2001

POLY MILLENNIAL 2000 Hilton Waikoloa Villages, Hawaii, December 9-13, 2000

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Conference Report

Poly Millenial 2000

Hilton Waikoloa Villages, Hawaii, December 9–13, 2000

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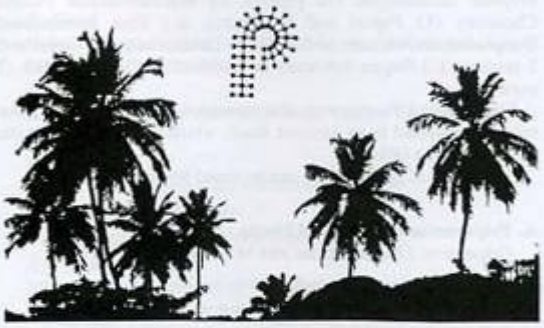
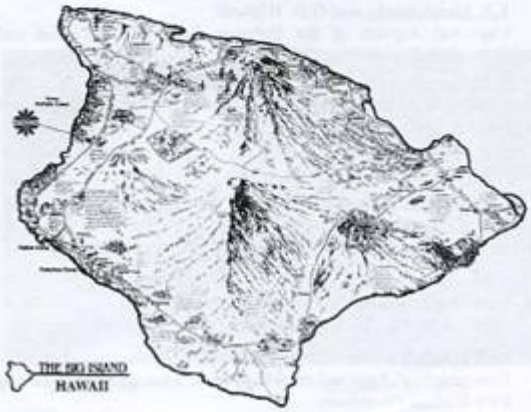


The Division of Polymer Chemistry, Inc. (Polymer Division) of the American Chemical Society held a major international symposium, POLY Millennial 2000, from December 9–13, 2000 in Hawaii. The International Polymer Symposium Committee, chaired by Joseph C. Salamone with Stanley C. Israel, Raphael M. Ottenbrite, James E. McGrath, and William H. Daly, organized POLY Millennial 2000. The General Chairman of the meeting was William H. Daly. This comprehensive meeting included the elements of a typical Biennial Polymer Symposium of the Polymer Division, but was expanded to allow six tracks of presentations to occur concurrently.



William H. Daly

The conference was held on the big Island of Hawaii at the Hilton Waikoloa Villages which is located near Kona on the West coast of the Big Island.

Hawaii, called the Big Island is the eastern-most island of the Hawaiian island chain. Its name was used to name the entire group of islands, which also includes Oahu, Maui and Kauai, but also Lanai, Molokai, Niihau and Kahoolawe. The Hawaiian Islands are the tips of massive mountains created by the a crack in the earth mantle that has been spewing molten rocks (lava) periodically for 25 million years. The oldest and western-most island is Niihau. The youngest island with still active volcanoes is the eastern-most island, the Big Island, Hawaii was populated about 1,000 years ago from Polynesia, which in turn was populated from East Asia via what is now Indonesia. Influences of the immigration that can be traced to Fiji, Tahiti and Samoa still exist today. The Hawaiian islands, enjoying a special tropical climate, are some of the most isolated, being 2500 miles from the closest landmass and 1400 miles north of the Equator. The latitude is similar to Southern Mexico, the Yucatan Peninsula.

The volcanic origin of the Hawaiian islands imbues them with a rugged landscape with spectacular gorges and valleys. The 'Big Island' has the most active volcano, Kiliauea and the highest mountain, Mauna Kea with a peak of 13,700 feet above sea level. The mountain actually rises over 32,000 feet above the ocean floor and could be considered the highest mountain on earth. The Big island, at 90 miles long and 80 miles wide, has an area more than all the other Hawaiian islands combined. The Hawaiian climate is pleasant for the tropics with the constant trade wind from the east which brings high rain fall in the east and almost desert like climate in the West. The

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mountains windward sides have tropical jungles, cascading waterfalls, the west is devoid of rainfall.

The big island is the youngest of the Hawaiian islands and the only one still growing. Kiliauea is the most active volcano on earth. The Hawaii Volcanoes National Park encompasses incredible volcanic sites. Mona Kea being the highest mountain on the island. The almost equally high Mona Loa and the previously mentioned Kiliauea are the only active volcanoes, which regularly erupt. These volcanoes are shield volcanoes which open up and release lava flows when they become active. Consequently there are residues of lava flow over most of the eastern and southern parts of the islands.

The Hawaiians were living as local tribes until King Kamehameha (1768–1819) united first the Big Island in the early 1790's and later captured the entire island chain. Known as Kamehameha the Great, his kingdom lasted until the mid 1890's when Hawaii was annexed as a territory by the US. Hawaii became the 50th state of the Union in 1959. In early 1800, the major trade of Hawaii was in sandal wood and whaling. Later in the 19th century, the Hawaiian islands, blessed by favorable weather conditions, developed a succession of tropical crops from sugar cane to pineapples. Now the most cost efficient crops are papaya and macadamia nuts, and of course, Kona coffee. Today, tourism is a major part of the Hawaiian economy.

Waikoloa Villages

Beach at Waikoloa

The Conference, POLY MILLENNIAL 2000 consisted of about 600 participants, of which over 450 were scientific participants. They came from 28 countries. Over 400 papers and posters were presented. The meeting was divided into 12 symposia and a plenary Herman F. Mark Symposium. We applaud the diligent efforts of the individual symposium organizers in planning, assembling, and running their symposia.

The following symposia were held:

A.) Polymers in Supercritical Fluids (21 Papers); B.) New Developments in Polymer Synthesis (27 Papers and 14 Posters); C.) Field Responsive Polymers (22 papers); D.) Academic-Industrial Interactions in Photonic and Non-linear Optical Polymer Development (32 papers and 10 posters); E.) Self-Assembled and Spontaneous Organized Polymeric Systems (18 papers and 13 posters); F.) Polyolefins (19 papers and 8 posters); G.) New Techniques for Polymer Characterization (25 papers and 10 posters), H.) Biorelated Materials (34 papers and 16 posters); I.) Evolution of Polymer Technologies (18 papers); J.) Macromolecular Plasma Chemistry (12 Papers and 8 posters); K.) First International Symposium on Polymers in the Marine Environment (37 papers and 5 posters); L.) Recent Advances in Engineering Thermoplastics (3 papers).

Sixty General Posters were also presented. The abstracts of these talks are collected in an Abstract Book, which is available from the POLY Business Office.

A selection of presentations can be found below:

A. Polymers in Supercritical Fluids
Organizers: J.M. DeSimone and M.A. McHugh

S. Beuermann and M. Buback
Free Radical Solution Polymerization in Supercritical Fluids

A.B. Homes, A.I. Cooper, S.A. Mang, M.A. Carroll, R.S. Gordon, T.R. Early, and L.M. Stamp
Controlled Synthesis in Carbon Dioxide

S.M. Howdle, P. Christian, M.R. Giles, R.C. Major, and R.M.T. Griffiths
Polymer Synthesis in Supercritical Fluids.

J.M. DeSimone
Fluoropolymers Enabling the Carbon Dioxide Technology Platfrom

E.Gulari
Rheology of Polymers Swollen with Carbon Dioxide

Y.B. Meinichenko and G.D. Wignall
Universal Aspects of the Polymer Behavior in Liquid and Supercritical Solvents

A.M. van Herk, M. Cleven, M. Kennere, and J. Keurentjes
Free Radical Polymerization in Supercritical Carbon Dioxide and Hybrid Systems

E.T. Samulski
NMR Studies in Supercritical Fluids

S.K. Ober, G. Weibel, V. Pham, H.P. Lewis, and K.Gleason
Next Generation Lithography: Studies of Supercritical CO_2 as an Enabling Developer for Superior Resist Performance

B. New Developments in Polymer Synthesis
Organizers: K.L. Wooley and K.E. Uhrich

C. J. Hawker, E. Harth, and T. Bosman
Combinatorial Approaches to Polymeric Materials Using Living Free Radical Procedures

K. Matyjaszewski
Block and Graft Copolymers by Atom Transfer Radical Polymerization

M. Sawamoto and M. Kamigaito
Transition Metal-Catalyzed Radical Living Polymerization: Catalyst Design and Precision Polymer Synthesis

Y. Kawakami. M. Oishi, and Y. Li
Controlled Synthesis of Si-Containing Polymers

D. Marsitzky and K.R. Carter
Functionalized Poly-2,7-Fluorenes: Advanced Designs for Improved OLED Devices

R.D. McCullough
Synthesis and Directed Assembly of Conducting Polymer Nanostructures

T. Aida
Hierarchical Self-Organization of Dendritic Macromolecules

K. Akagi
Helical Polyacetylene Synthesized in Asymmetric Liquid Crystalline Reaction Field

H.R. Allcock
New Approaches to the Synthesis of Hybrid Organic-inorganic Macromolecules

S.I. Stupp
Polymolecular Assemblies and Novel Materials

B. Zhao and W.J. Brittain
Surface-Immobilized Diblock Copolymers

R.F. Storey
Mid-infrared Monitoring of Carbocationic Polymerizations

R.P. Quirk, I. Yoo, T-H. Cheong, and Y. Lee
New Developments in the Anionic Synthesis of Functionalized Polymers

H. Higashimura, K. Fujisawa, Y. Moro-oka, S. Namekawa, M. Kubota, A. Shiga, H. Uyama, and S. Kobayashida
"Radical-Controlled" Oxidative Polymerization of Phenols

T. Narita, H. Hamana, and M. Takeshita
Radical Polyaddition of Perfluorinated Isopropenyl Esters with Methylene Compounds

M.E. Wright, D. Radford, and D.A. Schorzman
The Synthesis of Poly(carbyne) and Related Conjugated Polymers Using Palladium Catalysis

David Hill ***Graeme George***

C. Field Responsive Polymers
Organizers: G.E. Wnek, T.W. Smith, and M. Abkowitz

G.E. Wnek, G.L. Bowrin, and D.G. Simpson
Electrospraying and Electrospinning of Polymers for Tissue Engineering/Biomaterials Applications

J. L. West. G. Magyar, B. Taheri, and Y. Kim
Patterned Field-induced Polymer Structures in Liquid Crystal Displays

B. Nair, A. Moment, L. McAfee, J.-S. Wu and P.T. Hammond
Ordering and Orientation in Liquid Crystalline Thermoplastic Segmented and Block Copolymers

T.W. Smith and M.A. Abkowitz
Semiconductive PVF_2 Composities

T. Kato
Liquid-Crystalline Physical Gels: Significant Electro-optic Properties and Self-Organized Structures

D.H. Reneker
Electrospinning and Polymer Nanofibers

M.A. Reed
The Design and Measurement of Molecular Electronic Switches and Memories

C.W. Spangler
Design of Dendrimers for Photonics Applications

M. Galvin
Polymeric Light-Emitting Diodes: Effect of Polymer Structure

Darrell Reneker

D. Academic – Industrial Interaction in Photonic and Non-linear Optical Polymer Development
Organizers: Yang Yang, A.B. Holmes, and C.Y. Kim

L.R. Dalton
The Chemistry and Engineering of Nanostructured Polymeric Electro-Optic Materials

S. Tripathy and J. Kumar
Photonics Technologies Collaboration Between UMASS Lowell Laboratories and Area Industries

A.K.Y. Jen, H. Ma, S. Liu, X. Jiang, M. Liu, B. Chen, L. Zheng, and L.R. Dalton
High Performance Perfluorocyclobutane-Containing Polymers for Electro-Optic and Light-Emitting Diode Applications

K. Watanabe
POF Standardization Activity: Report from Japan

A. Takaya, Y. Koike, K. Yokoyama, and E. Higuchi
Thin Highly Scattering Optical Transmission Polymer Backlight with High Luminance and Low Power Consumption

K.D. Ahn, D.K. Han, and J.M. Kim
Fluorecscent Photo Imaging in Polymer Films Using Protected Dye Precursors Based on Chemical Amplification

M.E. Thompson, S. Lamansky, R. Kwong, S.R. Forrest, P.E. Burrows, M.E. Baldo, C. Adachi, T.X. Zhou, L. Michalski, K. Rajan, and J.J. Brown
Efficiency and Lifetime of Electrophosphorescent Light Emitting Diodes

D.J. Kido
Efficient Polymer EL Devices Based on Dye-Dispersed Poly(N-Vinylcarbazole)

C.H. Chen
Synthesis of Fluorescent Dopants for Organic Electroluminescent Devices

S.T. Kim
Applications of OLED Technology to Information Displays

T. Tsutsui
Seeking New Breakthroughs in Organic Light-Emitting Devices

E. Self-Assembled and Spontaneous Organized Polymeric Systems
Organizers: F. Papadimitrakopoulos and G. Decher

S.I. Stupp
Self Assembly Strategies for Materials and Devices

W.Y. Huang, M. Nakazawa, T.K. Kwei, S. Matsuoka, and Y. Okamoto
Self-Assembling in Solutions of Poly(alkyl substituted phenyleneethynylene)

B.A. Armitage
Templated Assembly of Helical Dye Aggregates Based on Biomolecular Recognition

V. Percec
The Polymer Science of the Single Molecule

Y.M. Lvov
Nanofabrication of Ordered Multilayers by Alternate Adsorption of Polyions, Proteins and Nanoparticles: From Planar Films to Microtemplates

D.J. Sandman, M. Kim, J.E. Whitten, and H. Sung
Optical Processes and Environmental Effects in Programmed Electrostatic Assemblies of Conjugated Polymers

T. Kunitake
Nano-Composite Layers and Molecular Imprinting in Ultrathin Films

Joseph C. Salamone *William H. Daly* *Stanley Israel*

F. Polyolefins
Organizers: J.J. O'Malley, J.E. McGrath, K.B. Wagener, and TL. Hanlon

T. Hopkins and K.B. Wagener
Linear Polyolefins Bearing Amino Acids

R.H. Grubbs
Polyolefin Synthesis Using Late Metal Catalysts

P. Brant, E.L. Solomon, J.M. Canich, P. Stevens, B. DeVries, P. Matsunaga, K. Squire, and M. Sansone:
In Situ X-Ray Absorption Spectroscopy of Olefin Polymerization Catalysts

A.R. Siedle, R.A. Newmark, and K.M. Theissen
Physical Organometallic Studies of Metallocene Catalysts

B. Endeward, P. Brant, M. Bemardo, and H. Thomann
Electronic Structure of Metallocenes Determined by Optically Detected Magnetic Resonance and *Ab Initio* Calculations

H. Ray
Give Your Catalyst a Good Home – How the Reactor Environment Influences Catalyst Performance

M.A. Hillmyer
Synthesis and Self-Assembly of Block Copolymers Containing Model Polyolefins

D. Takeuchi, S. Kim, and K. Osakada
Ring-Opening Polymerization of Methylenecycloalkanes by Late Transition Metal Complexes

P.J. Doerpinghaus, M.J. Bortner, S.E. Bin Wadud, and D.G. Baird
The flow Behavior of Sparsely Branched Metallocene Catalyzed LLDPE

K. Sakurai, S. Shinkai, W.J. Mcknight, D.J. Lohse, M. Ueda, and S. Sakurai
Crystallization and Microdomain Morpohology of Polyethylene-Atactic Polypropylene Block Copolymers

F. Song and M. Bochmann
A New Generic Approach to Highly Functionalized Polypropenes

G. New Techniques for Polymer Characterization
Organizers: B.D. Ratner and J. Rabolt

J.F. Rabolt
Infrared and Raman Studies of Polymer Orientation in the "Real-time" Domain

J.C. Seferis and M.S. Tillman
Advances in Micro-Thermal Analysis for Composite Systems

F.D. Blum and C.E. Porter
Modulated DSC and Segmental Dynamics of Thin PMMA Films

A. Abe, I Hiejima, T. Takeda, and H. Furuya
A Combined Use of *PVT* 2H NMR, and Computer

D.G. Castner
Polymer Surface Analysis in the New Millennium

J. Beister, C. Gosch and W. M. Kulicke
Use of Combined Techniques SEC-MALLS-DRI and FFFF-MALLS-DRI to Characterize Water Soluble Polysaccharides and Polyelectrolytes

G. Adamus and M. Kowalczuk
Electrospray Ion-Trap Multistep Mass Spectrometry for Structural Characterization of Poly [(R,S)-3-hydroxybutanoic acid] Containing a *beta*-Lactam End Group

P.A. Netti
Movement of Macromolecules and Particles within Polymeric Gels

H. Biorelated Materials
Organizers: S.-J. Huang and E. Chiellini

A.C. Albertsson
Degradable Aliphatic Polyesters

G. Swift
Biodegradable Polymers in a Sustainable Polymer Industry

Y. Doi
Biosynthesis, Structures and Properties of Polyhydroxyalkanoates: Biodegradable Polyesters

S. Huang
Hydrogen Bonding Ring Containing Biodegradable Polymers

L. Ambrosio and L. Nicolais
Advances on Hydrogels and Composites for Soft Tissue Implants

W.H. Daly and D. Logan
Antimicrobial Properties of Quaternary Ammonium Chitosan Derivatives

P.Y. Ghi, D.J.T. Hill, and A.K. Whittaker
Water Sorption into Some Methacrylate Based Polymer Hydrogels

R. Dorgan, J. Palade, J.S. Williams, D. Knauss, J. Wegner, and S. Dec
Stereochemical Content Effects on the Properties of Poly(lactic acid)

W.G. Glasser and A. Franko
Cellulose Fiber Composites with a Thermoplastic Cellulose Ester Matrix

T. Sakurai, T. Kimura, K. Koumoto, R. Iguchi, and S. Shinkai
Complementary Polynucleotide Mimic Behavior of the Natural Polysaccharide Schizophylian in the Macromolecular Complex with Single Stranded RNAs

J. Jonn, J. Moseley, J. Quintero, and J. Bobo
Bioabsorbable Surgical Adhesives Based on Ester Derived Cyanoacrylates: Design and Synthesis

K. Uhrich
Novel Synthetic Polymers for Drug Delivery

R.N. Borazjani and J.C. Salamone
Polymer Surface Properties Related to Bacterial Adhesion

R.M. Offenbrite, R. Zhao, and M. Haratake
Oligopeptides as Potential Drug Delivery Systems

C. Limozin, E. Ganachaud, and P. Hemery
Controled Anionic Polymerization of Isobutylcyanoacrylate (IBCA) in Water Using a New Miniemulsion Process

B.M. Culbertson, Q. Wan, and S.R. Schricker
Hyperbranched Multi-Methacrylates, New Oligomers for Formulating Improved Dental Composites

Thomas J. Pacansky ***Joseph C. Salamone***

I. Evolution of Polymer Technologies
Organizers: J.S. Riffle, T. Long, T.J. Pacansky, and K. Havelka

J. Geibel
Evolution of Poly(p-phenylene sulfide) Technologies

R.B. Prime and J.M. Bums
Evolution of Magnetic Recording Technology

P.M. Puckett
Evolution of Epoxy Technologies

A. Hale
Evolution of Optical Media for Telecommunications

J.C. Salamone and J. Künzler
Evolution of Contact Lens Material Technology

D.J. Brunelle
The Evolution of Polycarbonate Synthesis Techniques

D.B. Priddy, Sr.
Evolution of Polystyrene Technologies

H. Ito
Evolution of Photoresist Materials

B.D. Ratner
Evolution of Surface Analysis Techniques for Polymers

Akihiro Abe *Murray Goodman* *William Brittain*

J. Macromolecular Plasma Chemistry
Organizers: F. Denes and R.C. Woods

M.A. Lieberman
Pulsed Power Plasm Discharges for Materials Processing

R.D. Short
Unraveling the Mechanisms Plasma Polymerization

T.R. Gengenbach, E. Chong, X. Xie, and H.J. Griesser
Thiol Surfaces Prepared by Plasma Treatments and Plasma Polymerization

M. Kuzuya
Electronic Structure of Plasma Excited Solid Surface and its Applications to Drug Engineering

G.L. Grobe, P.L. Valint, D.M. Ammon, J.F. Künzler, and J.C. Salamone
Surface Engineering Aspects of Siloxane Hydrogel Contact Lens Materials

K. First International Symposium on Polymers in the Marine Environment
Organizers: K.J. Wynne, P. Gatenholm, and B. Freeman

J.H. Waite
In Pursuit of a Natural Trade Secret: The Mussel Adhesive Formulation

M.M.E. Callow, J.A. Callow, L.K. Ista, G.P. Lopez, and A.S. Brennan
Chemical and Surface Associated Cues for Attachment of Spores of the Green Alga *Enteromorpha*

N. Hayase, N. Yamamori, and J. Sunamoto
Polymers Secreted from Marine Microorganisms

J. Platko, M. Berglin, P. Gatenholm, and D.L. Kaplan
Characterization of Barnacle Adhesion Plaque Proteins

Y. Osada, J.P. Gong, I. Kaneko, and Y. Katsuyama
Hydrogels in Marine Environment

N. Ogata
Novel Optical Materials Derived from Salmon DNA

B.D. Freeman, M.A. Arnold, K. Nagai, and J. Yan
Nonporous Polymer Coatings for Fouling Reduction in Membranes for Water Purification

P. Gatenholm, M. Andersson, M. Jelvestam, S. Petronis, K. Berntsson, and T. Ward
Microstructured Surfaces: Towards Macrofouling Resistant Coatings with Reduced Drag

J. Stein, K. Truby, C. Wood, D. Wiebe, J. Montemarano, D. Wendt, C. Smith, E. Holm, A. Meyer, G. Swain, D. Lapota, C. Kavanagh and B. Kovach
Silicone Biofouling Release Coatings: Correlation of Compositional Variables with Macrofouling Attachment Strength

T. Kowalewski
In Situ Atomic Force Microscopy Studies of Polymer Surfaces in Contact with Water

M. Kishihara, M. Hori, H. Yoshizaki, and T. Muramatsu
A Study for a Silicone-Based Foul-Release Coating for Ships

M. Thouvenin, K. Vallee-Rehel, J.J. Peron, V. Langlois, and P. Guerin
Innovating Approach in the Development of Antifouling Paints in Better Keeping with Nature

K.L. Wooley, D. Gan, and A. Mueller
Amphiphilic Crosslinked Films from Multi-Architectural Components: Preparation, Characterization, and Protein Adsorption Behavior

J. Uilk, E. Johnston, S. Bullock, S.A. Myers, Merwin, and K.J. Wynne
Bulk Characterization and Surface Features of Elastomeric Coatings Prepared from a, co-dihydroxy-Polydimethylsiloxane and the Ethoxysiloxane Mixture 'ES40'

C.K. Ober, S.H. Kang, X. Li. E. Sivaniah, and E.J. Kramer
Non-Reconstructing, Semifluorinated Coatings for Marine Applications

J.D. Stenger-Smith, P. Zarras, C. Webber, and N. Anderson
Poly(bisdialkylaminophenylenevinylene)s as Potential Replacements for Chromium

K.J. Wynne
Nontoxic Fouling Release Coatings for the New Millennium: An Alternative to Toxicant (Cu, Sn), Release

I. Pinnau and J. Ly
Novel Fouling-Resistant Polyether-Polyamide Block Copolymer Membranes for Oily Wastewater Treatment

C.L. McCormick and R.S. Armentrout
pH-Responsive-Polymeric Surfactants: Capture/Release Mechanisms for Foulant Removal from Shipboard Wastewater

L. Recent Advances in Engineering Thermoplastics
Organizer: E. Paschke

D.R. Kelsey, B.M. Scardino, J.S. Grebowicz and H.H. Chuh
High Impact Terephthalate Copolyesters of Rigid Tetramethylcyclobutanediol with Flexible Diols

D. Feldman, D. Banu, L. Campanelli, and H. Zhu
PVC-Plasticized Lignin Polyblends

On Saturday afternoon, December 9, the registration was held in the Promenade, followed by the general poster session in the Water's Edge Ball Room. The reception was held at 7:00 p.m. at the Lagoon Lanai. It allowed participants to meet old friends, to make new acquaintances or just to mingle with participants and accompanying guests. Breakfasts were also at the Grand Promenade and the Lagoon Lanai.

At the Luau
Hawaiin Type Banquet

Thomas Smith

The Herman F. Mark Symposium was held on Tuesday morning with the presentations of the 6 Awardees. In the evening there was the Mark Reception in the Grand Promenade and the Grand Ballroom followed by the symposium banquet. In Hawaiian tradition, the banquet was held in the form of a Luau at the Lagoon Lanai. Luaus have as their center piece grilled entire suckling or very young pigs with numerous other courses.

The highlight of the Luau is the entertainment of dancers from the islands. They performed dances of the South Pacific, based on the cultures and traditions of the Polynesian islands Fiji, Samoa, Tonga, Tahiti and the world-famous *hula dances* of Hawaii.

Herman F. Mark Awardees
Otto Vogl, Murray Goodman, Robert W. Lenz, Leo Mandelkern, Henry Hall, Robert Grubbs (left to right)

The Herman F. Mark Symposium recognizing six awardees was the highlight of the meeting. In celebration of the 50th Anniversary of POLY and the Millennium, the Division of Polymer Chemistry of the American Chemical Society selected the following six prominent scientists to receive separately the Herman F. Mark Award in Polymer Chemistry, the highest scientific Award of the Polymer Division: the Awardees and summaries of their talks are presented below.

Award Presentation
Duane Pritty, William Britten, Otto Vogl, Thomas Pacansky (left to right)

Otto Vogl
(Department of Polymer Science and Engineering University of Massachusetts, Amherst, MA)

My Life with Polymer Chemistry: From the 1950's to the New Century

My early life in chemistry was dedicated to steroids and alkaloids, the chiral carbon atom and racemate separations. Some work followed on radical reactions and on heterocyclics, like purines and pyrimidines.

When I started working in my industrial career at Du Pont in the mid 50's, polymer chemistry had started in its greatest growth period. Stereospecific polymerization and many interesting new monomers were being developed, new principles in polymer chemistry and physics were evolving.

I was becoming involved with aldehyde polymerization, a subject, which would dominate a substantial part of my scientific life: Polymerization of higher aliphatic aldehydes, stereospecific and conformational specific polymerization, optical activity based on macromolecular asymmetry (not the chiral atom) – helicity and ultimately the single chiral helix. Many discoveries had to be made on the way to this lofty goal: Understanding and manipulation of the ceiling temperature of polymerization, cryotachensic polymerization, spatial requirement for specificity, measurements of the optical activity on polymer powders, the embryonic state of polymerization (how stereospecificity in chloral polymerization developed in the early part of oligomerization) and the racemate separation of the oligomer with two turns of the helix.

Functional polymers, polymers with functional groups, were also part of my scientific interests throughout my career. Starting with attachments of steroids on alternating maleic anhydride/olefin copolymers, my group was involved early in working on polymers as drugs or biologically active polymers. My ultimate commitment to functional polymers was in polymerizable and polymer-bound UV stabilizers and antioxidants.

A smaller part of the efforts in our research group was directed toward the synthesis and characterization of unusual structures of common addition polymers, head to head polymers of commodity plastics. Limited investigations took me into the synthesis and polymerization of uncommon polymer intermediates, high temperature polymers, and polymerization under extreme pressures.

In the last decade our interests became directed toward more general topics: Oriental lacquers, bile acid sequestering agents and the ultimate uniformity of isotopically pure uniform polymers.

Henry K. Hall
(The University of Arizona, Tuscon, AZ)

Donor-Acceptor Polymerizations: Past, Present, and Future

H.K. Hall, Jr. presented a lecture entitled "Charge – Transfer Polymerization – and the Absence Thereof!". An overview of this area, which originated in the 1960s and has continued to be active ever since, was presented. The principal features of so called CT polymerization of electron-rich monomers with electron-poor monomers were listed. These included spontaneous initiation, formation of either homopolymers or alternating copolymers between the donor and acceptor olefins, and accompanying formation of cycloadducts. Recent literature, as well as our own work, was cited to indicate the lack of participation of CT complexes in the propagation step. The alternation was ascribed to polar effects in free radical reactions, as extensively documented by the work of Bernd Giese and Hanns Fischer. According to this interpretation electron-rich radicals prefer to react with electron-poor monomers and vice versa.

As to the mechanism of spontaneous initiation, again various literature explanations were considered and discarded. In particular the occurrence of electron transfer to form ion radicals, as well as formation of vinyl radicals, were rejected. The correct explanation is found in the postulate of Rolf Huisgen proposing the formation of tetramethylene intermediates in reactions of e-rich olefins with e-poor olefins. The resulting tetramethylene zwitterion-biradical can either initiate ionic homopolymerization or free radical copolymerization, depending on substituents.

Finally, a new hypothesis was presented to the effect that any attractive force which brings the e-rich donor and e-rich monomer together enhances their rate of tetramethylene formation and hence polymerization. Examples in the literature included Coulombic interaction, Bronsted and Lewis acid-base interaction, hydrophobic/-hydrophilic interactions, and templating/tethering. Charge-transfer complexation may play this role as well.

Leo Mandelkern
(Department of Chemistry and Institute of Molecular Biophysics, Florida State University Tallahassee, FL)

How Polymers Crystallize

The microscopic and macroscopic properties of semi-crystalline polymers depend on the chain structure and morphology. These in turn are governed by the crystallization mechanisms that are reflected in the kinetics of crystallization from the melt. Thus, an understanding of the crystallization kinetics is fundamental to comprehending properties. In this paper the pinciples that govern the crystallization kinetics of polymers were discussed. They serve as the basis for interpreting the experimental results for a variety of polymer types.

Polymers follow the same general principles that govern crystallization of metals and other monomeric substances in terms of nucleation and growth. However, cognizance must be taken of the fact that the crystallizing units are covalently connected with one another. This introduces complexity into the analyses and needs to be taken into account as does the fact that the transformation from the liquid to crystalline state is rarely, if ever, complete. There are two main ways by which crystallization kinetics can be investigated. These are studies of either the overall crystallization or the spherulite growth rates. Each method has its advantages and disadvantages and, in fact, they complement one another.

Studies of the overall crystallization rate have demonstrated the importance of nucleation processes, the role of molecular weight, the structural regularity of the chains and the initial melt structure. The roles played by these factors were demonstrated by experiment. The necessary modifications to monomeric theory were presented. In particular, the physical meaning and significance of the Avrami approach to polymer crystallization was emphasized and the modifications needed, pointed out.

Spherulite growth rates were discussed in terms of nucleation theory and rate maximum that is observed with crystallization temperature. The relations, if any, between nucleation theory, lamellar structure and chain folding was critically examined. The basis for lamellar crystallite formation and the kind of chain folding that is involved were also discussed. It was demonstrated, by the analysis of crystallization kinetics of high molecular weight n-alkanes and low molecular weight polyethylene fractions, that nuclei composed of regularly folded chains were not required to form lamellar crystallites. There is no theoretical or experimental basis to assume such type nuclei. The physical nature of the regimes that have been postulated were also discussed. The question of their existence, and the transition from one to the other, were examined in terms of theory and the experimental results that are now available for many homopolymers.

Robert Grubbs
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Polymer Synthesis Using Late Transition Metal Complexes

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Polymer Chemistry, Biotechnology and Green Materials: Chemical vs. Biological Synthesis of biodegradable Polyesters

Poly-3-hydroxyalkanoates, PHA's, are a ubiquitous family of biopolymers, which are produced by a wide variety of bacteria as intracellular storage materials. Identical polyesters can be prepared chemically by the ring-opening polymerization of propiolactones substituted at the 3-position. In this presentation the biological and chemical routes were compared, and the application of PHA's as thermally processable, biodegradable polyesters for green materials were described.

In nature bacteria produce optically pure 3-hydroxyalkanoate monomers and isotactic polymers with alkyl groups at the 3-position from simple substrates such as acetic acid. However, in the laboratory, some bacteria can be induced to produce PHA's with functional groups on the substituents at the 3-position when the cells are grown on substrates containing such groups. The synthesis of chemically equivalent PHA's from propiolactones substituted at the 3-position can be carried out by either ester interchange, anionic or coordination polymerization reactions to obtain high molecular weight PHA's, which vary in stereoregularity according to the chirality of the monomers and the type of polymerization reaction used. We have studied extensively the coordination polymerization of both racemic and chiral lactones using different types of alumoxanes as coordination catalysts. These catalysts can form stereoblock, crystalline polymers from racemic lactones, and the crystallinity and stereoregularity control the biodegradability of the PHA's obtained. The procedures used to determine biodegradability with a variety of microorganisms and purified hydrolase enzymes were described.

The "in vitro" polymerization of 3-hydroxyalkanoate monomers, in the form of their Coenzyme A derivatives, were also studied using polymerase enzymes (synthesases) of different bacteria. These enzymes were obtained from recombinant strains of "E. coli" containing the appropriate genes, purified by chromatographic methods and characterized for molecular weight. The polymerases evaluated were stable in aqueous solution and very active (most likely in their dimeric form or as higher aggregates) as both catalysts and initiators for the chain growth polymerization of the monomers. The polymerization reactions were extremely fast and very high molecular weight polymers could be obtained with most monomers. In some cases, the reactions appeared to be living polymerizations, and block copolymers could be prepared.

Murray Goodman
(University of California – San Diego, CA)

From Oligomers to Biopolymers: An On-going Research Odyssey

This lecture was dedicated to his mentor Herman Mark. In it, two areas of biopolymer research ongoing in his laboratories were discussed. The first part dealt with the bound conformation of an antagonist to the a5b1 integrin receptor. The second part summarized broad aspects of our design and synthesis of monodisperse collagen mimetics.

A. Integrin Receptor

The a5b1 integrin (fibronectin receptor) plays an important role in mediating cell attachment to fibronectin, cell migration, tumor invasion and metastasis. We have successfully carried out ^{15}N-edited transferred NOE experiments that provide significant insight for the elucidation of the "bioactive"(bound) conformation of antagonist c[MpaRGDDVC] to the a5b1 receptor. Our results demonstrate that substantial conformational changes ("induced fit") occur upon ligand binding. The bound structure exhibits a type-Ib turn around Gly2 and Asp3 residues that play an important role in modulating the distance between the side chains of Arg1 and Asp3, a key factor in the specificity of ligand binding. The shorter distance between the charged side chains of Arg1 and Asp3 (< 6 Å) indicates that the binding pocket for a5b1 receptor is narrow compared to that of allbb3. The a5bl integrin is involved in tumor metastasis. Certain RGD-containing peptides can suppress metastasis in vitro by perturbing the function of a5b1. Therefore, these results allow the design of more specific and potent a5b1 antagonists which can lead to new cancer therapeutic agents. Furthermore, our spectroscopic studies establish the conditions for NMR studies of the receptor-bound conformations of other integrin antagonists.

B. Collagen Mimetics

In our collagen mimetic program, we sought to design and synthesize novel triple helical structures. Collagen mimetics composed of Gly-Pro-Hyp, Gly-Nleu-Pro and Gly-Pro-Nleu (where Nleu denotes N-isobutylglycine) were assembled on the Kemp triacid and TREN templates by segment condensation strategies. Template assembly of collagen-like peptide chains further stabilizes the triple helical structure and enhances the thermal stability as compared to equivalent single chain molecules. Triple helicity of these novel structures are characterized by biophysical measurements including temperature-dependent optical rotation measurements, CD and NMR spectroscopy and molecular modeling. Studies by optical rotation measurements and CD spectroscopy provide information on the structural nature of the triple helix, while NMR and molecule modeling allow insight into the intrinsic effect of each residue within the triple helical array. Bioassays of our structures have shown triple helical collagen mimetics composed of Gly-Pro-Nleu sequences do facilitate cellular attachment and migration of epithelial cells and fibroblasts. When immobilized on surfaces, the effect of (Gly-Pro-Nleu)10-Gly-Pro-NH2 for cell binding activity is comparable to that of natural collagen. Following the demonstration of the bioactivity of our collagen structures, we have directed collagen mimetic research toward the synthesis of dendrimer arrays and complex macromolecular assemblies for the development of biomaterials.

Editors Meeting
Progress in Polymer Science

Otto Vogl
Editor-in Chief

Rumen Duhlev
Senior Publishing Editor,
Elsevier Science Ltd.

Ann-Christine Albertsson
Editor, Biomacromolecules

As often arranged at major meetings, two editorial board meetings were held at this Symposium; for *Progress in Polymer Science* with the Editor-in-Chief *Otto Vogl*, and for *Biomacromolecules* with the Editor, *Ann-Christine Albertsson*.

Hawaiian Coast

POLY Millennial 2000 was an event that few people will ever forget, both for its scientific excellence and its Hawaiian splendor.

Meetings of the scientific ACS community held on Oahu, Hawaii and neighboring Hawaiian islands has now become a tradition. Several polymer related Conferences have been held on the islands in the last 2 decades. The Polymer Division has played a major part in most of these meetings. First, the ACS meeting in Honolulu was held in 1984. Then, the Polymer Division organized a Biennial Symposium in Wailea, Maui and was the lead organization of two Conferences of the Pacific Polymer Federation, PPC-1 at the Royal Lahaina Resort, Ka'anapali, in Maui [Polymer News, *15*, 191 (1990)], and PPC-4 at the Hyatt Resort in Poipu, Kauai [Polymer News, *21*, 419 (1996)].