出國報告（出國類別：其它-參訪交流）

赴以色列召開台以雙邊研討會及訪問

出國報告

出國人員：行政院國家科學委員會張清風 副主任委員
行政院國家科學委員會工程處 李清庭處長
行政院國家科學委員會生物處 郭明良處長
行政院國家科學委員會國合處 鄭慧娟副研究員

派赴國家：以色列
出國期間：100 年 12 月 10 日至 17 日
報告日期：101 年 2 月 20 日

目　錄

壹、目的

依據100年5月台以兩國在台北召開之第3屆台以科技年會，於2011年12月在台北舉辦以「人為活動對海洋環境的影響(Effects of human activities on marine environments」以及「人工智慧運算模式(Artificial intelligence and learning algorithm)」等二項為主題之雙邊研討會。

2011 年12月10-17日，本會張副主委率團赴以色列海法與以色列科技部共同舉辦研討會及會後參訪活動。本會邀請國立臺灣海洋大學龔國慶主任及國立成功大學鄭憲宗主任，分別擔任二項主題之台方召集人。經由以色列科技部安排，訪團與以色列科技部部長Prof. Daniel Hershkovitz餐敘，拜訪Israel Oceanographic and Limnological Research (IOLR)、the Technion、Tel-Aviv University、the Israel Academy of Sciences and Humanities，以及the Hebrew University。

本次訪以團成員包括張清風副主委、工程處李清庭處長、生物處郭明良處長及國合處鄭慧娟副研究員。

貳、過程與觀察

■主要行程/

1.參訪 Israel Oceanographic and Limnological Research (IOLR)

海洋團隊由以色列科技部Dr. Husam Massalha,Deputy Chief Scientist (Acting) Senior Division Director Environment and Agriculture 引導前往以色列海洋與湖沼研究所(Israel Oceanographic and Limnological Research; IOLR)參訪。雙方相互

介紹後，由IOLR向訪團進行簡報。簡報內容如下，

0845-0900：Barak Herut (Director IOLR), General overview of IOLR

0900-0915：Bella Galil (Biology Department), Effects of global change on marine alien species in the Mediterranean

0915-0930：Buki Rinkevich (Biology Department), Global change and reef restoration

0930-0945：Gil Rilov (Biology Department), A biodiversity crisis on event rocky reefs: the collapse of ecologically important benthic species

0945-1000：Issac Gertman (Physics Department), Dead Sea interannual changes

1000-1015：Dov Rosen (Geology Department), Sea level rise due to climate change, coastal erosion (and tsunami early warming activities of IOLR)

1015-1145：Visit to biology laboratory

2.拜訪海法大學 Department of Computer Science

AI 團隊由Dr. Fadil Salih, Director Division of Physics and applied Mathematics Ministry of Science and Technology,成員在國科會工程處李處長帶領下，至海法大學Computer Science 學系拜訪Prof. Larry Manevitz，並參訪Hecht Museum。其中Hecht Museum館藏非常豐富，在相關教授及研究人員介紹並展示Mobile Museum Guide 系統後，讓團隊成員對此一博物館印象深刻，相關技術已與相關產業合作，此一產學合作模式可為台灣學術界與產業界結合之參考。其實國內也有相關學者專家正進行國科會數位典藏國家型計畫，若能與以色列相關研究進行結合，應能產生更大效益。

3.拜訪以色列理工大學(Technion）

訪團由以色列理工學院(Technion)副校長Prof. Paul Fegin接待並進行簡報，介紹該大學的校況以及該校如何因應未來挑戰之策略，其中最值得借鏡的是，該校以interdisciplinary program的方式，設立了多個多學科的研究中心，鼓勵教師與學生進行跨領域的研究與教學。

以色列理工學院教授在2011 年獲得諾貝爾化學獎，並與許多世界大廠(如IBM、Microsoft、Yahoo、Intel、CISCO、Motorola、GE、Simens 及Google 等)合作，顯示其研發能量廣受各界肯定。AI組拜訪以色列理工學院Faculty of Computer Science 的院長Prof. Elie Biham，在團隊成員自我介紹後，Prof. Elie Biham 介紹該校Computer Science 相關研究及成員後，再由Prof. Ran El-Yaniv、Prof. ShaulMarkovitch 及Dr. Nir Ailon 簡要介紹其相關實驗室及研究成果。海洋科學組則參訪該校生物系（Department of Biology），由該系教師簡報利用基因技術從事海洋微生物演化與環境變遷方面的研究現況；另亦參訪該校農工中心（Agriculture engineering center），聽取該中心教授從事In-situ high resolution PIV measurements near the coral Favia Favus的研究，並參觀其實驗室。

4.拜訪台拉維夫大學動物研究中心(Meir Segal Zoological Garden)

海洋科學組訪問台拉維夫大學的動物研究中心(Meir Segal Zoological Garden)，及波特環境研究所(Porter School of Environmental Studies)，行程如下：

1500-1540：參觀動物研究中心，由 Prof. Amir Ayali 介紹。

1550-1635：參訪波特環境研究所，由 Prof. Pinhas Alpert 介紹，瞭解該研究單位的願景與目標及營運模式。這是一所虛擬的研究所，雖然所內沒有專任教師，但卻由各種不同領域的教師結合，從事跨領域的教學與研究工作，可提供學生多學科的訓練以及教師在技轉方面的協助。

1640-1700：由台拉維夫國際部業務主任 Ms. Etti Mond 進行校園導覽。

5.拜訪以色列科學院（Israel Academy of Sciences and Humanities）

由Israel Academy of Sciences and Humanities President Prof. Ruth Arnon 親自接待，並向訪團簡報。科學院的目標是To expand the frontiers of knowledge by harnessing science for the benefit of the country and humanities，並扮演以下三個主要的角色：

(1)To provide scientific activities and mainly basic research

(2)To advise the government on issue related to sciences

(3)To establish relationship with acdaemies abroad

Israel Academy of Sciences and Humanities 在以色列科技發展中，扮演舉足輕重的角色；除了每年會對重點科技發展提供建言，同時也是重要研究計畫的 funding agency。舉例來說，President Ruth Arnon 提到如何選定臨床醫學為重要發展重點，乃因，經仔細評估，以色列於該領域於世界居 15 名，相較於 Computer Science 居世界之冠，顯有落差，遂結合醫院遴選有志從事臨床醫學的醫師，由研究計畫中支付醫師一半薪資，讓醫師能有一半的時間投入研究工作，以提升整體研究的風氣與水準。會中張副主委及團

隊成員與 President Ruth Arnon 廣泛交換意見，並向其請教應如何培育諾貝爾獎得主。

6.拜訪希伯來大學（Hebrew University of Jerusalem）

由Vice-President Prof. Shy Arkin (Vice President for Research and Development)接待並向訪團進行簡報與座談。Hebrew University 為以色列頂尖大學，該校雖僅有約 900 位教師，但在學術及產學均有相當傲人的成就，主要的特色是學校具有甚多技轉成立的公司，該校有多位諾貝爾獎得主，亦為全球百大之頂尖大學，其傑出之研究成果令人印象深刻，亦值得我們學習。Hebrew University 的成功，肇因於學校開放積極的態度，並有十分專業的育成中心與技術移轉中心，充分的專業分工，讓教授們的研究成果，得以被產業界充分使用並產品化。同時高度國際化，除引起國際知名企業興趣，投入研發經費，並與多國政府有跨國的研究計畫，該校每年一有大量來自歐盟的研究經費。更令人佩服的是，該校育成的公司，許多還在美國上市上櫃。副校長並說:在 Hebrew University 他們相信 Science is the only international language，足見 Hebrew University 的國際視野，校方展現的企圖心與作為值得我國各大學重視與學習。

另海洋組拜訪希伯來大學地球科學研究所，並聽取該研究所在海洋科學領域方面的研究。此研究所是該校唯一有從事海洋科學研究的單位，其在 Gulf of Eilat 設有大學間共享的海洋工作站，由於有長期的觀測與研究資料，證實當地海域的箱網養殖會造成海域珊瑚礁生態的浩劫，促使以色列當局禁止在當地繼續從事箱網養殖的工作，值得臺灣方面借鏡。

至於AI組則同時由Prof. Danny Porat (Head of Nano Center)於Nano Center Meeting room進行簡報，接著參訪Hebrew University of Jerusalem Nano Center 中所建置的貴重儀器及相關研究成果，團隊成員並與Prof. Danny Porat 進行相當深入的討論。該研究團隊與台灣中央研究院已進行了兩年雙邊跨國合作，研究成果斐然。

隨後參訪位於Hebrew University of Jerusalem 校內之Albert Einstein Archives (Levy Bld., 2nd floor)，由Dr. Ronni Grosz 進行接待與介紹，在此Albert Einstein Archives 中，團隊成員參訪並親自看到愛因斯坦的珍貴手稿及書信，其中包括了愛因斯坦親自回覆一位小孩及中國留學生之書信。

7. 本會(NSC)與以色列科技部共同舉辦台以研討會(Effects of human activities on marine environments」

兩場研討會共同開幕式由 Prof. Martin Golumbic (Head, The Caesarea-Rothschild Institute)致歡迎詞，並由本會張副主委、Haifa 大學 President Prof. Aharon Ben-Zeev 及科技部國際事務部主任Ilana Lowi Ms. Hana Lowis、Haifa 大學Rector Prof. David Faraggi 以及副校長兼研究院長Prof. Michal Yerushalmy 分別致歡迎詞，展開了兩天的雙邊研討會。

以海洋科學為主題之研討會，我方由國立台灣海洋大學頂尖中心龔國慶主任擔任召集人，並由台方 5 位學者、以方 16 位學者發表論文。

龔國慶主任：簡介臺灣海洋科學研究單位及國科會支援海洋科學研究概況，以及全球變遷對海洋生地化循環及生態系統的影響，特別是在極端氣候狀況下，海洋的反應為何？

李明安院長：簡介臺灣在漁業科學與水產養殖的發展，以及全球變遷對漁業資源的影響。

吳朝榮所長：簡介臺灣在物理海洋的研究概況，以及全球變遷對海洋環流變動的影響。

戴昌鳳所長：簡介臺灣在珊瑚礁生態方面的的研究概況，以及全球變遷對珊瑚礁生態的影響。

夏復國研究員：簡介中研院在海洋方面的研究概況，特別是甫獲核准將於東沙環礁進行的海洋酸化主題計畫，以及全球變遷對海洋微生物生態的影響。

會議結束前也短暫討論未來雙方可能合作的議題，以方科技組提出海洋酸化可能是未來可以合作的研究重點。

*AGENDA: "EFFECTS OF HUMAN ACTIVITIES ON MARINE ENVIRONMENTS"

Organized by

Prof. Yehuda Benayahu

Program Committee: Prof. Amazia Genin, Dr. Daniel Sher, Dr. Maoz Fine, Prof. Aldo Shemesh, Prof. Yehuda Benayahu

December 12th-13th, 2011 University of Haifa

Caesarea-Rothschild Institute – Room 566, Education Building (except opening)

December 12th

8:00-9:30	Breakfast at the Hotel
10:30-10:00 Room 363 Education Building 3rd Floor	**Opening of the Conference – Room 363, 3th Floor, Education Building** Prof. Martin Golumbic, Head, The Caesarea-Rothschild Institute – Greetings – Prof. Ching-Fong Chang, the Taiwan Deputy Minister of National Science Council Prof. Aharon Ben-Zeev , President of the University of Haifa Ms. Ilana Lowi, Director, Division for International Relations, Ministry of Science and Technology

	Prof. Zvi Ben-Avraham, The Leon Charney School of Marine Sciences Prof. Michal Yerushalmy, Vice-president and Dean of Research	
Chair: Aldo Shemesh		
10:30-11:10	**Gwo-Ching Gong** (40 mn) National Taiwan Ocean University	Overview of oceanic research in Taiwan and effects of global change on marine biogeochemical cycling
11:11:30-10	**Yossi Loya** (20 mn) Tel Aviv University	Reproductive strategies in mushroom stony corals
11:50-11:30	Coffee Break	
12:10-11:50	**Ruth Yahel** (20 mn) Israel Nature and Park Authority	Marine conservation at the Israeli Mediterranean Sea: threats and challenges
12:30-12:10	**Maoz Fine** (20 mn) Bar Ilan University	Corals and coral reefs in a changing world
12:30-12:50	**Hudi Benayahu** (20 mn) Tel Aviv University	Octocorals: a platform for collaboration between Taiwanese and Israeli scientists
14:00-13:00	Lunch 6th floor, CRI Lounge, Education Building	
Chair: Maoz Fine		
14:40-14:00	**Ming-An Lee** (40 mn) National Taiwan Ocean University	Effects of global change on fisheries
15:00-14:40	**Arik Diamant** (20 mn) National Center for Mariculture	Alien and native fish assemblages in the warming eastern mediterranean from a parasitological viewpoint
15:20-15:00	**Muki Shpigel** (20 mn) National Center for Mariculture	Sustainable multi-trophic mariculture systems in the Red Sea: back to the future
15:40-15:20	**Dror Angel** (20 mn)	Sustainable Aquaculture - getting the

	Haifa University	most out of the ocean with the least effect
15:40-16:00	**Tamar Zohari** (20 mn) Kinneret Limnological Laboratory	Anthropogenic impacts on the Sea of Galillee: ecological responses
16:20-16:00	Coffee Break	

Chair: Daniel Sher		
17:00-16:20	**Chau-Ron Wu** (40 mn) National Taiwan Normal University	Effects of global change on ocean currents
17:-17:0020	**Aldo Shemesh** (20 mn) The Weizmann Institute of Science	Oxygen and carbon isotopes in marine and lacustrine diatoms: Indicators of global and regional paleoclimate
17:40-17:20	**Hezi Gildor** (20 mn) The Hebrew University of Jerusalem	Submesoscale mixing observations and modeling: from vertical density currents to horizontal barriers to mixing
17:40-18:00	**Eyal Ben Dor** (20 mn) Tel Aviv University	Hyperspectral remote sensing as an effective tool for aquatic mapping

December 13th

7:45-8:45	Breakfast	
Chair: Hudi Benayahu		
9:40-9:00	**Chang Feng-Dai** (40 mn) National Taiwan University	Effects of global change on coral reef system
09:40-10:00	**Avigdor Abelson** (20 mn) Tel Aviv University	Coral reef restoration: Is it a chronicle of failure foretold?
10:00-10:20	**Danny Tchernov** (20 mn) University of Haifa	The rise and fall of stony corals
10:10-2040	Coffee Break	
Chair: Dan Tchernov		

10:40-11:20	**Fuh-Kwo Shiah** (40 mn) Academia Sinica	Effects of global change on microbial ecology
11:20-11:40	**Debbie Lindel** (20 mn) Israel Institute of Technology, Technion	Genomic island variability facilitates coexistence between marine viruses and their *Prochlorococcus* hosts
11:40-12:00	**Assaf Vardi** (20 mn) The Weizmann Institute of Science	Sensing Environmental Stresses and Cellular Responses in Marine Phytoplankton
12:00-12:20	**Daniel Sher** (20 mn) University of Haifa	Patterns of interactions among marine microbes: what we know, what we want to know, and what we need to know
	Closing Remarks	
13:30-12:30	Lunch 6th floor, CRI Lounge, Education Building	

8. 本會(NSC)與以色列科技部共同舉辦台以研討會「人工智慧運算模式(Artificial intelligence and learning algorithm)」

以人工智慧為主題之研討會，我方由國立成功大學資訊系鄭憲宗主任擔任召集人，並由台方 5 位學者、以方 13 位學者發表論文。

AI-組的研討會由長得神似愛因斯坦的主持人Haifa 大學的 Prof. Larry Manevitz 致開場白後展開。首先由Jeff Rosenschein 開講，談的是如何應用賽局理論的機制設計來處理機器學習分類的問題，設計出一個機制讓使用機器學習的分類演算法也無法有利基來欺騙。Rosenschein 於100年5月剛來過台灣參加AAMAS 2011對台灣留有深刻良好印象。第二個演講由成大鄭主任講演利用 cellular automata 理論來處理汽車環境與駕駛之間的協調溝通問題。

第二場由Claudia Goalma-Shenar 講人機互動中系統如何自

動產生建議與忠告，主要論點基於不同的問題領域有不同的回應，就複雜問題領域與資訊掌握充分與否提出不同的建議。接下由Malik Yousef 報告主要發展一套只由正例沒有負例的機器學習演算法應用到生物資訊的MicroRNA 標的(target)的預測問題上。但是他用MIRANDA 的軟體系統工具來產生負例以測試其系統的表現，清華大學蘇豐文教授提問因MIRANDA 不可能預測的很準，所以評估上的表現應要有一點修正。

下午第一場由高雄大學林文揚教授主講DataStream 的資料探勘與應用。先介紹一下高雄大學後，主要談在datastream 探勘中如何尋找資料間間接的關係，並如何利用模型與使用者的需求來決定適當的window 大小。接下來Moshe Koppel 主要講演如何將混合的文章分離開來，並以聖經篇章為例作實驗，主要利用同義詞使用習慣的不同與自動分群技術將不同作者的文章分離開來。第三個演講由Larry Manevitz 講演如何利用MRI 的技術將人腦中的活動數據來解讀與檢視心理學家對於人腦記憶與思考模式是否不同的假說，機器學習的方法用來將活動數據分類。台南大學李健興教授詢問是否可利用MRI 數據來分辨不同程度圍棋棋手的思考。

李健興教授報告如何用type-2 fuzzy 本體知識的建構與應用，先用影帶介紹台南大學與台灣舉辦電腦圍棋的現況。並介紹台法在電腦圍棋技術合作與職業棋手交鋒的紀錄，李教授所報告的Type-2 Fuzzy Ontology 應用主題包括健康照護、電腦對局及軟體工程等領域。接下來Yaajov Gal 介紹e-learning 的系統工具，應用到科學教育，系統整合各種資訊來解構使用者的活動並結合教學情境提供教師來了解學生的程度。最後一個演講由Sarit Craus 講演如何利用對文化敏感的代理人來做人機間的協商，她設計一個需要協商的遊戲讓三個不同國家(US、以色列及黎巴嫩)

的157 個玩家上線玩以分析不同文化背景下玩家的協商策略。她設計的虛擬代理人可以與人協商而不讓玩家知道是在與機器互動。若成功則在虛擬代理人的協商技術又可以考慮文化差異的層次了。

由任職於以色列科技部的Gideon Ariely 博士主講，其題目是The Connectionist Approach vs. The Symbolic Approach in AI。其演講的主要重點是從哲學上的觀點比較人工智慧中的兩個傳統方法符號式方法(Symbolic Approach) 與類神經網路， 指出其異同與其對哲學的認識論(Epistemology)與認知心理學(Cognitive Psychology)的影響。第二場演講是由我方的人員主講，講員為任職於台灣科技大學資訊工程系的李育杰教授，其題目是Combine the Passive and Aggressive Algorithm with a Proximal Model。李教授於此演講中首先簡介Machine Learning 在台灣的研究現況與成就，過去幾年，在台灣舉辦Machine Learning 相關的國際研討會與曾訪台的重量級人士。接著介紹近來在線上學習(Online Learning)中相當受到矚目的PA(Passive and Aggressive)演算法。該演算法最初出處為2005 希伯來大學的技術報告。李教授指出此演算法因缺乏對過去案例的記憶機制，故較容易影響其學習的效率。因此，其研究提出一種新的(分類)規則的更新方法，藉由紀錄過去的類別的變異數與平均等訊息，其方法較不受輸入資料次序的影響，而且僅需一次的資料讀取即可得到接近最佳的分類器，其精采而深入的說明得到在場聽眾相當多的迴響。

第三場演講是由任職於特拉維夫大學資訊科學系的Yishay Mansour 教授主講，題目是Learning and Domain Adaptation。Mansour 教授的演講主要在介紹在機器學習領域中近來頗受重視的領域調適(Domain Adaptation)問題，其概念在探討如何運用在其他相關但不同領域所學習到的知識，如分類方式，運用到

未知的領域。Mansour 教授並介紹了這方面的研究概況以及他們的研究成果，對於有心於這分面的研究的學者是相當好的參考資訊。第四場演講是由任職於以色列理工學院的Shaul Markovitch 教授，題目是Wikipedia-based semantics, with application to Machine Learning and Information Retrieval 。Shaul Markovitch 教授先前在我們訪問該校時即曾與我們座談，並介紹其個人的研究概況，記憶中其研究相當廣泛且相當健談。在這個演講中，Markovitch 教授介紹他們研究團隊近來的一個研究成果，探討如何運用維基百科以建構詞彙的語意知識本體，並如何用在資訊檢索等相關的應用上。因其研究與我方的李健興教授及林文揚教授的研究有較多的關聯，故此二位教授提出不少的問題，會後也與Markovitch 教授有進一步的討論。

第五場演講再次由我方的人員主講，講者是清華大學資訊系統與應用研究所的蘇豐文所長，題目是Identify Drug Co-target to Fight Drug Resistance Based on a Random Walk Model。蘇教授在這個演講中介紹其近期的研究，如何由蛋白質交互作用網路中找出藥物反應路徑，並運用隨機漫步的方法辨識潛在的抗藥性標靶。其實驗以結核分支桿菌為例，找出的結果與最近的醫學實驗一致。第六場演講是由耶路撒冷工學院的Shulamit Reches 主講，題目是When to Stop? That is the Question。其演講主要在探討進行投資決策時常遇到的典型問題：在資訊變動頻繁的環境下，如何決定何時該投資而何時該等待的問題。她們的研究證明了要找出最佳的投資時機以獲取最大的利益是一個NP-hard 的問題，故其提出了一個近似演算法，可以在較短的時間內找到近似最佳解。

最後一場演講是由任職於特拉維夫大學的Nachum

Dershowitz 教授主講，題目是Algorithmic Paleography。Dershowitz 教授在這個演講中，介紹其團隊所進行的一項大型的研究計畫，如何將散居世界各地的古代文獻片段進行整合，以協助建立完整的古籍數位典藏，供相關的學者進行研究。其研究特別以Cairo Geniza 一個在開羅的猶太會堂發現的古代猶太書籍儲藏，後來散佈於17 個國家，約有280,000 個文章片段。這個研究的困難度在於這些文獻皆是手寫的，且許多模糊不易辨識，而許多文獻被分成許多片段，散居世界各地，如何組合還原是極大的挑戰。由於我國歷史悠久，亦具有許多古代的典籍文物，Dershowitz 教授的研究很值得借鏡，也是未來兩國可以合作的對象。

最後由地主海法大學Caesarea Rothschild Institute 的主任 Martin Golumbic 教授做當天會議的總結，其感謝所有參與這次會議的人員，也希望能藉此開啟兩國在人工智慧與學習領域的合作。

*ARTIFICIAL INTELLIGENCE AND LEARNING ALGORITHMS

organized by
Prof. Larry Manevitz

Program Committee: Prof. Nahum Dershowitz, Prof. Martin Golumbic, Prof. Sarit Kraus, Prof. Larry Manevitz

December 12th-13th, 2011 University of Haifa
Caesarea-Rothschild Institute – Room 570, Education Building (except opening)

December 12th

8:00-9:30	Breakfast at the Hotel
10:30-10:00 Room 363 Education	**Opening of the Conference – Room 363, 3th Floor, Education Building** Prof. Martin Golumbic, Head, The Caesarea-Rothschild Institute – Greetings –

Building 3rd Floor	Prof. Ching-Fong Chang, the Taiwan Deputy Minister of National Science Council Prof. Aharon Ben-Zeev , President of the University of Haifa Ms. Ilana Lowi, Director, Division for International Relations, Ministry of Science and Technology Prof. Zvi Ben-Avraham, The Leon Charney School of Marine Sciences Prof. Michal Yerushalmy, Vice-president and Dean of Research	
10:30-11:00	**Jeffrey Rosenschein** (25 mn talk) Hebrew University of Jerusalem	Strategy-proof Classification
11:011:-050	**Sheng-Tzong Cheng** (45 mn talk) National Cheng King University (NCKU)	Cellular Automata for Cars
12:00-11:50	Coffee Break	
12:30-12:00	**Claudia Goldman-Shenhar** (25 mn talk) General Motors, Israel	Automated Advice Generation for Human Machine Systems
13:00-12:30	**Malik Yousef** (25 mn talk) Sakhnin College	A Zero-Norm Feature Selection Method for Improving the Performance of the One-Class Machine Learning for MicroRNA Target Detection
14:00-13:00	Lunch 6th floor, CRI Lounge, Education Building	
14:50-14:00	**Wen-Yang Lin** (45 mn talk) National University of Kaohsiung (NUK)	Mining Indirect Associations over Data Streams and Its Applications
15:20-14:50	**Moshe Koppel** (25 mn talk) Bar Ilan University	An unsupervised method for decomposing a document into authorial components (with applications to the Bible)
15:50-15:20	**Larry Manevitz** (25 mn talk) University of Haifa	Establishing the Existence of a "Fast Encoding" Adult Human Declarative Memory System via Machine Learning on

		fMRI data
16:10-15:50	Coffee Break	
17:00-16:10	**Chang-Shing Lee** (45 mn talk) National University of Tainan (NUTN)	Type-2 Fuzzy Ontology and Its Applications
17:30-17:00	**Ya'akov (Kobi) Gal** (25 mn talk) Ben Gurion University	Cooperative Tools for Exploratory Domains
18:00-17:30	**Sarit Kraus** (25 mn talk) Bar Ilan University	A Cultural Sensitive Agent for Human-Computer Negotiation

December 13th

7:45-8:45	Breakfast	
10:00-9:00	Tour of the University	
10:50-10:00	**Yuh-Jye Lee** (45 mn talk) National Taiwan University of Science and Technology (NTU)	Combine the Passive and Aggressive Algorithm with a Proximal Model
11:15-11:00	Coffee Break	
11:45-11:15	**Yishay Mansour** (25 mn talk) Tel Aviv University	Learning and Domain Adaptation
11:45-12:15	**Shaul Markovitch** (25 mn talk) Israel Institute of Technology (Technion)	Wikipedia-based semantics, with application to Machine Learning and Information Retrieval
13:30-12:30	Lunch 6th floor, CRI Lounge, Education Building	
14:30-13:45	**Von-Wun Soo** (45 mn talk) National Tsing Hua University (NTHU)	Identify Drug Co-target to Fight Drug Resistance Based

		on a Random Walk Model
15:00-14:30	**Shulamit Reches** (25 mn talk) Jerusalem Institute of Technology	When to Stop? That is the Question
15:30-15:00	**Gideon Ariely** (25 mn talk) Ministry of Science and Technology, Israel	The Connectionist Approach vs. The Symbolic Approach in AI
16:00-15:30	**Nachum Dershowitz** (25 mn talk) Tel Aviv University	Algorithmic Paleography
16:00-16:15	Closing Remarks Prof. Martin Golumbic, Director CRI, University of Haifa	

參、心得

1.由駐台拉維夫台北經濟文化辦事處(Taipei Economic and Cultural Office in Tel-Aviv)主辦的歡迎本會訪問團晚宴，大約有250 人左右參與此一盛會，其中大約有三分之二與會人員為以色列科技部及相關大學之學者專家，大家在晚宴中也廣泛交換意見及進行學術交流之討論。此一晚宴在非常熱絡氣氛中進行，並由我駐以色列張良任大使及本會張副主委分別上台致詞，在會中並同時佈置中華民國國旗及以色列國旗，顯見台以兩國之合作夥伴關係極為穩定。

2.海法大學之Hecht Museum館藏非常豐富，在相關教授及研究人員介紹並展示Mobile Museum Guide 系統後，讓團隊成員對此一博物館印象深刻，相關技術已與相關產業合作，此一產學合作模式可為台灣學術界與產業界結合之參考。其實國內也有相關學者專家正進行國科會數位典藏國家型計畫，國內

在國立臺南大學亦設有全球唯一之柏揚文物館，館藏柏揚之生前珍貴手稿及重要文物，若能與以色列相關研究進行結合，應能產生更大效益。

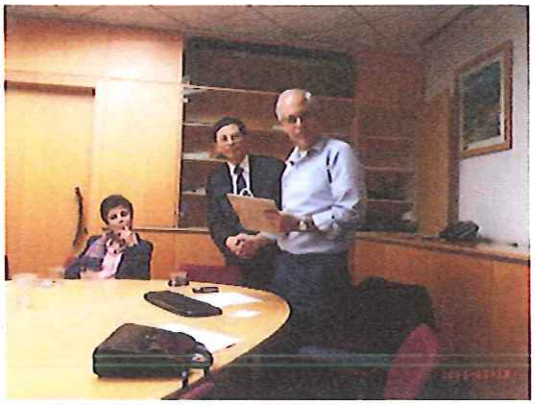
肆、建議事項

我國目前有中華民國人工智慧學會(Taiwanese Association for Artificial Intelligence, TAAI)，以色列也有類似的學術性組織，據瞭解稱為Israel Association for Artificial Intelligence (IAAI)，爲維持兩國間人工智慧領域方面的長遠合作與交流，建議未來可由TAAI 邀請以方IAAI 參與每年舉辦的人工智慧論壇以及人工智慧與應用研討會，甚至可合辦研討會。此次參訪的AI 團員大多為TAAI 的會員，相信應很容易促成此一美事。國內也有相關學者專家正進行國科會數位典藏國家型計畫，若能與以色列相關研究進行結合，應能產生更大效益。此次以方出席的講員的研究專長大多集中在機器學習與智慧型代理人，其他AI 領域如機器人學、模糊理論、演化式計算、類神經網路、資料探勘等極為少見，而這些領域在我國卻有相當多的學者，未來建議可擴大領域的參與面，提高雙方合作的意願與成功率。

◆附件--研討會及相關參訪行程照片

參訪以色列海洋與湖沼研究中心(Israel Oceanographic and Limnological Research)

參訪以色列國家科學院



參訪特拉維夫大學動物研究中心及波特研究所

台以雙邊學術研討會開幕

參訪以色列理工大學(Technion)

以色列科技部部長 Prof. Daniel Hershkovitz

משרד המדע והטכנולוגיה
Ministry of Science & Technology
وزارة العلوم والتكنولوجيا

行政院國家科學委員會
National Science Council

אוניברסיטת חיפה
לבלוט בנוף האקדמי

Leon H.Charney
School of Marine Sciences
בית הספר למדעי הים ע"ש ליאונרד

Caesarea Rothschild Institute
for Interdisciplinary Applications
of Computer Science

THE DUAL TAIWAN-ISRAEL RESEARCH SYMPOSIUM ON

"ARTIFICIAL INTELLIGENCE AND LEARNING ALGORITHMS"

AND

"EFFECTS OF HUMAN ACTIVITIES ON MARINE ENVIRONMENTS"

under the auspices of

The Israeli Ministry of Science and Technology

and

Taiwan National Science Council

organized by

Prof. Larry Manevitz
Department of Computer Science, University of Haifa

Prof. Yehuda Benayahu
Department of Zoology, Tel Aviv University

Dr. Fadil Salih
The Israeli Ministry of Science and Technology

Dr. Husam Massalah
The Israeli Ministry of Science and Technology

12th- 13th, December 2011

Caesarea-Rothschild Institute
Rooms 363, 566 and 570, Education Building

University of Haifa

Overview of Oceanic Research in Taiwan and Effects of Global Change on Marine Biogeochemical Cycling

Gwo-Ching Gong

Institute of Marine Environmental Chemistry and Ecology
Center of Excellence for Marine Bioenvironment and Biotechnology
National Taiwan Ocean University, Keelung, TAIWAN

The occurrences of extreme weather conditions appear on the rise under current climate change conditions, resulting in more frequent and severe floods. The devastating floods in southern China in 2010 and eastern Australia 2010-2011, serve as a solemn testimony to that notion. Accompanying the excess runoffs, elevated amount of terrigenous materials, including nutrients for microalgae, are discharged to the coastal ocean. However, how these floods and the materials they carry affect the coastal ocean ecosystem is still poorly understood. Yangtze River (aka Changjiang) which is the largest river in the Eurasian continent, flows eastward and empties into the East China Sea. Since the early twentieth century, serious overflow of the Changjiang has occurred four times. Extensive surveys of the on-going integrated project, "Long-term Observation and Research of the East China Sea (LORECS)" in the East China Sea, had been carried out in July of 1998, 2004, 2007, 2008, 2009 and 2010. The timing of those in 1998 and 2010 coincided with the flooding periods of Changjiang. During the two most recent ones in July 1998 and 2010, we found total primary production in the East China Sea reaching 147x103 tons carbon per day, which may support fisheries catch as high as 410x103 tons per month, about triple the amount of non-flooding periods based on direct field oceanographic observations.

As the frequencies of floods increase worldwide as a result of climate change, the flood-induced biological production could be a silver lining to the hydrological hazards and human and property losses inflicted by the excessive precipitations.

Reproductive Strategies in Mushroom Stony Corals

Yossi Loya[1] and K. Sakai[2]

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The reproductive modes of corals in the family Fungiidae are relatively poorly known. In this study we document the findings over five years of observations of various reproductive traits and seasonal reproductive patterns of 12 species of mushroom corals from northern Okinawa. We provide new records with respect to sexuality and mode of reproduction for six species. Furthermore, we indicate two new species that change sex (*Ctenactis crassa* and *Fungia scruposa*) and one species that exhibits multiple sex reversals *(C. echinata)*. Sex change occurs when an individual changes from one functional sex to another. The direction of sex change occurs mainly from male to female (protandry) or vice versa (protogyny), but sometimes may be bidirectional (repetitive). The multiple sex reversal displayed by *C. echinata* greatly resembles that of dioecious plants that display labile sexuality in response to energetic and/or environmental constraints. We posit that, similar to these plants, in the coral sex change increases its overall fitness reinforcing the important role of reproductive plasticity in the Phylum Cnidaria in determining their evolutionary

Corals and Coral Reefs in a Changing World

Maoz Fine

The Interuniversity Institute of Marine Sciences, Eilat
and The Mina E. Goodman Faculty of Life Sciences
Bar Ilan University

The marine environment across oceans and depths is currently challenged by rapid change in the chemo-physical conditions such as increased sea temperature and ocean acidification. Some organisms, such as reef building corals are confounded by a very tight set of requirements for their development and sustainability. It is therefore expected that in a changing environment, some reefs might cease to exist or undergo shifts in community structure. The physiological response of coral species to environmental stress determines their resilience to stressful conditions and/or their recovery following stressful events. This in turn, may determine the fate of coral reef ecosystems in a high CO_2 world. Our recent studies on the combined effect of elevated temperature and decreased pH show that while corals may detrimentally respond to elevated temperature, their response to ocean acidification is hitherto hard to detect at realistic pCO_2 although the damage to the primary reef framework builders by dissolution is immense. Corals that were incubated for over a year under ocean acidification conditions survived and reproduced while their skeleton completely dissolved. When sub-lethal temperatures were inflicted in combination with decreased pH, corals which were exposed to the combined effect showed synergistically negative effect as compared with corals that were exposed to low pH or high temperature only. A clear species specific threshold was detected. These findings are important for understanding the consequences of near future changes but also to better understand similar historical events which led to total disappearance of reefs from the geological record.

Octocorals: A Platform for Collaboration between Taiwanese and Israeli Scientists

Yehuda Benayahu

Department of Zoology
Tel Aviv University

As an outcome of several octocoral surveys conducted during the last two decades on the reefs of southern Taiwan, Green Is., Penghu Archipelago and Dongsha Atoll, a variety of new species as well as a new genus were found. The geographic setting of these reefs between the West Pacific Ocean and East China Sea and at the crossroads of the Philippine-Japan Is. Arch has produced reefs featuring a remarkable high octocoral biodiversity. The genus *Sinularia* is the most diverse there, accounting for >60% of the species-inventory. In tropical reefs Octocorals are usually not considered as reef builders. Certain *Sinularia* species, however, are capable of consolidating sclerites at the colony base to form spiculite. Nanwan Bay, southern Taiwan, features both fossilized and recently-formed boulders composed of spiculite, demonstrating the role of *Sinularia* in contributing to the reef structure. Section-radiography of a spiculite boulder revealed a regular density banding of 3~6-mm intervals. Core-survey indicated spiculite-coverage of 25-30% on the live reef and 30-40% on the uplifted boulders. Cores taken from living *Sinularia* revealed a distinct

transition from discrete sclerites to compact spiculite and amorphous calcium carbonate cementing the sclerites. Among *Sinularia,* sclerite formation appeared to start intracellularly, followed by a prolonged extracellular calcification process. At the calcification site, multiple sclerocytes formed expanded pseudopod-like membranes that interconnected, forming multicellular vesicles (MCVs) around the sclerites. At the colony base, vesicles were distributed among the sclerites, indicating a cementing process in progress. These findings suggest that colonies of *Sinularia* are able to cement sclerites and consolidate them at their base into spiculite, thus making them reef-builders. Due to the sensitivity of octocoral colonies and their sclerites to global change, the well-being of this reef-component should be carefully monitored.

Effects of Global Change on Fisheries

Ming-An Lee

Department of Environmental Biology and Fisheries Science
Center of excellence for Marine Bioenvironment and Biotechnology
National Taiwan Ocean University, Keelung, TAIWAN

The influences of climate change on the world ocean are characterized by rapid changes in marine environments as well as the consequent dynamic responses of marine organisms. These effects may include variability in sea surface temperature (SST), hydrological patterns, and change in geographic distribution of marine fish populations. This report attempted to examine the possible influence of climate variability on the response of mullet in the adjacent seas of Taiwan and of longline yellow-fin tuna fishery in the Indian Ocean.

The interannual variation of abundance of these two species might change through time. The migration of mullet (Mugil cephalus) between its feeding grounds in the coastal waters of China and spawning and nursing grounds in the southwestern waters of Taiwan are associated with the annual variation of the Kuroshio Branch Current (KBC) and the China Coastal Current (CCC). Since 2000 the influence of the CCC has been retreated to the north of Yunchang Ridge where geographically is the location that CCC and KBC balance and the migratory path that mullet travels to its spawning ground in wintertime. The fishing ground for mullet has gradually moved northward.

In addition, a wavelet analysis showed a significant coherence between the Dipole Mode Index (DMI) and the longline catch per unit effort (CPUE) of yellowfin tuna with a periodicity of 2-3 yr. The DMI was also found to be negatively correlated with CPUE of the yellowfin tuna in the western Indian Ocean. The areas with high CPUE in the western Indian Ocean were deceased during the positive DMI events and increased in the negative events, especially in the Arabian Sea and surrounding seas of Madagascar. Generalized additive model and histograms of high CPUE areas of the yellowfin tuna indicated that high CPUEs matched with the areas where sea surface temperature (SST) was in the range of 26-29.5°C and net primary production (NPP) in the range of 220-380 mg C/m²/d. The positive event brought higher SST and lower NPP than normal in the western Indian Ocean. It was suggested that decreasing the areas with optimal SST and NPP during the positive events would cause the decrease in areas with high CPUE in the western Indian Ocean, while increasing the optimal areas would result in increasing high CPUE areas in the negative events.

Alien and Native Fish Assemblages in the Warming Eastern Mediterranean from a Parasitological Viewpoint

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[2]Department of Zoology, Tel Aviv University, Ramat Aviv, Israel
[3]National Institute of Oceanography, IOLR, Haifa

Indo Pacific alien fish ("Lessepsian immigrants") are establishing in increasing numbers in the eastern Mediterranean, blending into local fish communities and creating novel species assemblages with virtually no past or contemporary counterparts. Such novel communities create new opportunities for parasite transmission and subject susceptible species to new parasites and may promote host-switching events, expand parasite dispersal boundaries, modify existing infection patters and generate disease outbreaks.

Trophic relationships between co-evolving fish, intermediate hosts and parasites in marine food webs have a resilience to withstand environmental fluctuations.

The eastern Mediterranean comprises a dynamic arena, impacted by numerous anthropogenic activities which include intense fishing efforts, pollution, coastal habitat degradation and in recent years, also climate change. In this environment, Indo-pacific alien species ("Lessepsian invaders") encounter a new environment to which they must adapt. While Lessepsian (thermophilic) aliens are in all likelihood pre-adapted to the warming waters of the Mediterranean, indigenous species are confronted with a shifting temperature regime, a warming ambience gradually departing from the temperate environment in which they evolved. In the newly formed eastern Mediterranean species assemblages, both host and parasite populations, adjusting to the new ecosystem conditions, generate novel predator-prey and host-parasite interactions that significantly modify the existing food webs and are rapidly changing many aspects of the eastern Mediterranean marine coastal communities.

Our familiarity with native eastern Mediterranean parasite species is still rather poor, and knowledge on parasite infections of invasive Red Sea species, whether in their original or newly adopted Mediterranean region, is even more rudimentary. In a recent survey of over 600 individual fish belonging to 13 alien and 7 native fish species from the Israeli and Turkish Mediterranean coasts, we examined parasites from the gills and alimentary tracts. The encountered taxa included the ectoparasitic Monogenea (15.3% prevalence), Copepoda (7.3%) and Isopoda (4.5%) and endoparasitic Nematoda (25.5%), Cestoda (18.7%) and Digenea (11.9%). No significant differences were noted between similar parasite taxon prevalences in the alien and native hosts. Heavy infections with two species of previously undescribed microsporidians, one in a native Mediterranean stingray and one in a Lessepsian migrant fish species, were encountered. Infections with these parasites induce severe pathological lesions, and clearly affect their host populations. The ecological significance of these newly discovered parasitic infections is discussed.

Sustainable Multi-trophic Mariculture Systems in the Red Sea: Back to the Future

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Scarcity of fresh water in many parts of the world, overfishing and reduction of biodiversity in the ocean, marine eutrophication by anthropogenic activities and the increasing demand for sea food, have all reached the point of requiring attention in a more comprehensive, global perspective. A sustainable aquaculture that cares for environmental, economic and sociological aspects can bring relief to at least some of these issues. Intensive monoculture, however technologically advanced, is hardly sustainable, as it requires vast resources in terms of water, feeds, fertilizers, chemicals and energy. In addition, it discharges faecal material, uneaten feed, excretions, and chemotherapeutic drugs into the environment. Intensive monoculture is devoted to a few luxury species, and does not supply a large amount of food. Furthermore, it causes eutrophication, with deleterious effects on the marine life, its biodiversity and natural habitats. The economic success of intensive monoculture in aquaculture facilities has much to do with the fact that the growers have rarely been held financially responsible for the environmental pollution their farms are causing. Two main approaches are emerging for handling the organic and nitrogenous wastes in an effective way: Bacterial dissimilation into gas, and plant assimilation into biomass. Recirculated Aquaculture Systems (RAS) are quite costly. Bacterial biofilter technologies are suitable for relatively small super-intensive land-based culture of lucrative organisms. There is no suggestion as to how such technologies can be upgraded to large-scale, low-cost fish production. In addition, these systems normally use much electricity and waste expensive nitrogen by converting it into gas, thus contributing to making the RAS systems little cost-effective. Nutrient assimilation in Multi-Trophic Systems (MTS) is a more promising method of water treatment. Costly nitrogen waste is assimilated into a valuable product that will increase profit for the farmer, improve food conversion rate (FCR), diversify the mariculture products, often create additional jobs, and, most importantly, reduce environmental pollution. The rationale behind the Multi-Trophic Systems is to convert the excretions of the organism cultured upstream into valuable food for the organism downstream, usually with the aid of solar energy. Marine algae and halophyte plants have high capacity for nutrient uptake per unit of culture area. In a typical integrated system, different species are cultured in separate spatial entities, in a modular structure that permits production intensification and optimization. Further research is necessary to control the balance between nutrient production by the main organism, nutrient uptake capacity of the algae, and the shellfish feeding rates on them. Other issues that require further study are the regeneration of the biodeposit materials, the control of disease outbreaks among the cultured organisms and the sanitary aspects for the consumers. There is of course always room for improvement also in the engineering of the facilities, the development of new markets of seaweed and halophyte for human consumption in particular in Europe and North America, and the consumer's acceptance of the MTS products. The general trend in the new millennium should be to move from intensive monoculture systems towards multi-trophic systems in freshwater agro-aquaculture and seawater aquaculture (both sea- and land-based), using mainly extractive organisms which are at the bottom of the food web, such as algae (macro and micro), bivalves, detrivores and algivore fish. Also, use of alternative energy (sun or wind) to operate the systems should be explored.

Sustainable Aquaculture: Getting the Most out of the Ocean with the Least Effect

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The demand for fish is expected to increase sharply in the coming years as global populations and the demand for healthy seafood rise. Since natural fisheries are fully exploited, and in some cases, over-exploited, the alternative is farming, but this will only succeed if aquaculture is practiced in a sustainable manner. Sustainable aquaculture includes many aspects, such as production or economic issues (e.g. food and energy conversion efficiency), spatial considerations (e.g. other users (stakeholders) of the same area) and ecological interactions. This presentation will focus on the environmental aspects of aquaculture, e.g. effluents and ecological footprint, and how to minimize these. A variety of approaches, including artificial reefs, biofilters, detritivores, sponge banks and integrated aquaculture have been explored in this context in Israeli aquaculture and will be highlighted and contrasted with similar experiences in Taiwan.

Anthropogenic Impacts on the Sea of Galilee: Ecological Responses

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Water levels of lakes and rivers fluctuate naturally in response to climatic and hydrological forcing. Human over-exploitation of water resources leads to increased annual and interannual fluctuations of water levels, at times far beyond natural amplitudes. Climate change models predict increased occurrence of extreme events (flooding; extended droughts), which will further magnify the seasonal and multi-annual amplitude of water level fluctuations in lakes. A relatively wide literature base already exists for shallow lakes, demonstrating that excessive water level fluctuations impair ecosystem functioning, ultimately leading to shifts between clear-water and turbid states. Evidence is gradually building up in the published literature to demonstrate that deep (stratified) lakes also respond adversely to excessive water level fluctuations. Lake Kinneret, Israel is used here as a case study of a stratified lake with water levels fluctuating far beyond natural as a result of over-exploitation. At moderate disturbance levels, littoral habitats and biota are impacted. At further disturbance levels ecosystem destabilization symptoms are observed, including weakening of key species, proliferation of nuisance and invasive species, loss of biodiversity. Ultimately eutrophication symptoms are manifested without increased external nutrient loading, especially cyanobacterial blooms. Both top-down and bottom-up processes promote the development of those symptoms. Several of those responses are demonstrated with data from the long-term monitoring program on Lake Kinneret.

Effects of Global Change on Ocean Currents

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As climate changes in this century, the current distribution under varied climatic conditions will be rearranged on the globe. Numerical experiments and observations suggested that the globe tends to have an El Ni.o-like climate state in the future, which is characterized by weakened trade winds due to a slowing Walker circulation. The responses of ocean circulations to the abrupt climate change essentially feedback to the globe via interactions between the ocean and atmosphere. In the tropical Pacific Ocean, the surface westward current South Equatorial Current (SEC) weakens, which is directly attributed to the relaxation of trade winds. A reduction is found in both the mean depth of the equatorial thermocline and the east-west thermocline gradient, which is also associated with the weakening of equatorial upwelling and the flattening in the east-west slope of the eastward subsurface Equatorial Undercurrent (EUC). The SEC and the EUC are two of the strongest equatorial currents. In other words, the global change will gradually slow down the operation of Pacific equatorial circulation system.

In the off-equatorial region, observation data shows that the North Equatorial Current (NEC) tends to strengthen and bifurcate southward in the last two decades. The southward shift of the NEC bifurcation makes the tropical gyre narrower and the subtropical gyre wider. Moreover, an increasing total transport of the NEC accompanies the intensifying of its northern branch Kuroshio, further effects the Luzon Strait Transport and the Indonesian Throughflow (ITF) transport. The ITF is the vital channel connecting the Pacific and Indian Oceans, and its heat and water transport plays a critically important part to the global climate system. There is a robust weakening of the warm water transport from the Pacific to the Indian Oceans via the ITF under the global change, which is consistent with the previous observed interannual variations of the ITF in relation to El Niño (La Niña) events, during a reduction (enhancement) of ITF transport.

Oxygen and Carbon Isotopes in Marine and Lacustrine Diatoms: Indicators of Global and Regional Paleoclimate

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Marine and lake sediments serve as one of the best natural archives of past climatic variability on the continents. Their datable sediments typically have accumulated continuously over thousands of years, and a variety of physical, chemical, and biological indicators preserved in sediments can be used to reconstruct past climatic change and landscape response. The studies of oxygen isotopes in sediments were restricted to the carbonate phase, analyzing authigenic carbonates and calcareous bottom dwellers. However, carbonate material is not available in all lakes or marine regions. Focusing on lakes, carbonates are absent especially in high altitude and high latitude lakes, in which the geological setting and the precipitation/evaporation ratio do not allow the chemical precipitation of authigenic carbonate. In contrast, lake sediments in these regions often contain biogenic silica. It is composed primarily of diatoms (photosynthetic algae) that deposit internal

opal ($SiO_2.nH_2O$) frustules. Because of light requirements for photosynthesis, silicification occurs only in the uppermost layer of the lake. Thus, diatoms are an ideal recorder of surface temperature and isotopic composition of the surface water. Recent studies demonstrate the potential of measuring the isotopic composition of oxygen in diatom frustules in order to reconstruct past climate changes, both quantitatively and qualitatively. The oxygen isotopic composition of opal depends on ambient water temperature and the lake-water isotopic composition, which is a complex function of the local hydrological setting. The interplay between the local hydrology and diatom isotopic composition will be presented in three key locations: the northern hemisphere, equatorial Africa and the southern hemisphere. The $\delta^{18}Osi$ down-core records will be discussed in terms of regional climate change and it relation to the Younger Dryas cooling. The carbon isotopes of the diatom organic matrix complements the oxygen isotope record and provides information about paleo productivity and nutrient supply/utilization in the lake.

Submesoscale Mixing Observations and Modeling: From Vertical Density Currents to Horizontal Barriers to Mixing

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Ocean submesoscale (~2-20 km) processes play a major role in oceandynamics, in physical-biological interactions, and in the dispersion of larvae and pollutants. We study submesoscale processes using a combination of observations and high-resolution numerical models. In this talk I will present two studies: In the first study we use a data set of surface ocean currents measured by high-frequency radar to identify the existence of temporary barriers to mixing. The existence of these barriers is also simultaneously verified by aerial-photographs. The existence of such barriers requires a new approach to the way mixing is parametrized in ocean and climate models. The second study deals with the dynamics of density currents. Density currents are an important component of the oceanic meridional overturning circulation, since they affect ocean climate and maintain a stable stratified world ocean. Because the Gulf of Eilat is separated from the Indian Ocean by two relatively shallow sills, deep and cold water from the world ocean cannot enter the gulf. Therefore, during the winter, dense currents evolve over the shallow shelves at the northern tip of the Gulf in response to buoyancy loss. Our observations and high-resolution 3D model results show pulses of density currents that form over night (when the buoyancy loss flux is at its maximum) during the winter months. The numerical simulations also demonstrate that it is necessary to include the diurnal cycle of air-sea fluxes in climate models in order to correctly simulate these currents in climate models.

Hyperspectral Remote Sensing as an Effective Tool for Aquatic Mapping

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Hyperspectral remote sensing (HSR) from airborne and orbital platforms is an advanced tool that generates high-spatial/spectral-resolution data from a far distance, with the aim of providing near-laboratory-quality radiance (and subsequent related information) for each single picture element (pixel). This information enables the identification of ground targets based on the spectral behavior of the material in question. This approach has been found to be very useful in many terrestrial and marine applications and works quite well across the 0.4 to 14 μm region, consisting of the following spectral segments: VIS (visible), NIR (near infrared), SWIR (shortwave infrared), MWIR (midwave infrared) and LWIR (longwave infrared). This technology is valid for all spatial domains and platforms (microscopic to macroscopic; ground, air and space platforms) and for all targets (solid, liquid and gas). For many years, HSR was used mainly for geology and terrestrial applications, while the aquatic-based applications were being further developed. The water-monitoring HSR application has become a practical tool for assessing chlorophyll and sediment content on a pixel-by-pixel basis, as well as estimating bathymetric distribution near the coastline. Monitoring of oil-seepage contamination is another such application recently developed for marine environments, along with mapping heavy metal contamination in marine sediments. HSR technology for water applications (inland and oceans) appears to be a promising tool for mapping the aquatic environment rapidly and quantitatively. With the rising number of HSR sensors from both airborne and spaceborne domains, the technology is likely to become an applicable method for aquatic monitoring. The new HSR satellites in orbit (the German-DLR EnMAP and the US-NASA HyspIRI) are promising tools to this end. The Remote Sensing Laboratory at Tel Aviv University is actively preparing for the operation of both orbital sensors, due in 2015 (EnMAP) and 2019 (HyspIRI).

Effects of Global Change on Coral Reef Systems of Taiwan

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Taiwan is located between 22 to 25°N and the marine environment is mainly influenced by the Kuroshio warm current which is suitable for coral growth. Corals are widely distributed on northern, eastern and southern coastal areas of Taiwan and offshore islets. However, due to regional differences of environmental factors, the species richness and reef development are diverse among regions which are generally separated by the Tropic of Cancer (TC). In the reef areas southern to TC, including Hengchun, Lanyu, Lyudao, southern Penghu and Xiaoliuchiu, there are approximately 200 to 300 species of scleractinian corals and the reef structures are well-developed. In the areas adjacent to TC, including northern Penghu Islands and eastern Taiwan,

there are about 150 species of scleractinians and the reefs are patchy. In northern and northeastern Taiwan, there are about 110 species of scleractinians forming non-reefal coral communities.

Coral reef ecosystems are vulnerable to global climate change such as sea temperature warming, ocean acidification, sea level rising, and climate anomalies. For example, the unusually high sea temperatures in 1998 and 2007 caused coral bleaching in southern Taiwan. While, the unusually low sea temperature in Penghu Islands in February 2008 caused severe coral bleaching and mass mortality of reef organisms. We applied IPCC data and niche model to simulate the possible impacts of climate change on corals in Taiwan. The results showed that under short-term (by 2025) impacts of climate change, sea temperature would rise about 0.5 to 0.75°C and the species richness of corals in northern and northeastern Taiwan would increase slightly with some species expanding their geographical ranges. Under mid-term (by 2055) impacts, the sea temperature in southern Taiwan will exceed the upper limit for coral growth and coral species in southern Taiwan, Lyudao, and Lanyu may decrease rapidly. While, the reefs in northern and eastern Taiwan may have more species since the sea temperature in these areas will be more favorable for corals. Under long-term (by 2085) impacts, the sea temperature surrounding Taiwan is projected to increase by 2.0-2.5°C and cause severe reductions of coral species and extinction of some species. Overall, climate change may induce severe impacts on coral reefs in Taiwan including the reduction of coral species and the shift of community structure, which may then cause the disappearance of organisms associated with coral reefs such as fish and invertebrates.

To monitor the impacts of environmental change on coral reefs, I propose to establish five monitoring stations around Taiwan, including Keelung, Penghu Islands, Lyudao, Kenting, and Donsgha Island. Each station will be equipped with instruments for collecting oceanographic and atmospheric data. By joining the Coral Reef Early Warning System (CREWS) Network of NOAA, we would be able to share the information for monitoring and conservation of coral reefs.

Coral Reef Restoration: Is it a Chronicle of Failure Foretold?

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The immense importance of coral reefs to human, on the one hand, and their accelerating decline, on the other hand, has led many marine ecologists to the notion that conservation alone is insufficient to rescue the decaying reefs, and that proactive management, notably restoration, is crucial. At present, the most commonly studied and applied coral reef restoration approach is the so-called 'coral-reef gardening', which is transplantation of coral fragments into deteriorated, barren reef areas. The gardening approach follows a concept according to which "*the choices are either the continuous degradation of reefs or active restoration to encourage reef development*".

However, despite ample seemingly supportive scientific findings and enormous investments we are yet to see even a single example of a successful reef recovery using this approach. Moreover, even if its targets are fulfilled, the coral-reef gardening approach does neither restore, nor rehabilitate the reef, and it certainly cannot be applied in wide areas to solve the problem of the world deteriorated coral reefs. The above limitations have led leading scientists to claim that: "*Realistically, regeneration processes in the wider seascape are the only means by which coral reefs can reestablish after large-scale damage. Consequently, restoration efforts should focus on improving water quality and restoring depleted fish stocks to bolster the innate resilience of coral*

reefs. Scarce reconstruction aid should not be squandered on simplistic and ineffective reef rehabilitation projects".

In my presentation I will try to highlight the flaws and drawbacks of coral-reef gardening as the most commonly used restoration technology, and will discuss a few alternative restoration tools such as the re-introduction of grazing species and the construction of artificial reefs.

The Rise and Fall of Stony Corals

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The coral-algae endosymbiosis is considered a classical example of mutualism and is credited with the evolution and propagation of tropical coral reefs .Determining the geologic history of this relationship has been difficult due to incongruence in the coral geologic record and dating from molecular clock methods. The evolutionary history of this relationship is particularly important as it produced of the aragonite matrix that forms the modern reef complex. This report synthesizes paleo-oxygen concentrations, molecular phylogenics and coral physiology to provide a new insight into how this relationship may have evolved.

Effects of Global Change on Microbial Ecology

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Coral reef ecosystems are characterized with high biodiversity and primary productivity. However, reef systems are subjected to the threats of global warming and ocean acidification. In Taiwan, the ecological studies of the benthic system have received much more attention than that of the pelagic system till recently. The major purpose of this study was to investigate the tempo-spatial variations of physical, chemical and biological properties within the water-column inside Dong-Sha atoll. Seasonal (May, Jul, Sep of 2010 and Feb of 2011) sampling of more than 13 environmental factors was performed at the 26 stations deployed inside the Atoll. The results are summarized below. (1). Physical hydrography: the cold and nutrient-laden deep-waters outside the Atoll might penetrate into the system at the east side via internal wave processes, which served as one of the important sources of "new" nutrient. Water residence time within the Atoll was about one month. (2). Chemical hydrography: More than 80% of our N/P ratio data were greater than the Redfield ratio of 16, indicating phosphate limitation occurred in most areas and seasons. This was confirmed by the results of the bioassay analysis. (3). Plankton structure and activity: Phytoplankton was dominated by Bacillariophyte, Cryptophyte, Chlorophyte and Cyanophyte. Zooplankton was dominant by Calanoida (34%), shrimp larva (32%) and crab zoea (32%). Biomass and production of phytoplankton and bacteria, as well as DOC concentrations were significantly higher than those recorded in the surrounding sea. (4). Microbial loop: Bacterial production and primary production were decoupled in most seasons. (5). System trophic status: The ratios of primary production to community respiration approached 1 except February, which had an average of 2.65±3.68. In conclusion, the Dong-Atoll is surrounded by oligo-trophic seawater, however, most of our measurements were high, similar to those recorded in meso-trophic environment. It is deduced that the Atoll itself and the organisms living inside are acting as a nutrient trap, taking up the inorganic nutrients imported from outside. These nutrients are then transformed and recycled within the atoll but had lower possibility of flowing outside (export) due to the semi-enclosed topography. The heterogeneous distribution of chemical and biological measurements could be ascribed to the weak physical circulation inside the atoll. In the perspective of climatic changes, This Atoll seems to be an ideal observatory in detecting global warming and ocean acidification.

Genomic Island Variability Facilitates Coexistence between Marine Viruses and their *Prochlorococcus* Hosts

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Cyanobacteria of the genus *Prochlorococcus* are extremely abundant in the oceans, as are the viruses that infect them. How hosts and viruses coexist in nature remains unclear, although the presence of both susceptible and resistant cells may allow this coexistence. We set out to understand the mechanisms enabling long-term coexistence between these abundant primary producers and their viruses and the impact this has on genome evolution. A combined whole genome sequencing and PCR screening strategy enabled the genome analysis of 77 substrains selected for resistance to ten viruses, revealing mutations primarily in non-conserved, horizontally transferred genes that localize to a single hypervariable genomic island. Mutations affected viral attachment to the cell surface and imposed a fitness cost to the host, manifested by significantly lower growth rates or a previously unknown mechanism of more rapid infection by other viruses. The mutant genes are generally uncommon in nature yet some carry polymorphisms matching those found experimentally. These data are the first empirical evidence indicating that viral-attachment genes are preferentially located in genomic islands and that viruses are a selective pressure enhancing the diversity of both island genes and island gene content. This diversity emerges as an important genomic mechanism that serves to reduce the effective host population size for infection by a given virus, thus facilitating long-term coexistence between viruses and their hosts in nature.

Sensing Environmental Stresses and Cellular Responses in Marine Phytoplankton

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Marine photosynthetic microorganisms (phytoplankton) are the basis of marine food webs. Despite the fact that their biomass represents only about 0.2% of the photosynthetic biomass on earth, they are responsible for nearly 50% of the global annual carbon-based photosynthesis, and greatly influence the global biogeochemical carbon cycle. These high ratios of productivity to biomass with very fast turnover make them very responsive to climate change. Phytoplankton can grow rapidly and form massive blooms that are regulated by environmental factors such as nutrient availability and biotic interactions with grazers and viruses. Since phytoplankton exerts a global-scale influence on the atmosphere and climate, we are interested in understanding what controls their fate during bloom "boom and bust" dynamics.

Despite the importance of marine phytoplankton, the molecular basis for their ecological success and the role of biological interactions are still in their infancy. The wealth of recent genomic information from marine microbes, coupled with availability of a suite of molecular resources and analytical tools, provide an unprecedented opportunity to address fundamental questions about their unique evolutionary history and ecological role. Nevertheless, there is a critical need to "decode" these genomic resources and translate them into cellular mechanisms, community structure and, eventually, to their role in ecosystem function.

Our research aims to understand the role of chemical signaling and cellular mechanisms employed by marine phytoplankton during their acclimation to the ever-changing environmental stress conditions. We explore three major biotic interactions that have profound significance in controlling bloom dynamics in the oceans; cell-cell and predator-prey signaling in diatoms and host-virus signaling in coccolithophores. We dissect unexplored signaling pathways employed by phytoplankton during biotic interactions and reveal the role of infochemicals in controlling cellular metabolism, growth, mortality and defense mechanisms. Newly identified genes and infochemicals are used as biomarkers for the study of the ecological impact of algal blooms in microbial food webs.

Our research interest is to provide novel insights into the role of a chemical-based "arms race" that mediates and structures the microbial interactions in the marine environment. Our overarching objective is to unravel the role of chemical signaling and related gene products in regulating phytoplankton surveillance systems in response to environmental stress conditions. We foresee that our research will provide a suite of cellular probes and metabolic "finger prints" that will allow *in situ* detection of chemical signaling and biotic interactions in the oceans and will highlight their importance in shaping microbial food webs. We plan to shed new light on evolutionary role of stress signaling pathways that were conventionally studied only in lab-based model organisms, and to give new ecological interpretation for their role in population dynamics of photosynthetic microbes.

Patterns of Interactions among Marine Microbes: What we Know, What we Want to Know and What we Need to Know

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Every drop of seawater contains around one million microorganisms (bacteria, small algae and other organisms such as ciliates and diatoms), which form the base of the marine food chain. Interactions between marine microbes such as symbiosis and competition determine the structure of the microbial community, and also directly affect global processes such as cloud formation, ocean acidification and greenhouse gas dynamics. Historically, interactions among marine microbes have been studied in single, binary laboratory co-cultures, with the aim of obtaining mechanistic insights. Recently, several approaches have been devised to look beyond single microbial interactions and attempt to detect large scale interaction patterns. These include high-throughput laboratory co-culturing, statistical methods for detecting co-occurrence and combinations of field perturbations and metagenomics/metatranscriptomics. A major current challenge lies in bridging results from the lab and the ocean to provide a mathematical framework describing interactions in sufficient detail to be realistic, yet simply enough to be linked into global ocean models.