



Newsletter Fall 2019

The Leon H. Charney School of Marine Sciences



Department News



Research Highlights

Fall 2019





Welcome to the Fall 2019 Newsletter of the Leon H. Charney School of Marine Sciences (CSMS) showcasing some of the research and related activities keeping us busy these past six months. Highlighting the end of the academic year, making both faculty and parents proud, are our graduating MSc and PhD students -totaling 29 and 7 respectively. This year we also marked our first School wide graduation ceremony which acknowledged each student personally in addition to the University's larger ceremony. While some students go out to the real world, others are coming into the folds of CSMS. We have, this vear. increased our efforts to recruit new students, including international students, that can choose one of three international programs within our 4 departments. We are also expanding the scope of research in the School and welcome our new faculty members: Tal Luzatto-Knaan opening up new frontiers in marine natural products at the Dept. of Marine Biology and Dr. Itzik Klein – specializing in underwater navigation – who joins the Hatter Dept. of Marine Technologies. In recent years, as the reputation of CSMS and its investigators increases, our

team has benefited by increasing the numbers of talented Post- doctoral fellows that come from around the world to research a variety of our most exciting projects (some obtaining very competitive fellowships including Zuckerman Fellows).

Our team is not complete without the talents of our technical and administrative support personnel, without whom CSMS business would "grind to a halt" (from engineering autonomous vehicles to IT support, to laboratory managers, to the department assistants and administrative director). Thanks to all of you for the hard work that makes the science "fly".

We are also aiming to keep on-track and expand this support infrastructure and network to facilitate the increasing faculty and student numbers and enable the academic excellence we are seeking.

I take this opportunity to wish our new academic faculty, staff, post-docs, and students an easy acclimation and success within CSMS. To everyone else in CSMS, I wish you a good and productive year – full of exciting science and learning, grants and publications. I would also like to bid farewell to our graduates and wishing you luck in accomplishing your dreams and succeeding with career choices.

Finally, to our supporters from Israel and beyond, we thank you for your trust in us and hope that you will continue to support us as we move forwards towards our vision of becoming the leading academic center of excellence for marine sciences in the eastern Mediterranean.

Best wishes for a fruitful and healthy year.

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NEWS FROM DEPARTMENT HEADS

The Department of Maritime Civilizations

The Department of Maritime Civilizations completes this busy academic year with twelve graduating M.A. students, seven research students submitting their dissertations, and five postdoctoral fellows completing their work with





us. In addition, we have awarded eight students the "Coastal and Underwater Excavation" for the first time. Early in the summer our two newest researchers, Emmanuel Nantet and Nimrod Marom, each won a significant ISF grant. This grant will allow them to initiate exciting new field projects in the upcoming year. Furthermore, all department members will continue their research along the Israeli coast and provide an enriching curriculum for our incoming students. The upcoming academic year opens with nineteen new students, fourteen of which belong to the international program. Additionally, we will have thirty-five continuing M.A. students, 28 Ph.D. students, and seven post-doctoral fellows. Under the guidance of Prof. Ruth Shahack-Gross, our new chair, and Prof. Assaf Yasur-Landau, the new head of RIMS, we plan to establish another international field school which will include our close collaborators from UC San Diego and Scripps Institute. We also expect to initiate a number of different field activities, including the spring departmental research cruise, fieldtrips, diving activities, as well as zodiac tours.

Dr. Moses Strauss Department of Marine Geosciences



The Department of Marine Geosciences is proud of its faculty and students who continue to shine

on both the local and international arena. We have been quite busy since the last newsletter. Recently, we hosted a workshop on the topic of "Remote Sensing of the Coastal Area Using State of the Art Techniques". The workshop was open to researchers from all Israeli universities, with ~ 40 attendees from both academic as well as the private sector. We are also proud to announce that three of our M.Sc. students received merit awards from the University-Omry Nachum, Marina Yarina, and Yu Juntao. Recently, a series of articles based on Ms. Naama Sarid's M.Sc. work examining the impacts of human development on the beaches of Haifa Bay has been published in the local press including Zavit and Ynet (https://www.ynet. co.il/articles/0,7340,L-5557732,00. html). Our Ph.D. student, Ernst Uzhansky, was nominated together with four students from other universities for the "LEIF BJØRNØ Award for Best Graduate Student Papers" at the Underwater Acoustics Conference and Exhibition (UACE) in Crete, Greece. In May, Dr. Sylvia Earle, one of the leading pioneers in marine exploration, received her honorary Ph.D. from the University of Haifa and was the personal guest of the department's Dr. Beverly Goodman-Tchernov. Additionally, Dr. Goodman-Tchernov was featured in Quartz magazine an article demonstrating how top explorers handle stressful situations in the field.

Last, but not least, as outgoing head, I would like to say that it has been an honor to serve the department and the Charney School and I am happy to pass on the baton to the capable hands of Dr. Beverly Goodman-Tchernov, who will replace me on October 1st, 2019.-Dr. Michael Lazar

The Department of Marine Biology

We are happy to welcome our new faculty member Dr. Tal Luzzatto, an expert in marine metabolomics, who will be joining us this October. I am also happy to announce that our program in Marine Biology is officially international, and welcomes both international and Israeli students to our M.Sc. program. Currently, the department has around 60 Ph.D. and M.Sc. students. Additionally, new post-docs are joining us in the coming year, and we wish them productive and enjoyable research. This year we have changed the structure of several courses and opened new courses; an AAUS scientific diving course, a course on how the Eastern Mediterranean Sea works, and a course on Elasmobranchs (sharks, rays, and skates). We were also fortunate to host guest scientists from all over the world, among them Dr. Sylvia Earle, a legendary oceanographer and explorer, and Prof. Paul Falkowski, the director of the Rutgers Energy Institute. We are looking forward to the new year and wishing all our students, scientists, and staff Shana Tova.



Photo: H. Nativ – Morris Kahn Marine Research Station



The Hatter Department of Marine Technologies



The Hatter Department of Marine Technologies החוג לעוכנולוגיות ימיות ע״ש האטר

The new logo of the Hatter Department of Marine Technologies

During the past six months the Department of Marine Technologies has continued to evolve and develop. A new faculty member, Dr. Itzik Klein, was recruited and will start his activities in the department this coming academic year. Dr. Klein is an expert in underwater navigation and will significantly strengthen the scientific capabilities of the department. In early July, the Department, together with the Faculty of Mechanical Engineering at the Technion and the Israel Navy, held a well attended conference on "Naval Architecture, Marine and Offshore Engineering". The conference provided an outstanding academic platform for researchers as well as representatives from both the industry and from the Israeli Navy to present the latest developments and engineering solutions, and exchange state-of-the-art knowledge in all aspects of marine and naval engineering. Prof. Ilana Berman-Frank opened the conference while the new Head of the Israel Navy Material Command, R. Admiral Ariel Shir, provided the keynote lecture on the development of the new Israeli Navy "Magen" class corvettes.

A new engineer has been hired at the Underwater Vehicle Laboratory with the aim of maintaining and contributing to the continuous development of the large underwater vehicles which will be used in the expected extensive research activities

that include the deployment of the AUV at a depth greater than 2,500 meters for several days. The THEMO observatory continues to evolve upon complete deployment of the deep array and has reached its full configuration as set out in the collaboration program between the University of Haifa and the Texas A&M University. Additionally, we successfully completed the development of a two-men portable autonomous underwater vehicle and autonomous small size floater. The Department faculty members continue to strengthen collaboration with members of other universities in Israel and recently established fruitful collaborations with faculty members at the Technion and the Ben-Gurion University. Relations with the local industry is also developing productively with several important high-tech industries. The Department continues to absorb outstanding students for the next academic year and to expand its curriculum. Finally, following a long maturation process, we are proud to reveal the department logo to you (see above).

WELCOME NEW FACULTY

Dr. Tal Luzzatto-Knaan



Metabolomics is the large-scale study of small molecules, metabolites, and their interaction within a biological system. My main interest is understanding the functional role of natural products and their potential for biotechnological and medicinal applications. As a post-doctoral fellow at UC San Diego, I specialized in cutting-edge mass spectrometrybased metabolomics by developing tools for studying microbial chemistry and natural products discovered in marine cyanobacteria. Joining the Department of Marine Biology at the Leon H. Charney School for Marine Sciences, my lab aims to pioneer the field of 'Functional Metabolomics' by exploring the biological role, regulation, diversity and distribution of natural products in polymicrobial environments and marine plants. These highly prolific environments are a treasure trove for novel chemistry and potential drug discovery.



NICE TO MEET

Dr. Nimer Taha



Dr. Nimer Taha working with the Multi Sensor Core Logger

Nimer Taha holds a Ph.D. degree in chemistry. His B.Sc., M.Sc. and Ph.D. degrees were received from the Department of Chemistry at the Hebrew University of Jerusalem in 2001, 2005 and 2010, respectively.

Dr. Nimer is a lab manager in the Basin Analysis & Petrophysical lab (PetroLab, headed by Dr. Nicolas Waldmann) and in the Sedimentology & Environmental Lab (headed by Dr. Revital Bookman), both at the Department of Marine Geosciences, Charney School of Marine Sciences at the University of Haifa.

Research at the PetroLab includes both field and laboratory studies of modern and ancient marine and lacustrine depositional systems and the research in the sedimentology lab is in the field of Quaternary and Environmental Geology with interests in marine and lacustrine sedimentology, paleoceanography and paleoclimate, and sediment mass transport processes connected to geo-hazards. Dr. Nimer is also responsible for safety procedures related to operating and working with radioactive and X-ray devices for the whole university.

As part of Nimer's tasks, he is responsible for the lab environment & safety and managing the daily operations of the lab. Among his other responsibilities are equipment maintenance, training users of the labs, and preparations for research sea cruises.

SPECIAL HIGHLIGHTS

International Summer Program – The Mediterranean: Past, Present and Future

This year the Leon H. Charney School of Marine Sciences hosted the international summer program "The Mediterranean: Past, Present and Future" in collaboration with the University of Haifa International School, funded by the Israeli Council for Higher Education. This year marks the fourth year of the program, with a record number of 51 international students at undergraduate and graduate levels. The program was taught by Dr. Or Bialik from the Department of Marine Geosciences and Dr. Michal Grossowicz (currently from GEOMAR – but a past graduate student of the CSMS), with academic directorship of Dr. Beverly Goodman-Tchernov (Marine Geosciences) and Prof. Em. Michal Krom (Marine Biology). Eleven graduate students from the departments of Marine Geosciences and Marine Biology assisted the program as TAs.

The course program covered multiple aspects of the Mediterranean including its tectonic history, oceanography, ecology, environment, and interaction of humans and the Mediterranean over its history. Additionally, the students participated in several fieldtrips to obtain firsthand experience with regards to the Mediterranean's past and present. Moreover, the students toured the labs of the School of Marine Sciences and were introduced to the possible graduate level programs it offers.



Participants and teachers of the International summer course - The Mediterranean: Past, Present, and Future



The program ended at the end of August, with the students returning to their home countries. Several participants of the program in the past have returned to the School of Marine Sciences as full time students in the graduate programs and this year's program holds similar promise.

South North Atlantic Transect Shipboard Training - Debra Ramon

The South North Atlantic Transect Training (SoNoAT) program is collaboration between the Partnership for Observation of the Global Ocean (POGO). The Nippon Foundation-Japan and the Alfred Wegener Institute- Germany with the goal of providing young developing marine scientists shipboard training. This summer I had the opportunity to be a part of this program where I spent an entire month aboard the RV Polarstern, an icebreaker research vessel used in polar research, learning from 15 experts in marine and climate sciences. Twenty-three scholars were chosen from all over the world, and together we crossed the entire

Atlantic Ocean from the Falkland Islands until Germany, a journey of 13,000 kilometers. The training was full of hand on learning opportunities and was composed of five major modules taught by leading experts in the field; 1) Oceanography, 2) Climate Change (taught by climate expert and Nobel Peace Prize Laureate Prof. Peter Lemke) 3) Microbiology & Microplastics, 4) Remote Sensing, and 5) Marine Technologies, Data Crunching & Outreach. In addition to conducting measurements of the entire water column of the different water bodies, we combined the data with both satellite data and atmospheric imagery to provide a multi-disciplinary angle to oceans under climate change. We also had the opportunity to deploy five new Argo floats that will spend the next few years continuously gathering data from the waters of the South Atlantic. Data produced from these floats contributes to a long-term data set accessible by scientists from all over the world and allows for better insight on the movement of the



Images from the SoNoAT Cruise, including photos of Debra Ramon as one of the fortunate 23 international students chosen to participate in the research cruise. Photo credits: Lica Maria, Tim Schauenberg

ocean currents. While on the ship we participated in outreach with schools from all over the world, answering their questions on the marine environment and discussed important issues such as the human impacts on the oceans. Such a wonderfully diverse and international group as this encourages discussion and collaboration, and we all leave with deeper insight and feel encouraged to continue working together to better understand our oceans.

Or Bialik sails on a scientific cruise on board of the RV Sonne to the Mascarene Plateau, Indian Ocean



Dr. Or Bialik in front of the R/V SONNE

On September 6th Dr. Or Bialik from the Dr. Moses Strauss Department of Marine Geosciences (in collaboration with the University of Hamburg) set sail from Hong Kong aboard the German research vessel Sonne on research expedition SO270 across the Indian Ocean. They will sail for over two weeks until arriving in the Mascarene Plateau in the western Indian Ocean where the core of the research work will be done. In total, the expedition members will spend nearly two months as sea researching the Indian Ocean. This is Dr. Bialik's second venture across the Indian Ocean, having sailed with the International Ocean Discovery Program (IODP) in 2015 for a two

LEON H. CHARNEY School of Marine Sciences

months' research expedition of the Maldives.

The current RV Sonne is the newest and most advance vessel in the German research fleet, having replaced its predecessor of the same name end of 2014. It is 118m long, has a top speed of 16 knots and a crew of 35 in addition to 40 scientists. In the scope of this expedition, it will deploy geophysical instruments as well as multiple water and sediment collection instruments.

The Mascarene Plateau, located between the Seychelles in the north and Mauritius in the south is one of the least known and enigmatic locations in the oceans. This large carbonate platform extends from hundreds of kilometers, large swaths of it in water depth of only a few meters, forming an extensive system of reefs and lagoons. The location of the Mascarene Plateau positions it at the interfaces of many of the surface and subsurface currents of the Indian Ocean, shaping it in ways that are still poorly understood. Dr. Bialik's work on this expedition will deal with the unique characteristics of the sediments of the Mascarene Plateau's margins and their relations to the water mases with which they interact. These results will shade new light on our understanding of this part of the ocean and may provide a new perspective to look at ancient deposits from similar environments.

CONGRATULATIONS

Congratulations to our faculty for newly funded grants:

Dr. Regina Katsman and Prof. (Emeritus) Boris Katznelson from the Department of Marine Geosciences – BSF – "Theoretical Study and Remote Acoustic Observations of Dynamics of Gaseous Methane in Aquatic Environment: Lake Kinneret, Israel, As a Case Study".

Dr. Laura Steindler from the Department of Marine Biology – NSF-BSF – "The Role of Rhodopsin Phototrophy in Ocean's Solar Energy Capture and Its Regulation in Contrasting Nutrient Regimes".

Dr. Tamar Lotan from the Department of Marine Biology – ISF – "Studying the Molecular Mechanisms that Underlie Fish Infection by Myxozoan Parasites".

Dr. Emmanuel Nantet from the Department of Maritime Civilizations – ISF – "Hammat Tiberias, a Major Roman Harbor in the Sea of Galilee and its Role in Lake Connectivity".

Dr. Nimrod Marom from the Department of Maritime Civilizations – ISF – "The Zooarchaeology of Southern Phoenicia: An Animal View on Cross-Mediterranean Interactions".

We wish them as well as all our faculty members interesting and productive research.

RESEARCH HIGHLIGHTS

Marine Imaging Lab (Dr. Tali Treibitz)

Sea-thru: A Method for Removing Water from Underwater Images

Derva Akkaynak, a post-doc in the marine imaging lab published a paper in the prestigious IEEE conference of 'Computer Vision and Pattern Recognition', titled: "Sea-thru: A Method for Removing Water from Underwater Images". The paper shows how to use the revised underwater image formation model that Akkaynak and Treibitz previously developed which recovers color of underwater scenes. Consistent removal of water distortion will open up large underwater datasets to powerful computer vision and machine learning algorithms, creating exciting opportunities for the future of underwater exploration and conservation.

Microsoft AI for Earth & ASSEMBLE + Transnational Access

Artificial Intelligence for Coral Reef Mapping

Recently, the Marine Imaging Lab has been awarded an AI for Earth grant from Microsoft, led by Matan Yuval, to help further their efforts in automatic classification of benthic



Figure 1. Result of the Sea-thru algortihm.[Left] Raw image. [Right] Sea-thru result



image-based maps. The grant will provide the group with computing resources and labeling services to accelerate their work on semantic mapping. This research project is an integral part of the group's effort to develop a highly automatic pipeline for underwater photogrammetry, followed by data extraction using deep-learning algorithms for genus specific classification of marine sedentary organisms. The Marine Imaging Lab led by Dr. Treibitz is one of the newest laboratories to be recognized by Microsoft for its impact and future potential and will join a growing number of AI for Earth grantees worldwide.

St. Eustatius Fieldwork

In May 2019, two of our team members, Aviad Avni and Matan Yuval, visited the island of St. Eustatius in the Eastern Caribbean through the access provided by the Caribbean Netherland Science Institute (CNSI) and funded by the ASSEMBLE+, European Union's Horizon 2020 research and innovation program. They conducted over 25 SCUBA dives and mapped large areas of the reef around the island, including artificial reefs and archeological sites. The maps will be used to examine differences in the benthic community structure between the Northern Red Sea and Eastern Caribbean, as well as generalization of our protocol for automatic benthic classification.



Figure 2. Artificial reef (left). Ancient anchor, camera calibration board, and Southern Stingray (Middle); Ancient Shipwreck overgrown by corals and sponges (right)



Figure 3.Examples of a transect map of a 10 X 2 m2 area in the Eastern Caribbean and Northern Red Sea



Figure 4. Arrival at the island of St. Eustatius, preparing to dive with custom imaging systems, and presentation at the local youth center (top and bottom left-center). 3D model of a Barrel Sponge presented in VR at the Marine Imaging Lab (bottom right).



What can infrared spectroscopy tell us about submerged settlements?



Photograph by Dr. E. Galili showing Ph.D. student Isaac Ogloblin sampling 9000 years old mud bricks in the submerged settlement of Atlit Yam. Inset shows the infrared spectrometer housed in the laboratory of Prof. Shahack-Gross that allows achieving new insights about early mud brick technology

Sea level rise in the last millennia resulted, among other things, in the submergence of ancient coastal settlements. The Carmel coast includes some of the world's most ancient such settlements, dating as much as 9,000 years ago. A recent study conducted in the Laboratory for Sedimentary Archaeology headed by Prof. Ruth Shahack-Gross in the Department of Maritime Civilizations utilizes infra-red spectroscopy to shed light on the ancient technology of building with mud bricks. Shahack-Gross's Ph.D. student Isaac Ogloblin, co-supervised by Dr. Ehud Galili, has revealed that these mud bricks, among the earliest in the world, have been prepared from local marshland deposits that were mixed with straw and fired at temperatures that range between 500 and 900°C. The purposeful firing of mud bricks

is among the earliest identified in the world thus far. These findings are prepared for publication in the *Journal of Archaeological Science*.

Remote Sensing Workshop - Department of Marine Geosciences

Students Naama Sarid and Semion Polinov, from The Dr. Moses Strauss Department of Marine Geosciences, initiated and executed a first workshop on remote sensing together with Lia Engineering Ltd. The workshop included lectures given by Yoav Lehahn, Head of the Remote Sensing laboratory from the Dr. Moses Strauss Department of Marine Geosciences, Barry Grinker, former Head of the Hydrography Department in the Israeli navy and today at Lia Engineering ,and Semion Polinov, a GIS specialist from our department. The workshop also included a field work demonstration of coastal measuring given by Tzachi Kivenshtein from Lia Engineering, with explanations about methods, techniques, and problems.

It was great to see all the interest in this field of work. Remote sensing is at the forefront of scientific research, as we aim to be. We also believe that providing knowledge to our colleagues from academia, the industry, the security forces and future scientists- will benefit everyone involved and place the Department of Marine Geosciences in the spotlight.



Has an Indo-Pacific spiny lobster invaded the Mediterranean? (Prof. Emeritus E. Spanier)

The Levant basin in the eastern Mediterranean is a very dynamic one regarding the invasion of nonindigenous species, especially from the Indo-pacific region via the Suez Canal, as numerous Lessepsian tropical species have been colonizing. While many *Lessepsian* species have been observed lobsters have not. In summer 2018, Prof. (emeritus) Ehud Spanier, from our Department of Maritime Civilizations, identified an intact molted exoskeleton (exuvia) of a spiny lobster found off the coast of southern Haifa as that of a fullygrown adult female of the western long-legged spiny lobster *Panulirus* longipes longipes. Despite the wide distribution of this lobster in the Indo-West Pacific region, it has not been reported from the Red Sea, and the closest locations is Kenya, where it is fished commercially.



The proximity of the finding site to the opening of the port of Haifa supports transfer of larvae, juvenile or adults in ballast water of a ships, which may have passed through the geographical distribution range of this species. Haifa Bay also supplies the proper habitats for adults, and the discovery site, deep in a dark shelter, is typical to molting habitats of spiny lobsters. Additionally, this species is used also in the aquaria trade, and possibility cannot be rejected that it



was disposed of from an aquarium of a passing cruise-ship passing the close-by Haifa port. If the molt was really fresh, as its strong colours indicate, the adult may still be found in the vicinity. Yet, intensive and repetitive SCUBA diving searches in the general location of the find since spring 2018, as well as widespread inquiry among fishermen in the area have been, so far, fruitless.

Coral Biomineralization and Physiology Lab - Dr. Tali Mass

And our journey continues...



Photo: H. Nativ – Morris Kahn Marine Research Station

At the end of July 2019 Dr. Tali Mass from the University of Haifa in Israel and Dr. Gretchen Goodbody-Gringley from the Bermuda Institute of Ocean Sciences (BIOS), came together again, collecting larvae in Bermuda (Western Atlantic Ocean) from the same depths and latitude as done previously in the Gulf of Aquaba To begin the project, Dr. Goodbody-Gringley and her team travelled to Eilat in March 2019, funded by the Assemble Plus Award from the EU in addition to a travel award from the Rector of the University of Haifa. The second phase of the project, which took place in Bermuda, was funded



Photo: H. Nativ – Morris Kahn Marine Research Station

by the BIOS Grant-in-Aid and BSF for Mass's team of technical rebreather divers from the Morris Kahn Marine Research Station. As qualified AAUS technical rebreather divers, Dr. Mass and Dr. Goodbody-Gringley, and their research teams can access reefs beyond the depth of traditional diving limitations. So far, they have collected larvae from shallow (5 m) and deep (45 m) coral colonies and are testing attributes of larvae development in the lab as well as on the reef.

Basin Analysis and Petrophysical Lab – Dr. Nicolas Waldmann

In October 2019, Dr. William Daniels will join Dr. Nicolas Waldmann and the Basin Analysis and Petrophysics Laboratory as a Zuckerman

Postdoctoral Scholar. Daniels received his Ph.D. from Brown University in 2017 while studying paleoclimate and paleoecology. He has worked in Alaska, Greenland, Russia, and Antarctica to reconstruct climate and pollution using novel organic geochemical techniques, as well as traditional methods such diatom analysis, sediment minerology, and sediment geochemistry. "I'm thrilled to come to Haifa as a Zuckerman Fellow, to learn new methods in sedimentology, and to experience Israel for the first time," says Daniels. At the School of Marine Science. Daniels and Waldmann will examine a unique sedimentary record from St. Paul Island in the Bering Sea to better understand the climate dynamics of the last deglacial period



approximately 10,000 years ago. In addition, St. Paul Island was one of the last places on earth where woolly mammoths lived. "Ultimately, we aim to test the hypothesis that climate change contributed to the demise of the local mammoth population on the island," says Daniels.



Dr. William Daniels joining the Waldmann Laboratory this October as a Zuckerman Postdoctoral Scholar

Gene Regulation in Development and Evolution Lab – Dr. Smadar Ben-Tabou de Leon

Possible co-option of a VEGFdriven tubulogenesis program for biomineralization in echinoderms

Biomineralization is the process by which living organisms use minerals to form hard structures that protect and support them. Biomineralization is believed to have evolved rapidly and independently in different phyla utilizing pre-existing components. The mechanistic understanding of the regulatory networks that drive biomineralization and their evolution is far from clear. A new study from

our lab that was recently published in PNAS, revealed that the sea urchin skeleton had probably evolved by an adaptation of an ancestral program for blood vessel formation. The sea urchin calcite spicules and vertebrate blood vessels are quite distinct in their function, yet both have a tubular structure and are controlled by the vascular endothelial growth factor (VEGF) pathway. We studied the downstream program by which VEGF signaling drives sea urchin skeletogenesis and find remarkable similarities to the control of vertebrate vascularization. The similarities are observed both in the upstream gene regulatory network, in the downstream effector genes that build the skeleton and the cellular processes that VEGF signaling controls. We speculate that sea urchin skeletogenesis and vertebrate vascularization diverged from a common ancestral tubulogenesis program that was uniquely coopted for biomineralization in the

echinoderm phylum. This could be an example of the way that phylum specific biomineralization programs rapidly evolved through the insertion of novel biomineralization modules into ancestral developmental GRNs.



PNAS cover showcasing images of echinoderms from the research published by the Ben-Tabou de Leon lab

CONFERENCES/WORKSHOPS SAVE THE DATES The 7th Haifa Conference on Mediterranean Sea Research **14-15.1.2020** FOOD FROM THE SEA





סדנא פתוחה לקהל הרחב בנושא:

השפעות תוצרי הזרמה ממפעלי ההתפלה על הסביבה הימית

The Impacts of Seawater Desalination Discharges on the Marine Environment

אוניברסיטת חיפה

10:00-16:00

יום ג', 2020, ים די

SAVE THE DATE מיקום מדויק ותוכנית הסדנא יפורסמו בהודעה נפרדת