PROCEEDINGS OF THE HAWAIIAN ACADEMY OF SCIENCE...

THIRTIETH ANNUAL MEETING 1954–1955

Published by the University of Hawaii Honolulu, Hawaii, 1955

CONTENTS

THE HAWAIIAN ACADEMY OF SCIENCE WAS ORGANIZED JULY 23, 1925. ITS OBJECTS ARE "THE PROMOTION OF SCIENTIFIC RESEARCH AND THE DIFFUSION OF SCIENTIFIC KNOWLEDGE, PARTICULARLY AS RELATED TO HAWAII AND THE PACIFIC AREA."

ANNUAL REPORT 1954-55

In 1955 the Hawaiian Academy of Science completed thirty years of service in its efforts to "promote scientific research and the diffusion of scientific knowledge in Hawaii and the rest of the Pacific area." At the final session of the Annual Meeting on April 23, 1955, members paused a moment to honor the memory of Dr. F. C. Newcombe who, in 1925, gathered together a small group of local members of the American Association for the Advancement of Science and other scientific organizations to inaugurate the formation of the Hawaiian Academy of Science. That Dr. Newcombe might well be proud of what has come from his original idea and his efforts will be testified to in the following compilation from the reports of committees and officers.

MEMBERSHIP

At the end of its twenty-ninth year the membership of the Academy totaled 458. Forty-four persons were elected to membership in April, 1954, and 58 in November, 1954. Of these, 95 were recorded as new members, the other 7 having failed to pay dues. In addition, one old member was reinstated, making the total gain in membership 96. There was a loss in membership of 5, through resignation, and 14 were dropped because of failure to pay dues. We regret the loss through death of one member:

Ralph J. Borden

As of the end of the thirtieth year, therefore, the membership was 534. The election of 37 new members at the final business meeting in April, 1955, set the membership for the beginning of the thirty-first year at 571.

Membership Committee

Charles F. Poole, Chairman
Floyd Ashton
Edwin H. Bryan, Jr.
Horace Clay
Doak C. Cox, ex officio
Ralph Heinicke
Stephen M. K. Hu
Colin G. Lennox, ex officio
Kathryn Orr
Pieter van Weel
J. Warren White

AFFILIATION

The Academy is affiliated with the American Association for the Advancement of Science, and was represented at its 1954 meetings in Berkeley. The Academy has benefited from this association with the AAAS and its Academy Conference. A research grant of $67 from the AAAS was supplemented from Academy funds to make a total of $100. The recipients of this AAAS–HAS grant were:

Madorah Smith—For special costs involved in the publication of a paper, "Relation between word variety and mean letter length with chronological and mental ages."

Ralph N. Akamine—For special equipment in research on carbohydrate-protein complexes in cartilage autographs and homographs.

A set of standards or requirements for associations or societies invited to affiliate, or requesting affiliation with the Academy was drawn up by the Affiliations Committee. These standards have primarily to do with membership, programs, and evidence of stability.

Two new affiliates, the Hawaii Psychological Association and the Hawaiian Botanical Society, were admitted as Associated Societies during the year. This makes a total of nine societies which have affiliated with the Academy to date.

The Academy was represented on the Conservation Council for Hawaii by President Colin G. Lennox.

Affiliation Committee

Colin G. Lennox, Chairman
Arthur S. Ayres, Amer. Soc. Agron., Hawaii Chap.
Fred A. Bianchi, Hawaii Ent. Soc.
George O. Burr, Amer. Chem. Soc., Hawaii Sec.
Doak C. Cox, ex officio
Dan A. Davis, Geophys. Soc. Hawaii*
Fred I. Gilbert, Jr., Hawaii Med. Assoc.
D. Elmo Hardy, Hawaii Ent. Soc.*
Katharine Luomala, Anthrop. Soc. Hawaii
John F. Mink, Geophys. Soc. Hawaii
O. E. Sette, ex officio
G. Donald Sherman, Sigma Xi, Hawaii Chap.*
Marlowe D. Thorne, Amer. Soc. Agron., Hawaii Chap.*
W. Edgar Vinacke, Sigma Xi, Hawaii Chap.
Herbert Weaver, Hawaii Psychol. Assoc.

* Resigned.

AAAS REPRESENTATIVES

Dr. Leonard D. Tuthill, alternate for Mr. O. E. Sette, served as official delegate to the annual AAAS Council meeting held in Berkeley in December. The question of security clearances and concomitant regulations and procedures on the part of the federal government in research supported by government funds was one of the principal matters of concern at the meeting.

Dr. Robert W. Hiatt, alternate for Dr. Leonard D. Tuthill, represented the Academy on the AAAS Academy Conference in Berkeley.

PROGRAM

At the first and final sessions of the Annual Meeting a total of twenty papers was presented, including a symposium on areas for action in developing Hawaii's resources, an invitational paper on research progress in Central America and Mexico, and the presidential address on the land use of an isolated Hawaii valley, Waipio.

The Academy was cosponsor, with the Geophysical Society of Hawaii, of two symposia on the physical problems in rain and cloud, and on problems in atmospheric chemistry, on November 16 and 17, 1954. The speakers were research men from all over the world, gathered in Hawaii to engage in "Project Shower." The Academy also jointly sponsored, with the University of Hawaii Geophysics Committee, the Geophysical Society of Hawaii, the Hawaii Chapter of the Society of the Sigma Xi, and Sigma Phi Sigma,

a lecture on the opportunities in geophysics by Dr. H. Kirk Stephenson, program chairman of Earth Sciences of the National Science Foundation.

At the suggestion of the Council, a subcommittee on popular programs was initiated. The plans of this subcommittee called for a series of meetings to acquaint members, especially those who are science teachers, with the activities and facilities of the various research institutions of Honolulu. The first of these meetings, arranged by the Hawaii Chapter of the Society of the Sigma Xi and cosponsored by the Academy, consisted of a symposium entitled "An introduction to marine biology and oceanography in Hawaii"; this covered research carried on in the botany and zoology departments of the University of Hawaii, the Pacific Oceanic Fisheries Investigations laboratories, and the Division of Fish and Game in the Territorial Board of Agriculture and Forestry. The second meeting in the Popular Series was held at the Bishop Museum, where members of the staff of that institution presented a symposium on research conducted there.

Business meetings were held during the first scheduled session in November, 1954, and following the annual banquet in conjunction with the final session in April, 1955.

Program Committee

A. J. Mangelsdorf, Chairman
Brenda Bishop
Leroy D. Christenson
Doak C. Cox, ex officio
Maxwell S. Doty
George Felton
Fred I. Gilbert
J. Linsley Gressitt
Beatrice Krauss, ex officio
Colin G. Lennox, ex officio
Leonard Mason
Marlowe D. Thorne*
John N. Warner

* Resigned.

NOMINATIONS

The Nominating Committee prepared a slate of candidates for the following offices for 1955–56: president-elect, A. J. Mangelsdorf and G. Donald Sherman; two-year councilor, Donald L. McKernan and Colin J. Herrick; secretary, Doak C. Cox; treasurer, Beatrice H. Krauss—the latter two, incumbents. Ballots were distributed and returned by mail, and tallied at the business meeting at the final scheduled session in April, 1955.

Nominating Committee

Robert W. Hiatt, Chairman
L. D. Baver
Walter Carter
Colin G. Lennox, ex officio
Carey D. Miller

AUDIT

The Auditing Committee, consisting of W. M. Bush, as chairman, and T. T. Tanimoto, examined the Treasurer's report, which is presented under FINANCES, and found it correct and in order.

SCIENCE TEACHERS

At an organizational meeting, this Committee decided that it should concern itself primarily with ways in which the Academy could be of greatest assistance to science teachers in the secondary schools of Hawaii. A subcommittee investigated means of helping promote the teaching of science in Hawaii, while another subcommittee investigated the possibility of establishing a science film library for private schools, similar to the D.P.I. film center maintained for the public schools. It is hoped that all film libraries—the proposed private schools' film library, the D.P.I. film center, and the Bishop Museum natural history educational units—may be integrated, if this appears desirable and practical.

The two symposia in the Popular Series of Academy programs were specially directed toward the science teachers. Their attendance was encouraging.

Science Teachers Committee

Paul L. Breese, Chairman
Horace Clay, Vice-chairman
Doak C. Cox, ex officio
Natalie Holladay
Ralph Heinicke
Phillip T. Kelley
Colin G. Lennox, ex officio
Donald Mitchell
Katherine O'Dea
Brother John T. Sayer
Spencer Tinker

AAAS FELLOWS

This Committee presented a list of fifteen names of local members of the AAAS for election as Fellows in their respective disciplines. The AAAS accepted the Committee's recommendations and these persons are now Fellows of the AAAS. Fellows of the AAAS are so-designated with a double asterisk before their names in the list of Academy members.

AAAS Fellowship Committee

L. D. Baver, Chairman
J. H. Beaumont
E. H. Bryan, Jr.
Walter Carter
Harold St. John
G. Donald Sherman
O. E. Sette

PUBLICATION

The twenty-ninth Proceedings were published in an edition of 850 copies. Distribution was to the membership of the Academy and to more than 200 institutions scattered over the world, chiefly on an exchange basis.

Publication Committee

Marjorie B. R. Milnes, Chairman
Doak C. Cox, ex officio
Marion P. Goddard
Colin C. Lennox, ex officio
Lydia C. Nickerson

PUBLIC INFORMATION

The work of this Committee, with Harry L. Arnold as chairman, was concerned chiefly with newspaper publicity for the two sessions of the Annual Meeting, the symposia and special lecture meetings. Robert Scott handled this for the *Honolulu Star-Bulletin,* and E. H. Bryan, Jr., for the *Honolulu Advertiser.*

HAWAII DIVISION

The Hawaii Division was established during the year in response to a petition to the Council, permitted under a constitutional amendment. The Hawaii Division is composed of 59 Academy members, resident on the island of Hawaii. The Division held four meetings during the year; three meetings were in Hilo, and one in Kona. The Academy grants the Division a sum of 25 cents per member from the Academy treasury for operational costs.

Hawaii Committee

Chester K. Wentworth, Chairman and Representative on the Academy Council
Elizabeth G. Eklund, Secretary-Treasurer
Hannah Bowman
Clifton J. Davis
Amy Greenwell

FINANCES

Balance on hand, April 15, 1954	$834.72
Receipts	
Dues	$371.00
AAAS research grant	67.00
Reprints sold	102.57
Miscellaneous	143.75
Total	$684.32
Expenditures	
Proceedings (HAS share)	$285.00
AAAS-HAS research grants	100.00
Programs and reprints	175.80
Stationery and postage	132.28
Dues allocation to Hawaii Division	10.00
Miscellaneous	139.63
Total	$842.71
Balance on hand, April 12, 1955	$676.33

Comparative status of dues at end of period:	April 12, 1955	April 15, 1954
Dues paid in advance	$155.00	$211.00
Dues in arrears	135.00	52.00

OFFICERS

1954–55

President	Colin G. Lennox
President-elect	Willis A. Gortner
Secretary	Doak C. Cox
Treasurer	Beatrice H. Krauss
Councilor for 2 years	Vernon E. Brock
Councilor for 1 year	Kiyoshi Ito
Ex officio	W. B. Storey

1955–56

President	Willis A. Gortner
President-elect	A. J. Mangelsdorf
Secretary	Doak C. Cox*
	Beatrice H. Krauss†
Treasurer	Beatrice H. Krauss
Councilor for 2 years	Colin J. Herrick
Councilor for 1 year	Vernon E. Brock
Ex officio	Colin G. Lennox

* On leave, 1955.
† Acting secretary, 1955.

THE 30th ANNUAL MEETING 1954-55

Program

FIRST SESSION

November 9, 1954

D. T. Fullaway: Coffee Green Scale in Hawaii.
Edward J. Britten: White Clover in Hawaii.
Joseph E. King: Some Observations on the Sea Birds of the Central Pacific.
J. Linsley Gressitt: Natural History of Taiwan.
Sterling B. Hendricks: The Effect of Light on Growth.

November 10, 1954

AREAS FOR ACTION IN DEVELOPING HAWAII'S RESOURCES—A SYMPOSIUM
Colin G. Lennox, Moderator

Robert S. Craig: The Need for Development of Hawaii's Resources and Current Progress.
Frederick Simpich, Jr.: Criteria for Success in Potential Developments and their Application.
Atherton Richards: Land and Water Development.

SPECIAL SESSIONS

November 16, 1954

PHYSICAL PROBLEMS IN RAIN AND CLOUD—A SYMPOSIUM
Wendell A. Mordy, Moderator

Patrick Squires: Drop Size Distribution in Clouds.
John Warner: Liquid Water Content in Clouds.
E. J. Workman: Thunderstorm Electricity.
Duncan C. Blanchard: Electrified Droplets from the Bursting of Bubbles at an Air-Sea Interface.
Vincent Schaefer: A Fire-Weather Program.

November 17, 1954

PROBLEMS IN ATMOSPHERIC CHEMISTRY—A SYMPOSIUM
Wendell A. Mordy, Moderator

Ben K. Seely: A Microchemical Technique for Detecting Atmospheric Particles.
Alfred H. Woodcock: Atmospheric Sea Salt.
Sean Twomey: A Phase-Transition Test for Identifying Atmospheric Particles.
Erik Eriksson: The Place of Atmospheric Chemistry in Meteorology.

(The above symposia were sponsored jointly with the Geophysical Society of Hawaii.)

March 29, 1955

AN INTRODUCTION TO MARINE BIOLOGY AND OCEANOGRAPHY IN HAWAII—A SYMPOSIUM
Vernon E. Brock, Moderator

Howard J. Boroughs: Research at Coconut Island.
Maxwell S. Doty: Research in Marine Productivity.
William F. Royce: Biological Research at the Pacific Oceanic Fisheries Laboratory.
Thomas S. Austin: Oceanographic Research in the Pacific.
Yoshio Yamaguchi: Inshore Fishery Research.

(The above symposium was sponsored jointly with the Hawaii Chapter of the Society of the Sigma Xi.)

April 12, 1955

THE SCIENTIFIC ACTIVITIES AND FACILITIES OF THE BISHOP MUSEUM—A SERIES OF SHORT TALKS BY STAFF MEMBERS, WITH EXHIBITS

Participants:
Colin G. Lennox, J. Linsley Gressitt, Alexander Spoehr, Edwin H. Bryan, Jr., Kenneth B. Emory

April 14, 1955

H. Kirk Stephenson: Opportunities in Geophysics.

(Sponsored jointly with the Geophysical Society of Hawaii, University of Hawaii Geophysics Committee, Hawaii Chapter of the Society of the Sigma Xi, and Sigma Phi Sigma.)

FINAL SESSION

April 21, 1955

Howard Boroughs, Sidney J. Townsley, and Robert W. Hiatt: The Uptake, Internal Distribution and Excretion of Radiostrontium by Fish.
Maxwell Doty, R. R. Guillard, and E. C. Jones: The Productivity of the Inshore Waters in Hawaii.
John E. Randall: Spawning Cycle, Development, and Growth of the Convict Surgeon Fish or Manini (*Acanthurus triostegus sandvicensis*).
M. Oguri and George W. T. C. Chu: Influence of Diet on the Susceptibility of Domesticated Ducks to Parasitism by a Marine Trematode.
Robert L. Pyle: Pictorial Survey of the Native Hawaiian Landbirds.

April 22, 1955

G. Donald Sherman, Ada C. Chu, and Clarence M. Sakamoto: The Influence of Application of Soluble Silicates on Phosphorous Availability in Certain Hawaiian Soils.
Joseph E. Alicata and Sa'eb W. Dajani: Parasitological Studies in the Hashemite Kingdom of Jordan.
Sidney L. Halperin: Is Mental Illness Inherited.
Samuel D. Allison: Newer Modalities in Dermatology.
Sterling Wortman: Research Progress in Central America.

April 23, 1955

Business Meeting

Address of the Retiring President
Colin G. Lennox: Waipio Valley—An Example of Today's Problems in Land Use of Isolated Hawaiian Valleys.

HAWAII DIVISION

October 29, 1954 (Hilo)
March 4, 1955 (Kona)

Wendell A. Mordy, Vincent Schaefer, E. J. Workman, Duncan Blanchard, and Patrick Squires: "Project Shower."

March 9, 1955

Leonard D. Baver: Soil Puddling and Compaction—an Hawaii Problem.

April 15, 1955

Juliette Wentworth, Clarence Lyman, A. M. Hieronymus, Robert S. Nekomoto, Hitoshi Kamasaki, and David Young: Plant Damage by Volcanic Fumes.

Abstracts

COFFEE GREEN SCALE IN HAWAII

The author pointed out that the coffee plant in Hawaii enjoys comparative freedom from insect pests and disease (we have no Hemilea disease or seed weevil) and explained this happy circumstance by a recital of the known facts regarding the introduction of the coffee plant. However, the green scale has been known here as a coffee pest since 1893, according to the record, and has received attention from various entomologists who have worked in the Kona district of Hawaii on coffee, including Pemberton, Willard, Illingworth, and the author. It is believed the green scale entered the Territory on some ornamental plant, of which many were introduced previous to 1893. As far as coffee is concerned, Nature takes care of this pest to keep its population's level sub-economic. Coffee planters have never had to spray trees with insecticidal liquids or to fumigate with insecticidal gases to control this pest.

D. T. FULLAWAY

WHITE CLOVER IN HAWAII

White Clover (*Trifolium repens*) has been found to be a highly variable pasture plant. It has a world-wide natural distribution, being found under a broad range of environmental conditions. Cross pollination, together with self-sterility factors assures a possibility of constantly changing genetic makeup, enabling it to adapt itself to new locations.

The Hawaiian Islands have compressed within their small land area tremendous variations of such environmental factors as temperature, rainfall, and soil. Mean annual temperature variations on the Islands occur within distances of 20 miles which are comparable to that occurring from New York to Florida. Annual rainfall averages extend from about 20 to nearly 500 inches on the Islands, more than four times the range from the driest to the wettest state of the Union.

White Clover with its inherent capacity for variation was first introduced to Hawaii with its wide environmental extremes over one hundred years ago. It has undoubtedly been introduced a number of times to various localities since that time.

Reports indicating that White Clover has gradually been extending its range on the Islands have instigated a study of its present range with the objective of isolating a strain suitable to the pasture of the lower elevations.

Collections made on Hawaii and Maui have revealed White Clover to be growing at extremes of 8,000–500 feet which have extremes of annual temperature means of about 52° F. and 73° F. Extremes of annual rainfall in areas at which White Clover was collected varied from about 25 to over 200 inches.

Considering the environmental extremes at which White Clover has been collected, and in view of its demonstrated capacity to adapt itself to a wide range of conditions, it seems probable that new strains of White Clover have developed on the Islands. Experiments are planned to test this hypothesis.

E. J. BRITTEN

SOME OBSERVATIONS ON THE SEA BIRDS OF THE CENTRAL PACIFIC

Although primarily concerned with the tuna fishes of the central Pacific, the Pacific Oceanic Fishery Investigations is also interested in the sea birds, and for four reasons primarily: (1) they are a direct aid to both the scientist and the fisherman in finding tuna schools, (2) their variations in abundance may contribute information on the general productivity or amount of available food in different ocean areas, (3) in some localities at certain times of the year they may be serious competitors of tuna for food and also competitors of tuna fishermen for bait, and (4) the staff have found that a study of the birds and their identification relieves some of the monotony associated with long ocean voyages.

POFI scientists have unusual opportunities to observe the sea birds on their nesting grounds and feeding on the open ocean. Most of the islands on which the birds breed are uninhabited by man and rarely visited by ornithologists. Although Oahu is surrounded by water, bird students here who must make their observations from the shore see relatively few species of oceanic birds and never see the dense aggregations characteristic of the breeding islands.

The sea birds ordinarily occurring in the central Pacific belong to six major groups or families: (1) the albatrosses (Diomedeidae), represented by 2 species; (2) the shearwaters and petrels (Procellariidae), by 8 or possibly 10 species; (3) the terns (Laridae), by probably 7 species; (4) the frigate birds (Fregatidae), by 2 species; (5) the boobies (Sulidae), by 3 species; and (6) the tropic-birds (Phaethontidae), by 2 species—a total of about two dozen species. In addition gulls and jaegers are occassionally reported, particularly in the northern portion of the region.

(Kodachrome slides were shown of 15 species illustrating both juvenile and adult stages and nesting habits, with accompanying remarks on the general abundance of different species, their distribution and nesting cycles.)

JOSEPH E. KING

NATURAL HISTORY OF TAIWAN

Taiwan holds a conspicuous position among the islands or archipelagoes fringing eastern Asia. Though just over twice the area of the Hawaiian Chain, it is very rich in natural productions. It is the nineteenth largest island, but the fourth highest, being exceeded by New Guinea, Borneo, and Hawaii. Two of its peaks are nearly as high as Mauna Loa, and some 50

are higher than Haleakala. The eastern half is very mountainous and the western half nearly flat. The world's highest sea cliffs occur along the upper part of the east coast, and to their south is a long narrow rift valley with a lesser steep, narrow range to its east.

The mountains of Taiwan consist of greatly raised and folded sedimentary and metamorphic rocks, many tilted even vertically, and consisting largely of shale, slate, and sandstone. There are minor deposits of coal, sulphur, and a little gold. There is raised limestone, a mud crater, and some old volcanic stocks in the south, and some solfataras and extinct volcanoes in the north. The ocean to the east and south is deep, but that in the Formosa Straits is less than 100 meters deep. Taiwan was considerably raised in the Eocene, later joined to South China, and last separated in the early Pleistocene. It was connected with the Ryukyus as a peninsula from South China before separating from both.

The human population of Taiwan is dense (over 8,000,000). The oldest residents are former head-hunters of six distinct tribes who probably came from Luzon at various periods. They were pushed into the mountains during the past millenium by Chinese, who came mostly from Amoy. Other elements are Hakkas, some Foochownese, some mixtures of Chinese and aborigines in the south, a few remaining Japanese, and many refugees from East China and other parts of China. Agriculture occupies much of the population. Camphor, lumber, and fish are also important.

The flora and fauna are of rich continental nature, richer and more balanced than is the case in Hawaii. That is, representation of families and genera is more complete, although there is less endemism and less spectacular speciation in limited taxonomic categories than in Hawaii.

Higher plants are represented by some 4,000 species. Extensive forests remain in the mountains, with coniferous forests at higher altitudes. There are 27 species of 15 genera of conifers, including familiar Holarctic genera like *Taxus, Abies, Picea, Pinus, Tsuga, Chamaecyparis,* and *Juniperus.*

The fauna is rich in all groups. There are some 50 kinds of mammals, a few hundred kinds of birds, and many reptiles and amphibians. Perhaps 10,000 species of insects are known, with many more still unclassified.

Biogeographically, Taiwan is primarily Indo-Chinese in its relationships, but in the higher mountains there is an extensive Palearctic element. Many species are possessed in common with South China, northern Indo-China, northeastern India, Burma, and the Ryukyu Islands, or are represented by species closely related to those in the above areas, or in Japan. The relationship to the Philippines is distant, and in most cases can be attributed to a common southeast Asian origin, suggesting that the Philippines and Taiwan were never connected except by way of the Malayan regions. However, the small island Botel-Tobago, just east of the south end of Taiwan, is both geologically and biologically part of the Philippine Archipelago.

J. LINSLEY GRESSITT

THE EFFECT OF LIGHT ON GROWTH

Photoperiodism, the control of growth by length of day, or more properly by length of night has been demonstrated locally by the artificial inhibition of flowering in sugar cane and poinsettias by illumination at night. It is a phenomenon of much wider importance affecting both animals and plants in a variety of ways.

In plants light exercises a control over seed germination, internode elongation, leaf enlargement, plumular hook unfolding, epinasty, leaf abscission, cambial activity, rhizome growth, dormancy, root development, bulb formation, pigmentation, phylloidy of bracts, tillering, and sex expression. In different plants the same control may be exercised in opposite ways. For example, the blooming of chrysanthemums is initiated by long nights, that of barley by short nights. The times of lighting required for control may be very short. For example, lettuce seeds, which kept in darkness will not germinate, will germinate if they are exposed to light for a period as short as 10^{-4} sec. The energy levels required for various controls in various plants vary considerably. They vary also with the color of light used, and for all controls with all plants the band of wave lengths of maximum effect is almost exactly the same, varying from about 5400 to 7000 Å, a part of the visible spectrum.

A narrow band in the infrared from about 7000 to 8000 Å with a maximum near 7400 Å has been found that reverses the effects of visible light. For example, lettuce seeds exposed briefly to 6500 Å red light will germinate, but if exposed subsequently to 7300 Å infrared light will not germinate. The reversals may be repeated. The seeds exposed in sequence to red, infrared, and red will germinate. Those exposed to red, infrared, red, and infrared will not.

It appears that there is in plants some unidentified pigment absorbing light in the 5400 to 7000 Å range and sensitive to such light so that it converts to some other pigment sensitive to light in the 7000 to 7600 Å range and reverting to the first pigment. Because the energy levels required for control and reversal are variable but always reciprocal, it appears that another molecule besides the pigment is involved, the variability in energy being explained by the variation in the relative concentrations of the second molecule and its product. The second pigment apparently reacts with some other compound to start the actual control. This reaction takes some time. The reversibility of control with the lettuce seeds is ineffective if the time interval between red light and subsequent infrared light is more than about 30 minutes. The opposite effects in different plants with the same lighting schedule is probably due to attachment of one compound at two points to another, which permits self-inhibition. The means for measuring time in the plant is the return of the infrared absorbing pigment to the red absorbing one by a dark reaction.

In animals such processes as the change of plumage or fur, sexual activity, and migration are controlled by photoperiodicity. Song birds have been brought to voice in Japan by control of day length for the last millennium. Laboratory experimentation on the effective wave lengths of light has been successful only with Hydractinea, a coelenterate, which releases eggs or sperm 55 minutes after sunrise. In Hydractinea, control is effected most efficiently by light with about the same range of color as in the plants plus a very effective band in the blue. The pigment involved has been found to be copraporphyrin III, a pigment found in the central nervous system of vertibrates, and in particularly high concentrations in birds. This same pigment is probably responsible for the control in other animals, but the effective bands of light are narrower and variable because of the deep burial of the pigment in higher animals and the filtering of the light by overlying tissues.

In both plants and animals other controls besides the fundamental photoperiodic control are exercised, and in some organisms, such as man, the additional controls mask the effects of the photoperiodic control, which is nevertheless believed to be still present and effective.

STERLING B. HENDRICKS
Agricultural Research Service
Beltsville, Md.

AREAS FOR ACTION IN DEVELOPING HAWAII'S RESOURCES—A SYMPOSIUM

COLIN G. LENNOX, Moderator

INTRODUCTION

This symposium will present problems of developing Hawaii's economy to meet the demands that are made on it by the growing Hawaiian population. The economy must be based on Hawaii's resources, which were discussed by Academy members in a symposium two years ago. This symposium, conducted by businessmen, is intended to indicate to Academy members, some of whom are relatively remote from applications of their work, the problems in the action line where men and resources are put to work.

It must be recognized that Hawaii is a pocket employment market, in which the employment situation is isolated by travel costs from the mainland. The employment situation has varied repeatedly in the past. In 1936 there was difficulty placing new workers coming onto the labor market in jobs. Between 1941 and 1946 labor was so short it had to be rationed. In 1949 unemployment reached a peak.

COLIN G. LENNOX

THE NEED FOR DEVELOPMENT OF HAWAII'S RESOURCES AND CURRENT PROGRESS

In this mid-century period in America, business leadership dare not fail in achieving impressive results in providing employment and improving living standards. This is because the temper of the times—as measured by such foremost public opinion authorities as George Gallup, Elmo Roper, and Claude Robinson—is this: If business leadership fails in providing employment and rising living standards, the citizen expects his government to do something about it. If his government does not, he will vote it out and vote in a new one. This is significant for Hawaii because our labor force of approximately 200,000 is growing at the rate of about 5,000 a year, and will presumably thus reach 300,000 in 20 years barring unforeseen increases in out-migration.

Hawaii faced a similar problem when 25,000 workers were displaced by mechanization of plantations between 1940 and 1950. Increases in employment in service and other lines, plus Federal defense employment, largely solved this problem.

No one can now predict how additional workers will be employed in 20 years, any more than how the 25,000 displaced would be absorbed could have been predicted in 1940. No single solution is likely.

Hotels now under construction should give employment to some 5,000. There are several prospects, such as sugar and pineapple by-products, fresh and processed foods for export and local consumption, expansion of the garment industry for export, new small industries for local consumption, and entirely new industries in such light products as possibly electronics for export.

There are several requirements for our needed development, first of which is new capital investment ranging upwards of $25,000,000 a year. Others are bold enterprisers, increased use of applied science, a socio-political climate favorable to business growth, community-wide determination to support the needed development, and an educational program geared to achieving the required skills.

The Industrial Research Advisory Council (IRAC) in the past five years through over 50 research grants has already (1) developed new export food products in such lines as papaya, passion fruit, and guava, (2) assisted in developing by-product livestock feeds, (3) shown the way to dehydrated feeds from legumes, (4) stimulated expansion of crafts, (5) solved basic fresh fruit shipping problems, (6) started an impressive experiment in saline agriculture, (7) overcome plant disease and pest problems in commercial flowers, (8) surveyed mainland markets, (9) stimulated formation of three industry associations for self-help, and (10) assisted in launching many public and private new industry studies.

These are a few examples of ways in which skills of scientists have been brought to bear upon the problems of economic expansion. It can be hoped that serendipity will, as in the past, be present in the continuing efforts of researchers. The literature of scientific research is liberally sprinkled with examples of discoveries far more important than the goals originally sought.

ROBERT S. CRAIG
Hawaiian Economic Service
Honolulu, Hawaii

CRITERIA FOR SUCCESS IN POTENTIAL DEVELOPMENTS AND THEIR APPLICATION

It is important in discussing the broadening of our economic base to recognize the economic limitations of our objectives. In considering any new product for export from the Territory, we should recognize that it will have a greater chance of success if it possesses a number of these qualities:

(1) Low labor content per dollar of cost because of our relatively high wage scales;
(2) High dollar value per unit of weight because of our shipping costs;
(3) An agricultural product difficult to grow elsewhere—such as, pineapple or macadamia nuts, for the obvious competitive advantages gained;
(4) It should not be readily subject to spoilage because of the harvesting and labor relations problems spoilage presents;
(5) It should be capable of being packaged in paper because of the costs of importing and forming tin.

Probably no one commodity meets all these criteria, but the nearer we come to satisfying these standards, the more likely we are to achieve a lasting success. For example: papayas do not fare very well against this check list; macadamia, in contrast, fares remarkably well.

Turning to imports, there are undoubtedly many small areas of activity, largely in the processing field, where small enterprisers could find profitable activity, for example the local manufacturer of soft-drink and milk bottles which now come in by ship and which cube very large. But the fact is that only seven or

eight commodities are imported at a cost of a million dollars a year or more. Most either cannot be produced locally or cannot be produced locally at a profit. Others break down into so many categories, sizes, etc., that no one type is imported in sufficient volume to merit local production.

There are, however, three other avenues of approach to the problem. The first of these is the possibility of local manufacture or processing of articles for sale on the mainland of a size and nature that neither freight rates nor style changes would disadvantage. We have a highly intelligent population and one that is manually dexterous. Our factory wage scales are lower than those on the mainland, in contrast to agriculture where our rates exceed those on the mainland. What I have in mind is subassembly of articles like electronic devices.

A second area for activity is in the travel field. The potential is staggering. Immediate needs include making some more land at Waikiki and construction of an auditorium so that air and surface carriers can solicit the convention business we must now turn away. The growth of pension plans in the last twenty years, the impact of the social security system, and the lengthening life span are beginning to be manifested in a growing body of prosperous, vigorous, retired persons. The large landowners, the carriers, and the insurance companies, could jointly pool their promotional efforts to induce some of these people to come here and live.

Finally, we must look to scientists, particularly the organic chemists, to give our resources the thorough examination they deserve. My company is studying two possibilities in the drug field. The By-Products Committee of the HSPA has found that the local production of nitrogen from the air would be profitable and that, under slightly improved marketing conditions, the manufacture of furfural from bagasse would make an attractive investment. The same group has learned how to make paper of competitive quality from bagasse. The Sugar Research Foundation in New York, which the HSPA supports, is on the brink of starting a whole new chain of chemical development from carbohydrates. What this may mean may be estimated from the vast field of petro-chemicals that has arisen from twenty years' work with the petroleum molecule. I urge on scientists the need for application of their skills to the problem and assure them that if they develop opportunities, management and venture capital can be found for their development.

FREDERICK SIMPICH, JR.
Castle and Cooke, Ltd.
Honolulu, Hawaii

LAND AND WATER DEVELOPMENT

Current progress in the development of land and water indicate the potentialities of further development of these resources in Hawaii.

Rocky land, both forested and dry, is being successfully cleared for pasture development as in Kohala, and for the cultivation of crops like coffee, as in Kona, and macadamia nuts, as in Puna. Land is being reclaimed for agricultural uses from saline swamps as at Kekaha, Kauai. Crops are being selected on Molokai for growth on lands for which brackish water is available for irrigation. New or expanding crops are increasing the potentialities of lands not formerly used, for example macadamia nuts, papayas, and most recently lilikoi.

Some lands present special problems not yet solved. In general, the large steep-walled valleys, once centers of population, are now abandoned or put to very low use. Waipio Valley on Hawaii is an example. The growth of ti from which to extract levulose is being considered there. Further water development by bulkheaded tunnels in the dike complexes at the heads of some valleys is of interest.

The extension of soil conservation measures is essential to the saving of soils for existing or potential agricultural use in some areas, for instance on Molokai.

The restoration of Hawaiian fish ponds, for example those on Molokai, is of potential economic importance.

ATHERTON RICHARDS
Bernice P. Bishop Estate
Honolulu, Hawaii

DISCUSSION

Lilikoi cultivation, being in a rapidly expanding stage, is the subject of much speculation and experimentation. Experiments on the most efficient types of trellis or terrace are underway. The useful length of life of the lilikoi vines is uncertain, being limited in Australia, at least, by a virus.

Factors tending to increase the tourist and retirement possibilities in the Islands are the decreasing separation from the mainland in terms of the time and cost. The Island atmosphere remains clear, in contrast with the increasing pollution of the continental atmosphere. It is necessary to guard against the replacement of a relaxed way of life by high-pressure attitudes induced by the very striving for tourist trade.

The development of special forms of energy does not appear to be likely in the immediate future, though the utilization of volcanic heat in the area of the active volcanoes, the further trapping of the sun's energy, and the development of atomic energy are of interest.

For the further development of agricultural export business, a solution is necessary to the problem of recurrent strikes that make guarantees of mainland deliveries impossible. The extension of the National Labor Relations Act to the shipping industry is perhaps a solution, though there is no general agreement yet that it is the proper one.

That potentialities of expansion of the economy in the immediate future exist is demonstrated by the recent development of a business processing lilikoi and guava puree, which from a $50,000 capital expenditure produced $300,000 in sales in the first year.

THE PANEL AND SPEAKERS FROM THE FLOOR

PHYSICAL PROBLEMS IN RAIN AND CLOUD—A SYMPOSIUM

WENDELL A. MORDY, Moderator

DROP SIZE DISTRIBUTION IN CLOUDS

Rain requires clouds, but clouds do not always produce rain. Understanding of the rain-forming process is sought by studying the colloidal structure of clouds. A raindrop is equivalent in mass to from 1,000 to 1,000,000 cloud drops. How cloud drops grow to raindrop size is the critical issue.

In the case of warm clouds, growth by condensation is inadequate to produce rain and it appears that the cloud drops must coalesce. The most likely way for coalescence to happen is by the accretion of large cloud drops as they fall through and pick up smaller

ones. If this mechanism is the dominant one, then some relatively large cloud drops must be present in a cloud before rain can occur.

All drops form initially by condensation on small particles called nuclei. Generally larger nuclei yield larger drops. Condensation occurs when air is cooled beyond some critical temperature. Rising air undergoes cooling at a rate which is proportional to the rate of rise. If the cooling is very rapid, the ensuing cloud will consist of a great many uniform, small drops. If the cooling is slow, the cloud drops will be fewer but more varied in size.

Measurements of cloud drops obtained by exposing coated slides from an aircraft have shown that there are fewer and larger drops in oceanic clouds than in clouds over continents.

PATRICK SQUIRES
CSIRO, Sydney, Australia

LIQUID WATER CONTENT IN CLOUDS

One of the important cloud parameters affecting rain formation is the liquid water content, usually expressed as the number of grams of water per cubic meter of air. An instrument was developed using an electrical technique to make continuous measurements of liquid water in clouds from an aircraft.

Data obtained with the instrument reveal large variations in cloud water content. Using only the peak values at each level, however, a consistent picture for the cloud as a whole is obtained. Liquid water content increases with height from the cloud base to about 1,000 feet below the top, then decreases. Near the cloud base, the values observed are about equal to that expected from condensation due to adiabatic cooling. At higher levels, however, the measured amounts are only a small fraction of the theoretical values. This discrepancy points to mixing of dry environmental air with the cloud air. Such mixing, to account for the observations, must be effective across the entire cloud.

JOHN WARNER
CSIRO, Sydney, Australia

THUNDERSTORM ELECTRICITY

Thunderstorms account for nearly all of the rain which falls in New Mexico. This area has consequently been the center of much thunderstorm research. In 1948, Reynolds and Workman reported on an experiment in which a very dilute solution of caesium fluoride was placed in contact with a copper block maintained at a temperature of –20° C. One end of a wire lead was suspended in the water and the other end connected to the copper block. An ammeter was connected in series with the wire. When the solution began to freeze, a current was indicated by the ammeter. It was found that 1 cc. of the dilute solution freezing per minute produced a current of one-fourth milliampere.

Further investigation revealed that charge generation was restricted to areas where ice and water were in contact. The process is accompanied by the electrolysis of water, and the consequent release of hydrogen. All of the hydrogen in the atmosphere might have been produced by this process.

E. J. WORKMAN
New Mexico Institute of
Mining and Technology
Socorro, New Mexico

ELECTRIFIED DROPLETS FROM THE BURSTING OF BUBBLES AT AN AIR-SEA WATER INTERFACE

Salt particle distributions in the atmosphere have been measured and studied by Woodcock. An effort to find a mechanism for transferring salt from ocean to atmosphere led to a study of air bubbles bursting at a water surface. Through laboratory experiments, it was found that, when a bubble bursts, a small jet of water was produced which broke into a number of small drops rising from 1 millimeter to 20 centimeters above the water surface. Further study revealed the drops were charged.

The charge increases with drop radius and is predominantly positive on drops less than about five microns radius. The possible effect of the phenomena on the space charge over the ocean is the subject of continued study.

DUNCAN C. BLANCHARD
Woods Hole Oceanographic
Institution
Woods Hole, Massachusetts

A FIRE-WEATHER PROGRAM

A program has been undertaken by the Munitalp Foundation in cooperation with the Forest Service to study the problem of forest fires caused by lightning. A school for observers was set up covering the following topics:

Description of clouds
Cloud patterns
Lightning storms
Fires

An area in the Northwest United States, 150 by 200 miles, was chosen for study. Careful observations were made of clouds, lightning storms, and fires. It was found that about 75 per cent of the fires in the area were started by lightning. The program will stress better forecasting of storms and possible control by cloud-seeding methods.

A film was shown demonstrating the use of lapse time pictures taken from high flying aircraft as a means of recording and observing cloud patterns.

VINCENT SCHAEFER
Munitalp Foundation
Schenectady, New York

PROBLEMS IN ATMOSPHERIC CHEMISTRY—A SYMPOSIUM

WENDELL A. MORDY, Moderator

A MICROCHEMICAL TECHNIQUE FOR DETECTING ATMOSPHERIC PARTICLES

Microchemical techniques were developed at the New Mexico Institute of Mining and Technology to enable identification of atmospheric particles. The method utilizes a spot test analysis which permits identification of masses as small as 10^{-10} to 10^{-15} grams. The particles, collected on a gelatine-coated cellulose acetate strip, form characteristic halos which may be examined under a microscope.

Copper, cobalt, and nickel may be identified by mixing rubeanic acid in with the gelatine. Other reagents are used to identify iron compounds, sodium and potassium chlorides, and carbonates. The test for carbonates is not specific, as certain oxides and hydroxides yield a similar reaction.

The technique has been used as a control in studying the decay rate of silver iodide when used as a cloud-seeding agent.

The technique was also used in the Keanae Valley cloud study on Maui, where copper was used as a tracer in order to determine the effects of spraying small drops into a cloud from the ground.

BEN K. SEELY
New Mexico Institute of Mining and Technology
Socorro, New Mexico

ATMOSPHERIC SEA SALT

Liquid droplets are ejected into the air when the bubbles, which are formed by "white caps," burst at the sea surface. The water quickly evaporates from these air-born droplets, leaving minute saline particles or nuclei. The quantity of this sea salt present in the air over the sea has been measured from aircraft. From these measurements, the variation in number of salt particles with wind speed and altitude was determined. The amount of salt increases with increasing wind and decreases with increasing altitude. The average total weight of salt found near cloud base levels in Hawaii was about 2.5 micrograms per cubic meter.

Comparisons between the number of large atmospheric salt particles and observed salinities of rainwater point to a close relationship between salt and rainfall.

ALFRED H. WOODCOCK
Woods Hole Oceanographic Institution
Woods Hole, Massachusetts

A PHASE-TRANSITION TEST FOR IDENTIFYING ATMOSPHERIC PARTICLES

Measurements of hygroscopic particles in the atmosphere were made over SE Australia, following the method of Woodcock. High concentrations were found in air hundreds of miles inland, raising a question as to their source.

The composition of the larger (greater than 10^{-12} grams) hygroscopic particles was investigated, using a phase-transition method. Particles were collected on stretched spider webs exposed from an aircraft. It was found that the hygroscopic particles were usually composed of sea-salt, sometimes in combination with insoluble material. A chemical test on individual particles indicated that no appreciable decrease in chloride content or replacement of chlorides by carbonates took place as air moved inland. Only occasionally were large soluble particles, other than sea-salt, detected.

SEAN TWOMEY
CSIRO, Sydney, Australia

THE PLACE OF ATMOSPHERIC CHEMISTRY IN METEOROLOGY

Meteorology is a study of the atmosphere by means of the senses and by means of instruments. Properties measured may be separated into three classes:

1. Physical, including temperature, pressure, wind, and electricity;
2. Chemical, including nitrogen, oxygen, water, ammonia, etc.;
3. Biological, including bacteria, insects, birds, etc.

Physical properties are studied from the aspect of medical and social effects, physical chemistry and geophysics.

Geophysics and geochemistry involve the distribution and circulation of properties. Thus with regard to sources and sinks, and transport of properties, a close relation exists between atmospheric chemistry and other phases of meteorology.

ERIK ERIKSSON
Institute of Technology
Stockholm, Sweden

AN INTRODUCTION TO MARINE BIOLOGY AND OCEANOGRAPHY IN HAWAII— A SYMPOSIUM

VERNON E. BROCK, Moderator

RESEARCH AT COCONUT ISLAND

The author reported on marine biological research at the University of Hawaii's marine laboratory on Coconut Island, Kaneohe Bay. These studies are chiefly on basic research from which data of economic value can later be learned.

Included are studies of water striders, minute seagoing bugs, by Jon L. Herring; digestion in sea cucumbers, the "earthworms of the sea," by Shirley Trefz; the development and early life of the maomao, a damsel fish, by Philip Helfrich; studies of swimmer's itch, by George Chu and Charles E. Cutress, showing it to be caused by parts of jelly-fishes.

Robert Amai's study of purple pigment in sea urchins; life history of the manini, a surgeon fish, by John Randall; snapping shrimp investigations from Saipan to Tahiti, by Albert H. Banner; reproduction in crustacea, by Donald C. Mathews; plankton studies by Everett C. Jones.

Research on aholehole, nehu, and tuna behavior, by Albert L. Tester; how marine organisms pick up metals from the sea, where do these go and how long do they stay in the organism, studied by means of radioactive substances, by Sidney Townsley and Howard J. Boroughs.

HOWARD J. BOROUGHS

RESEARCH IN MARINE PRODUCTIVITY (ALGAL PRODUCTIVITY NEAR HAWAII)

Various variables and dimensions of the productivity of our island waters have been investigated. The productivity per acre per year seems to be about like that of an acre of good farm land. As the shore is approached closely, however, productivity increases perhaps 100 or 1,000 times. There seems to be evidence also for seasonality.

Though there is little concrete evidence it appears that the standing crop likewise increases as the shore is approached. It is not clear whether the increase in the standing crop is directly proportional to the increase in productivity or not, but it seems this might be so under climax conditions.

MAXWELL S. DOTY

BIOLOGICAL RESEARCH AT THE PACIFIC OCEANIC FISHERIES LABORATORY

The author outlined the biological research being carried on by the POFI whose chief objective is to increase the catch of tuna and related fishes.

Yellow fin tuna are being investigated in equatorial waters, aku or skipjack about the Hawaiian Islands, and albacore in cooler waters to the north.

Problems include not only where are these fishes, but how best to catch them.

One limiting factor is bait fish, and means of catching tuna without bait are being studied. One of the most promising of these is electric fishing. When an interrupted direct current is discharged in water, fish will swim toward the positive pole. Too little current may repel the fish, too much may kill them, so the problem is just how much current should be used.

WILLIAM F. ROYCE

OCEANOGRAPHIC RESEARCH IN THE PACIFIC

The author told how the distribution and abundance of large fish, such as the tuna, are related to chemical and physical forces in the seas.

Chemical substances are most abundant where there are upwellings of water rich in phosphorus and other chemicals which had previously sunk to lower levels of the sea. Such upwellings occur along the equator in the central Pacific, around chains of islands, such as the Hawaiian chain, and in the north Pacific in winter.

It is in these regions that the phytoplankton, which feed on these chemical substances, are found in large quantities. The zooplankton feed on these, and in turn are used for food by the forage fish. The forage fish, are in turn, fed upon by the tunas. Thus it is in these three regions that the tunas are sought commercially.

THOMAS S. AUSTIN

INSHORE FISHERY RESEARCH

An attempt is being made to increase the amount of bait fish, and the introduced *tilapia* shows promise for this use.

Studies are being made of certain inshore food fishes, such as the akule or big-eyed scad. Catches of this are declining steadily, and the reason is being sought.

Most of the reef fish around the Hawaiian Islands are of no use to man. Located on the fringe of the area occupied by the Indo-Pacific fish fauna, Hawaii lacks certain valuable food species which are abundant further south and west.

Study is being made of the possibility of introducing certain snappers and sea bass to Hawaii's reefs. An effective management program is needed for conservation of marine life.

YOSHIO YAMAGUCHI

THE SCIENTIFIC ACTIVITIES AND FACILITIES OF THE BISHOP MUSEUM

(No abstracts)

COLIN G. LENNOX EDWIN H. BRYAN, JR.
ALEXANDER SPOEHR J. LINSLEY GRESSITT
KENNETH B. EMORY

OPPORTUNITIES IN GEOPHYSICS

(No abstract)

H. KIRK STEPHENSON
National Science Foundation
Washington, D. C.

THE UPTAKE, INTERNAL DISTRIBUTION AND EXCRETION OF RADIOSTRONTIUM BY FISH

Although certain elements occur in very low concentrations on the earth, it has long been known that some organisms are capable of accumulating them in excess of that found in their environment. Under experimental conditions other organisms have been shown to be able to substitute one element for a similar one in the periodic table, although the substitution may not be along the same metabolic pathways. Such is the case of strontium. Strontium has been detected in all phases of the biosphere, but due to the difficulties of analyzing trace quantities in the presence of calcium, only a few scattered analyses were reported in the early literature. Until the advent of nuclear fission, the study of this and related elements from a chemical and physiological standpoint was very difficult. The use of radioisotopes now makes it possible to study the role of these elements in the physiological environment of the living organism. We have been investigating the metabolism of strontium in marine organisms using the isotope strontium^{89} as a tracer.

One dose of radioactive strontium^{89} in the form of the chloride solution was fed to fish and the fish were sacrificed at specified time intervals. The organs were then removed, weighed, dried and ashed in a muffle furnace. The remaining ash was then counted using a Geiger-Muller tube to determine the amount of radioactivity in each organ.

Calculation of the total amount of radioactivity remaining at each interval showed that of the total dose administered about 50 per cent had been excreted within the first two hours, and by 24 hours only about 1 per cent remained. Thus radiostrontium is very rapidly excreted. The 1 per cent remaining was found to persist for 27 days after administration of the dose.

The remaining 1 per cent of the dose in the fish was found to be distributed in all the organs. However, it is apparent that there are two distinct groups of tissues with respect to the physiology of this element, namely the visceral and structural. The visceral organs and tissues including the blood, kidney, gut, spleen, liver, caecum and heart showed a continuing decrease in radioactivity from the one hour level. On the other hand, the axial skeleton, head and opercular bones and gill arches, the skin, and the muscle appear to rapidly concentrate the strontium to a level which is maintained more or less constant over a long period of time. The turnover or excretion of strontium in these structures is therefore relatively slow. Within seven hours the distribution of the isotope is practically complete in the structural organs and comprises about 95 per cent of the total radiostrontium in the body.

Of the total activity, 10 per cent is attributable to the skin and this amount may be broken down into 4 per cent from the flesh and 6 per cent from the scales. The extremely rapid excretion of the ingested isotope, coupled with its rapid and increasing appearance in the skin suggests that the skin may be a pathway for the excretion of strontium. In order to test this hypo-

thesis we are now preparing tanks in which fish will be held so that the head will be in water containing the isotope while the tail will be in isotope-free water. Our preliminary investigations have shown that non-radioactive fish kept in tanks with contaminated fish pick up the isotope from solution, although it is not immediately clear how much excretion of the isotope takes place through the skin, gills, urine, or feces.

It is apparent from these experiments that strontium behaves differently in marine fish than in mammals and fresh water fish. The concentration and long biological half-life in the bony elements is similar in all three groups, but the turnover in other organs is considerably different.

HOWARD BOROUGHS, SIDNEY J. TOWNSLEY, AND ROBERT W. HIATT

THE PRODUCTIVITY OF THE INSHORE WATERS IN HAWAII

There are a number of suggestions in the literature that the waters immediately surrounding oceanic islands contain a higher plant and animal population than the offshore waters. Such a population increase is easily observed along the coasts of large land masses, particularly when there is an upwelling of enriched water along the shore. However, around oceanic islands it is difficult to obtain quantitative information describing the population density as a function of the distance offshore.

This paper describes the measurement of plankton photosynthesis at different distances from the shore of Oahu. This measurement is significant because the total animal and plant population ultimately depends upon the production of food materials by photosynthesis.

Photosynthesis has been measured by following the uptake of radioactive carbon by planktonic algae. The water samples come from four stations, one within Kaneohe Bay (Station 4), one just outside the bay (Station 3), and two others, Stations 2 and 1, about five and ten miles respectively from Station 3.

During the period October, 1954, to February, 1955, we observed a consistently increasing rate of photosynthesis from Stations 1 to 4; that is, from offshore to within Kaneohe Bay. The photosynthesis at Stations 1 and 2 was low (up to 0.1 milligram carbon fixed per hour per cubic meter); that at Station 2 was measurably higher at all times except one. Photosynthesis at Station 3 was in general an order of magnitude higher, and that at Station 4, within the bay, two orders higher.

The figures are for surface photosynthesis alone, and it is well known that the depth to which light penetrates in the water influences the total photosynthesis in the body of water. Our measurements of light penetration into these waters are incomplete, but are sufficient to show that the total photosynthesis at these four stations follows the same pattern of increasing as shore is approached.

The periods of highest photosynthesis at Stations 3 and 4 coincided with periods of heavy rain and lower water salinity, suggesting that runoff from the Oahu shore fertilized the Bay and nearby waters, resulting in higher algal productivity. Because of the presence of bottom dwelling algae, the total production within the Bay is higher even than our measurements indicate.

MAXWELL DOTY, R. R. GUILLARD, AND E. C. JONES

SPAWNING CYCLE, DEVELOPMENT, AND GROWTH OF THE CONVICT SURGEON FISH OR MANINI

(*Acanthurus triostegus sandvicensis*)

The acronurus or late postlarva of the manini (*Acanthurus triostegus sandvicensis*) enters tide pools from the pelagic state. It is discoid, naked, transparent with silvery abdomen, has a short digestive tract, and is armed with poisonous second dorsal, second anal, and pelvic spines. Within four to five days transformation to adult-type configuration and coloration is complete, and the digestive tract has lengthened about three times, reflecting the change-over in food habits from feeding on zooplankton to browsing on algae.

Collections of small manini from tide pools indicate that spawning in Hawaii is seasonal. The young were found from February 14 to October 5. A concurrent study of the gonads of adult fish revealed ripe females from December 1 to July 21. Duration of larval life is therefore estimated at 2½ months.

The bulk of the young enter tide pools in Hawaii during the time of new moon. Since the acronuri come into shallow water only at night, it was suspected at first that moonlight inhibited this influx and caused the fluctuation in abundance. It is now believed that some lunar factor influences the spawning of adults, resulting in the periodicity of incoming young. Of 3,641 adults examined throughout the season, 39 running ripe females were found, 35 of these from 12 days before to 2 days after the full moon.

Early development was studied following artificial fertilization of the eggs. The egg is .67 millimeter in average diameter, has a single oil globule, and floats at the surface of an aquarium. Hatching occurs in 26 hours at 24° C. As yolk is used up, the larvae show a progressive tendency to sink. They combat this by upward swimming movements. Feeding begins at the age of 5½ days. No young were maintained in an aquarium past 6½ days; however, postlarvae from 3.5 to 5 millimeters in standard length have been found among the plankton collections of the Pacific Oceanic Fishery Investigations. The most striking feature of their morphology is the extremely elongate second dorsal, second anal, and pelvic spines.

Growth of juveniles, as determined by rearing of captive fish, recovery of marked fish, and progression of modes in successive graphs of tide-pool collections, is 12 millimeters/month. It tapers off to 1.1 millimeter/month in adults 100–120 millimeters in standard length and .81 millimeter/month in 120–141 millimeters adults (growth of adults based on recovery of tagged fish). Growth of both juveniles and adults ceases during winter months.

JOHN E. RANDALL

INFLUENCE OF DIET ON THE SUSCEPTIBILITY OF DOMESTICATED DUCKS TO PARASITISM BY A MARINE TREMATODE

In North America, certain wild birds such as herring gulls and common gulls have long been known to be the definitive hosts for the marine trematode, *Parorchis acanthus* (Nicoll 1906) Nicoll 1907. In Hawaii, we have found that, instead, the definitive host of this parasite was the ruddy turnstone (*Arenaria interpres interpres*), and that several species of marine birds (Noddy terns, Sooty terns, and Wedge-tailed shearwaters), when fed exclusively with squid (*Loligo opalescens* Berry), showed 100 per cent susceptibility to infection with *P. acanthus.*

In contrast to wild birds, when domesticated birds such as chickens and ducks were maintained on a commercial poultry feed (all age mash), their resistance to *Parorchis* infection was complete.

Attempts were then made to feed squid to the chickens and ducks for a few days before and during the tests, in order to simulate the natural diet of marine birds. Only ducks were able to survive as long as three months on a squid diet. In one experiment, two young (2–4 wks.) ducks were fed with squid and two others were kept on a mash diet for control. Their susceptibility was tested by feeding each of them 150–200 cysts of *Parorchis*. When autopsied 3–4 weeks later, the squid-fed ducks proved to have the trematode infection and the mash-fed ducks had none. Similarly, in another experiment, three Pekin ducks were fed with squid and two with mash. Upon autopsy at intervals of 1 week, 1 month, and 2.5 months, again the squid-fed ducks were found to be infected with *Parorchis,* while the mash-fed ducks were uninfected.

Since *P. acanthus* was a parasite of the bird's cloaca, a bacteriological analysis of the feces of the squid-fed ducks and terns and those of mash-fed ducks was made. As far as aerobes, anaerobes, coliforms, and enterococci were concerned, the microflora appeared to be similar in all cases. However, lactobacilli were conspicuously absent from the feces of those animals fed with squid. Whether or not lactobacilli were associated with the factor or factors in determining the resistance or susceptibility of domesticated ducks to parasitism by *P. acanthus* remains unknown at present.

M. OGURI AND GEORGE W. T. C. CHU

PICTORIAL SURVEY OF THE NATIVE HAWAIIAN LANDBIRDS

Kodachrome slides, of a portrait nature, were presented to illustrate nearly all species of the native Hawaiian landbirds. Field marks and other points of difference between species were stressed, with special reference to Amadon's recent reclassification of the Drepaniidae. Present status of each species was mentioned. Mounted birds have been used as subjects of the photographs.

ROBERT L. PYLE

THE INFLUENCE OF APPLICATION OF SOLUBLE SILICATES ON PHOSPHOROUS AVAILABILITY IN CERTAIN HAWAIIAN SOILS

The rapid fixation of phosphorus in difficult available forms is a serious problem in the management of certain tropical Hawaiian soils. Many soils of the latosolic and latosol groups having a high content of hydrated sesquioxides will fix over 90 per cent of added soluble phosphorus in a heavy application of superphosphate within 24 hours after application. These soils have developed under conditions of rapid chemical weathering in which the desilication processes have decomposed all of the primary silicate and most of the secondary layered alumino-silicates. Weathering has progressed to a point where the amount of soluble silicate in the soil solution has been reduced to trace quantities. From previous work of McGeorge in the Islands, there is a suggestion that the application of soluble silicate to the soil would influence the uptake of phosphorus by plants. This study is a reinvestigation of these findings and its application to more recently acquired knowledge of the mineral composition of tropical soils.

Sodium silicate was applied to soil of the Wahiawa Family of the Low Humic Latosol Group and to the soil of the Honolua Family of the Humic Latosol Group at 0, 250, 500, 1,000, and 2,000 pounds per acre. No beneficial response in the growth of sudan grass was obtained from the application of sodium silicate to the Wahiawa soil. The Wahiawa soils are predominantly kaolin soils containing goethite and interstratified 2:1 layered alumino-silicates. The application of 1,000 pounds per acre of sodium silicate to the Honolua soil increased the yield of sudan grass threefold. The application of sodium silicate eliminated the typical phosphorus deficiency symptoms of the sudan grass.

The analysis of sudan grass grown on several latosolic and latosol soils receiving application of 500 and 1,000 pounds per acre of sodium silicate showed a direct relationship between the uptake of silicate by the plant to the concentration of phosphorus in the plant. The plants assimilated more phosphorus as the silicate intake by the plant increased. This relationship does not exist in soils having 2:1 layered alumino-silicate minerals.

G. DONALD SHERMAN, ADA C. CHU, AND CLARENCE M. SAKAMOTO

PARASITOLOGICAL STUDIES IN THE HASHEMITE KINGDOM OF JORDAN

Malaria and intestinal parasitism constitute important human health problems in Jordan. During a four months period, June to October, 1954, a study was carried out among 230 inhabitants of the village of Safut to secure further information on the efficacy of pyrimethamine (Daraprim) as a suppressant of malaria under field conditions. In this period, 110 persons were given Daraprim tablets (25 milligrams for adults and 12.5 milligrams for children under 15 years of age) once a week, and 120 other persons were given placebos once a week and served as control. Blood study for the presence of malaria among all these individuals was made at the beginning of the study, and thereafter repeated every 6 weeks. The results showed that at the beginning of the study 12 per cent of the 230 villagers showed malaria parasites (*Plasmodium vivax*) in the blood. By the end of the four months period none of the individuals who had received Daraprim developed malaria, whereas of the control group, 25 persons developed malaria. The results indicated that the individuals receiving the drug were effectively protected from malaria infection.

In addition to the above, the incidence of intestinal parasitism was determined among 125 persons from Jerusalem and 300 persons from Amman. The percentage prevalence of the most important parasites found was as follows: *Entamoeba histolytica,* 12.0 per cent in Jerusalem and 20.3 per cent in Amman; *Ascaris lumbricoides,* 77.6 per cent in Jerusalem and 51.3 per cent in Amman; *Trichuris trichiura,* 78.4 per cent in Jerusalem and 44.3 per cent in Amman. The indicated incidence of infection, especially that of the amoebas, between the two cities is not considered comparable because the survey in Jerusalem was conducted during the cooler portion of the year (April) and in Amman during the warmer months (August–October) when chance of parasite transmission is probably greater.

Of interest in the intestinal parasite survey was the apparent absence or rareness of hookworm infection. Furthermore, considering the generally poor sanitary conditions, abundance of flies during the summer months, and closeness of group and family associations characteristic of Arabic countries, the incidence of parasitism, especially that of the protozoa, is comparatively low. There is a possibility, however, that intense sunlight, drought, and dryness of the soil over several months of the year in that area present important factors in the destruction of many eggs, larvae, and cysts of the parasites.

JOSEPH E. ALICATA AND SA'EB W. DAJANI

IS MENTAL ILLNESS INHERITED?

It is widely reported that there is a specific genetic predisposition to schizophrenia and the affective disorders, both of which comprise the majority of hospitalized cases. However, a critical review of the available data fails to reveal convincing evidence of a specific genetic mode of inheritance to explain satisfactorily mental illness. This suggests the need for considerable caution in the advice we give to relatives of mental patients.

A serious shortcoming in current research into the biology of emotional breakdown may be the failure to accept a simpler hypothesis that would recognize two obvious facts, both of which are essentially environmental in origin. First, a growing child, under the unfavorable influences of living with an emotionally unstable parent, is likely to be conditioned along abnormal patterns of behavior and is subject to constant emotional trauma. The other observation, quite familiar to clinical psychiatry, is that the severity of a person's discomfort is almost invariably related directly to the degree of impact of environmental stress.

An alternate view, in keeping with clinical experience and not inconsistent with published research, would ascribe to multiple genes with additive effect, the inheritance of human general potential. The manner in which such potential is utilized, whether spent in normal adjustment or wasted in neurotic and psychotic modes of conflict, would depend upon the subtle influences of environmental pressures. The observed variability would describe a normal curve of distribution, similar to what we now accept for one aspect of this energy, namely, responses to tests of intelligence.

In the viewpoint expressed here, the personality structure is seen as responding to external stress or inner needs in a unique way. Human energy potentials are mobilized by the personality acting as an integrated whole, and the environment is likewise perceived as a total experience. There is thus created a state of delicate equilibrium between pressures, on the one hand, and a constantly changing personality structure, on the other. With shifts in this equilibrium, anxieties, tensions, and conflicts arise. Psychological mechanisms are employed to regain the subtle balance the personality seeks to maintain in effort to adjust, and indeed to survive. In this view there is little place for a fatalistic approach to mental illness.

In our fight against mental illness, research funds could profitably be invested in learning about the subtle environmental influences during the formative years.

SIDNEY L. HALPERIN

NEWER MODALITIES IN DERMATOLOGY

During recent years fantastic changes have occurred in dermatology. With the advent of penicillin the dermatologist and syphilologist lost one-half of his specialty, syphilis. No longer is the dermatologist concerned with the treatment of infestations or superficial infections. Even the eczemas are responding to the new steroids. With the changing nature of his practice, the dermatologist has explored newer methods of treating old diseases and has now entered the field of superficial remedial surgery. Two interesting developments are the use of low penetration radioactive substances and dermal abrasion.

Thorium X: This radioactive element, long used in Europe, is now available in United States and Hawaii. This element, having a half-life of 3.64 days and emitting mostly alpha particles, is useful in superficial skin conditions which respond to radiation. It is of particular value because of its limitation in effect to the epidermis and the upper portions of the dermis. As a consequence it can be used for long periods without danger of radiation sequelae. Its greatest value is in treating scattered lesions of psoriasis, some types of keratoses and warts, localized neurodermatitis, pruritis ani, and certain recalcitrant eczemas. It is one of the few modalities of some value in the treatment of the superficial birthmark, nevus flammeus.

Dermal Abrasion: One of the most exciting developments in recent years has been the introduction of abrasive methods for the treatment of acne and other scars. Early in the century Kromayer experimented with various abrasive techniques. Following World War II sandpaper was used in scar removal. More recently Kurtin introduced a method of skin planing using a rapidly revolving wire brush to plane skin frozen with ethyl chloride. This procedure can be carried out in the office surgery. This technique has its greatest value in removing the physically and psychologically devastating scars of acne. It is also of value in the removal of certain other types of scars, moles, keratoses, wrinkles, and other skin conditions.

SAMUEL D. ALLISON

RESEARCH PROGRESS IN CENTRAL AMERICA

In the region between the western frontier of Colombia and the Rio Grande, seven independent and proud nations are in business. In each the national government has recognized, to some degree, the value of research as a part of its program for economic development.

The effectiveness of research in this region seems to be associated with stability and nature of government, size of the country, physical resources, level of education, and availability of facilities for communication.

The dominant concern of certain governments is survival. In these countries, research receives little attention from national leaders, and morale among the research workers is low. Continuity of research is restricted.

In small countries, research is limited by the high cost per capita of investigation in specialized fields. This cost is magnified by the establishment of individual administrative agencies in each country which process, but do not produce, useful information. In the fields of nutrition and education, some progress has been made in decreasing costs through establishment of regional cooperative institutions.

Because of inadequate schools and colleges, the supply of trained nationals is too low to permit rapid establishment of sound research programs. The absence of trained research leaders is acute in some countries, but this problem has been solved to some extent by the establishment of United States aid programs.

Some countries are finding it difficult to get the results of applied research to the people because of poor roads and inadequate transportation. The absence of good means for interchange of research information is a serious barrier to progress.

Each nation provides a separate sample of the effects of political, sociological, and physical environment upon the effectiveness of research.

STERLING WORTMAN

WAIPIO VALLEY—AN EXAMPLE OF TODAY'S PROBLEMS IN LAND USE OF ISOLATED HAWAIIAN VALLEYS

PRESIDENTIAL ADDRESS, 1955

There are about ten valleys in the major islands of the Hawaiian chain, which in the pre-Captain Cook period supported large populations and provided food for even larger populations, that are today either totally deserted or only sparsely populated and cultivated. They all have a similarity of pattern in climate and geomorphology. They face the tradewinds (E to N to NW), annual rainfall ranges between 60 inches and 150 inches, sunlight is reduced by high precipitous valley walls and trade wind clouds. They are deeply cut into the mountain ranges with the arable valley floor lands mostly alluvial silt or clay loams of good fertility. They have an abundant firm irrigation water supply in dry seasons and in wet periods are beset with frequent devastating flash floods which pour down the 1,000- to 3,000-foot valley walls.

The total area suitable for cropping is about 1,900 acres. On the island of Hawaii the valleys of Waipio, Waimanu, Honopue, Honokane, and Pololu account for 1,500 of these acres, with Waipio the largest of 910 acres. On Molokai the valleys of Halawa, Wailau, and Pelekunu account for about 280 acres while on Kauai the valley of Kalalau and two very small ones account for 120 acres. They are all isolated from markets by normal means of transportation and all except two are entered only by steep trails or from the sea during periods of calm weather. This isolation is one of the most dominant factors in inhibiting the establishment of a rural population and the use of the lands for the production of crops requiring market outlets.

The pattern of land ownership in each valley is very similar. The major drainage of a valley is under one or two owners while the arable valley floors are a mosaic of many small individual holdings ranging in size from .1 to 4 acres each. They represent those farm and living areas of the commoners for which "Quiet Land Titles" were obtained under the Act of December 10, 1845, called the "Great Mahele." The consolidation of these many parcels into units associated with a single land class or drainage area so that the tools of modern agriculture can be used for crop production will be a monumental task of boundary surveys and purchase negotiations which, in many cases, will exceed the value of the land. This task has been compounded by changes in the courses of streams following floods. The lands of the "ahupuaa" or major valley area controlled by the chief were those on which the commoner did not obtain title, those used solely for the chief, or those which were stream beds or unused areas. These make up the foundation on which the small ownerships are laid.

The study of the land capability of Waipio as a prototype of these valleys disregarded the ownership problem. A series of Land Classes were established which had a similar pattern of soil, terrain, and factors affecting vegetative growth as evidenced by the resident vegetative communities. The economic potentials for a large number of crops suitable for each Land Class were studied with heavy weight being given to those crops which have a heavy water demand since the principle asset of the valleys is an abundance of cheap irrigation water. Crops suitable for the Land Classes and climate whose products do not demand a rapid transport to market are: taro, lotus root, ginger root, dasheen, passion fruit, macadamia nuts, and ti root for levulose. None of these crops are in "land short" supply for present existing market demands. The ti crop will be particularly suitable for these areas if success is attained in building up an agricultural industry around this plant for its levulose content because of the latitude (4 to 10 years) in harvesting the crop.

The value of the areas for tree plantations of species producing high value woods for cabinet and artifact use was examined. It is estimated that the investment per acre at harvest time would be from $700 to $900 per acre which would require a grower's stumpage percentage of 10 per cent of gross market value. Such a high percentage would be unlikely in such remote areas having exceptionally high transportation costs.

It is concluded that the lands of these valleys have little economic value at the present time because of the many problems enumerated.

COLIN G. LENNOX

PROJECT SHOWER

The general problems in cloud physics were discussed, a history of cloud physics research in Hawaii was related, and a description of "Project Shower," held from October to December, 1954, was given.

WENDELL A. MORDY, VINCENT SCHAEFER, E. J. WORKMAN, DUNCAN BLANCHARD, AND PATRICK SQUIRES

SOIL PUDDLING AND COMPACTION—AN HAWAII PROBLEM

(No abstract)

LEONARD D. BAVER

PLANT DAMAGE BY VOLCANIC FUMES

The eastern rift of Kilauea flared into activity in Puna on February 28, 1955, and continued until the middle of April. About March 6 and again about April 1 fume damage to vegetation was noted at various places within a radius of 50 miles of the source vents. Aside from the expected injury in the immediate vicinity of activity, the most severe effects were reported from Kulani and Kilauea Volcano areas, both roughly 30 miles from the source of fume and both backed by Mauna Loa. It is believed that during the two days of injury an inversion layer hung at about 6,000–7,000 feet and that fume, carried by

kona weather currents, was trapped beneath this layer against the slopes of Mauna Loa so that Kulani at 5,200 feet and Kilauea at 4,000 feet were subjected to the gas-laden haze.

Fume constituents that could have caused the observed plant injury include sulfur dioxide, sulfur trioxide, and various hydrocarbons. It is impossible to identify the destructive agent with certainty until further observations and results of gas analyses and controlled studies are available.

Plant symptoms—variously described as similar to spray burn, sun scald, or lack of water—suggest a dehydration effect characteristic of exposure to the sulfur oxides or their hydrolysis products, sulfurous and sulfuric acids. Bleaching, browning, or curling of leaf tips or margins, defoliation, and fruit and flower bud drop, in varying degrees depending on plant species and location, were reported. In all cases, with the possible exception of a fern, normal growth resumed shortly after both periods of injury.

Sugar cane received a set-back over large areas of Olaa Plantation—a set-back described as comparable to the effect of 2 weeks of severe drought. Vegetable growers in the Kilauea Volcano area were able to salvage part of their lettuce and Chinese cabbage crops by removing "burned" outer leaves; but young cucumber and zucchini plantings were damaged to the extent that the crop will be much later than expected and considerable replanting will be necessary. Volcano and Kulani Methley plum trees dropped such a high percentage of young fruit that a very poor crop is expected this year. Guava leaves became russet-colored and dropped, leaving plants almost completely defoliated. Papaya plants in the Puna district appeared more susceptible to fume than to heat radiated from the lava flows. Leaves were severely affected, but fruit ripened, though somewhat impaired as to quality. A wide range of ornamentals was injured in varying degrees, and species in this group of plants showed striking varietal susceptibility. Passion fruit vines recovered rapidly after losing new growth on terminals. Coffee and citrus trees showed little effect. The plant most outstandingly resistant was ohia lehua, which showed no detectible evidence of injury, even in the Puna area.

JULIETTE WENTWORTH, CLARENCE LYMAN, HITOSHI KAMASAKI, A. M. HIERONYMUS, ROBERT S. NEKOMOTO, AND DAVID YOUNG

NECROLOGY

RALPH J. BORDEN

Ralph J. Borden was born in Fall River, Massachusetts, on June 1, 1892. After his graduation from Massachusetts Agricultural College in 1913, he joined the faculty of Kamehameha School as athletic coach and teacher of agriculture, which position he held for the ensuing eleven years. A charter member of the Hawaiian Football Officials Association, he retained his interest in sports throughout his lifetime.

In 1922 he received his M.S. degree from the University of Hawaii. From 1925 to 1926 he was Director of Agricultural Education at the Territorial Normal School. From 1926 to 1932 he was Director of the Chilean Nitrate Educational Bureau for Hawaii.

In 1932, Mr. Borden joined the staff of the Experiment Station, Hawaiian Sugar Planters' Association, as Associate Agriculturist. In 1934 he became head of the Agricultural Department of the Station in which capacity he served with distinction for the next sixteen years. In 1950 he was appointed head of the newly established Department of Experimental Statistics, which position he held until his death.

A prodigious worker, Mr. Borden's contributions to sugar cane agriculture were impressive. In addition to carrying on his demanding administrative and research activities, he played a leading role in developing a program of training for young men preparing to join the sugar industry. Many of the present leaders in the Hawaiian sugar industry received their initial training under his guidance.

For more than ten years Mr. Borden was a member of the Board of Judges of the Honolulu Star-Bulletin School and Home Garden contests. In 1935 he served as president of the Association of Hawaiian Sugar Technologists, and in 1938–39 as Councilor of the Hawaiian Academy of Science. With his untimely death on June 8, 1954, Hawaii lost an outstanding leader in the field of agriculture.

Errata

Proceedings, 29th Annual Meeting

Page 11, paper by Poole, column 1, line 3: *for* heridity *read* heredity.

Page 16, paper by Macdonald, column 2, line 18: *for* possibly a thousand *read* possibly thousand.

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Valenciano, Santos
Van Campen, Wilvan
Van Landingham, John William
*Van Weel, Pieter
**Van Zwaluwenberg, R. H.
Vernon, Mabel D.
**Vinacke, W. Edgar
Vinacke, Winifred R.
Voorhees, George

**Wadsworth, Harold A.
Wagoner, Howard Eugene
*Walker, Hastings H.
Wallace, George C.
Wallace, Keith K.
**Waring, Gerald A.
Warner, Bernice

*Warner, John N.
Warner, H. H.
Wassman, Rudolph Carl III
Watson, Leslie J.
*Wayman, Oliver
Weaver, Herbert
Weber, Leroy D.
*Weeth, Howard J.
Weller, D. M.
Welsh, Pearl Hageman
**Wentworth, C. K.
Wentworth, Juliette
*White, J. Warren
Whiton, Nat
Wilbar, Charles L.
*Wismer, Chester A.
Withington, Paul
Wong, Arthur G. H.
Wong, Erwin L. S.
Wong, Kenneth A.
Wong, Ruth E. M.
Woodside, David H.

Yamamoto, Earl S.
Yamanaka, Leslie
Yamasaki, Yoshio
Yamashita, Daniel T.
Yamaura, Teruko S.
Yanagihara, Iichi
*Yoshioka, Tad T.
Young, Hong Yip
Yuen, Heeny
Yuen, Quan Hong

Ziesel, Edward Loeling
*Zoebisch, Oscar C.