



Akira Okubo 1925-1996



suggested that the Okubo Symposium was one of the easiest events to plan because people were eager to honor the man who had touched their lives so significantly. With participants coming from across the country, Dr. Levin's words certainly capture the sentiments of all who participated.

MSRC Dean and Director, Kirk Cochran, opened the Symposium with an overview of Akira Okubo's long and distinguished career. In Dean Cochran's words, Akira "left us all gasping for breath." Beginning his intellectual life in Japan, Akira received his Bachelors of Engineering in 1947 and his Masters of Science in Physical Chemistry in 1949 from the Tokyo Institute of Technology. He then served as Chief of the Chemical Oceanographical Section of the Japan Meteorological Agency in Tokyo from 1950 - 1960. In 1959, Akira came to the United States to pursue his Ph.D. at the Chesapeake Bay Institute (CBI) at the Johns Hopkins University in Baltimore. Under the tutelage of Donald Pritchard Akira completed his degree in 1963 and continued to work at the CBI until 1974 when he was appointed Professor of Mathematical Ecology at the Marine Sciences Research Center. At MSRC, Akira quickly distinguished himself as a faculty member, not only in physical oceanography, but also in the many other disciplines that incorporated his wide interests in oceanic diffusion,

▶ On February 1, 1996 the world lost a distinguished scientist and the faculty, staff and students of the Marine Sciences Research Center lost a beloved colleague, mentor, teacher and friend. Akira Okubo died peacefully in his sleep after a long battle with cancer. Fortunately, the Center was able to honor Akira and commemo-

rate his distinguished life and achievements at a two-day Symposium on July 21 and 22, 1995. After a career spanning almost 50 years, Akira, a man of diverse interests and talents, a man of incredible generosity and compassion, celebrated his retirement among friends, colleagues and students. One of the presenters, Dr. Simon Levin,

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Professors Emeriti Donald Pritchard (left) and Harry Carter (2nd from right) share a joyous reunion with Akira Okubo and Robert Wilson.



animal and insect swarming, and studies at the physical-biological interface. Akira became the compleat theoretician — an applied mathematician with a keen sense of physics and biology, and a rare insight into where the significant problems lay. Actively sought out by leading marine scientists worldwide over the years, Akira worked with almost one hundred collaborators. As sole author and with his colleagues he published over 150 papers.

Akira's remarkable contributions earned him numerous honors, including the prestigious Medal of the Oceanographical Society of Japan, and a Senior Visiting Scholarship at the University of Oxford. His studies ranged from dye diffusion in the ocean, circulation in oceanic fronts, Lagrangian dispersion, and midge swarming behavior from its chemistry to ethology. He applied his insights into turbulent mixing to subjects as disparate as seed dispersion, animal grouping behavior, and spider webs. His text on mathematical models for diffusion and ecological problems, published in 1980, remains a modern classic.

The diversity of Akira's interests was reflected in the topics of the presentations. With talks ranging from, *Scaling from Individuals*

to *Ecosystems*; (Simon Levin from Princeton) to *Plankton Patchiness and Reaction-Diffusion Mechanisms*; (Thomas Powell from University of California, Berkeley,) to *Space Versus Time; Who Won?*; (John Steele from Woods Hole Oceanographic Institution) to *Turbulent Transport of Gametes and Larvae Near Wave-swept Shores*; (Mimi Koehl from University of California, Berkeley) to *The Interface Between Physics and Biology in the Mixed Layer*; (Trevor Platt from the Bedford Institute of Oceanography, Canada) to *Objects Drifting the Seas: 5,000 Years BP to the Present* (Curtis Ebbesmeyer from Evan-Hamilton, Inc. in Seattle Washington). The character, content and tone of the Symposium told the story of the amazing breadth of Akira's remarkable career.

Yet, over and over again during the course of the two day Symposium, presenters and

participants hinted that the sum of Professor Okubo's achievements and influence added up to so much more than his life as a scientist. In Dean Cochran's words, "Akira is a professor in the truest sense of the word. His colleagues have learned as much from him as his students have. We consider Akira Okubo our national treasure." Few scientists have touched as many lives and hearts. Through his own enthusiasm and through his natural role as a mentor, Akira multiplied his influence among his colleagues and students many times over. Everyone who has come in contact with Akira has found their life immeasurably enriched.

To honor Akira's memory the Center is establishing an endowment fund to support student scholarships, student travel to scientific meetings and visiting scholars. Contributions to this fund should be made payable to the Stony Brook Foundation "Okubo Fund" and sent to Dr. J. Kirk Cochran at MSRC. ■

Summer Environmental Camp

What do the Long Island Landfill Law and an environmental camp for children have in common? The answer, surprisingly, is a great deal. When three Suffolk County towns — East Hampton, Riverhead and Southold — refused to comply with the Landfill Law, they became subject to fines imposed by the New York State Department of Environmental Conservation. With some creative negotiating, some of the fines which became part of the DEC's Environmental Benefit Fund were earmarked for an escrow account to create an environmental camp, Camp Seawolf, on Long Island.

Asked to aid in the establishment of the camp, the Marine Sciences Research Center and Stony Brook's Center for Excellence and Innovation in Education (CEIE) participated in the planning process and assisted in drafting an agreement with the three east end towns. With CEIE overseeing the escrow account and maintaining responsibility for the administration of the camp and with MSRC providing its expertise to create a curriculum with an emphasis on coastal issues, the marriage proved to be successful. According to the agreement, the three east end towns will contribute a total of \$840,000 to the escrow over the next seven years. The funds, managed by CEIE, will be used to administer the camp, purchase supplies and equipment,

offset tuition costs and provide scholarships to eligible children.

For several years, the DEC has been interested in replicating its successful upstate environmental camp program on Long Island. And, though the DEC is not directly involved in the administration of Camp Seawolf, they did provide a model which was tailored, with the aid of MSRC, to Long Island's unique coastal and freshwater environments. Piggybacking on an established SCOPE camping program at Suffolk County's Peconic Dunes Camp in Southold, Stony Brook's Camp Seawolf became a reality.

On July 23, 1995, the Camp opened its doors to 105 children between the ages of 11 and 14 for the initial week-long program. Drawing on the natural resources of the Peconic Dunes Camp — a freshwater lake, the Sound and a healthy saltmarsh — Camp Seawolf provided its student campers with an overview of Long Island's diverse ecosystems. Though the emphasis is on instruction, the curriculum does include some fun. In addition to the wonderful natural environment, the Peconic Dunes Camp boasts an abundance of sleeping and recreational facilities, including beautiful dormitories overlooking the Sound, canoes for boating on the lake, and craft and science centers, to accommodate, entertain and educate campers of all interests. ■



This summer, **Camp Seawolf** will run three one-week sessions **July 21-27, July 28-Aug. 3 and Aug. 4-10**. Campers are charged \$225/week. **For more information** call the Center for Excellence and Innovation in Education at **632-7696**



► Vincent Breslin

FOCUS ON RESEARCH

After a number of years of as a landlubber, working on sod and composting projects in eastern Long Island Vince Breslin has begun work on several research programs which will take him back to the water, though in two very different directions.

Marine Construction

The first direction is a series of studies which examine two types of materials used in marine construction — pressure treated lumber and plastic lumber. The material of choice for marine construction has traditionally been wood. To guard against degradation by marine borers, wood for marine uses must be treated. Though pressure treated lumber has been around for decades, recent concerns have surfaced about the potential adverse effects of metal leaching from chromated copper arsenate Type C (CCA-C) treated wood used in waterfront construction and the possible toxic effects of these metals on non-target organisms. The concern is such that the Planning Board of East Hampton Township, as well as other coastal towns around Long Island, have considered banning CCA treated wood placed in or near the marine environment.

Is the concern justified? The evidence is contradictory. In one group of studies (Aresenalt, 1975; Johnson, 1977), examination of CCA treated products following prolonged terrestrial and marine weathering showed that CCA-C treated wood effectively retained copper (Cu), chromium (Cr) and arsenic (As). Another study (Hegarty and Curran, 1986), however, found that CCA treated beech and Scots pine specimens, weathered in seawater over a one-year period, evidenced measurable losses of Cu, Cr & As. In addition, laboratory studies examining leachate solutions containing CCA treated wood show measurable concentrations of Cu, Cr, and As. (Weis et al., 1991; Weis et al., 1992)

Failing to rigorously examine factors which may influence the leachability of these metals from CCA treated wood specimens, this earlier research, according to Breslin, is not truly representative of what happens in an estuarine environment. Frequently conducted at a fixed liquid to solid ratio in confined systems, leaching and bioassay studies do not adequately predict the long-term release of metals and may overestimate the toxicity of leachates from CCA treated wood. Further results of the



marine construction. Plastic lumber is commonly manufactured using post-consumer or industrial scrap plastic.

If plastic lumber is shown to be a durable material, suitable for the construction of docks, bulkheads and piers, it would provide a market for waste plastics which would otherwise be burned or landfilled. Construction of a 50 x 1 meter plastic lumber pier, using a high quality HDPE material was completed in December 1995 and is located at the West Meadow Marine Conservation Center. The materials were donated by Trimax of Long Island Inc., Ronkonkoma, New York. A monitoring, testing and evaluation plan was developed to assess the engineering and environmental properties of plastic lumber (e.g., dimensional stability, specific gravity, compression testing).

Up to this point, the pros and cons of plastic lumber have been based largely on anecdotal evidence. Exposed to different environmental conditions, how will plastic lumber behave long-term? Is it as structurally durable as wood? By constructing a working pier using plastic lumber, Breslin will quantify its effectiveness in a stressful marine environment. Selected stressed members of the pier have been designed for replacement so that a long-term history of engineering properties, such as static and dynamic loading, can be determined.

With these two studies, Breslin and his collaborators will develop a thorough picture of the pros and cons of these two marine construction materials. "We have been able to take advantage of the resources provided by these two different funding sources to provide an overall engineering and environmental assessment of these two distinctly different marine construction materials."

The Great Lakes

The second focus of Breslin's current work is a

other cargo residues (e.g., taconite and limestone), and ship-derived combustion products (boiler and fly ash, and elemental carbon) under the shipping lanes in Western Lake Ontario. The proposed research includes field studies on distributions of ship-derived wastes; the history and transport of dumped materials (through particle type/contaminant tracer geochronologies of sediment cores traversing away from four areas with large deposits); the possible effects of these materials on benthic populations (species abundance and community structure along the same transects); and the bioavailability of PAHs and a selection of metals (e.g., As, Ni, Se, V, Zn) as determined by measuring body burdens in zebra mussels, *Dreissena polymorpha*, and the dominant amphipod, *Diporeia spp.*

Breslin, Flood and Cerrato began work on the study in June 1995 with a cruise on the U.S. Coast Guard buoy tender Bramble along with a remotely operated vehicle (ROV) supplied by the National Underwater Research Program. With data provided by Canadian geophysicists Cameron, Lewis and Mayer, the cruise focused on characterizing the acoustic targets with ROV video transects and an extensive suite of sediment cores obtained by ROV and shipboard boxcoring. Areas of the bottom under the shipping lanes for which there is strong evidence of acoustic anomalies were carefully examined. Transects of boxcores across affected areas and in unaffected areas were conducted at three or four water depths. This approach enabled the study to obtain sediment and organism samples across a range of features and to compare sediment chemical distributions, contaminant body burdens, and benthic populations between sites affected and by ship-derived wastes.

New York Sea Grant Institute funds have been secured to support the analyses of samples collected on the cruise. Breslin, Flood and Cerrato will conduct a second major cruise this summer, building on the experience and results of the first expedition. Areas deemed to show the maximum impact of ship-derived wastes will be characterized in more detail with additional sonar surveys, boxcoring, and grab sampling of the lakebed. In a closely related project funded by National Underwater Research Program (NURP) this team of scientists along with Bruce Brownawell will expand the scope of the work in Western Lake Ontario to include more detailed analyses of the sediments for PAHs and examine the bioavailability of PAHs from sediments impacted with ship derived wastes.

One of Breslin's major interests in this research project is the extent to which the chemistry of the Lake Ontario sediments under the shipping lanes are affected by the presence of coal and ash particles. Breslin has conducted previous research examining the elemental composition of coal, coal and oil boiler slags, coal fly ash and oil fly ash particles. Coal ash and oil ash are produced by the combustion of coal and oil, respectively for the production of steam for the generation of electricity or power (ship boilers). The combustion process results in the enrichment of trace elements in the ash, most often associated with

FACULTY & ALUMNI NOTES

April - October 1995

Roger Flood participated in a cruise June 4-14th on board the USCGC Bramble in western Lake Ontario finding and sampling cargo sweeping deposits by ROV with **Bruce Brownawell**, **Bob Cerrato** and **Vince Breslin**. He spent June 18-24 in Eckernforde, Germany doing acoustic studies in conjunction with scientists from Lamont-Doherty Earth Observatory. And July 24-26, Roger Flood attended the Ocean Drilling Program "Site Survey Panel" meeting at Lamont-Doherty Earth Observatory to assess status of possible Ocean Drilling Programs.

In July, **Cindy Lee** gave a lecture at the Estuarine Processes Gordon Conference in New Hampshire. Dr. Lee's student, **Silvio Pantoja** gave a talk at the Central-Atlantic Regional Association of Biogeochemists in Pennsylvania in May, winning an award for the Best Presentation. In July, Silvio also presented a poster at the Chemical Oceanography Gordon Conference in New Hampshire.

Darcy Lonsdale with Dr. Terry Snell, Georgia Institute of Technology, received a grant from the Biological Oceanography, Ocean Sciences Program of the National Science Foundation entitled "Chemical Communication in Marine Copepods."

Malcolm Bowman attended the Spring Annual Meeting and the Editors' Meeting of the AGU in Baltimore, May 30-June 1. He also presented a seminar entitled "Modifications to Circulation in Doubtful Sound, by a Hydro-Electric Scheme," at the Department of Atmospheric and Oceanic Sciences at McGill University on May 21st.

Gordon Taylor presented a talk entitled, "Factors Influencing Microbial Degradation of Sorbed Organic Matter in Marine Sediments and Elsewhere," at the Department of Oceanography at Old Dominion University on April 28th. Bruce Brownawell's student **Lawrence LeBlanc**, presented a paper at the SETAC North Atlantic Chapter Meeting, entitled "Effects of Sediment Resuspension on the Degradation of Phenanthrene" on July 16th.

In June, **John Mak** received a three year grant from the National Science Foundation entitled "Isotopic Analysis of Atmospheric Carbon Monoxide."

Marvin Geller received a grant from NASA Goddard Space Flight Center for \$90k in October for "Interdisciplinary Global Change Research."

Hartmut Peters executed two cruises in August and October 1995 on the R/V *OnRust* as the field phase of experiment HUDMIX with Rocky Geyer and John Trowbridge of Woods Hole Oceanographic Institute. MSRC student **Reinoud Bokhorst**, and others participated.

wood specimens and the initial concentration of the metals in the wood specimen.

Funded by the New York Sea Grant Institute, Breslin's research more closely approximates estuarine conditions to examine the release of Cu, Cr and As from pressure treated wood. Breslin, with co-PI, Larry Swanson and research assistant, Leslie Adler, designed a study to determine the long-term flux of Cu, Cr, and As from CCA treated wood specimens in solutions of different salinity and temperature. Results of these studies will then allow for estimates of the impacts of these metals from CCA treated structures in different coastal environments.

A second major focus of the study addresses the potential for the uptake of Cu, Cr and As by non-target marine organisms using the blue mussel (*Mytilus edulis*). Blue mussels are commonly used as an indicator organism of marine water quality. Previous studies have shown that marine organisms exposed to CCA lumber have accumulated copper in measurable amounts (Weis). Breslin has designed flow-through laboratory seatable studies and field studies in Flax Pond to determine the extent to which these organisms accumulate metals leached from CCA-C treated wood.

Because of the potential concerns surrounding the use of pressure treated wood in coastal waters, plastic lumber is being considered as an alternative material. As a companion to the Sea Grant study, Vince Breslin, Larry Swanson and Sheldon Reaven have secured funding from the New York State Energy Research and Development Authority Secondary Materials Development Program — Phase II to examine the environmental and engineering properties and market suitability of plastic lumber used in

scientists Roger Flood and Bob Cerrato. Funded by the New York Sea Grant Institute, the study examines the distribution and effects of ship-derived wastes in the sediments of Lake Ontario from a geochemical and ecological perspective.

For as long as ships have been on the Great Lakes, materials have been disposed of over the side. Historically, steam ships disposed of ash, clinker and unburned coal overboard. Today, losses of cargo routinely occur during loading, unloading and when cargo ships rinse down residual cargo and dust between loads from the deck, topside, cargo tunnels and holds (a practice known as cargo sweeping) discharging materials and water overboard. Typically, the cargo and ash residues fall to the bottom of the lake and accumulate in bottom sediments and with especially high concentrations beneath shipping lanes where ship traffic is heaviest.

These materials can have an environmental impact because of changes in substrate (e.g., sand and gravel deposited in muddy or rocky areas; changes in sediment nutritional content and permeability), the introduction of potentially toxic materials into the sediments (e.g., contaminants associated with coal, coke and ash), and local changes in water and/or sediment chemistry (e.g., rock salt, fertilizers, potash, decomposing grain, and possibly gypsum and limestone). The potential effects of ship-derived wastes are expected to be greatest under shipping lanes in regions of low sediment accumulation rates, where sand and gravel sized particles cannot be rapidly buried.

Breslin's study seeks to examine the distribution and possible geochemical and biological consequences of coal,

ash particles are found in arsenic and selenium (>100 ug/g) while the nickel and vanadium contents of oil ash particles can be in excess of 100,000 ug/g. As a result, coal ash and oil ash particles have unique elemental compositions which distinguish them from typical lake sediments.

Currently, Breslin and Maura Clyne, an undergraduate Chemistry major and future MSRC graduate student, are measuring the trace element content of the surface sediments collected within and away from the shipping lanes searching for the presence of these elemental signatures in the lake sediments. Sediment samples collected during the June 1995 cruise are being digested using a HF-HClO₄-HNO₃ acid digestion technique and the digest solutions analyzed for major and trace elements by atomic absorption spectrophotometry. Using the elemental compositions of these combustion residues along with their unique particle morphologies, Breslin will assess the extent to which combustion residues and other cargo residues are impacting the sediments below the shipping lanes in Western Lake Ontario.

As these trace elements are mostly surface associated and are of environmental concern, another important objective of the study is to examine the potential for these trace elements to be bioaccumulated in benthic organisms. To determine if the benthic organisms are bioaccumulating trace elements associated with these surface sediment deposits, deposit feeding amphipods were collected from within and away from ship waste affected sediment deposits using a suction sampler attached to the ROV. A comparison will be made of the trace element body burdens in benthic organisms representing a range of sedimentary environments. ■

Programs for Children at West Meadow Creek Conservation Center

The Marine Sciences Research Center in cooperation with the Stony Brook Community Fund (SBCF) continues to expand its programs for children at SBCF's West Meadow Creek Conservation Center. Last summer, a two-day program, entitled "Island Adventures," was offered throughout July and August. The program provided nine through twelve year olds with an opportunity to sail aboard the replica of an 18th/19th century schooner, the "Phoenix," discover the natural history of Long Island and cruise through the Wetlands Preserve at West Meadow Creek aboard the pontoon boat, *Discovery*. With graduate students providing instruction, participants were taken back in time to learn how Long Island was formed, how West Meadow Creek estuary evolved, and how native Americans and early Long Islanders used natural resources and made their livings. As part of the program, children were able to explore a touch tank with native shellfish and finfish, examine images of micro-organisms from water samples and identify plants and animals during a nature walk.

In addition, MSRC graduate students guided cruises through the wetlands aboard *Discovery*. Cruising from Stony Brook Harbor through the Stony Brook Community Fund Wetlands Preserve at West Meadow Creek, the program introduced people of all ages to the beautiful and fragile nature of the wetlands. Learning about the glacial moraine, the West Meadow sandspit, the estuary, tidal flow, marsh plants, waterfowl and more, the visitors were able to experience the life of the wetlands.

This season the adventure continues. *Discovery* is cruising through the wetlands from May through October and school groups continue to enjoy the learning experience at the Conservation Center on West Meadow Creek. ■

RECENT GRADUATES

May 1995

Leonardo R. Castro (Ph.D.) Robert K. Cowen
Thesis: Ichthyoplankton distribution around Barbados: patterns and processes conducive to retention

Robert J. Chant (Ph.D.) Robert E. Wilson
Thesis: Tidal dynamics of the Hudson River Estuary

Sean P. Colin (M.S.) Jeannette Yen
Thesis: Male search behavior in locating females for copulation in copepods

Mara R. Diaz-Romero (Ph.D.) Edward J. Carpenter
Thesis: Metabolism of methylated compounds by saline bacteria

Michael H. Doall (M.S.) Jeannette Yen
Thesis: The search behavior, attack volume, and capture efficiency of *Euchaeta rimana*, a predatory calanoid copepod

Mijin Lee (M.S.) Gordon T. Taylor
Thesis: The role of marine vibrios in unexplained mortality of the hatchery-reared, juvenile eastern oyster, *Crassostrea virginica*

Xianzhi Liu (M.S.) Sultan Hameed
Thesis: SLP and SST variations associated with the North Pacific oscillation

Jyotika I. Virmani (M.S.) Marvin Geller
Thesis: An evaluation of the added scientific impact of HIRDLS, a side-scanning infrared limb radiometer

Xintai Wang (M.S.) Roger D. Flood
Thesis: Seasonal resuspension of contaminated sediment in southern Lake Ontario

August 1995

Victor Chan (M.S.) Robert DeZafra
Thesis: Retrieval of stratospheric trace gases profiles by constrained matrix inversion method

Brian D. Connolly (M.S.) Kamazima Lwiza
Thesis: Bathymetric and stratification effects on the flow patterns through the mouth of the Hudson River

Christopher J. Gobler (M.S.) Elizabeth M. Cospir
Thesis: Effect of iron on the growth of *Aureococcus anophagefferens* (*Chrysochyaeae*)

Liviu Goisan (M.S.) Henry Bokuniewicz
Thesis: Beach dynamics on the Romanian Black Sea Coast

Boris V. Khattatov (Ph.D.) Marvin Geller
Thesis: Dynamics of the mesosphere and lower thermosphere as seen by MF radars and by HDR/UARS

Elizabeth M. Lamoureux (M.S.) Bruce J. Brownawell
Thesis: Linear alkyl benzenes as tracers of sewage sludge and associated hydrophobic organic contaminants at the deep ocean 106-mile dumpsite

Zongming Pan (M.S.) Jeannette Yen
Thesis: Lipid variation during the development of *Euchaeta antarctica*, a marine copepod in the Antarctica

Kate L. Stansfield (Ph.D.) Malcolm J. Bowman
Thesis: Coastal ocean circulation around the island of Barbados, West Indies

Senjie Lin (Ph.D.) Edward J. Carpenter
Thesis: Studies on cell cycle proteins (PCNA, p34cdc2, cyclin B) as potential cell cycle markers for species-specific growth rate estimation for marine phytoplankton

Ningli Zhu (Ph.D.) Bruce J. Brownawell
Thesis: Reacnatural organic matter and its constituents reductive dehalogenation reactions

Yi-chao Wu (M.S.) Peter J. Minnett/Hartmut Peters
Thesis: A comprehensive comparison between AVHRR and ATSR brightness temperature measurements

December 1995

Timothy H. Anderson (M.S.) Gordon T. Taylor
Thesis: Pelagic microbial processes influencing hypoxia in western Long Island Sound

Lorraine A. Heilman (M.S.) Kamazima Lwiza
Thesis: Physical factors affecting larval transport in the lower Hudson River estuary

Kevin H. Hovel (M.S.) Steven G. Morgan
Thesis: Predation and photodamage as selective factors promoting rapid transport of decapod larvae through a salt marsh

Thomas P. Hurst (M.S.) David O. Conover
Thesis: Implications of winter mortality of Hudson River young-of-the-year striped bass (*Morone saxatilis*)

Holly B. Kunze (M.S.) Steven G. Morgan
Thesis: Larval transport in the lower Hudson River estuary

Andrew E. Matthews (M.S.) Steven G. Morgan
Thesis: Cross shelf transport of decapod larvae in New York Bight

Kimberly A. Roberts (M.S.) J. Kirk Cochran
Thesis: ²¹⁰Pb scavenging in the northeast water Polynya, Greenland

Weixing Shen (Ph.D.) Marvin A. Geller
Thesis: Effect of mean state on tropical cisk-waves: selective excitation, induced mean flow acceleration and zonal variability

Ajit Subramaniam (Ph.D.) Paul G. Falkowski
Thesis: Optical properties of *trichodesmium*