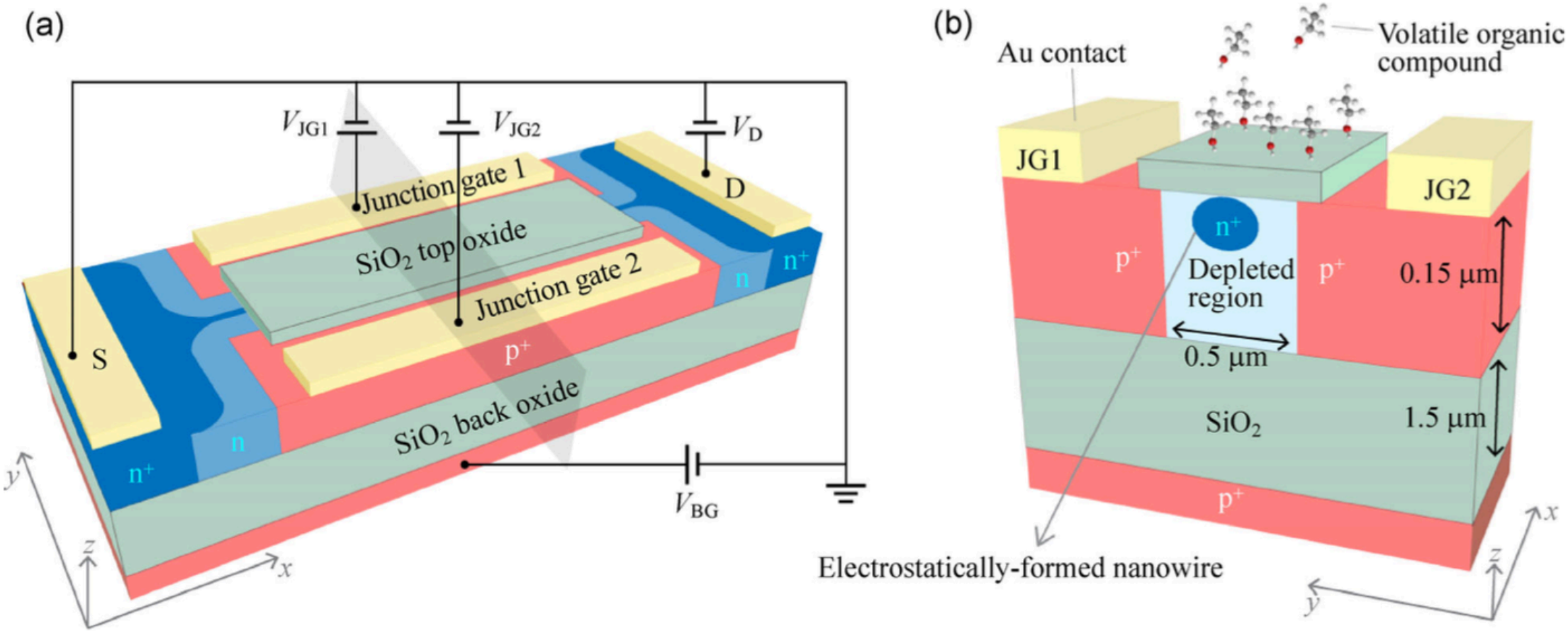
Fabrication

- Top-down (a)
  - Expensive
  - Time consuming
  - 20-100nm
- Bottom-up (b)
  - No mass product
  - Alignment
  - <10nm possible

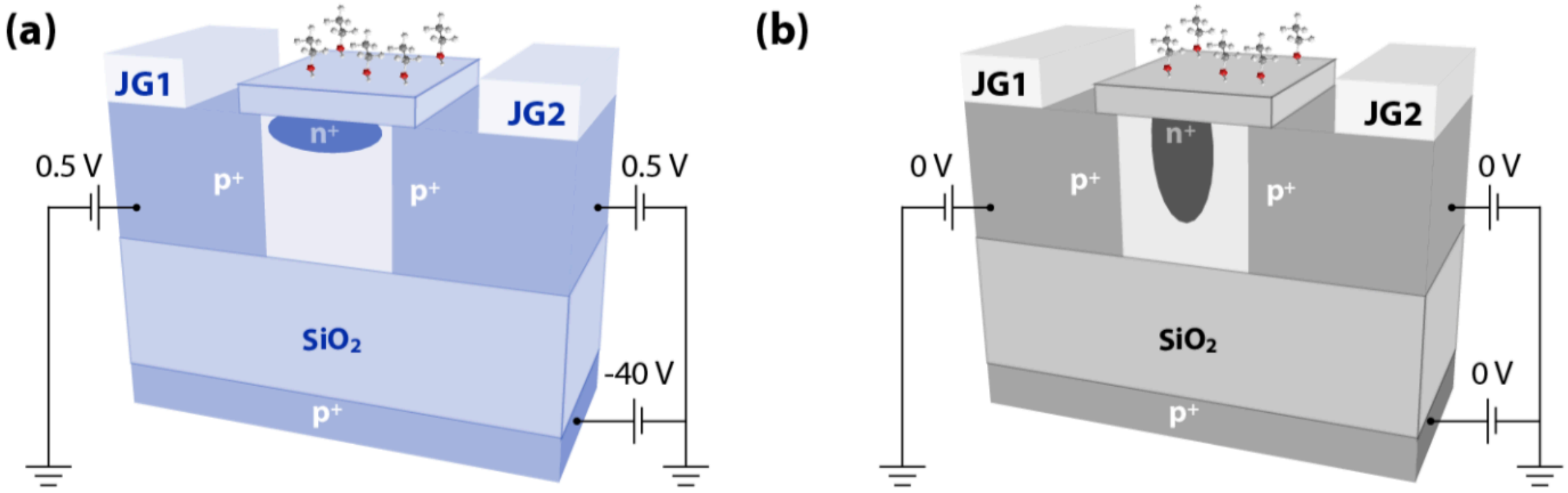




Electrostatically formed Nanowire

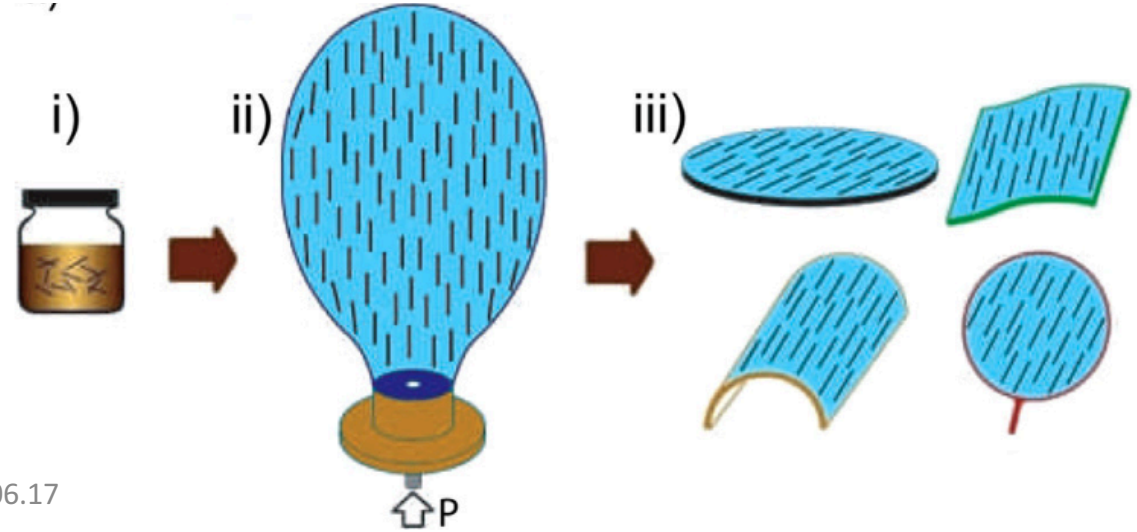


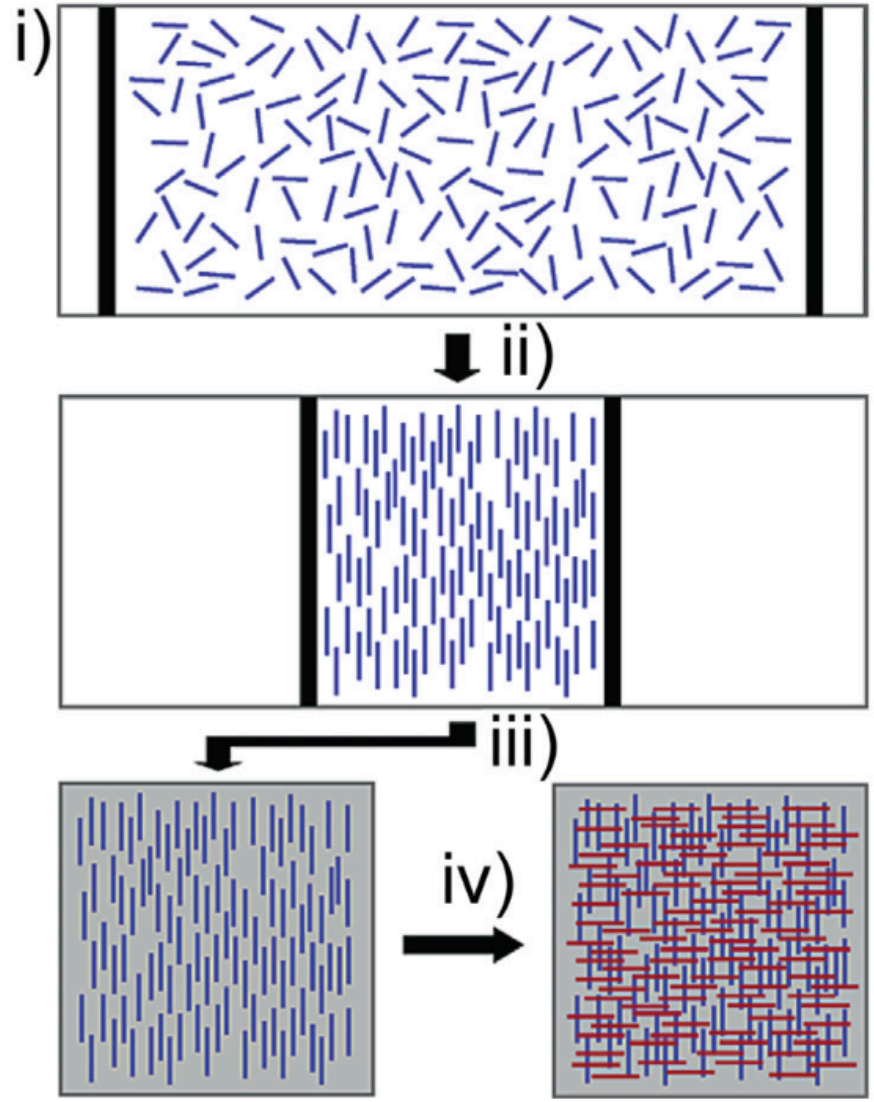
Tuning and Scanning



Controlled Alignment

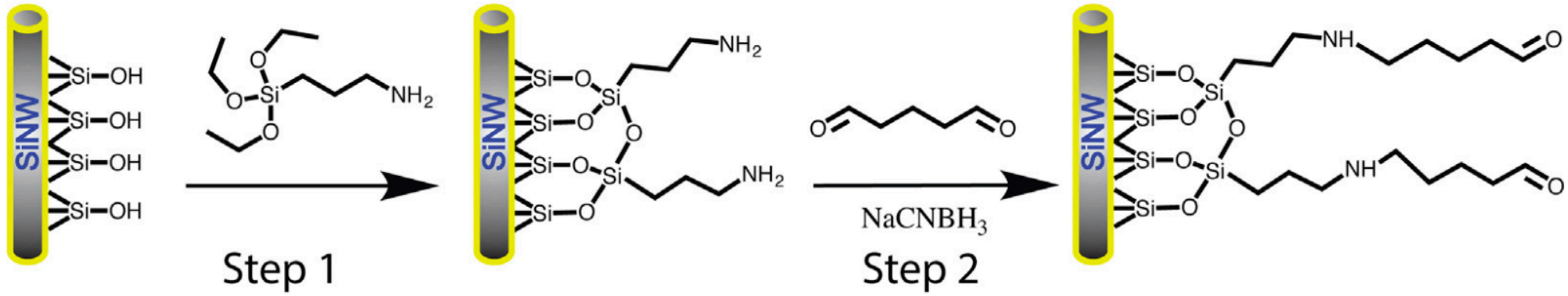
- Lengmuir-Blodgett
  - Water-air interface
  - 8-10 NW per μm
- Blown-bubble
  - Gas flow 1 NW per 3 μm





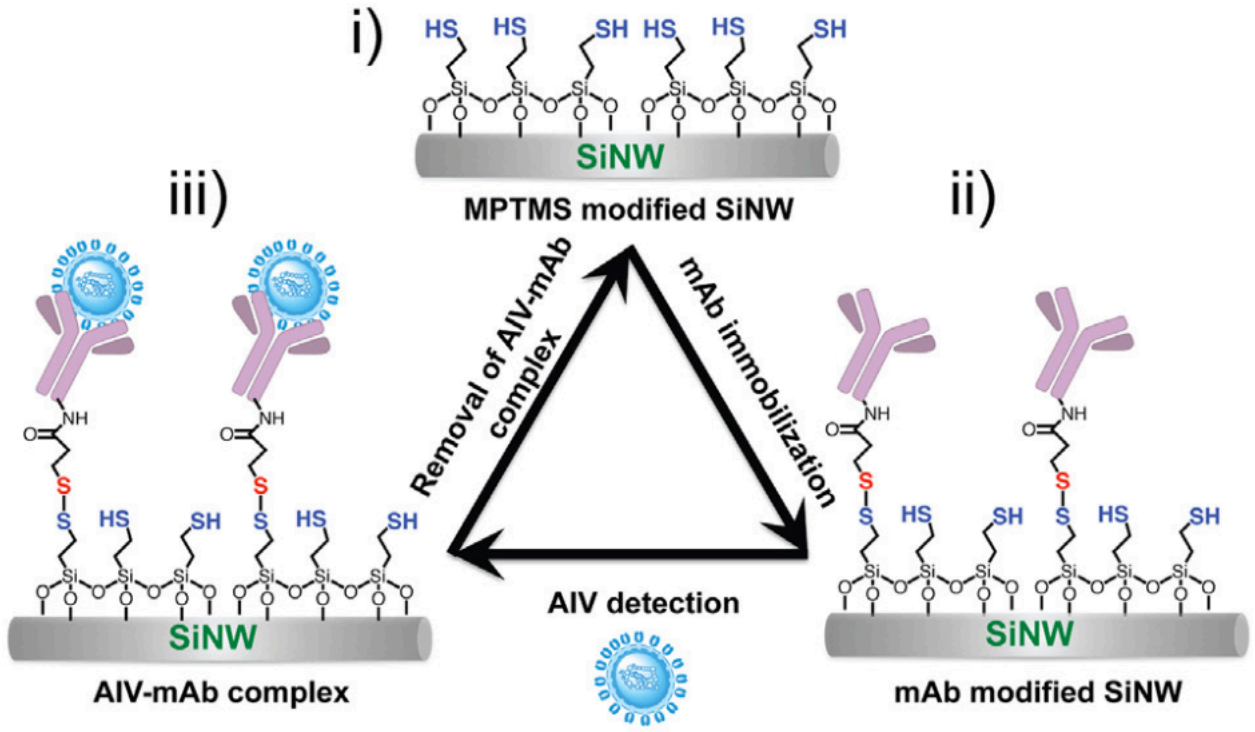
Surface functionalization

- 1-2 nm native oxide layer
- Silanol groups



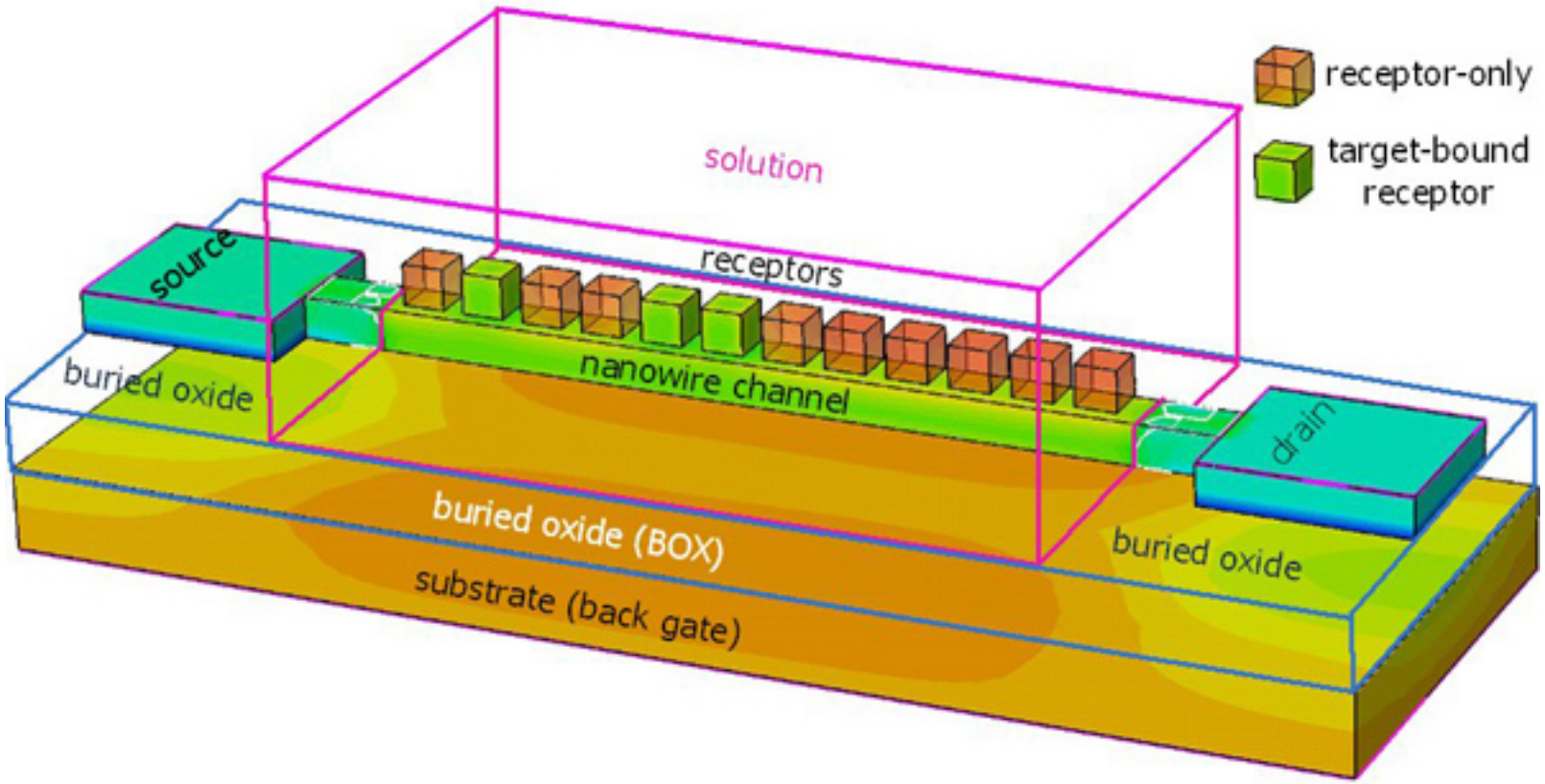
Reusable Surface

- Functional group
- Antibody
- Sensing
- Clean an reuse



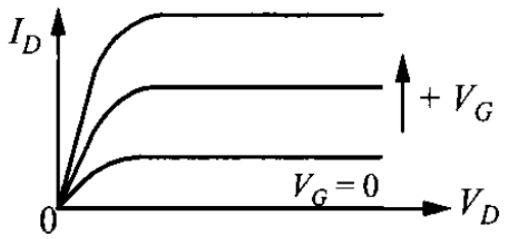
How it works

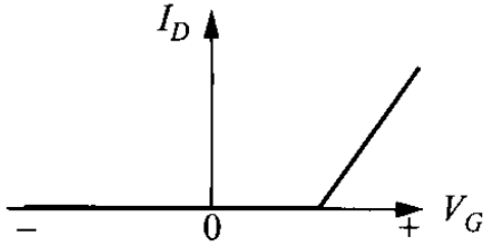
- Receptors on SiNW
- Between S and D
- Sensing solution
- Change of conductance

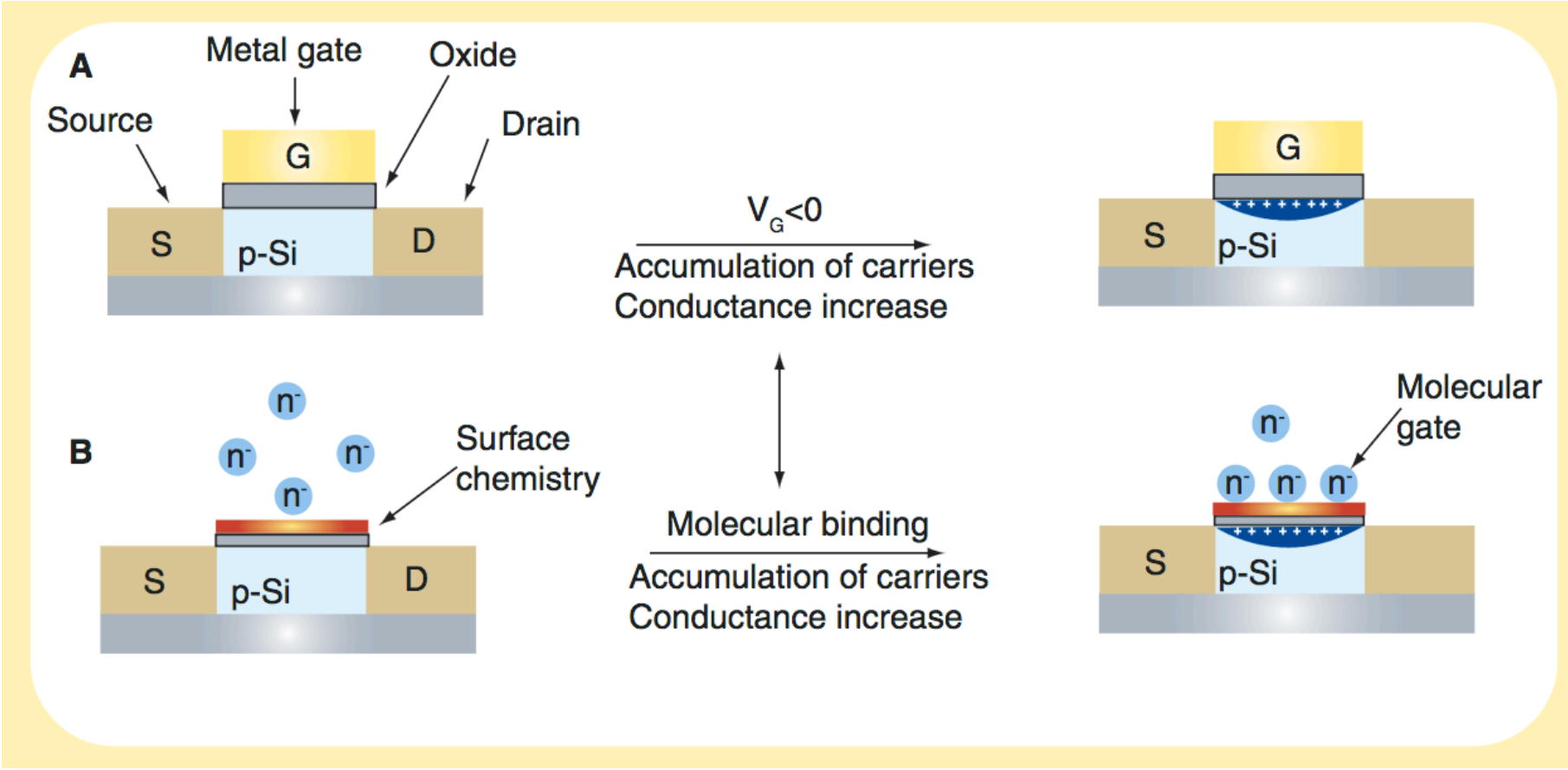


FET

n-channel
Enhancement-mode
(Normally-off)

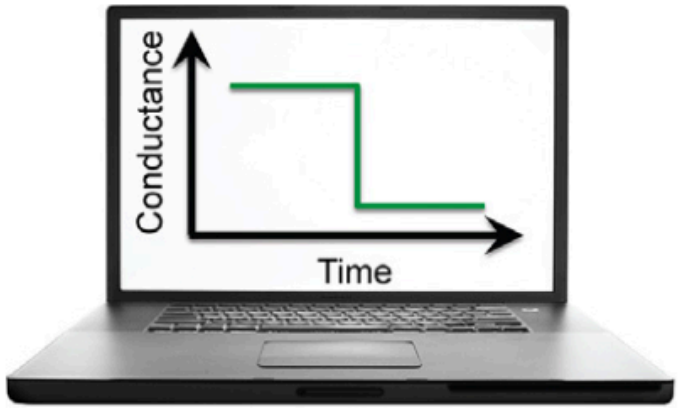


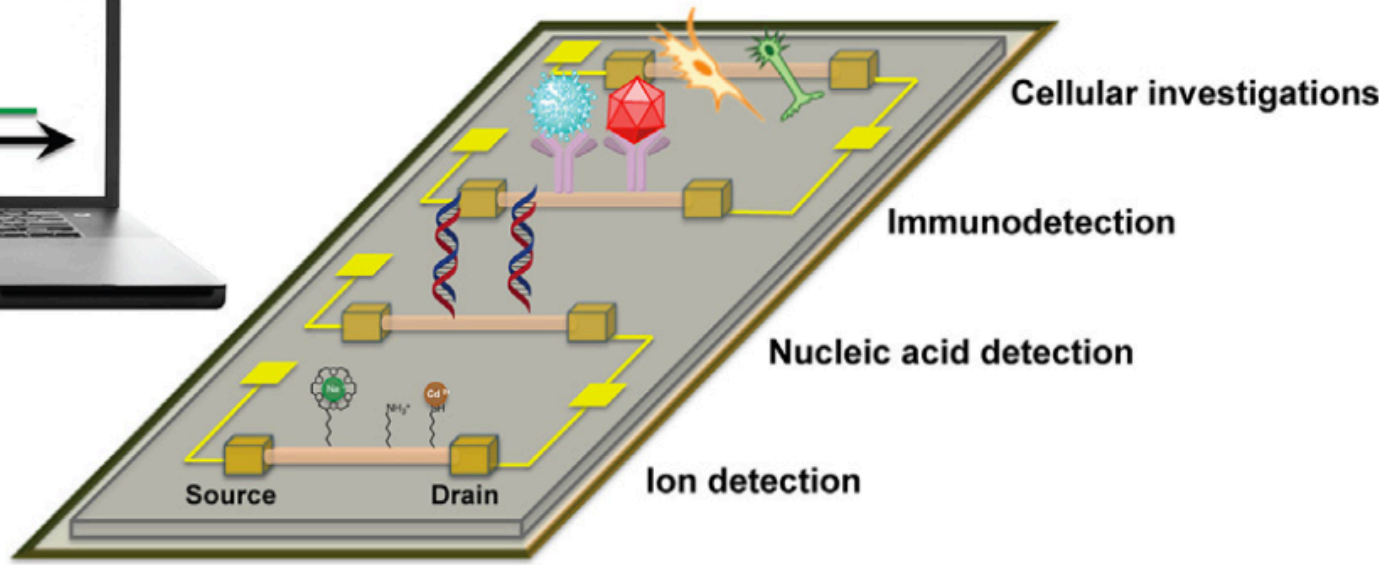




Summary

- Small
- Low cost
- Label-free
- Real-time
- Sensitive
- Diagnostics of diseases
- Screening
- Environmental monitoring





References

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- Silicon nanowires as field-effect transducers for biosensor development: a review; M. Omair Noor et al 2013
- Silicon Nanowire Field-Effect transistors a versatile class of potentiometric nanobiosensors; Luye M U et al 2015
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