FOREWORD

The year began with a membership of 304. Nineteen new members were elected at the fall meeting and 35 at the spring meeting. Nine members resigned, 24 were dropped, and 3 were lost through death. The present membership is 322, largest in the history of the Academy.

Seventeen scientific papers were presented at the meetings held November 30, December 1, and May 10 and 11 (one by title only). At the request of the University of Otago, New Zealand, the Percy Smith medal was presented to Dr. Peter H. Buck for outstanding work in Pacific anthropology.

The Academy, with the material assistance of the Secretariat of the Pacific Science Council, sponsored the Hawaii Symposium on Scientific Research in the Pacific on March 9 and 10. This was attended by about 130 of the leading scientists of the Hawaiian Islands. After hearing addresses and reports of current research being carried on by institutions and organizations represented in Hawaii, 11 committees met and presented more than 150 recommendations. The Proceedings of the Symposium are summarized in this publication.

Because of illness, President Auchter was not able to be present at the Symposium or the spring session. His place was taken by Vice-President L. D. Baver, who presided over these two series of meetings and also presented the annual address, entitled “Science versus Phobias.”

OFFICERS

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)

1951-1952

President, L. D. Baver
Vice-President, Harry L. Arnold, Jr.
Secretary-Treasurer, E. H. Bryan, Jr.

Councilor (2 years), J. H. Beaumont
Councilor (1 year), Andrew W. Lind
Councilor (1 year), E. C. Auchter (ex officio)

THE HAWAIIAN ACADEMY OF SCIENCE WAS ORGANIZED JULY 23, 1925, FOR "THE PROMOTION OF RESEARCH AND THE DIFFUSION OF KNOWLEDGE."
THE 26th
ANNUAL MEETING 1950-51

Program

NOVEMBER 30, 1950
Sam Naiditch and Herrick L. Johnston: A Differential Microadsorption Apparatus.
Harold L. Lyon: What Habitat Will the Spotted Deer Choose if Liberated on the Island of Hawaii?

DECEMBER 1, 1950
W. A. Murdy and C. K. Stidd: Some Implications in Rainfall Frequency Distributions in Hawaii concerning Large-scale Circulation Patterns in the Pacific.
Leonard Mason, Robert W. Hiatt, and Doak C. Cox: The Arno Atoll Project.

MAY 10, 1951
Ruth Ann Aust: Contributions to Physical Therapy from Analysis of Yoga Technique.
Reed A. Gray: Composition of Honeydew Excreted by Pineapple Mealybugs (Pseudococcus brevipes Ckll.) as determined by Paper Chromatography and Radioautography.
Masaru Nakata and Sam Naiditch: Further Investigations of the Physical and Chemical Behavior of the Vortex Tube.
Doak C. Cox and Walter H. Munk: Analysis of Tidal Fluctuation in Basal Ground-water Bodies.

MAY 11, 1951
P. B. van Weel: Degeneration and Regeneration in the Tropical Fresh-water Sponge, Spongilla proliferae Annand.
Sidney C. Hsiao: Embryonic Chemical Heterauxesis in Some Poeciliids.

MAY 12, 1951
Annual Dinner
Business Meeting
Installation of Officers
Address of Retiring President, L. C. Auchter, delivered by L. D. Baver; Science versus Phobias.

Abstracts

HURRICANE HIKI—A CLIMATIC CURIOSITY

During the third week of August, 1950, the Hawaiian Islands came under the influence of a tropical cyclone of full hurricane force, the first in nearly 50 years of meteorological record in this area. As the first such storm, it was christened "ABLE" in the phonetic alphabet, which in the Hawaiian language is "HIKI," and became widely known as Hawaiian Hurricane Hiki.

In evaluating the factors which led to the development of this storm, so unusual for these meridians, the importance of warm sea-surface temperatures to the development and maintenance of hurricane intensity in a tropical storm, as stressed by Palmén, must be considered. During the summer, sea-surface temperatures between Hawaii and the Mainland are characterized by a tongue of cool water which protrudes equatorward, east of Hawaii. This tongue of cool water is believed to be of importance in segregating the tropical cyclogenetical regions off the west coast of Central America from that area to the south and west of Hawaii, and tends to shelter the Hawaiian Islands from frequent onslaught of dangerous tropical storms.

It is argued that, should the recently discovered trend of warming in polar regions continue in equal magnitude during the next 50 years, this protective tongue of cool water between Hawaii and the Mainland may recede sufficiently, in connection with the subsequent readjustment of ocean currents, to remove one barrier which protects Hawaii from westward-moving tropical cyclones.

R. H. SIMPSON

THE MAKAWELI DEPRESSION OF KAUAI—A GRABEN

The Makaweli depression is defined as the triangular area lower than the surrounding terrain, bounded on the west by the west wall of Waimea Valley and on the northeast by a southwest-facing scarp crossed by tributaries to the Waimea River from Koiae Stream to Olokele Stream. It is shown to be a graben or downfaulted area, partly filled by flows of the Waimea Canyon series, and not, in the main, a partly filled erosional valley.

The west fault is indicated by the discordant course of the Waimea River that flows south, where streams consequent on the flanks should flow west and southwest. The course of the Waimea might be explained by displacement caused by flows from a course along an early caldera fault that controls the position of Waiahulu Stream and that disappears under later flows...
in the Makaweli depression. However, the sections across the depression provided by the Waimea tributaries indicate the filling of an already existing, wide depression, instead of a valley being simultaneously widened westward, except at the extreme western edge.

The northeast fault is indicated by the straightness of the buried part of the northeast scarp. There are no buried valleys entering the depression as tributaries to the Waimea, as there would certainly have been if the scarp had been the wall of an erosional valley.

The fault origin is further suggested by the presence of a few dikes cutting the talus buried along the west scarp, numerous dikes cutting the clinkery flows that poured over the northeast scarp, and feeding vents that contributed to the fill of the graben. Except for these dikes along the margins, there are no dikes in the fill of the graben.

The fault origin is also borne out by the petrographic picture. The bulk of the graben fill appears to be more closely related to the Waimea Canyon series that makes up the main part of the Kauai dome than to the post-erosional Koloa series. No evidence of an erosion interval in Waimea Canyon time sufficient to permit the carving of the depression is indicated elsewhere on Kauai. There are in the depression a few dense columnar flows, typical of the post-erosional Koloa series, but these are definitely limited to terraces in the valleys.

The history of the Makaweli area may be summarized as follows:

1. Growth of the southwest flank of Kauai dome by accretion of successive Waimea Canyon flows.
2. Faulting on the caldera fault along Waiahulu Stream, with downthrow to the north.
3. Partial fill of the caldera by Waimea Canyon flows, probably in part synchronously with faulting, probably to overflow in the Makaweli area.
4. Graben faulting, forming the triangular Makaweli depression.
5. Partial fill of the graben by Waimea Canyon flows pouring over the northeast scarp from vents farther north and also by flows from vents along the northeast fault, with thin intercalated gravels near the northeast edge of the depression and thick talus along the west scarp.
6. Erosion of valleys essentially to present shape.
8. Re-excavation of valleys by erosion, leaving only terraces of the Koloa fills.

DOAK C. COX

A DIFFERENTIAL MICRO- ADSORPTION APPARATUS

Gas adsorption studies were undertaken to find out whether the surface forces of normal tin are different from those of superconducting tin and to establish the order of magnitude of such difference if any is found. Helium was used as the adsorbate since (1) it is the only gas with a sufficiently high vapor pressure to be practical with the techniques used; and (2) the helium-helium interactions in the adsorbed film are sufficiently weak so that the adsorption isotherms should be sensitive to small changes in solid-gas interactions.

In carrying out this program, two experimental approaches were used, namely, (1) the determination and comparison of the separate complete adsorption isotherms of helium on both normal and superconducting tin powder with a Pease-type apparatus; and (2) the investigation of the relative adsorption of helium on tin in the two states of the metal with a differential apparatus. A magnetic field was used to cause the transition from superconducting to normal tin. A differential method is advantageous since comparisons of adsorption can thus be made on a single sample of solid in two different states with identical submicroscopic surfaces at the same temperature. After admitting helium gas to the system, the equilibrium pressure above the superconducting tin is recorded. Then a magnetic field is applied to destroy the superconductivity, and the new equilibrium pressure is measured. After correcting for the effect of the magnetic field on the pressure of the helium in the cell, any remaining difference might be attributed to the difference in surface forces in the two states of the tin powder.

The use of an external magnetic field to destroy superconductivity precludes the use of the gravimetric adsorption techniques such as the quartz spiral balance. Initial experiments were carried out with a modified Pease-type volumetric apparatus. Highest sensitivity of the adsorption apparatus is necessary with low pressures when the amount of helium adsorbed is considerably less than a monolayer, since, under these conditions, co-operative interactions between the adsorbed helium atoms are at a minimum. The differential sensitivity and accuracy of the Pease-type apparatus at 2°K with half a monolayer of adsorbed helium was of the order of 10 per cent. No differences were established between normal and superconducting helium under these conditions. In order to increase sensitivity from about 1 part in 10 to 1 part in 1,000 the apparatus was modified considerably.

Micropipet gauges at liquid-air temperatures were used, rather than mercury manometers or McLeod gauges, in order to (1) reduce the dead volume of the manometer; (2) avoid the introduction of mercury vapor into the adsorption cell; (3) eliminate small fluctuations in the volume of the apparatus due to fluctuations in the mercury levels in the manometers; and (4) obtain a high sensitivity to small changes in pressure at low pressures.

The capillary connecting the adsorption cell with the system outside the helium bath was fitted with a Dewar in order to maintain a constant thermal gradient in this capillary even though the liquid-helium constant-temperature bath level changed considerably during the experiment.

A gas pipette system was substituted for the conventional mercury gas burette. This pipette operates without mercury. The volume, temperature, and initial pressures were kept constant during a run, only the residual pipette pressure varied. By reducing the number of operating pipette variables to one, considerable simplification resulted both in experimental work and in subsequent computations.

SAM NAIDITCH AND HERRICK L. JOHNSTON
WHAT HABITAT WILL THE SPOTTED DEER CHOOSE IF LIBERATED ON THE ISLAND OF HAWAII

On May 23, 1950, the Territorial Board of Commissioners of Agriculture and Forestry (hereinafter referred to as the Board), by a majority vote, adopted a game-development program which included the liberation of a herd of axis deer (spotted deer) in the vicinity of Pohakuloa on the island of Hawaii. This action of the Board was promptly and vigorously objected to by so many people in these Islands and on the Mainland that, at its meeting on June 29, the Board decided to “defer action on this matter for further consideration at some other time.” This does not mean that the Board abandoned its plan to permit the deer on Hawaii. It did not delete this project from the program which it adopted May 23; it merely placed the matter in suspense. Since the Board is going to give “action on the matter further consideration,” the public should do likewise.

The axis deer is native to India and Ceylon. The best authorities on this deer tell us that in India it dwells in the low-lying, hot, forest jungles, not venturing above 4,000 feet elevation. The Board initiated a study of the axis deer on Molokai and learned that the deer do not venture much, if any, above 3,000 feet elevation. The only wet forest remaining on Molokai lies above 3,000 feet elevation and, because the axis deer on Molokai do not roam in this forest, the Board would have us believe that these deer would not enter the wet forests below 3,000 feet on Hawaii.

Four of man’s domesticated animals—cattle, goats, sheep, and swine—were allowed to run wild on the island of Hawaii, and, during the years, they have wrought such enormous damage to the native forests on the island’s watersheds that now Hawaii suffers sometimes from water shortages and sometimes from floods. In recent years the cattle have been confined within prescribed boundaries, but the goats, sheep, and pigs still roam at large and continue their depredations. The goats choose the dry and semi-dry regions which provide their natural habitat. The sheep seek, and confine themselves to, their natural habitat, which is the sparsely forested areas at the higher elevations on the mountains. Both the goats and the sheep shun the wet forests at the lower elevations. The pigs do not limit their depredations to any particular habitat but range not only the wet forests, but also the habitats of both the sheep and the goats.

Now, the Board proposes to turn loose on the island of Hawaii another forest-destroying animal, the axis deer. These deer will not compete with the goats in their habitat nor with the sheep in theirs, but will promptly invade the low-lying wet forests which afford their natural habitat.

HAROLD L. LYON

SOME IMPLICATIONS IN RAINFALL FREQUENCY DISTRIBUTIONS IN HAWAII CONCERNING LARGE-SCALE CIRCULATION PATTERNS IN THE PACIFIC

By constructing daily rainfall frequency distributions for each of the months of the year, a relationship becomes apparent between the seasonal variation in storm frequency and the sizes of rains experienced in various climatic zones in Hawaii.

Relationships can also be shown between the frequency of light trade-wind rainfall and the persistence of trade winds in summer. The annual march of average monthly rainfall amounts, which is observed for very wet stations throughout the Territory, exhibits three maxima and three minima. By combining the greater frequency of trade-wind showers in summer with the greater intensity of storm rainfall in winter, an explanation is given for the complicated character of these annual march curves.

W. A. MORDY AND C. K. STIDD

METEOROLOGICAL ASPECTS OF THE GREAT PACIFIC HAZE OF JUNE, 1950

During the second and third weeks of June, a curious, dry haze reduced visibility over vast areas of the north Pacific between latitudes 10° and 30°. Streaks of this haze extended from 1,500 miles east-southeast of Hawaii, westward to a point 4,000 miles north of Guam.Visibilities were lowered to 1 mile at many stations and occurred with remarkable suddenness in some places, such as Wake Island, where visibility fell from greater than 20 miles to 2 1/2 miles in less than 1 hour.

While the most obvious source of haze particles was the volcano Mauna Loa, which was in active eruption during this period, several factors were present which made it difficult to attribute the entire effect to the volcano. These were: (1) no reduction in visibility was reported from any station during the first 7 days of the eruption; and (2) the haze, reported at great distances east of Hawaii, could have reached that area from the volcano only by means of an extensive clockwise loop movement that would have carried it first northwest, then north as far as the 45th parallel.

In an attempt to trace the source of haze particles, whose diameters were of the order of 0.2 microns, and which filled the air with more than 500 times the normal number of suspended particles, air trajectories were computed in reverse from each station affected, beginning with the time visibility first lowered, and working backward in search of plausible sources. This was done for the gradient level (2,500 feet), 10,000 feet, and 18,000 feet. These three levels were considered because the volcano produced two sources of effluent. One source was along the rift, 10,000 to 12,000 feet above the trade-wind inversion. The other, below the trade-wind inversion, combined fumes and ash from the flowing lava with pulverized lava particles and atomized sea water, produced by the explosive action which occurred as aa lava flowed into the sea. These trajectories indicated that (1) the air reaching Wake at the time visibility first lowered had a high-level source over Japan and low- and intermediate-level sources from the east, no horizontal current of which had its origin at or near the volcano; and (2) air reaching stations in Hawaii on the day they were first affected by haze had a low-level source in southern California and a high-level source near the volcano after describing a mammoth 8,000-mile clockwise loop over the northeastern Pacific.

It is concluded, therefore, that (1) the transport of volcanic materials was the prime source of haze; (2) a secondary source may have been provided by dust from deserts in southern California; (3) haze particles experienced considerable vertical transport while
being scattered horizontally; and (4) concentrations of the material were maintained by gently converging streams of air which followed paths somewhat to the left of the trajectory required of a parcel which conserves its absolute vorticity.

R. H. SIMPSON

THE ARNO ATOLL PROJECT

The Arno Atoll project was the culmination of ideas first set forth at the Pacific Science Conference held in Washington, D. C., in 1946, and later made Project E., The Economic Development of Coral Islands, in the recommendations of the Economic Development Committee of the Research Council of the South Pacific Commission in 1949. By a grant of funds from the Office of Naval Research, through the Pacific Science Board of the National Research Council, the present project was organized and the field work was completed during the summer months of 1950. Co-operating agencies were the Department of the Navy, Military Air Transport Service, the Civil Administration of the Trust Territory of the Pacific Islands, and the various universities which supplied personnel and equipment. Project outlines for the various scientific disciplines included in this survey were formulated around the general theme—the human carrying capacity of an atoll. Members of the scientific staff from Cornell University were J. W. Wells and Donald Squires, Geology, and Earl Stone, Soils and Agriculture; from Arizona, Joe T. Marshall, Vertebrate Zoology; from the University of California, Robert Usinger, Entomology; and from the University of Hawaii, Leonard Mason and John Tobin, Anthropology, Gerald Wade, Geography, Robert W. Hiatt and Donald Strasburg, Marine Zoology; and from the Hawaiian Sugar Planters' Association Experiment Station, Doak C. Cox, Hydrology. The results of the integrated study will appear in a volume on Arno Atoll and in suitable technical journals.

LEONARD MASON, ROBERT W. HIATT, AND DOAK C. COX

MAUNA LOA ERUPTION OF JUNE, 1950

This paper consisted chiefly of the showing of moving pictures taken from an airplane by Mr. and Mrs. James Humpert. The pictures were of the source part of the eruption during the early morning of June 2, continuing down the flow, and of the west coast of Hawaii on the afternoon of the same day, with a narrative by Mr. Humpert.

The flank eruption of Mauna Loa, which had been expected since the summit eruption of January, 1949, broke out on the evening of June 1, 1950, along a rift above and below 12,000 feet. About an hour later the chief activity had been transferred to between 8,000 and 10,000 feet elevation, on the southwest rift zone. About 2 hours after its first appearance, the northern flow from the lower vent had crossed the main Kona Road at Hookena and, 1/2 hour later, had reached the sea. Soon afterward, in the early morning of June 2, a new flow started down the mountainside, crossed the highway about 5:00 A.M., and entered the sea just after noon. Meanwhile, about midnight, a new flow had started from the lower line of fissures between 7,500 and 9,000 feet, crossed the road about 4 miles south of the previous flow about 2:00 P.M. on June 2, and reached the sea at 3:30 P.M. There were other, smaller lava tongues, but this latter one accounted for nearly half of the total volume left on land and probably more than half of an estimated 100 million cubic yards which entered the sea. The total is estimated by Macdonald and Finch as more than 600 million cubic yards, probably somewhat greater than the 1859 Mauna Loa flow and, hence, the greatest during the 150 years of recorded history.

Despite the sparseness of settlement on the west slope of Mauna Loa, there was considerable property damage, and several dwellings were destroyed. The capacity of the lava flows to cross the highway and reach the sea at more than one point in a few hours from vents 15 miles away is impressive and emphasizes the continued importance of preparedness and remedial measures. The large and small eruptions of the past century indicate a rate of growth of the upper part of Mauna Loa comparable to the rate of about 10 feet per century in the 30,000 years since the last glacial epoch suggested by the meager geologic evidence. We cannot say that the volcanic activity of Mauna Loa is either increasing or decreasing, as viewed during the historical period.

CHESTER K. WENTWORTH

CONTRIBUTIONS TO PHYSICAL THERAPY FROM ANALYSIS OF YOGA TECHNIQUE

Prepared by the secretary.

Author's abstract not available.

The East-West Philosophers' Conference, held in Honolulu in 1949, provided opportunity for a comparison between yoga and physical therapy, and for ascertaining what the latter could learn from this Indian philosophy. Stages in progress for yogi include (1) motivation, the relinquishing of worldly desires; (2) being in rapport with the teacher (guru); (3) the rapport of the guru with the pupil, desire to help; (4) development of insight, confidence, and peace of mind; (5) establishment of emotional disciplines, purging the mind; and (6) muscle-mind disciplines.

An analysis of Hindu yoga showed a similarity to Western psychology. It indicated that physical therapy had much to learn from yoga, especially in the following: (1) The relationship between patient and physician, (2) peace of mind of the patient, and (3) emotional control in muscle training. The polio patient, particularly, could profit by fixing the mind to achieve muscular control.

RUTH ANN AUST

COMPOSITION OF HONEYDEW EXCRETED BY PINEAPPLE MEALYBUGS (PSEUDOCOCCUS BREVIPES CKLL.) AS DETERMINED BY PAPER CHROMATOGRAPHY AND RADIOAUTOGRAPHY

The general view that plant-sucking insects, which excrete copious quantities of excess carbohydrates in their honeydew, must take in large amounts of plant juice in order to get sufficient amounts of amino acids and proteins was not found to be the case with pineapple mealybugs. Relatively large amounts of as high as 17 different amino acids and amides have been found in the honeydew excreted by pineapple mealybugs.
(Pseudococcus brevipes Ckll.), by the method of paper chromatography. The number of amino acids excreted was shown to increase with the period of feeding by the bugs. The amino components of the honeydew, which have been identified from their Rf values, are cystine, aspartic acid, glutamic acid, serine, glycine, asparagine, threonine, alanine, glutamine, tyrosine, tryptophane, valine, phenylalanine, histidine, and proline.

At least five amino acids were found in the honeydew which were not found in the food source. There may be a relationship between the presence of certain amino acids in the excretion and symbionts within the bugs as well as between the presence of certain amino acids and the toxicity of the bugs.

The carbohydrate components were identified by different sprays and radiograms of honeydew excreted by mealybugs while feeding on a radioactive pineapple leaf. The leaf was made radioactive by allowing it to photosynthesize in an atmosphere of C14O2. The compounds identified are fructose, glucose, sucrose, glucose-1-phosphate, and possibly maltose. A new spray test was found for identifying ketose sugars.

Malic acid, citric acid, and salts of citric acid were also found in the honeydew.

FURTHER INVESTIGATIONS OF THE PHYSICAL AND CHEMICAL BEHAVIOR OF THE VORTEX TUBE

A series of studies was undertaken to improve the efficiency of thermal separation of the Ranque-Hilsch vortex tube and to explore the applicability of this device to the separation of chemical mixtures. Johnson reported negative results on the chemical separation of air, using the vortex tube. Improvement in the thermal separation was undertaken, as it appeared likely that conditions for good thermal separation might be closely associated with those for chemical separation.

Results that are comparable to those of Hilsch were obtained for the thermal study. Improvement in the thermal separation of the mixture at 50 psi and no throttling, the following results were obtained:

<table>
<thead>
<tr>
<th>Difference in composition between hot and cold sides</th>
<th>Difference in chemical separation factors between hot and cold sides</th>
</tr>
</thead>
<tbody>
<tr>
<td>mol fraction of carbon dioxide</td>
<td>mol fraction of carbon dioxide</td>
</tr>
<tr>
<td>0.947</td>
<td>0.0053</td>
</tr>
<tr>
<td>0.880</td>
<td>0.012</td>
</tr>
<tr>
<td>0.106</td>
<td>0.114</td>
</tr>
</tbody>
</table>

If we let r denote the chemical separation factor of argon on the cold side and r on that on the hot side, it follows that, for the foregoing results,

either 1.106 is not less than r or is not less than 1.053
and 0.947 is not less than r or is not less than 0.894

and either 1.114 is not less than r is not less than 1.057
or 0.943 is not less than r is not less than 0.886.

The separation factor thus exceeds that for diffusion alone, since the separation factor for Graham's Law is 1.050. The carbon dioxide content in the hot gas was increased.

Note added in proof: Elser and Hoch have carried out a striking series of studies. Their results correspond to r = 1.053 for oxygen in air. This is of the same magnitude as our results, although it is smaller than the Graham's Law separation factor of 1.068. Similarly, for carbon dioxide in air, their results are of the order of r = 1.09, compared to the Graham's Law value of 1.23. The facts that our separation factor exceeds that for diffusion alone, and that the argon, rather than the carbon dioxide, was enriched on the cold side both appear to be incompatible with the theory presented in their paper.

ANALYSIS OF TIDAL FLUCTUATION IN BASAL GROUND-WATER BODIES

Tidal fluctuation is often noted in basal ground-water bodies whose discharge is controlled by sea level. Computation of mean water levels indicative of climatic or draft changes requires analysis of the tidal fluctuation.

The ground-water tides may be correlated with ocean tides if the semidiurnal and diurnal tidal components are separated by harmonic analysis, and if the lags and damping of each component are analyzed separately. For each component:

\[ \delta_w - \delta_o = \log_{A_w} \frac{A_o}{A_w} \]

where \( \delta_w - \delta_o \) = phase lag between ocean and well in radians.

\[ A_o/A_w = \text{ratio of amplitude at ocean to amplitude at well.} \]

The phase lags of different components are inversely proportional to the square root of the periods of the components, and a single constant, describing the difference between the tides at a well and those in the ocean, may be computed from any component and from either phase lags or damping ratios:

\[ C = \sqrt{\tau} \left( \delta_o - \delta_w \right) = \sqrt{\tau} \log_{A_w} \left( \frac{A_o}{A_w} \right) \]

where C = tidal difference constant, with the dimensions of \( \sqrt{\tau} \).

\( \tau = \text{the period of the tidal component.} \)
For a simple, ideal case, considering an unconfined ground-water body in a shallow aquifer underlain by an impermeable layer, and assuming instantaneous vertical transmission of pressure, as would be the case if the boundary between aquifer and ocean were vertical:

\[
\frac{f}{C} = \frac{1}{\sqrt{kd\mu\rho g}}
\]

where \(x\) = distance from shore
\(f\) = porosity of aquifer
\(k\) = coefficient of permeability
\(d\) = depth of aquifer
\(\mu\) = viscosity of water
\(\rho\) = density of water
\(g\) = acceleration of gravity

Theoretical application to other more realistic cases has not yet been made.

The analysis is presented in its present stage of development because it already has valuable uses: (1) Computation of mean water-table altitudes from single measurements of the water-table altitude for wells whose tidal difference constants are known, at any time when ocean tides are known; computation of a static level with tidal fluctuations from a given mean static level, as a base from which to measure drawdown; (2) computation of long-period tidal fluctuations to permit separating them from long-period fluctuations originating from draft or climate changes; (3) analysis of relative permeability through comparison of tidal difference constants.

It is hoped that the theory may be extended to provide a better tie between the tidal difference constants, distances from the shore, and permeabilities.

DOAK C. COX AND WALTER H. MUNK

THE PRESENCE OF A MARINE SCHISTOSOME IN HAWAII

Marine snails, identified as *Littorina pintado* Wood, were collected from Bird Island (Moku Manu) near Kaneohe on November 24, 1950, and found infected with a species of schistosome. This same species of schistosome was also found recently in *L. pintado* snails obtained from Rabbit Island (Manana), near Waimanalo, Oahu. Both of these islands are Bird Reserve areas where a large number of sea birds of such common species as the sooty terns, wedge-tailed shearwaters, etc., nest and aggregate. (Acknowledgment is made to Mr. Wray Harris, marine malacologist, of Bishop Museum, Honolulu, Hawaii, for the identification of the snail intermediate host.)

In studying the anatomy of this schistosome, the mean measurements in millimeters of 50 specimens show that the sizes for the various structures are: body length, 0.248; width of body, 0.091; length of head organ, 0.088; length of tail stem, 0.203; length of furca, 0.109; diameter of ventral sucker, 0.062; and distance from ventral sucker to posterior end of body, 0.087. Although these measurements are at variance with the schistosome cercariae described by Penner (1950), we believe there is no significant anatomical structure which would show the schistosome cercariae found in Hawaii to be of a different species. Therefore, we tentatively identified these schistosome speci-

mens as *Cercaria littoralinae* Penner 1950 until we know the morphology of the adults.

That the cercariae are of the dermatitis-producing type was confirmed by the experimental infections of five human volunteers. A double layer of cotton gauze, cut to approximately 2 cm. x 1/2 cm. was saturated with 80–100 cercariae in sea water. This piece of cotton gauze was then placed on the forearm of a volunteer. In all five patch-tested individuals, the sensation of itching was experienced. Two produced typical schistosoma dermatitis lesions, two had erythema around the points of entrance, and one individual was not reactive.

Normal human serums (77-8 per cent of 54 specimens), after inactivation at 56°C. for 30 minutes, had the power in low titers (1-2 to 1-8) to form agglutinates with the individuals of this marine schistosomes cercaria in vitro at room temperature. Inactivated serums, when guinea pig complement was added to each in the proportion of 1-10, also showed a precipitin reaction around the tail as well as on the body. Certain fresh human serums, without previous inactivation, developed the precipitin reaction in similar ways. Investigations are now in progress to study the immunological relationship, if any, involved in the formation of precipitates or agglutinates by *C. littoralinae* in human and animal serums.

GEORGE W. T. C. CHU AND JOHN L. PELGEN

DEGENERATION AND REGENERATION IN THE TROPICAL FRESH-WATER SPONGE, *SPONGILLA PROLIFERENS* ANNAND

Because degeneration and regeneration are normal physiological processes in sponges, neither process can be considered separately from the other. The sponge reacts under unfavourable conditions by degenerating totally, but, at the same time, it forms gemmules from which new sponges will develop as soon as conditions grow better, thus starting regeneration at the same time degeneration sets in. In *Spongilla proliferens*, contrary to the claims made in other species, no special or specific cells play a part in either of these processes. In fact, this sponge has very few different cell types with which to perform all life processes.

Degeneration starts with the formation of protein reserve material — oval-shaped, strongly eosinophile bodies in the phagocytes. Many of these cells and a few amoebocytes form cell packets, or immature gemmules, at the base of the sponge. The next stage is a rapid degeneration of the epithelium of the flagellated chambers. The resulting cell debris is invaded by protozoa and phagocytes of the sponge, which phagocytize this amorphous mass. Following this stage, the cells of the sponge, not participating in the formation of gemmules, clump together and degenerate, so that eventually only naked spicules and gemmules remain.

In the meantime, scleroblasts gather around the young gemmule and start producing a wall of spicules. After finishing this wall, they secrete a thin layer of spongion and then die. The gemmules themselves produce a thicker spongy layer at the inner side of the spicule wall.

Small wounds are healed by the normal cells of the sponges moving toward the wounds. Closing of a
wound is characterized by the formation of a bud which may remain but often disappears after a few weeks.

P. B. VAN WEEL

EMBRYONIC CHEMICAL HETERAUXESIS IN SOME POECILILIDS

This is a report on the heterauxesis of chemical entities during the embryonic development of several species of poeciliids collected in Honolulu. Growing ova (from 0.1 mm. to maximum size attained at maturity) were analyzed for protein, using the sub-micro Kjeldahl nitrogen estimation method, and for total lipids, and the data so obtained were correlated with dry weights, and with dry weights of which increase outward from the cyclone. There is a constant ratio between total protein and dry weight during the period when the ova grow to half their maximum size. After that, there is a rapid increase in the deposition of lipoid substances, and the ratio assumes another value. After fertilization there is a further increase in size of the ovarian follicles, indicating continued growth by the uptake of material from maternal source. The total protein, laid down in the mature ovum cannot account for all the protein in the embryo at parturition. Lipids are used at a later stage of the gestation period.

SIDNEY C. HSIAO

SOME PECULIARITIES OF KONA STORM DEVELOPMENT AND BEHAVIOR

A study of 76 kona storms which occurred over a 20-year period has revealed two sources of development for this subtropical cyclone of the central Pacific. One source is in connection with the occlusion of a frontal wave cyclone whose northward movement is blocked and the source of cold air cut off by an anticyclone moving rapidly eastward. When this occurs, the occluded cyclone becomes circular, frontal discontinuities disappear, and the central cold vortex is encircled by warm tropical air. This vortex, which becomes the nucleus of the kona storm, is associated with widespread cloudiness, heavy rains, and squally winds, all of which increase outward from the cyclone center and reach a maximum some 200 to 500 miles east of the low-pressure center.

A secondary source of kona storm development is through cyclogenesis in the trade-wind easterlies. This is associated with a pre-existing cyclone in the upper troposphere which intensifies and extends its counterclockwise circulation earthward to the surface.

The movement, subsequent intensification, and behavior of kona cyclones—like most cold lows—is erratic, but distinguished by marked tendencies to move westward for considerable distances before dying or recurring northward.

The ultimate stages of development of the kona cyclone depend upon the environment which its meandering path may provide. This path usually leads to a new source of cold air which favors frontogenesis and allows the low center to reintensify as a wave cyclone. In some instances, however, the kona cyclone may develop the characteristics of a tropical cyclone, in which strongest winds and heaviest rains are very near the center. In this case the storm is more violent and has the eye characteristics of a tropical storm. This development occurs, apparently, from an impetus in the upper troposphere which causes isallobaric convergence of tropical air about the cold low of the cyclone. This intrusion of the rain-laden currents of tropical air causes release of large quantities of latent heat of condensation near the low center. This results in a reversal of horizontal temperatures as the core of the lower vortex becomes warmer than its surroundings. As this transformation is completed, the surface currents which converge upon the storm center rise and are slung centrifugally outward from the vortex and circulate in a kinetic energy-releasing sense, which could not be realized as long as the core of the cyclone was cold. This provides energy for rapid intensification of the storm. A detailed analysis was made of such a kona storm which affected Oahu in March, 1951, and whose structure illustrates these principles.

The kona storm is a significant feature of subtropical circulations in both Atlantic and Pacific Oceans, though it occurs less frequently in the Atlantic. It is a cyclone uniquely intermediate between the well-known wave cyclone of extratropical origin and the tropical cyclone and should be properly identified as a subtropical cyclone.

R. H. SIMPSON

SCIENCE VERSUS PHOBIAS

Presidential address, 1951.

During recent years there has been an epidemic of phobias, especially in the field of agriculture. The scientist is motivated by the search for facts; the phobist, probably, by the urge to get into the public eye faster by disguising half truths as whole truths. Some examples of agricultural phobias include: (1) "Plowman's folly"—the belief that vegetables will grow better without plowing; (2) the desirability of having large numbers of earthworms in the soil; (3) organic versus natural products such as fertilizers; and (4) "hidden-hungeritis," the notion that crops grown on worn-out soil are not fit to eat.

Regarding the fourth it was noted that, if there is sufficient fertility in the soil to produce a crop, this will have adequate food value for the users. One way to judge soil is to note how the weeds grow. Nowadays a man can care for soil deficiencies. Clay soils may have more minerals, but, with careful management, sandy soil can be made to produce good crops. The formula for successful productivity is soil plus weather plus man. Lowbrow plants can become highbrow plants through man's care. Poverty usually precedes poor nutrition. These and other similar phobias were discussed.

L. D. BAYER
RESOLUTIONS

The following resolutions were moved and adopted unanimously at the annual meeting of the Hawaiian Academy of Science, May 12, 1951.

RESOLVED, That the Resolutions adopted by the Hawaii Symposium on Scientific Research in the Pacific, sponsored by the Hawaiian Academy of Science, March 9 and 10, 1951, be adopted as recommendations of the Academy; and be it further

RESOLVED, That the Pacific Science Council Secretariat be invited and authorized to draw to the attention of appropriate agencies, through the Pacific Science Association's established channels of communication, resolutions that may be of concern outside Hawaii; and be it further

RESOLVED, That the Hawaiian Academy of Science express its thanks to the Secretariat of the Pacific Science Council, Pacific Science Association, for its aid in organizing and conducting the Hawaii Symposium on Scientific Research in the Pacific, and that the Academy compliment the Secretariat on so effectively fulfilling one of its terms of reference in thus assisting Pacific scientists.

NECROLOGY

JOHN F. EMBREE

John F. Embree was born in New Haven, Connecticut, August 26, 1908, the son of Dr. Edwin R. Embree, authority on the Far East and President of the Julius Rosenwald Fund. John Embree received degrees from the University of Hawaii (A.B., 1931), University of Toronto (M.A., 1934), and University of Chicago (Ph.D. in Anthropology, 1937). He returned to Hawaii in 1937 as research associate and (1940-41) assistant professor of anthropology. Interested in the acculturation of ethnic groups, he made a study of a Japanese village, Suye Mura, and then of people of Japanese ancestry in Kona, Hawaii. Returning to Toronto (1941-42) he applied his knowledge of the Japanese to wartime intelligence—for the Office of Strategic Services (1942), the War Relocation Authority (1942-43), and as head of Japanese area studies at the Civil Affairs Training School in Chicago (1943-45). He was associate professor of anthropology at the University of Hawaii (1945-47) and in 1947 he was the first cultural relations attaché to the U. S. legation in Thailand. In 1948 he became associate professor of sociology and Southeast Asia studies at Yale University and, in July, 1950, director of Southeast Asia studies. His untimely death occurred on December 22, 1950, through an automobile accident. Dr. Embree was a research associate of Bernice P. Bishop Museum and an adviser to various other scientific organizations, such as the National Research Council, the Council of Learned Societies, and the Social Science Research Council. As a consultant for the Foreign Economic Administration, he advised on problems of Micronesian administration. His many studies are reported in numerous scientific papers. Anthropology has lost a promising authority on the peoples and cultures of East Asia and the Pacific in his passing. (For a tribute to his work, see American Anthropologist 53 (3): 376-382, 1951.)

VERN HINKLEY

Vern Hinkley, journalist, was born in Sioux City, Iowa, July 12, 1892. He was graduated from Cornell College (Mt. Vernon, Iowa) in 1915. He came to Hawaii in March, 1922, to join the staff of the Honolulu Star-Bulletin. He edited the Hilo Tribune-Herald from 1924 to 1926, but returned to the Star-Bulletin, becoming City Editor in 1927, a position he held until shortly before his death. Mr. Hinkley was interested in various branches of natural science, but particularly in volcano research. He died on January 7, 1951.

HORACE JOHNSON

Horace Johnson, retired engineer, died on August 20, 1950. He was born at Newburyport, Massachusetts, August 12, 1878, educated in the public schools of Massachusetts and in Abilene (Kansas) high school, and graduated from the Massachusetts Institute of Technology. He came to Hawaii in 1900 to accept the position of chemist at the Waialua plantation. In 1911 he went to Pepeekeo Sugar Company and the following year became supervising chemist of all plantations represented by C. Brewer and Company. In 1915 he became a vice-president of that organization and also a director of the Onomea, Pepeekeo, Honomu, Hilo, Wailuku, and Waimanalo plantations. He retired from C. Brewer and Company on September 1, 1934. One of Mr. Johnson's outstanding contributions to sugar technology was the designing of the mill at the Waimanalo plantation. After retiring from active service, he was executive secretary of the Hawaiian Agricultural Advisory Committee and a member of the Civil Service Commission and other civic bodies, the Hawaiian Sugar Technologists' Association, and various clubs.
MEMBERSHIP
MAY 1951

Abel, Marjorie
Akin, Helen K.
Akan, Theodore K.
Alber, Ernestine
Alticata, J. E.
Anderson, Earl J.
Apel, Viv B.
Arnold, Harry L.
Arzamendi, Don H.
Atberson, J. Ballard
Aucher, E. C.
Auss, Ruth A.
Ayres, Arthur S.

Baker, Ray J.
Baltin, John D.
Baner, Albert H.
Bartling, Wray R.
Barr, Elwood L.
Baver, L. D.
Belmont, J. H.
Beebe, James M.
Beer, Morton
Bent, Henry
Bianchi, Fred A.
Bice, Charles M.
Bilger, Earl M.
Bilger, Leon N.
Bishop, Brenda
Bisbe, Harold M.
Bonnet, David D.
Borden, Ralph J.
Bowles, Mildred
Bryson, L. T.
Bryan, W. H.
Bryan, L. W.
Bryson, L. T.
Bush, William M.
Bush, William M.
Bush, Robert L.

Campbell, Edward L.
Campbell, Max H.
Carret, Walter D.
Casy, Edward L.
Chad, Arno R.
Chiles, Arno R.
Chung, Mabel
Christian, Elizabeth
Chu, George W.
Chun, Edwin Y.
Clay, Horace F.
Clements, Harry F.
Clepper, Robert W.
Colbert, Frederick
Collins, J. L.
Conboy, Philip M.
Connell, Arno H.
Cox, Don A.
Cox, Joel B.
Crow, William
Cross, Robert F.
Croswell, David

Davis, Clifton J.
Davis, David A.
Dean, Arthur L.
Delahanty, Berle L.
Degener, Otto
Denning, Horace G.
Denison, Harry L.
Dillingham, Frank T.
Dwyer, Ralph

Edmondson, C. H.
Eguchi, George
Ehret, William R.
Ehret, Willard H.
Emory, Kenneth H.
Engard, Charles J.
Enright, James R.

Feldkau, W. F.
Field, Harry L.
Finch, Roy H.
Fong, Francis
Forbes, Thea W.
Fosberg, F. P.
Foster, Zera C.
Fukimoto, Giichi
Fukuda, Mitsujiro
Fukuyama, David T.

George, Clarence A.
Goninetti, G.
Gill, Robert F., Jr.
Gladwin, Elizabeth
Gottner, Willis A.
Griffith, William
Gray, Reed A.
Greenwell, Amy B. H.
Greenwell, Amy B. H.
Greene, Charles H.
Gregory, Herbert E.

Halperin, Sidney L.
Handy, E. E. C.
Hanson, Noel
Harada, M. B.
Harris, Anna E.
Harvey, Wray
Harry, J. V.
Harrington, Eugene E.
Harwell, Alfred S.
Heinicke, Ralph M.
Herrick, William A.
Herron, John S.
Hosaka, E. Y.
Hoso, Kiyoshi
Hazard, Sidney C.
Hu, Stephen M. K.
Hudson, L. G.
Humblet, Roger P.

Ito, Kiyoshi
Jackson, David C.
Jaggers, T. A.
Jermann, Robert E.
Jessen, Louise A.
Jorgensen, Margaret K.

Kamamoto, Haruyuki
Kaneko, Yoshinori
Kask, John L.
Katsumi, T.
Kawakami, Felice W.
Kawano, Henry
Kelley, Arthur R.
Kendall, Mary C.
Kepner, Gerred B.
Kepner, Richard D.
Kern, Kenneth R.
King, Maurice V.
King, W. Norman
Kingbury, Joe W.
Kirch, William
Kissman, M. Helena
Kirschman, H. D.
Kodama, Yoshio
Koh, Eiko
Krauskopf, Beatrice
Krauskopf, F. G.
Krauskopf, N. L. H.

Lam, Margaret Z.
Lam, Robert L.
Lamb, Alvin F.

Larrabee, L. M.
Larson, Nils P.
Larson, Norma
Larson, Harry W.
Leeper, Robert W.
Lennox, Colin G.
Levine, Max
Lind, Andrew W.
Livesey, T. M.
Lohman, Marion L.
Look, William B.
Lord, Edith
Loucks, Burton J.
Loucks, Ruth B.
Louis, James L.
Louis, Lucille
Lum, C. K.
Lyons, Harold L.
Lyons, Mrs. H. L.

McCarthy, Harold
McGee, Walter L.
McGuire, Thos. R.
McDonald, Gordon A.
Magistad, O. C.
Manchester, C. A. Jr.
Mangelsdorff, A. L.
Marcy, Verna B.
Martin, Joseph P.
Mason, Leonard
Matthews, Donald C.
Mau, Kong Tong
Midkiff, Frank E.
Miller, Harry D.
Miller, Robert C.
Mitchell, Donald
Mitchell, Wallace B.
Moe, Clayton R.
Moiz, William W. G.
Moreda, Wendell A.
Morin, Joseph E.
Moulton, Margaret

Naiditch, Sam
Nakamoto, Goichi
Nakamura, W. T.
Nakao, Harry
Nakui, Dorothy
Naughton, John J.
Neal, Marie C.
Newell, Irwin
Nickerson, Thomas
Ningan, Gordon T.
Nishida, Toshiyuki
Nishimura, Eiichi
Nita, Doris
Nordfeld, Sam
Nutting, Lewis M.

Okimoto, Marion C.
Okubo, Shigeo
Orr, Kayden J.
Palafoux, A. L.
Palmer, Harold S.
Parks, Lawrence
Payne, John H.
Pemberton, C. E.
Pen, Florence
Pinkerton, F. J.
Poole, Charles F.
Potter, Colin
Powell, Howard A.
Pugh, Mabel J.

Rhea, Clifton C.
Rippon, J. C.
Ross, Stanley F.
Rosenberg, Morton M.
Rueck, Kenneth J.

St., John, Harold
Sakuma, Kyu
Scheet, Bradley T.

Schmidt, Carl T.
Schmidt, Helen D.
Schrauer, Paul J.
Scott, Arthur M.
Seyler, Dode A.
Seikoguchi, Nao
Sext, Oscar F.
Sheek, Kenneth W.
Sherrill, Donald
Sherman, Martin
Shiga, Gordon T.
Sideris, C. P.
Sidewell, A. P.
Simpson, Robert H.
Sinclair, Gregg M.
Slattery, Mabel
Smith, Elbert G.
Smith, Madarath
Smith, R. G.
Spalding, P. E.
Spiegelberg, Carl H.
Spitzer, Blanch H.
Springer, Doris
Stearns, Marjorie
Stewart, William S.
Sudds, C. R.
Srokes, E. G.
Storv, William B.
Suehiro, Any
Suzuki, F. T.
Sweezy, O. H.
Sykes, Walter E.

Takahashi, David
Takahashi, Makoto
Takazawa, Futoshi
Tanimoto, Ralph B.
Tanimoto, Tyrus T.
Taylor, H. H.
Taylor, Keith L.
Tester, Albert L.
Thompson, M. D.
Titcomb, Margaret
Tucker, Leo W.
Tushill, Leonard

Umeda, Rose M.
Urata, Rokuro

Vakivic, K. N.
Van den Bosch, Robert
Van Wiel, Peter
Van Zwalwouw, R. H.
Vernon, Mabel D.
Vinacke, W. Edgar
Vinacke, Winifred R.
Voorhees, George

Wadsworth, Harold A.
Wakai, Ted Y.
Walker, Leonard
Wallace, George C.
Wallace, Keith M.
Warner, H. H.
Watson, Leslie J.
Weatherbee, Carl
Weaver, Carl
Wentworth, J. L.
Welch, Dorothy
Wisherd, Richard
Wittkower, Juliette
White, J. Warren
Widler, Chas. L.
Wismer, Chester
Wise, George H.
Wong, Arthur G. H.

Yamamata, George
Yamaguchi, Ichii
Yasuda, Philip K. K.
Yoshio, Takeo
Yoshioka, Tat T.

Zetlin, Harry
Zimmerman, E. C.
Zeobisch, Oscar C.
INTRODUCTION

Invitations were sent out by President E. C. Auchter (and, after his departure for the mainland United States, by the Secretary of the Academy) to about 90 persons living in the Hawaiian Islands, interested in applied science, to take part in the proposed symposium. A chairman was selected and appointed for each of 11 committees into which the applied sciences were divided. Additional invitations were sent, at the suggestion of these chairmen and others, until a total of nearly 150 persons had been invited to participate. These invitations were not confined to members of the Academy and, in a few instances, went to persons outside the Territory of Hawaii, who were expected to be in Honolulu at about the time of the meetings.

Mimeographed summaries of background data were prepared by the Pacific Science Council Secretariat and distributed to those invited to participate. These summaries included specific recommendations of the seven Pacific Science Congresses, the Bishop Museum, the South Pacific Commission, and the Pacific Science Conference sponsored by the National Research Council and held in Washington, D.C., June 6-8, 1946. An agenda was prepared by the chairman of each of the 11 committees, and copies of these, together with the program of the opening meeting and a list of 137 participants, were distributed.

The program was presented as scheduled, with a few changes, made necessary by the absence of two of the speakers and the addition of another. Dr. L. D. Baver, vice-president of the Academy, presided. The opening session was held in the seminar room of the Pineapple Research Institute. Summaries of the addresses and reports presented at this opening session are printed herein.

The committees met Friday afternoon and Saturday morning in various rooms on or near the University of Hawaii campus. Summaries of their deliberations are given below.

The group as a whole reassembled in the seminar room of the Pineapple Research Institute at 3:00 P.M., Saturday, May 10, to hear the reports of the committees. Copies of most of these reports were mimeographed, through the help of volunteer workers, and distributed prior to their presentation. These recommendations, as adopted, with slight editorial changes made in the interests of uniformity, are printed below.

Verbatim recordings of the Friday morning and Saturday afternoon meetings were made with Gray Autograph Sound Writing equipment on Flexograph discs, through the courtesy of Fisher Corporation, Ltd., of Honolulu. Photographs of the opening session and of some of the committee groups were made by the University of Hawaii.

The Academy is grateful to the Pineapple Research Institute, the University of Hawaii, the Pacific Oceanic Fishery Investigations, and the Institute of Pacific Relations for providing meeting places and other facilities.

The help of Loring G. Hudson, executive secretary, and Miss Brenda Bishop, of the Pacific Science Council Secretariat, is gratefully acknowledged. They carried out their objective of co-operating with other scientific groups seeking to advance knowledge concerning the Pacific area, in a most efficient and helpful manner.

EDWIN H. BRYAN, JR.,
Secretary-Treasurer.
Program

FRIDAY, MARCH 9, 9:00 A.M. Opening meeting, Seminar Room, Pineapple Research Institute.

ADDRESSES
L. D. Baver, Chairman.
Peter H. Buck, Director, Bernice P. Bishop Museum.
K. C. Leebrick, Vice-President, University of Hawaii and Alternate Commissioner for the United States for the South Pacific Commission.
Harold J. Coolidge, Executive Secretary, Pacific Science Board.
Loring G. Hudson, Executive Secretary, Pacific Science Board Secretariat.

MESSAGE
From B. M. Gonzalez, President, Eighth Pacific Science Congress.

RESEARCH REPORTS
C. A. Manchester, Jr., Chairman, Research Committee, University of Hawaii.
H. A. Wadsworth, Dean, College of Agriculture and Director, University of Hawaii Agricultural Experiment Station.
J. L. Collins, Pineapple Research Institute.
Colin G. Lennox, President, Territory of Hawaii Board of Agriculture and Forestry.
Otto L. Burton, Captain, Medical Corps, U.S. Navy.
H. M. Mayo, Staff Agriculturist, Trust Territory, Pacific Islands.
L. D. Baver, Director, Experiment Station, Hawaiian Sugar Planters' Association.
Frank R. Oberhansley, Superintendent, Hawaii National Park.

FRIDAY, MARCH 9, 1:30 P.M. Committee meetings.

SATURDAY, MARCH 10, 9:00 A.M. Committee meetings.

SATURDAY, MARCH 10, 3:00 P.M. Combined committees' co-ordinating session to receive committee reports and recommendations and to adopt symposium resolutions; L. D. Baver, presiding.

ABSTRACTS

Addresses

ADDRESS OF WELCOME

In welcoming the delegates to the symposium, Dr. Baver said that the symposium program will deal with research phases in the islands which have implications throughout the Pacific.

We regret that Dr. E. C. Auchter, President of the Academy, who has been so active in planning the symposium, is unable to be present and to preside.

Research is that tool by which we find the facts of the case. Nearly every problem may be solved, needs basic information. For example, we need a better picture of the origin culture of peoples in the Pacific area and of methods by which this culture may be preserved. We need basic data that can guide us in the conservation of the resources we have, both natural and human, in order to build a modern economy. We need to gather sociological facts to improve the standards of living of these peoples.

The world moves as a result of conflict between man and nature. This conflict is necessary if we are to have any kind of sociological environment in which people can carry on even the most primitive type of life. Man wants food, shelter, wealth, recreation. In order to obtain these, he takes or destroys natural resources. We must help man to conserve as well as to take. Natural resources also include climate, soil, and life in the sea.

The job of this symposium is to establish facts which will help man to satisfy his needs, develop areas, and at the same time preserve what is worth preserving. In building up a modern economy in the Pacific, we should not destroy either the culture or the resources that have come to us from the past.

Man's livelihood on the earth is influenced by the evolution of his ideas and by his ability to make progress. All progress is based upon facts. We will become stalemated if we have no new information on which to build an economy. We hope that the various committees that have been appointed as a part of the symposium will incorporate this idea in their considerations.

L. D. BAYER

BERNICE P. BISHOP MUSEUM

What we need today is more co-operation between the sciences, so they can come together in a symposium such as this, to add to the general building up of science and knowledge. During the coral atoll symposium we gathered a wealth of information from a number of people who one might think would have little or no interest in coral atolls.

Natural science and anthropology were not built up by abstract thought. They were built upon the study of material things. It is impossible for an individual to make all the needed collections. This has to be done by a number of people, and there must exist museums and other institutions which will bring together and care for these material things.
Scientific progress has been made possible in Hawaii by various institutions—university, museum, experiment stations, research organizations—which are established here. Pacific investigations can be achieved best through co-operation between students of the different sciences. The Bishop Museum is able and willing to care for collections which are assembled. It is open to you all. We are happy to help you, and you can help us by telling us what we lack and by helping us to fill the gaps.

In New Zealand, spring planting was a co-operative undertaking; everybody helped—commoners, warriors, chiefs, women, even the children. Theirs was a form of symposium. The coming of spring was announced by the Song of the Cuckoo which ended with the command, "Koia (dig)"!

PETER H. BUCK

SOUTH PACIFIC COMMISSION

The South Pacific Commission is an advisory and consultative body set up by the six governments which administer non-self-governing territories in the South Pacific region. Its purpose is to advise the member governments on means of promoting the well-being of the peoples of these territories—their social and economic development and their health. The expenses are borne by the six governments according to fixed proportions.

The Commission seeks, as far as possible, to carry out its purposes, aims, and functions by advising and encouraging activities of the local administrations rather than by doing for these territories what they can do more directly for themselves. It deals chiefly with problems of common interest which can be undertaken better by regional co-operation. It has concentrated upon a number of clearly defined problems that show promise of early results, and it will use its international character to spread knowledge of the results achieved by other institutions.

The following are fields for co-operative effort through the Commission: (1) Partnership enterprises, such as epidemiological information, advice on vocational training, plant introduction projects, and quarantine measures, between territories that otherwise would be separated by national boundaries; (2) interchange of information; (3) projects, such as illiteracy, marketing problems, and help to atoll dwellers, so area-wide and so far from solution that effort on a common basis is justified; and (4) pilot or experimental projects, such as community development.

The Research Council meets yearly to draw up a work program. This is approved and financed by the 12 Commissioners. Projects in operation or to be undertaken during 1951 are: 9 on health, 13 on economic development, and 13 on social development.

K. C. LEEBICK

PACIFIC SCIENCE BOARD

The Pacific Science Board is a regional committee of the National Research Council, with 11 members, a number of consultants, and 6 standing committees. It was established, as a result of the Pacific Science Conference held in Washington, D.C., in 1946, to aid scientists of America who wish to engage in scientific investigations for which there is a need in the Pacific area, to advise governmental and other agencies on scientific matters pertaining to the Pacific, and to further international co-operation in the field of Pacific science.

These objectives have been carried out during the past 4 years. The principal activities have been: (1) co-operation with the Department of the Navy, with the help of funds granted by the Office of Naval Research, in carrying out scientific investigations primarily in the islands of the Trust Territory. These have included CIMA, SIM, and ICCM, which last has become ICCP (Invertebrate Consultants Committee for the Pacific) which has advised on problems of pest control and quarantine, and sponsored an insect survey of Micronesia; (2) organization of United States participation in the Seventh Pacific Science Congress, New Zealand, 1949; (3) organization of an Alaskan Science Conference; (4) participation in five international conferences; (5) establishment of co-operation with foreign scientists; (6) advising the Department of the Army on problems in the Ryukyus; (7) co-operation with international agencies; and (8) development of a 5-year program of fundamental ecological research on coral atolls, commencing work on Arno Atoll, Marshall Islands. In many of these activities the Board has received valuable and welcome help from scientists in Hawaii.

The future of scientific work in the Pacific will depend upon: (1) the development of increasingly active international co-operation in research, aided greatly by the Pacific Science Congresses and the Secretariat which has been established in Honolulu; (2) an ever-increasing flow of American scientists and research funds into Pacific areas; and (3) aiding these by the establishment in Honolulu of a center for Pacific scientific research, and supporting the great and widely respected scientific institutions of Hawaii.

HAROLD J. COOLIDGE

SECRETARIAT, PACIFIC SCIENCE COUNCIL

One of the instructions laid down by the Seventh Pacific Science Congress in establishing this international Secretariat was that it assists scientists. This symposium provides an excellent opportunity for just such co-assistance. Bringing together scientists from various fields and facilitating free flow of scientific information among workers are services that come well within the terms of reference of the Secretariat.

The permanent Secretariat was opened in March, 1950, with offices at the Bishop Museum, which is the Pacific Science Association's representative institution for Hawaii. There are two officials, Miss Brenda Bishop and myself. Financial support for 2 years has come from UNESCO, the Rockefeller Foundation, the Coolidge Foundation, the Government of France, and Hawaii's own McNerny Foundation.

The Secretariat is established to: (1) assist governments, institutions, and individuals, as well as standing committees of the Pacific Science Association, in the implementation of resolutions and recommendations adopted by Pacific Science Congresses; (2) serve as a central office for the Pacific Science Council, especially during the intervening periods between Congresses; (3) serve as an information dissemination center in Pacific science matters; (4) assist in maintaining a continuity in the relationship between the Pacific Science Association and such international bodies as the specialized agencies of the United Nations and the South Pacific Commission.
Carrying out plans and instructions of the Seventh Pacific Science Congress, the Secretariat has: (1) inspired the formation of the Conservation Council for Hawaii; (2) laid plans for establishing a Public Health Information Center; (3) arranged with UNESCO Field Science Cooperation office to assist scientists passing through Honolulu on their way from one country to another; (4) undertaken to produce nine information bulletins a year; (5) commences a file on current research in the Pacific; and (6) summarized data on expeditions in the Pacific since 1900, with maps.

Through the Pacific Science Association's established channels, the Secretariat is in a position to act as a means of liaison for furthering co-operation among scientists in different disciplines and in different territories.

LORING G. HUDSON

MESSAGE TO HAWAIIAN ACADEMY OF SCIENCE

(Published in full.)

In the name of the National Research Council of the Philippines and the organizers of the Eighth Pacific Science Congress, I send greetings to the Hawaiian Academy of Science on the occasion of its symposium on scientific research in the Pacific.

The example set by Hawaii in promoting general community welfare has set a pace for other nations to emulate. It is indicative of a commonly observable fact that leadership does not necessarily lie in size or in numbers. The broad outlook and the friendly attitude toward other nations, which dominate Hawaiian thought, have influenced the life of other nations of the Pacific. Examples of this are the Pacific Science Congresses which Hawaii started modestly in August, 1920, and which, through the last three decades, have become a potent influence for healthy growth and development in the material and the scientific, through the altruistic, constructive and friendly approach to national problems among the countries bordering the Pacific. We recognize the contagious example set by Hawaii.

We, the organizers of the Eighth Pacific Science Congress, which we hope to convene in Manila and Quezon City in the Philippines during the months of October and November, 1953, extend our hearty congratulations to the Hawaiian Academy of Science for demonstrating once more its active interest in promoting scientific research in the Pacific and wish it every success in its endeavors. We also hope that in its deliberations it will have in mind the larger scope and interests of the Eighth Pacific Science Congress and will pass on to us, by way of suggestions, any significant ideas or plans that might develop in the course of the discussions in the present symposium.

B. M. GONZALEZ

Research Reports

UNIVERSITY OF HAWAII RESEARCH

In order to encourage faculty research, the University of Hawaii grants reductions of one-quarter to three-quarter time from the normal teaching load of 12 hours and allotted funds for research. Two members of the Stenographic Pool devote full time to research typing. Research is especially encouraged in the area of Pacific studies.

To further the program, a Research Committee has been appointed which has the duties and responsibilities of (1) advising the Dean of Faculties regarding teaching-load reductions and the allotment of funds; (2) advising the Publications Office regarding research studies proposed for publication; (3) maintaining a file of faculty research projects completed; (4) making available to the faculty information regarding fellowships and financial aids to research; and (5) advising the President and University Senate of the general research policies of the University.

The committee recommended reductions in teaching load for 18 faculty members for the academic year 1949-50 and for 24 in 1950-51. Twenty-eight members of the faculty reported the completion of one or more research projects during the academic year 1949-50. This report was not entirely complete, so was not included in the total completed.

During the same year the Stenographic Pool typed all or parts of 8 books and 35 papers.

During 1949-50, the Research Committee approved the expenditure of $2,156. The bulk of this was for the Arno Atoll Research Project in which five members of the University participated.

The departments reported research projects completed as follows:

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<th>Department</th>
<th>Geography, 3</th>
<th>English, 1</th>
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<td>Zoology, 6</td>
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<td>Chemistry, 1</td>
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<td>Anthropology, 4</td>
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<td>Botany, 4</td>
<td>Sociology, 1</td>
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C. A. MANCHESTER

HAWAII AGRICULTURAL EXPERIMENT STATION

The College of Agriculture, with a program of teaching, extension, and research, and involving all the colleges and departments of the University, enjoys one-third of the appropriations made to the University of Hawaii and lists among its personnel one-third of the University's employees.

Lately, our teaching program has been directed toward training in tropical crop production, the better to fit young people for jobs in the tropics of the Pacific area.

In the Extension Service, we have nine island sections manned by Extension Agents and Home Demonstration Agents. These people are drawn upon frequently for temporary service in other parts of the Pacific area, such as the Philippines, Okinawa, and the Trust Territory.

In the Agricultural Experiment Station, we have 13 departments, ranging from agricultural economics to vegetable crop production. In addition we have experimental stations and substations, one on the islands of Hawaii and Maui and two on Oahu.

A program is being started to analyze in our nutrition laboratory food samples collected by a qualified
nutritionist in Pacific islands under American administration. We are also doing what we can to bolster the single exportable crop—copra—of the Trust Territory. H. A. WADSWORTH

PINEAPPLE RESEARCH INSTITUTE

The commercial growing and canning of pineapples in Hawaii started in the early days of this century. Expansion of the industry made experimental studies necessary. The present Pineapple Research Institute, supported co-operatively by the pineapple companies of Hawaii, is the product of this growth and evolution. The headquarters, comprising administrative offices, research laboratories, and a specialized library are located adjacent to the University of Hawaii. Part of the field experimentation is conducted on a 90-acre farm at Wahiawa, equipped with offices, laboratories, glass and lath houses, and farming machinery. Other experimental studies are carried out in plantation fields in co-operation with the companies.

Both applied and basic research is performed. Basic research in the biology of the pineapple is necessary and important as without it the applied function eventually would become sterile and stagnant. For most mainland agricultural crops there are a number of state and federal institutions throughout the country where fundamental research studies are conducted. Pineapples do not share this source of basic research.

Some of the problems now under study concern (1) the control of diseases and pests which adversely influence production or quality, (2) the regulation of plant and fruit growth through the use of plant-growth hormones, (3) more efficient and economical control of weeds through the use of specially adapted chemical herbicides, (4) crop improvement through plant selection or roguing, and (5) the development of new varieties having resistance to major diseases through crossbreeding with wild resistant species and with other varieties.

Other studies include the improvement of soil management, development of new and more efficient farm machinery, the relation of meteorological conditions to plant growth, and the development of new and more efficient means of soil fumigation. Basic studies are continuing on these subjects in order to improve methods of crop production. These researches are directed by a staff of 30 scientists in the departments of Agricultural Engineering, Entomology, Genetics, Plant Chemistry, Plant Physiology, Plant Pathology, Soils, and Meteorology. Frequently two or more of these eight departments work together on a single problem.

The results of applied studies are made available to the Hawaiian pineapple industry in the form of special reports. Results of fundamental or basic studies which are of general scientific interest are published in appropriate technical journals.

J. L. COLLINS

TERRITORIAL BOARD OF AGRICULTURE AND FORESTRY

The work of the Board of Agriculture and Forestry is primarily one of managing and protecting certain of the resources of the Territory, as it is authorized to do by law. Research is incidental to these activities. Some of it is fundamental, but most of it is applied. The Board is supported by territorial appropriations augmented by federal funds.

The work of the Board is done through a number of independent divisions: (1) Animal Industry seeks to safeguard the animal health of the Territory and to supervise sanitary work as it relates to animals. A bacteriological pathology laboratory is maintained for research on animal diseases, but in the main the findings of national and international research are applied to the local situation. (2) Entomology is set up primarily to control pests that enter the Islands and to guard against further introductions through an inspection service. Natural enemies are introduced and some fundamental research performed. (3) Fish and Game administers the fish and game laws and advises on matters of conservation and utilization. A fair amount of fundamental research is carried on, but research is mainly applied. One objective is the production of a better huntable surplus of birds and animals. To do this, fundamental research in better management is necessary, largely supported by federal appropriations. (4) The primary job of the Forestry division is the proper management and protection of the forest reserve system that has been set up to safeguard the water supply of the Territory. Studies are made of exotic trees in relation to Hawaiian environments (particularly cover for watersheds), but little work is done in actual use of forest products other than water. (5) A division concerned with the marketing of agricultural crops does applied research in establishing standards on which to enforce laws relating to the protection of agricultural crops.

COLIN G. LENNOX

SOIL CONSERVATION SERVICE, U.S. DEPARTMENT OF AGRICULTURE

"The use of every acre of agricultural land in accordance with its capabilities, and the treatment of every acre in accordance with its needs" are the basic objectives of the Soil Conservation Service. This requires a soil survey. To make this survey we must send soil scientists into the field to map the nature and depth of the soil, its texture and permeability, underlying materials, slope, degree of erosion, and possibly such other factors as wetness, salinity, and frequency of overflow. From this survey we prepare technical recommendations which we call the conservation farm plan. We look to the Hawaii Agricultural Experiment Station for assistance in research. The work of the Soil Conservation Service is done almost entirely in co-operation with soil conservation districts, which are set up by state or territorial law. Those of the Territory of Hawaii were set up in 1947. The Hawaii soil conservation committee is composed of the president of the Board of Agriculture and Forestry (chairman), the director of the Agricultural Experiment Station, and the director of the Extension Service. In Hawaii there are eight soil conservation districts; one on Maui, one on Molokai, three on Oahu, and three on Hawaii. There is none at present on Kauai. Any agreements with farmers concerning work which is voluntary on their part are entirely between the District governing body—a board of five directors—and the individual farmer. The District determines priority of work. The Honolulu office passes on the technical soundness of the job to be done on the individual farms and provides technicians for the surveys. A fine degree of co-operation between agencies and scientists exists in the Territory of Hawaii.

WALTER SYKES
MEDICAL PROGRAM IN THE TRUST TERRITORY

The Navy's Health Service policy for the Trust Territory, as originally conceived, embraced four programs: (1) Preventive medicine and public health, (2) medical and dental care, (3) native training, and (4) stimulation of research.

Before an effective long-range public health program could be established, it was necessary to conduct a health and sanitation survey of the Trust Territory. Such a survey has been conducted by the ship Whidbey for 2 1/2 years and should be completed this June (1951). Appropriate health and vital statistics are being collected. There are some 50,000 natives; approximately 30,000 had been examined by the end of 1950. Most of them have been immunized for smallpox, typhoid, and tetanus. The principal existing diseases appear to be tuberculosis, yaws, intestinal parasites, filariasis, and leprosy.

Provisions have been made for the reporting of preventable diseases.

Medical and dental care and hospital facilities are available at dispensaries at Koror, Saipan, Truk, and the six Fijian islands. Patients requiring hospital care are sent back to district dispensaries. Health aides or nurse's aides, who are capable of giving first aid at the district dispensaries, have been trained during a 3-month course.

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Medical and dental care and hospital facilities are available at dispensaries at Koror, Saipan, Truk, Pohnpei, and Majuro, and a subdispensary at Yap. Outlying islands have small dispensaries manned by health aides or nurse's aides, who are capable of giving simple medical care. Medical field teams from the district dispensaries, designated to act on the findings of the Whidbey, spend 2 to 3 weeks on visits to outer islands. Patients requiring hospital care are sent back to district dispensaries.

Health aides and nurse's aides are given 3 to 9 months training in sanitation and first aid at the dispensaries. Three professional training schools were in operation by the Navy on Guam: School for Medical Assistants (38 students, December 1, 1950), School for Dental Assistants (28 students), both offering a 4-year course, and School for Nursing (43 students), a 3-year course. The first two were deactivated February 15, 1951, the students being transferred to Suva, Fiji.

Research programs are in the making as more medical statistics become available. Special studies are being made in the treatment of filariasis with hydroxybenzylidene, and a research project on the use of streptomycin in the treatment of leprosy has been in progress since November, 1949.

Dental examinations show fairly good dental conditions among younger natives; older natives show evidence of poor mouth hygiene.

OTTO L. BURTON

PACIFIC OCEANIC FISHERY INVESTIGATIONS

Interest in the research and development of the central Pacific Ocean, generated in Hawaii and on the West Coast, led to passage in 1947 by the Congress of the United States of Public Law 329, "The Farriington Act." Under this Act, implemented by necessary appropriations, the mission of the Pacific Oceanic Fishery Investigations of the United States Fish and Wildlife Service is to explore and investigate the potentialities for large-scale commercial high-seas fisheries in the Hawaiian Islands, Samoa, Guam and the Trust Territory, and intervening waters.

Not all this vast area nor all these fishes can be studied at once. Initially we are concentrating on the yellowfin tuna or abu and the skipjack or aku in the area directly south of the Hawaiian archipelago to about 5 degrees south of the equator. Our problem is to determine areas of concentration and seasonal or other shifts and fluctuations. These probably are governed by the system of ocean currents, so our research must include oceanography. The habits and reactions of tunas are bound up with peculiarities of life histories and feeding requirements. Our work also includes exploratory and experimental fishing on a semicommercial scale.

Equipment for performing our mission includes a newly built laboratory on the University of Hawaii campus, a vessel docking site at Pearl Harbor, one combination oceanographic and fishing research vessel, and two exploratory and experimental fishing vessels. Our staff, including the crews of the vessels, currently numbers 90 persons.

During our first year of operations we have found that the productivity of the sea and the abundance of tuna is greatest in the zone lying between 1 and 7 degrees north latitude where a current system of some complexity exists and draws to the surface from underlying reservoirs nutrient salts which in turn give rise to plankton growth on which small fishes and invertebrates can subsist and in turn furnish fodder for the tunas. Similar updrafts of nutrient materials appear to occur near islands, atolls, and reefs. The habits and reactions of tuna in the area differ sufficiently from those along the American coast so that new methods of taking these fish in commercial quantities must be developed.

It is planned to survey the more westerly areas, out through the Trust Territory, before engaging intensively on gear-developing phases of the problem.

OSCAR E. SETTE

U. S. GEOLOGICAL SURVEY

The Geological Survey came to Hawaii in 1909 and started a program of measuring surface waters and streams of the Territory and of getting records of artesian wells. At about the same time, the Survey started mapping the Islands. Topographic maps, with contours, of all the Hawaiian Islands were completed in 1950. Last year a revision of the topographic maps by photogrammetric processes was commenced. A survey of the general areal geology with respect to ground water of the entire Territory is nearly completed. Another activity of the Geological Survey in Hawaii has been volcanology, continuing the work started by Dr. T. A. Jaggar.

In the Pacific, outside the Territory of Hawaii, very little has been done by regular branches of the Geological Survey. During the war the necessities of the military resulted in the organization of a Section of Military Geology. At present they are co-operating with the Far East Command Headquarters at Tokyo, and a general and rather detailed survey of the islands of the Trust Territory and Guam is being undertaken. Some of the islands have been fairly well covered. The ground-water branch of the Survey has placed a geologist on Guam to study the ground water there, and another is starting to make a ground-water survey of the Trust Territory. Surface-water work has not been done outside the Hawaiian Islands, except for a few attempts to make estimates on very inadequate data. The Survey is doing geophysical work in the Marshall Islands, which is now classified.

MAX H. CARSON
U. S. WEATHER BUREAU

Research in the Pacific area by the Weather Bureau is and will continue to be directed primarily toward problems in general meteorology. In the Hawaiian area, research is carried on in co-operation with the Pineapple Research Institute and the Hawaiian Sugar Planters' Association.

While the principal focus of attention has been on rainfall distribution and forecasting, research efforts have been directed more recently toward the general circulation of the atmosphere. Special attention is being given to circulations in the upper troposphere, with broad application to tropical meteorology in general.

Studies are being planned for forecast improvement which will attempt to develop successful methods of 5-day trend forecasts for Hawaii. Special projects include the installation of (1) an automatic weather station at the Pali (Oahu) for use in studying the relation between variation in the trade-wind inversion and rainfall on the Kooolau, (2) automatic weather stations at the summit of Mauna Loa (Hawaii), including instrumentation for studying wind gustiness, microstructure of pressure waves, and atmospheric radiations, and (3) an automatic radio weather station at Mt. Waialeale (Kauai) in co-operation with the U. S. Geological Survey.

R. H. SIMPSON

TRUST TERRITORY
OF THE PACIFIC ISLANDS

A comprehensive program planned for agriculture in the Trust Territory has been handicapped by lack of personnel and finances. With the co-operation of the Navy, we are carrying on the program originally instituted in these islands by the Foreign Economic Administration in 1944 and 1945 and continued by the U. S. Commercial Company. A growing program is progressing satisfactorily, and, with the transfer from the Navy to the Department of Interior, we hope to continue all these projects and others still in the planning stage. The latter include a cacao project on Saipan and one on abaca on Ponape. The cacao project is as yet not really underway but is being investigated with the help of Dr. George Bowman from Costa Rica, who is enthusiastic about the possibilities for cacao production in the Trust Territory. There are no visible signs of serious diseases or pests of this crop in the Ponape area where a start will be made, beneath the Metalumun coconut groves. Ramie and abaca are products that will stand shipping and long-period storage. Processing the product must be kept comparatively simple and within the range of ability of the native people.

A poultry project is fairly well underway at Truk, where selected varieties and strains of chickens are being bred to help rehabilitate the poultry industry.

The co-ordination of agriculture and education is being planned in conjunction with Commander Taylor and the educational group. Unless these are co-ordinated, agriculture will be bound by customs and traditions of the native people. The co-operation between these two groups has been excellent and we are also most appreciative of help received from the University of Hawaii, the Hawaiian Sugar Planters' Experiment Station, and other institutions here in Hawaii.

H. M. MAYO

HAWAIIAN SUGAR PLANTERS' EXPERIMENT STATION

Our organization was set up in 1895. Since the cessation of fundamental work of the Java station at Pasuruan, we are probably the only sugar research station in the world doing fundamental research in conjunction with applied research.

This experiment station has the following departments: (1) Agricultural Engineering, concerned with mechanical harvesting of cane and fertilization and tillage practices, at the Agricultural Engineering Institute maintained jointly with the University of Hawaii and Pineapple Research Institute; (2) Agronomy, concerned with such projects as irrigation, fertilization, rat control, control of weeds by chemicals, and soil improvement and conservation; (3) Chemistry, primarily concerned with chemicals to control weeds and with soil and plant analysis preparatory to making fertilizer recommendations; (4) Climatology, concerned with means for measuring radiation and with the relationship of other climatological factors to sugar-cane growth; (5) Entomology, interested in the control of insect pests, chiefly through biological control; (6) Experimental Statistics, handling the planning and analyzing of our experimental work; (7) Genetics, responsible for cane breeding and the development of new varieties of sugar cane; (8) Geology, responsible for locating water for cane irrigation; (9) Meteorology, concerned with research leading to better short-time forecasts that can be used in plantation operations, in co-operation with the Pineapple Research Institute; (10) Pathology, responsible for the control of sugar-cane diseases, at present by developing disease-resistant varieties, in co-operation with the Department of Genetics; (11) Physiology and Biochemistry, concerned with such fundamental work as control of tasseling, use of radioactive isotopes in the nutrition of the cane plant, and the effect of temperature on cane physiology; (12) Sugar Technology, concerned with milling problems, such as those of molasses and the clarification of cane juices; (13) Personnel Training, in both agriculture and factory engineering, giving young college graduates a 2-year program to prepare them for plantation operation.

The Station has representatives and substations on each sugar-cane-producing island. A library of over 50,000 volumes is open to researchers. The staff at the main Experiment Station numbers over 100 persons.

Much public service is done. A spectroscope, set up for the chemistry and agronomy departments, is widely used for such work as determining the amount of sodium in poi. A weekly tour and discussion of research activities is given for tourists and other visitors.

L. D. BAYER

NATIONAL PARK SERVICE

Objectives of this Service are: (1) to preserve, or restore as far as possible, the flora and fauna in their natural and undisturbed state in all park areas, and (2) to provide opportunities for the people to understand and enjoy the higher values of the plant and animal life of the park areas. This implies (3) the major objective, which is to secure a thorough knowledge of the flora and fauna of national parks and monuments through research.
With reference to non-native plants and animals, it is the policy of this Service to eliminate or hold to a minimum any exotic species, provided complete eradication is impossible. Furthermore, every possible measure shall be employed to prevent the invasion of parks by non-native plants or animals. This explains why our biologists are concerned with the proposal to bring axis deer to Hawaii and why this Service does not confine its interest in wildlife problems to the Park but extends them to the island as a whole. There is every possibility that if deer were introduced to Hawaii they would eventually move into the Park forests where rapid impoverishment and irreparable loss of native plants would result. We are attempting to restore the numbers of endangered plant species to a point of safety, and even though it is granted that hunting pressure might control deer numbers, one animal could exterminate an entire species from Hawaii National Park in a matter of a few hours' time.

F. R. OBERHANSELY

COMMITTEE ACTION

Recognizing the importance of noting the action taken upon suggested recommendations by a committee of specialists in a given field, the sponsors of the symposium requested that a record of such considered action be made. A brief report on such action, including the general trend of committee discussions, is recorded in the following section. Text of the resolutions, as adopted, is given at the end of these proceedings.

COMMITTEES

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<tr>
<th>COMMITTEES</th>
<th>CHAIRMEN</th>
<th>RECORDERS</th>
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<tr>
<td>1. Geology, geophysics, and hydrology</td>
<td>Doak C. Cox</td>
<td>Max Carson</td>
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<td>2. Meteorology</td>
<td>R. H. Simpson*</td>
<td>H. S. Palmer</td>
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<td>W. A. Mordy</td>
<td>W. A. Mordy</td>
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<td>3. Oceanography and zoology</td>
<td>A. D. Tester</td>
<td>A. H. Banner</td>
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<td>C. E. Pemberton</td>
<td>H. A. Bess</td>
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<td>4. Entomology</td>
<td>L. D. Baver</td>
<td>Marlowe Thorne</td>
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<td>6. Museums in Pacific research</td>
<td>Zera C. Foster</td>
<td>J. C. Kingsbury</td>
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<td>7. Soil survey and land classification</td>
<td>J. L. Collins</td>
<td>W. B. Storey</td>
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<td>8. Crop improvement and soil management</td>
<td>J. H. Beaumont</td>
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<td>Sam B. Nordfeldt</td>
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<td>Leonar C. Mason</td>
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<td>C. L. Wilbar</td>
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<td>9. Animal improvement</td>
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<td>10. Anthropology and social sciences</td>
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<td>11. Health and nutrition</td>
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* Prepared agenda, but was unable to be present at sessions.

Committee 1

GEOLOGY, GEOPHYSICS, AND HYDROLOGY

I. The Pacific Basin and Its Floor
   A. Hydrology (C. A. George)
      Discussion of charts of the Pacific Area.
   B. Geodesy (Doak C. Cox)
      Discussion of gravity anomalies along the Hawaiian chain.
   C. Seismology (Roland F. White)
      Magnetic observations have been made on Oahu since 1901.
   D. Geomagnetism (Roland F. White)
      The U.S. Coast and Geodetic Station at Barbers Point, Oahu, keeps continuous records of magnetic-field intensities and direction.
   E. Other geophysical techniques (Doak C. Cox)

II. High Simatic Islands
   A. Geology and geophysics
      1. Topography and hydrography (C. A. George)
      2. Areal geology coverage (Dan A. Davis)
         All Hawaiian islands have been mapped for ground-water studies by the U.S. Geological Survey and the Territorial Bureau of Hydrography.
      3. Volcanology (Gordon A. Macdonald, presented by Doak C. Cox)
      4. Petrology (Gordon A. Macdonald, presented by Doak C. Cox)
      5. Tectonics, not directly volcanic (Harold S. Palmer)
      6. Erosion and sedimentation (Chester K. Wentworth)
      7. Age (Dan A. Davis)
         Topographic features and oldest fossils are Pleistocene.
B. Hydrology
1. Surface water (Max H. Carson)
   More stream-gauging stations are needed.
2. Ground water
   a. Course of ground water (Harold S. Palmer)
   b. Dike compartment hydraulics (Chester K. Wentworth)
   c. Ghyben-Herzberg ground-water hydraulics (Chester K. Wentworth)
3. Evapotranspiration (Max H. Carson)

III. High Sialic Islands
A. Geology (Dan A. Davis)
The U. S. Geological Survey has made a
rather thorough study of Saipan, Tinian, and Yap.
B. Hydrology
1. Surface water (Max H. Carson)
2. Ground water (Dan A. Davis)

IV. Coral Atolls
A. Geology and geophysics (Doak C. Cox)
B. Hydrology (Doak C. Cox)

Committee 2

METEOROLOGY
1. General circulation of the atmosphere (Leon Sherman)
   No adequate description of circulation in tropical
   regions can be given because of the sparseness of
   meteorological stations and observations.
2. Exchange of radiation energy
   Present stations furnishing radiation measurements include Canton Island, Wake Island, and various stations in the Hawaiian Islands.
3. Upper tropospheric cyclones (C. K. Stidel)
4. Cloud physics and artificial nucleation (W. A. Mordy)
5. Energy exchange between wind and sea
6. Weather forecast improvement (E. M. Vernon)
   Either more use of available data or more observations are needed.
7. Synoptic observation networks in the Pacific (C. M. Woffinden)
8. Depository for Pacific weather information
   A subcommittee consisting of Lt. Col. Jones, Dr. Sherman, Mr. Mordy, and Mr. Woffinden was appointed to draft recommendations.

Committee 3

OCEANOGRAPHY AND ZOOLOGY

1. Scope and Organization
   The committee divided this combined field into three categories: (1) physical and chemical oceanography—as it influences life in the sea; (2) biological oceanography—marine zoology and marine botany in all their aspects; and (3) terrestrial zoology—excluding entomology (Committee 4).
   Dr. M. S. Doty was named chairman of a subcommittee to consider and present recommendations.

II. Summary of Projects

A. Bernice P. Bishop Museum (C. H. Edmondson)
   1. Marine wood borers and their control
B. Division of Fish and Game (Vernon E. Brock)
   1. Terrestrial game birds and animals
   2. Fisheries investigations
   3. Pollution studies
      a. Hilo Harbor (completed)
      b. Honolulu Harbor
   4. Livebait project
   5. Artificial key for identification of fishes of Hawaii
   6. Statistical summary of fishes of Hawaii
   7. Minor projects
      Studies of marlin, akule (Selar crumenophthalmus), large tuna, trolling lures used in Hawaiian waters, and Hawaiian trap fishing.
C. Pacific Oceanic Fishery Investigations (O. E. Sette)
   1. Compilation and analysis of information and literature on tunas from Japanese and other sources
   2. Problem of races and geographic limits of tuna stocks
   3. Physical and chemical oceanography of the tropical and subtropical Pacific
   4. Distribution and abundance of tunas in relation to environmental factors, and potential productivity of various areas of the sea
   5. Food and feeding habits of tunas
   6. Study of maturation and spawning of tunas and of the distribution of eggs, larvae, and juveniles
   7. Age and growth of tunas
   8. Studies of bait fishes
   9. Experimental fishing and gear development
   10. Exploration of fishing activities
   11. Reaction of tuna to various physical and chemical stimuli
D. Hawaii Marine Laboratory (R. W. Hiatt)
   1. Marine projects
      a. Taxonomy and distribution (12 completed, 6 active)
      b. Physiology and ecology (5 completed, 10 active)
      c. Productivity (5 completed, 10 active)
      d. Hydrography (2 completed, 1 active)
   2. Non-marine studies
      a. Evolution of terrestrial invertebrates
      b. Ecology and physiology of marine birds

Committee 4

ENTOMOLOGY

1. Brief review of literature
2. Consideration of submitted recommendations
3. Insect surveys and taxonomic work on collections
4. Centralization of collections
5. Appropriation for publication
6. Geographical distribution of species, especially economic pests, their hosts, and their importance
7. Biological control of insect pests
8. Artificial control of insect pests
9. Quarantine
10. Biological control of pest plants
11. Relation of insecticides to biological control
12. Termite distribution in Hawaii
Committee 5

CONSERVATION

This committee divided its agenda into two symposia:
1. Preservation of ecological areas
   a. Ecological changes in the Pacific area as affected by man (H. L. Lyon)
   b. Preservation of vegetation types in the Hawaiian Islands (F. R. Oberhansley)
   c. Control of exotic animals (Colin G. Lennox)
2. Preservation of beaches
   a. Mechanics of beach erosion (Chester K. Wentworth)
   b. The problem of the Waianae beaches
      (1) From the point of view of the Corps of Engineers (F. H. Falkner)
      (2) From the point of view of the City Engineer, (Karl Sinclair)
   c. The problem of the Black Sands of Hawaii (F. R. Oberhansley)

In addition to the foregoing, two papers were submitted by F. R. Fosberg: "Thoughts on the Axis Deer Problem" and "Wilderness Areas as Research Tools."

Committee 6

MUSEUMS IN PACIFIC RESEARCH

1. Relations between museums, taxonomy, and biogeography
2. International cooperation in Pacific research
3. Botanical and zoological surveys
   a. Known distribution of plants and animals in the Pacific
   b. How surveys can be made to fill gaps in this knowledge
   c. Need for trained personnel and adequate finances

The committee agreed with, and indorsed in principle, most of the numerous recommendations of other scientific groups regarding the need for botanical and zoological surveys, ecological studies, preparation of bibliographies, check lists, regional studies and handbooks, training of taxonomists and museum personnel, and wide distribution of specimens and data. However, it saw no value in repeating such recommendations, except as ways and means could be suggested for implementing them.

Committee 7

SOIL SURVEY AND LAND CLASSIFICATION

This committee (1) considered the types of surveys needed for studies of soil, land capabilities and land use, data needed, and personnel recommended; (2) agreed with the many recommendations made by the seven Pacific Science Congresses, 1920–49, and by the National Research Council in 1946; and (3) was gravely concerned because so very little seems to have been done in accordance with these recommendations.

Committee 8

CROP IMPROVEMENT AND SOIL MANAGEMENT

This committee found its problems and discussions so broad and general that, to cover adequately the subjects assigned, it divided into two groups: (1) crop improvement (J. L. Collins, chairman, W. B. Storey, recorder), and (2) soil management (J. H. Beaumont, chairman, J. C. Riperton, recorder). A joint report was submitted.

In considering the agricultural problems of the tropics and subtropics to which research might be directed, the committee was guided by (1) statements and actions already taken by the seven Congresses of the Pacific Science Association, the Pacific Science Conference of the National Research Council, and the South Pacific Commission; (2) the fact that since representatives of foreign countries were not present, the problems discussed should be those confronting agriculture in Hawaii, but of such fundamental character as to have possible general application; and (3) the fact that problems of the Trust Territory of the Pacific could be considered specifically, in that this area is the direct responsibility of the United States and, therefore, of Hawaii.

The subcommittee on crop improvement considered crops which might be of value in the Pacific region, either as subsistence crops or as potential commercial crops. These included pineapple production (J. L. Collins), sugar cane (A. J. Mangeleldorff), corn (John Warner), tomatoes, leafy crops such as Chinese cabbage and mustard, and other vegetable crops (D. C. McGuire), sweet potatoes (C. F. Poole), forage crops and legumes (O. C. Zoebisch), and miscellaneous fruit, spice, drug, and fiber crops (W. B. Storey).

From a round-table discussion of the Pacific area, principally the Trust Territory, led by Harold Mayo, it was brought out that the greatest immediate need is improvement of subsistence crops rather than of the existing or potential export crops. The important subsistence crops of the area, more or less in order of importance, are breadfruit, sweet potato, banana, yam, cassava, taro and yautia, Pandanus, Tacca arrowroot, papaya, and Polynesian chestnut.

Committee 9

ANIMAL IMPROVEMENT

1. Considerations
   a. Present status of animal industry in the Pacific
   b. Consideration of previous recommendations
   c. Other eventual considerations
2. Discussions
   a. Animal industry areas in the Pacific
   b. Vacuum in animal industry in certain areas due to World War II; how to restore the industry to normal
   c. Breeds and breeding
   d. Feeds and feeding
   e. Animal diseases
   f. Improving animal industry by market regulations
   g. Other problems of importance

Committee 10

ANTHROPOLOGY AND SOCIAL SCIENCES

The work of this committee was divided between five major subjects — anthropology, geography, sociology, linguistics, and education. Its recommendations were concerned primarily with Oceania (Polynesia, Micronesia, and Melanesia). In addition to the five major subjects, it was agreed that studies in psychol-
ology, political science, and economics should be included in any well-rounded program of Pacific research.

1. Anthropology (Katharine Luomala)

Surveys of research in Polynesia have appeared in two Bishop Museum bulletins. No comparable statements on the status of research in Micronesia exist as yet. Projects have been co-ordinated by the Pacific Science Board. Melanesia lacks a general ethnographic statement as well as surveys of research. The South Pacific Commission has been energetic in applied research. In Polynesia, acculturation studies have been made in New Zealand, Tonga, the Cook Islands, and the Tuamotus. Little is known of the Polynesian outliers in Melanesia.

2. Geography (Neal Bowers)

Geographic research in the Pacific has been limited, although much basic source material has been gathered by other disciplines.

3. Sociology (C. E. Glick)

The Pacific is an area of increasing culture contact between immigrant peoples and the indigenes, with major political and economic decisions being made in metropolitan centers of the world. The special task of the sociologist is to trace the gradual absorption of the various parts of the Pacific within the emerging "Great Society."

4. Linguistics (Sam Elbert)

In Melanesia, Capell has produced most of the reliable work in language study. Other parts of Melanesia, particularly New Guinea and the Solomons, need study. In Micronesia, one of the first problems is orthography as no standards exist. Phonemic analysis and grammars are available for Truk and Ponape and will be completed for Yap. Few satisfactory grammars of Polynesian languages have been produced.

5. Education (J. L. Taylor)

Except for isolated chapters and fragmentary comments on the broader phases of education, little research has been done in this field. Even in the case of mission groups, which initiated formal schooling and which still bear the responsibility for much of the formal educational activity in the islands, there are no exhaustive or comprehensive studies.

RESOLUTIONS

GENERAL

1. Resolved, That governmental agencies having data of value concerning the Pacific area be encouraged to publish these data or make them available to science whenever security regulations permit.

2. Resolved, That the Secretariat of the Pacific Science Council be requested to compile a register of institutions and individuals (particularly scientists) actively interested in the natural history (geology, botany, zoology, anthropology, and related subjects) of the Pacific area, as a basis for mutual co-operation and the interchange of information and specimens. This might lead to the "clearing house" which has been recommended.

3. Resolved, That for Micronesia, there remains the important task of an intensive search by properly qualified personnel for published Japanese material in Japan. Japanese scientists who have worked in Micronesia should be contacted and encouraged to publish studies based on prewar research.

4. Resolved, That translation of significant documents from Japanese, German, and other languages is desired, especially where such translations can be annotated by scientists familiar with the present-day situation in the area.

5. Resolved, That the symposium, noting with satisfaction the establishment of the Pacific Science Council Secretariat in Honolulu, Hawaii, and recognizing the need for such an organization, recommends that the Secretariat be continued on a permanent basis to further international action and co-operation in Pacific science.

6. Resolved, That the Hawaiian Academy of Science express its gratitude for and appreciation of the establishment of a branch office of the Pacific Science Board of the National Research Council in Hawaii and the Academy notes with satisfaction that the field work of the Board has involved, to date, the participation of scientists from the Hawaiian Islands; and that the Hawaiian Academy of Science go on record as offering full co-operation in furtherance of the activities of the Pacific Science Board.

7. Resolved, That the Hawaiian Academy of Science make available information on the different agencies which might make possible the extension of research by local scientists to the Trust Territory and other Pacific countries.

8. Resolved, That, in general, bibliographic studies of Pacific literature and cartography be required as an aid to researchers.

GEOL OGY, GEOPHYSICS, AND HYDROLOGY

1. Resolved, That recent expeditions attempting deep-sea exploration by geophysical, bathymetric, and sampling techniques be commended, and that similar and related work be prosecuted as rapidly as possible, with financial assistance from the Federal government.

2. Resolved, That the work of the Coast and Geodetic Survey and other agencies in the Seismic Sea Wave Warning System be commended, and that improvement in communications be sought to permit addition of a South American and a Tahitian station to the tidal stations reporting to the System.

3. Resolved, That the geologic bulletins of the Hawaii Division of Hydrography and the accompanying geologic maps, now largely out of print, be kept in print with revision as required.

4. Resolved, That the establishment of a joint observatory in volcanology and meteorology on Mauna Loa be encouraged.

5. Resolved, That it be recommended that a geophysical institute be established at the University of Hawaii.

6. Resolved, That efforts be made to establish a volcanological laboratory on Niuafoou with the co-operation of the Tongan government.
7. Resolved, That surface-water, ground-water, and evapotranspiration studies be prosecuted with the aim of developing quantitative inventories of water supplies in the Hawaiian Islands.

8. Resolved, That modern hydrographic surveys of Hawaiian waters be made as soon as possible; and until such surveys can be made, that utilization of hydrographic data that are now being collected or that might easily be collected by ships other than regular survey ships be investigated as a possible means of improving local hydrographic charts. (Made jointly with Oceanography and Zoology Committee.)

9. (See Meteorology Resolution 11.)

10. (See Oceanography and Zoology Resolution 9 and Conservation Resolutions 2, 3, and 4.)

METEOROLOGY

1. Resolved, That the further study of large-scale circulation patterns including intertropical air movements be encouraged with emphasis on: (1) obtaining sufficient data to enable adequate description of weather processes; (2) developing adequate models for weather disturbances through tropical regions; (3) interrelationships between tropical and extratropical disturbances. In this respect a recommendation of the Seventh Pacific Science Congress (New Zealand, 1949) is endorsed: "In climatological measurements an almost complete lack of operative radiation stations is noted. Radiation measurements, in addition to being of direct use in the agricultural meteorology of the Pacific, are essential to the solution of the basic problem of energy exchange between sea and air."

2. Resolved, That an integrated, planned program of radiation measurements be expanded in the Pacific area (see previous resolution).

3. Resolved, That every encouragement be given for further research in cloud physics and the theory of rainfall formation. Because of the controversy over the effectiveness of cloud seeding, special attention should be given to the means of evaluating these experiments.

4. Resolved, That the recommendation of the Seventh Pacific Science Congress concerning the exchange of energy between the sea and atmosphere by wind moisture and heat be endorsed: "In order to follow the cycle of transfer of energy to the sea in low latitudes, transport by surface currents through middle latitudes and dissipation into the atmosphere in high latitudes, considerable study of the fundamentals of this energy exchange across the interface is required with particular attention to radiation, wind and water transport. This involves studies of wave generation, wind driven current, convection cells, radiation balance, evaporation and rainfall over the sea, and should include comparison methods of investigation."

5. Resolved, That, recognizing a need for greater emphasis on applied research, the following be recommended:
   1. That such synoptic data, records, etc., as are required for research in local forecasting problems, be made easily available to workers in the Pacific through a planned program for the collection and reproduction of such data.
   2. That investigation of the dynamics of the trade-wind inversion be encouraged.

3. That investigation of high-level influences on developments in the lower atmosphere be encouraged. In this connection note is taken of the recommendation of the Committee on Meteorology of the National Research Council Pacific Science Conference (1946) and it is suggested that the emphasis be extended to levels as high as 200 mb: "Study of medium and high altitude meteorology (above 5,000 feet), particularly of the northern and western Pacific areas, basic theoretical work on the cause and mechanism of fog and a synoptic and geographic study of the distribution of fog in the north Pacific. Study of the thermal, moisture, and wind micro-structure of the lower layer of atmosphere (less than 5,000 feet). Research in formation, structure, and motion of typhoons. Study of meteorological conditions causing anomalous propagation of ultra-high-frequency radio and radar in the western Pacific area."

4. That investigation of the life history of "cold lows" in tropical latitudes and the relationships between such disturbances and the general hemisphere circulation be encouraged.

5. That a problem of primary importance in the tropical and subtropical atmosphere of the Pacific is an understanding of the structure and life history of warm-core tropical storms, including those which do not reach typhoon intensity.

6. Resolved, That the following resolution of the Seventh Pacific Science Congress (New Zealand, 1949) be endorsed: "The weather reporting network in the Western Pacific is not considered adequate; it is strongly urged that additional stations be established immediately in the outlying islands of the occupied territory and the islands of the Trust Territory," and that a network of stations in the Trust Territory at least as dense as the pre-war Japanese network be established. In this connection an emphasis on upper-winds observations is favored.

7. Resolved, That it be recommended that additional weather ships be assigned to the Pacific and that the meteorologists have a greater part in their placement. The important contribution made by weather reconnaissance flights is noted and the extension of this program encouraged.

8. Resolved, That the recommendation of the Seventh Pacific Science Congress concerning the need for additional upper-air stations to complete an upper-meridian cross section from Pole to Pole be endorsed: "Attention is drawn to the need for establishment of upper air stations and the desirability of a complete upper air meteorological section from Pole to Pole. Such an upper air section would provide valuable observation data for the much needed attack on the problem of the general circulation."

9. Resolved, That, noting the importance of weather observations from transient aircraft, recommendations be made for improvement in instrumentation to improve the accuracy of these weather observations and the Seventh Pacific Science Congress resolution on this program be endorsed: "The importance of observations from ships in the Pacific cannot be overstressed. With the large oceanic area, surfaces of which are unbroken by islands, it is necessary to devise means of taking and utilizing not only the weather observations commonly made from vessels at sea, but also observations of radiation, rainfall and sea surface
temperature. It is also recommended that attention be paid to the problem of obtaining accurate and representative air temperature measurements from ships at sea. This particular element is currently the most poorly observed. The use of aspirated thermometers is believed necessary.

10. Resolved, That, noting the plan of the Weather Bureau to install automatic reporting equipment in mountain areas in the Hawaiian Islands, encouragement be given to this proposal.

11. Resolved, That steps be taken by appropriate agencies for the establishment of a depository for original and summarized meteorological observations in the Pacific area for the purpose of co-ordinating local research. It is suggested that this depository might be located in the Secretariat of the Pacific Science Council of the Pacific Science Association. (Joint Resolution of Meteorology with Geology, Geophysics, and Hydrology.)

12. (See Oceanography and Zoology Resolution 8.)

OCEANOGRAPHY AND ZOOLOGY

1. Whereas, The logical avenue of approach to a scientifically derived understanding is in general from the observational aspects (taxonomy to morphology, distribution, and ecology) to the experimental aspects; and

Whereas, The observational aspects are only in the initial stages in this area; therefore be it Resolved, That investigations designed to assemble and complete the initial steps in this logical approach be encouraged in particular.

2. Whereas, It is essential to consider the dominating practical aspects as well as the purely scientific problems; therefore be it Resolved, That studies be encouraged in the fields of phylogeny and ecology as well as productivity.

3. Whereas, It is inefficient and impractical to investigate the entire Pacific as a unit; therefore be it Resolved, That encouragement be given to intensive studies in selected areas.

4. Whereas, In the Tropical and Central Pacific one of the principal barriers to scientific endeavor is transportation; therefore be it Resolved, That the Pacific Science Council Secretariat be requested to investigate the problem of transportation of scientific personnel by military and nonmilitary agencies.

5. Whereas, The ocean is an area of relatively unknown potential; and

Whereas, The resources of the ocean are great; and

Whereas, The location of Hawaii is peculiarly favorable for the study of the tropical ocean; therefore be it Resolved, That a major portion of efforts in oceanographic investigation be directed along lines devised to elucidate the chemical, physical, and biological nature of the Central Pacific.

6. Whereas, The time and space variations of the general circulation are little known; and

Whereas, The dynamic aspects of physical oceanography are believed to be of basic importance to organic production in the ocean; therefore be it Resolved, That studies of circulation and related factors be intensified.

7. Whereas, A more complete knowledge of the distribution, variations, and fluctuations of the chemical constituents of sea water is necessary for an understanding of productivity; therefore be it Resolved, That studies of nutrient salts and oxygen concentrations be recommended in particular.

8. Whereas, The major ocean currents are maintained by the stress of the wind; and

Whereas, The variations of these currents are related to the time and space variations of the wind; therefore be it Resolved, That combined oceanography-meteorology programs to clarify this relationship be initiated.

This type of investigation of the important North Equatorial and Counterequatorial Current region is recommended in particular.

9. Whereas, Information as to the physical nature of the environment is essential to biological investigations; and

Whereas, Such information is widely scattered; therefore be it Resolved, That encouragement be given the establishment of a recognized repository for information, particularly concerning the more physical and economic aspects of oceanography of the area; and

Be it further resolved, That the publication of a periodical containing the materials in such a repository be encouraged.

It is suggested that the depository be located in the Secretariat of the Pacific Science Council of the Pacific Science Association. (Resolution made jointly with Geology, Geophysics, and Hydrology Committee.)

10. Whereas, Analysis of tidal records does give valuable information on oceanic currents; and

Whereas, These motions are primary factors in distribution and productivity of marine forms; therefore be it Resolved, That it be recommended that additional tide gauge stations be established and maintained where feasible in the tropical and subtropical Pacific.

11. Whereas, It is essential for the continuing intensive studies in Kanohe Bay, Oahu, that correctly evaluated empirical data on distribution of nutrients, fish eggs, fish larvae, and growth of all organisms be available; therefore be it Resolved, That support be given to a detailed hydrographic study of the Bay and related inshore waters.

12. Whereas, All phases of the biology of the Central Pacific are inadequately known; and

Whereas, The knowledge of taxonomy, distribution, and ecology is essential to an understanding of the biota and its productivity; therefore be it Resolved, That investigations so directed be encouraged.

13. Whereas, There is at present an almost complete lack of information as to algal forms in the area; and

Whereas, These forms are responsible essentially for the energy available to biological processes in the Pacific Ocean; therefore be it Resolved, That the collection and identification of both the sessile neritic forms and planktonic forms be encouraged.

14. Whereas, It is recognized that the rich Indo-Pacific biotic region is attenuated toward Hawaii; therefore be it Resolved, That studies of the nature, relationships, and derivation of the marine fauna and flora be intensified.

It is felt that investigations of certain forms, e.g., flukes, plankton, and certain groups of invertebrates
where exhibit particular advantages for the study of the problem, are most necessary.

15. Whereas, It is essential for workers in nontaxonomic fields of biology to be able to name that with which they are working; therefore be it

Resolved, That encouragement be given and funds provided for the preparation of faunal and floral handbooks on marine life.

16. Whereas, There are a great many species of reef and inshore fish that apparently range over a large portion of the tropical Pacific; therefore be it

Resolved, That morphometric studies be made of selected populations of some of the species better to determine the real status of and relationship among these populations.

17. Whereas, Detailed information on the egg and larval period of bait fish is important toward understanding the effect of natural factors on survival and growth; therefore be it

Resolved, That studies be intensified on the development of larvae of the anchovy, Stolephorus purpureus, and the atherinid, Prionurus lanceolatus, under controlled variations in temperature, salinity, water movement, and food supply.

18. Whereas, There is virtually no information on developmental growth rates of economically important fish and invertebrate species; and

Whereas, Such information is necessary for the evaluation of important aspects of productivity; therefore be it

Resolved, That studies be continued on the life history of such species.

19. Whereas, Hawaii contains shores ranging from those recently formed by lava flows into the sea through all stages of the development and degeneration of coral reefs; and

Whereas, These reefs are so immensely important to the tropical and Central Pacific; and

Whereas, Hawaii is one of the few places where such studies can be carried on efficiently; therefore be it

Resolved, That studies of the ecological successions on such reefs be intensified and supported.

20. Whereas, The reef community can be considered as a superorganism; therefore be it

Resolved, That its physiology as a superorganism be studied.

21. Whereas, Holothurians have long been suspected of being obstructive to coral reefs; and

Whereas, Such reefs are such important and conspicuous elements of the tropical and Central Pacific; therefore be it

Resolved, That support be given to a study of the anatomy and histology of the digestive system of some abundant type, such as Holothuria atra, to provide a basis for physiological studies directed toward an evaluation of their triturating effect on coral fragments.

22. Whereas, Recent studies have shown that close relationships between animals probably result from a chemical dependence between them; and

Whereas, Commensal associations are numerous on Hawaiian reefs; and

Whereas, Laboratory facilities are available for such experimentation; therefore be it

Resolved, That studies be recommended on the nature of the attraction of hosts for their commensals.

23. Whereas, The sensory responses of fish and invertebrates are basic in their behavior patterns; and

Whereas, Such responses may be utilized to design more effective catch methods; therefore be it

Resolved, That studies be further supported on responses of marine animals to electrical, sonic, chemical, and visual stimuli.

24. Whereas, A thorough understanding of the physiology and dynamics of digestion of marine animals is basic to an evaluation of area productivity; therefore be it

Resolved, That such studies be encouraged.

25. Whereas, The marine wood borers cause great economic loss, especially in the tropics; and

Whereas, None of the current methods of treating wooden structures is adequate; therefore be it

Resolved, That the following investigations be recommended: (a) a taxonomic study of the wood borers obtained through Naval surveys in the Pacific; (b) an investigation of the chemical treatment of wood with a view to increasing its resistance to attack by borers; (c) detailed studies on the embryology, metamorphosis, and later developmental anatomy of the several major species of marine boring organisms; (d) a study of the effect of parasitic copepods upon their terebo hosts; and (e) an investigation of methods of controlling Limnoria chemically, since this genus is resistant to present methods effective in other marine borers.

26. Whereas, Bait fish are essential for present-day methods of catching tuna and because the bait fish supply in the Central Pacific is not extensive; therefore be it

Resolved, That current studies on Hawaiian bait fish be further encouraged and supported to determine the maximum sustained productivity in Hawaiian waters in particular and in tropical waters in general.

27. Whereas, The available nitrogen is nearly always a limiting factor in oceanic productivity; and

Whereas, The Myxophyta, or blue-green algae, are known in many cases to fix nitrogen; therefore be it

Resolved, That a study of those of the oceanic area be initiated.

28. Whereas, Enrichment culture studies in relatively enclosed shallow waters in temperate regions have proved promising in increasing the total productivity; therefore be it

Resolved, That similar studies in appropriate areas of Kanehie Bay, Oahu, be undertaken.

29. Whereas, Productivity in tropical waters is significant for evaluating resources in tropical seas; and

Whereas, The productivity in tropical waters has been little studied; therefore be it

Resolved, That detailed studies of plankton productivity in inshore, neritic, and oceanic waters, correlated with physical and chemical hydrographic features, be undertaken in Hawaii.

30. Whereas, Oceanic islands are classically recognized as providing unique opportunities for the study of adaptation and speciation; and

Whereas, The Hawaiian Islands are exceptionally favorable for observations of the adjustments of exotic species to new environments; therefore be it

Resolved, That studies of evolutionary processes in both indigenous and exotic species be emphasized.

31. Whereas, The endemic fauna is rapidly being destroyed along with the indigenous forests on the Pacific islands; therefore be it
Resolved, That an active program of faunistic and floristic surveys be initiated and continued on these islands.

32. Whereas, Guano deposits in the Pacific islands are of economic and biological interest; and whereas, A thorough survey of literature bearing upon guano has been made; and whereas, The lacunae in knowledge of the genesis of guano deposits in the past and possibilities for the future can be gleaned; therefore be it resolved, That mineralogical surveys of guano deposits and biological studies of guano birds, such as their populations and the environmental factors influencing these populations, be encouraged.

33. Whereas, The Hawaiian archipelago, especially the leeward Hawaiian Islands, has long been known as one of the finest rookeries for oceanic birds; and whereas, Virtually nothing is known about these species except taxonomy and distribution; and whereas, Man-induced environmental changes are known to affect adversely some species; therefore be it resolved, That studies on life history and ecology of oceanic birds be undertaken.

34. Whereas, The opportunities in Hawaii are unique for a study of those factors basic to evolution, as exemplified by speciation and dispersal of endemic species on an oceanic island; therefore be it resolved, That advantage be taken of the phenomenal speciation of appropriate organisms, such as Drosophila, Oecobius, and land snails, for morphological and cytogenetic studies.

35. Whereas, Resolution 31 is of critical interest to the sections on Entomology, Conservation, and Museums in Pacific Research, as it bears upon plant and animal distribution; therefore be it resolved, That this resolution be referred to those sections.

36. (See Geology, Geophysics, and Hydrology Resolution 8.)

ENTOMOLOGY

1. Resolved, That the activities of the Bishop Museum in compiling a complete bibliography of Pacific entomology be commended and their continuation approved.

2. Resolved, That the recommendations of the Pacific Science Conference of the National Research Council (1946) and the Second and Seventh Congresses of the Pacific Science Association be endorsed insofar as they apply to entomology.

3. Resolved, That more collecting should be done in the Pacific area. There are many opportunities and an urgent need for taxonomic work and further monographic studies.

4. Resolved, That, as far as possible, it is urged that Pacific island insect collections be deposited in the Bishop Museum, and that strong representations be made for increasing the Bishop Museum facilities for handling them.

5. Resolved, That, inasmuch as the publication of results is essential to adequate use of accumulated scientific data, financial provision be strongly recommended for such publication.

6. Resolved, That the development of economic entomology in the Pacific be urged as essential to the economic well-being of the peoples of the Pacific, and that this development proceed along the following lines:

(a) Information be obtained and made available concerning the origin, distribution, and importance of agricultural insect pests.

(b) Measures be devised for control of these pests by agronomic, biological, chemical, or other means.

(c) The basis for these control measures be adequate ecological studies of the species concerned.

7. Resolved, That, in view of the entirely inadequate status of plant quarantine in much of the Pacific area, the whole question of these quarantines be reviewed by competent authority, and adequate procedures be established and maintained.

The Hawaiian Academy of Science recommends that the South Pacific Commission convene a conference on quarantine regulations covering pests and plant and animal diseases and weeds, this conference to be held in April, 1951.

8. (See Oceanography and Zoology Resolution 31.)

CONSERVATION

1. Whereas, The soil, water, flora, fauna—archaeological and aesthetic resources with which we have been entrusted—are inextricably interwoven with the health and welfare of the people of this Territory; and whereas, The conservation and restoration of these resources is a duty of all citizens for the benefit of our descendants; and whereas, The expansion of the population and the economy of this Territory has presented problems in conservation of these resources not hitherto confronting the people; and whereas, There has been formed in the Territory of Hawaii a body known as the Conservation Council for Hawaii, consisting of conservationists, naturalists, scientists, and other persons representing various organizations, both public and private, which are vitally interested in the conservation of our resources; therefore be it resolved, That the Hawaiian Academy of Science recommend to His Excellency the Governor and to the Legislature of the Territory of Hawaii that the aforesaid Conservation Council for Hawaii be named an official advisory body for conservation for the Territory, and that the fullest use be made of its services in research and in the solution of such problems as may arise; and be it further resolved, That the Hawaiian Academy of Science tender its support to the Conservation Council for Hawaii in its actions to protect and preserve the resources of Hawaii.

2. Whereas, The conservation of Hawaiian beaches involves the need for flood control and the use of sand for commercial purposes as well as recreational aspects; therefore be it resolved, That the Territory of Hawaii immediately set up a commission to initiate studies on the overall problem of the conservation of beaches, with particular attention to (a) evaluating the annual damage caused by floods in relation to the damage that would occur by removing sand bars from mouths of streams; (b) evaluating area and number of people affected by flood problems; (c) evaluating annual costs of clearing channels without selling the sand; (d) developing alternate plans for flood control compatible with beach maintenance at a reasonable cost; (e) evaluating need for and value of beaches as relating to tourist...
trade, population centers, accessibility to bathers, and availability to other beaches; (f) determining the volume of littoral drift which moves along the beaches in order to obtain information on the receding and building up of beaches; (g) determining the needs of commercial sand for construction purposes and the sources of such sand, such as studying the cost of trading dune sand for beach sand, crushed lava as substitute for sand, etc.; and

Be it further resolved, That this Commission on the conservation of beaches chart the critical beaches of the Territory for preservation in order of priority; and

Be it further resolved, That a special study be made of the Black Sands of Hawaii for preserving the scenic and recreational values of this irreparable resource; and

Be it further resolved, That, until a long-term program for conservation of beaches is developed by the aforementioned Commission, the present method of removal of sand from mouths of streams for flood control be continued under strictest policing to make sure that sand is removed according to specifications presented; that the Hawaiian Academy of Science concur in the recommendations of the City Engineer that the responsibility for keeping the streams open shall be vested in the Territory of Hawaii; that the Academy strongly urge the Territory provide the police protection essential to causing minimum damage to the beaches in such removal of sand.

3. Whereas, The conservation of native species is highly desirable for educational, scientific, and cultural purposes of any area; therefore be it

Resolved, That appropriate agencies catalogue areas of primeval vegetation for purposes of conservation; that the Kipahulu Valley on Maui and a suitable section of the upper Olua or Waialea Forest area on Hawaii be included in the National Park system; that the appropriate federal and territorial agencies make a study of the plant successions, native and introduced, on volcanic flows.

4. Resolved, That, in light of the controversial aspects of the importation of axis deer to the island of Hawaii, it be recommended that (1) a national authority on wildlife management be brought to the Islands to prepare a complete brochure on the behavior of axis deer in other world habitats, to make a thorough analysis of the behavior of axis deer on Molokai in relation to their probable behavior on Hawaii, and to advise on whether the deer should be extended to other islands; (2) all groups interested in the transfer of axis deer to other islands hold these interests in abeyance until the aforementioned study has been made; (3) legislation be enacted making it illegal to transport deer from one island to another until the aforementioned study has been completed; and (4) the present bill before the Legislature of Hawaii to appropriate $20,000 for transporting axis deer to Hawaii be reconsidered in the light of subsections (1), (2), and (3).

5. (See Oceanography and Zoology Resolution 31.)

MUSEUMS IN PACIFIC RESEARCH

1. Resolved, That Bernice P. Bishop Museum be commended for the extensive scientific work which it has done in the Pacific with very limited means, and that ways be sought to expand its finances so that its work can be increased in the future, including the expansion of its storage and research facilities, its library, and its work for the public.

2. Resolved, That the Bishop Museum be requested to compile and maintain a file of scientific projects which should be undertaken and kinds of specimens which should be sought in different areas of the Pacific, particularly in Polynesia and Micronesia, such a file to be used by persons planning to visit particular areas and by those preparing field programs.

Wide co-operation is urged in compiling the aforementioned file.

3. Resolved, That the scientists of Hawaii co-operate in the preparation of a guide for collecting different kinds of natural-history specimens, stressing the need for adequate field data and including sample field label blanks; that the Bishop Museum be asked to co-ordinate the preparation of such a field guide, said guide to be used to encourage amateur collectors to obtain specimens of scientific value and to assist scientists in handling specimens in other than their own field.

4. (See Oceanography and Zoology Resolution 31.)

SOIL SURVEY AND LAND CLASSIFICATION

1. Whereas, Soil and water are basic to the health, wealth, and happiness of the population; therefore be it

Resolved, That a systematic and comprehensive survey of land and water in the Pacific, along the lines of the Food and Agriculture Organization of the United Nations' program, be given high priority.

2. Resolved, That surveys relating to soil and land factors be in sufficient detail to determine land-use capability classes.

3. Resolved, That steps be taken to expedite the publication of the soil survey of the Hawaiian Islands.

The necessary information for this report has been in the office of the U. S. Department of Agriculture.

4. Resolved, That a committee be appointed to work in co-operation with the Pacific Science Association Standing Committee on Soil and Land Classification and the Pacific Science Council Secretariat in collecting such information on soil and land classification as applies to the Pacific area.

CROP IMPROVEMENT AND SOIL MANAGEMENT

1. Whereas, The greatest immediate need in the Trust Territory, Central and South Pacific, is improvement of subsistence crops rather than of existing or potential export crops; therefore be it

Resolved, That, in order to implement a program of crop improvement with particular attention to subsistence crops in the Trust Territory, the area under the jurisdiction of the South Pacific Commission and adjacent and similar areas, the following be recommended: (1) establishment and maintenance of experiment stations and/or experimental gardens, staffed by competent personnel in representative locations; (2) introduction of new plants and reintroduction of improved varieties of the more important subsistence crops, with adequate quarantine measures to guard against the introduction of pests and diseases; (3) exchange of information relating to varietal performance and to acceptance by native peoples; and (4) utilization of the services of scientists in Hawaii and other tropical and subtropical areas in attacking specific problems and in promoting a program for the exchange of plant materials.
HAWAI\'I SYMPOSIUM

2. Resolved, That research in the exchange, adaptation, and culture of native food crops of the Trust Territory be emphasized.

3. Resolved, That, to prevent erosion and to conserve soil fertility in cultivated tropical soils, it be recommended that emphasis be placed upon the proper use of grass and legume mulches, green manures, crop residues, and rotation, as basic practices in tropical agriculture.

4. Resolved, That, to prevent erosion on nonarable lands in tropical areas, it be recommended that emphasis be placed upon the development of permanent vegetative covers and the use of economic plants where possible.

5. Resolved, That research into the development and use of legumes, especially perennial legumes suitable for food, feed, and soil conserving uses, be greatly enhanced.

6. Resolved, That research on range and pasture improvement in Hawaii and other tropical areas be directed especially to the control of pasture pests, to the development of improved grasses and legumes, and to improved management.

7. Resolved, That development and utilization of local agricultural crops and by-products, which would contribute to a more adequate animal production, be encouraged.

8. Resolved, That intensive research and effort be directed to the culture and adaptation of fruits, nuts, and forest trees which are likely to yield greater self-sufficiency and economic returns than pasture or other crops grown on the same land.

9. Resolved, That intensive research be directed to comparative crop ecology in order to define better those factors which determine the present and potential distribution of economic plants.

10. Resolved, That, in the development of a permanent agriculture in a well-organized society, a national consciousness of the importance of farming be developed, and an appreciation of the dignity of his profession be engendered in the farmer.

(See also Health and Nutrition Resolution 3.)

ANIMAL IMPROVEMENT

1. Resolved, That, before introducing livestock for meat, milk, eggs, or wool, a careful investigation be undertaken of local needs for these products and the feasibility of producing them at prices within the means of consumers.

2. Resolved, That local stocks be evaluated and maximum use made of adapted stocks in any improvement plan.

3. Resolved, That large-scale introductions of animals be avoided until their adaptability has been clearly demonstrated by adequate experimental introductions. Unless animal introductions, either experimental or on a commercial scale, are under the supervision of trained personnel with adequate facilities for taking care of them, a fair estimate of their potential value is unlikely.

4. Resolved, That an animal-improvement program through breeding be accompanied by equal or greater improvement in nutrition, sanitation, and general management practices.

5. Resolved, That, before introducing livestock, the availability and value of local forage, other crops, and by-products that may have value in animal nutrition, and the interaction of soil, climate, and plants with regard to their effects on animals be investigated.

6. Resolved, That, in adapting animals to a new environment, selection pressure be exerted toward functions rather than form.

7. Resolved, That the knowledge of Mendelian inheritance and the mechanics of pedigree breeding be more widely disseminated and the establishment of local breeding farms encouraged.

8. Resolved, That the need for greater knowledge of characteristics determining climatic tolerance of livestock and techniques for evaluating such characteristics be acknowledged.

9. Resolved, That the feasibility of producing them at prices within the means of consumers.

10. Resolved, That co-ordinated, standard, experimental procedures be adopted to enhance the interchange of information between investigators who are studying the same problems.

11. Resolved, That increased attention be given to the determination of cost per unit T.D.N. of each crop when grazed, cured as hay, ensiled, etc.

12. Resolved, That a study be undertaken of infectious and parasitic diseases of animals in the Pacific area so control measures can be formulated and recommended.

13. Resolved, That further investigations be undertaken to determine the causes of sterility in cattle.

14. Resolved, That flocks of sheep, in which multiple twinning is frequent, be collected in order to increase the frequency of genetic factors influencing that characteristic.

15. Resolved, That studies be undertaken to determine the causes of small litters in swine.

16. Resolved, That strains of chickens adapted to Pacific conditions be developed.

17. Resolved, That studies be undertaken on the correct use of carbohydrates in ruminant feeding, with particular emphasis upon the microflora of the intestinal tract.

18. Resolved, That increased animal production be sought through better pasture-management practices.

19. Resolved, That the use of rotational pastures be developed so forage may be grazed under more optimum conditions.

20. Resolved, That further studies be undertaken to determine the optimum period for harvesting animal
feed with regard to the interaction between available T.D.N. and time.

21. Resolved, That routine screening of local and introduced forage crops be established for the elimination of poisonous crops.

22. Resolved, That further studies be undertaken concerning the toxic effect of insecticide and weed-killing sprays.

23. Resolved, That studies be undertaken on the application of nutrients to lactating and nonlactating ruminants and other animals, with specific attention to the dry period prior to parturition.

24. Resolved, That emphasis be placed upon the interrelationship between antibiotics and microorganisms in the intestinal tracts of animals.

25. Resolved, That further studies be encouraged toward the evaluation and utilization of locally produced ingredients in poultry feeding. It is recommended that greater use be made of by-products from the sugar, pineapple, fish, and meat packing industries.

26. Resolved, That a study be undertaken of the problem of piroplasmosis (Texas fever) in the Pacific area. It is recommended that control measures be instituted previous to introducing livestock into areas known to be infested.

27. Resolved, That a study be undertaken of liver flukes and the feasibility of eradicating fresh-water snails through biological control.

28. Resolved, That an investigation be made of the distribution of kidney worms in swine with further studies on prevention and treatment.

29. Resolved, That basic information is needed on the distribution of infectious and parasitic diseases of poultry before specific recommendations can be made.

ANTHROPOLOGY AND SOCIAL SCIENCES

1. Resolved, That emphasis be given to team research and co-operation of scientists within the social sciences and also between the social and natural sciences. In this connection, attention is directed to the team projects successfully completed, under the Pacific Science Board, such as the Coordinated Investigation of Micronesian Anthropology in 1947 and the Arno Atoll Ecological Study in 1950. The Moturiki community development project in Fiji, under the South Pacific Commission, is a further example of the team approach.

2. Resolved, That emphasis be placed on the need for more standardized methods in field and library research in the social sciences. Closer co-ordination of scientific activities would avoid needless duplication of effort. The value of Human Relations Area Files (Yale University) is particularly noted as a guide to standard classification and filing of accumulated data.

3. Resolved, That, although field researches and publications on aboriginal cultures in Polynesia (except for archaeological investigations) are nearly done, further work be undertaken in the Ellice Islands among the Polynesian outliers of Micronesia and, especially, Melanesia.

4. Resolved, That studies of acculturation and culture change be undertaken in Polynesian communities for which the basic anthropological research has been completed.

5. Resolved, That reviews be made of the status of field research and literature concerning Micronesia and Melanesia, along the lines of the Bishop Museum's "Specialized Studies in Polynesia" and "Introduction to Polynesian Anthropology."

6. Resolved, That a comprehensive bibliography of Micronesian anthropology, comparable to those undertaken by Keeling (Polynesia) and Elkin (Melanesia) for the South Pacific Commission, be undertaken. Such a bibliography should include a summary of post-war field work and publication, work now in progress, and unpublished materials otherwise available.

7. Resolved, That a more intensive study be made of Fiji, as an important link between the culture areas of Melanesia, Polynesia, and Micronesia.

8. Resolved, That syntheses of ethnohistorical studies of isolated Micronesian and Melanesian communities be undertaken along the lines of the Polynesian research done by Bishop Museum.

9. Resolved, That additional studies of Oceanic somatology and serology supplement the present data, for a better understanding of racial trends and intermixtures in Oceanic history.

10. Resolved, That, as approximate dates of archaeological sites through the radioactive carbon technique may possibly be attained, systematic archaeological excavations throughout Oceania be undertaken to establish the movement of peoples and cultures.

11. Resolved, That land inventory be undertaken of island areas, with consideration of land types, land utilization, and possible improvement of land use in type areas, with attention to needed conservation measures. Such an inventory would facilitate land-planning projects and the settlement of native peoples on now-unoccupied islands.

12. Resolved, That study be undertaken of the extent of the agricultural land supporting the present population, the possibility of extension of farm land under present production techniques, and the determination of total supporting capacity of the land.

13. Resolved, That study be undertaken of the edaphic, climatic, and labor requirements of commercial crops suitable for introduction into the agricultural pattern of the Trust Territory.

14. Resolved, That study be undertaken of native settlement patterns—advantages and disadvantages, possible modifications, and extension into now-unoccupied areas.

15. Resolved, That, for geography of Pacific island handicrafts, study be undertaken of distribution and nature of raw materials, products, and techniques of production, cost of production, and possible markets.

16. Resolved, That survey and evaluation be undertaken of American efforts in Guam to increase the development of local resources and the self-sufficiency of the island. Comparisons with Japanese methods of increasing native production in the former mandated area are recommended.

17. Resolved, That study be undertaken of the influence of demographic loss and displacement resulting from World War II upon the production and trade of the former Japanese Mandated Islands.

18. Resolved, That study be undertaken of relationships between vegetation, soil, land utilization, and microclimates on the high islands, and that possible
use of microareas for commercial agricultural production be considered.

19. Resolved, That the Division of Geography of the Department of the Interior be encouraged to participate in furthering field studies in the Pacific. Considering the facilities of the Board on Geographic Names and the important role of place-name terminology in the work of Pacific scientists, it is urged that work in the production of atlases and gazetteers be promoted.

20. Resolved, That airphoto coverage and mapping of areas in the Pacific, especially in Micronesia, as being carried out by various government agencies for restricted use, be made available to scientists and scientific institutions as soon as possible for non-government use.

Involved in this is the problem of declassification of materials and co-ordination of distribution through a proper government agency or a professional geographic organization.

21. Resolved, That more attention be given to studies of island communities from the point of view of their incorporation in the developing world society. Among other things, this means increased emphasis upon the study of the cultural and social relations between Europeans, Orientals, and indigenous populations, if and as these develop in island communities of the Pacific.

22. Resolved, That attention be given to the value of the application of research studies on relations between European and Oriental peoples in areas bordering the insular Pacific to research problems along lines suggested in the preceding resolution.

23. Resolved, That co-operation between sociologists and anthropologists be augmented, especially in those island communities where acculturation has progressed to the point that the specialized techniques and conceptual approaches of anthropology and sociology are both needed for proper analysis of the cultural situation.

24. Resolved, That a series of island communities falling along a continuum from the aboriginal state to one of Western orientation be studied to determine principles and processes involved in the progressive incorporation of communities into the developing world society.

25. Resolved, That attention be given to the need for further empirical studies on a wide variety of subjects concerned with problems of race and culture contacts in the Pacific. Among the studies needed are the following: demography; race mixture; situations of dual and plural economies; occupational succession; labor movements; political administration in multicultural situations; nativist movements; nationalistic movements; political integration of Caucasian, Oriental, and indigenous peoples into unified political units; cultural assimilation of persons and ethnic groups in heterogeneous cultural situations; emergence of "Neo-Pacific" cultures; social and racial movements; personality in relation to heterogeneous cultural situations; personality of mixed bloods and of second and third generation offspring of Oriental immigrants; social types in intercultural situations.

26. Resolved, That the need, throughout the Pacific, for intensive studies of indigenous languages by trained personnel be recognized.

Much of the older missionary work in languages needs revision. Scattered manuscript materials need collation and annotation.

27. Resolved, That the need for orthographies based upon scientific analysis of the phonemics of native vernaculars be considered. Linguists should cooperate with anthropologists and educators for popular acceptance of these orthographies.

28. Resolved, That grammars and dictionaries be written for laymen—educators and administrators who have to deal with linguistic problems.

Many scientific studies have no utility for the non-linguist in the Pacific because of their problems of technical terminology.

29. Resolved, That, with the production of more field studies by trained linguists, attention be given to comparative research in pure linguistics with special regard for historical relationships of Oceanic languages.

30. Whereas, The function to be served by the school (whether government or mission), the formulation of educational aims, the provision of educational materials, and the adoption of methods of instruction are matters which can be determined effectively only in the light of more accurate and exact knowledge than is now available of the traditional educational arrangements of the island peoples concerned; therefore be it

Resolved, That intensive studies be undertaken by anthropologists (with educators participating at least in the planning phases of the research) to determine what the traditional arrangements were in the various island societies, the extent to which these arrangements are still utilized, the degree of their effectiveness, and trends toward persistence, change, disintegration, or abandonment.

31. Whereas, Although educational activity conducted or influenced by Europeans and Americans has been carried on in the various island groups for periods ranging from one to three centuries, the lack of dependable historical accounts is surprising; therefore be it

Resolved, That historical research be undertaken which would contribute toward an understanding of the role which has been served by:

(1) Mission schools. The problem of tracing the development and role of missionary schools as a whole is dependent upon preliminary research on the role of such groups as the American Board of Commissioners for Foreign Missions, the Jesuits, the London Missionary Society, the Society for the Propagation of the Faith, and other religious orders, societies, and sects which have initiated and operated schools of various sorts. Studies may range from the history of a specific school (e.g., the "Protestant School" on Kusaie) to broad integrated studies.

(2) Government schools. A number of studies are needed which will trace not only the history but the implied philosophy (administrative, as well as educational) of government schools in areas which have been under Dutch, German, French, British, Australian, Japanese, and American domination. Ideally, this large project would be one to be undertaken by a team of scholars working under a generous subvention.
(3) Evaluation of educational programs now in operation. Research is needed to assess the effectiveness of varying kinds of education now operating, both with respect to the ends toward which such activities are professedly directed and with reference to the effect upon the persistence or abandonment of native institutions and practices, the maintenance of stability in transition to new cultural patterns and values, and the personality organization of the individuals affected.

An interesting research undertaking would be a comparison of educational practices and outcomes considered in relation to the guiding philosophy of administration in two or more areas, e.g., the Trust Territory on the one hand, British Borneo or Dutch New Guinea on the other.

HEALTH AND NUTRITION

1. Resolved, That adequate nutrition occupy a major position and be a consideration in all studies concerned with health, since it is a problem of world-wide significance and is of primary importance in the preservation and maintenance of health.

2. Resolved, That support be given to the immediate completion of the compilation of an annotated bibliography on nutrition and related matters in the Pacific in order that knowledge of previous research, now scattered, can be assembled, and that this information be published and widely disseminated to all workers in the field of health in the Pacific. When the bibliographical data are collected, a systematic program of food analysis and diet study in those areas where this information is not available will then be needed.

3. Resolved, That it be requested that agricultural committees give adequate consideration to the nutritive qualities of the food plants which may be introduced into Pacific island economies.

4. Resolved, That facilities be provided for the collection of data on the incidence and nature of the etiological agents associated with intestinal diseases of the inhabitants of the Pacific islands.

5. Resolved, That, since the poisonous fish of the Pacific constitute a serious health problem to the Hawaiian Islands and to other islands of the Pacific where fish constitute a significant part of the diet, and since much additional work in the study of this problem is needed, the present investigations by Dr. Bruce Halstead (School of Tropical and Preventive Medicine, Loma Linda, California) and others be encouraged and receive adequate financial support.

6. Resolved, That the Symposium, recognizing the need for timely reporting of the prevalence of communicable diseases in the Pacific, endorse in principle the recommendations made at the Seventh Pacific Science Congress held in 1949 in New Zealand concerning the formation of a center to correlate such information. It is recommended that: (1) A Communicable Disease Information Center for the Pacific be established in Hawaii; (2) the five pestilential diseases (yellow fever, plague, typhus, cholera, and smallpox), presently being reported by the World Health Organization, be excluded; (3) the Secretariat of the Pacific Science Council, with the aid of the Department of Health, Territory of Hawaii, proceed to develop a program with a view to establishing a permanent Communicable Disease Information Center in conformity with the resolution of the Executive Board of the World Health Organization, February 3, 1951; and (4) this Communicable Disease Information Center not duplicate present functions of the Epidemiological Section of the World Health Organization, but rather serve to complement its present work in the Pacific.

7. Resolved, That education of medical, dental, and other assistants in health professions and crafts be continued and augmented in the Pacific islands wherever these services are needed, and that concentrated efforts be made to have basic, accurate public health and nutrition information incorporated into the primary education of the population of these islands. To implement this recommendation, the Symposium recommends that a Standing Committee on Health and Nutrition be established by the Eighth Pacific Science Congress of the Pacific Science Association.

8. Resolved, That the Symposium recommend that, in view of the large number of mosquitoes and mosquito-borne diseases in the Pacific, necessary steps be taken to determine the types of species and subspecies which act as vectors for disease in each of the island areas of the Pacific.

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