

**PROCEEDINGS OF THE  
HAWAIIAN ACADEMY OF SCIENCE . . .**

**TWENTY-FIFTH ANNUAL MEETING . . . . . 1949-1950**

**Published by the University of Hawaii**

**Honolulu, T. H., 1950**

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THE HAWAIIAN ACADEMY OF SCIENCE WAS ORGANIZED JULY 23, 1925, FOR  
"THE PROMOTION OF RESEARCH AND THE DIFFUSION OF KNOWLEDGE"

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## FOREWORD

The year began with a membership of 288; 22 new members were elected, 4 members resigned, and 2 died during the year, leaving a membership of 304.

The Academy made a financial contribution toward a fund to make possible a series of lectures in Honolulu by Dr. Hans Pettersson, distinguished oceanographer and leader of the expedition around the world on the Swedish research ship "Albatross."

A special meeting was planned for the evening of April 5, 1950, to hear Dr. L. G. N. Baas Becking, head of the Research Council of the South Pacific Commission, but had to be cancelled.

Dr. Herbert E. Gregory was appointed a delegate to represent the Academy at the 7th International Botanical Congress, Stockholm, Sweden, July 12 to 20, 1950, and at the 6th International Congress of the History of Science, Amsterdam, Holland, August 14 to 20, 1950.

A questionnaire was circulated and card catalogue compiled of the scientific skills and interests of the members of the Academy. The cards were classified into some 50 categories for ready reference.

Nearly half of the members of the Academy are listed in the latest (1949) issue of *American Men of Science*.

In this volume of its *Proceedings* the Hawaiian Academy of Science presents the program and abstracts of papers presented at the Fall and Spring sessions of the twenty-fifth annual meeting. As in many years past, meetings, including the annual dinner and business meeting, were held at the University of Hawaii.

## OFFICERS

### 1949-1950

President, Robert W. Hiatt  
Vice-President, E. C. Auchter  
Secretary-Treasurer, E. H. Bryan, Jr.

Councilor (2 years), A. J. Mangelsdorf  
Councilor (1 year), G. Donald Sherman  
Councilor (1 year), John H. Payne (ex officio)

### 1950-1951

President, E. C. Auchter  
Vice-President, L. D. Baver  
Secretary-Treasurer, E. H. Bryan, Jr.

Councilor (2 years), Harry L. Arnold, Jr.  
Councilor (1 year), A. J. Mangelsdorf  
Councilor (1 year), Robert W. Hiatt (ex officio)

# THE 25th ANNUAL MEETING 1949-50

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## Program

NOVEMBER 17, 1949

- Harry L. Arnold, Jr., and David D. Bonnet: "Swimmers' Itch": Its First Appearance in Hawaii.  
Doris Springer: Awareness of Racial Differences by Preschool Children in Hawaii.  
W. Edgar Vinacke and Nathalie Van Order Smith: Responses to Humorous Stimuli of Caucasian, Japanese, and Chinese Students.  
Leonard Mason: Cultural Adaptation of the Bikini Islanders to a New Environment.

NOVEMBER 18, 1949

- Chester K. Wentworth: How Far and How Rapidly Should Man Change His Natural Environment?  
G. Donald Sherman: Genesis and Morphology of the Hawaiian Laterite Crusts.  
Constance E. Hartt: The Assimilation of Radioactive Carbon Dioxide by Leaves of the Sugar Cane Plant.  
R. L. Metcalf: Resistance of Insects to Insecticide Action. (Paper by Invitation.)

APRIL 27, 1950

- David T. Fullaway: *Apanteles* in Hawaii.  
Calvin W. Schwabe: Manson's Eyeworm in Hawaii.  
Carey D. Miller, Adelia Bauer, and Mildred Higa: Enamel Erosive Properties of Fruit and Fruit Juices.  
E. S. C. Handy: Genethnics, a New Technique for Systematic Anthropological Appraisal.

APRIL 28, 1950

- O. A. Bushnell, Mitsuno Fukuda, and Takashi Maki-nodan: The Antibacterial Properties of Some Plants Found in Hawaii.  
John J. Naughton and Francis J. Norton: Carbon Isotope Ratio in Hawaiian Volcanic Gases.  
Sidney C. Hsiao: Effect of Silt upon *Ostrea virginica*.  
Chester K. Wentworth, Arnold C. Mason, and Dan A. Davis: Effect of Phosphate Mining on Water Supply on Angaur Island, Palau.

APRIL 29, 1950

- Annual Dinner  
Business Meeting  
Installation of Officers  
Address by Retiring President  
Robert W. Hiatt: Marine Biological Stations in North America.

## Abstracts

### "SWIMMERS' ITCH": ITS FIRST APPEARANCE IN HAWAII

During 1948-1949, numerous cases were reported (52 directly to the Board of Health) of a skin eruption consisting of discrete itchy papules, characteristic of insect stings or "bites." They had been sustained by persons immersed for varying periods of time, swimming or searching for crabs, clams, or mussels, in the West Loch of Pearl Harbor and in the Ala Wai Canal, Waikiki, and from no other areas. The eruption was self-limited, requiring only symptomatic treatment for relief.

The Health Department, Territory of Hawaii, attempted to determine the causative agent, with the following results: Jellyfish, hydroids, and annelid worms in these areas were examined and patch tested, but no positive rash could be obtained. Studies of streams of water indicated no external contamination by irritating substances which might cause the swimmers' itch. Not all individuals exposed showed evidence of the rash, indicating some individual resistance or lack of sensitivity. Many individuals reported that the severity of the symptoms increased with multiple exposure. This would indicate the possibility of a sensitization or anaphylaxis phenomena. In an effort to avoid the rash, individuals, while clamming, avoid areas where the mud is stirred up. This would indicate the possibility that a minute, mud-loving organism might be the cause of the rash. To date the causative agent has not been identified positively, but further work will be engaged in to determine the cause, if possible.

HARRY L. ARNOLD, JR., AND  
DAVID D. BONNET

### AWARENESS OF RACIAL DIFFERENCES BY PRESCHOOL CHILDREN IN HAWAII

This study was an investigation of the development in young children of an awareness of differences in physical characteristics of various national-racial groups. The subjects were 287 children, three through six years of age, of varied national-racial ancestry. Some of the subjects were attending preschools in which many national-racial groups were represented; and others were in preschools in which the children and teachers were almost exclusively Oriental. In individual interviews, the subjects were asked to identify themselves and their brothers and sisters, and to indicate preferences for portraits of children. The thirty portraits used were 5-x-7-inch hand-colored pictures of boys and girls of Chinese, Japanese, Caucasian, Filipino, and Hawaiian-Caucasian ancestry.

The results of the study indicated that the children were conscious of their own physical characteristics and those of their siblings and were able to identify these characteristics in pictures of children of their own race. When indicating preferences, the children tended to choose pictures of their own racial background. Children of mixed racial ancestry chose more non-Oriental than Oriental pictures. Attendance in preschools where many national-racial groups were represented, as contrasted with schools where the children were Oriental, was not related to accuracy of identification but was related to preferences expressed by Oriental subjects. Orientals in heterogeneous groups chose significantly more Caucasian pictures than Orientals in homogeneous groups.

There were no significant age differences. The only sex difference was in the very marked preference of boys and girls for pictures of their own sex at every age. The names of nationalities held significance for many children and influenced their preferences and rejections. Reasons given for their choices indicated that specific physical characteristics were important determinants when identifying actual persons, whereas, judgments of psychological factors based on physical characteristics frequently determined preferences.

DORIS SPRINGER

#### REACTIONS TO HUMOROUS STIMULI OF DIFFERENT GENERATIONS OF JAPANESE, CHINESE, AND CAUCASIANS\*

An experiment was conducted to test the hypothesis that Caucasians, Japanese, and Chinese differ in their responses to jokes. For this purpose, samples of college students and of older persons (median age 45) of these three national-racial groups were tested with jokes falling into a large number of categories. Differences occurred in the "punch" lines supplied for uncompleted jokes. Caucasians supplied more positive and negative completions, Japanese and Chinese more neutral completions. In response to jokes of Chinese origin, younger Caucasians less often rated them as "good"; older Caucasians agreed more closely with the Japanese and Chinese. With respect to Japanese jokes, Caucasians of both generations less often rated them as "good." Differences also occurred in other categories, the consistency of which was evaluated by comparing results obtained under three conditions. In general, there was less difference between generations than between Caucasians and either generation of Japanese and Chinese. Some previously found characteristics of humor do not seem to differentiate between the groups. The conclusion is that differences, and also similarities, exist between these groups in their preferences for jokes, but the experiment is essentially exploratory in nature. Many hypotheses may be advanced to account for the results, but an explanation of the specific dynamic and cultural factors responsible must await further investigation.

W. EDGAR VINACKE AND  
NATHALIE VAN ORDER SMITH

\* Title of abstract altered by authors from that on original program.

#### CULTURAL ADAPTATION OF THE BIKINI ISLANDERS TO A NEW ENVIRONMENT

(See: Leonard Mason, *The Bikinians: A Transplanted Population*. *Human Organization* 9 (1): 5-15, Spring, 1950.)

Requirements of United States national defense prompted the transplanting in March, 1946, of 167 Marshallese from Bikini Atoll to Rongerik, a smaller uninhabited atoll over 100 miles to the east. Both atolls are typical of the poorly endowed northern Marshalls—small, low, coral sand islands surrounding a lagoon and only sparsely covered with coconut and pandanus trees, arrowroot, and scrubby beach vegetation. Drinking water is scarce and is obtained by rain catchment during the wetter period preceding the dry winter months. Only a bountiful marine resource saves Bikini from being sub-marginal in terms of human subsistence.

Within two years the move to Rongerik had proved itself ill-advised, since the smaller land and lagoon areas were inadequate for the needs of the Bikini people. Their physical condition deteriorated; the community became reorganized on a completely cooperative basis in the face of increasing food crises. An extreme situation required extreme measures. The group was moved once more, this time to Kwajalein where, near administration headquarters, a temporary encampment was erected for the evacuees until a final decision could be made as to their permanent residence on some other Marshall island.

In November, 1948, eight months after Rongerik had been abandoned, the Bikinians moved to Kili, a small single island in the better-favored southern Marshalls. The disadvantage of Kili's lack of a lagoon, isolating the population a part of each year during the stormy months, is offset by the luxuriant vegetation and variety of food-producing plants. New foods about which the Bikinians are learning include taro, breadfruit, sweet potatoes, bananas, and papayas. Formerly the site of a commercial plantation, Kili offers the new residents a considerable source of income in production of copra for export. Marshallese agree that Kili is a good exchange for Rongerik, perhaps even for Bikini, but a planned program of education, such as learning to handle small craft in rough surf, to cure copra by artificial heat during the frequently rainy weather, and to cultivate and process the strange foods to which they have been introduced, is necessary to aid the newcomers in adjusting themselves to their new environment.

LEONARD MASON

#### HOW FAR AND HOW RAPIDLY SHOULD MAN CHANGE HIS NATURAL ENVIRONMENT?

Drastic excavation, the stripping of soil, the sale of top soil, and the very marked upsetting of vegetation and moisture conditions in progress in various inland subdivision areas raises the questions: Is this sort of thing good? Will it lead to objectionable consequences that from a community standpoint may outweigh any immediate advantage or convenience? Will the effect of deep cutting on one property be restricted to that property, or does the adjacent owner sustain a tangible change in his property as well?

A definition of conservation is favored that includes use as well as preservation, but community prudence suggests restrictions be put on use so that renewable resources may continue to be renewed.

A running stream is a natural feature in which adjacent land holders have certain rights. Owners of land adjacent to lakes also have certain rights and responsibilities. Movement of injurious or harmful plants and animals is rightfully restricted. We recognize the need and try to administer protections against too rapid and disorderly commercialization in our various zoning procedures.

An acre of forest or field or any other terrane, formerly in the midst of many acres of the same, and now cut around by deep excavation, stripping of vegetation, and various ecologic and microclimatic changes, is by no means the same acre. Some redress may be had for damage done, but is the rate of modification wise?

In the interest of a common good, such facilities as highways, airfields, harbors, or other industrial installations may involve almost complete destruction of natural terrane and ecological pattern. But is this likewise good in residential tracts? Should the owner of property retain the undisputed right to change the vegetational regime and microclimate adjacent to his neighbor? Are we starting something that we cannot finish and that may finish us?

CHESTER K. WENTWORTH

#### GENESIS AND MORPHOLOGY OF THE HAWAIIAN LATERITE CRUSTS

(Published in full in *Pacific Science* 4 (4): 315-322, October, 1950.)

The laterite crust has developed in three general areas of the Hawaiian Islands: namely, the southern and western slopes of leeward Kauai; the westerly slopes of the main mountain range of Molokai; and on the white trachyte cliffs of West Maui. Laterite crusts are found on the long slopes which have a region of very high rainfall at the higher elevations and a semi-arid condition at the lower elevations of the slope. The areas of laterite crusts are located at higher elevations which have a definite alternating wet and dry season.

The laterite crust profiles have a hard, slaglike surface horizon, which has a very high apparent specific gravity. This layer is underlain by a friable layer of a thickness varying from 4 to 36 inches. This always lies over an impervious layer of either rock or a plastic clay. The hard surface horizon is rich in iron and titanium oxides and very low in volatile matter. The friable layer is made up of iron oxides, which may make up as much as 80 percent of the soil.

A hypothesis is advanced as to the genesis of these laterite crusts. This would involve the movement of iron and hydrated titanium oxides in the percolating waters from the soils developed on the wet areas of the higher elevations by lateral movement through the impervious subsoil layers and their subsequent accumulation in the surface horizon by capillary action in regions having an alternating wet and dry season climate. The hydrated iron oxide and titanium oxides are stabilized by dehydration and are converted to hematite and anatase in the surface horizon. This gives rise to the hard compacted surface horizon having a very high apparent specific gravity.

G. DONALD SHERMAN

#### THE ASSIMILATION OF RADIOACTIVE CARBON DIOXIDE BY LEAVES OF THE SUGAR CANE PLANT

Radioactive carbon dioxide is being used at the Experiment Station of the Hawaiian Sugar Planters' Association in studies of the formation and transport of sugar in the sugar cane plant. The experiments show that glucose is formed before sucrose in photosynthesis. The sugars were isolated and purified after dilution with a carrier. Using a mica window counter, no radioactivity could be detected in sucrose formed in 5- or 15-second exposure to sunlight, whereas the glucose was definitely radioactive. Using an internal counter, the relative total counts per minute per mg. of tissue were: for 5 seconds, glucose 149.5 and sucrose 5.6; for 15 seconds, glucose 286.4 and sucrose 25.0. The relative specific activities of the undiluted sugars were: 5 seconds, glucose 242,000 and sucrose 181; 15 seconds, glucose 461,000 and sucrose 902. Glucose and sucrose were separated chromatographically. After crystallizing the glucose, glucose penta-acetate was prepared and recrystallized to constant radioactivity. With longer exposures more sucrose accumulated than glucose or fructose; at 300 seconds the total counts were: sucrose 49,773, glucose 3,349, and fructose 5,734.

Total counts in the barium-zinc precipitate at 5 seconds were 220, and these increased to 56,541 at 300 seconds. Total counts in the 95 percent alcohol-insoluble fraction were 252 at 5 seconds, increasing to 32,830 at 60 seconds, and decreasing to 24,208 at 300 seconds. Total counts in the residue after alcohol were 27 at 5 seconds, increasing to 13,382 at 300 seconds. The petrol ether extract began at 0 counts and reached 64.8 total counts. The water-insoluble fraction began at 0.3 counts and reached 115 total counts at 300 seconds.

Leaves fed radioactive invert sugar in the dark made radioactive sucrose.

Radioactive glucose, fructose, and sucrose have been prepared from both green and albino blades fed radioactive carbon dioxide in total darkness as well as in sunlight.

CONSTANCE E. HARTT

#### RESISTANCE OF INSECTS TO INSECTICIDE ACTION

(Paper by Invitation)

Examples were given of strains of insects which had developed resistance to the toxicity of various insecticides. They included resistance of flies and mosquitoes to DDT and other sprays, citrus scales to HCN gas, citrus thrips to nicotine compounds, and blue ticks in Africa to arsenic dips and benzene hexachloride. Even bacteria may become resistant to penicillin.

Flies are especially useful in testing chemical sprays because of their rapid breeding (over 30 generations a year) and the relationship between their resistance and the spacial arrangement of the formula of the insecticide. It was found that resistance does not disappear when treatment is stopped. After 30 generations without exposure to DDT, the progeny of resistant flies were still resistant. In most spraying operations, some "strong" flies get away before they get a lethal dose and produce resistant offspring. When flies become resistant to all sprays, we will have to go back to the fly swatter.

R. L. METCALF

## APANTELES IN HAWAII

Species of *Apanteles* are microwasps which specialize in the parasitism of lepidopterous larvae. Since the Lepidoptera constitute one of the largest orders of the class Insecta and, with very few exceptions, are harmful insects from our standpoint, these microwasps, which parasitize them and hold them in check, are likely to assume an important role in any localized fauna, especially with respect to species of Lepidoptera which are crop pests.

There are hundreds of species of *Apanteles*, but they appear to be a very homogeneous group. Efforts to separate them into smaller divisions have been unrewarding. Definite, but microscopically fine, characters of form and structure readily distinguish the different species. Dr. C. F. W. Muesebeck of the U. S. National Museum has published a key to the 164 Nearctic species; Dr. C. Watanabe has done the same for 44 Japanese species. According to Wilkinson of the British Museum of Natural History, there are 62 Ethiopian species and 74 in the Indo-Malay region.

Although Hawaii has close to a thousand species of endemic Lepidoptera, there are no endemic *Apanteles*. The species occurring here are either immigrants or were introduced purposely. During the nearly half a century that I have collected and studied them in Hawaii, the number of species has increased from three to nine. Five of these, possibly a sixth also, we know positively were introduced, all to control crop pests, as follows:

*Apanteles glomeratus*, from Japan in 1923, to control the cabbage worm, *Pontia rapae*. The wasp larvae are gregarious and probably result from multiple parasitism, in contrast to most species, which are solitary.

*Apanteles scutellaris* and, possibly, *A. dignus* from Southern California in 1933, to help control the potato tuber moth, *Gnorimoschema operculella*. *A. dignus* is specifically attached to the tomato pin worm, *Kliferea lycopersicella*.

*Apanteles marginiventris*, from Brownsville, Texas, in 1942, to aid in the control of the grass armyworm, *Laphygma exiguae*, a grass feeder and pest in sugar cane cultivation and cattle ranching.

*Apanteles bedelliae*, from Kansas in 1945, to help control the sweet potato leaf miner, *Bedellia orchelella*, a serious pest of sweet potato vines.

*Apanteles praesens*, from Southern California in 1925, to help control *Anacamptodes fragilaria*, a pest common on leguminous plants, especially koa haole (*Leucaena glauca*), an important forage shrub. Not having been recovered from the field, its establishment is not certain.

The three immigrant species not purposely introduced include: a handsome species with banded wings, described by Dr. Muesebeck as *A. trifasciatus*; *A. carpatus* (once called *A. hawaiiensis*), a parasite of the clothes moth; and an unidentified species bred from the pink scavenger caterpillar, *Batrachedra rileyi*.

Efforts have been made to introduce the Australasian species *A. antipoda*, but without success.

DAVID T. FULLAWAY

## MANSON'S EYEWORM IN HAWAII

This nematode parasite, first described in Amoy, China, has been known in Hawaii since before 1913. It is widely distributed in warmer regions of the

world. It is found in the eyes of domesticated poultry and other birds. Part of its life cycle is spent in the burrowing roach, *Pycnoscelus surinamensis* (L.), which is not seriously affected by the nematode. Poultry eat the roach, the nematode ascends the oesophagus and soon enters the eyes.

Poultrymen are likely to attribute any eye trouble to this parasite. To learn the extent of its infestation, a study was made (1) of the life cycle, which was found almost identical to the species in Australia; (2) of the importance of the nematode in poultry raising; and (3) means of control.

The maximum number of nematodes found in the eye of a chick was 200. Large numbers, constantly in motion in the eye, cause considerable irritation to the chicks and a definite tissue response but no pathological results, such as blindness or destruction of the eyeball, are caused as long as the birds are well cared for. When not well cared for, the irritation may permit entry of other infections. It is believed that the damage caused by the nematode is overrated.

Suggested control measures include: (1) Killing the parasites in the bird's eyes by mechanical removal or creolin solution; this leaves the eyes exposed to reinfection. (2) Making the eye an unsuitable habitat for the nematode by removing the nictitating membrane by a simple operation with no ill effects on the chick. (3) Controlling the roach or preventing its serving as intermediate host. Growing the chicks on wire helps to keep them from eating roaches. With floor brooding, insecticides may be used to control the roach. There is no known effective natural enemy of the roach.

In the life cycle of the parasite, about 51 days are spent in the roach. Parasites require 2 weeks to reach maturity and lay eggs in the bird. The eggs pass down the ducts and out with the feces, to be taken up by the roach.

CALVIN W. SCHWABE

## ENAMEL EROSIVE PROPERTIES OF FRUITS AND FRUIT JUICES

(Published in full as follows: Carey D. Miller. Enamel Erosive Properties of Fruits and Fruit Juices. *Journal of Nutrition*, 41 (1): 63-71, 1950.)

Five tropical and semi-tropical fruits—grapefruit, guava, Java plum, mango, and pineapple—and juices prepared from them were fed to standard rats to determine their enamel erosive properties.

The pH and titratable acidity were determined for each lot of sweetened fruit and fruit juice used.

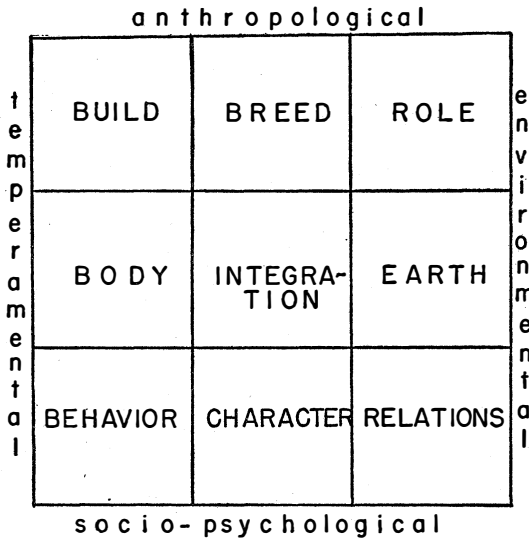
Quantities of juice equivalent to the daily fruit supplement had three to ten times the enamel erosive properties of the fruits themselves. No adequate explanation for the different effect of fruit and fruit juice can be offered at the present time, but it appears not to be related to the titratable acidity of the two.

Data given for five fruits of widely different species and preliminary experiments with two other fruits appear to justify the postulate that acid fruits generally have a slight enamel erosive effect, in contrast to the marked effect of the juices made from them.

CAREY D. MILLER, ADELIA BAUER,  
AND MILDRED HIGA

## GENETHNICS, A NEW TECHNIQUE FOR SYSTEMATIC ANTHROPOLOGICAL APPRAISAL

Genethnics is a graphic means for indicating the interrelationship between man or other organisms and their environment. This is done in a systematic manner by means of symbols placed in the eight squares ("panels") around the "genethnic screen" shown below.



Applying this screen to man, his name is placed in the center square and the eight panels contain the following data: "Body"—the twelve accepted anatomical-physiological "systems" of the body. "Build"—the relative fat, brawn, or leanness within five body regions and overall, obtained by photographs or body measurements. "Breed"—characteristics in racial-ethnic terms observed in the same five body regions or from facts of heritage. "Role"—cultural attainments of the person. "Earth"—environmental conditions and factors. "Relations" with persons, individually or collectively, and to places and things. "Character" comprising interests, aptitudes, and talents. "Behavior" actually observed in the person studied. The roles which a person plays at particular times in life do not necessarily reflect either his aptitudes or his interests (i.e., "Character"). He may in fact be cast by conditioning and changing circumstances in active roles quite at variance with either aptitude or interests, in which case the cross-currents and probable frustrations will reflect themselves significantly in "Behavior" and "Relations" and, as psychosomatics now recognizes, in "Body."

E. S. C. HANDY

## THE ANTIBACTERIAL PROPERTIES OF SOME PLANTS FOUND IN HAWAII

(Published in full in *Pacific Science*, 4 (3): 167-183, 6 tables, July 1950.)

Tissue juices expressed from different parts of 101 species of Hawaiian plants collected at random were tested *in vitro* for their antibacterial properties against *Micrococcus pyogenes* var. *aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*. Extracts from 13 of these

plants were very effective in their action against the bacteria. Determinations of effectiveness were made by testing extracts by the Oxford cup method developed for the assay of penicillin.

Extracts obtained from the following plants were the most effective: uluhe (*Dicranopteris linearis*); red ginger (*Alpinia purpurata*); koa (*Acacia Koa*); tamarind (*Tamarindus indica*); lime (*Citrus aurantifolia*); sand-box (*Hura crepitans*); three species of passion-fruit (*Passiflora edulis* f. *flavicarpa*, *P. foetida* var., and *Passiflora* sp.); pomegranate (*Punica Granatum*); mountain apple (*Eugenia malaccensis*); ohia lehua (*Metrosideros macropus*); and guava (*Psidium Guajava*).

O. A. BUSHNELL, MITSUNO FUKUDA,  
AND TAKASHI MAKINODAN

## CARBON ISOTOPE RATIO IN HAWAIIAN VOLCANIC GASES

Volcanic gases were collected at the Kilauea fume vents, and extracted from pumice thrown up in the 1949 eruption of Mauna Loa. The method of collection and extraction using high vacuum equipment was demonstrated. Also illustrated was the method of fractionation used to isolate and concentrate the carbon dioxide, sulfur dioxide, and hydrogen sulfide present in the gas. These gases were sent to Dr. Francis J. Norton of the General Electric Research Laboratory, who will determine the ratio of the isotopes of the elements present. In particular a comparison will be made of the ratio of the isotopes of carbon ( $C^{12}$  and  $C^{13}$ ) in the volcano gas to the ratio of these isotopes in the carbon found at the earth's surface.

A preliminary result which seems to show differences in the carbon isotope ratios which are of significance has been received from Dr. Norton. These differences seem to indicate a concentration of the heavier isotope of carbon ( $C^{13}$ ) in the volcano gas. Interpretation of this result has not as yet been attempted, but it may be due to diffusion fractionation of the isotopes.

The mass spectrogram received also showed a peak at mass 14. This, in conjunction with other peaks, seemed to indicate the existence of the radioactive mass 14 isotope of carbon. However, tests for radioactivity by Dr. George Burr of the Experiment Station of the Hawaiian Sugar Planters' Association were completely negative.

For confirmation of the results mentioned we are awaiting the results of complete and more exact experiments by Dr. Norton, and by Alfred O. C. Nier of the University of Minnesota, who has agreed to cooperate in the work.

JOHN J. NAUGHTON AND  
FRANCIS J. NORTON

## EFFECT OF SILT UPON *OSTREA VIRGINICA*

The effect of silt upon the activities of oysters has been investigated in the laboratory by the use of kymographs and continuous circulation of sea water containing known amount of silt in suspension. The following results were obtained: 1. The more turbid the water, the more irregular the respiratory-feeding movements of the shells of the oysters. 2. When graded silt suspension was used, increasing from 100 to 15,000 parts per million, the animals, compared with the controls in approximately 20 p.p.m. sea water, showed

decreasing activity. On the average, total duration of shell movement decreased from 78 to 15 percent of the total time of exposure, with extremes, in the 15,000 p.p.m. suspension, as low as 3 percent. 3. Reduction in turbidity of the medium was followed immediately by increase of shell movement in both duration and amplitude, returning to 100 percent when the turbidity became the same as that of the control.

When silt suspended in very turbid sea water was allowed to settle and deposit upon the oysters so as to cover them, it was found that the animals responded immediately by cessation of shell movement for 16 to 19 hours. Later, with irregular movements, they attempted to reopen their shells in an effort to get rid of the silt. Oysters recovered if the silt deposited upon their shells did not remain for more than 2 days. If the deposition remained on the oysters beyond 3 days the animals died.

SIDNEY C. HSIAO

#### EFFECT OF PHOSPHATE MINING ON GROUND WATER ON ANGAUR ISLAND, PALAU

Rock phosphate has been mined on Angaur in the Palau Group since 1903, first by the Germans, between the wars by the Japanese, and recently by a Japanese company set up under the Army command in Tokyo. Mining was resumed soon after the end of the Pacific war to provide phosphate urgently needed for Japanese agriculture. Angaur has an area of 3 square miles and effective mining requires excavation below sea level. Resulting ponds and lakes at sea level are found to affect adversely the ground water lens resulting from the 115-inch annual rainfall, and the native people, despite royalty payments, have increasingly questioned the wisdom of action that could possibly lead to serious future damage.

Protests to the office of the Trust Territory have led to conferences between the Army and the Navy, and the writers were appointed as a joint hydrologic team to survey existing and probable future damage to water supply and agricultural land. From our 9-day survey it appears that there has been an increase in salinity of some lakes and ground water in the northwestern third of the island and that such increase will continue unless remedial measures are taken. The stability of the fresh ground water in the southeastern and larger sector indicates that rainfall is sufficient to maintain a functional fresh Ghyben-Herzberg lens where suitable rock structure exists. It was recommended that the mining operations be permitted to continue on condition that a program of hydrologic observation be set up and that extensive backfilling and

subdividing of lakes be commenced in an effort to retard, and perhaps reverse, the increase in salinity due to the mining. It is impossible to say categorically how much remedy can be achieved, but it is believed that this course offers the best prospect and that in any event some very valuable gains in understanding of fresh-water-salt-water relations in small islands can be made.

CHESTER K. WENTWORTH, ARNOLD C. MASON,  
AND DAN A. DAVIS

#### MARINE BIOLOGICAL STATIONS IN NORTH AMERICA

Presidential address 1950, by ROBERT W. HIATT

Reporting an 8-month trip, during which he visited some 55 centers of marine biological investigation in North America, Dr. Hiatt traced the history and trend of scientific work being done. Twenty-three of the stations were located on the Atlantic coast, 9 on the Gulf of Mexico, and 23 along the Pacific coast.

Outstanding were the institutions at Woods Hole, Massachusetts; La Jolla and Pacific Grove, California; Friday Harbor, Washington; and Nanaimo, Vancouver Island. The setting and facilities of these and several others were described and illustrated with Kodachrome slides.

The trend was noted from early emphasis on taxonomy to present-day problems of physiology and experimental fields. International aspects of fishing and other marine biology were discussed.

It was stated that 70 species of fish yield some two million pounds of commercial product. Concerning 30 of these species we have little or no scientific knowledge; there is some knowledge about one-third; and only one-sixth are known at all well, after 90 years of investigation.

New tools for fishery research—the bathythermograph, high speed plankton net, methods of age determination, statistical analysis, and oceanographic data—were discussed.

More funds seemed to be available for oyster research than for all other fishery studies combined. Many of these funds came from oil and paper pulp companies, in connection with lawsuits involving millions of dollars.

The contrast was noted between the amounts being spent annually by Federal agencies for fisheries research (24 cents per capita), agricultural research (\$6.66 per capita), and national defense (\$132 per capita).

# NECROLOGY

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## G. H. W. BARNHART

George H. W. Barnhart, sugar technologist and engineer, died in the Queen's Hospital, February 17, 1950, following a brief illness.

He was born in Honolulu, August 8, 1892, and educated at McKinley High School and the College of Hawaii. After graduating with the class of 1914, he returned for 2 years of graduate study in chemistry and sugar technology. During this period he served as instructor in engineering.

A position as assistant mill engineer with the Hawaiian Sugar Co., Makaweli, Kauai, was interrupted

by a call to service in World War I. Commissioned a second lieutenant at Schofield Barracks, he was assigned to command the S.A.T.C. unit at the College of Hawaii and, later, units at Schofield.

He joined the sugar technology department of American Factors in 1919 and continued in their employ as an engineer, punctuated by periods of teaching sugar house engineering at the University of Hawaii, from which he received the degree of Master of Science in 1921.

## J. N. S. WILLIAMS

John Norman Spencer Williams, retired construction engineer, died February 11, 1950, at the age of 92.

Born in Cowbridge, South Wales, May 11, 1857, he accompanied his parents to Canada as a child and was apprenticed to a New Brunswick engineering firm. He came to Hawaii in 1886 as a representative of the Risdon Iron Works of San Francisco. He became manager of the Union Iron Works of Honolulu in 1890, and, later as engineer for the Honolulu Iron Works, he designed sugar mills at Ewa, Olaa, and Puunene. He went to Cuba in 1893, but returned in 1898, be-

coming active in sugar and other engineering enterprises, including the Hawaiian Commercial and Sugar Co., Kahului Railway, and Theo. H. Davies and Co.

"Retired" in 1931, he interested himself in sugar chemistry, specializing in uses for cane cellulose. This led to his association, as an official and director, with Hawaiian Cane Products Co., manufacturer of wall-board made from sugar cane fiber. In 1943, at the age of 86, he earned a Master of Science degree at the University of Hawaii. He was active in scientific, professional, and fraternal organizations.

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