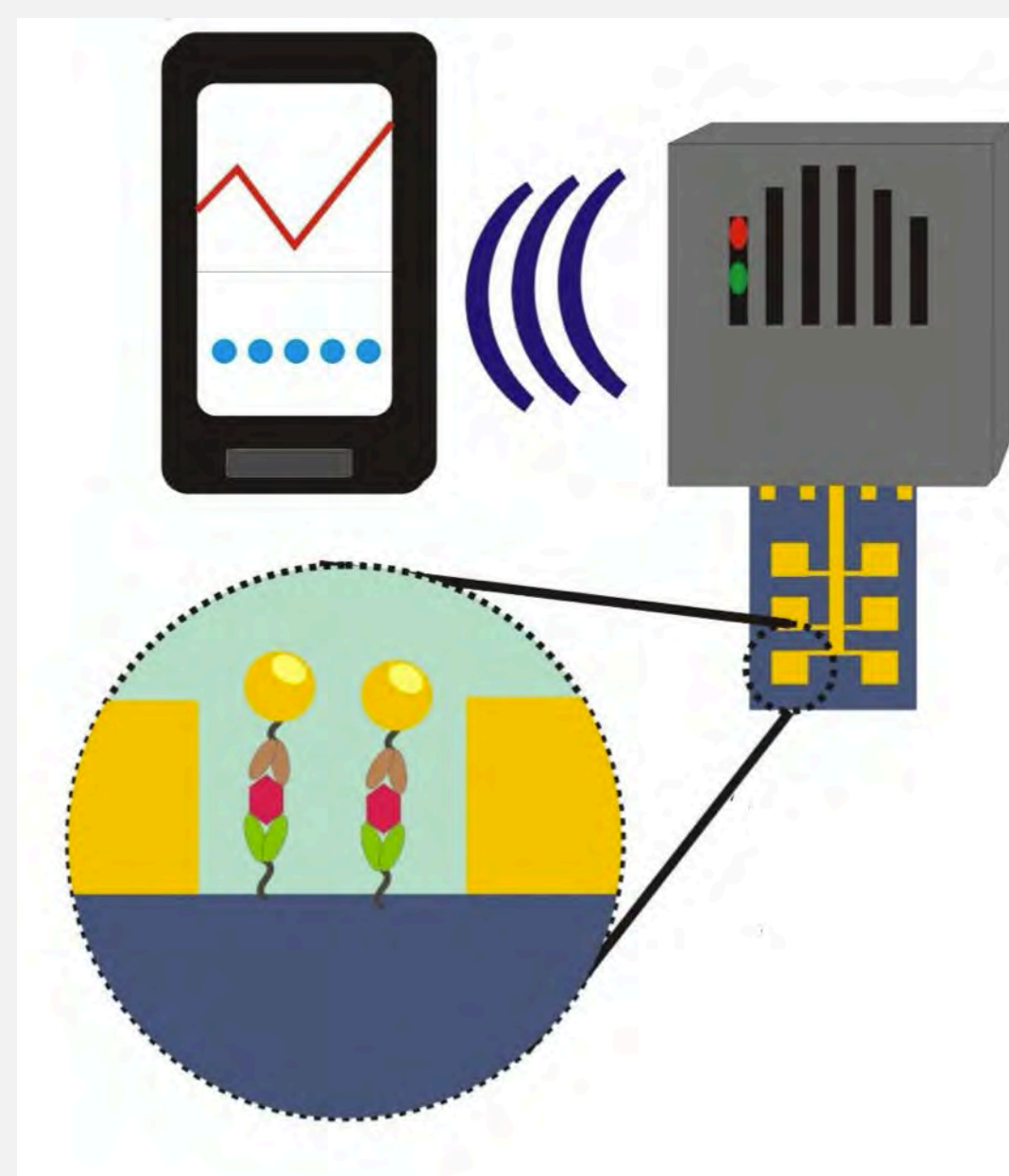
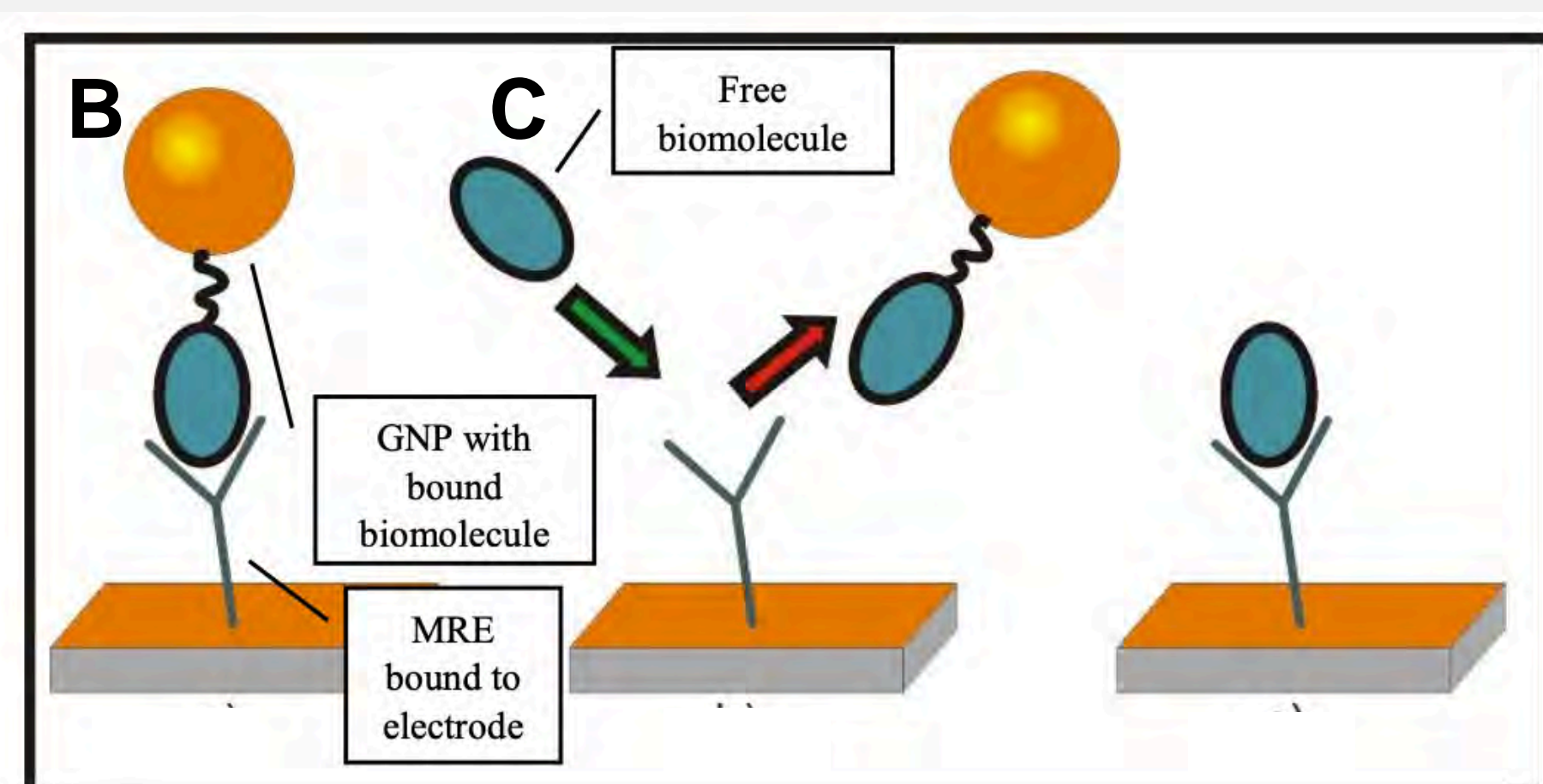
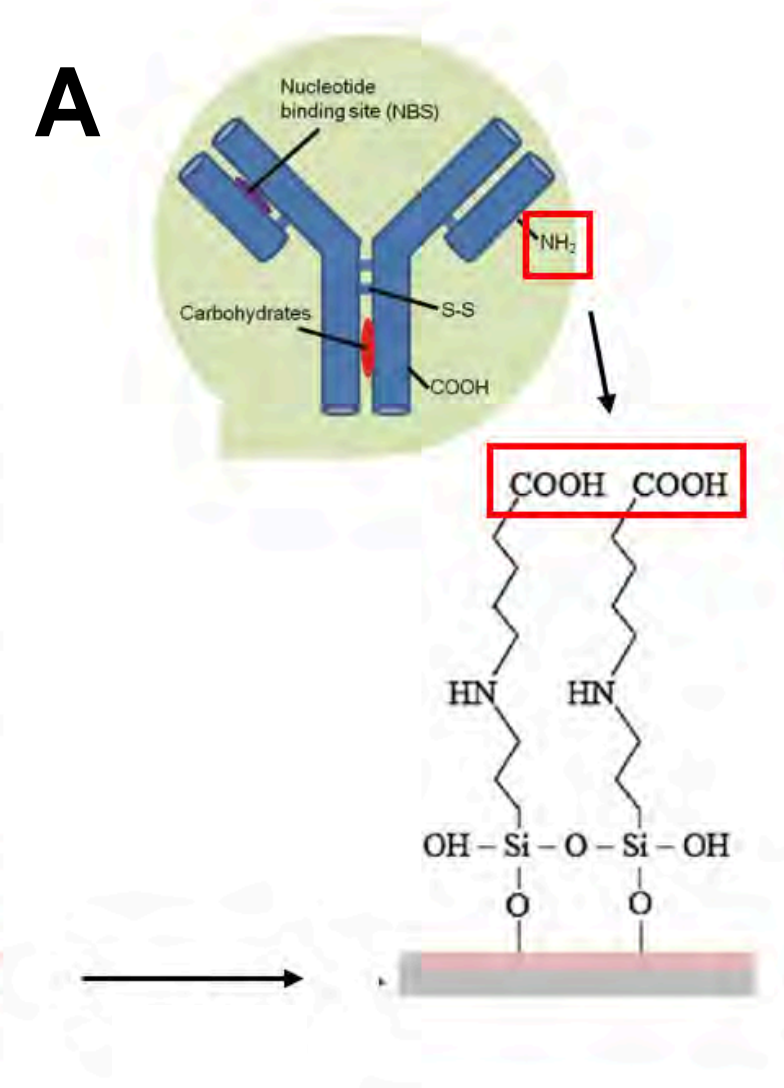


## Introduction

- Colorectal cancer represents 10% of estimated new cancer cases and 11% of estimated cancer deaths in 2022
- A more reliable, inexpensive and portable test would better allow for point-of-care colon cancer screening
- Three specific urinary metabolites can be used as biomarkers for detecting colon cancer: diacetylspermine, creatinine and hippuric acid
- These metabolites need to be conjugated to liposomes or gold nanoparticles (GNPs) to amplify a change in the electrical impedance of the sensor system
- The binding and detachment of the conjugated metabolites to an electrode surface modified with metabolite-specific antibodies can cause a detectable change in electrical impedance



## Methods



- Attachment of metabolite specific antibody
- Incubation with metabolites conjugated to liposome or GNPs to allow attachment to antibodies
- Competitive binding between conjugated metabolites and free metabolites

## Results

### Impedance Testing



### Scanning Electron Microscopy (SEM)

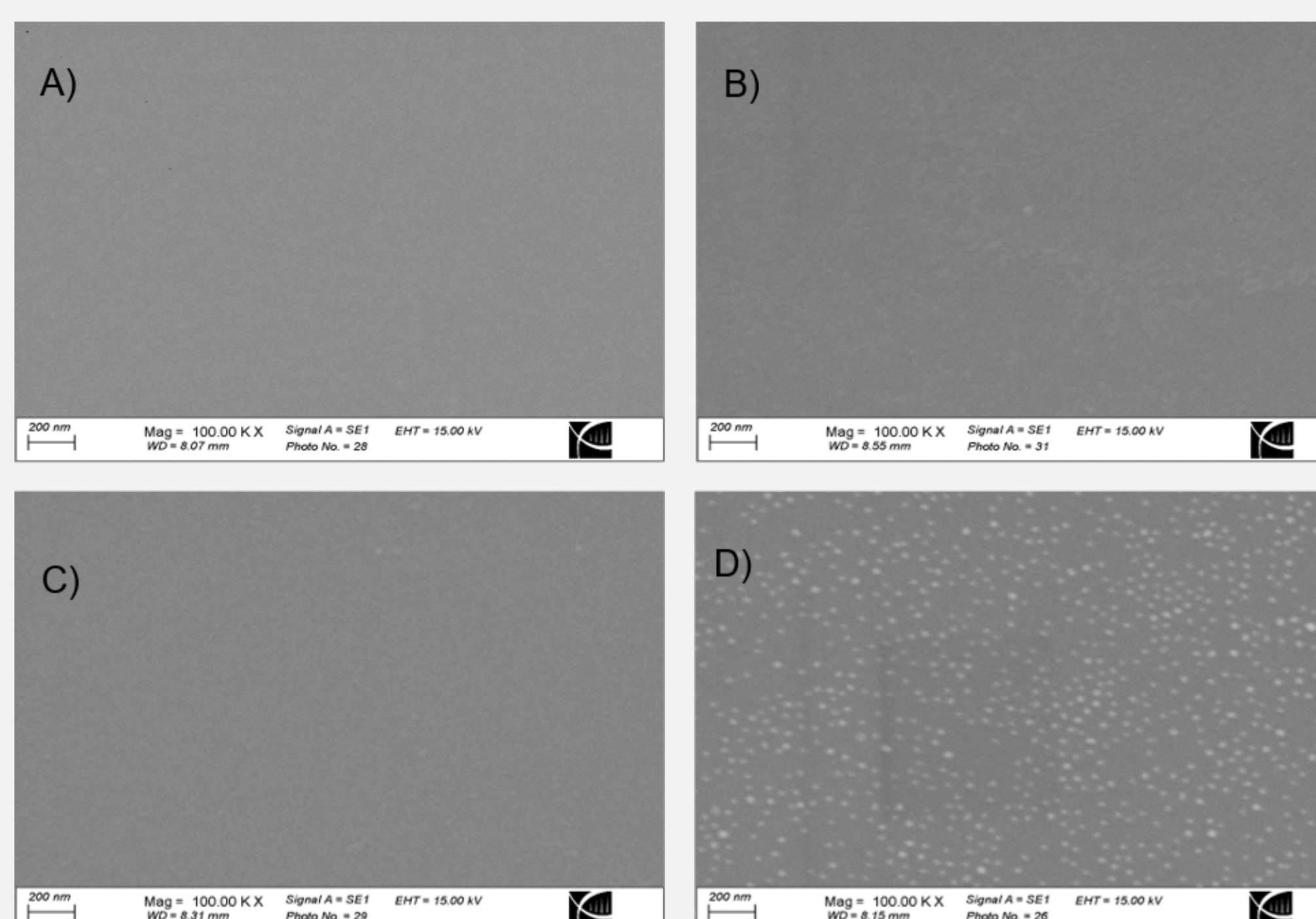


Figure 1. Representative SEM pictures of 1cm by 1cm Silicon Dioxide Wafers. A) No surface modification. B) Addition of APTES. C) Creatinine antibody- treated surface. D) Surface treated with creatinine antibody and GNP-Creatinine

### Atomic Force Microscopy (AFM)

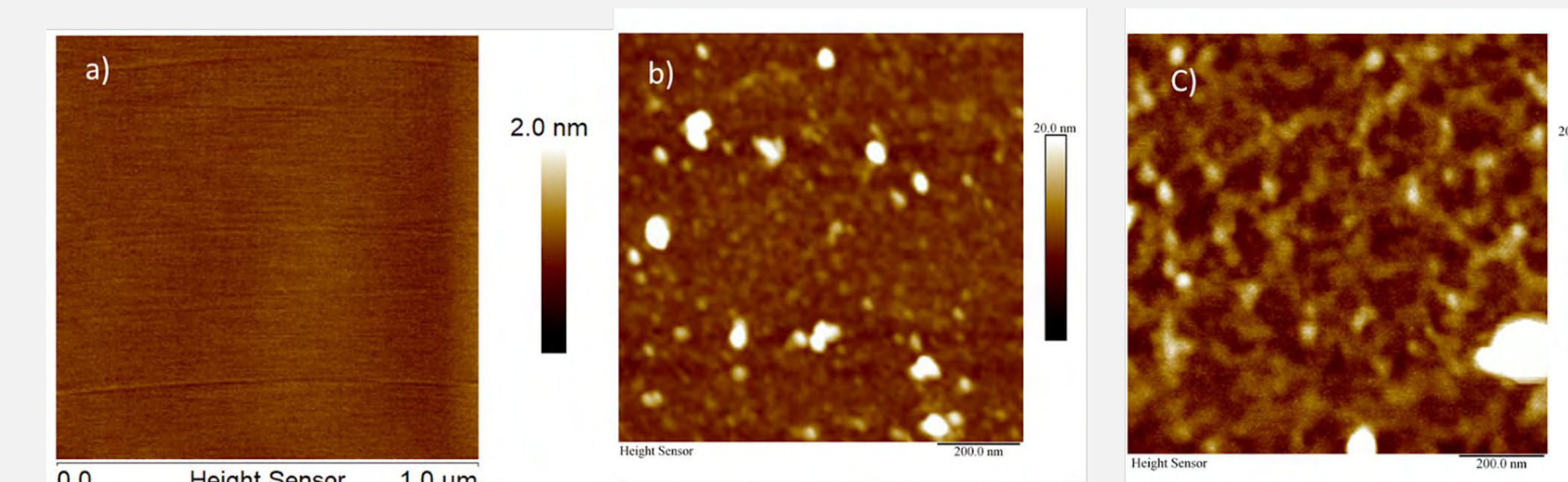


Figure 2. AFM height images of (a) the surface of the electrode with no modifications (b) electrode surface treated with diacetylspermine antibodies and exposed to GNP-AcSpm (c) electrode surface treated with hippuric-acid antibodies and exposed to GNP-Hippuric Acid

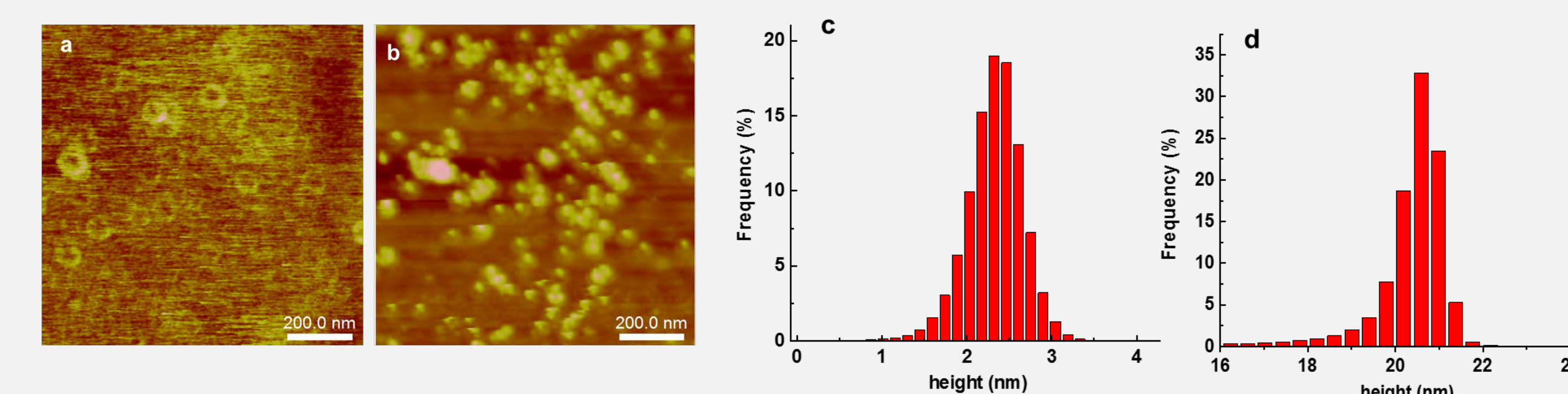


Figure 3. AFM height images of (a) the surface of the electrode with no modifications (b) electrode surface treated with creatinine antibodies and exposed to GNP-creatinine. The corresponding height histograms are shown in (c) and (d).

## Conclusions

- Gold nanoparticles and liposomes can be conjugated to creatinine, hippuric acid and diacetylspermine
- These conjugated nanoparticles can be detected by attaching to the surface of an antibody-modified electrode via impedance signalling

## Acknowledgements



## References

- Mackay, S., 2017, "Design of an Impedance-based, Gold Nanoparticle Enhanced Biosensor System," PhD Thesis, University of Alberta, Edmonton
- Senel S, Kremer M, Katalin N, Squier C. Delivery of bioactive peptides and proteins across oral (buccal) mucosa. Current Pharmaceutical Biotechnology. 2001;2(2):175-186. doi:10.2174/1389201013378734
- Ta TK, Tran TN, Tran QM, Pham DP, Pham KN, Cao TT, Kim YS, Tran DL, Ju H, Phan BT. Surface functionalization of WO3 thin films with (3-aminopropyl)triethoxysilane and succinic anhydride. Journal of Electronic Materials. 2017;46(6):3345-3352. doi:10.1007/s11664-017-5408-x