

Alon Greenbaum

E-mail: agreenbaum@ucla.edu, agreenbaum@engineering.ucla.edu

EDUCATION

**PhD, Electrical Engineering (HHMI International Student Research Fellow),
September 2010 – Present, (GPA: 3.92/4.00)**

University of California - Los Angeles (UCLA), CA, U.S.A

Thesis: *Wide-field microscopy without lenses for on-chip micro/nano imaging using multi-height pixel super resolution* (advisor: Prof. Aydogan Ozcan)

- Co-invented and developed a *lensfree microscope* for imaging spatially dense samples.
- Implemented a *portable pap-smear imager* for point-of-care diagnostics.
- Achieved a *numerical aperture of 0.9* across a field of view of more than 20 mm² with lensfree microscope for *microscopy applications*.
- Mentored five undergraduate student researchers for one year.

Master of Science, Electrical Engineering, April 2009 (GPA: 91.2/100.0)

Tel Aviv University, Tel Aviv, Israel

Thesis: *Electrical interfacing with engineered neuronal circuits* (advisor: Prof. Yael Hanein)

- Developed a *multi-electrode array* coated with *carbon-nanotubes* that enables high fidelity electrical investigation of small ordered neuronal networks.
- Investigated the interaction of *neuronal cells with rough surfaces*.

Bachelor of Science, Electrical Engineering, *Magna Cum Laude*, July 2007 (GPA: 91.4/100.0)

Tel Aviv University, Tel Aviv, Israel

- Majored in communication systems and computers.

TEACHING

Tel Aviv University, Tel Aviv, Israel (October 2006 – October 2008)

- Teaching Assistant for “Introduction to MEMS”, “Digital logic systems” and “Digital electronic circuits”.

EMPLOYMENT

Test Engineer, KLA-Tencor, USA (January 2010 - July 2010)

- Testing and resolving issues with reticle inspection systems. The position required aligning a complex optical system.

Hardware Engineer, IBM Haifa Development Lab, Israel (October 2005 - October 2006)

- Chip design verification, the position included learning a design thoroughly, writing and running tests in complex environment, featuring several verification tools such as: C, Vera, Specman and Sugar.

AWARDS

1. The Howard Hughes Medical Institute (HHMI), *International Student Research Fellow*. The award is worth \$43,000 a year and is given up to three years (2013).
2. *Excellent Presentation Award* “Computational super-resolved color microscopy on a chip”, 14th annual UC Systemwide Bioengineering symposium (2013).
3. SPIE Optics and Photonics Education Scholarship (2013).
4. 2-year *Summer Chancellors Award* for Ph.D. studies, from Electrical Eng. Dept. of University of California, Los Angeles (2011 and 2012)
5. Tel Aviv university engineering faculty award for outstanding achievements, *Graduate Award* (2008).
6. Intel study grant for outstanding students, *Undergraduate Award* (2005).

PATENTS

1. A. Ozcan and A. Greenbaum, “Maskless Imaging of Dense Samples Using Multi-Height Lensfree Microscope,” USPTO Patent Application, PCT/US12/47725 (2012).

PUBLICATIONS

Book Chapters:

1. S. O. Isikman, A. Greenbaum, M. J. Lee, W. Bishara, O. Mudanyali, T. W. Su, A. Ozcan, “Lensfree Computational Microscopy for Cell and Tissue Imaging at the Point-of-Care and in Low-Resource Settings”, in “New Approaches to Cell and Tissue Imaging in Pathology,” Editor: Stanley Cohen, (to be published in 2013)

Full List of Journal Papers:

1. A. Greenbaum, A. Feizi, N. Akbari, W. Luo, and A. Ozcan, “Field portable pixel super-resolution colour microscope,” *PLoS ONE* 8, e76475 (2013).
2. A. Greenbaum, A. Feizi, N. Akbari, and A. Ozcan, “Wide-field computational color imaging using pixel super-resolved on-chip microscopy,” *Opt. Express* 21, 12469-12483 (2013).

3. **A. Greenbaum**, W. Luo, B. Khademhosseini, T. W. Su, A.F. Coskun, and A. Ozcan, "Increased space-bandwidth product in pixel super-resolved lensfree on-chip microscopy," *Sci. Rep.* **3**, 1717 (2013).
4. E. McLeod, W. Luo, O. Mudanyali, **A. Greenbaum**, and A. Ozcan, "Toward giga-pixel nanoscopy on a chip: a computational wide-field look at the nano-scale without the use of lenses," *Lab Chip* **13**, 2028-2035 (2013).
5. O. Mudanyali, E. McLeod, W. Luo, **A. Greenbaum**, A. Coskun, Y. Hennequin, C. Allier, and A. Ozcan, "Wide-field optical detection of nano-particles using on-chip microscopy and self-assembled nano-lenses," *Nature Photonics*, **7**, 247-254 (2013).
6. H. Zhu, S. O. Isikman, O. Mudanyali, **A. Greenbaum** and A. Ozcan, "Optical Imaging techniques for point-of-care diagnostics," *Lab Chip* **13**, 51-67 (2013).
7. J. Weidling, S.O. Isikman, **A. Greenbaum**, A. Ozcan, E. Botvinick, "Lens-free computational imaging of capillary morphogenesis within three-dimensional substrates," *J. Biomed. Opt.* **17**, 126018-126018 (2012).
8. S. O. Isikman, **A. Greenbaum***, W. Luo, A. Coskun, and A. Ozcan, "Giga-pixel lensfree holographic microscopy and tomography using color image sensors," *PLoS ONE* **7**, e45044 (2012). (* **Joint first author.**)
9. **A. Greenbaum**, W. Luo, T-W. Su, Z. Gorocs, L. Xue, S.O. Isikman, A.F. Coskun, O. Mudanyali, and A. Ozcan, "Imaging without lenses: achievements and remaining challenges of wide-field on-chip microscopy," *Nature Methods* **9**, 889-895 (2012).
10. **A. Greenbaum**, and A. Ozcan, "Maskless imaging of dense samples using pixel super-resolution based multi-height lensfree on-chip microscopy," *Opt. Express* **20**, 3129-3143 (2012).
11. **A. Greenbaum**, U. Sikora, and A. Ozcan, "Field-portable wide-field microscopy of dense samples using multi-height pixel super-resolution based lensfree imaging," *Lab Chip* **12**, 1242-1245 (2012).
12. S. O. Isikman, **A. Greenbaum**, M. Lee, W. Bishara, O. Mudanyali, T. W. Su and A. Ozcan, "Lensfree computational microscopy tools for cell and tissue imaging at the point-of-care and in low-resource settings," *Anal. Cell. Pathology* **36**, 1-19 (2012).
13. G. Biener, **A. Greenbaum**, S.O. Isikman, K. Lee, D. Tseng and A. Ozcan, "Combined reflection and transmission microscope for telemedicine applications in field settings," *Lab Chip* **11**, 2738-2743 (2011).
14. **A. Greenbaum**, S. Anava, A. Ayali, M. Shein, M. David-Pur, E. Ben-Jacob and Y. Hanein. "One to one neuron-electrode interfacing," *J. Neurosci. Meth.* **182**, 219-224 (2009).
15. R. Sorkin, **A. Greenbaum**, M. David-Pur, S. Anava, A. Ayali, E. Ben-Jacob, and Yael Hanein, "Process entanglement as a neuronal adhesion mechanism," *Nanotechnology* **20**, 015101 (2009).
16. S. Anava, **A. Greenbaum**, E. Ben Jacob, Y. Hanein and A. Ayali, "The regulative role of neurite mechanical tension in network development," *Biophys. J.* **96**, 1661-1670 (2009).
17. M. Shein, **A. Greenbaum**, T. Gabay, R. Sorkin, M. David-Pur, E. Ben-Jacob, and Y. Hanein, "Engineered neuronal circuits shaped and interfaced with carbon nanotube microelectrode arrays," *Biomed. Microdevices* **11**, 495-501 (2009).

International Conferences

The presentations indicated by () were oral presentations by Alon Greenbaum*

1. **A. Greenbaum***, A. Feizi, N. Akbari and A. Ozcan, "Computational lensfree color microscopy for wide field-of-view imaging," SPIE Photonics West, Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing XXI, February 1-6 2014, San Francisco, CA, USA, paper #8949-15.
2. **A. Greenbaum***, N. Akbari, A. Feizi and A. Ozcan, "Field-portable lensfree holographic color microscope for telemedicine applications," IEEE Global Humanitarian Technology Conference (GHTC), October 20-23, 2013 San Jose, CA, USA.
3. **A. Greenbaum***, N. Akbari, and A. Ozcan, "Computational Field-Portable Microscope for On-Chip Imaging of Confluent Samples," BMES (Biomedical Engineering Society) Annual Meeting, September 25-28, 2013, Seattle, WA, USA.

4. J. Weidling, S. Isikman, **A. Greenbaum**, A. Ozcan, and E. Botvinick, "Can Capillaries Grown in 3D Culture be Imaged without the Use of an Optical Lens System?" BMES (Biomedical Engineering Society) Annual Meeting, September 25-28, 2013, Seattle, WA, USA.
5. W. Luo, C. Gong, F. Shabbir, C. Gulec, J. Pigeon, J. Shaw, **A. Greenbaum**, T. Su, A. F. Coskun, S. Tochitsky, C. Joshi, and A. Ozcan, "High-throughput Analysis of CR39 Detectors using Lensfree Holographic On-Chip Microscopy," North American Particle Accelerator Conference (NA-PAC'13), September 29 – October 4, 2013, Pasadena, CA USA, Contribution ID #2345.
6. W. Luo, **A. Greenbaum**, B. Khademhosseini, T. W. Su, A.F. Coskun and A. Ozcan, "Enhanced Space-Bandwidth Product In Lensfree On-Chip Microscopy," IEEE Photonics Conference 2013, September 8-12, 2013, Seattle, WA, USA.
7. E. McLeod, W. Luo, O. Mudanyali, **A. Greenbaum**, and A. Ozcan, "Giga-pixel nanoimaging using computational on-chip microscopy," IEEE Photonics Conference, September 8-12, 2013, Seattle, WA, USA.
8. **A. Greenbaum***, A. Feizi, N. Akbari and A. Ozcan, "Computational Super-resolved Color Microscopy on a Chip", 14th Annual UC Systemwide Bioengineering Symposium, June 19-21, 2013, University of California, San Diego, USA.
9. E. McLeod, W. Luo, O. Mudanyali, **A. Greenbaum**, A. Ozcan, "Giga-pixel lensfree computational imaging of nano-objects on a chip", 14th Annual UC Systemwide Bioengineering Symposium, June 19-21, 2013, University of California, San Diego, USA.
10. **A. Greenbaum**, W. Luo, B. Khademhosseini, T. Su, A.F. Coskun, and A. Ozcan, "Increasing Space-Bandwidth Product In Pixel Super-Resolved Computational On-Chip Microscopy", 14th Annual UC Systemwide Bioengineering Symposium, June 19-21, 2013, University of California San Diego, USA.
11. O. Mudanyali, E. McLeod, W. Luo, **A. Greenbaum**, A. F. Coskun, Y. Hennequin, C. Allier, and A. Ozcan, "High-throughput Imaging of Single Viruses using Self-assembled Nano-lenses and On-Chip Holography," OSA Conference on Lasers and Electro-optics (CLEO '13), June 9-14, 2013, San Jose, CA USA, Paper # AW11.6.
12. E. McLeod, O. Mudanyali, W. Luo, **A. Greenbaum**, A. F. Coskun, Y. Hennequin, C. Allier, and A. Ozcan, "Self-Assembled Nanolens Formation for Widefield Computational Imaging of Nanoparticles on a Chip," OSA Conference on Lasers and Electro-optics (CLEO '13), June 9-14 2013, San Jose, CA USA, Paper # CTh3I.6.
13. W. Luo, **A. Greenbaum** and A. Ozcan, "Giga-Pixel Imaging on a Chip: High Numerical Aperture Lensfree Microscopy Over a Wide Field-of-View", IEEE International Symposium on Biomedical Imaging (IEEE ISBI), April 7-11, 2013, San Francisco, CA, Paper# TuBT3.2.
14. W. Luo, **A. Greenbaum**, A. F. Coskun, U. Sikora and A. Ozcan, "High Numerical Aperture (NA=0.9) and Wide-field On-Chip Microscopy," SPIE Photonics West, Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing XX, February 2013, San Francisco, CA, paper #8589-9.
15. O. Mudanyali, E. McLeod, W. Luo, **A. Greenbaum**, A. F. Coskun, J. Dinten, Y. Hennequin, C. P. Allier and A. Ozcan, "Single nanoparticle and virus imaging using computational on-chip microscopy," SPIE Photonics West, Frontiers in Biological Detection: From Nanosensors to Systems, February 2013, San Francisco, CA, paper #8570-22.
16. **A. Greenbaum**, U. Sikora and A. Ozcan, "Giga-Pixel Lensfree Computational Microscopy on a Chip," 13th Annual UC Systemwide Bioengineering Symposium, June 21-23, 2012, University of California, Berkeley, USA.
17. **A. Greenbaum*** and A. Ozcan, "Lensfree Imaging of Dense Samples using Holograms Recorded at Multiple Heights," OSA Conference on Lasers and Electro-optics (CLEO '12) (May 6 -11, 2012), San Jose, CA USA, Paper # CF11.1.
18. **A. Greenbaum***, U. Sikora and A. Ozcan, "Field-Portable Pixel Super-Resolution Microscopy of Dense Samples using Lensfree Holograms Recorded at Multiple Heights," OSA Digital Holography and Three Dimensional Imaging, (April 28 – May 2, 2012) Miami, USA.
19. **A. Greenbaum***, U. Sikora, and A. Ozcan, "On-chip imaging of dense samples using pixel super resolution based multi-height lensfree microscopy," SPIE Defense, Security, and Sensing Conference (April 23-27, 2012), Baltimore, USA, Paper # 8366-26.
20. **A. Greenbaum**, U. Sikora, O. Mudanyali, and A. Ozcan, "Field-portable wide-field microscopy for imaging Papanicolaou smears," University of California, Global Health Day, February 4, 2012, University of California, Berkeley, USA.

21. G. Biener, **A. Greenbaum**, S.O. Isikman, K. Lee, D. Tseng and A. Ozcan, "Field-Portable Reflection and Transmission Microscope for Telemedicine Applications," MicroTAS 2011 – The 15th International Conference on Miniaturized Systems for Chemistry and Life Sciences, Seattle, USA (October 2-6, 2011).
22. G. Biener, **A. Greenbaum**, S. Isikman, K. Lee, D. Tseng and A. Ozcan, "Field-Portable Reflection and Transmission Microscope," BMES – Biomedical Engineering Society Annual Meeting, Hartford, Connecticut (October 12-15, 2011).
23. G. Biener, **A. Greenbaum**, S.O. Isikman, K. Lee, D. Tseng, and A. Ozcan, "Dual-mode Telemedicine Microscope," 12th Annual UC Systemwide Bioengineering Symposium, June 13-15, 2011, University of California, Santa Barbara, USA.
24. **A. Greenbaum***, M. Shein, M. David-Pur, S. Anava, Eshel B. Jacob, A. Ayali, and Y. Hanein, "Electrical interfacing with engineered neuronal circuits," Euroensors XXII, September 7-10, 2008, Dresden, Germany.