

Democratization of Next-Generation Imaging, Sensing and Diagnostics Toward Connected Health

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COI Disclosure: Co-founder of Holomic LLC (holomic.com)

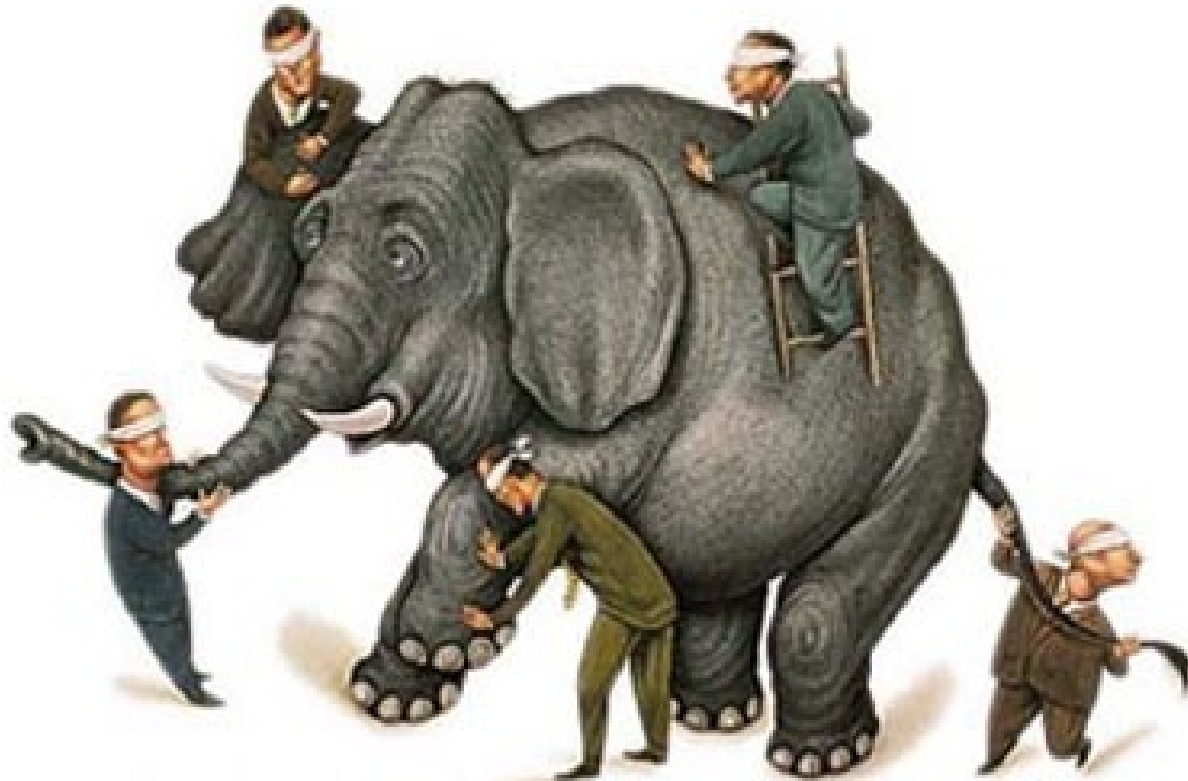


“Technology – broadly defined” will be part of the solution for cancer.

It may not be the most significant or critical element/ingredient for better patient care and outcome, but transformative technologies might open up new avenues and opportunities that could not be imagined before.



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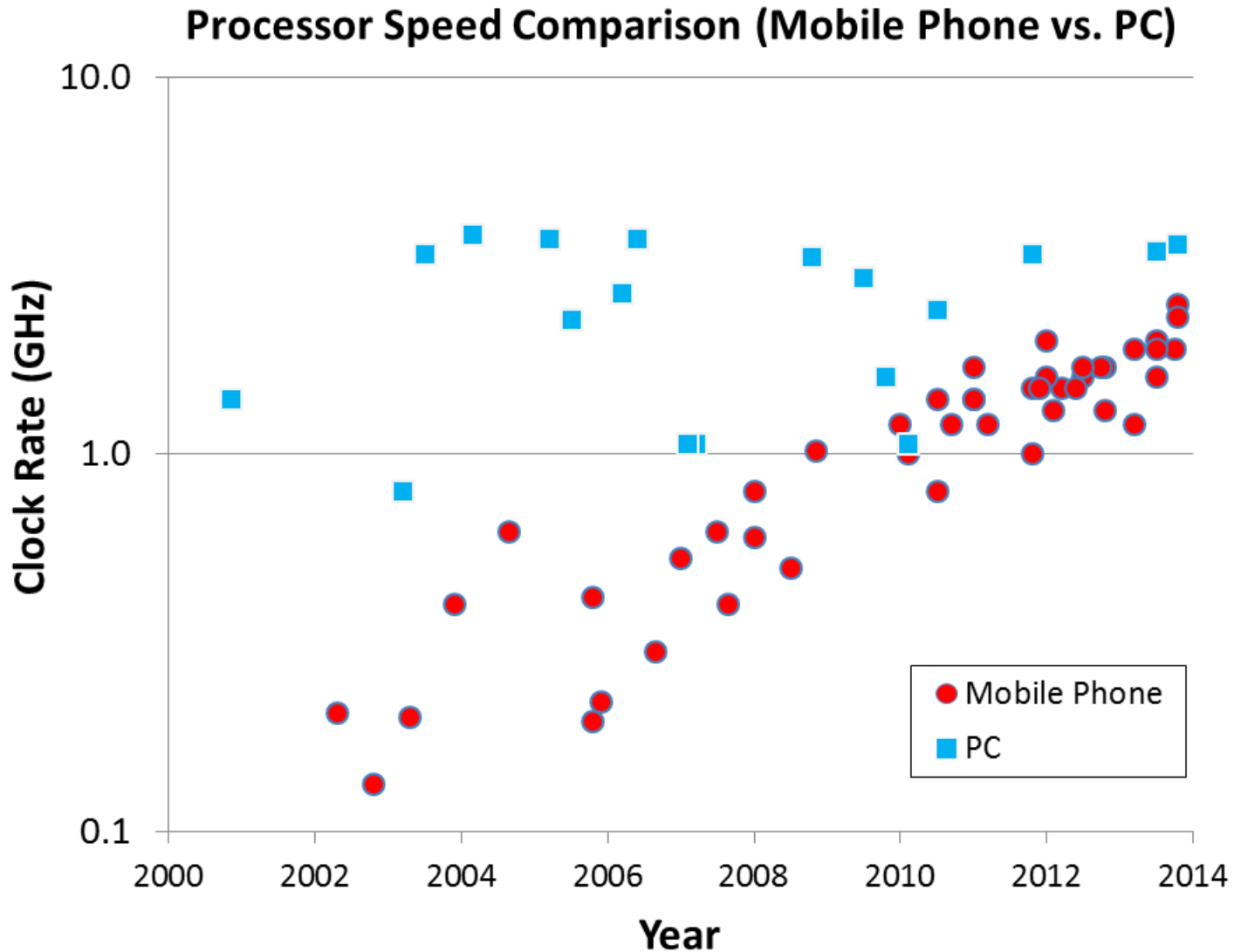
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- Can we convert patient's home into an advanced 24/7 laboratory for medical diagnosis, monitoring of patients, high-risk and aging populations, preventive & personalized medicine?*
 - Manage costs better, early diagnosis, better treatment, better adherence, etc?*
 - Global health & under-served communities: Can cancer diagnostics and care be practiced in resource limited settings using innovative and cost-effective technologies at massive scales?*
 - Harnessing Big/Small Data for better patient outcomes*

Digital Diagnosis



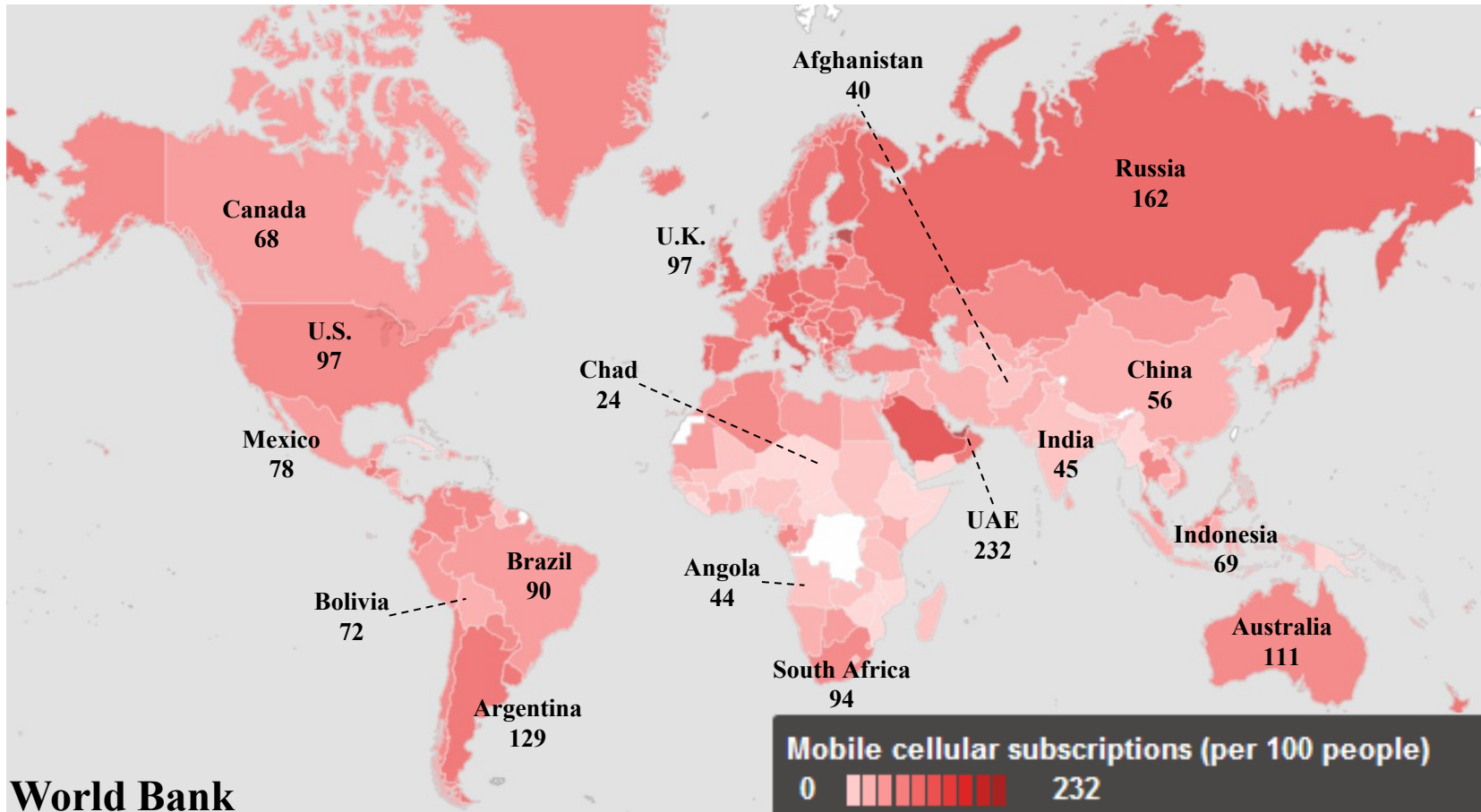


Smart-phones as super-computers





Cell phones are now everywhere: A great potential for connecting patients

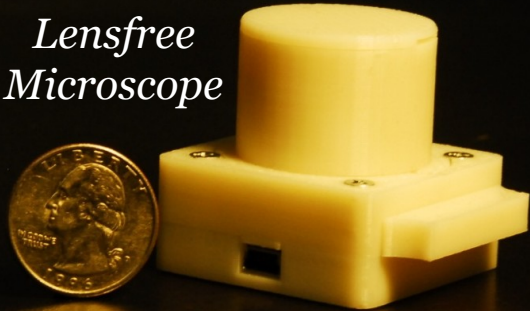


- ~7 billion cell phones are being used worldwide.
- ~15 billion cell phones have been sold so far.
- > 75% are in developing countries. (International Telecommunication Union)

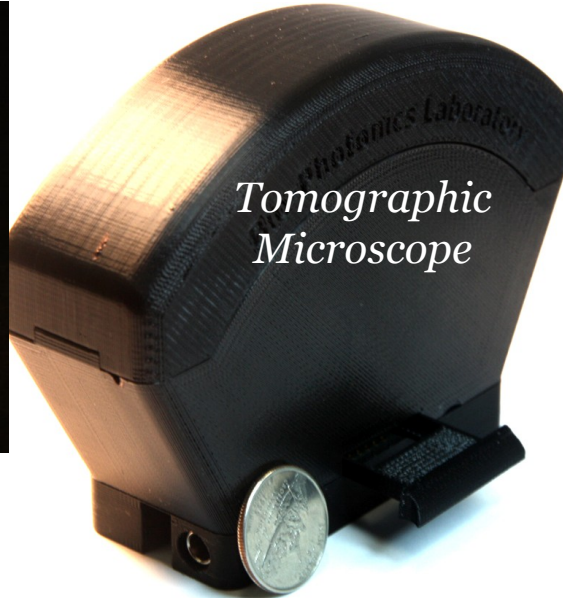


New platforms for connected health

*Lensfree
Microscope*



*Tomographic
Microscope*



*Cellphone
Fluorescent
Microscope*



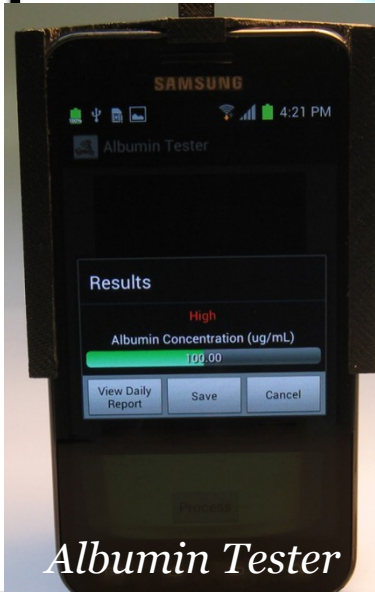
*Lensfree
Super-resolution
Microscope*



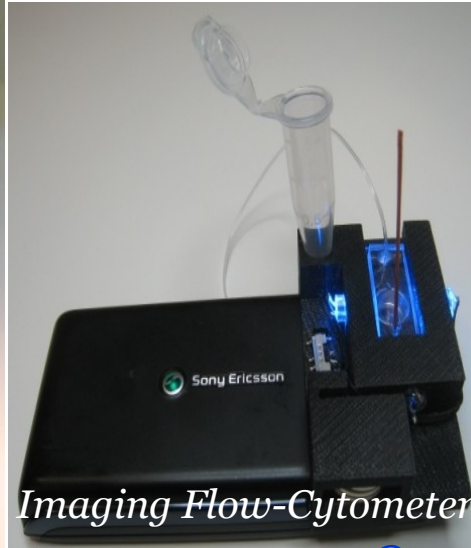
*Cellphone
Holographic
Microscope*



Albumin Tester



Imaging Flow-Cytometer





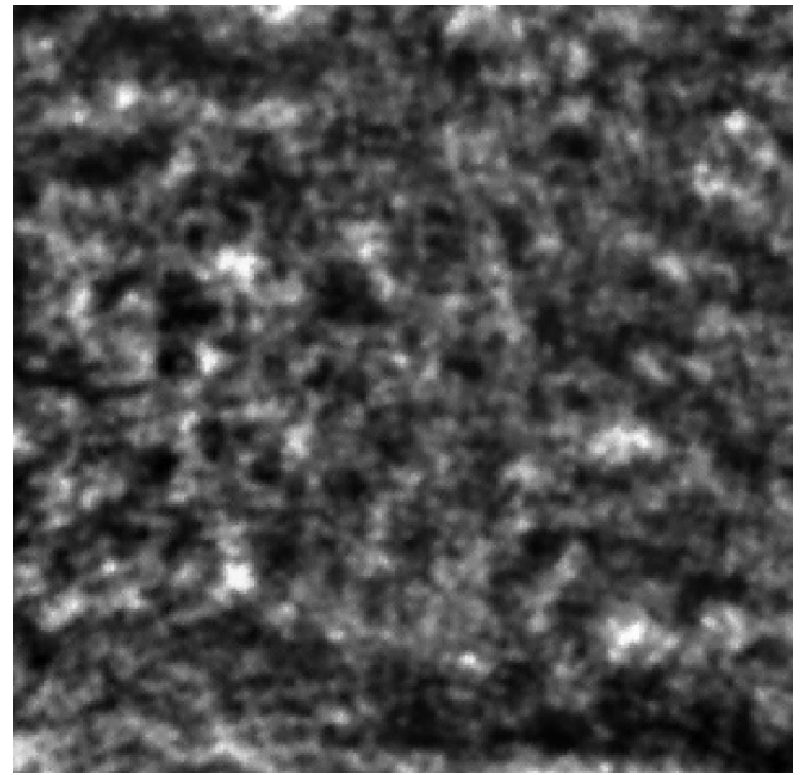
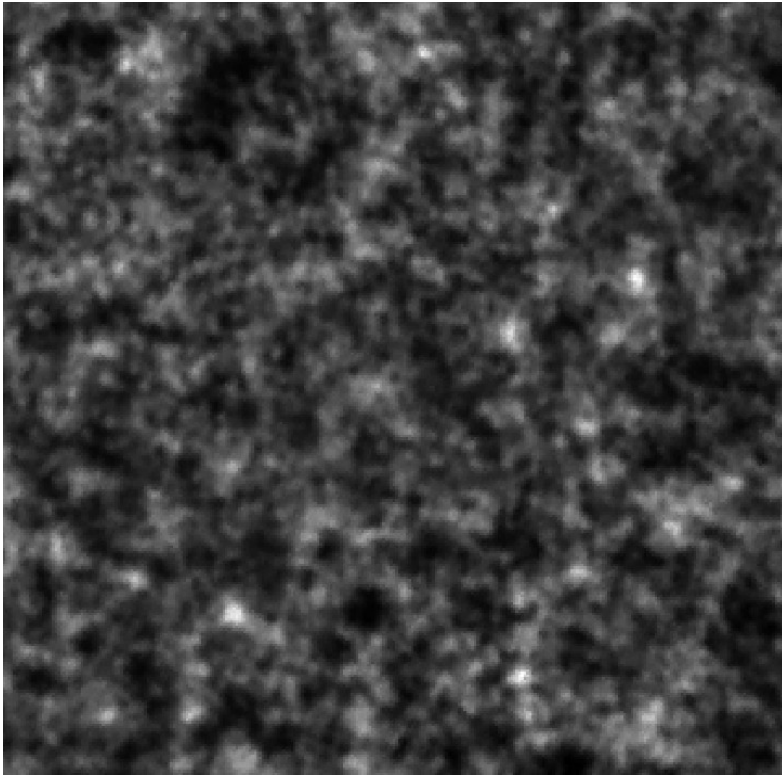
Imaging and reconstruction of shadows

*Lensfree
Super-resolution
Microscope*





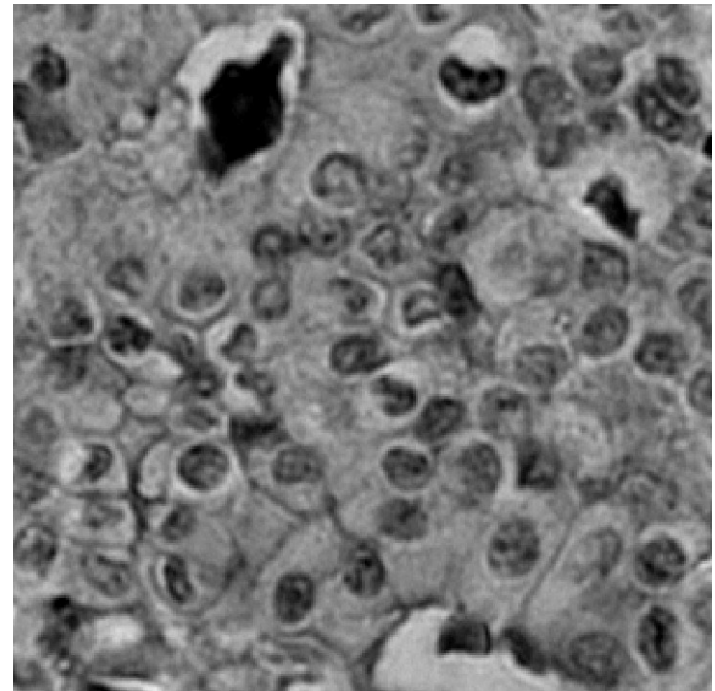
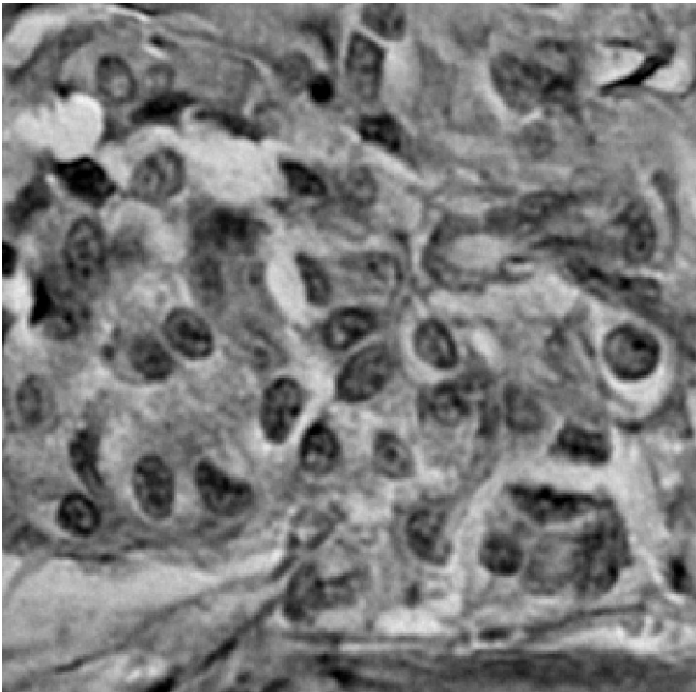
Imaging and reconstruction of shadows



Breast Cancer Tissue



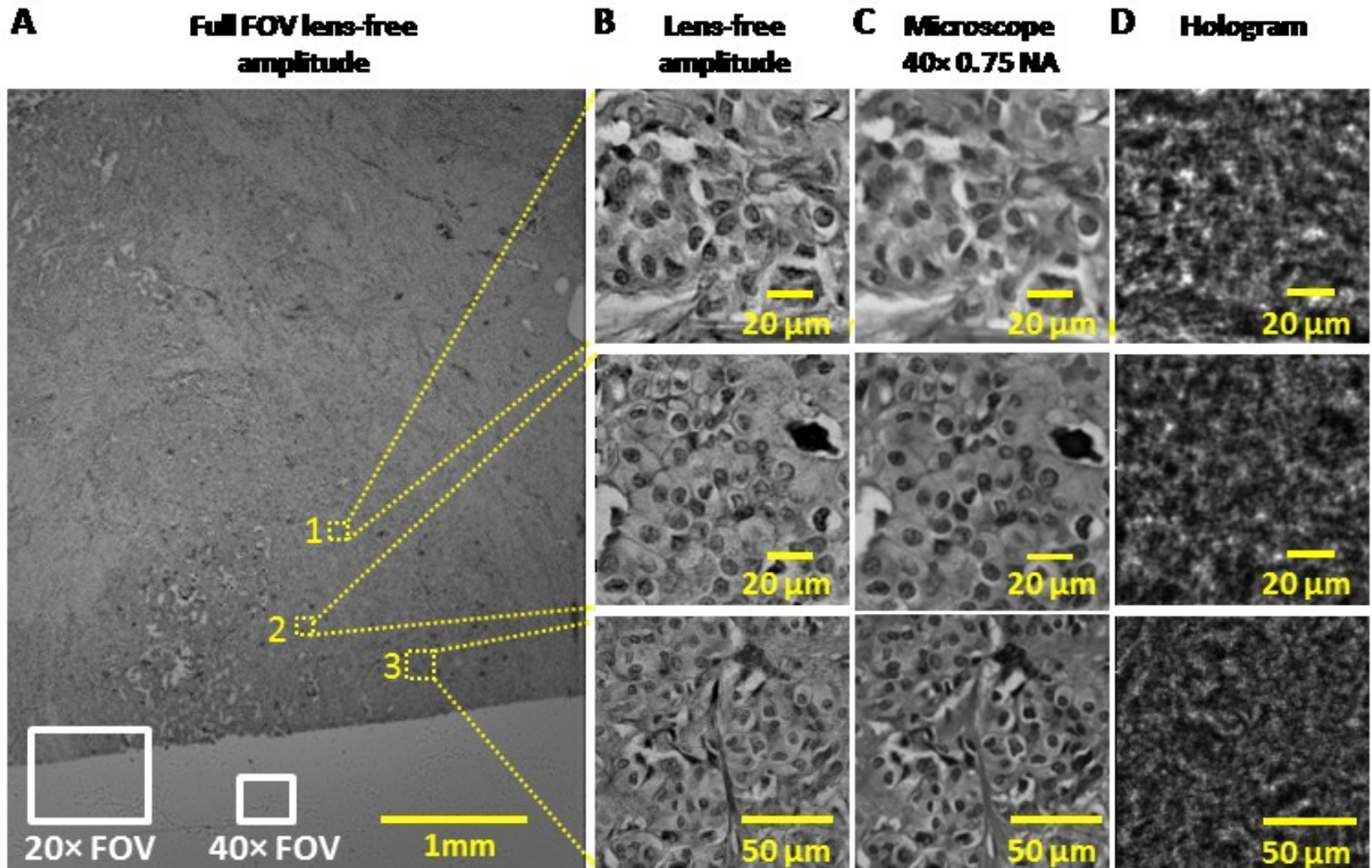
Imaging and reconstruction of shadows [2]

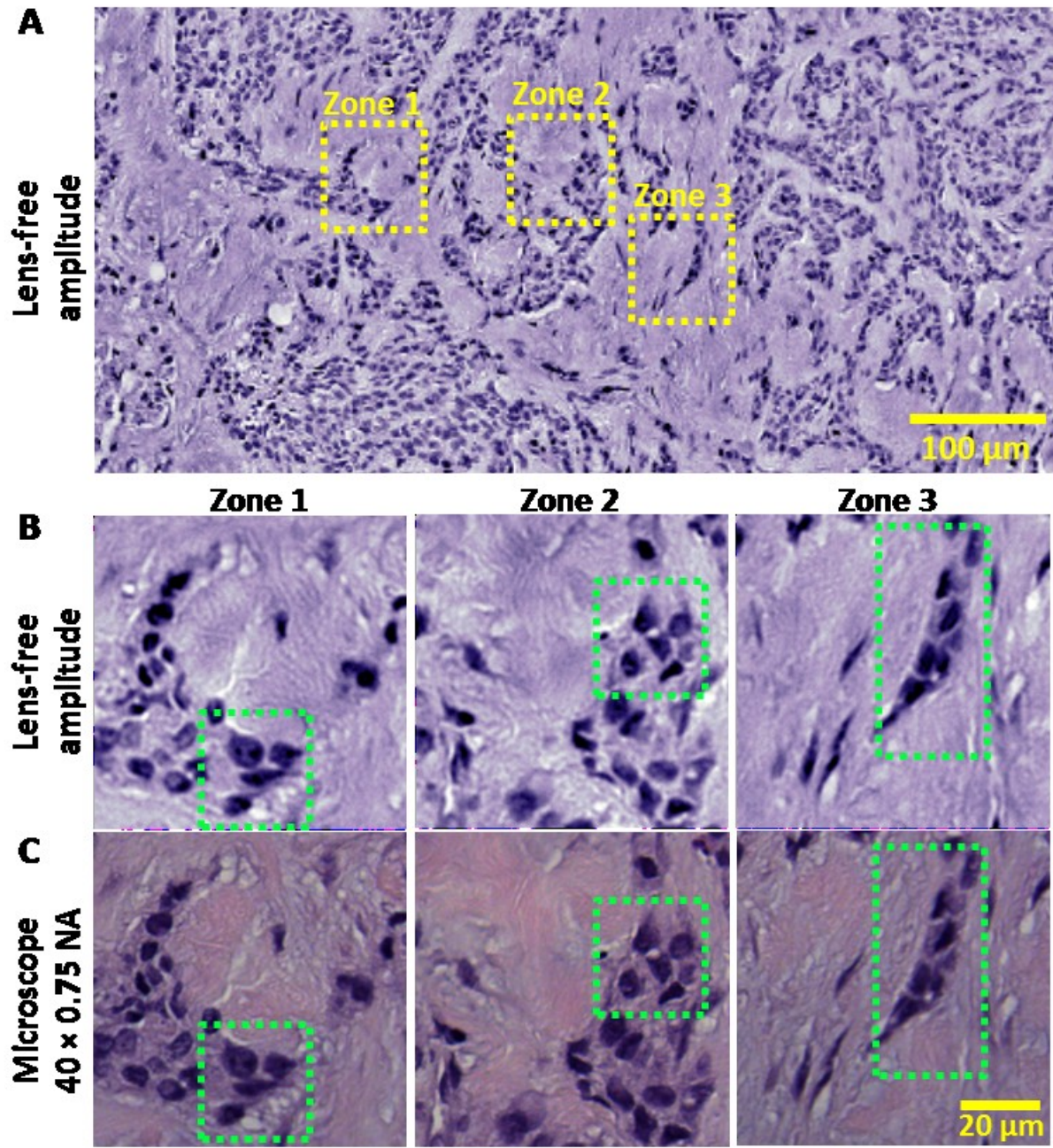


Breast Cancer Tissue

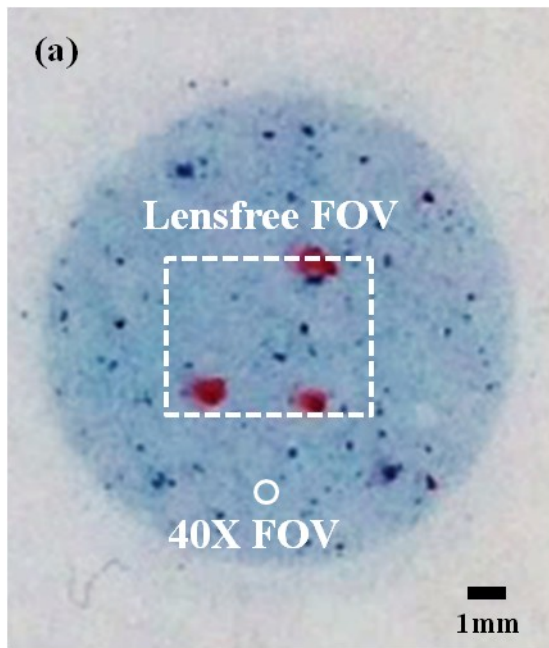


Lensfree imaging of histopathology slides





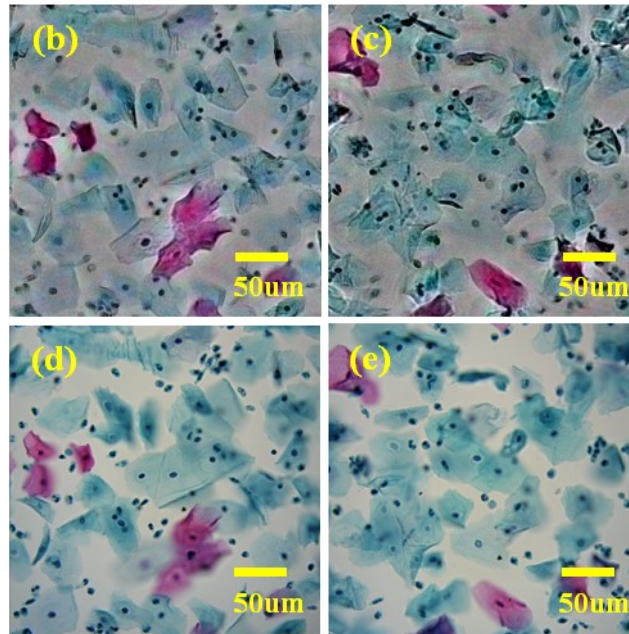
Science Translational Medicine - AAAS (2014)



Lensfree reconstructed amplitude (colored)

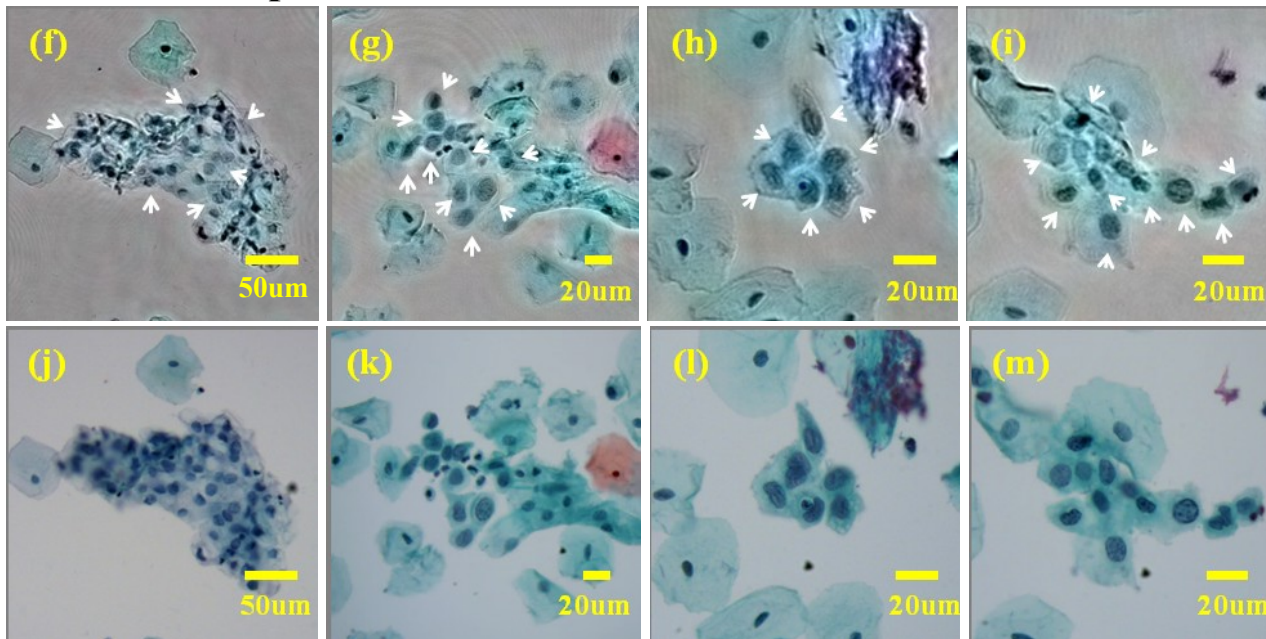
Microscope 40X 0.75NA

Pap Smear

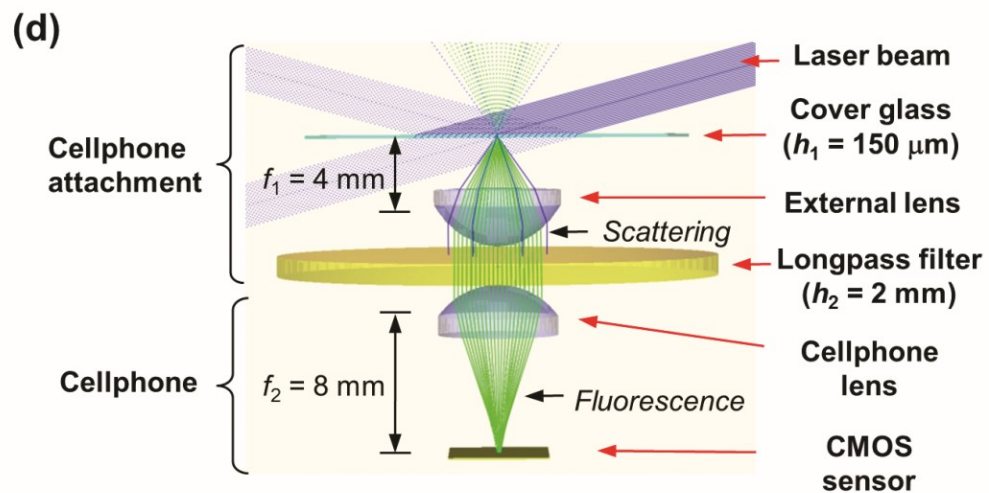
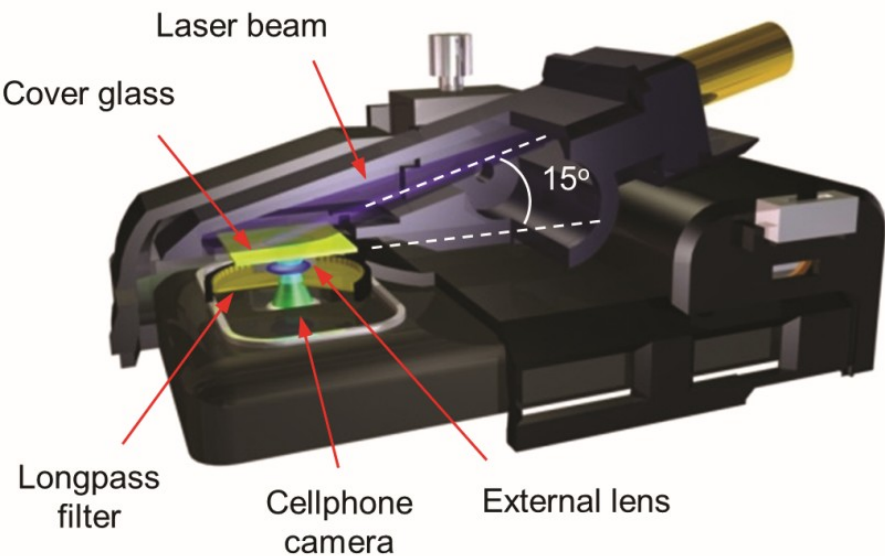
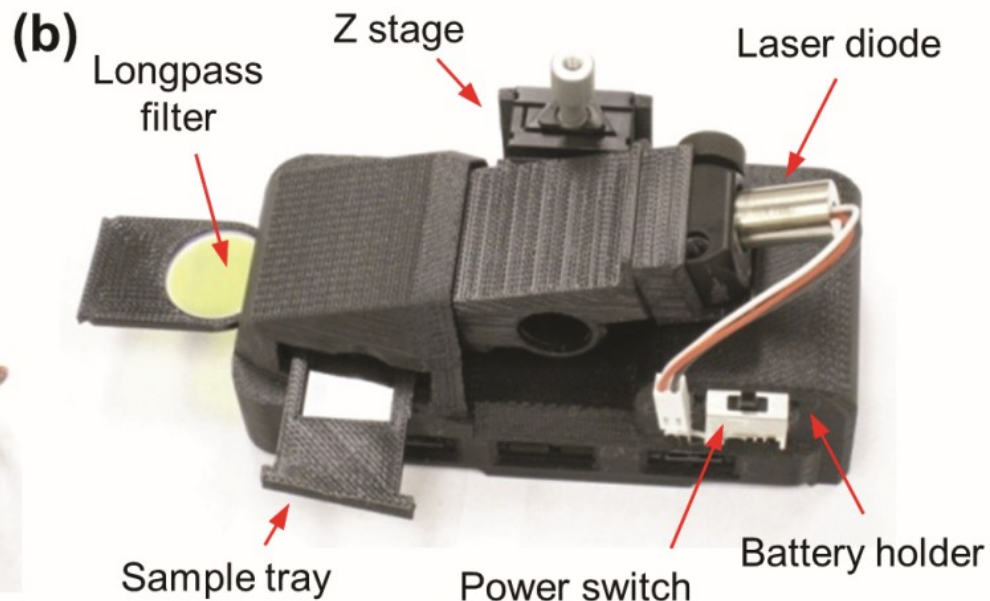


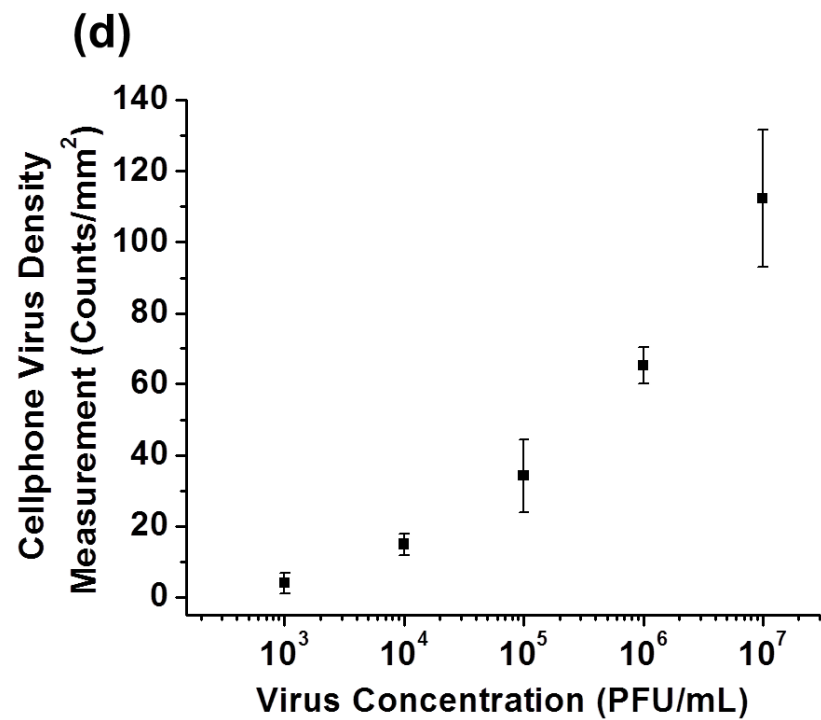
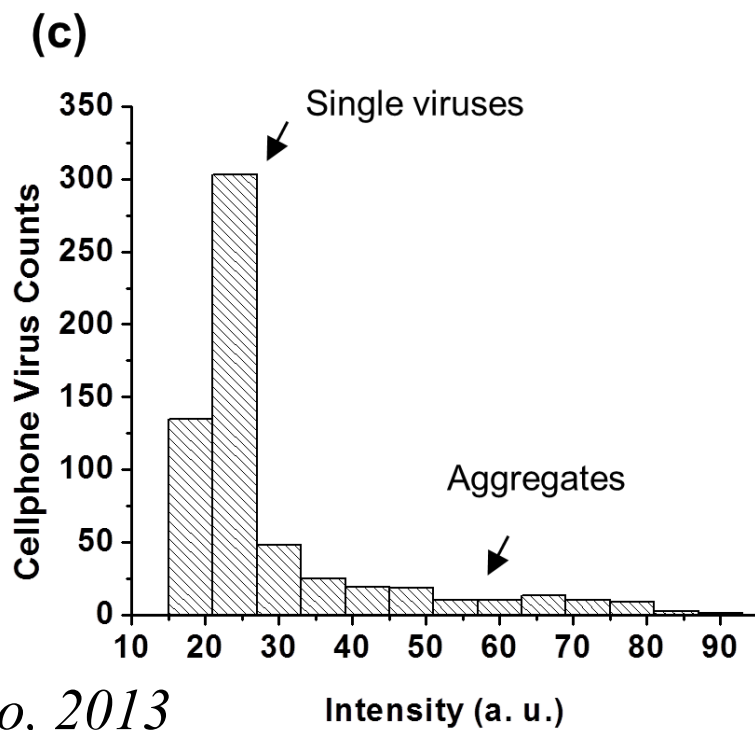
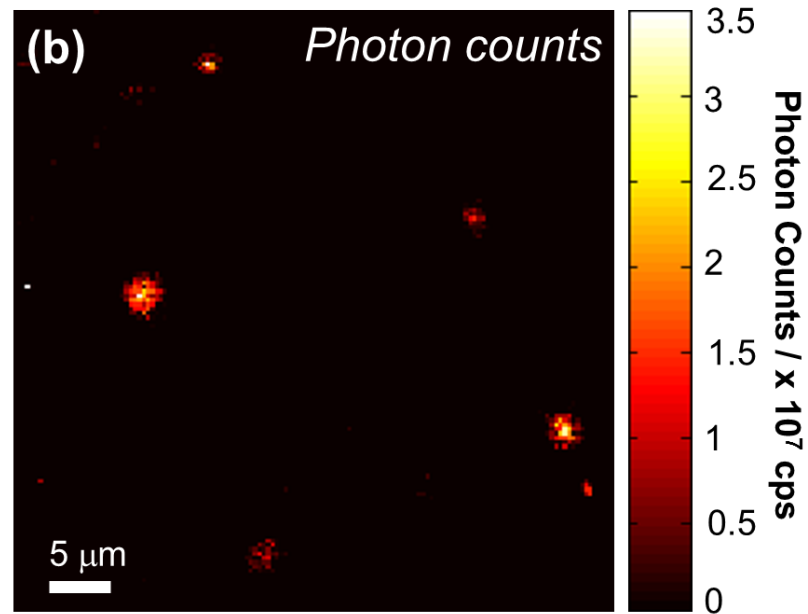
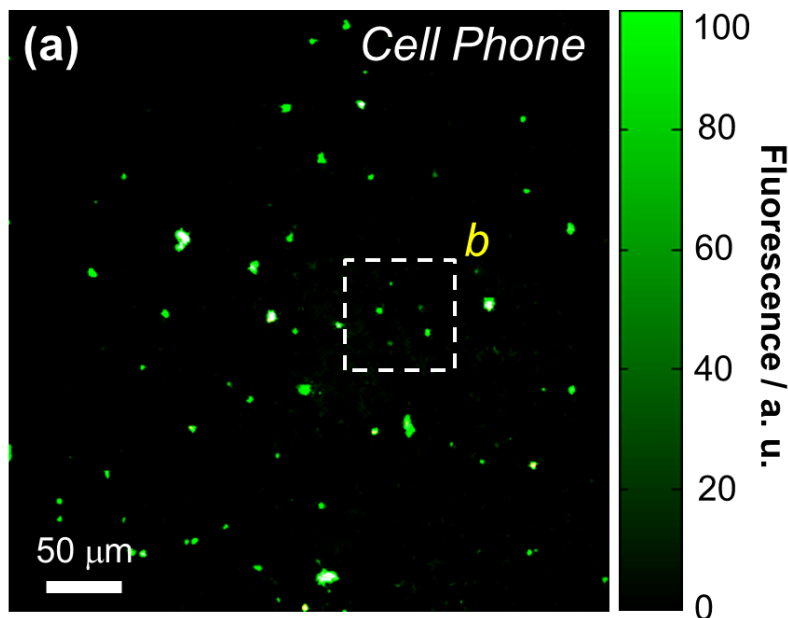
Abnormal Pap Smear

Lensfree reconstructed amplitude



Microscope 40X 0.75NA



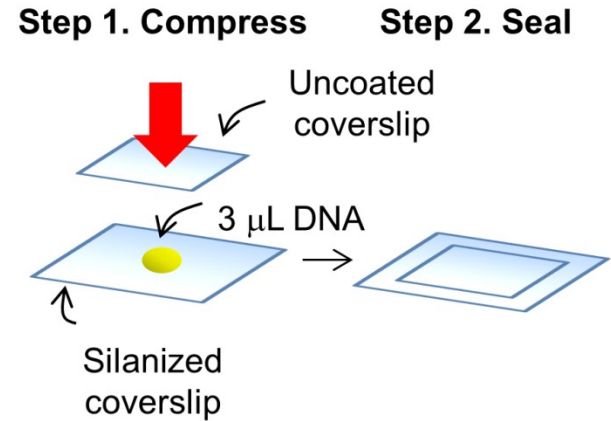


Imaging and Sizing of Single DNA Molecules on a Mobile-Phone

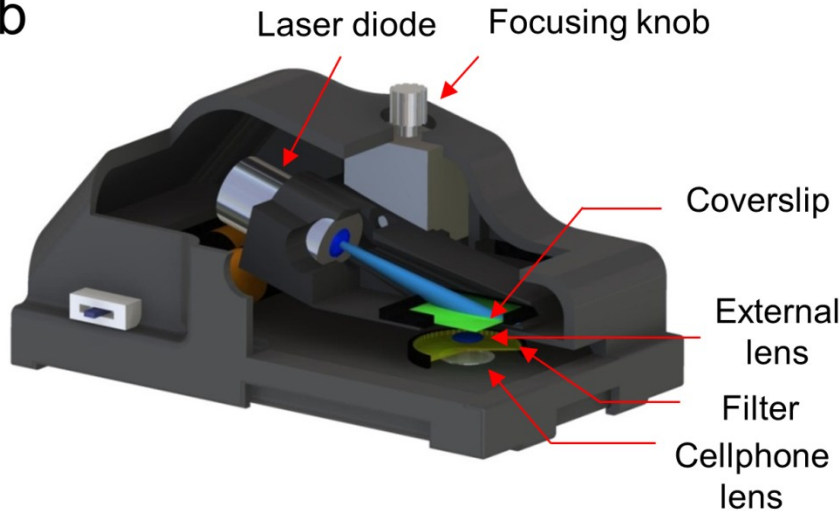
a



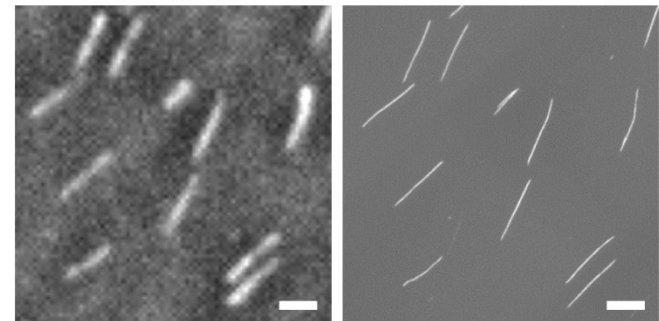
c



b



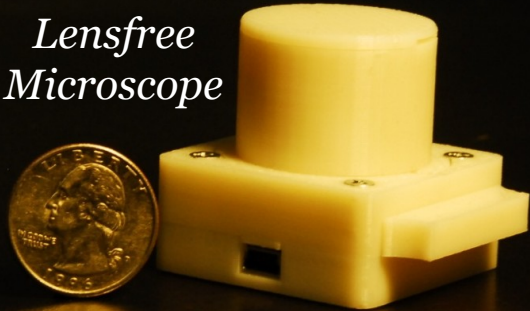
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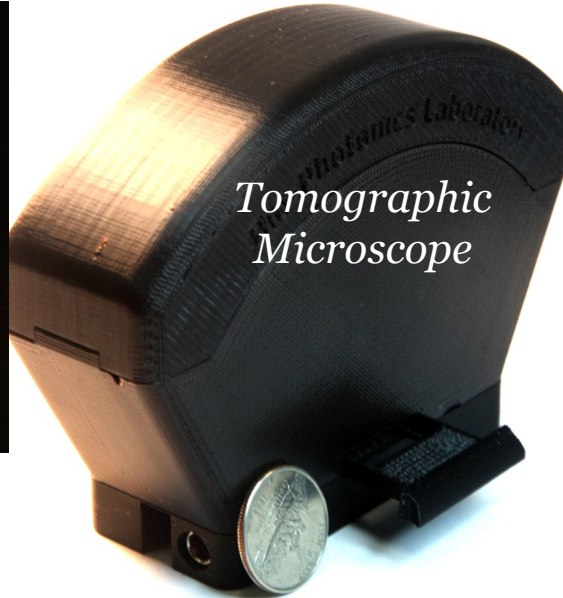


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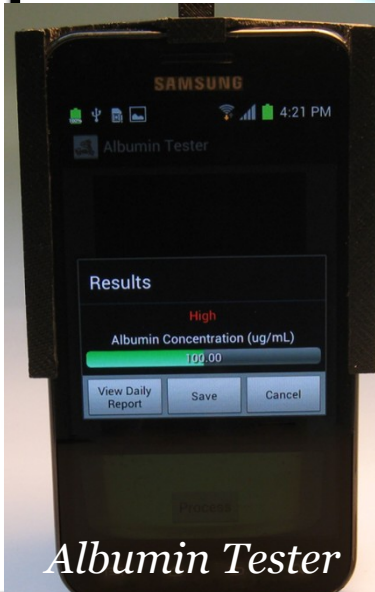
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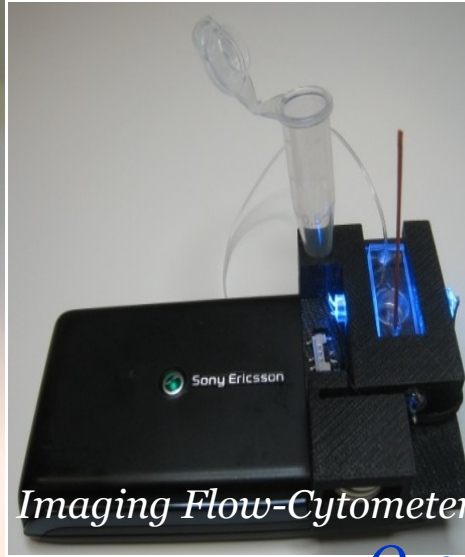
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Albumin Tester



Imaging Flow-Cytometer





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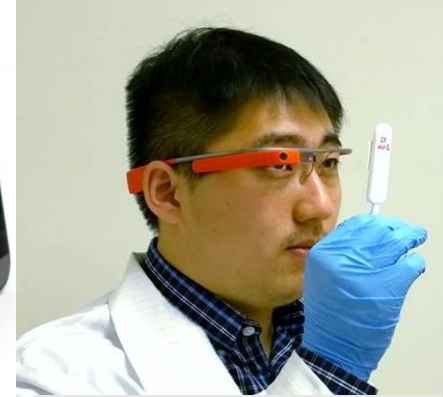
E. coli sensor



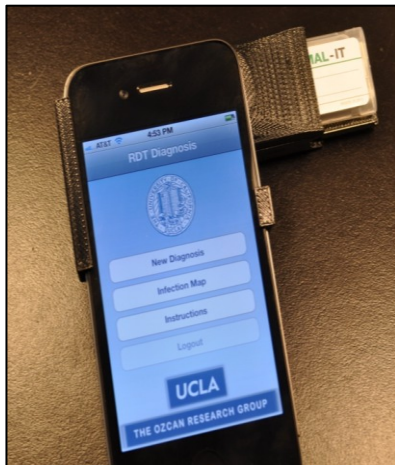
Allergen detector



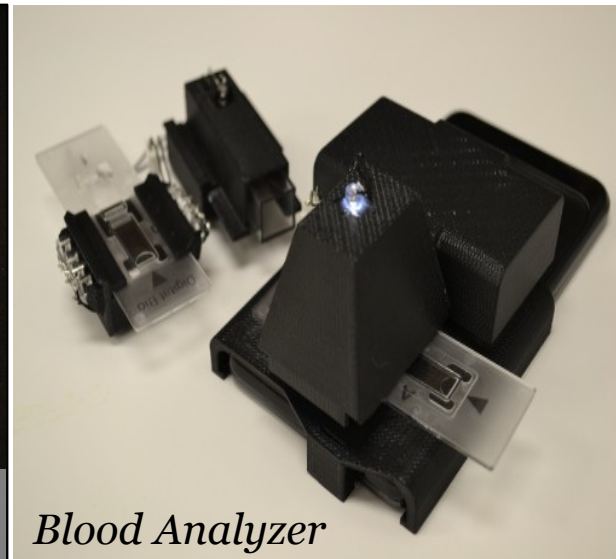
Heavy metal detector



Google Glass based Diagnostics



Diagnostic test reader (HIV, malaria, etc.)



Blood Analyzer



Blood Analyzer



The μ -Internet



Big Data & Connectivity

*New opportunities in micro- and nano-analysis,
medical diagnostics and epidemiology*



-
- Can we convert patient's home into an advanced 24/7 laboratory for medical diagnosis, monitoring of patients, high-risk and aging populations, preventive & personalized medicine?*
 - Manage costs better, early diagnosis, better treatment, better adherence, etc?*
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Some of the Challenges:

- Cost sensitivity (instruments, reagents, connectivity/data interface, analysis)*
- Standardization of measurement tools, apps, platforms (similar to internet protocol)*
- Quality control of data/information (different than internet/http analogy) → affects harnessing of data and automated predictions*
- Complexity of use/test for an average patient*
- Regulatory approvals (also consider the short lifetime of an average consumer electronic device)*
- Adoption & Deployment*



Ozcan Research Group – Members & Funding





A different view of the Moore's Law

