The Department of
Marine Biology

Alumni newsletter

Keeping in touch with the Marine Biology Department after you graduate

July 2018

אוניברסיטת חיפה
University of Haifa
جامعة حيفا

LEON H. CHARNEY
SCHOOL OF MARINE SCIENCES
בית הספר למדעי הים על שם ליאון צ'רני

Dear students and alumni,

Welcome to the first edition of the Department of Marine Biology Alumni Newsletter. This is the first of what we plan to be a continuing series, which we will be sending out to you once a year. We see it as a way of keeping you informed about what is happening in our department after you leave here and as a way for you to keep in touch with us. This is my first year as the Head of Department and it has been a busy year, meeting and working with our campus partners. I have also had the opportunity to reflect on the program we offer our students and on our general contribution to the University.

This year, our program was evaluated by an international committee nominated by the Israel Council for Higher Education as part of a national assessment of the marine sciences in Israel. I would like to thank you all for the great feedback we received owing to your efforts. Our research products are published in top-tier journals mainly because of your scientific enthusiasm and motivation. We currently have more than 50 MSc and PhD students and postdocs and about 50 alumni. Our facilities have grown from several offices in 2010 to well-equipped labs and marine cultivation and experimental systems. Additionally, the Morris Kahn Marine Research Station was opened in Kibbutz Sdot-Yam.

This is also an opportunity to express our thanks to Prof. Danny Tchernov, co-founder and former Head of the Department, who invested much time and efforts to bring us to where we are today, and to whish Prof. Michael Krom, who is changing his title to emeritus professor, many new discoveries. I would like to express our gratitude to Prof. Zvi Ben Avraham, who led the vision to establish the Leon Charny School of Marine Sciences and to welcome Prof. Ilana Berman Frank as the new Head of the school. Finally, we would very much like to hear from you and to learn how you have fared since your graduation. Please stay in touch and update us (marine@univ.haifa.ac.il) on your new research or work venture.

Have a great summer,

Dr. Tamar Lotan

Over ten years ago I had a vision. It was to set up a school where geologists, biologists, archaeologists, engineers, historians, social scientists and law makers would come together to teach, study and share their experiences working in the marine environment. The University of Haifa allowed me the platform to do this. I am proud of all the departments within the Charney School of Marine Sciences, but particular proud of the Department of Marine Biology. During the last eight years, I have seen the department grow into the leading institute in Israel for marine biology and one of the world leaders in this field. This is down to the high-quality of the researchers and to a large part, also down to you – the students and graduates. A pyramid is only as strong as its base. You have provided a solid and sturdy foundation for the scientific output of the Department. Without you, none of this would be possible. I wish you all the best in future endeavors and hope to see you soon out at sea.

Prof. Zvi Ben-Avraham

To the graduates of the Department of Marine Biology, Ten years ago, the University of Haifa decided to expand the study of marine sciences in Israel. Under the leadership of Prof. Zvi Ben Avraham, and the founding team, The Leon Charney School of Marine Sciences was established as Israel's first, and still only, graduate school in Marine sciences. Today, over 70 faculty and staff and almost 200 graduate students comprise the four departments of the School: Maritime Civilizations, Marine Geosciences, Marine Biology, and our latest Department of Marine Technologies. **You, the graduates from these first ten years, have played an essential role in helping develop and strengthen both the academic program and the research of the Department**.

Joining the School recently as both a faculty member of the Department of Marine Biology, and the School's Director, I believe that the integration of Marine Biology within the wider and interdisciplinary context of Marine Sciences provides you – its graduates – with an inherent advantage as you enter the job market. Your experiences at the Leon H. Charney School of Marine Sciences empower you to reach past the traditional world of the 'marine biologist'. Training with some of Israel's most talented marine biologists, combining new techniques and cutting-edge technologies, you study the diverse life in the oceans. Yet, you are also educated to understand the complex and dynamic marine environment, its' historical and cultural perspectives, the threats to the coastal and pelagic environments, and the potential for sustainable utilization and conservation of these under-researched resources.

I believe that with these tools you now hold, you can continue to excel and to become future leaders promoting the importance of marine biology in academia, in research, in industry, government, or in non-profit organizations.

As we look forward to the next decade of growth at the Leon H. Charney School of Marine Sciences, we aim to become one of the leading academic centers of excellence in marine sciences in the Mediterranean, expanding our faculty and academic programs, fostering domestic and international collaborations and partnerships, spreading the discoveries and knowledge gained to relevant industries, and impacting policy makers and public opinion.

Let me wish you good luck in your future ventures and I hope that you will help us in building bridges, in making and maintaining a community of excellence, and in sharing the community spirit of the Leon H. Charney school of marine sciences wherever you go.

Sincerely,
Prof. Ilana Berman-Frank

Ms Tzili Charney – recipient of Doctor of Philosophy, Honoris Causa

A curator, producer, a highly respected costume designer for Habima Theatre in Israel, The Cameri Theater of Tel Aviv, and the Jewish Repertory Theater and the National Yiddish Theatre Folksbiene in New York. She is an activist, and a philanthropist with a passion towards justice and peace. Together with her late husband Leon, she is one of the most prominent supporters of the University of Haifa, especifically the Leon H. Charney School of Marine Sciences.

We are deeply honored and grateful to you and to your late husband Leon for your extraordinary contribution to the establishment of our school, which has revolutionized the field of Marine Sciences in Israel.

Research being done: Prof. Michael Krom

In 1986 I joined the National Institute of Oceanography with the aim of developing an autoanalyzer to measure dissolved nutrients for the first time in the Eastern Mediterranean. The work was extraordinarily successful, and we published a series of papers including a paper in 1991 (Krom et al., 1991) which was honored recently as one of the top cited papers in the history of Limnology and Oceanography. But at the time I was deeply concerned that I was using frozen samples to measure these nutrients and deliberately did not interpret any data in the photic zone where most of the biological activity takes place. I said at the time and many times since, that to measure nutrients in these nutrient depleted waters, we must measure the samples fresh, without freezing.

Well finally more than 30 years later, we are doing just that. In the Morris Kahn Marine Station, we have finally installed an ultra-sensitive SEAL autoanalyzer, which is capable of measuring nutrients with a limit of detection of a few nanomoles. In addition to this low detection limit, we are measuring filtered samples with 12 hours of sampling and hence finally getting useful data form the biologically active photic zone. We are making some of the core measurements for the THEMO seasonal cruises organized by Daniel Sher. Our results so far show that the Israeli Coastal Shelf is P limited in Winter and Spring contrary to the published results using frozen samples. In addition, we are finding some very unusual ammonia profiles showing that there are active biogeochemical processes producing and consuming ammonia below the deep chlorophyll maximum and at the top of the nutricline. This work is continuing, and we expect further exciting results through the rest of this 12-month project as well as new insights into the base of the food chain in this unusual P limited ultra-oligotrophic inland sea. Watch this space.

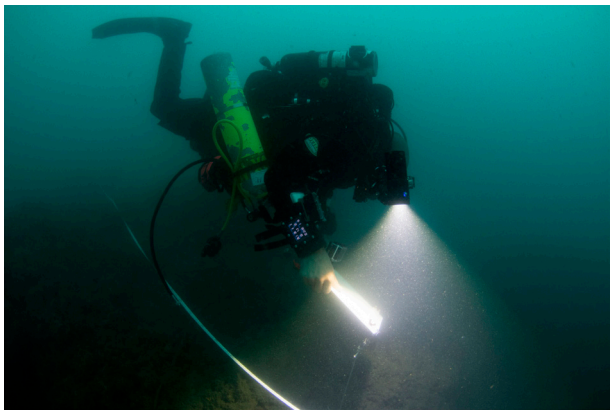
Krom, M.D., Brenner, S., Kress, N. and Gordon, L.I. (1991) Phosphorus limitation of Primary Productivity in the E.Mediterranean sea. Limnol. Ocean. 36 (3): 424-432. Included in the 60th anniversary virtual issue of Limnology and Oceanography 2016 as one of the 60 most cited papers in that journal.

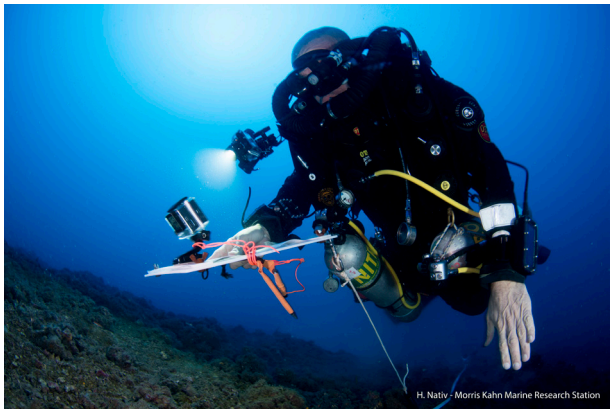
The Morris Kahn Marine Research Station

located in Kibbutz Sdot-Yam, was established by The Leon H. Charney School of Marine Sciences of the University of Haifa. The station's focus is on Long-Term Ecological Research of the Eastern Mediterranean Sea at its doorstep. This will address the accelerated development along its coastline, in the deep sea and the demand for a reliable database for decision-makers, scientists and the public.

The facility deals with 5 meta-layers, representing 5 different habitats, all which contribute to a full understanding of this complex environment. These are: (1) Sediment, (2) Rocky Reefs, (3) Biogeochemistry, (4) Top Predators and (5) Marine Pathogens and these are built into a public open source, cloud database.

To accomplish these goals, the facility is equipped with controlled seawater flow and biological experimentation systems that are required for aquaculture and renewable energy-related research. The marine station has a research vessel that serves as a diving platform for our coastal water research. Other smaller laboratories are equipped with facilities for dissection, necropsies, and separate areas dedicated for graduate and visiting researchers to sit.





The facility labs are equipped with the most sophisticated and sensitive equipment, and home to the highly trained and qualified scientists that conduct the innovative research using the novel and up-to-date methods for collecting as much data as possible in the shortest period of time.

You are welcome to contact Shai Einbinder the COO of the Research Station or Prof. Dan Tchernov Scientific Director of The M. Kahn Marine Research Station.

4th Academic Get-Together

The 4th academic meeting of the Department of Marine Biology was attended by about 70 PhD and MSc students, postdoctoral fellows, principal investigators, research fellows and scientists. The meeting included lectures by students from every research group. The talks covered a wide range of research methods and fields, from apex marine predators through molecular works on various organisms to marine bacteria. In addition, some 30 students presented their projects in two poster sessions. At the end of the meeting, prizes were awarded to the three best posters and talks.







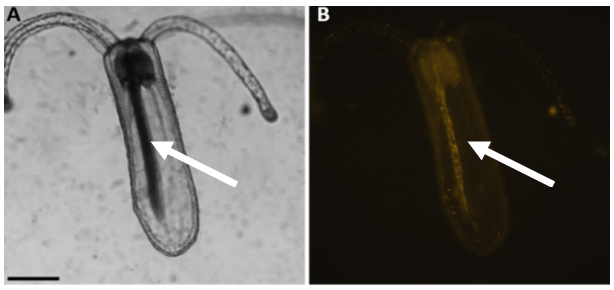



We are pleased to share with you the abstracts of six of our students, who won awards at the meeting.

Primordial germ cells lineage characterization in the basal sea anemone *Nematostella vectensis*

Neta Sa'ar, Vera Brekhman and Tamar Lotan

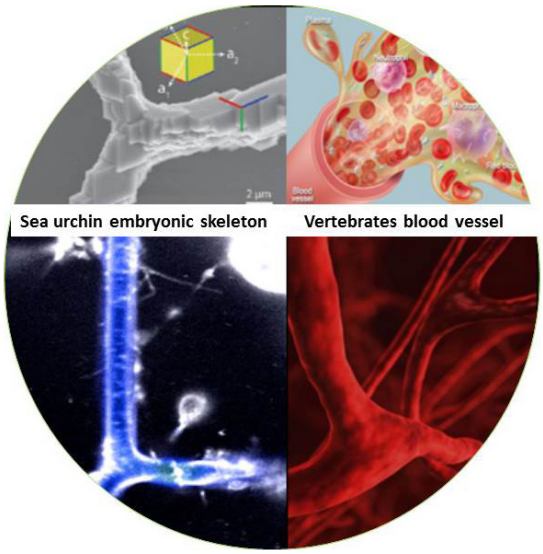
In the process of sexual reproduction, a germ cell is any cell that gives rise to gametes, either eggs or sperm. In Cnidaria, the sister group to Bilateria, germ cells have been reported to be generated continuously throughout reproductive life, yet little is known about the molecular pathways governing this process. In order to track the lineage of Primordial Germ Cells (PGCs) in the basal anthozoan *Nematostella vectensis*, I have generated positive transgenic animals, expressing mOrange (fluorescent reporter gene) under the promoters of two known PGCs markers: *PL10* and *nanos2*. Both are widely conserved across Metazoa and are considered critical genes in bilaterian germ cell specification and development. In *Nematostella* primary polyps, both genes were identified in early mesenteries, the future gonad-acting tissue. I have established a stable mosaic F0 generation, that has reached sexual maturity and can now be outcrossed to obtain fully transgenic heterozygous F1 animals. Using my transgenic lines, I aim to characterize PGCs expression profiles and gain insights into the origin of gametogenesis and the evolution of bilaterian traits in the common eumetazoan ancestor.



PL10 F0 transgenic primary polyp showing specific expression in mesenteric cells. Fluorescent microscopy under ***(A)*** *Bright field;* ***(B)*** *mOrange filter. Arrows point to the mesentery. Scale: 100µm.*

Capturing the dynamic effect of VEGF signaling on skeletogenesis using 3D live imaging of sea urchin embryos

Miri Morgulis, Tsvia Gildor, Modi Roopin, Noa Sher, Assaf Malik ,Smadar Ben-Tabou de-Leon

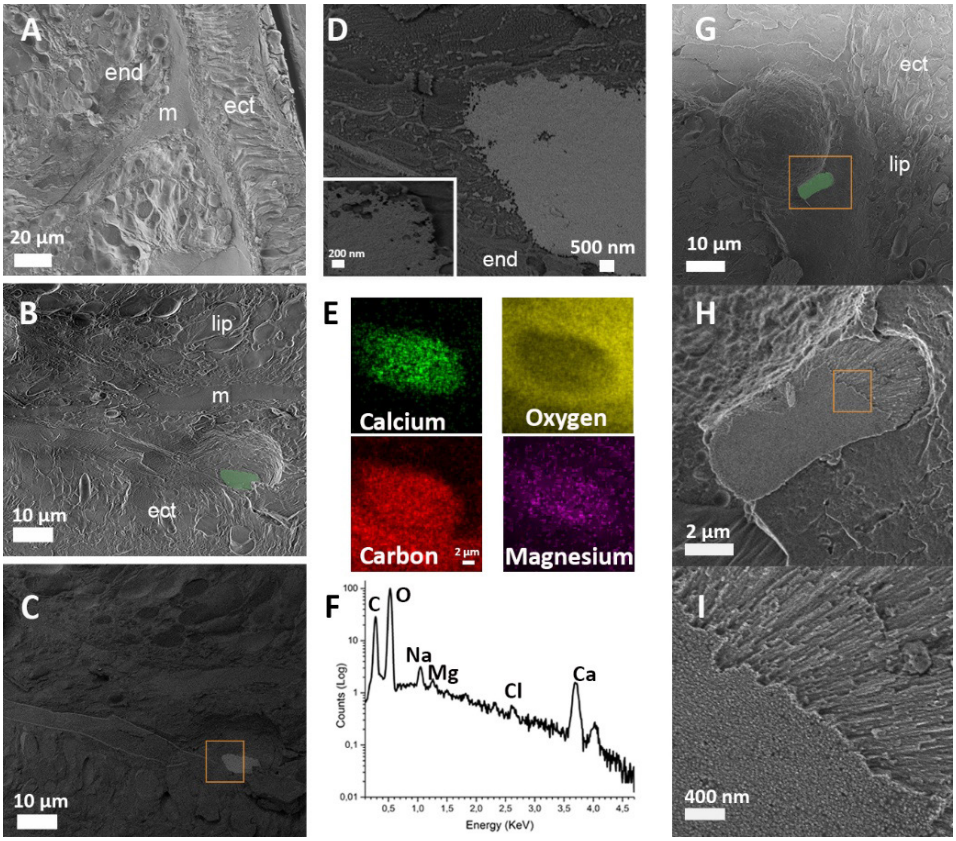


Sea urchin embryos calcite spicules and vertebrates' blood vessels have completely distinct functions, yet there are striking similarities between the cellular processes and molecular control systems that drive the formation of these two tubular organs. We seek to test the hypothesis that Vascular Endothelial Growth Factor (VEGF) pathway is a part of a conserved program for tubulogenesis that was adapted during echinoderms evolution to incorporate biomineralization. We believe that this will provide unprecedented mechanistic view of the genetic control of morphogenesis as well as illuminate how genetic developmental programs evolve to acquire a new function. To achieve our goals we purpose to use genetic/ pharmacological sea urchin embryos perturbation experiments, live imaging in whole fluorescence stained embryos and computational analysis to provide new insights on sea urchin embryos skeletogenic process and to examine the cellular and molecular homology between sea urchin embryos skeletogenesis and vertebrate's blood vessels formation.

Tracking the early events of mineral formation during coral development

Maayan Neder, Anat akiva, Keren Kahil, Rotem Gavriel, Iddo pinkas, Gil Goobes, Tali Mass

Aragonite skeletons in corals are key contributors to the storage of atmospheric CO_2 worldwide. Hence, understanding coral biomineralization/calcification processes is crucial for evaluating and predicting the effect of environmental factors on this process. While coral biomineralization studies have focused on adult corals, the exact stage at which corals initiate mineralization remains enigmatic. Here we show that minerals are first precipitated as amorphous calcium carbonate and small aragonite crystallites, in the pre-settled larva, which then evolve into the more mature aragonitic fibers characteristic of the stony coral skeleton. The process is accompanied by modulation of proteins and ions within these minerals. These findings may indicate an underlying bimodal regulation tactic adopted by the animal, with important ramification to its resilience or vulnerability towards a changing environment.



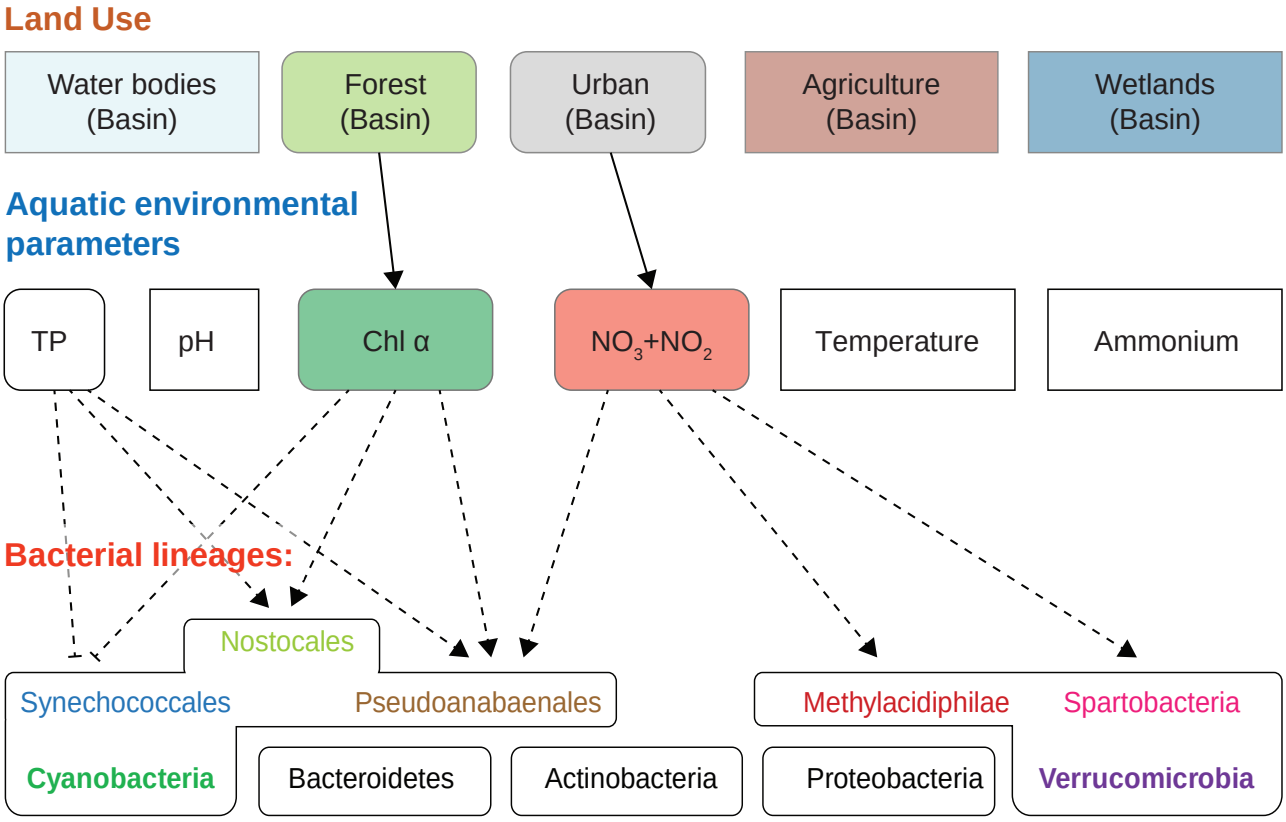
Mineral deposits at the pre-settled metamorphosed planula stage, detected by cryo-SEM. ***(A)*** *Top view secondary electron (SE) image of a pre-settled metamorphosed planula. (B-D) Early stage of mineral deposition.* ***(B)*** *SE image of a mineral deposit randomly found within the organic material of the endoderm and lipidic region. The mineral deposit is ~10 µm long. It is digitally colored in green based on the back-scattered electron (BSE) image in C.* ***(C)*** *BSE image of the same region as in B.* ***(D)*** *Higher magnification of the region depicted by an orange box in (B and C), showing the mineral deposit morphology and the interface with the organic material of the tissue. The mineral is composed of nano-granular particles as can be seen in the insert in D.* ***(E)*** *cryo-EDS maps of the mineral deposit in B, showing the distribution of calcium, oxygen, carbon and magnesium in the mineral deposit and in the surrounding organic matter.* ***(F)*** *Cryo-EDS spectrum of the mineral in B. The spectrum is presented on a logarithmic scale. (G-I) A developing aragonite mineral embedded in the organic material of the tissue.* ***(G)*** *SEM image of a 10 µm aragonite crystal, it is digitally colored in green based on the back-scattered electron (BSE) image.* ***(H)*** *SE image of the region depicted in an orange box in G, showing the mineral.* ***(I)*** *Higher magnification of the region depicted in an orange box in H, showing that acicular aragonite crystals emerge from a nano-granular structure. (end, endoderm; m, mesoglea; ect, ectoderm; lip, lipid gland).*

The role of land use and water quality in structuring the microbiomes of a system of connected lakes

Sophi Marmen, Lior Blank, Ashraf Al-Ashhab, Assaf Malik, Lars Ganzert, Maya Lalzar, Hans-Peter Grossart and Daniel Sher

For centuries, humans have reshaped and designed the form and process of ecosystems across the biosphere changing dominant plant species and land uses. Feshwater aquatic ecosystems, in particular, may be highly sensitive to human impact. The microbial communities ("microbiomes") in freshwater are intimately connected with water quality and human health.

In this study, we investigated the microbiomes of 46 lakes in Germany. Our major goal was to understand what shapes microbial population in a system of connected natural water bodies that surrounded by different land-uses. We discovered an indirect influence of land uses on bacterial population structure by affecting water chemical characteristics. Specifically, we found two land uses, which positively associated with specific water parameters, and a set of water parameters that significantly affect bacterial distributions. Moreover, we found bacterial separation in deeper taxonomic levels among sampling sites, suggesting bacterial physiological and metabolic adaptations.

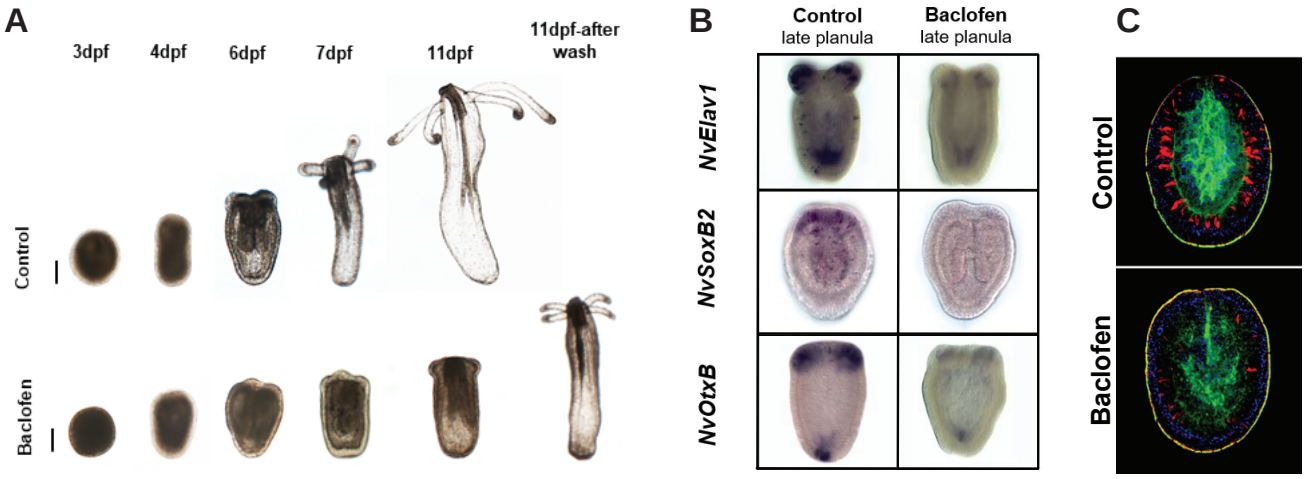


Conceptual model summarizing the observed effects of land use on water chemistry, and of water chemistry on the microbiome. Solid arrows represent important correlations between land use and aquatic environmental parameters, based on the GLMs. Dashed arrows represent positive relationships between aquatic environmental parameters and specific microbial lineages inferred from the CCA plots, and blunt dashed lines represent negative relationships inferred in the same manner. Forest and urban land uses correlate with high Chl α and NO_3+NO_2 concentrations, respectively. These parameters in turn, are part of the aquatic environmental conditions which determine, to some extent, the relative distribution of specific cyanobacterial classes and verrucomicrobial orders.

$GABA_B$ Signaling regulates metamorphosis and neurogenesis in the sea anemone *Nematostella vectensis*

Shani Levy, Vera Brekhman and Tamar Lotan

The sea anemone *Nematostella vectensis* is a member of the Cnidaria, a sister group to Bilateria. Dated to 700 million years ago cnidarians are the oldest metazoan taxa that possess a nervous system. Although simple and non-centralized, their nervous system shares most of the components and associated genes with those of higher organisms, including humans. In our study, we use *Nematostella vectensis* as a model for studying the role of $GABA_B$ receptors during planula-to-polyp transformation and specifically in neural development. In mammalians $GABA_B$ receptors play key roles in synaptic neurotransmission and during brain development. We found that GABAergic genes are present in *Nematostella* and that activation of $GABA_B$ receptor by its specific agonist, baclofen, caused inhibition of metamorphosis and downregulation of planula neurogenesis and ciliogenesis. We demonstrate that treatment with $GABA_B$ agonist resulted in downregulation of a battery of neuronal-related genes and in a decrease of RF-amide neurons differentiation. Additionally, we show that planula motility was arrested. RNA-Seq analysis revealed that in the presence of $GABA_B$ agonist, genes related to cilia structure and function were downregulated. Our findings suggest an ancestral role of $GABA_B$ signaling pathway as a negative regulator of neurogenesis and ciliogenesis.

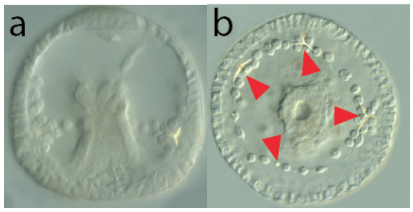


$GABA$ and $GABA_B$ agonists cause reversible inhibition of metamorphosis and decrease in expression of neural genes and in neurons differentiation. ***(A)*** *Planula development and metamorphosis with or without baclofen treatment. Planulae treated with the agonist do not metamorphose. Four days post baclofen removal, planulae recovered and transformed into primary polyps. Scale bars-100 µm.* ***(B)*** *In situ hybridization of genes involved in neurogenesis. Expression of the tested genes was down-regulated following baclofen treatment.* ***(C)*** *Planulae treated with baclofen exhibited a reduction in RF-amide neurons. RF-amide neurons- red; phalloidin stain for actin-green; DAPI stain for nuclei-blue.*

Hypoxia affects sea urchin larval skeletogenesis possibly through VEGF signaling

Majed Layous, Lama Khalaily, Tsvia Gildor, Smadar Ben-Tabou de-Leon

Despite the wide morphological variety of embryogenesis within the animal kingdom, some highly conserved signaling pathways govern a specific response and have a common function in the majority of animals. The hypoxia pathway plays a role in embryonic development across metazoan; however, the molecular mechanisms that underlie this pathway in early embryogenesis are still not fully understood. In vertebrates, hypoxia-inducible factor α (HIF1α), the downstream transcription factor of the hypoxia pathway, activates the expression of the gene that encodes the Vascular Endothelial Growth Factor (VEGF) that regulates the formation of new blood vessels. In sea urchin embryos, hypoxic conditions disrupt the formation of the dorsal-ventral (DV) axis and strongly affect skeletal patterning.



Skeletogenic phenotypes of hypoxia applied immediately after fertilization. ***(a)*** *control embryo.* ***(b)*** *hypoxic conditions: multiple spicules radially placed in the blastocoele, as indicated by arroheads*

Interestingly, HIF1α is an early activator of dorsal ectodermal genes in normal sea urchin development and the skeletogenesis process is guided by VEGF signaling. Therefore, the effect of hypoxic conditions might be mediated through interference with HIF1α and VEGF signaling in the sea urchin embryo that leads to the observed skeletal defects. Here, I propose to examine which factors mediate the response to hypoxic conditions in the sea urchin embryo and specifically investigate the response of the transcription factor HIF1α and whether it regulates VEGF expression in these conditions. My studies will hopefully decipher which pathways are modulated by hypoxic conditions and affect skeletogenesis in the sea urchin embryo and allow for a comparison between this system and the upstream regulation of VEGF during angiogenesis in vertebrates.

Maxim Rubin

We are very proud and delighted about the joining of Max, one of our first alumni, to the Israel Oceanographic and Limnological Research.

I am fascinated with the enigmatic life in the deep ocean. Elucidating the deep biosphere in the Mediterranean Sea was envisioned by the founders of the Leon H. Charney School of Marine Sciences, and in the year 2009, I joined the Department of Marine Biology to pursue the deep-sea research. Being a part of the scientific team aboard the E/V Nautilus, I studied animals and microbes that inhabit gas seeps offshore Israel. In this environment, which is devoid of sunlight and thus photosynthesis, animals engage in symbiosis with bacteria that use chemical energy to gain nutrition. Following the Ph.D. studies, I joined the Symbiosis group at the Max Planck Institute for Marine Microbiology in Germany, to investigate the molecular biology of the animal-bacteria symbioses as a postdoctoral researcher. Nowadays I am a scientist at the Israel Oceanographic and Limnological Research, who studies the molecular ecology of the deep-sea microbes.

We wish Max lots of success in his new position.

Taken from the Nautilus control room

The 10th Anniversary of the Leon H. Charny School of Marine Sciences – celebration at The 46th Meeting of the Board of Governors

Please send us any news or published stories that we could share on our website. Your ideas and contributions are most welcomed.

Have a great summer

מאחלים לכולם חופשת קיץ מהנה