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PROCEEDINGS HAWAIIAN ACADEMY OF SCIENCE

FOURTEENTH ANNUAL MEETING
1938-1939

BERNICE P. BISHOP MUSEUM
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1939

HAWAIIAN ACADEMY OF SCIENCE

The Hawaiian Academy of Science was organized July 23, 1925, for "the promotion of research and the diffusion of knowledge."

The sessions of the Fourteenth Annual Meeting were held in Social Science Hall, University of Hawaii, November 17 and 18, 1938, and April 27 and 28, 1939, ending with a banquet at the Pacific Club on April 29.

OFFICERS

1938-1939

President, Walter Carter
Vice-President, Harry L. Arnold
Secretary-Treasurer, Mabel Slattery
Councilor (2 years), Cyril E. Pemberton
Councilor (1 year), Willard H. Eller
Councilor (1 year), Ralph J. Borden

1939-1940

President, Harry L. Arnold
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Councilor (2 years), Carey D. Miller
Councilor (1 year), Harry Clements
Councilor (1 year), Walter Carter (ex officio)

PROGRAM OF THE FOURTEENTH ANNUAL MEETING

THURSDAY, NOVEMBER 17, 1938, 7:30 P. M.

Preliminary announcements.

Election of members.

Appointment of committees.

Presentation of papers:

E. H. Bryan, Jr.: The natural history of the Phoenix Islands.

Kenneth P. Emory: The archaeology of the Phoenix Islands.

Stanley S. Ballard, Paul L. Gow, Martin Nelson: Apparatus for the production of absorption spectra.

Chester K. Wentworth: Specific gravity of sea water near Hawaii.

Joseph F. Kunesh: Planning in Hawaii.

Gordon T. Bowles: The Determination of genetic variables in man.

FRIDAY, NOVEMBER 18, 1938, 7:30 P. M.

Lyman A. Dean: Rainfall and coffee production in the Kona district.

John H. Beaumont: An analysis of growth and yield relationships of coffee trees in the Kona district, Hawaii.

Marie C. Neal: A List of mosses and vascular plants collected on Mauna Kea, August 1935. (By title only.)

Joseph Alicata: Life cycle and control of parasites of man in Hawaii.

George C. Munro: Protection for Hawaiian birds.

Bryce M. Stewart: Evolution of social legislation in modern democracies.

THURSDAY, APRIL 27, 1939, 7:30 P. M.

Charles L. Wilbar, Jr.: Sugar cane as a source of minerals in infant feeding.

Joseph E. Alicata: The relation of diet to parasitic infection.

Christopher Hamre: Survey of hemoglobin and blood cell levels of pre-school children.

Nils P. Larsen, George Pritchard, Charles L. Wilbar, Jr., A. L. Y. Ward: Ten-year study on tooth decay among children in Hawaii.

Edwin H. Bryan, Jr.: Polynesian natural history catalogs at Bishop Museum. (By title only.)

Edwin E. McNiel: Psychopathology in Hawaii.

FRIDAY, APRIL 28, 1939, 7:30 P. M.

Harold T. Stearns: Geology of the island of Kahoolawe, Hawaii.

C. H. Edmondson: Resistance of various woods to the action of Teredo.

Howard A. Powers: Hawaiian adz materials in the Haleakala section of Hawaii National Park.

G. K. Parris: A new disease of papaya.

D. M. Weller: Some effects of colchicine on sugar cane.

Stanley S. Ballard and L. A. Dean: The characteristics of radioactive phosphorus in solutions and soils.

N. E. Winters: The program of the U. S. Soil Conservation Service.

SATURDAY, MAY 7, 1939, 6:45 P. M.

Pacific Club Banquet.

Constitutional order of business.

Installation of new officers.

Presidential address: Some observations on Tropical Agriculture and their Significance to agriculture in Hawaii.

Adjournment.

ABSTRACTS OF PAPERS

SOME OBSERVATIONS ON TROPICAL AGRICULTURE AND THEIR SIGNIFICANCE TO AGRICULTURE IN HAWAII

By

WALTER CARTER
(Presidential Address)

A brief survey of the most important crops observed during a tour of tropical areas indicates that, so far as production of tropical crops is concerned, Hawaii is neglecting agricultural possibilities. Suggestions for the inclusion of tropical crops in the Hawaiian economy are made in the following paragraphs.

Cashew nuts, cloves, black wattle, and quinine are examples of tree crops which could be incorporated into the forestation program in Hawaii. Each of these commercial products requires processing. Operations requiring labor in the production of cloves could be largely mechanized. Prospects for quinine are particularly significant. As a strategic material on which the United States is dependent from outside sources, it is becoming more and more important. Suitable forest areas could be planted to serve the purposes of forestation and at the same time create an important reserve supply of quinine within United States territory.

With the aid of central cooperatives, the growth of coconuts on many of our coastal areas might be encouraged as an additional small farmer's crop as well as an item in the reserve fruit supply of the islands. Apart from processed coconut products, the export of nuts is a neglected item.

The importations of ginger into the United States are sufficiently high to call attention to the possibilities of increasing the planting of this crop profitably.

Silk production on a mechanized basis seems to offer an ideal opportunity for Hawaii. The possibilities in silk industry have been demonstrated in California, and Hawaii has certain climatic advantages which would materially reduce costs.

There is need for a drug and chemical manufactory in the islands, which could process and market many materials which could be grown, though not in sufficient quantities at first to justify separate processing units. A unit of the Hawaii Agricultural Experiment Station devoted to the possibilities of economic agricultural chemistry might well become an important factor in the diversification program.

It has been pointed out that, with the exception of the production of

island food, any material increase in small holdings at the expense of corporate agricultural lands would ultimately lead to a lower standard of living in the islands. New crop development should be planned to fit in with our highly organized technical system of agriculture which is ideally suited to the needs of the island population because of the high grade of labor available and the opportunity it affords for the development of technical and semi-technical occupations.

(Illustrated with slides and motion pictures.)

NATURAL HISTORY OF THE PHOENIX ISLANDS

By

E. H. Bryan, Jr.

The Phoenix group, eight low, coral islands in the mid-Pacific, between 2 and 5 degrees south of the equator, are scattered over an area which measures 210 miles (E. to W.) by 120 miles (N. to S.). There is much variation in size and form, from atoll with spacious lagoon with numerous entrances to small sand flat with lagoon reduced to a shallow pool. In the order of their size the islands are:

Island	Latitude South	Longitude West	Length miles	Width miles	Lagoon type	Lagoon entrances
Canton	2° 49′	171° 43′	9.5	4.5	A*	3
Hull	4 30	172 12	6	3	A	20
Gardner	4 41	174 34	4	1.4	A	1
Enderbury	3 07	171 03	2.5	1	C	0
Sydney	4 27	171 16	2	2	B	0
Phoenix	3 42	170 42	0.8	0.6	C	0
McKean	3 37	174 07	0.6	0.6	C	0
Birnie	3 35	171 31	0.8	0.4	C	0

*A. Lagoon large and moderately deep; land a narrow rim.
B. Lagoon of moderate size and depth; wider ring of land.
C. Lagoon a shallow pond, which may nearly dry up.

None of the islands reaches a height of more than 40 feet, the average height of the rim being less than 20 feet, with lower elevations within.

The vegetation indicates that rainfall is heaviest on the three southern islands (Gardner, Hull, Sydney), on which grow trees and shrubs. The three smallest islands support only scattered herbs and low shrubs. On Canton and Enderbury there are a few patches of trees (*Cordia, Tournefortia, Morinda*), shrubs (*Scaevola, Pemphis, Sida*), and a few planted coconut palms, in addition to the low growth. Groves of coconut palms do well on Sydney and Hull, and some have been planted on Gardner. The trees and other plants on these islands are species widespread in the Pacific.

Sea birds, such as frigates, boobys, terns, tropic birds, petrels, and shearwaters, are numerous; and at times there are flocks of such migratory birds as plover, turnstones, and curlew. Rats are common on some of the islands; one species, probably of aboriginal introduction. Rabbits, abandoned by guano diggers, still survived in 1924 on Phoenix. Lizards and hermit crabs abound. Turtles come out of the sea to lay eggs. Fish and other marine life are abundant about the reefs. Insects, which are few in number of species but abundant in individuals, include roaches, silverfish, leafhoppers, plant bugs, small beetles, small moths, ants, and flies. On the wooded islands there are also large moths, butterflies, grasshoppers, crickets, and dragonflies. No mosquitoes were noted. Ground spiders are abundant, but no venomous arthropods.

"Discovered" during the first half of the 19th century, but previously known by Polynesians, these islands have been visited in turn by whalers, guano diggers, and (the southern ones) copra producers. They have been claimed by the United States and Great Britain. Canton and Hull have most value as stopping places for land and sea planes.

ARCHAEOLOGY OF THE PHOENIX ISLANDS

By

KENNETH P. EMORY

On a map of Sydney Island in the Phoenix group, made from a British Survey in 1889, ancient stone ruins are located at two places. E. H. Bryan, Jr., of Bishop Museum, photographed several of these in 1924, and several similar structures on Hull. He brought back a shell adz from Hull. The yacht *Zaca* stopped at Hull and Sydney in 1933 to enable Gordon Macgregor, returning from a Bishop Museum expedition to Rennel, to make a survey of archaeological remains. They discovered on Sydney Island a marae similar to the inland maraes of Tahiti and the Tuamotuan maraes. But the other structures, with the exception of one other marae of this kind, have not been found in Tahiti or the Tuamotus. As these maraes do not appear on Hull, though some of the other Sydney structures do appear there, it would seem that the maraes were built by the people of some visiting canoe, from the Tahitian region, which had sailed before the prevailing Trades, but that the other structures were left by a different group which settled for a time on both Hull and Sydney. The platforms, gravelike and shrinelike structures which they left, are strongly reminiscent of Caroline Islands structures and suggest that the people who left them came from that region. From the situation and condition

of the eastern Polynesian maraes on Sydney, there is a hint that they were erected after the other structures. If this be so, the other, older structures may have been left by Polynesians on their way from Micronesia into eastern Polynesia, in which case they show that the early Polynesians have greatly modified the original structures with which they were familiar, while the peoples inhabiting Micronesia have kept to the old forms.

APPARATUS FOR THE PRODUCTION OF ABSORPTION SPECTRA

By

STANLEY S. BALLARD, PAUL L. GOW, AND MARTIN E. NELSON

Apparatus has been designed and constructed for producing and photographing absorption spectra, particularly the selective absorption spectra of liquids. The apparatus consists of a light source giving a continuous spectrum, absorption tubes for holding the liquid being tested, and a spectrograph to record the spectra. For a strong continuum in the ultra violet a hydrogen discharge tube capable of standing rather high current density is recommended. Tubes of this type have been constructed and have been found to operate satisfactorily. The tubes are energized by a portable voltage unit capable of giving up to 400 milliamperes at 4,000 volts. This unit was built with funds furnished by the Hawaii Agricultural Experiment Station.

We have designed and constructed three kinds of absorption cells—simple glass tubes with quartz windows cemented on the ends and with side tubes for introducing the liquid, cells of the same sort but modified so that the length can be varied from 1 mm. to 150 mm., and glass tubes arranged so that the quartz windows are held on mechanically by caps which screw over the ends of the tube. These last cells have the advantage that no cement is used, and hence there is no danger of the liquid attacking the cement and the windows falling off. These are quite similar to the saccharimeter tubes so common in Hawaii. In fact standard saccharimeter tubes can be used, when fitted with quartz windows.

The spectrograph was constructed in the Physics Department of the University of Hawaii. Since the optical parts are of fused quartz the instrument has low resolving power, which, however, is adequate for this type of work. The spectral range from 7,000 to 2,400 angstrom units is photographed on a single ten-inch plate.

The equipment is at present being used in the determination of the vitamin A and carotene contents of Hawaiian animal and vegetable products. Many other uses for the equipment are foreseen.

SPECIFIC GRAVITY OF SEA WATER NEAR HAWAII

By

CHESTER K. WENTWORTH

Sea water generally is from 20 to 30 parts per thousand heavier than fresh water. Figures for the vicinity of Hawaii available from oceanographic studies show an average value for 27 degrees Centigrade of 1.0230, referred to fresh water at 4 degrees, in accordance with common laboratory and oceanographic practice. In order to determine the important Ghyben-Herzberg ratio which applies to basal and artesian water supplies, fresh and sea water should be compared at the mean groundwater temperature in the artesian aquifer, which is about 22 degrees. Full correction involves the thermal contraction of sea water from 27 to 22 degrees at 0.00030 per degree (+ 150), and the thermal expansion of fresh water from 4 to 22 degrees (+ 220), as well as a slight correction for the greater density of artesian water than distilled water (— 23). Result is about 1.02647.

Recently somewhat over 100 samples have been collected, mostly from rocky shores around Oahu, but 27 from ships of the Inter-Island Steam Navigation Company and other agencies. Variation between the specific gravities, corrected to 22°/22°, of shore agencies, and ship averages, is less than 0.00001. Variations from time to time, at the same points, are nearly twice as great as the variations from place to place at the same time, this apparently being due to variable mixing of shallower and deeper layers of ocean water in connection with changing wave and current conditions. Final value for the specific gravity of sea water at 22 degrees, referred to artesian water at 22 degrees, is 1.02610, with a probable error of the mean of 0.000012. This reduces the Ghyben-Herzberg ratio to 1:38.3, as compared to 1:40, or 42, or 41 2/3, used by others.

PLANNING IN HAWAII

By

JOSEPH F. KUNESH, DIRECTOR

(TERRITORIAL PLANNING BOARD)

Planning in Hawaii began as early as the year 1906 when Charles Robinson wrote "The Beautifying of Honolulu." The excellent work of the Outdoor Circle began in 1911, and in 1915 the Honolulu City Planning Com-

mission came into existence. The Shade Tree Commission, organized in 1923, has been an important factor in Honolulu's esthetic planning. The Outdoor Circle's eradication of the billboard nuisance in Honolulu constitutes one of the major accomplishments of civic planning in Hawaii.

In the City of Hilo a planning commission, organized in 1929, continued to function advisorily until 1937.

The effective work of the Highway Planning Survey of the Territorial Department of Public Works was begun in 1935.

Lewis Mumford, author of "The Culture of Cities" recently proclaimed that while Honolulu is fraught with the usual "growing pains" of a community, it is still a "malleable" city—amenable to effective long-range planning.

The Territorial Planning Board was created by legislative act in 1937. Nine members were named by the Governor, and the appointment of a planning staff of five members followed. Based on the technique developed by the National Resources Committee and 46 State Planning Boards, the methods and fields of planning in the Territory have been developed. Meetings are held monthly, including outside counties; and programs are presented and discussed. The reception of the plans by public-spirited citizens has been cordial, enthusiastic, and profitable.

Under preparation is the Board's first biennial report to the Legislature: "A Historic Inventory of the Physical, Social and Economic and Industrial Resources of the Territory of Hawaii." Acknowledgments are made to some 30 collaborators whose spontaneous and enthusiastic response has furnished a stimulus to initial stages of planning in Hawaii. A Land Planning Committee of fourteen members has been named. Implementation of other advisory committees is contemplated. The Works Progress Administration has kindly offered assistance in a 50-man project now under way.

The Territorial Planning Board is charged with duties of scheduling public works with respect to employment, and approval of major public improvements.

A much criticized source of cost of government lies in the fact that there are some 175,000 separate governments in the United States. Up to the present 1,700 town and city planning bodies have been set up, largely to consolidate efforts frequently duplicated. Hawaii now has two planning bodies and is keeping abreast of trends on the Mainland of which it is, very much, an integral part.

THE DETERMINATION OF GENETIC VARIABLES IN MAN

By

GORDON T. BOWLES

Studies in the problems of heredity in man have thus far dealt primarily with anatomical and secondarily with physiological factors. More especially they have been concerned with physical characters which are traceable to mutant variations which have been grouped together as "abnormalities."

These mutant variations are extremely varied as regards their importance to the organism as a whole. Some, such as color blindness, are comparatively trivial and are not generally ascertainable by casual external observation. The appearance of others, for example haemophilia and allergies, may be induced; while still others are continuously observable but are of minor significance. Among these may be listed dental and digital peculiarities, the occasional occurrence of "tails", partial or complete albinism, and irregularities of the ears, eyes, and hair. Finally, there are abnormalities which profoundly affect the anatomy and which are either definitely or tentatively attributed to physiological maladjustments. These include disturbances of the primary and secondary sex characters, giantism and dwarfism in its various manifestations, and many other gross abnormalities in which the entire organism undergoes continued or intermittent change.

The number of such abnormalities now totals several hundred but they are concerned with a relatively small proportion of any population and while extremely important in demonstrating the applicability of Mendelian laws to the problems of inheritance in man are otherwise of little use in dealing with inheritance in the vast majority of individuals who exhibit no such extraordinary peculiarities. To be sure, any "normal" population will individually exhibit varying degrees of metabolic and other physiological differentiation in which genetic as well as environmental factors are undoubtedly operative. The assignment of relative values to either set of factors is, however, so difficult as to render the importance of their measurement highly questionable.

It would seem more reliable to depend upon those physical characters which are affected primarily by age changes and sexual differences rather than by disturbances of a more or less pathological nature or which can be attributed even in part to environment.

These characters appear most prominently in the appendages and external organs of the head, primarily, and especially the face. They include the ears, nose, mouth, chin, and eyes in the soft parts and the bony supporting structures associated with them.

If each of these and other easily observable regions of the anatomy were to be studied in very close detail on several hundred or several thousand individuals genetically related it might be possible to determine what particular features could be determined as individual genetic variables.

Criticism of present methods lies primarily in the inadequacy of observations thus far attempted and the lack of a careful genetic approach.

RAINFALL AND COFFEE PRODUCTION IN THE KONA DISTRICT, HAWAII

By

L. A. DEAN

1. There were two distinct periods of heavy rainfall and one period of markedly light precipitation during the period 1901 to 1936.

2. The dry season occurs during the winter months and these months having low means are the ones which have uncertain rainfall.

3. Much of the variability in annual coffee production may be ascribed to fluctuations in February to June rainfall occurring during the years in which the fruiting wood was produced.

AN ANALYSIS OF GROWTH AND YIELD RELATIONSHIPS OF COFFEE TREES (COFFEA ARABICA L.) IN THE KONA DISTRICT, HAWAII

By

J. H. BEAUMONT

This study of the yield and growth measurements of two groups of coffee trees—the Akamatsu trees which are 7 years of age and relatively low in vigor and production, and the Fukuda trees which are 13 years of age and high in vigor and production—shows that, with minor exceptions, the same relationships exist in both groups. Thus it may be concluded:

1. That certain growth responses of the tree are largely dependent upon or conditioned by the size or volume of the developing crop.

2. That the volume of the crop is largely determined by the growth made in the preceding growing and crop season.

3. That a dominant weather factor, such as spring rains, may disturb these relationships as Dean (4) shows but the tree will resume its normal,

overlapping, 2-year growth-and-bearing cycle in succeeding average years.

4. That by judicious pruning and fertilization—the first of which would tend to reduce the current or immediate year's crop and both of which would tend to increase the production of vigorous fruiting wood—and perhaps by other cultural practices, such as mulching which would tend to conserve moisture, the extreme fluctuations in annual yields may be reduced and the average yield as well as the general size and vigor of the tree may be considerably increased.

A LIST OF MOSSES AND VASCULAR PLANTS COLLECTED ON MAUNA KEA, AUGUST 1935

By

MARIE C. NEAL

Plants collected August 6-20, 1935, by the Mauna Kea Expedition, which was under the auspices of the Hawaiian Academy of Science, include bacteria, algae, fungi, lichens, mosses, liverworts, ferns, and spermatophytes. The altitudinal range covered from 5,800 feet to the summit of Mauna Kea, at 13,784 feet, chiefly parts of the alpine and subalpine zones on the southern and southeastern slopes of the mountain. The mosses, ferns, and spermatophytes total 146 species and varieties. Other groups have not been studied. The altitudinal range of many species was found to be greater than previously recorded. The mosses include 36 species and varieties (23 endemic, 9 cosmopolitan, 3 from Asia and islands of the Pacific, 1 from Europe) ; 3 species of mosses are new. The ferns include 20 species (10 endemic, 6 widespread, 2 from Asia or Fiji, 2 from America). The spermatophytes include 90 species and varieties (46 endemic, 9 widespread, 7 from Australia and islands of the Pacific). These figures show endemism to be high in all three groups and, which was unexpected, highest in the mosses. The large number of families and genera and the small number of species in each genus are also to be noted in an analysis of the plants. Aside from lichens found on rocks at the very summit, the highest plant, a cosmopolitan fern, *Asplenium adiantum nigrum,* was collected at an altitude of 13,500 feet on the Summit Cone. The same species of fern was also observed at many lower altitudes.

LIFE CYCLE AND CONTROL OF PARASITES OF MAN IN HAWAII

By

JOSEPH E. ALICATA

This paper included a discussion of the following parasites of man occuring in Hawaii:

Protozoa: *Endamoeba histolytica, Plasmodium* sp. (asexual stage);
Spirochaetes: *Trepanema pallidum, Leptospira icterohaemorrhagiae;*
Nematoda: *Ascaris lumbricoides, Trichuris trichiura, Necator americanus, Strongyloides stercoralis, Enterobius vermicularis, Trichinella spiralis;*
Cestoda: *Hymenolepis nana, Taenia saginata;*
Trematoda: *Fasciola gigantica, Stellantchasmus falcatus.*

(The paper was illustrated with charts.)

PROTECTION FOR HAWAIIAN BIRDS

By

GEORGE C. MUNRO

This year the subject of protection for Hawaiian birds is amplified and cogent reasons given for such protection.

Despite publicity and appeals last year and this, showing the necessity for protection, our vanishing shore and migratory birds are on next year's open shooting list. This is due to the fact that influential persons who desire to hold shooting privileges oppose protection and the fact that the public is apathetic. Our backwardness in adequate bird protection and wastefulness in shooting the plover is evident.

Dr. R. C. L. Perkins may be quoted from Fauna Hawaiiensis (vol. 1, pt. IV, "Vertebrata" under "Aves", p. 449, 1903) to show the value of the plover and the folly of shooting it. Dr. Arthur A. Allen may be quoted from the "Book of Birds" (Nat. Geogr. Soc., 1937) to show by present day interpretation that the plover should not be a game bird.

Sugar planters are going to expense to combat the army worm and neglecting the plover which costs nothing as a means of combating the worm.

Landowners whose efforts to protect the plover have failed, will stop all shooting on their lands. A strong appeal is made to the public—naming sections, societies, and groups—to bring pressure to bear on the Fish and Game Commission to have shooting of shore and migratory birds suspended pending legislation to give them permanent protection and sanctuary. Failure to have these birds protected can be blamed only on our neglect. We cannot blame the sportsmen or the Board of Agriculture and Forestry. It will reflect on

us if the protection of Hawaii's migratory birds has to be taken up by the Federal Government.

THE EVOLUTION OF SOCIAL LEGISLATION IN MODERN DEMOCRACIES

By

BRYCE M. STEWART

Democracy has achieved a relatively high degree of freedom in expression, politics, religion and personal morality, but these liberties are conditioned by slow evolution of economic independence.

A conscious attack on this problem has been proceeding for more than a century, as is evidenced by a growing body of social legislation. Progress in the United States has been slow for stated reasons, and the present plethora of social legislation is in part a reaction to this condition.

Among the principal motivating factors is the political and economic inevitability of higher individual real incomes as population shifts from agriculture to industry, as its rate of growth declines, as mass production requires mass consumption, and depressions give rise to social discontent.

The term social legislation is restricted to labor legislation, and five classes of laws concerned with the following subjects are considered: (1) trade unions and collective bargaining; (2) working conditions and protection of wages; (3) organization of the labor market; (4) industrial and social hazards; (5) agencies for administration of labor laws.

The evolutionary pattern of each group is traced, and a tendency toward centralization in the national government is indicated. Finally, labor legislation moves into the international sphere; witness the work of the International Labor Organization.

The sporadic growth should be replaced by planned orderly progress, gauged to industry's capacity to assume the burden, with which no doubt wage earners would rest content. The alternative is violent change that will shake the social foundations.

Is the task within the powers of political and industrial leaders? Keynes finds substantial progress since the sixteenth century and asserts that, assuming no important wars and no important increase in population, the economic problem may be solved within a hundred years.

The progressive realization of higher standards in industrial relations as expressed in the policies and practices of individual employers and in labor legislation is vital to the survival of democracy and its flowering in the freedom of the human spirit.

SUGAR CANE SYRUP AS A SOURCE OF MINERALS IN INFANT FEEDING

By

CHARLES L. WILBAR, JR.

Calcium, phosphorus, iodine, and iron are the minerals most apt to be ingested in insufficient quantities by an infant. The intake of iodine is not a problem in Hawaii, as iodine is comparatively abundant here. Milk is high in calcium and phosphorus, but after the age of seven or eight months it takes nearly a quart of milk a day to meet the calcium and phosphorus requirements.

Iron is the mineral most apt to be insufficiently supplied in an infant's diet. A normal milk intake supplies only half of the infant's iron requirement. Nutritional anemia, due to an insufficient iron intake, is widespread among infants, including those on the Hawaiian sugar plantations. In 1936 a study by the Ewa Health Project on 238 babies under three years of age at Ewa and Waialua plantations showed an average hemoglobin of 62 percent. The average for children under one year of age was 59 percent.

A sugar cane syrup made from first crusher juice has been used as a carbohydrate in the infant formula for the past three years at Ewa. Analyses of this syrup show it to be a good source of calcium and a fair source of phosphorus. Other body minerals are present in liberal amounts. The important thing about the syrup is that it has a high iron content, containing about two to three milligrams of iron per 100 grams of syrup. All of this iron is in solution and in the ferrous state and should be available to the body.

The addition of sugar cane syrup to an infant's formula theoretically supplies enough iron to prevent nutritional anemia. This was substantiated clinically at Ewa by an average rise in hemoglobin of 20 percent among children under three years old during a two year period in which they were given cane syrup. A control group of children at Waialua, who received no cane syrup, still showed a marked anemia in 1938 (57 percent hemoglobin).

The sugar cane syrup is approximately 50 percent glucose, 25 percent dextrose and 25 percent levulose. It has been well digested by infants at Ewa, where practically every infant receives it.

THE RELATION OF DIET TO PARASITIC INFECTION

By

J. E. ALICATA

In recent years nutritionists have demonstrated that a diet deficient in any of the essentials (amino-acids, fatty acids, vitamins, and minerals) reduces the general vitality of the individual and breaks down the natural or acquired

resistance to infections. Parasitological studies have indicated that a proper diet decreases susceptibility to parasitic infections so that fewer parasites become established in the body of the host, and, in some instances, that those parasites which do become established are retarded in growth.

Studies on parasites of poultry by J. E. Ackert and his collaborators over a period of several years have shown that deficiency of vitamin A and, to some extent, of vitamin B lowered the resistance of chickens to roundworms (*Ascaridia galli*), so that more and larger worms were present in chickens on the deficient diet. In later work it was demonstrated that the type of amino-acid resulting from digestion in the host might influence the course of infection: the inclusion of animal protein supplements (liquid skim milk and meat meal) in a cereal ration increased the growth ratio and resistance of chickens to parasitism, whereas the inclusion of a plant protein supplement (peanut meal) in a cereal ration resulted in slower growth and greater susceptibility to infection. These results were attributed in part to the wider range of amino-acids made available in the diets containing animal protein as contrasted with the restricted range of amino-acids in the plant diet.

My recent studies confirm the above findings. Birds on a cereal diet plus animal-protein supplements develop fewer parasites than those on the same basal diet plus plant-protein supplements. Tests were conducted on the resistance of the birds to nematodes (*Ascaridia galli*) and also to tapeworm (*Hymenolepsis exigua*) infection. The results are indicated in the following tables.

Table 1.—Relation of diet to nematode (*Ascaridia galli*) infection in poultry. All birds (chicks) were fed about 1,000 infective eggs at the age of 1 month and were killed about 1 month later.

Ration		Number of birds used	Total parasites recovered	Average number of parasites per bird		Age and average weight of birds when killed	
						Age	Weight
Basal	Supplement			Mature	Immature	Weeks	Grams
Cereal	None	30	1,482	44.40	4.93	9.5	244
Cereal	Fish meal	30	309	0.30	30.00	9.5	699
Cereal-mineral	Dried skim milk	25	424	0.32	16.60	9.5	498
Cereal	Soybean; sesame meal	35	587	12.70	3.70	10.3	762
Cereal	Fish meal; dry skim milk	35	146	2.10	2.00	10.3	900

Table 2.—Relation of diet to tapeworm (*Hymenolepis exigua*) infection in poultry. All birds (chicks) fed 100 infective tapeworm larvae (cysticercoid) at the age of 3 weeks, and were killed 3 weeks later.

Ration		Number of birds used	Total parasites recovered	Average number of parasites per bird	Weight of birds when killed Grams
Basal	Supplement				
Cereal	Fish meal; dried skim milk	25	353	14.12	465
Cereal	Yeast; sesame peanut, soybean meal	25	1,640	65.6	337

A SURVEY OF HEMOGLOBIN AND BLOOD CELL LEVELS OF PRE-SCHOOL CHILDREN

By

CHRISTOPHER J. HAMRE AND KAMEHAMEHA WONG

The present study[1] was undertaken as a part of an extensive survey of blood values for normal human subjects residing in the Hawaiian islands. Since there are age differences for blood values, the results of the present study are characteristic only for children of the pre-school age. One hundred and seventy-eight children, 90 boys and 88 girls, of different races attending Castle Kindergarten and ranging in age from three to six years were examined for their blood values for hemoglobin, red blood cells, leucocytes, platelets, volume of packed red blood cells and differential leucocyte counts. The values for the corpuscular constants, mean corpuscular volume, mean corpuscular hemoglobin content and mean corpuscular hemoglobin concentrations were calculated from the values obtained for hemoglobin, red blood cells, and volume of packed cells. The extensive data so collected were submitted to statistical analysis wherever possible. The observations and conclusions derived from this study may be summarized as follows:

1. Racial differences did not occur for any of the blood values studied.
2. Age differences for the blood values of this group did not occur.
3. Sex differences for the blood values did not occur.
4. Infestations with pinworms did not influence blood values.

[1] Aided by grants from the Hawaiian Academy of Science and the Honolulu County Medical Association.

5. Significant differences for the blood picture of children above or below normal weight did not occur.
6. Social and economic status of the parents of this group of children was not reflected in the blood values for these children.
7. The mean values for the various blood elements for this group agree closely with those given for children of this age of other geographic localities.
8. The mean values for the hematological elements of this group are as follows:

Hemoglobin, 13.6 ($\pm$ 0.090) grams per 100 c.c. blood.
Erythrocytes, 4,810,000 ($\pm$ 0.03 $\times$ 10^6) per cu. mm. blood.
Leucocytes, 7,900 ($\pm$ 0.152 $\times$ 10^3) per cu. mm. blood.
Platelets, 295,000 ($\pm$ 0.759 $\times$ 10^4) per cu. mm. blood.
Volume of packed red blood cells, 40.5 ($\pm$ 0.347) percent.
Mean corpuscular volume, 84.7 ($\pm$ 0.720) cubic micra.
Mean corpscular hemoglobin, 28.5 ($\pm$ 0.231) micromicrograms.
Mean corpuscular hemoglobin concentration, 33.8 ($\pm$ 0.271) percent.

Differential leucocyte count:

Polymorphonuclear leucocytes,	38.2 ($\pm$ 0.683) percent.
Eosinophile leucocytes,	4.9 ($\pm$ 0.255) percent.
Basophile leucocytes,	0.3 ($\pm$ 0.028) percent.
Lymphocytes,	48.4 ($\pm$ 0.777) percent.
Monocytes,	4.5 ($\pm$ 0.131) percent.
"Stab" Cells,	3.7 ($\pm$ 0.321) percent.

TEN YEAR STUDY ON TOOTH DECAY AMONG CHILDREN IN HAWAII

By

NILS P. LARSEN, GEORGE PRITCHARD, CHARLES L. WILBAR, JR., A. L. Y. WARD

Review of many theories regarding the relationship of the factors "per se" in diet and tooth decay. The authors, after summarizing the literature and their own ten year observation, lean toward Bodecker's recently expressed view that there may be a group of variables of which a number of different combinations can produce caries. For correction, therefore, the defect or deficiency of the diet or environment of the place in question should be analyzed and corrections of whatever element or elements that might be missing or decreased, should be made.

A study of the children on one plantation made in 1939 after ten years of diet education, shows that 50 percent fewer teeth are decayed than ten years ago, that the size of the lesion present is very much smaller, and that rampant decay which was common ten years ago has become a rarity. A very careful family diet study was then conducted. It showed that in the "good" diet families only 19 percent of 2,258 teeth showed decay; in the "fair" diet families 27.5 percent of 3,008 teeth showed decay; and in the "poor" diet

families 47 percent of 626 teeth showed decay. These diets were analyzed in relation to the amount of fruits, vegetables, and milk to cereals, and called "good" or "poor", depending on the amount of protective foods consumed. To quote from Bodecker,

> The evidence is clearcut that dental decay is related to diet. The accumulating evidence also suggests that there is not a factor "per se" but that dental decay is the end result of various combinations of factors, several different sets of which may bring on the same end result—tooth decay.

POLYNESIAN NATURAL HISTORY CATALOGS AT BISHOP MUSEUM

By

E. H. Bryan, Jr.

As aids to taxonomic research on the plant and animal life of the oceanic Pacific region (Polynesia, Micronesia, and Melanesia) check lists with bibliographic references are available at Bernice P. Bishop Museum as follows:

Botany: A set of the bibliographic slips giving reference to species, compiled by E. D. Merrill in the course of preparing his Polynesian botanical bibliography (B. P. Bishop Mus., Bull. 144, 1937). A card catalog of all specimens in the Museum's herbarium. A card catalog of Hawaiian names of plants with their scientific equivalents.

Entomology: A card catalog of insects recorded from the whole area, one set arranged alphabetically by genus and species, a duplicate set arranged systematically by insect groups, and the same data arranged systematically by Pacific island groups. Check lists of 16 insect groups have been revised by specialists and published by the Museum.

Malacology: A card catalog of the land shells of Polynesia, Micronesia, Fiji, and the New Hebrides, giving bibliographic references, synonymy, geographical distribution, and notes concerning type specimens where these have been studied.

Ichthyology: Fishes of Oceania and its two supplements, by Henry W. Fowler, have been published (B. P. Bishop Mus., Mems. 10, 1928; 11 (5, 6), 1931, 1935).

Ornithology: A manuscript check list, with bibliography and distribution, of the birds recorded from the whole region.

Other zoology: A partial card catalog of bats, and the commencement of a manuscript list of land reptiles.

Ethnology: A file of photographs of important Polynesian specimens in other collections, together with notes regarding these, is being assembled.

The cooperation of persons working on any phase of natural history in the oceanic Pacific is sought.

PSYCHOPATHOLOGY IN HAWAII

By

EDWIN E. MCNIEL

Psychopathology is concerned with unusual thinking and feeling processes. In this paper an attempt is made to discuss psychopathology as the author has found it in the Territory of Hawaii.

The unusual geographical situation and subtropical setting of Hawaii have contributed to a series of conflicts which many newcomers and some old timers experience. The pioneering situation of the islands has enticed residents who may have been dissatisfied in their previous locale or who enjoy pioneering. The author feels that many of the so-called "bugaboos of the tropics" are overestimated and that many of the difficulties are primarily based on suggestion.

While Hawaiian folklore and religious practices have given much to the culture of the islands, they also have contributed a good deal to the psychopathological patterns found in mental patients, even formed a basis for strong suggestion, and occasionally have added to the emotional discomfort of some island residents.

Many of the interesting psychopathological problems in Hawaii arise on the basis of the various racial groups. Inter-racial marriages occasionally evidence some instability in one of the marital partners, and they may add to some of the emotional insecurity in the children. In the second and third generation of Japanese children in Hawaii we see a breaking up of old Japanese family customs and patterns. There is a tendency on the part of the children to emancipate themselves from parental authority. While some of these trends are in a healthy direction, others contribute to psychopathology and the development of definite emotional and mental disabilities.

From the standpoint of the sex life in the general community, probably the most unhealthy condition that exists is the large number of unmarried males in comparison with the small number of unmarried females.

GEOLOGIC HISTORY OF THE ISLAND OF KAHOOLAWE, HAWAII[2]

By

HAROLD T. STEARNS

Kahoolawe Island is an eroded volcano 1,491 feet high 94 miles southeast of Honolulu. The important stages in the geologic history follow.

LATE TERTIARY (?) AND EARLY PLEISTOCENE (?) TIME

1. Building of a shield-shaped volcano consisting of basalt flows and a few thin beds of vitric tuff about 1,500 feet high in relation to present sea level over rifts trending east, north, and southwest. Typical olivine, olivine-feldspar, and olivine-free basalts of the Kilauean type were poured out as thin pahoehoe and aa flows chiefly from the southwest rift.

2. A caldera about 3 miles in diameter and more than 800 feet deep formed by collapse at the summit. The southwest rift likewise collapsed, forming a graben about 1 mile wide bounded by échelon fault scarps. Outpouring of lava continued during this stage.

3. Progressive decrease in the rate of collapse with the result that lavas pouring out from the central crater and from the rifts finally buried completely the caldera and the southwest rift-zone graben. These lavas gradually differentiated into a slightly more silicious type containing olivine and pyroxene phenocrysts.

4. Cessation of volcanism, followed by a long period of weathering and erosion. A drainage pattern was established but erosion proceeded slowly because the island is sheltered by Maui from prevailing winds and has a relatively light rainfall. Cliffs formed along the east and south shores, which are exposed to strong wave action.

PLEISTOCENE TIME

5. Submergence of an unknown but large amount, drowning the mouths of the valleys and causing their floors to be alluviated. It culminated at a shore line at least 800 feet above present sea level, as is shown by the stripping of the soil from slopes below that level.

6. Gradual emergence of at least 800 feet. It is likely that during this time the island was subjected to a complicated series of submergence and emergence similar to those on the islands of Maui and Lanai, but here no marine deposits record these changes. Waves cut into the east side of the lava-filled caldera.

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[2] Published by permission of the Director, Geological Survey, United States Department of the Interior.

RECENT TIME

7. Five eruptions on the face of the cliff in Kanapou Bay, mostly along ancient faults of the old caldera. In places the cinders and thin sheets of lava rest upon gravel and talus. One of these eruptions was unique in that pumice was intruded into gravel. The eruptions were probably concurrent with the Recent eruptions on Haleakala.

8. Live stock introduced about 150 years ago destroyed the vegetation, so that the wind has stripped off practically all the soil down to bedrock over the entire summit of the island. Loess is still being deposited on the west slope of the island.

THE RESISTANCE OF WOODS TO THE ACTION OF TEREDO

By

C. H. EDMONDSON

In the course of my work on the shipworms of Hawaii, six stations have been established about Oahu—one in Hanauma Bay, one on Waikiki reef, one in the Ala Wai Canal, one in Pearl Harbor, and two in Kaneohe Bay. Seven species of shipworms have been recognized: *Teredo bartschi,* prevailing in Kaneohe Bay and in Pearl Harbor; *T. affinis,* in Hanauma Bay, on Waikiki reef, in Ala Wai Canal, and also observed in Kaneohe Bay; *T. parksi,* widely distributed about the island; *T. diegensis,* occasionally seen at several stations; *T. trulliformis,* seen but once, in Ala Wai Canal; *T. gregoryi,* observed in Kaneohe Bay and on Waikiki reef, and an undetermined species of *Bankia* frequently seen on Waikiki reef. The two most destructive shipworms at the stations under observation are *T. bartschi* and *T. affinis.*

Test blocks of more than 20 woods were employed and their resistance to *Teredo* noted. Results separate the woods into two groups; first, those offering little resistance to the shipworm and second, those offering a fair degree of resistance. In the first group are fir, cedar, maple, koa, kou, milo, guava, monkeypod, mokihana, silk oak, red lauan and white lauan. In the second group are redwood, kamani, ohia, eucalyptus, kauila, hau, ulei, primavera, Wolmanized wood, and Masonite composition.

Woods of the first group are usually heavily attacked in 60 to 90 days. Four of the second group, kauila, hau, ulei, and primavera have shown a high degree of resistance.

Narrow copper bands placed one half inch apart are very effective in stopping *Teredo,* for periods of a few months. Zinc bands placed in a similar

manner possess no such merit. Antifouling paints repel *Teredo* in highly infested waters for periods of at least 8 months.

An untreated fir pile employed in construction at Midway Island by the United States Army was heavily infested in 9 months by *Teredo diegensis* and was also attacked by a large form, probably *Teredo gregoryi* Bartsch.

HAWAIIAN ADZ MATERIALS IN THE HALEAKALA SECTION OF HAWAII NATIONAL PARK

By

HOWARD A. POWERS
(ACTING DISTRICT RANGER)

The quarries and workshops of Hawaiian adz makers found on Haleakala are located along a small section of the northwest rim of the crater-rift between the old Rest House and Kilohana. The quarries are all on the inner cliff slope of the rim which exposes the numerous flows of lava which make up the upper part of the volcano. The workshops are more numerous and more scattered—some are on the inner slope near the quarries, others are on the outer slope of the volcano located in or near sheltered spots or caves which offered some protection from the elements.

The rock used for adz-making is compact, fine-grained lava which chips very readily under a sharp blow. It is very brittle, and many partly-shaped adz blanks are found discarded because they broke in the wrong place. In contrast, the stones used for hammers in shaping the adzes are always of tough, porous rock which shatters less readily. Most of the hammer stones were carried in by the workmen; some from deposits of stream gravel lower on the mountain; and some even from the sea beaches, as many of the hammers show remnants of the smooth rounded surface typical only of wave-rounded cobble stones.

Microscopic study of thin sections of the adz rocks shows that all of the Haleakala material is from the same lava formation, an unusual rock which contains mica. This material is easily distinguished from the rock of the Mauna Kea adz quarries.

A NEW DISEASE OF PAPAYA

By

G. K. PARRIS

A disease of papaya (*Carica papaya*) new to the Territory of Hawaii was first seen in July 1937. It apparently is confined to Oahu and has caused losses of 6 to 30 percent at Lualualei, Waialua, and Poamoho.

Affected plants are badly stunted, and the foliage is yellowed with leaves crinkled and distorted. There is little necrosis except of the edges of very young leaves and of the interveinal regions of older leaves. The petioles of diseased leaves are characteristically bent downward at the point of attachment, whereas healthy leaves are borne on petioles which leave the stem at an angle at or above the horizontal. Usually only the upper two thirds of a tree shows symptoms. Diseased leaves abscise rapidly, and finally only a few small distorted leaves remain at the top of the plant; leaves formed prior to symptom development persist as a fringe around the lower third of the plant. In severe infections the plant may die.

On the petioles and main trunk of a diseased tree are linear, darker green than normal, slightly raised, hydrotic-like streaks. Streaks are 1/8 to 1 inch long by 1/32 to 3/8 inch wide. Streaking may or may not proceed other symptoms.

Fruits formed on diseased trees are distorted and occasionally "bleed" profusely; their taste is insipid and undesirable.

Juice inoculations from diseased plants to healthy plants, using carborundum as an abrasive, have given better than 75 percent transmission. The disease would, therefore, appear to be of the nature of a virus, though in some respects the disease does not show the reactions expected of a virus. When a diseased plant is decapitated, or when death of the growing point occurs naturally, new growth develops from lower portions of the stem. This new growth (one to eight shoots per tree) has in almost all instances remained healthy. The virus cannot be obtained from these symptomless shoots.

SOME EFFECTS OF COLCHICINE ON SUGAR CANE

By

D. M. WELLER

A new method of inducing polypoidy in plants, now successfully used with many varieties, promises to become a useful tool in the hands of the geneticist. This method consists of the simple expedient of applying the alkaloid drug colchicine[3] to growing points, buds, ends of stumps of cut-off branches or shoots, or to seeds of plants under treatment with the result that plants developing after such treatment may be vegetatively larger in size and more vigorous than the parent plants, just as are (and for the same reason) polypoid hybrids produced by Mendelian crossing. Flowers (and fruit) of such plants may be larger than normal and, in addition to the normal pollen grains, produce others of considerably larger size. Increase in size of pollen grains and of stomata may be taken as indications of an increase in the number of chromosomes in the nuclei of such plants, which may be used to advantage in crosses with other plants by the usual Mendelian method. Also colchicine may induce fertility in sterile hybrids produced by the classical method. Plants produced by this non-Mendelian method of plant breeding may be propagated by cuttings, their improved characteristics and increased chromosome numbers remaining constant throughout succeeding generations.

Several thousand sugar-cane seedlings developing from colchicine-treated seeds of some 50 hybrids within the genus *Saccharum* showed various effects. Below the lethal treatment, which differed for different varieties, stimulation or depression of growth resulted according to concentration of solutions and duration of treatment. Shoots developing after treatments with high concentrations were short, broad, globose, or differed little in external appearance from the normal. Cytological studies of such seedlings showed the cells of their coleoptiles and growing points to contain lobed nuclei or multi-nuclei. Division figures exhibited abnormal spindles and increased numbers of chromosomes staining more deeply than normally.

Very young buds near the growing points of stalks of mature cane developed into shoots differing vegetatively (thickness and hairiness of leaf) from the parent plant. Flowers of such shoots produced pollen grains six to eight times the size of the normal pollen grains. Such referred effects may be quite as practicable and valuable to the plant breeders as direct effects.
(Illustrated with demonstration material and projected photomicrographs.)

[3] According to R. A. Gortner colchicine (C_{22} H_{25} NO_6) is not an alkaloid drug. It is obtained from the autumn crocus, *Colchicum autumnale* and was once used as medicine for gout.

THE CHARACTERISTICS OF RADIOACTIVE PHOSPHORUS IN SOLUTIONS AND SOILS

By

STANLEY S. BALLARD AND L. A. DEAN

Phosphate fertilizer problems are being studied by the use of "tracer" phosphorus atoms rendered radioactive by bombardment with high speed deuterons in the cyclotron of E. O. Lawrence. Since these atoms are chemically identical with ordinary phosphorus atoms, they undergo the usual reactions in soils and plant materials. However, their unusual physical property of ejecting high speed electrons allows their progress through the soil and into the plant to be followed by sensitive electrical instruments.

Preliminary experiments have dealt chiefly with the development of a technique for measuring with a Lauritsen electroscope the radioactivity of the "labelled" phosphorus when in soils, solutions, and plant material ash. With constant concentration of phosphorus and depth of material, the measured radioactivity was found to vary linearly with the free surface area of the soil or solution being tested, so long as this area was smaller than that of the electroscope chamber. With constant concentration and area but varying amount of material, the measured radioactivity did not increase for depths greater than 15 mm., due to the absorption of the electrons emanating from the lower levels. With constant dimensions but varying dilution, the measured radioactivity of solutions was linearly proportional to the concentration of radio phosphorus. The approximate average error of such measurements was 1 percent for solutions and 3 percent for soils.

A relation between phosphorus sorption and soil particle size was indicated, the phosphorus appearing to go preferentially to the smaller particles of a heterogeneous soil. The rate of sorption and the total phosphate-fixing power of a soil could be tested readily, and they were determined for several soils.

A series of 26 observations, extending over a period of six weeks, was made on the strength of a certain test sample of phosphorus. As a result, the half-life period of the radioactive phosphorus was computed to be 14.3 days. This value is in good agreement with values quoted in the literature.

This work was made possible only through the generous gift by the Radiation Laboratory of the University of California of a sample of radio phosphorus. This gift and the encouragement and cooperation of Dr. John H. Lawrence are gratefully acknowledged.

THE PROGRAM OF THE UNITED STATES SOIL CONSERVATION SERVICE

By

N. E. WINTERS

The total land area of the continental United States is about 1,903,000,000 acres. About 415,000,000 acres have been placed under cultivation for the production of crops. About 161,000,000 acres of the plowed area, or 39 percent, is suitable for cultivation under present practices. About 254,000,000 acres or 61 percent is not suitable to be continued in cultivation under present practices. It is estimated that an additional area of land suitable for cultivation under present practices could be utilized, including something over 21,000,000 acres of plowable pasture land; about 20,000,000 acres now in brush and timber; 6,500,000 acres of wet land that can be drained; 3,000,000 acres that can be irrigated; or a total of something over 50,000,000 acres, making a grand total area suitable for cultivation under present practices of nearly 212,000,000 acres.

About 18 percent of the crop land or approximately 76,000,000 acres is not suitable to continue under cultivation under prevailing economic conditions, even with the best conservation practices known.

LAND SUITABLE FOR CULTIVATION UNDER BEST SOIL CONSERVATION PRACTICES

Now in cultivation	339,079,482
Plowable pasture	52,722,676
In brush and timber	42,151,544
In need of drainage	7,663,821
In need of irrigation	5,848,729
Total	447,466,252

EROSION PROBLEM FOR THE CONTINENTAL UNITED STATES

Of the 339,079,482 acres now classified as good crop land, 178,000,000 acres, or 52 percent is eroded very seriously, while only 161,000,000 acres, or less than one half, can be continued in cultivation indefinitely under present practices without serious erosion injury.

In 1934, a nation wide erosion survey showed that 100,000,000 acres of our cultivated fields have now lost practically all of their top soil, and a large percentage of the top soil is gone from another 125,000,000 acres, or in other words, over 75 percent of the rich top soil is gone from 225,000,000 acres. Fifty-seven million acres of our cultivated fields have been practically

destroyed by erosion from either wind or water or both; many of them in frequent gullies, with much of the sub-soil washed away. This does not count the 145,000,000 acres in mesas, canyons and bad lands on which man cannot do much about the problem.

In the continental United States, including cultivated land, pasture, wood lots, brush, and timber, we have a total of about 1,000,000 acres in farms, and with the installation of the best conservation practices known, we have a total of over 447,000,000 acres suitable for cultivation after retiring permanently from cultivation, the 76,000,000 acres that is absolutely unsuited for the production of cultivated crops. We have about 750,000,000 acres in all kinds of pastures and of this area 165,000,000 acres of grass lands have been devastated by erosion. The serious erosion that is now occuring on 176,000,000 acres of our cultivated areas can be controlled by practices that have been demonstrated to be economical and feasible by owners and operators.

Practical Methods of Procedure in Erosion Control

Some of the field practices that will help in the conservation of soil and water are:

1, adaptable crop rotations
2, contour farming
3, erosion resistant strip crops
4, terracing
5, protection of lands, grass lands, and crop residues from fire
6, use of cover crops for erosion control, pasture, and soil organic matter
7, improvement of our pastures by controlled grazing and other methods
8, retirement of undesirable crop land from cultivation and rededication of the same to less intensive but profitable uses
9, economic control of gullies in our fields and pastures by means of water diversion, vegetative plantings and mechanical methods
10, installation of farm ponds to provide water facilities for live stock, supplemental irrigation and other useful purposes

The Enlarged Functions of the Service

In addition to these practical methods of conserving the basic soil and water resources, the Department of Agriculture has placed upon the Soil Conservation Service the responsibility for the improvement of physical land use programs to involve the participation in the operation of agricultural lands, including not only erosion control, but also the following: Sub-marginal land purchases and the development of the same, formerly administered by the Bureau of Agricultural Economics, under Title 3 of the Bankhead-Jones

Farm Tenancy Act of 1937; the agricultural phase of flood control under the Flood Control Act of 1936, to plan and carry out further protection measures with a view to reducing hazards of flood to human life and property, and damage to stream channels, reservoirs, harbors and ditches by deposits of eroded material. Also under the Water Facilities Act of 1937, assistance is given to farmers and ranchers in the improvement and development of farm and range and water supplies in the arid and semi-arid areas, with a view to promoting the better use of land and advancing human welfare (for the present, this program is limited to 17 western States); the farm forestry program of the Cooperative Farm Forestry Act of 1937, in which it is our duty to further the program of farm forestry in agriculture with a view to conserving soil and water resources, improving farm income and aiding in the establishment of sound and economical land-use methods; drainage and irrigation, under the Agricultural Appropriations Act of 1932, and subsequent appropriation acts, formerly administered by the Bureau of Agricultural Engineering. In this phase of the program, the objective is to develop efficient and economical methods of draining and irrigating agricultural lands with a view to promoting better land use.

The basic problem of the Soil Conservation Service is to aid in bringing about better physical adjustments in land use with a view to bettering human welfare, conserving natural resources, establishing a permanent and balanced agriculture, and reducing the hazards of flood and siltation. While the program covers several lines of action, they all have a common ultimate goal of better land use, better life for the people living on the land, and the protection of public welfare through the conservation of our soil, the control of rainfall, flood control, and prevention of the destruction of expensive reservoirs and navigable streams through siltation and sedimentation.

(The above lecture was illustrated by lantern slides showing actual erosion conditions and methods of control.)

NECROLOGY

Reverend William D. Westervelt, author of historical papers and leader in the civic life of Honolulu, died March 9, 1939, at the age of 89.

He was born in Oberlin, Ohio, December 26, 1849; studied for the ministry, and was graduated from Oberlin College, B.A. 1871, B.D. 1874.

He was the pastor of churches in Cleveland, Ohio, Morristown, N. Y., Denver, Colorado, and Chicago, Illinois. He came to Hawaii in 1889 to devote two years to missionary work, and returned ten years later to make the islands his home.

In addition to taking an active interest in civic welfare in Hawaii, he devoted much time to historical research, and was the author of several books and numerous articles on the history and legends of Hawaii. He was one of the world's great stamp collectors. During the World War he engaged in draft and relief work.

He was a member of numerous scientific, historical, civic, and fraternal organizations, in all of which he took an active part. He held charter membership in the Hawaiian Academy of Science.

Bruce Cartwright, Jr., Honolulu business executive, whose avocations included Polynesian history and ethnology, died in Honolulu, March 11, 1939.

He was born in Honolulu, January 22, 1882, the third generation of Cartwrights prominent in the business life of Hawaii. His grandfather, Alexander Joy Cartwright, came to Hawaii from Nantucket, by way of California, during the period of the gold rush; he became a close friend of royalty, built up a business, and helped to found many public institutions.

Bruce Cartwright was educated at Punahou and military academies in California, and received the degree of Ph.B. from Sheffield Scientific School, Yale University, in 1905.

His work in Honolulu included engineering activities for the U. S. Navy at Pearl Harbor, and estate and insurance business. During the World War he served as a captain in the motor transport corps, U. S. Army; and later he held reserve commissions in both the army and navy.

Mr. Cartwright had many interests and devoted much time to civic enterprise. He was a commissioner of the Hawaii Board of Agriculture and Forestry, a trustee of the Library of Hawaii and the Queen Emma Estate, Associate in Ethnology with Bernice P. Bishop Museum, a leader in the Hawaiian Historical Society and Hawaii Volcano Research Association, and a member of many civic and fraternal organizations. He was an authority on postage stamps and coins, was a member of scientific expeditions to the main and outlying Hawaiian islands and Samoa, and wrote several papers on scientific subjects.

Charles Sheldon Judd, for many years chief forester of the Territory, died June 29, 1939, at the age of 58. Born in Honolulu on July 11, 1881, he was the grandson of Dr. G. P. Judd, one of the first American physicians in Hawaii, a noted statesman of the old monarchy.

After graduating from Punahou Mr. Judd attended Yale University, taking his Bachelor of Arts degree in 1905 and becoming Master of Forestry in 1907. After four years in the United States forest service, principally in Washington and Oregon, in which he rose to the position of assistant district

forester, he returned to Honolulu to become land commissioner for the territory. In January 1915 he was appointed territorial forester, the position he held until his death.

In addition to his governmental duties, Mr. Judd taught forestry at the University of Hawaii, and wrote extensively on Hawaiian forestry and forest problems. He was a member of the Bishop Museum expeditions to the Hawaiian Islands Bird Reservation in 1923, and was a member of the Academy of Science since the year of its organization.

David LeRoy Topping, a charter member of the Hawaiian Academy of Science, was born in the village of North Harpersfield, N. Y., on November 2, 1861, and died in Honolulu on July 29, 1939. A life long natural history enthusiast, he was particularly devoted to hiking and botany and had collected extensively in various parts of the world. He specialized in ferns and fern allies but by no means limited his collecting to these groups, as is evidenced by his varied contributions to many scientific institutions. He came to Hawaii to live in 1922 after twenty years of Government service in the Philippines, and most of his work was done in these two regions. Other places where he made noteworthy collections were the environs of Washington, D.C., upper New York State, North Borneo, Siberia, Japan, China, and India. He is survived by two brothers, both residents of New York State.

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Dougan, C. Alvin

Edmondson, C. H.
Egler, Frank E.
Eguchi, George
Ehrhorn, E. M.
Elbert, Samuel H.
Eller, Willard H.
Ely, Charles
Emory, Kenneth P.
Engard, Charles J.
Enright, James R.
Erwin, Ada B.

Farden, Carl A.
Faus, R. B.
Feldwisch, W. F.
Fennel, E. A.
Field, Harry P.
Ford, A. H.
Foster, Z. C.
Fronk, C. E.
Fujimoto, Giichi
Fukunaga, Edward T.
Fullaway, D. T.
Furer, W. C.

Gantt, Paul A.
Giacometti, G.
Gilbert, James
Gordon, Alta
Goto, Y. B.
Gotschalk, H. C.
Gow, Paul
Gregory, H. E.

Hadden, F. C.
Hammond, W. H.
Hamre, Christopher J.
Hance, F. B.
Handy, E. S. C.
Harker, E. L.
Harne, de Maurice A.
Harry, John V.
Hartt, Constance E.
Hartung, Marguerite
Hashimoto, I.
Henke, Louis A.
Hirashima, Bert
Holdaway, F. G.
Holmes, Henry
Holmes, W. G.
Hosaka, Edward Y.
Howe, Jane G.
Hoy, Elvin A.
Hoy, Ruth
Hutchinson, A. E.

Illingworth, J. F.
Ito, Kiyoshi

Jackson, Dean C.
Jaggar, T. A., Jr.
Jensen, Jorgen P.
Johnson, Horace
Johnson, June
Jones, Winston W.
Jordan, A. E.
Joy, A. B.
Judd, Albert F.

Katsuki, I.
Keck, C. B.
Keesing, Felix
Keller, Arthur R.
Kerns, Kenneth R.
Kikuta, Kazuo
King, Norman
Koehler, Lucy J.
Krauss, Beatrice H.
Krauss, F. G.

Krauss, W. W.
Kunesh, Joseph

Lam, Margaret
Lam, Robert L.
Lamb, Alvin R.
Larrabee, L. M.
Larsen, N. P.
Lee, Richard K. C.
Lee, Robert
Lennox, Colin G.
Ley, Gaston J.
Libbey, Valentine B.
Linford, Maurice B.
Livesay, T. M.
Loomis, Chas. F.
Louis, James L.
Louis, Lucille
Love, Russell
Lyon, H. L.
Lyon, H. L., Mrs.

Manglesdorf, A. J.
Martin, Joseph P.
Mason, Arthur C.
Mau, Kong Tong
McAllep, Will R.
McBride, O. C.
McCalla, Mary D.
McGuire, Thos. R. L.
McHenry, Jack
McKay, William
McNiel, Edwin E.
McPhail, M.
McVeagh, Thomas C.
Meinecke, Joseph B.
Meinecke, William H.
Meyer, H. A.
Michener, H. D.
Millard, Robert
Miller, C. D.
Miller, Milton A.
Mitchell, Donald
Moltzau, Ralph H.
Moomaw, Ben F., Jr.
Morgan, Edward
Moss, L. C.
Munro, George C.

Nakamoto, G.
Neal, Marie C.
Nelson, Frances
Nelson, Martin
Nieman, Helen E.
Nikaido, Raymond
Nightingale, G. T.
Northwood, J. d'A.

Okimoto, Marion C.
Okubo, Shigeo
Oliveira, Juliette M.
Olson, Gustaf W.
Ostergaard, Jens

Palmer, H. S.
Parker, H. P.
Parris, G. Keith
Patton, E. K.
Payne, H.
Pemberton, C. E.
Penn, Ray E.
Phillips, L. G.
Phillips, Vance
Pinkerton, F. J.
Potgieter, Martha
Potter, Colin
Powers, Howard A.
Pritchard, George P. J.

Ripperton, J. C.
Runyan, Mabel
Ryerson, Martha S.

Sakimura, Kay
Satterthwaite, Ann Y.
Schmidt, Carl T.
Schmidt, Helen D.
Shellhorn, Katherine
Sideris, C. P.
Simmons, W. L.
Sinclair, Gregg M.
Slattery, Mabel
Smith, Leslie R.
Smith, Madorah E.
Smith, Ronald Q.
Spalding, P. E.
Spiegelberg, Carl H.
Stearns, Harold T.
St. John, Harold
Stokes, J. F. G.
Storey, W. B.
Street, Alison Watt
Suehiro, Amy
Suzuki, Francis T.
Swezey, O. H.

Takahashi, Tokue
Tam, Richard K.
Tilden, Irvin L.
Tinker, Spencer
Titcomb, Margaret
Tower, B. A.

Vaksvik, Knute N.
Van Zwaluwenburg, R. H.
Vernon, Mabel D.
Voorhees, George

Wadsworth, Harold A.
Waesche, Hugh H.
Wakabayashi, S.
Wall, Garton E.
Ward, Andrew Lee Yates
Warner, H. H.
Webster, James N. P.
Weidman, Arah
Weinrich, William
Welch, J. E.
Weller, D. M.
Welty, E.
Wentworth, Chester K.
Wentworth, Edna C.
West, R. T.
Wicke, Henry
Wilbar, Chas.
Wilder, Stuart G.
Willard, H. F.
Williams, F. X.
Williams, John N. S.
Wilson, Walter J. L.
Wingate, E. G.
Winchell, Horace
Winstedt, Ruth M.
Winter, William
Winters, Mary E.
Winters, N. E.
Withington, Paul
Work, Samuel H.

Yang, Y. C.
Yap, Francis T. C.
Yee, Phillip K. H.
Yoshida, Ruth K.
Young, H. Y.

Zimmerman, E. C.