

CALIFORNIA INSTITUTE OF TECHNOLOGY

*Seventy-Second
Annual Commencement
June 10, 1966*



CALIFORNIA INSTITUTE OF TECHNOLOGY

*Seventy-Second
Annual
Commencement*

FRIDAY AFTERNOON AT FOUR-THIRTY O'CLOCK

JUNE TENTH, NINETEEN SIXTY-SIX

Academic Procession

Chief Marshal, David S. Wood, Ph.D.

Assistant Marshals

William H. Corcoran, Ph.D. Richard A. Dean, Ph.D.

Rodman W. Paul, Ph.D.

MARCHING ORDER

Division I

CANDIDATES FOR THE DEGREE OF BACHELOR OF SCIENCE

CANDIDATES FOR THE DEGREE OF MASTER OF SCIENCE

CANDIDATES FOR THE DEGREE OF ENGINEER

CANDIDATES FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Division II

THE FACULTY

THE CHAIRMEN OF DIVISIONS

THE DEANS

THE PROVOST

THE TRUSTEES

THE COMMENCEMENT CHAPLAIN

THE PRESIDENT

THE COMMENCEMENT SPEAKER

THE CHAIRMAN OF THE BOARD OF TRUSTEES

Program

CALIFORNIA INSTITUTE OF TECHNOLOGY

SEVENTY-SECOND ANNUAL

COMMENCEMENT

PRESIDING: ARNOLD O. BECKMAN, Ph.D., LL.D.

Chairman of the Board of Trustees

PRELUDE AND PROCESSIONAL

Organist: James H. Shearer, A.R.C.M., A.R.C.O.

INVOCATION The Reverend Mr. James F. Patten

Knox United Presbyterian Church, Pasadena

COMMENCEMENT ADDRESS

"The Role of the Scientist in Society"

Theodore O. Yntema, Ph.D., Sc.D., LL.D.

Formerly Vice President and Director, Ford Motor Company

Program—continued

CONFERRING OF DEGREES . . . Lee A. DuBridge, Ph.D., Sc.D.
President of the California Institute of Technology

PRESENTATION OF CANDIDATES FOR DEGREES

For the degree of Bachelor of Science . . . Paul C. Eaton, A.M.
Dean of Students

For the degree of Master of Science . . . Harold Lurie, Ph.D.
Associate Dean of Graduate Studies

For the degree of Engineer . . . H. Frederic Bohnenblust, Ph.D.
Dean of Graduate Studies

For the degree of Doctor of Philosophy . . . Dean Bohnenblust

CONCLUDING REMARKS President DuBridge

BENEDICTION The Reverend Mr. Patten

RECESSIONAL Mr. Shearer

*The audience is requested to remain standing until
the end of the Recessional*

Candidates for Degrees

BACHELOR OF SCIENCE

John Richard Adams, *Wilmette, Illinois.* Physics.
Carl Lawrence Anderson, *Santa Rosa, California.* Engineering.
Lawrence Sven Anderson, *Lincoln, Massachusetts.* Astronomy.
Michael Paul Anthony, *Vista, California.* Physics.
James Alfred Aries, *Redmond, Washington.* Physics.
Michael George Aschbacher, *Sepulveda, California.* Mathematics.
James Warren Austin, *Little Rock, Arkansas.* Engineering.
Jared Asher Austin, *Reseda, California.* Chemistry.
Rodney Kent Bergman, *Bakersfield, California.* Engineering.
Robert Lee Bernstein, *New Milford, New Jersey.* Physics.
Richard Henry Bigelow, *Long Beach, California.* Mathematics.
Gary Lee Bornzin, *La Grange, Illinois.* Physics.
James Weldon Brooks, Jr., *Oxnard, California.* Physics.
William Bruce Broste, *Wilton, North Dakota.* Physics.
Fred Davis Brunswig, *San Francisco, California.* Geology.
Jonathan Ferris Callender, *Pasadena, California.* Geology.
Paul Michael Chaikin, *Brooklyn, New York.* Physics.
Clement Grasham Chase, *Tucson, Arizona.* Geology.
David Chu, *New York City, New York.* Physics.
Stephen David Clamage, *Los Angeles, California.* Engineering.
David Harry Close, *Peru, Illinois.* Economics.
Philip Lynn Coleman, *Spring Valley, California.* Physics.
Elmer William Colglazier, Jr., *San Antonio, Texas.* Physics.
Jack Clifton Comly, Jr., *Los Angeles, California.* Physics.
Ronald Lee Constable, *La Canada, California.* Engineering.
Rex Arthur Couture, *Seattle, Washington.* Chemistry.
Michael John Creutz, *Rancho Santa Fe, California.* Physics.
Michael Alan Cunningham, *Las Vegas, Nevada.* Physics.
Walter Ziesche Davis, Jr., *Spokane, Washington.* Engineering.
Benjamin Dembart, *Alhambra, California.* Mathematics.
George Wilson Dickinson, Jr., *Littleton, Colorado.* Engineering.
Ronald Scott Douglass, *San Diego, California.* Engineering.
Donald N. Dumont, *Madera, California.* Biology.
John George Eastment, *Floral Park, New York.* Engineering.
Cary Blake Eklof, *Eugene, Oregon.* Engineering.
Steven Paul Elliott, *Seattle, Washington.* Chemistry.
Michael Alan Erle, *Pasadena, Texas.* Chemical Engineering.
Leonard A. Fisher, *San Diego, California.* Engineering.

Students whose names appear in boldface type are being graduated with honor in accordance with a vote of the Faculty.

BACHELOR OF SCIENCE—*continued*

Douglas Whitney Gage, *Milford, Connecticut*. Physics.
Ralph Raymond Gajewski, *Castro Valley, California*. Engineering.
Stuart Wilber Galley, *El Cajon, California*. Physics.
James Stanley Gibson, *Piedmont, California*. Chemistry.
Leonard Howard Gordy, *Rome, New York*. Physics.
Mark Elliott Granoff, *Lawton, Oklahoma*. Physics.
Robert William Greenwood, Jr., *Needles, California*. Engineering.
Jesse Grodnik, *Middle Village, New York*. Physics.
James Allison Hall, *Garden Grove, California*. Chemical Engineering.
Alan William Harris, *Newberg, Oregon*. Geology.
Girard Eastman Haven, Jr., *Ft. Benning, Georgia*. Mathematics.
Melville Yance Hirschi, *St. George, Utah*. Physics.
Alden Douglas Holford, *Houston, Texas*. Physics.
Albert Victor Holm, *Iron River, Michigan*. Astronomy.
Arthur Stewart Hopkins, *Los Angeles, California*. Engineering.
Michael Dan Hunsaker, *San Diego, California*. Engineering.
Dario Iaculli, *Naples, Italy*. Geology.
Guy Delacy Jackson IV, *Atlanta, Georgia*. Chemistry.
Eric Manning Jones, *Wantagh, New York*. Astronomy.
Andrew Janis Kampe, *Riga, Latvia*. Engineering.
Robert Alan Karski, *San Francisco, California*. Engineering.
Kenneth Robert Kimball, *La Canada, California*. Engineering.
Kenneth Kosai, *Spokane, Washington*. Engineering.
Douglas Charles Kubler, *Durham, New Hampshire*. Physics.
Philip James Laipis, *Portsmouth, New Hampshire*. Chemistry.
Johann Ott Lau, Jr., *Sherman Oaks, California*. Engineering.
David Joseph Lischinsky, *Los Angeles, California*. Biology.
Alston Clemens Lundgren, *Hobart, Indiana*. Chemical Engineering.
Raymond Paul Lynch, *Long Beach, California*. Physics.
Ernest Seu-Keung Ma, *Hong Kong*. Physics.
Julius Michael John Madey, *Clark, New Jersey*. Engineering.
Dan McCammon, *Hawthorne, California*. Physics.
David Burnett McCarroll, *Oakland, California*. Astronomy.
Lynn Ayres Melton, *Denton, Texas*. Chemistry.
Larry Robert Miller, *North Hollywood, California*. Physics.
Tom Richard Miller, *Lawrenceville, Illinois*. Physics.
William Patrick Miller, Jr., *Portland, Oregon*. Engineering.
Joseph Beril Milstein, *Brooklyn, New York*. Chemistry.
John Warren Mowery, *Seattle, Washington*. Engineering.
Gordon Earl Myers, *Rocky River, Ohio*. Engineering.
Richard Lee Myers, *Pipersville, Pennsylvania*. Chemistry.
Lawrence Herbert Nagel, *Lynwood, California*. Chemical Engineering.
Lawrence Ronald Newkirk, *Aurora, Colorado*. Engineering.
Louis George Newman, *North Hollywood, California*. Chemistry.
Richard Carl Nielsen, *Lakeport, California*. Engineering.

BACHELOR OF SCIENCE—continued

Thomas Emil Oberjat, *Thousand Oaks, California*. Biology.
Wallace Lee Oliver, Jr., *Kirkwood, Missouri*. Chemistry.
William Franklin Orr, *Denver, Colorado*. Mathematics.
William Wallace Owens II, *Tulsa, Oklahoma*. Engineering.
Jay S. Pearlman, *West Hempstead, New York*. Engineering.
Edward Harris Perry, *Memphis, Tennessee*. Engineering.
Robert G. Petrie, *Altadena, California*. Engineering.
Wayne H. Pitcher, Jr., *Bismarck, North Dakota*. Chemical Engineering.
David Browne Posner, *Owings Mill, Maryland*. Chemistry.
Howard Thomas Powell, *Woodland, Washington*. Physics.
Vern Sheridan Poythress, *Fresno, California*. Mathematics.
Jeffrey L. Pressing, *La Mesa, California*. Chemistry.
Seth Jay Putterman, *Brooklyn, New York*. Physics.
Richard Arnold Quint, *New Brunswick, New Jersey*. Mathematics.
Donald Wade Radcliffe, *Paterson, New Jersey*. Engineering.
Gary Allen Ratner, *New Haven, Connecticut*. Biology.
Thomas Alexander Resney, *Chicago, Illinois*. Engineering.
J. Herman Rickerman, Jr., *New Milford, New Jersey*. Astronomy.
Edward Lowell Robertson III, *St. Paul, Minnesota*. Mathematics.
John David Rouse, *Madison, Wisconsin*. Geology.
Charles Anthony Sawicki, *Cincinnati, Ohio*. Physics.
Carl John Scandella, *Sacramento, California*. Chemistry.
Robert Alan Schaar, *Pacific Palisades, California*. Engineering.
David Wayne Schwartz, *Chicago, Illinois*. Engineering.
Robert Emil Serafin, *San Diego, California*. Mathematics.
Jean Christopher Shelton, *San Diego, California*. Physics.
David Lee Sherlock, *Ridgecrest, California*. Engineering.
Lynwood David Shields, *Abilene, Texas*. Mathematics.
Frederic Waters Shultz, *Rockville, Maryland*. Mathematics.
Richard Neil Silver, *Tarzana, California*. Physics.
Richard Anthony Siquig, *San Jose, California*. Physics.
Terry L. Smith, *Covina, California*. Engineering.
Sean Carl Solomon, *La Canada, California*. Geology.
Richard Peter Stanley, *Savannah, Georgia*. Mathematics.
Marvin C. Stearns, *Tigard, Oregon*. Engineering.
Timothy Lee Stephens, *Seattle, Washington*. Physics.
David Lewis Stolfa, *Phoenix, Arizona*. Physics.
Joseph John Stupak, Jr., *La Puente, California*. Engineering.
John Charles Trijonis, Jr., *Bristol, Connecticut*. Engineering.
John R. Tucker, *Palos Verdes Estates, California*. Physics.
William King Tyler, *Rock Island, Illinois*. Economics.
Joseph Paul Tymczyszyn, *Douglas, Arizona*. Engineering.
Richard Ray Underwood, *Garden Grove, California*. Mathematics.
Norman Minoru Uyeda, *Watsonville, California*. Physics.
John Peyton Walter, *Riverside, California*. Physics.

BACHELOR OF SCIENCE—*continued*

Robert Kenneth Weatherwax, Jr., *Whittier, California*. Engineering.
Harold A. Williams, Jr., *Orange, New Jersey*. Mathematics.
Ronald James Williams, *Lomita, California*. Mathematics.
Thomas Clifford Williams, *Prattville, Alabama*. Geology.
Larry Dawson Wittie, *Tyler, Texas*. Mathematics.
Peter William Wyatt, *Sacramento, California*. Engineering.
Jerry Michael Yudelson, *Van Nuys, California*. Engineering.

MASTER OF SCIENCE

AERONAUTICS

- Brian Thomas Barcelo. *B.S., Tulane University, 1965.*
Michel Sadek El Raheb. *B.Sc., Cairo University (Egypt), 1964.*
Sankaraiyer Gopalakrishnan. *B.Sc., Loyola College (India), 1960; B.Tech., Indian Institute of Technology, 1964.*
Michael Meehan Griffin. *B.S., Georgia Institute of Technology, 1965.*
Paul Craig Kochendorfer. *B.S., California Institute of Technology, 1965.*
Francis Jean-Pierre Latapie. *Ing., Ecole Nationale Supérieure de l'Aéronautique (Paris), 1965.*
Michael John Laughlin. *B.S., Purdue University, 1965.*
Thomas Edmond McSweeney. *B.S., Northrop Institute of Technology, 1965.*
Dallas Joel Meggitt. *B.S., California Institute of Technology, 1965.*
Susann Jane Novalis. *B.S., Cornell University, 1965.*
Thomas Antone Pucik. *B.S., California Institute of Technology, 1965.*
Robert Benson Scott. *B.S., California Institute of Technology, 1965.*
Ozires Silva. *B.S., Instituto Tecnológico de Aeronáutica (Brazil), 1962.*
Milton Earl Teske, Jr. *B.S., Iowa State University, 1965.*
Jiunn-jenq Wu. *B.S., National Taiwan University, 1964.*

APPLIED MECHANICS

- James Leslie Deleget. *B.S., Purdue University, 1965.*
Richard Skipp Frenk. *B.S., California Institute of Technology, 1965.*
David Charles Gakenheimer. *B.E.S., Johns Hopkins University, 1965.*
Robert Francis Jeffers. *B.Sc., National University of Ireland (Cork), 1964; M.S., 1965.*

ASTRONOMY

- Arsine Victoria Peterson. *S.B., Massachusetts Institute of Technology, 1963.*
Bruce Alrick Peterson. *S.B., Massachusetts Institute of Technology, 1963.*

BIOLOGY

- Barbara Wyman Bernstein. *A.B., Oberlin College, 1964.*

CHEMISTRY

- David Armstrong Brueckner. *B.S., Ohio University, 1960.*

CHEMICAL ENGINEERING

- George Thaddius Lengyel. *B.S., Lehigh University, 1965.*
Axel Meisen. *B.Sc., Imperial College of Science and Technology (London), 1965.*
Donald Sherwood Remer. *B.S.E., University of Michigan, 1965.*
Douglas Cecil White. *B.Ch.E., University of Florida, 1965.*

MASTER OF SCIENCE—*continued*

CIVIL ENGINEERING

- John Tweedsmuir Buchan. *B.Sc. (Hons.), University of Edinburgh, 1964.*
Bryan Virge Butler. *B.S., University of Utah, 1965.*
John David Ditmars. *B.S.E., Princeton University, 1965.*
Shaukat Hayat Michael Feroz. *B.E., University of Peshawar (West Pakistan), 1964.*
Julio Kuroiwa Horiuchi. *Ing. Universidad Nacional de Ingenieria (Peru), 1960.*
Wade Katsuto Morikone. *B.S., University of Hawaii, 1965.*
Josephat Kanayo Okoye. *B.S., Purdue University, 1965.*

ELECTRICAL ENGINEERING

- Mashood Olayide Adegbola. *B.S.E.E., Purdue University, 1965.*
David Albert Bird. *B.S.E.E., Purdue University, 1964.*
James Grant Blackinton. *B.S., California Institute of Technology, 1965.*
William Gravenor Bounds. *B.S., Northrop Institute of Technology, 1965.*
James David Brown. *B.S., United States Military Academy, 1964.*
Jerry Butman. *B.Eng., McGill University, 1965.*
Chih Chieh Chao. *B.S., University of Illinois, 1965.*
Ko-Chuan Chi. *B.A., National Taiwan University, 1960; B.S., University of Wisconsin, 1965.*
John Crockett Diebel. *B.S., California Institute of Technology, 1965.*
Charles Lawrence Dorsett. *B.S., University of Redlands, 1965.*
Altan K. Eris. *B.E., Youngstown University, 1965.*
Donald Allen Germann. *B.S.E.E., Purdue University, 1965.*
Burton William Graves. *B.S., California Institute of Technology, 1965.*
James Raymond Hannigan. *B.S., United States Military Academy, 1963.*
Robert Theodore Jenkins. *B.S., California Institute of Technology, 1965.*
Wolf Dieter Kabiersch. *Ing., Université de Grenoble, 1960.*
Mark Howard Kryder. *B.S., Stanford University, 1965.*
Jen Kai Kung. *B.Sc., Taiwan Provincial Cheng Kung University, 1963.*
Joel Eric Lerendu. *Ing., Université de Grenoble, 1965.*
John Victor Levy. *B.E.Ph., Cornell University, 1965.*
Harold Mack II. *B.S., Howard University, 1964.*
Tse Chin Mo. *B.S., National Taiwan University, 1964.*
Robert Cole Morgan. *B.S., University of California (Los Angeles), 1965.*
James Theodore O'Farrell. *B.S., United States Naval Academy, 1960.*
Gerhard Hans Parker. *B.S., California Institute of Technology, 1965.*
William Paul Proffitt. *B.S., University of Maryland, 1965.*
Jason Niles Puckett, Jr. *B.S., California Institute of Technology, 1965.*
Freeman Harding Rose, Jr. *B.S., California Institute of Technology, 1965.*
William Joseph Rosenberg. *B.S., California Institute of Technology, 1964.*
Serge Seletzky. *Ing., Ecole Supérieure d'Electricité (Paris), 1965.*
Richard David Sherman. *S.B., Massachusetts Institute of Technology, 1965.*

MASTER OF SCIENCE—continued

ELECTRICAL ENGINEERING—continued

- Reiner Ludwig Stenzel. *Dipl., Technische Hochschule (Braunschweig), 1965.*
Joseph Dean Taynai. *B.S., California Institute of Technology, 1964.*
John D. White, Jr. *B.E.S., Johns Hopkins University, 1964.*
Jefferson K. Wise. *B.S., California Institute of Technology, 1965.*

ENGINEERING SCIENCE

- Richard Bruce Chapman. *B.S., Purdue University, 1965.*
Joe Ching. *B.S., University of California, 1965.*
Roger Carl Davisson. *B.S., California Institute of Technology, 1965.*
Jeffrey Archibald Gorman. *B.C.E., Cornell University, 1958.*
Ronald Lee Kerber. *B.S., Purdue University, 1965.*
Edward Thomas Meschko. *B.S., United States Air Force Academy, 1965.*
John Stalker Murray, Jr. *B.A., Pomona College, 1964.*
Justin Taro Okada. *B.S., Oregon State University, 1965.*
Charles Brady Peck, Jr. *B.S., Harvey Mudd College, 1965.*
Lee Louis Peterson. *B.S., California Institute of Technology, 1964.*
Sylvie Françoise Potigny. *Ing., Ecole Supérieure de Physique et de Chimie Industrielles (Paris), 1965.*

GEOLOGY

- Walter Joseph Arabasz, Jr. *B.S., Boston College, 1964.*
George Richmond Clark II. *A.B., Cornell University, 1961.*
Dean Norman Clay. *B.Sc., McGill University, 1963.*
James Albert Douth. *B.S., Pennsylvania State University, 1962.*
Jeffrey Langman Friedberg. *S.B., Massachusetts Institute of Technology, 1964.*
Steven David Hall. *B.S., California Institute of Technology, 1965.*
Bruce Rene Julian. *B.S., California Institute of Technology, 1964.*
James Robert Lawrence. *B.S., Union College, 1964.*
Thomas Bard McCord. *B.S., Pennsylvania State University, 1964.*
Richard John O'Connell. *B.S., California Institute of Technology, 1963.*
Paul Granston Richards. *B.A., Cambridge University, 1965.*
Hartmut A. W. Spetzler. *B.S., Trinity University, 1961; M.S., 1962.*
Robert James Tait. *B.S., California Institute of Technology, 1962.*
Lawrence S. Turnbull, Jr. *B.A., Occidental College, 1963.*
David Bruce Wenner. *B.S., University of Cincinnati, 1963.*

MATERIALS SCIENCE

- Philippe Louis Maitrepierre. *Ing., Ecole Nationale Supérieure des Mines (Paris), 1965.*

MASTER OF SCIENCE—*continued*

MATHEMATICS

Leslie Creighton Higbie. B.S., *St. Lawrence University*, 1963.

MECHANICAL ENGINEERING

Robert Thomas Barron. B.M.E., *Villanova University*, 1964.

Peter Lorin Bryant. Sc.B., *Brown University*, 1965.

Donald Ray Chivens. B.S., *California Institute of Technology*, 1965.

Delo Kwai Kum Chun. B.S., *University of Hawaii*, 1965.

Glenn Gary Clinard. B.S., *California Institute of Technology*, 1965.

Larry Cooper. B.S., *University of Missouri School of Mines and Metallurgy*, 1965.

Robert Barry Dunbar. B.Sc., *University of Alberta*, 1965.

Stephen Hopkins Garrison. B.S., *California Institute of Technology*, 1965.

William Lester Gavan. B.S. (M.E.), *California State Polytechnic College*, 1965;
B.S. (Ma), 1965.

Robert Lee Gran. B.S., *University of Washington*, 1965.

Harold Jay Haskins. B.S., *California Institute of Technology*, 1963.

William David Hixson. B.S., *California Institute of Technology*, 1965.

Kum Wah How. Dipl., *Singapore Polytechnic*, 1963.

Stewart Milton Kohler. B.A., *The Rice University*, 1964; B.S., 1965.

Patrick Joseph McDaniel. B.S., *United States Air Force Academy*, 1965.

Charles King Michener. B.S., *California Institute of Technology*, 1965.

Herbert Schiller. B.M.E., *Polytechnic Institute of Brooklyn*, 1965.

Bernard José Sitt. Ing., *Ecole Polytechnique (Paris)*, 1964.

Donald Richard Street. B.S., *United States Military Academy*, 1962.

Peter Heinz Wirtz. Dipl., *Rheinisch-Westfälische Technische Hochschule
(Aachen)*, 1965.

PHYSICS

James Roger Prior Angel. B.A. (Hons.), *University of Oxford*, 1963.

Richard Harold Ault. B.S., *University of Miami*, 1964.

Lloyd Craig Davis. B.S., *Iowa State University*, 1963.

Michael James Freeman. B.Sc., *University of British Columbia*, 1964.

Lorella Margaret Jones. B.A., *Radcliffe College*, 1964.

Gary Luxton. B.Sc., *McGill University*, 1964.

Edward Tait Olsen. S.B., *Massachusetts Institute of Technology*, 1964.

John Longstreet Wallace. A.B., *Temple University*, 1964.

Warren Jackman Wiscombe. S.B., *Massachusetts Institute of Technology*, 1964.

John Tzun-ke Yoh. B.A., *Cornell University*, 1964.

ENGINEER

AERONAUTICAL ENGINEER

Jean-Marie François Grange. Ing., *Ecole Nationale Supérieure de l'Aéronautique (Paris)*, 1963; M.S., *California Institute of Technology*, 1964.

Andreas Puhl. Dipl. Ing., *Technische Hochschule Stuttgart*, 1961; M.S., *California Institute of Technology*, 1964.

MECHANICAL ENGINEER

James Richmond Barnes. B.S., *Stanford University*, 1960; M.S., *California Institute of Technology*, 1964.

Georges Pierre Alexis Giraudbit. Dipl. *Ecole d'Ingénieurs Arts et Métiers (Paris)*, 1963; M.S., *California Institute of Technology*, 1964.

Stanley Brun Mellsen. B.Sc., *University of Alberta*, 1961; M.S., *California Institute of Technology*, 1962.

Robert Rosen. B.S., *University of Miami*, 1960; M.S., *Northwestern University*, 1962.

Donald Richard Street. B.S., *United States Military Academy*, 1962.

Po Kee Wong. B.Sc., *Taiwan Provincial Cheng Kung University*, 1956; M.Sc., *University of Utah*, 1961.

DOCTOR OF PHILOSOPHY

- James Louis Aronson (*Geochemistry and Geology*). B.A., The Rice University, 1959; M.S., California Institute of Technology, 1961.
Thesis: Geochronology of the Plutonic and Metamorphic Rocks of New Zealand.
- Wayne Metcalf Beebe (*Aeronautics*). B.S., California Institute of Technology, 1951; M.S., 1952.
Thesis: An Experimental Investigation of the Dynamics of Crack Propagation in Plastic and Metal.
- Wilhelm Behrens (*Aeronautics*). Dipl. Ing., Technical University (Munich), 1960.
Thesis: Flow Field and Stability of the Far Wake Behind Cylinders at Hypersonic Speeds.
- Thomas Andrew Beineke (*Chemistry*). B.S., Ohio State University, 1961.
Thesis: I. The Crystal Structure of a New Dimer of Triphenylfluorocyclobutadiene.
II. A Low Temperature Refinement of the Cyanuric Triazide Structure.
- Edward Anton Bender (*Mathematics*). B.S., California Institute of Technology, 1963.
Thesis: Symmetric Representations of an Integral Domain over a Subdomain.
- Thomas Livingston Benjamin (*Virology and Biochemistry*). B.A., Amherst College, 1959.
Thesis: Radiobiological and Biochemical Investigations of Polyoma Virus-Cell Interactions.
- Charles Edgar Billings (*Civil Engineering*). B.S., Northeastern University, 1950; S.M., Harvard University, 1953.
Thesis: Effects of Particle Accumulation in Aerosol Filtration.
- David Jordan Blakemore (*Electrical Engineering and Economics*). B.S., California Institute of Technology, 1960; M.S., 1961.
Thesis: Microcycle Spectral Estimation.
- James Lawrence Blue (*Physics*). A.B., Occidental College, 1961.
Thesis: A Method of Calculating Regge Trajectories.
- Robert Marcus Bowman (*Aeronautics and Nuclear Engineering*). B.Aero E., Rensselaer Polytechnic Institute, 1956; M.S., USAF Air University, 1961.
Thesis: Investigation of Shock Front Topography in Shock Tubes.
- James Brown Boyd (*Biochemistry and Chemistry*). B.A., Cornell University, 1959.
Thesis: I. Turnover of the Hemolymph Proteins of *Drosophila melanogaster*.
II. A New Method for the Detection of Deoxyribonucleases and its Application to Studies of *Drosophila melanogaster*.

DOCTOR OF PHILOSOPHY—*continued*

- Gerald Lee Bradley (*Mathematics*). B.S., Harvey Mudd College, 1962.
Thesis: On the Set of Eigenvalues of a Class of Equimodular Matrices.
- Arthur Gerald Brady (*Civil Engineering*). B.E., University of Auckland, 1959;
M.E., 1960; B.Sc., 1961.
Thesis: Studies of Response to Earthquake Ground Motion.
- Richard Taber Brockmeier (*Physics*). B.A., Hope College, 1959; M.S.,
California Institute of Technology, 1961.
Thesis: Isotope Shift of the $K_{\alpha 1}$ X-Ray in Uranium.
- Tsiu Chiu Chan (*Electrical Engineering*). B.E., McGill University, 1961;
M.S., California Institute of Technology, 1962.
Thesis: A Study of Nonlinear Phenomena in the Propagation of
Electromagnetic Waves in a Weakly Ionized Gas.
- Subhash Chandra (*Astronomy*). B.S., University of Lucknow, 1954;
M.S., 1958; M.S., California Institute of Technology, 1961.
Thesis: A Study of Spectroscopic and Kinematic Characteristics of
Peculiar A-Type Stars.
- Shiou-Shan Chen (*Chemical Engineering and Chemistry*). B.S., Taiwan
Provincial Taipei Institute of Technology, 1958; M.S., California Institute
of Technology, 1962.
Thesis: Mass Transfer from a Cylinder to an Air Stream in Axisymmetrical
Flow.
- Charles Richard Christensen (*Chemistry*). B.E., Vanderbilt University, 1960.
Thesis: I. Chronopotentiometry in Thin Layers of Solution.
II. Application of Thin Layer Chronopotentiometry to Kinetic Studies.
III. Proton Spin Relaxation in Hydrogen Deuteride.
- Milton John Clauser (*Physics*). S.B., Massachusetts Institute of Technology,
1961.
Thesis: Mössbauer Effect Investigations of the Hyperfine Interactions and
Relaxation Phenomena in Salts of Thulium.
- Don Paul Clausing (*Materials Science*). B.S., Iowa State University, 1952;
M.S., California Institute of Technology, 1962.
Thesis: The Tensile Fracture of Mild Steel.
- Edward Thomas Cline, Jr. (*Mathematics*). B.S., California Institute of
Technology, 1962.
Thesis: On an Embedding Property of Generalized Carter Subgroups.
- John Thomas Cookson, Jr. (*Civil Engineering*). B.S., Washington University,
1961; M.S., 1962.
Thesis: Kinetics and Mechanisms of Adsorption of *Escherichia coli*
Bacteriophage T_4 to Activated Carbon.

DOCTOR OF PHILOSOPHY—continued

Harold Thompson Couch (*Chemical Engineering and Aeronautics*). B.S.E., Princeton University, 1958; M.S., University of Southern California, 1961.

Thesis: I. Latent Heat of Vaporization of N-Decane.

II. Heat and Mass Transfer from a Cylinder in a Turbulent Air Stream.
Sherwood and Froessling Numbers for Material Transport as
a Function of Free Stream Reynolds Number and Turbulence Level.

Richard Clark Crewdson (*Engineering Science*). B.S., Lafayette College, 1961.

Thesis: Structure and Properties of Amorphous Palladium Silicon Alloys.

Donald Leslie Cronin (*Mechanical Engineering*). B.S., Rutgers University, 1957; M.S., California Institute of Technology, 1961.

Thesis: Response of Linear, Viscous Damped Systems to Excitations
having Time-Varying Frequency.

Steven Collins Crow (*Aeronautics and Applied Mathematics*). B.S., California Institute of Technology, 1962; M.S., California Institute of Technology, 1963.

Thesis: I. The Spanwise Perturbation of Two-Dimensional Boundary Layers.

II. The Turbulent Rayleigh Problem.

III. The Propagation of Free Turbulence in a Mean Shear Flow.

Iain George Currie (*Applied Mechanics*). B.Sc., University of Strathclyde; M.A.Sc., University of British Columbia, 1962.

Thesis: The Instability of Fluids with Time Dependent Heating.

Charles David DeBoer (*Chemistry*). B.S., Iowa State University, 1962.

Thesis: I. Thermal Rearrangements of Small Ring Hydrocarbons.

II. Photosensitized Rearrangements of Small Ring Hydrocarbons—
Nonvertical Energy Transfer.

Paul Claire Denny (*Developmental Biology and Plant Physiology*). A.B., Westmont College, 1960.

Thesis: I. Studies on Alkaline Phosphatase Activity in Developing
Sea Urchin Embryos.

II. Studies on the Activation of Protein Biosynthesis in
Sea Urchin Eggs at Fertilization.

Richard Dolen (*Physics*). B.E. Ph., Cornell University, 1957.

Thesis: The Vacuum Regge Trajectory in Conventional Field Theory.

Larre Nyman Egbert (*Biochemistry*). B.S., Utah State University, 1959; M.S., 1963.

Thesis: Isolation and Characteristics of a Bacteriophage for
Bacillus stearothermophilus.

DOCTOR OF PHILOSOPHY—*continued*

Robert Charles Erdmann (*Applied Mechanics and Physics*). B.S.M.E., Newark College of Engineering, 1960; M.S., University of California (Los Angeles), 1962.

Thesis: Time-dependent Monoenergetic Neutron Transport in Two Adjacent Semi-infinite Media.

Hugo Breed Fischer (*Civil Engineering and Business Economics*).

B.S., California Institute of Technology, 1958; M.S., 1963.

Thesis: Longitudinal Dispersion in Laboratory and Natural Streams.

Michael Fried (*Virology and Chemistry*). B.A., Hunter College, 1959.

Thesis: Studies of Temperature Sensitive Mutants of Polyoma Virus.

Fergus John Gaines (*Mathematics*). B.Sc., University College (Dublin), 1960; M.Sc., 1961.

Thesis: Some Generalizations of Commutativity for Linear Transformations on a Finite Dimensional Vector Space.

Edward Stanley Glazer (*Chemistry*). A.B., University of Pennsylvania, 1961.

Thesis: Applications of Nuclear Magnetic Resonance Spectroscopy to the Study of Medium-Sized Rings:

I. Conformational Properties of Cycloheptane.

II. Conformational Properties of Cyclooctane.

Ellen Rose Glowacki (*Biochemistry*). B.A., Swarthmore College, 1960.

Thesis: Studies on Rabbit Reticulocyte Ribosomes and Polyribosomes and their Relation to Hemoglobin Synthesis.

Robert Gordon (*Mathematics*). A.B., University of California (Los Angeles), 1962.

Thesis: Rings Faithfully Represented on their Left Socle.

Charles August Greenhall (*Mathematics*). B.A., Pomona College, 1961.

Thesis: Lq Estimates for Rearrangements of Fourier Series.

James Edward Gunn (*Astronomy and Physics*). B.A., The Rice University, 1961; M.S., California Institute of Technology, 1965.

Thesis: A Mathematical Framework for Discussing the Statistical Distribution of Galaxies in Space and its Cosmological Implications.

Ralph Stuart Hager (*Physics*). B.S., University of Minnesota, 1961.

Thesis: Anomalous Electric Dipole Internal Conversion.

William Douglas Harrison (*Physics*). B.Sc., Mount Allison University, 1958; B.Sc., Imperial College of Science and Technology, 1960.

Thesis: A Study of the Compound Nucleus ${}^7\text{Be}$.

DOCTOR OF PHILOSOPHY—*continued*

- Edward Gerald Hauptmann (*Applied Mechanics*). B.Sc., University of Alberta, 1960; M.S., California Institute of Technology, 1961.
Thesis: An Experimental Investigation of Forced Convective Heat Transfer to a Fluid in the Region of its Critical Point.
- William George Herkstroeter (*Chemistry*). B.A., Wesleyan University, 1960.
Thesis: Kinetic Studies of Energy Transfer to the Geometric Isomers of Stilbene and 1,2-Diphenylpropene by Kinetic Spectrophotometry.
- Lincoln Steffens Hollister (*Geology and Geochemistry*). A.B., Harvard College, 1961.
Thesis: Electron Microprobe Investigations of Metamorphic Reactions and Mineral Growth Histories, Kwoiek Area, British Columbia.
- Walter Richard Holmquist (*Chemistry*). B.S., Washington and Lee University, 1957; B.S., California Institute of Technology, 1961.
Thesis: The Origin, Partial Structure, and Properties of Hemoglobin A_{1c}.
- Paul Yu-fei Hu (*Mechanical Engineering and Electrical Engineering*). B.S., University of Maryland, 1961; M.S., California Institute of Technology, 1962.
Thesis: Analytical and Experimental Studies of Random Vibration.
- Glen Owen Hultgren (*Chemistry and Physics*). B.S., University of California, 1958.
Thesis: A Theory of the Annulenes.
- Lane Richard Johnson (*Geology*). B.S., University of Minnesota, 1960; M.S., 1962.
Thesis: Measurements of Mantle Velocities of P Waves with a Large Array.
- Susan Elizabeth Kayser (*Astronomy and Physics*). A.B., Radcliffe College, 1960.
Thesis: Photometry in the Nearby Irregular Galaxy, NGC 6822.
- Vassilios Kerdemelidis (*Electrical Engineering*). B.E., National School of Engineering, University of New Zealand, 1957; M.S., California Institute of Technology, 1961.
Thesis: A Study of Cross-Polarization Effects in Paraboloidal Antennas.
- Gerhard Joachim Klose (*Mechanical Engineering*). B.S., California Institute of Technology, 1959; M.S., 1960.
Thesis: Unsteady Forces on Oscillating Hydrofoils.
- Hon-Yim Ko (*Civil Engineering*). B.Sc., University of Hong Kong, 1962; M.S., California Institute of Technology, 1963.
Thesis: Static Stress-deformation Characteristics of Sand.

DOCTOR OF PHILOSOPHY—*continued*

Stanley Garson Krane (*Biochemistry*). B.S., City College of New York, 1957;
M.S., Michigan State University, 1958.

Thesis: Studies on the Biosynthesis of $\phi X174$ Coat Protein.

Jen-shih Lee (*Aeronautics and Mathematics*). B.S., National Taiwan
University, 1961; M.S., California Institute of Technology, 1963.

Thesis: Application of Finite Elastic Theory to the Deformation of
Cylindrical Tubes.

John Seymour Letcher, Jr. (*Aeronautics and Applied Mathematics*). B.S.,
California Institute of Technology, 1963; M.S., 1964.

Thesis: Transverse Hydrodynamic Forces in Free-Surface Flows at Low Speed.

George Wladimir Lewicki (*Electrical Engineering and Physics*). S.B.,
Massachusetts Institute of Technology, 1960; M.S., California Institute
of Technology, 1961.

Thesis: Electron Tunneling through Thin Films of Aluminum Nitride.

Gerald Herbert Lindsey (*Aeronautics*). B.E.S., Brigham Young University,
1960; M.S., 1961.

Thesis: Hydrostatic Tensile Fracture of a Polyurethane Elastomer.

Peter James Lingane (*Chemistry*). A.B., Harvard College, 1962.

Thesis: I. Chronoamperometry and Chronopotentiometry with Unshielded,
Circular, Planar Electrodes.

II. Applications of Potential Step Chronocoulometry.

III. Faradaic Integration of the Diffuse Double Layer.

Peter Barry Stuart Lissaman (*Aeronautics*). B.Sc., Natal University, 1951;
B.A., Cantab., 1954; M.S., California Institute of Technology, 1955.

Thesis: A Linear Solution for the Jet Flap in Ground Effect.

Hans Ludewig (*Applied Mechanics and Physics*). B.Sc., University of
Natal, 1959; M.Sc., 1961; M.S., California Institute of Technology, 1962.

Thesis: Geometrical Effects on the Resonance Absorption of Neutrons.

Jon Christian Luke (*Applied Mathematics*). S.B., Massachusetts Institute
of Technology, 1962; S.M., 1963.

Thesis: Nonlinear Dispersive Wave Problems.

Joseph Maserjian (*Materials Science*). B.S., Rensselaer Polytechnic
Institute, 1952; University of Southern California, 1955.

Thesis: Conduction through Thin Titanium Dioxide Films.

James Henry McNally (*Physics*). B.E.Ph., Cornell University, 1959.

Thesis: Nuclear Reactions Leading to Energy Levels of Ar^{87} and K^{87} .

DOCTOR OF PHILOSOPHY—*continued*

Richard Graham Miller (*Physics and Biophysics*). B.Sc., University of Alberta, 1960; M.Sc., 1961.

Thesis: Mass Measurements of Some Proton-Rich Nuclei.

Catalin Dan Mitescu (*Physics*). B. Eng., McGill University, 1958.

Thesis: Current Dependence of the Energy Gap in Superconductors: A Direct Measurement.

Donald Wayne Moon (*Materials Science*). B.S., University of Illinois, 1956; M.S., 1957.

Thesis: Influence of Dislocation Mobility on Yielding of Silicon-Iron.

Lawrence Carlton Moore, Jr. (*Mathematics*). B.S., North Carolina State College, 1961.

Thesis: Locally Convex Riesz Spaces and Archimedean Quotient Spaces.

K. R. Ananda Murthy (*Aeronautics*). B.E., University of Mysore, 1951; M.S.E., Princeton University, 1958.

Thesis: A Possible Analytical Explanation for the Micrometeorite Concentration near the Earth.

Gary Lawrence Neil (*Chemistry*). B.Sc., Queen's University, 1962.

Thesis: The Structural Specificity of alpha-Chymotrypsin.

I. Polypeptides as Substrates.

II. N-Acylated Peptide Esters as Substrates.

III. Some Reactive Esters of N-Acylated Amino Acids as Substrates.

Heiko Herbert Emil Walter Ohlenbusch (*Chemistry and Economics*). B.S., Columbia University, 1959.

Thesis: I. Electric Birefringence Studies of Deoxyribonucleic Acids.

II. Selective Dissociation of Nucleohistone Complexes.

Baldomero Marquez Olivera, Jr. (*Chemistry and Chemical Engineering*). B.S., University of the Philippines, 1960; B.S., Chem., 1961.

Thesis: The Interactions of Basic Proteins and DNA:

I. Electrophoresis of the Nucleic Acids.

II. The Cytochrome C/DNA Complex.

III. Studies of the Electrophoresis and Melting Behavior of Nucleohistones.

IV. The Dissociation of Histone from Calf Thymus Chromatin.

Mervyn Daniel Olson (*Aeronautics*). B.A.Sc., University of British Columbia, 1962; M.S., California Institute of Technology, 1963.

Thesis: Supersonic Flutter of Circular Cylindrical Shells.

Allen Michael Pfeffer (*Mathematics*). B.S., California Institute of Technology, 1963.

Thesis: On Certain Discrete Inequalities and Their Continuous Analogues.

DOCTOR OF PHILOSOPHY—*continued*

Charles Young Prescott (*Physics*). B.A., The Rice University, 1961.

Thesis: Eta Meson Photoproduction in the Region of the Third Nucleon Resonance.

Paul Walton Purdom, Jr. (*Physics*). B.S., California Institute of Technology, 1961; M.S., 1962.

Thesis: Electromagnetic Decay of the 1.7- and 2.43-Mev. Levels in ^9Be .

John Douglas Reichert (*Physics*). B.A., University of Texas, 1961; B.S., 1961.

Thesis: High Energy Scattering Processes with Cuts in the Angular Momentum Plane.

Norman Molesworth Rice (*Mathematics*). B. Sc., Queen's University, 1962.

Thesis: Multiplication in Riesz Spaces.

Arthur Dale Riggs (*Biochemistry and Chemistry*). A.B., University of California (Riverside), 1960.

Thesis: I. Studies on Mycoplasma gallisepticum.

II. Autoradiography of Chromosomal DNA Fibers from Chinese Hamster Cells.

Richard Dale Rocke (*Applied Mechanics*). B.S.M.E., Bradley University, 1960; M.S., University of Southern California, 1962.

Thesis: Transmission Matrices and Lumped Parameter Models for Continuous Systems.

David John Roddy (*Geology*). A.B., Miami University, 1955; M.S., 1957.

Thesis: The Paleozoic Crater at Flynn Creek, Tennessee.

Joseph Emil Scheibe, Jr. (*Plant Physiology*). A.B., University of California, 1960.

Thesis: Studies on Photoblastic Germination in Lettuce Seeds.

Henry Gerard Schwartz, Jr. (*Civil Engineering*). B.S.C.E., Washington University, 1961; M.S., 1962.

Thesis: Studies on Adsorption and Microbial Degradation of the Pesticides Isopropyl N-(3-Chlorophenyl) Carbamate and 2,4-Dichlorophenoxyacetic Acid in Aqueous Solutions.

George August Sellers (*Geology and Geochemistry*). B.S., Pennsylvania State University, 1959; M.S., California Institute of Technology, 1961.

Thesis: Hydrothermal Experiments on the Thermal Stability of Amino Substances in Sediments.

Edwin Charles Seltzer (*Physics*). B.S., California Institute of Technology, 1959.

Thesis: Nuclear Structure Effects in Internal Conversion.

DOCTOR OF PHILOSOPHY—*continued*

Harvey Kenneth Shepard (*Physics*). B.S., University of Illinois, 1960;
M.S., California Institute of Technology, 1962.

Thesis: The Influence of the NN* Channel on Elastic NN Scattering.

Ralph Vencil Skarda, Jr. (*Mathematics*). B.A., Pomona College, 1961;
M.S., California Institute of Technology, 1964.

Thesis: Some Central Limit Theorems for Doubly Restricted Partitions.

Furman Yates Sorrell, Jr. (*Aeronautics*). B.S., North Carolina State College,
1960; M.S., California Institute of Technology, 1961.

Thesis: On the Generation of Shock Waves in an Inverse Pinch Shock Tube.

Alexander James Sutherland (*Civil Engineering and Mathematics*).
B.E., University of Auckland, 1961; M.E., 1962.

Thesis: Entrainment of Fine Sediments by Turbulent Flows.

Christopher Kwong Wah Tam (*Applied Mechanics and Physics*). B. Eng.,
McGill University, 1962; M.S., California Institute of Technology, 1963.

Thesis: On the Transport Properties of Fluid-Particle Flow.

Ta-liang Teng (*Geophysics and Applied Mathematics*). B.S., National
Taiwan University, 1959.

Thesis: Body-wave and Earthquake Source Studies.

Karvel Kuhn Thornber (*Electrical Engineering, Physics and Applied
Mathematics*). B.S., California Institute of Technology, 1963; M.S., 1964.

Thesis: I. Electronic Processes in α -Sulfur.

II. Polaron Motion in a D.C. Electric Field.

Alan Morton Title (*Physics*). A.B., University of California (Los Angeles),
1959; M.S., Columbia University, 1960.

Thesis: A Study of Velocity Fields in the H α Chromosphere by Means of
Time-Lapse Doppler Movies.

Pin Tong (*Aeronautics and Mathematics*). B.S., National Taiwan University,
1960; M.S., California Institute of Technology, 1963.

Thesis: Liquid Sloshing in an Elastic Container.

Chang-chyi Tsuei (*Materials Science*). B.S., National Taiwan University, 1960;
M.S., California Institute of Technology, 1963.

Thesis: Electrical Resistance and Thermoelectric Power of the
Metastable Phases in Tellurium-base Alloys.

John Clayton Urey (*Biochemistry and Genetics*). B.A., Swarthmore College, 1960.

Thesis: Enzyme Induction in *Neurospora crassa*.

DOCTOR OF PHILOSOPHY—*continued*

- Donald H. Valentine, Jr. (*Chemistry*). B.A., Wesleyan University, 1962.
Thesis: I. Thermal and Photosensitized Dimerization of 1,3-Cyclohexadiene.
II. Further Study of Photosensitized Isomerization of Stilbene.
- Chiu-sen Wang (*Chemical Engineering*). B.S., National Taiwan University, 1960; M.S., Kansas State University, 1963.
Thesis: A Mathematical Study of the Particle Size Distribution of Coagulating Disperse Systems.
- Jack Milton Widholm (*Biochemistry and Chemistry*). B.S., University of Illinois, 1961.
Thesis: Physical and Biological Studies of Crab Deoxyribonucleic Acid.
- Richard R. Williams (*Aeronautics*). B.S., Purdue University, 1961; M.S., California Institute of Technology, 1962.
Thesis: Application of the Two Variable Expansion Procedure to the Commensurable Planar Restricted Three-Body Problem.
- Richard Alan Wolf (*Physics*). B.E.Ph., Cornell University, 1962.
Thesis: I. Rates of Nuclear Reactions in White-Dwarf Stars.
II. The Cooling of Neutron Stars.
- Francis Taming Wu (*Geology*). B.S., National Taiwan University, 1959.
Thesis: I. Lower Limit of the Total Energy of Earthquakes and Partitioning of Energy Among Seismic Waves.
II. Reflected Waves and Crustal Structures.
- Michael Jeffrey Yarus (*Biophysics and Chemistry*). B.A., Johns Hopkins University, 1960.
Thesis: Bacteriophage ϕ X-174: Its Sensitivity to Ultraviolet Light and Growth in Starved and Irradiated Cells.
- Gerold Yonas (*Engineering Science and Physics*). B.E.Ph., Cornell University, 1962.
Thesis: Aligned Fields Magneto-Fluid Dynamic Flow Past Bodies.

Prizes and Awards

GEORGE W. GREEN MEMORIAL AWARD

Awarded to the undergraduate student who, in the opinion of the Division Chairmen, has shown outstanding ability and achievement in the field of creative scholarship.

(Recipient to be announced)

FREDERIC W. HINRICHS, JR., MEMORIAL AWARD

Awarded to the senior who, in the opinion of the Undergraduate Deans, has throughout his years at the Institute made the greatest contribution to the welfare of the student body and whose qualities of leadership, character and responsibility have been outstanding.

(Recipient to be announced)