

Sefi Vernick, Ph.D.

Researcher
Bioelectrochemistry & Bioelectronics
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EDUCATION

- 2007 – 2011 **Ph.D., Molecular Microbiology and Biotechnology and Electrical Engineering**
Faculty of Life Sciences and Faculty of Engineering - Physical Electronics
Tel Aviv University, Israel
Thesis: “Integrated Multi-method Biosensing for Colorectal Cancer Diagnostics”
Advisors: [Prof. Yosi Shacham-Diamand](#) and [Prof. Amihay Freeman](#)
- 2003 – 2005 **M.Sc. (cum laude), Biotechnology**
Faculty of Life Sciences
Tel Aviv University, Israel
Thesis: “Directed Metallization of Single Enzyme Molecule with Preserved Biological Activity”
Advisors: [Prof. Amihay Freeman](#) and [Prof. Yosi Shacham-Diamand](#)
- 2000 – 2003 **B.Sc., Biology**
Faculty of Life Sciences
Tel Aviv University, Israel

RESEARCH INTERESTS

- Investigation of biomolecular interaction kinetics and structural dynamics with single-molecule approaches
- Characterization of aberrant genomic and proteomic markers using bio-electronic platforms
- Transduction of bio-recognition events to electrical currents – characterization, manipulation and applications
- Electrochemical modulation of conformational behavior and biomolecular interactions
- The effect of protein misfolding on electrochemical properties
- The integration of functional biomaterials with electrically conductive nano- and microinterfaces (organic, e.g., carbon nanotubes or inorganic, e.g., metals)

RESEARCH EXPERIENCE

- 2013 – 2017 **Post-Doctoral Research Associate**
[Bioelectronic Systems Lab](#), Department of Electrical Engineering, Columbia University, New York, NY, United States
PI: [Prof. Ken Shepard](#)
Research project: “Carbon nanotube-based Single-molecule Field-effect Transistor for Genomic Identification”
- Demonstrated for the first time the effect of electrostatic modulation on single-molecule DNA hybridization kinetics

- Developed a new method for a single base mismatch detection (label and amplification-free SNP detection)
- Characterized unexplored intermediate pathways in DNA hybridization
- Contributed significantly to the pioneering single-molecule measurements of a DNA secondary structure
- Established a bio-electrochemistry sub-group which has promoted multiple research projects
- Led a research team of undergraduate and doctoral students from multiple disciplines
- Published one first-author paper ('Nature Communications'), two co-author papers ('Nano letters'), two talks at major conferences (one invited) and one patent.

2011 – 2012

Research Associate

“Lab-on-Chip for Electrochemical Detection of Cancer Biomarkers”, project manager and lead scientist

Faculty of Engineering

Tel Aviv University, Israel

- Designed and established a research plan for a new biomedical device
- Supervised a team of engineers and a biologist within the university and multiple professional outside vendors
- Created a four year budget plan including R&D, regulatory and administrative expanses
- Co-designed human clinical trials complying with both Israeli regulations and FDA requirements
- Managed a co-operative effort with academic (Faculty of Engineering), Clinical (Rabin Medical center), technology transfer (Ramot), legal (patent attorneys) and administrative (Investors etc.) partners.

2003 – 2006

Graduate Research Assistant

Faculty of Life Sciences, Department of Molecular Microbiology and Biotechnology

Faculty of Engineering, Department Of Physical Electronics

Tel Aviv University, Israel

- Studied the expression pattern of colorectal cancer cell protein biomarkers
- Designed and demonstrated feasibility of a multiplexed whole-cell and whole-tissue electrochemical immunoassay
- Developed an integrated biosensor device for an accurate rapid detection of colon cancer
- Created and fabricated a biochip and a platform for bioelectrochemical measurements
- Applied a new microelectromechanical (MEMS) actuator to single cell mechanical measurements
- Conducted human clinical trials
- Established a new method for directed metallization of single enzyme molecules with preserved biological activity

2002 – 2003

Undergraduate Research Assistant

Faculty of Life Sciences

Tel Aviv University, Israel

- Studied Protein crystal mediated biotemplating. Supervised by Prof. Amihay Freeman and Prof. Felix Frolov (1947-2014), Department of Molecular Microbiology and Biotechnology

- Assisted in the characterization of melatonin efflux and signal transduction under the supervision of Prof. Nava Zisapel, Department of Neurobiochemistry

TEACHING EXPERIENCE

- 2009 **Teaching Assistant**
Department of Physical Electronics, Faculty of Engineering, Tel Aviv University
Course: Microelectronic Fabrication Technologies
- Graded assignments for undergraduate and graduate students
 - Shared teaching responsibilities with the lecturer
- 2005 **Teaching Assistant**
Department of Molecular Microbiology and Biotechnology, Faculty of Life Sciences, Tel-Aviv University
Course: Lab in Molecular Biology
- Graded assignments and tests for 20 undergraduate students
 - Led a weekly lab session for students in the core lab of molecular biology

MENTORING AND TUTORING EXPERIENCE

- 2016 – 2017 **Columbia University**
Department of Electrical Engineering extracurricular course for EE graduate students
Course: ' Introduction to Bioelectrochemistry'
- Developed a full curriculum for a an introductory course with focus on bio-electrochemical measurements
 - Tutor a class of 30 graduate students
- 2013 – 2017 **Columbia University**
Department of Electrical Engineering
- Co-advisor of doctoral students
 - Advisor of undergraduate project students and interns
- 2007 – 2012 **Tel Aviv University**
Department of Molecular Microbiology and Biotechnology, Faculty of Life Sciences and Department of Physical Electronics, Faculty of Engineering, Tel Aviv University
- Mentoring of doctoral students
 - Advisor of Undergraduate Project Students
 - Advisor of a resident MD (Pathology) in a 'basic science' project

ACADEMIC AND PROFESSIONAL AWARDS

- 2008 **Best poster award** - Recipient of the 'Nano2Life-European network of excellence' best poster award, Nano2Life Annual Meeting (2008), Champery, Switzerland
- 2008 **Katzir travel award for outstanding Ph.D. students**, Weizmann Institute of Science, Israel
- 2007 **Nano2Life European network of excellence summer school program**, acceptance (27 participants out of all European member states) and travel award (2007), Athens, Greece

PUBLICATIONS

1. **Vernick, S.**, Trocchia, S. M., Warren, S. B., Young, E. F., Bouilly, D., Gonzalez, R. L. Jr., Nuckolls, C., Shepard, K. L. (2017). Electrostatic melting in single-molecule field-effect transistor with applications to genomic identification. *Nature Communications* **2017**, *8*, 15450.
2. Bouilly, D., Hon, J., Daly, N. S., Trocchia, S., **Vernick, S.**, Yu, J., Warren, S. B., Wu, Y., Gonzalez Jr., R. L., Shepard, K. L. and Nuckolls, C. (2016). Single-Molecule Reaction Chemistry in Patterned Nanowells. *Nano Lett.*, *16* (7), pp 4679–4685
3. Warren, S. B., **Vernick, S.**, Romano, E. and Shepard, K. L. (2016). Complementary Metal-Oxide-Semiconductor Integrated Carbon Nanotube Arrays: Toward Wide-Bandwidth Single-Molecule Sensing Systems. *Nano Lett.*, *16* (4), pp 2674–2679
4. Porat-Ophir, C., Dergachev, V., Belkin, A., **Vernick, S.**, Freynd, G., Katsnelson, M., Chetvertnykh, V., Rishpon, J., & Shacham-Diamand, Y. (2015). Chip level agitation effects on the electrochemical sensing of alkaline-phosphatase expressed from integrated liver tissue. *Sensors and Actuators B: Chemical*, *213*(0), 465-473
5. Porat-Ophir, C., Belkin, A., **Vernick, S.**, Dergachev, V., Freynd, G., Katsnelson, M., & Shacham-Diamand, Y. (2013). Electrochemical Biochip Characterization of the Effect of Formaldehyde on the Activity of Alkaline Phosphatase. *ECS Electrochemistry Letters*, *2*(12), G8-G10
6. Mossberg, M., **Vernick, S***, Ortenberg, R., Markel, G., Diamand, Y. S., & Rishpon, J. (2014). A Direct Electrochemical Detection Method of Melanoma Based on Melanoma Biomarker. *Electroanalysis*, *26*(8), 1671-1675
7. Mor, G., **Vernick, S.**, Moscovich-Dagan, H., Dror, Y., & Freeman, A. (2011). Novel Biologically Active Silver-Avidin Hybrids. *Journal of Physical Chemistry C*, *115*(46), 22695-22700
8. **Vernick, S.**, Freeman, A., Rishpon, J., Niv, Y., Vilkin, A., & Shacham-Diamand, Y. (2011) Electrochemical Biosensing for Direct Biopsy Slices Screening for Colorectal Cancer Detection. *Journal of the Electrochemical Society*, *158*(1), P1-P4.
9. Almog, R., Daniel, R., **Vernick, S.**, Ron, A., Ben-Yoav, H., and Shacham-Diamand, Y. (2010) On-chip detection of cellular activity. *Advances in Biochemical Engineering/Biotechnology* *117*, pp. 179-191
10. Shacham-Diamand, Y., Belkin, S., Rishpon, J., Elad, T., Melamed, S., Biran, A., Yagur-Kroll, S., Almog, R., Daniel, R., Ben-Yoav, H., Rabner, A., **Vernick, S.**, Elman, N. and Popovtzer, R. (2010) Optical and Electrical Interfacing Technologies for Living Cell Bio-Chips. *Current Pharmaceutical Biotechnology*, *11* (4), 1-7.
11. **Vernick, S.**, Moscovich-Dagan, H., Porat-Ophir, C., Rishpon, J., Freeman, A., & Shacham-Diamand, Y. (2009) Directed Metallization of Single-Enzyme Molecules With Preserved Enzymatic Activity. *IEEE Transactions on Nanotechnology*, *8*(1), 95-99.

Submitted Publications

1. Trocchia, S. M., Warren, S. B., **Vernick, S.**, Young, E. F., Shepard, K. L., (2017) Wafer-scale fabrication of spin-cast single-molecule carbon nanotube field-effect transistors for DNA hybridization studies. *ACS Nano* (2017)

Conference Proceedings (Reviewed)

1. **Vernick, S.**, Trocchia, S. M., Warren, S. B., Young, E. F., Bouilly, D., Gonzalez, R. L. Jr., Nuckolls, C., Shepard, K. L., (2017) Electrostatic Control of DNA Hybridization Kinetics Studied with the Single-Molecule Field-Effect Transistor. *Biophysical Journal* *112* (3), 331a

2. Bouilly, D., Hon J., Daly N.S., **Vernick, S.**, Trocchia, S. M., Warren, S. B., Shepard, K. L., Gonzalez, R. L. Jr., Nuckolls, C. (2016) Probing DNA Conformational Changes in Real Time Using Single-Molecule Electronic Sensors Based on Carbon Nanotube Field-Effect Transistors. *ECS Meeting abstracts* 7, 608.
3. Ofek-Almog R., Sverdlov Y., **Vernick S.**, Shacham-Diamand Y., (2015) Gold/Polypyrrole Multilayer Electrode for Biochip Applications. *ECS Meeting abstracts*, 14, 1135.
4. **Vernick, S.**, Niv, Y., Vilkin, A., Freeman, A. & Shacham-Diamand, Y. (2012) Colon Cancer Diagnosis by Multiple Biomarker Electrochemical Detection in Biopsy Slices. *Gastroenterology* 142, S-345.
5. **Vernick, S.**, Freeman, A., Rishpon, J., and Shacham-Diamand, Y. (2009) Direct Biopsy Screening of Colorectal Cancer by Electrochemical Biosensor. *ECS Transactions*, 19 (33) 61-68.
6. Ben-Yoav, H., Yorish, S., Elad, T., **Vernick, S.**, Belkin, S. and Shacham-Diamand, Y. (2007) A novel microfluidic whole cell biosensor for water toxicity analysis using bioluminescence detection. *Proceedings of MicroTAS 07 v2, Paris, France*, pp. 1049-1052.

Books and Book Chapters

1. **Vernick, S.**, (2014). Integrated Multi-method Biosensing for Colorectal Cancer Diagnostics. *Scholars' Press, OmniScriptum GmbH & Co. KG. Saarbrücken, Germany*
2. Almog, R., Daniel, R., **Vernick, S.**, Ron, A., Ben-Yoav, H., & Shacham-Diamand, Y. (2010). On-Chip Detection of Cellular Activity. In: *Whole Cell Sensing Systems I (Vol. 117, pp. 179-191)*. (S. Belkin & M. B. Gu, eds.), Springer Berlin / Heidelberg

PATENTS

1. Rishpon, J., Popovtzer, R., Shacham-Diamand, Y., Neufeld, T., **Vernick, S.**, “Methods of Detecting Cancer Cells and use of same For Diagnosing And Monitoring Treatment of The Disease” US patent no. 8,268,577 B2, European patent no. EP 2 142 661 B1, Israeli patent no. 201258, Chinese patent no. 1151853
2. Rishpon, J., Popovtzer, R., Shacham-Diamand, Y., Neufeld, T., **Vernick, S.**, “Electrochemical methods of detecting cancer with 4-aminophenyl phosphate” US patent no. 8,530,179
3. **Vernick, S.**, Shacham-Diamand, Y., Rishpon, J., Mossberg, M. “A Direct Electrochemical Detection Method of Melanoma And Melanoma Biomarkers” (2013 US national phase, EU national phase)
4. Shacham-Diamand, Y., **Vernick, S.**, Niv, Y., Rishpon, J., Freeman, A., Methods Of Determining Enzyme Activity in Preserved Cell Samples, (2012) *US provisional patent application*

MEMBERSHIP IN PROFESSIONAL SOCIETIES

2016 – Present	BPS (Biophysical society), Member
2015 – Present	Advancing Computer Science Careers Through Enhanced Networking and Training (NYC ASCENT), Member
2013 – Present	MRS (Materials research society), Member
2008 – 2013	ECS (The Electrochemical society), Member
2007 - 2008	IVS (Israel Vacuum Society), Member

CONFERENCE PRESENTATIONS AND WORKSHOPS

Invited Talks

1. MRS (Materials Research Society) Fall meeting (2014), Boston, USA.
2. Invited seminar and classes, Perm National Research Polytechnic University (2012), Perm, Russia
3. Invited Seminar – TAU Center for Nanoscience and Nanotechnology (2010)

Presentations

1. BPS (Biophysical society) annual meeting (2017), New Orleans, USA
2. DDW (Digestive Disease Week) congress (2012), San Diego, USA
3. ECS (The Electrochemical Society) 215th Meeting (2009), San Francisco, USA
4. NanoBio-Europe conference (2007), Munster, Germany
5. Nano2Life Annual Meeting (2006), Saarbrucken, Germany

Posters

1. Nano2Life Annual Meeting (2008), Champéry, Switzerland.
2. IMEC-14 The 14th Israel Materials Engineering Conference (2009)
3. IVS Israel 28th IVS annual conference and technical workshop (2009)
4. EMNT 08: The Seventh International Symposium on Electrochemical Micro & Nanosystem Technologies (2008), Ein-Gedi, Israel. **Co-organized this conference.**
5. Nano Conference, 4th meeting of TAU Nano center (2007), Ha'Goshrim, Israel
6. TAU Molecular Microbiology and Biotechnology department annual meeting (2007)

Workshops

1. Nano2Life European network of excellence summer school program: "*Methods in Nanonotechnology and Micro-nano Technology*", (2007) NCSR Demokritos, Athens, Greece

MEDIA

1. An article published in *The Guardian, UK*: 'Lab-on-a-chip' tech for cancer test' (2009)
2. Tel-Aviv University News (AFTAU newsroom): A Real-Time Diagnosis for a Treatable Cancer (2009)