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**Prof. Zvy Dubinsky**




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## *Prof. Zvy Dubinsky*

### **i Scientific Leadership Profile**

In his research Zvy Dubinsky have developed important key aspects in coral ecophysiology and conservation, aquatic photosynthesis, and microalgal biotechnology. His major contributions were the following:

1. Modeling for the first time the response of zooxanthellate, reef building corals to the underwater light field. **This groundbreaking result led to the understanding of the way light controls the bathymetric distribution of corals, and the ways they optimize available light by a combination of adjusting colony morphology, algal pigmentation and quantum yields.**

Falkowski PG & **Dubinsky Z** (1981) Light-shade adaptation of *Stylophora pistillata*, a hermatypic coral from the Gulf of Elat. *Nature* 289:172-174

**Dubinsky Z**, Falkowski PG, Porter J, Muscatine L (1984) The absorption and utilization of radiant energy by light and shade-adapted colonies of the hermatypic coral, *Stylophora pistillata*. *Proc Roy Soc Lond* 222B:203-214

2. The analysis of the physiology of the adverse response of reef building corals to anthropogenic eutrophication. This revealed that nutrient enrichment of waters surrounding reefs leads to the uncontrolled proliferation of the algal symbionts, thereby reducing their contribution to the coral host's metabolic needs. This was a crucial contribution in the struggle for the removal of the fish cages from the Gulf of Aqaba.

**Dubinsky Z**, Stambler N, Ben-Zion M, McCloskey L, Falkowski PG, Muscatine L (1990) The effects of external nutrient resources on the optical properties and photosynthetic efficiency of *Stylophora pistillata*. *Proc Roy Soc Lond* B239:231-246

**Dubinsky Z**, Stambler N (1996) Eutrophication, marine pollution and coral reefs. *Glob Change Biol* 2:511-526

3. Invention of the application of **photoacoustics** to the study of phytoplankton photosynthesis. **This innovation enables researchers to truly and directly evaluate all components of the flow of energy in photosynthesis.**

**Dubinsky Z**, Feitelson J, Mauzerall DC (1998) Listening to phytoplankton: measuring biomass and photosynthesis by photoacoustics. *J Phycol* 34:888-892

4. Proving that the optical properties of algae such as the *in vivo* optical cross section of algae changes with photoacclimation. This changed the prevailing view that the *in vivo* optical cross sections of chlorophyll are constant, and revealed their relation to photoacclimation.

**Dubinsky Z**, Berman T (1981) Light utilization by phytoplankton in Lake Kinneret (Israel). *Limnol Oceanogr* 26:660-670

**Dubinsky Z**, Berman T, Schanz F (1984) Field experiments for in situ measurement of photosynthetic efficiency and quantum yield. *J Plankton Res* 6:339-349

5. Developing the theory and analysis of light energy utilization and quantum yields of photosynthesis in the laboratory and in nature. This showed how dramatically quantum yields of algae change with depth and with light intensity, a concept of important applications in algal biotechnological applications.

Iluz D, Yehoshua Y, **Dubinsky Z** (2008) Quantum yields of phytoplankton photosynthesis in the Gulf of Aqaba (Eilat), Northern Red Sea. *Isr J Plant Sci* 56:29-36

**Dubinsky Z**, Falkowski PG, Post AF, van Nes UM (1987) A system for measuring phytoplankton photosynthesis in a defined light field with an oxygen electrode. *J Plankton Res* 9:607-612

6. Developing an integrated view of the photoacclimation mechanisms of phytoplankton and of their ecological consequences. **This aspect showed for the first time how all parameters of photosynthesis and dark respiration are affected by irradiance level and result in the optimization of cellular growth rate as evidenced in the onset of phytoplankton blooms.**

**Dubinsky Z**, Falkowski PG, Wyman K (1986) Light harvesting and utilization in phytoplankton. *Plant Cell Physiol* 27:1335-1350

7. Applying environmental stress in the biotechnological production of poly-unsaturated fatty acids and antioxidants from microalgae. This work showed how nutrient limitation and irradiance levels can be applied as factors forcing the biosynthetic pathways of microalgae towards the maximization of the yield of high-value target biochemicals.

**Dubinsky Z** (1989) The application of environmental stress in the biotechnological exploitation of microalgae. *J Chem Technol Biot* 42:306-308

These contributions revolutionized views in the related fields of the biophysics of photosynthesis, algal biotechnology and coral reef conservation. The recognition of the importance of these findings was evident from his invitation to advise governmental and commercial organizations in the fields of environmental policy and exploitation of algae. A characteristic of his scientific philosophy has been to develop interdisciplinary approaches and seek for synthesis and integration of results in different fields such as physics, physiology and ecology. **This has resulted in the publication of some 200 scientific papers (68 in the last 10 years) in top journals of the Marine Biology, Plant Sciences, Ecology, and Oceanography subject areas, as well as Multidisciplinary Sciences**, and the invitation to scores of International symposia, seminars, conferences, research cruises, workshops, all over the world, guest appointments and sabbaticals in most prestigious institutions in the US and Japan.

He proposed and edited the Coral Reefs volume 25 in the *Ecosystems of the World Series*, Elsevier (1991), which became and still is the standard reference work in the field. Recently, he was invited by Springer to edit a new volume covering the current views and recent developments in the field of coral and coral reef research. This book is in advanced stage of production with the leading authorities in the field contributing chapters. An additional volume has likewise been invited by Springer: "All flesh is grass: Plant animal Interactions" and is also in the final stages of production.

His activity attracted over 60 graduate students; several of them became leaders in their fields as scientists.

#### **List of some examples**

Dr. David Zakai, Red Sea Marine Biologist, Israel Nature & National Parks Protection Authority, Israel. Showed the lunar control of coral reproduction in the Red Sea and how seaweeds interfere with coral recruitment.

**Zakai D**, Dubinsky Z, Avishai A, Caaras T, Chadwick NE (2006) Lunar periodicity of planula release in the reef-building coral *Stylophora pistillata*. *Mar Ecol Prog Ser* 311:93-102.

Dr. Ram Porat, Chief Reservoir Biologist, Mekorot National Water Authority. Studied how management can control the proliferation of toxic cyanobacteria in the National Water Carrier.

**Porat R**, Teltsch B, Mosse AR, Dubinsky Z, Walsby AE (1999) Turbidity changes caused by collapse of cyanobacterial gas vesicles in water pumped from Lake Kinneret into the Israel National Water Carrier. *Wat Res* 33:1634-1644.

Dr. Ilana Berman-Frank, Senior Lecturer, Faculty of Life Sciences, Bar Ilan University. Revealed the way iron limitation controls nitrogen fixation by cyanobacteria.

**Berman-Frank I**, Lundgren P, Chen Y, Kupper H, Kolber Z, Bergman B, Falkowski PG (2001) Segregation of nitrogen fixation and oxygenic photosynthesis in the marine cyanobacterium *Trichodesmium*. *Science* 294:1534-1537.

**Berman-Frank I**, Falkowski PG (2002) On the evolution of N<sub>2</sub> fixation. *Science* 295:799.

Dr. Oren Levy, Lecturer, Faculty of Life Sciences, Bar Ilan University. **For the first time described the presence and role of cryptochromes in corals.**

**Levy O**, Appelbaum L, Leggat W, Gothilf Y, Hayward DC, Miller D, Hoegh-Guldberg O (2007) Lightresponsive cryptochromes from the simplest marine eumetazoan animals. *Science* 318: 467-470.

Dr. Razi Vago, Professor Biomaterials, Ben Gurion University. Developed the production of matrices for major bone replacement, based on his work with coral growth and calcification.

**Vago R** (2008) Cnidarians biomineral in tissue engineering, a review. *Mar Biotech* 10:343-349.

**Vago R** (2008) Beyond the skeleton: cnidarian biomaterials as bioactive extracellular microenvironments for tissue engineering. *Organogenesis* 4:18-22.

Dr. Leonid Sokoletski, Researcher, Remote Sensing, Environmental Protection Agency, USA. Formulated simplified, robust mathematical models to estimate chlorophyll concentrations from satellite data.

**Sokoletsky L** (2005) Comparative analysis of selected radiative transfer approaches for aquatic environments. *Applied Optics IP* 44:136-148.

**Photography and film:** He produced Prize winning science teaching film, and had several exhibitions of art photography, ten covers for scientific journals such as *Bioscience*, *Symbiosis*, *Journal of Phycology*, *Molecular & General Genetics*, *Israel Journal of Chemistry*, *Israel Journal of Plant Sciences*, and *Marine Biotechnology*.

## ii Curriculum Vitae

Zvy Dubinsky was born in Barcelona, 18/10/1934, emigrated to Israel in 1944 where he served in the army, was member of a Kibbutz, trained as a teacher, and worked as such for a few years. During that period he participated in developing an advanced, modern biology curriculum for high schools, and produced biology films for the National Center for Science Teaching, one of these won the Executive Prize in the Tokyo Science Film Congress. In 1970 he started studying biology at Bar Ilan University, continued for his M. Sc. on "The influence of select environmental factors on the abundance and composition of algal populations from Lake Kinneret (Tiberias)" and proceeded to obtain his Ph. D. on "*Light as an ecological factor in Lake Kinneret phytoplankton dynamics*". Zvy Dubinsky was a post doctoral fellow at Queens College, NY, where he worked on the physiology and biochemistry of algal lipids and on their potential in biofuel production. He was offered a position at the Department of Life Sciences at Bar Ilan University, where he progressed rapidly to full professor. He established a program in ecology and developed a laboratory focusing on aquatic photosynthesis, covering biophysical, physiological and ecological aspects. His contributions in the fields of photoacclimation of phytoplankton and their interactions with the underwater light field have changed the field markedly. Subsequently he added to his activities a strong interest in coral ecology and photobiology, forming the first integrated views unifying energy and nutrient fluxes in zooxanthellate corals. These views were instrumental in understanding the detrimental effects of anthropogenic eutrophication on coral reefs. Additional project were ecophysiology of desert invertebrates and physiology of mangroves.

Zvy Dubinsky was invited to spend sabbaticals at (1) Brookhaven National Laboratories, where working with Paul Falkowski he laid the foundations of phytoplankton photobiology. This was followed by a year at (2) Rockefeller University where he worked with David Mauzerall, on biophysical aspects of algal photosynthesis, and subsequently developed the application of **photoacoustics** to the study of phytoplankton photosynthesis. Three sabbaticals at (3-5) Research Center for Advanced Science and Technology, Tokyo University were devoted to the production of algal antioxidants and poly-unsaturated fatty acids, and to the molecular biology and physiology of mangroves.

He headed several research expeditions to the coral reefs of Sinai, participated in research cruises to the Antarctic, Eritrea and the Seychelles, worked on research projects at the Australian Institute of Marine Science, Hawaii Institute of Marine Biology, University of the Ryukyus, Okinawa.

Scientific Advisory: 1985-1987 Chairman, Israel Society for Ecology and Environmental Quality Sciences. 1986-1988 National Representative on the Council of the International Association of Ecology (INTECOL). 1989 Member, Scientific Advisory Forum to the Israel Minister of Environmental Quality. 1989-1993 Chairman, Scientific Advisory Committee on the Prevention of Pollution in the Gulf of Elat (Red Sea), Ministry of Environmental Quality. 1992 Consultant on conservation of Caribbean Coral Reefs for the Ministry of the Environment, Mexico. 1992-1997 National Committee on Biotechnological Infrastructure. 1999-2003 Steering Committee of L. Kinneret Monitoring, Ministry of Infrastructure. 2001 Head, Scientific and Technical Team: National Water Project, The Begin-Saadat Center for Strategic Studies. 2003-5 First President, Israel Society for Aquatic Sciences.

Zvy Dubinsky is currently chair of the Board of Governors of the Interuniversity Institute for Marine Science of Eilat, Israel, and is National Representative of the General Assembly of SCOPE (Scientific Committee on Problems of the Environment).

Zvy Dubinsky has sponsored over 30 M. Sc. and 30 Ph. D. students and has published 200 scientific papers, edited the volume Coral Reefs (vol 25, Ecosystems of the World, Elsevier), was member of Editorial Board of Global Change Biology, and currently is member of editorial boards of the Israel Journal of Plant Sciences, and Journal of Marine Biology and served as Guest Editor in Trees: Structure and Function, Limnology and Oceanography and Aquatic Sciences. Currently, he is editing a new volume, covering trends in the field of corals and coral reefs research, which will be published by Springer.

He organized, convened and chaired several International symposia, workshops and seminars including: 1982, Group on Primary Productivity (GAP) of SIL, Konstanz. 1984, GAP of SIL, Haifa, Israel. 1987, Chairman, Bat Sheva De Rothschild Advanced Seminar: Symposium on Marine Symbioses. 1988, GAP of SIL, L'Houmeau, France. 1988, Photobiology Minisymposium, 6th International Coral Reef Symposium, Townsville, Australia. 1989, United States – Israel Binational Workshop on Marine Symbioses, Eilat. 1991, United States – Israel Binational Workshop on Nutrient Limitation in the Symbiotic Association between Zooxanthellae and Reef Building Corals, Hawaii Institute of Marine Biology. 1993, United States - Israel Binational Workshop on Optical properties of Aquatic Photosynthetic Systems, Eilat. 1994, United States - Israel Binational Workshop on Measurement of Ultraviolet Radiation in Tropical Coastal Ecosystems, East - West Center, Honolulu, Hawaii. 1999, GAP International Organizing Committee, Zurich. 1999, Chairman, International Mangrove Symposium, Tokyo University. 2008, Co-convenor, GAP Workshop, Eilat.

Zvy Dubinsky advised companies interested in Biofuel and fine chemicals production from algae.

He is the recipient of several international and Israeli grants (last 10 years):

1995-1999 Biological, geochemical and remote sensing intercalibration for synoptic estimation of marine primary productivity: Gulf of Aqaba bloom experiment (GABE), Ministry for Science and Technology, Germany (BMFT) (DEM 100,000)

1996-1999 CANIGO, Bio-Optical Characterization of the Azores-Canaries Region of the Atlantic Ocean, EU MAST III, (ECU 300,000).

1997-2000 United States-Israel Binational Science Foundation. **Photoacoustics** as a tool in the study of phytoplankton biomass and photosynthesis (USD 150,000).

1998-2003 US-AID Gulf of Aqaba Peace Park: Joint Israel-Jordan-Egypt-USA Coral Reef monitoring and Conservation Program (USD 8000 per year)

1998 Bar Ilan Research Authority. Coral behaviour (ILS 18,000).

1999-2001 Red Sea Program (RSP) Ministry for Science and Technology, Germany (BMFT), (DEM 100,000).

1999-2002 Technion Water technologies: Development of light sources for photoacoustic phytoplankton sensor (USD 30,000 per year).

2002-2003 IET International Expert Team Ministry of the environment (USD 40,000)

1999-2004 Agency for International Development, Middle East Research Corporation (AID MERC) Fast Track: Development and Implementation of Tools for Real time Monitoring and Evaluation of Coral Health in the Gulf of Aqaba (USD 50,000)

2003-2007 Israel Science Foundation: Population genetics of the symbiotic complex: *Stylophora pistillata*/zooxanthellae, from the Red Sea, Gulf of Eilat (Aqaba) (USD 150,000)

2003-2007 United States - Israel Binational Science Foundation: Time Resolved Photosynthesis Energy Budget Combining Photoacoustics, Fluorescence and Oxygen (USD 175,000)

2006-2010 NATO The effects of dust storms on the plankton of the Gulf of Eilat (Aqaba) (EUR 150,000).

### **iii 10-Year-Track-Record**

In the last decade, as matter of principle, Zvy Dubinsky regularly place junior colleagues and graduate students as senior authors. During the last ten years **he published 68 articles in ISI journals, which have overall been cited 374 times (excluding auto citations) in top journals of the subject categories oceanography, ecology, plant sciences, marine biology, and multidisciplinary sciences such as *Nature* and *Science*.**

### **Selected publications**

- 1) Berman-Frank I, **Dubinsky Z** (1999) Balanced growth in aquatic plants: Myth or reality? Phytoplankton use the imbalance between carbon assimilation and biomass production to their strategic advantage. *Bioscience* 49:29-37
- 2) Takemura T, Hanagata N, Sugihara K, Baba S, Karube I, **Dubinsky Z** (2000) Physiological and biochemical responses to salt stress in the mangrove, *Bruguiera gymnorrhiza*. *Aquat Bot* 68:15-28
- 3) Titlyanov E, Bil' K, Fomina I, Titlyanova T, Leletkin V, Eden N, Malkin A, **Dubinsky Z** (2000) Effects of dissolved ammonium addition and host feeding with *Artemia salina* on photoacclimation of the hermatypic coral *Stylophora pistillata*. *Mar Biol* 137:463-472
- 4) **Dubinsky Z**, Berman-Frank I (2001) Uncoupling primary production from population growth in photosynthesizing organisms in aquatic ecosystems. *Aquat Sci* 63:4-17
- 5) Wielgus J, Chadwick-Furman NE, **Dubinsky Z** (2004) Coral cover and partial mortality on anthropogenically impacted coral reefs at Eilat, northern Red Sea. *Mar Pollut Bull* 48:248-253
- 6) Stambler N, **Dubinsky Z** (2005) Corals as light collectors: an integrating sphere approach. *Coral Reefs* 24:1-9
- 7) Levy O, Achituv Y, Yacobi YZ, Stambler N, **Dubinsky Z** (2006) The impact of spectral composition and light periodicity on the activity of two antioxidant enzymes (SOD and CAT) in the coral *Favia favaus*. *J Exp Mar Biol Ecol* 328:35-46
- 8) Bachar A, Achituv Y, Pasternak Z, **Dubinsky Z** (2007) Autotrophy versus heterotrophy: The origin of carbon determines its fate in a symbiotic sea anemone. *J Exp Mar Biol Ecol* 349:295-298
- 9) Mass T, Einbinder S, Brokovich E, Shashar N, Vago R, Erez J, **Dubinsky Z** (2007) Photoacclimation of *Stylophora pistillata* to light extremes: metabolism and calcification. *Mar Ecol Prog Ser* 334:93-102
- 10) Goffredo S, Caroselli E, Mattioli G, Pignotti E, **Dubinsky Z**, Zaccanti F (2009) Inferred level of calcification decreases along an increasing temperature gradient in a Mediterranean endemic coral. *Limnol Oceanogr*, 54: 930-937

### **Membership to Steering Committees or Programme Committees of International Conferences**

- 1999 International Organizing Committee GAP (Group on Aquatic Primary Productivity), Zurich
- 1999 Chairman, International Mangrove Symposium, Research Center for Advanced Science and Technology, Tokyo University
- 2003 Head, Scientific and Technical Team: National Water Project, The Begin-Saadat Center for Strategic Studies
- 2008 Co-convenor, Steering and Program Committee member GAP Workshop, Eilat
- 2008 Steering and Program Committee member, 15<sup>th</sup> Workshop of the International Association of Phytoplankton Taxonomy and Ecology (IAP), Ramot, Israel, 23 – 30 November 2008

### **Invited presentations**

#### **1. Dubinsky Z**

Environmental factors control the fluxes of material and energy between algal symbionts and their coral hosts. The 64<sup>th</sup> Meeting of the Israel Chemical Society, Ramat Gan, (1999).

#### **2. Dubinsky Z**

Photosynthesis and Population Growth in Phytoplankton. 7<sup>th</sup> International Workshop: Group on Aquatic Primary Productivity GAP 99 Zurich (1999).

#### **3. Dubinsky Z**

Ecosystem Interactions in Coastal Zones, XI<sup>th</sup> General Assembly, Scientific Committee on Problems of the Environment - SCOPE, Bremen, 2001.

#### **4. Dubinsky Z**

Energy and nutrient fluxes in hermatypic corals. Inst. of Photosynthesis Research, Russian Academy of Sciences, Puschino, Moscow, 2003.

**5. Dubinsky Z**

The interaction of irradiance and nutrient status in controlling metabolic patterns in zooxanthellate corals. 7<sup>th</sup> International Conference on Coelenterate Biology, Kansas 2003

**6. Dubinsky Z, Brenner S, Chomsky O**

Was the Asian Tsunami's death toll act of God? 2<sup>nd</sup> Conference of the Israeli Association for Aquatic Sciences (2005)

**7. Dubinsky Z**

Photoacclimation processes in phytoplankton: Mechanisms, consequences and applications. International Botanical Congress, Vienna, (2005).

**8. Dubinsky Z, Levanon T, Schwartzberg M**

Light, photosynthesis, calcification and growth of hermatypic corals European society for reef studies, Bremen, Germany (2006)

**9. Dubinsky Z**

Photoacoustics as a novel tool to study the efficiency of photosynthetic energy storage in phytoplankton. Aquafluo, Nove Hradý, Czech Republic, (2007).

**10. Dubinsky Z**

Photoacclimation Processes in Phytoplankton: Mechanisms, Consequences and Applications. 8<sup>th</sup> International GAP Workshop, Eilat, (2008).

**11. Dubinsky Z, Schofield O**

The light from the darkness: Thriving at the light extremes in the oceans. 15<sup>th</sup> Workshop of the International Association of Phytoplankton Taxonomy and Ecology (IAP), Ramot, Israel, 23 – 30 November 2008

**Research expeditions**

First IUI Seychelles Cruise, funds by the Israel Academy of Sciences and the Inter University Institute, Eilat, Chief Scientist, Seychelles, 1999

International Summer program of the Center of Excellence, University of the Ryukus, funds by University of the Ryukus, Coral/seaweed project leader, Okinawa (Japan), 2008

**Organisation of International conferences**

1999 International Organizing Committee GAP 99, Zurich

1999 Chairman, International Mangrove Symposium, Tokyo

2003 Head, Scientific and Technical Team: National Water Project, The Begin-Saadat Center for Strategic Studies

2008 Co-convenor GAP Workshop, Eilat

2008 International course, University of the Ryukus, Okinawa, Japan.

2008 15<sup>th</sup> Workshop of the International Association of Phytoplankton Taxonomy and Ecology (IAP), Ramot, Israel, 23 – 30 November 2008

**Membership to Editorial Boards of International Journals**

1994-2006 Global Change Biology

1993-2005 Israel Journal of Plant Sciences

1999 Guest Editor, Journal of Marine Biology

2000 Guest Editor, Trees: Structure and Function

2003 Guest Editor, Limnology and Oceanography

2008-present Aquatic Sciences