



Ayelet Voskoboynik

Assistant Professor (Research) of Biology

Bio

BIO

Ayelet Voskoboynik is an expert in the field of comparative immunology and stem cell biology. Her studies significantly contribute to the development of the colonial chordate *Botryllus schlosseri* as a model system to study stem cell biology, aging, and the evolution of immunity.

Ayelet led the *Botryllus* genome project and developed a novel method to obtain a synthetic long read sequence (SLR). She isolated BHF, the gene that encodes self/non-self and determines “graft” outcomes in this organism. Ayelet identified the first adult stem cell niche and the first germline stem cell niche in *Botryllus*, led a comprehensive cellular, molecular, and functional characterization of the *Botryllus* immune system, and investigated the molecular clock and neurodegeneration pathways in young and old colonies. Recently, she led an international effort to build the *Tabula compositi* chordate, an atlas of *Botryllus* embryogenesis and blastogenesis, revealing unique molecular landscapes for each developmental mode. Dr. Voskoboynik work has opened the door to a better understanding of the evolution of stem cell and immune cell properties during development, regeneration, transplantation, and aging.

ACADEMIC APPOINTMENTS

- Assistant Professor (Research), Biology
- Member, Bio-X
- Member, Wu Tsai Human Performance Alliance

PROFESSIONAL EDUCATION

- Postdoctoral Fellow, Stanford University, Stanford, California , Stem Cell Biology (2006)
- Ph.D, Technion, Israel institute of technology, Haifa , Cell Biology (2001)
- M.Sc, Tel-Aviv University, Tel-Aviv, Israel , Zoology (1995)
- B.Sc, The Hebrew University of Jerusalem, Israel , Animal science (1991)

PATENTS

- Ayelet Voskoboynik; Dmitry Pushkarev, Stephen Quake. "United States Patent 61/532,882; International application No. PCT/US2012/054461 Methods for obtaining a sequence. US 61/532,882, filed September 9, 2011(Pending); International application No. PCT/US2012/054461, filled September 10, 2012 (Pending); United Kingdom patent application 1216076.8 filed September 10, 2012 (Pending)"

LINKS

- <https://marinestemcell.stanford.edu/>: <https://marinestemcell.stanford.edu/>
- *Botryllus schlosseri* genome browser: <http://botryllus.stanford.edu/botryllusgenome/>
- <http://botryllus.stanford.edu/index.html>: <http://botryllus.stanford.edu/index.html>

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

We study several stem cell interrelated phenomena using the colonial chordate, *Botryllus schlosseri*. The adult stem cells of *Botryllus schlosseri* mediate formation of all body organs de-novo every week. This includes formation of heart, central nervous system, respiration system, digestive system, thyroid like gland, ovary and testis. Under certain conditions, *B. schlosseri* can even regenerate its body from the vasculature alone. This species which has a chordate larval stage and an invertebrate adult form, is the closest living relative to *Homo sapiens* that maintains this unique regeneration capacities throughout life. In addition to their extensive regeneration capacities, in *Botryllus* chimeras the adult circulating stem cells of one partner can compete and replace the germ line and/or the soma of the other partner (termed germ line or somatic stem cell parasitism). This ability to replace host tissues follows genetic (heritable) hierarchies of winner strain that replace loser strain tissues.

We use genetic, genomic, and cell biological approaches to investigate: The evolutionary molecular mechanisms that regulate the decline of tissue regenerative potential during aging and allogeneic stem cell competition in host.

The lab is located at Stanford's Hopkins Marine Station on the Monterey Peninsula.

Teaching

COURSES

2023-24

- Sustainability in Marine Organisms: Learning from the Evolutionary Survivors: BIO 74, OCEANS 74H (Win)

2022-23

- Hopkins Marine Station Seminar: BIOHOPK 114H (Win)
- Hopkins Marine Station Seminar: BIOHOPK 214H (Win)
- Hopkins Marine Station Seminar: OCEANS 114 (Win)
- Sustainability in Marine Organisms: Learning from the Evolutionary Survivors: BIO 74, BIOHOPK 74H, OCEANS 74 (Win)

STANFORD ADVISEES

Postdoctoral Research Mentor

Tal Gordon, Tom Levy

Publications

PUBLICATIONS

- **Two distinct evolutionary conserved neural degeneration pathways characterized in a colonial chordate.** *Proceedings of the National Academy of Sciences of the United States of America*
Anselmi, C., Kowarsky, M., Gasparini, F., Caicci, F., Ishizuka, K. J., Palmeri, K. J., Raveh, T., Sinha, R., Neff, N., Quake, S. R., Weissman, I. L., Voskoboynik, A., Manni, et al
2022; 119 (29): e2203032119
- **Sexual and asexual development: two distinct programs producing the same tunicate.** *Cell reports*
Kowarsky, M. n., Anselmi, C. n., Hotta, K. n., Burighel, P. n., Zaniolo, G. n., Caicci, F. n., Rosental, B. n., Neff, N. F., Ishizuka, K. J., Palmeri, K. J., Okamoto, J. n., Gordon, T. n., Weissman, et al
2021; 34 (4): 108681
- **Complex mammalian-like haematopoietic system found in a colonial chordate.** *Nature*
Rosental, B. n., Kowarsky, M. n., Seita, J. n., Corey, D. M., Ishizuka, K. J., Palmeri, K. J., Chen, S. Y., Sinha, R. n., Okamoto, J. n., Mantalas, G. n., Manni, L. n., Raveh, T. n., Clarke, et al

2018

- **Identification of a colonial chordate histocompatibility gene.** *Science*
Voskoboynik, A., Newman, A. M., Corey, D. M., Sahoo, D., Pushkarev, D., Neff, N. F., Passarelli, B., Koh, W., Ishizuka, K. J., Palmeri, K. J., Dimov, I. K., Keasar, C., Fan, et al
2013; 341 (6144): 384-387
- **Repeated, Long-Term Cycling of Putative Stem Cells between Niches in a Basal Chordate** *DEVELOPMENTAL CELL*
Rinkevich, Y., Voskoboynik, A., Rosner, A., Rabinowitz, C., Paz, G., Oren, M., Douek, J., Alfassi, G., Moiseeva, E., Ishizuka, K. J., Palmeri, K. J., Weissman, I. L., Rinkevich, et al
2013; 24 (1): 76-88
- **The genome sequence of the colonial chordate, Botryllus schlosseri.** *eLife*
Voskoboynik, A., Neff, N. F., Sahoo, D., Newman, A. M., Pushkarev, D., Koh, W., Passarelli, B., Fan, H. C., Mantalas, G. L., Palmeri, K. J., Ishizuka, K. J., Gissi, C., Griggio, et al
2013; 2
- **Identification of the Endostyle as a Stem Cell Niche in a Colonial Chordate** *CELL STEM CELL*
Voskoboynik, A., Soen, Y., Rinkevich, Y., Rosner, A., Ueno, H., Reshef, R., Ishizuka, K. J., Palmeri, K. J., Moiseeva, E., Rinkevich, B., Weissman, I. L.
2008; 3 (4): 456-464
- **Stem cell-mediated development, regeneration, chimerism, and aging in the colonial chordate Botryllus schlosseri.** *Genesis (New York, N.Y. : 2000)*
Voskoboynik, A.
2023; e23542
- **Multiple Forms of Neural Cell Death in the Cyclical Brain Degeneration of A Colonial Chordate.** *Cells*
Anselmi, C., Caicci, F., Bocci, T., Guidetti, M., Priori, A., Giusti, V., Levy, T., Raveh, T., Voskoboynik, A., Weissman, I. L., Manni, L.
2023; 12 (7)
- **Stemness Activity Underlying Whole Brain Regeneration in a Basal Chordate.** *Cells*
Gordon, T., Zaquin, T., Kowarsky, M. A., Voskoboynik, Y., Hendin, N., Wurtzel, O., Caicci, F., Manni, L., Voskoboynik, A., Shenkar, N.
2022; 11 (23)
- **Contributions from both the brain and the vascular network guide behavior in the colonial tunicate Botryllus schlosseri.** *The Journal of experimental biology*
Thompson, S. H., Anselmi, C., Ishizuka, K. J., Palmeri, K. J., Voskoboynik, A. N.
2022
- **Botryllus schlosseri as a Unique Colonial Chordate Model for the Study and Modulation of Innate Immune Activity.** *Marine drugs*
Goldstein, O., Mandujano-Tinoco, E. A., Levy, T., Talice, S., Raveh, T., Gershoni-Yahalom, O., Voskoboynik, A., Rosental, B.
2021; 19 (8)
- **Stem Cells and Innate Immunity in Aquatic Invertebrates: Bridging Two Seemingly Disparate Disciplines for New Discoveries in Biology.** *Frontiers in immunology*
Ballarin, L., Karahan, A., Salvetti, A., Rossi, L., Manni, L., Rinkevich, B., Rosner, A., Voskoboynik, A., Rosental, B., Canesi, L., Anselmi, C., Pinsino, A., Tohumcu, et al
2021; 12: 688106
- **Evolutionary perspective on the hematopoietic system through a colonial chordate: allogeneic immunity and hematopoiesis.** *Current opinion in immunology*
Rosental, B., Raveh, T., Voskoboynik, A., Weissman, I. L.
2020; 62: 91-98
- **Sixty years of experimental studies on the blastogenesis of the colonial tunicate Botryllus schlosseri** *DEVELOPMENTAL BIOLOGY*
Manni, L., Anselmi, C., Cima, F., Gasparini, F., Voskoboynik, A., Martini, M., Peronato, A., Burighel, P., Zaniolo, G., Ballarin, L.
2019; 448 (2): 293-308
- **Natural Chimerism and Tolerance Induction in a Colonial Chordate** *Advances in Comparative Immunology*
Voskoboynik, A., Newmab, A. M., Kowarsky, M., Weissman, I. L.
Springer .2018: 18
- **Developmental cell death programs license cytotoxic cells to eliminate histocompatible partners** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*

- Corey, D. M., rosental, B., Kowarsky, M., Sinha, R., Ishizuka, K. J., Palmeri, K. J., Quake, S. R., Voskoboynik, A., Weissman, I. L.
2016; 113 (23): 6520-6525
- **Characterization of Ambra1 in asexual cycle of a non-vertebrate chordate, the colonial tunicate *Botryllus schlosseri*, and phylogenetic analysis of the protein group in Bilateria** *MOLECULAR PHYLOGENETICS AND EVOLUTION*
Gasparini, F., Skobo, T., Benato, F., Gioacchini, G., Voskoboynik, A., Carnevali, O., Manni, L., Valle, L. D.
2016; 95: 46-57
 - ***Botryllus schlosseri*, an emerging model for the study of aging, stem cells, and mechanisms of regeneration** *INVERTEBRATE REPRODUCTION & DEVELOPMENT*
Voskoboynik, A., Weissman, I. L.
2015; 59: 33-38
 - ***Botryllus schlosseri*, an emerging model for the study of aging, stem cells, and mechanisms of regeneration.** *Invertebrate reproduction & development*
Voskoboynik, A., Weissman, I. L.
2015; 59 (sup1): 33-38
 - **Guidelines for the Nomenclature of Genetic Elements in Tunicate Genomes** *GENESIS*
Stolfi, A., Sasakura, Y., Chalopin, D., Satou, Y., Christiaen, L., Dantec, C., Endo, T., Naville, M., Nishida, H., Swalla, B. J., Volf, J., Voskoboynik, A., Dauga, et al
2015; 53 (1): 1-14
 - **Ontology for the Asexual Development and Anatomy of the Colonial Chordate *Botryllus schlosseri*** *PLOS ONE*
Manni, L., Gasparini, F., Hotta, K., Ishizuka, K. J., Ricci, L., Tiozzo, S., Voskoboynik, A., Dauga, D.
2014; 9 (5)
 - **Ascidian Mitogenomics: Comparison of Evolutionary Rates in Closely Related Taxa Provides Evidence of Ongoing Speciation Events** *GENOME BIOLOGY AND EVOLUTION*
Griggio, F., Voskoboynik, A., Iannelli, F., Justy, F., Tilak, M., Xavier, T., Pesole, G., Douzery, E. J., Mastrototaro, F., Gissi, C.
2014; 6 (3): 591-605
 - **Chimerism a natural ability to tolerate kin, evolutionary traits connecting mammalian and protochordates** *ISJ-INVERTEBRATE SURVIVAL JOURNAL*
Voskoboynik, A.
2009; 6 (1): S9-S20
 - **Stem Cells, Chimerism and Tolerance: Lessons from Mammals and Ascidians** *Stem Cells in Marine Organisms*
Voskoboynik, A., Rinkevich, B., Weissman, I. L.
Springer Netherlands.2009: 281–308
 - **A conserved role of the VEGF pathway in angiogenesis of an ectodermally-derived vasculature** *DEVELOPMENTAL BIOLOGY*
Tiozzo, S., Voskoboynik, A., Brown, F. D., De Tomaso, A. W.
2008; 315 (1): 243-255
 - **Striving for normality: whole body regeneration through a series of abnormal generations** *FASEB JOURNAL*
Voskoboynik, A., Simon-Blecher, N., Soen, Y., Rinkevich, B., De Tomaso, A. W., Ishizuka, K. J., Weissman, I. L.
2007; 21 (7): 1335-1344
 - **BS-Cadherin in the colonial urochordate *Botryllus schlosseri*: One protein, many functions** *DEVELOPMENTAL BIOLOGY*
Rosner, A., Rabinowitz, C., Moiseeva, E., Voskoboynik, A., Rinkevich, B.
2007; 304 (2): 687-700
 - **fester, a Candidate allorecognition receptor from a primitive chordate** *IMMUNITY*
Nyholm, S. V., Passegue, E., Ludington, W. B., Voskoboynik, A., Mitchel, K., Weissman, I. L., De Tomaso, A. W.
2006; 25 (1): 163-173
 - **Macrophage involvement for successful degeneration of apoptotic organs in the colonial urochordate *Botryllus schlosseri*** *JOURNAL OF EXPERIMENTAL BIOLOGY*
Voskoboynik, A., Rinkevich, B., WEISS, A., Moiseeva, E., Reznick, A. Z.
2004; 207 (14): 2409-2416

- **Rejuvenescence and extension of an urochordate life span following a single, acute administration of an anti-oxidant, butylated hydroxytoluene** *MECHANISMS OF AGEING AND DEVELOPMENT*

Voskoboynik, A., Reznick, A. Z., Rinkevich, B.

2002; 123 (9): 1203-1210