CONTENTS

Presidential Address ......................................................... 3
Annual Report ................................................................. 7
  ISSEC Report ............................................................... 9
Program ........................................................................... 14
Abstracts and Papers ......................................................... 15
  First Session .................................................................. 15
  Special Sessions .............................................................. 16
  Final Session .................................................................. 23
Necrology ........................................................................... 28
Membership ......................................................................... 29
PRESIDENTIAL ADDRESS 1964

URANIA AND AGORA: SCIENTIFIC CONTRIBUTIONS OF AN INDUSTRIAL RESEARCH ORGANIZATION

Donald P. Gowing

In his highly interesting book *Science for the Citizen*, Lancelot Hogben develops the theme that a large number of scientific discoveries were made as a result of directed searching in response to meeting a human need. He cites many instances of this, among them the investigations of the physics and thermodynamics of the behavior of gases that followed Newcomen’s invention of the steam engine. A good deal of this was the direct or indirect result of efforts to improve the efficiency of steam engines for pumping water out of mines. To find evidence in other fields, one has only to consider the advances in knowledge of human physiology and health made by medical practitioners, past and present, and the enormous increase in knowledge about the nature of electromagnetic phenomena developed within the electronics and communications industries. I think the principle is well established. However, this does not mean that it is well recognized.

In the period of my association with a private industrial research organization, the Pineapple Research Institute of Hawaii, there have often been occasions when professional visitors have questioned this principle. It is argued that research time oriented toward the solution of practical problems is “wasted,” particularly if any portion of the results are withheld from the public domain. Moreover, so runs the argument, our scientists fail to meet the obligations to the masters who trained us in the expectation that our work in turn would be solely directed to the advancement of scientific knowledge and its free disclosure.

Taking these things one at a time, I am convinced that the PRI professional staff over the years has been both busy in applied research and productive of scientific information available to everyone. That pineapple agriculture in Hawaii has had (thus far at least) a technological superiority over that in most other areas needs no debate. And my evidence of the scientific contributions of the staff is the number and range and content of papers published in the professional and technical journals by the PRI scientists, dating from those days in the early 1920’s when the pineapple experiment station of the Hawaiian Pineapple Packers Association was first organized.

Proposing such evidence assumes, of course, that reviewers for papers for scientific journals, and their editors, do not accept any paper unless it does make a contribution. One could argue that this standard was not set on the early series of circulars and bulletins from the Pineapple Experiment Station. One could argue that articles for the Pineapple Quarterly and Pineapple News of former years might not have been subjected to as rigid a scrutiny as that of the journals of the national scientific societies. This view, however, is too narrow. There is a wealth of valid original scientific information on insect, fungus, and nematode ecology and taxonomy, plant morphology, identification and descriptions of pineapple fruit and plant diseases, and other material in these publications. Also, the greater latitude allowed in such papers, in the discussion of research findings, makes them in some respects more significant than the new-data-only format insisted on by today’s editors of journals with more limited space.

Moreover, there are a number of papers concerned with methods of investigation. Someone will write a book one day on how much scientific discovery has awaited the development of the simple appropriate technique. The use of agar in bacteriology, the Warburg apparatus in enzyme...
chemistry, and the powerful paper and gas chromatography techniques are obvious examples.

At PRI, the devising of field plot techniques, of objective characterization of fruit quality, and of the instrumentation of field and laboratory measurements did much to reduce and codify the research data within the pineapple investigations. Some of these inventions have since been adopted or adapted for standard approaches by scientists in other fields.

But setting aside the sympathies of local reviewers and local journal series, Institute scientists have also published nearly 300 papers in the Technical Paper series, and some 50 Miscellaneous Papers. There have been over 80 in entomology, 45 in plant pathology and microbiology, almost 40 relating to nematology and soil fumigation, 60 in plant physiology, over 30 in chemistry and biochemistry, 10 in genetics, about 25 in meteorology, more than 15 in agronomy, some in engineering, and another 20 or more in botany, botanical history, and the like. In addition, two books by retired members of the Institute have been recently published: J. Lloyd Collins' The Pineapple, and Walter Carter's Insects in Relation to Plant Disease.

Dr. Carter covers in one chapter his work on mealybug wilt of pineapple. Quite apart from the very considerable accomplishment in working out a practical control of this disease, Carter's thorough description of the syndrome, and of the complex relationships of mealybug feeding, and the development and epidemiology of mealybug wilt, stands as a landmark in entomological and phytopathological lore. Equally important to the student is his insistence on the biological approach to plant virus problems, and the illustrations of it in his own work. Attempts in the laboratory to isolate and identify a virus from wilt-infected plants have not been successful, but Carter's demonstration of the disastrous effects of mass-feeding of mealybugs following transmission of the infective entity by a single bug, placed mealybug wilt in a unique category amongst virus diseases. These phenomena and that of the pineapple plant's recovery from wilt had implications both in the field control of the disease and as an example of information that would escape a researcher with the "test tube" attitude. (The expression is Carter's.)

Maurice B. Linford was equally committed to the biological viewpoint in his investigations on the yellow spot of pineapples. This virus disease is transmitted by a thrips for which pineapple plants are apparently only an incidental host. The thrips is normally found on the Flora's paintbrush (Emilia sonchifolia), a common composite weed in pineapple fields, and on some other hosts. Disturbance of these weeds by weed control operations causes the movement of the infective thrips to the pineapple plant. The key to control of yellow spot was control of Emilia before it became big enough to become diseased.

Kanjiyo Sakimura's later work establishing the identity of this virus with that of tomato spotted wilt, and his extensive work in thrips taxonomy and ecology in ensuing years have been important contributions to the study of this group of insects. And indeed, the additional papers by these and Schmidt, Illingworth, and other PRI authors on the ecology and life histories of ants, beetles, and other forms, the taxonomy of symphilids, etc., have given our entomological work international recognition.

Equally stimulating and substantial contributions have been made in the fields of plant pathology, microbiology, and nematology. The carelessness might dismiss the granting of patents to PRI scientists for two of the three most widely used fumigants in the world as mere improvements in technology. However, to PRI workers must go a great deal of the credit for recognizing the extent of damage by two nematode species. And, moreover, in agricultural research, a scientific principle often cannot be tested because some uncontrolled factor limits the response. The practical control of nematodes has since permitted the investigation of many another set of experimental variables whose effects had been masked on plants whose root systems were under attack. I think the discovery of the effectiveness of these fumigants was a scientific advance. The ingenious methods and devices, and the improvements in standard techniques used in the study of root diseases and pathogens—window boxes, mist chambers, trap-crop, partial sterilization, and others—have also been widely adopted. Our controlled laboratory experiments with soil fungus pathogens and our field experiments with control agents have yielded information that has a wider application than the single instance. For example, the work of Anderson and others showing that root rot from Phytophthora cinnamomi was controlled by chloropicrin, not because of a direct effect of the fumigant on the fungus but because of the antag-
onism of a burgeoning population of *Trichoderma*, is a case in point. The chloropicrin fumigant apparently was effective in controlling those organisms which normally hold *Trichoderma* in check.

While on the topic of plant disease, it is interesting that pineapple root diseases are mostly related to pythiaceous fungi, and much less to the *Fusarium* and *Rhizoctonia* species held to be most important elsewhere in the tropics. Further, in contrast to other areas, our major *Pythium* offender appears to be *P. arrhenomanes*, rather than *P. debaryanum*. The moral is there for those who uncritically hold the view that these other forms are universally the most important fungus pathogens in tropical crops. They would do well to examine again the evidence in their own fields of interest.

On quite another topic, an opinion widely held by plant physiologists at one time was that plants grew better on nitrate rather than ammonium as a nitrogen source. This view derived from solution culture work, and was re-examined profitably some years ago. Here, too, PRI work provided some of the basis for this reappraisal. I refer to the work of Tam, Sideris and co-workers, Clark and co-workers, and Nightingale, comparing pineapple plant growth with the two nitrogen sources, examining the interaction of nitrogen with other plant nutrients, and demonstrating that soil fumigants inhibited nitrifying bacteria but improved the growth of the plants, in spite of the supply of ammonium nitrogen.

Nightingale is actually best known for his work on nitrogen nutrition, or carbohydrate/nitrogen balance, and for his work on the "crop log." This system of tissue analysis and measurement of growth is a device for assuring that at least the factors studied will be adjusted during plant growth. These steps provide odds that these factors will not be limiting plant growth. The principle, seemingly obvious, still awaits adaptation and adoption by agricultural scientists. Only a handful of crops are "logged" at present.

Sideris worked in microbiology, analytical chemistry, and soil science, as well as in plant physiology, and in my opinion his conclusions have a particular authority because of his familiarity with these several fields. He published most extensively in the area of mineral nutrition, and his researches on iron-nitrogen relationships especially will have a cogency for years to come.

Another area in physiology in which outstanding contributions have been made is that relating to experimental morphogenesis, and in particular to the physiology of flowering and growth regulator metabolism. The demonstration by Clark and Kerns that flowering could be induced by naphthaleneacetic acid, and the controlled production of slips by 4-chlorophenoxyacetic acid, still stands as a unique response of the pineapple, or of bromeliads at least. The subsequent series of papers by Gowing and Leeper demonstrating induction of flowering by hydroxyethylhydradrazine, developing the theory of activity of growth regulators in induction of pineapple flowering, and discussing chemical structure in relation to this and other growth regulator responses, is still too new to have been widely assessed. However, it is clear that the popular view that differences between chemicals which influence growth ("auxins") are only quantitative in any response in which some are active, is untenable. Particularly in morphogenetic responses—differentiation responses—certain of them have unique and non-general properties. The important differences are qualitative as well as quantitative.

Gowing's theory on the reduction of the actual or effective level of indoleacetic acid (the major native auxin of the pineapple plant), as responsible for initiation of flowering in the pineapple, has found support in several experimental approaches, and in some circumstantial evidence as well. Part of this lies in the work of Gortner and colleagues on the indoleacetic acid oxidase system, its naturally-occurring stimulators and inhibitors, and the climatic conditions which affect the levels of phenolic compounds in the plant. The tissue levels of the phenolics fluctuate in ways which well could be related to natural flowering, but further work in which the connection may be tested by experiment, rather than by correlation only, is required. The relation of these results to other plants—oats, peas, beans, and barley—has yet to be investigated.

We should not fail to mention the improvements in methodology of growth regulator assay made by Gortner and Kent. The characterization of potency on which theories of activity are based is obviously critical to the validity of the theories. Miss Kent's many-fold improved sensitivities of the standard *Avena* and split-pea stem curvature tests make it obvious that other workers have been content with less than accurate data. And Young and Sideris have published a number of papers on
new or improved chemical methods for growth regulators and other chemicals as well.

Several other quite different lines of scientific contributions should also be discussed, and the brevity of their consideration here is no reflection on the quality or importance of the work. Beatrice Krauss and Marion Okimoto authored a classic series on the morphology and anatomy of the plant and fruit, and it is a tribute to their thorough treatment that no one has yet had the courage to attempt a similar study of the differentiating inflorescence—desirable as this would be.

Dr. Lloyd Collins, as an avocation, collected the history of the pineapple. This comprises a chapter in his book, as well as being the subject of several scholarly papers. And the monumental work of Collins and Kerns on the cytology and genetics of the pineapple also stands unchallenged and unparalleled by current work on the plant. Not that all the pineapple genetics problems have been solved, but the span of time and amount of work that supports the published papers by Collins and Kerns appears to have discouraged others from extending this base. It may be that we do not now have the time; I suspect it is also that we lack some of the perseverance and patience of 25 years ago. They found it worth it; they determined 50 to be the correct chromosome number of Ananas comosus, and determined which of numerous plant and fruit characters were fixed and which were stable, and learned which to select for and which to gain by hybridization, and to recognize, develop, and confirm in pineapple material the established or tentative principles of plant breeding of the time.

Perhaps it is mostly in the reaffirmation or illustration of principles (as well as in the more thankless task of collection of data) that the merit lies in the work of the PRI meteorologists and climatologists. But I remember that I was surprised to learn that rain in Hawaii did not generally develop from freezing clouds and formation of ice crystals aloft, the way it does mostly over continental masses. Under our conditions, the nuclei for clouds are more often salt particles, raised through ocean spray and carried up by air currents. Being hygroscopic, they grow with moisture until the droplets fall and, in falling, contact other droplets and coalesce until they are big enough to become rain. This, at least, is one theory developed in some of the papers dealing with meteorological subjects. Another has to do with the formation of orographic clouds—those around the mountains. In Hawaii, these are warm clouds, and are continually being made as long as there is sufficient moisture at the lower level, a temperature inversion aloft, and even moderate air movement upward. When the moisture droplets coalesce, they return to us as rain. Depending on the humidity at the lower level, such clouds can appear "stationary," although they are constantly dissipating at one edge while forming at the other.

In summary, my thesis has been that original research of scientific importance can be and is being done under the philosophy that work be not only good, but good for something. And, moreover, that Institute scientists are conscious of their obligations to science as well as to the pineapple industry.

I must admit that there is a very great deal of additional information at PRI of significance in applied science which has not been made available in the open literature. And regrettably, there is a good deal more information of basic scientific importance which has not been published because the researcher has not had the inclination, or more often because he was too busy to stop what he was doing in order to go to the trouble of getting out a publication. PRI scientists are not unique in that respect!

To paraphrase Hogben's essay by warping his title slightly, "Science for Civilization" is not a dead-end street but an advancing frontier.
ANNUAL REPORT 1963-64

HAWAIIAN ACADEMY OF SCIENCE

The thirty-ninth year of the Academy ended with a total membership of 711. The Academy Council met four times during the year: June 19, October 2, January 16, and April 1. The minutes of these meetings are on file.

The Academy Council again approved presentation of a $35 wish award for meritorious projects entered in the Science Fair. This year, $15 went to Melvin Sakurai, Arthur Young, and Clifton Ching of Highlands Intermediate School at Pearl City, for their project on the effects of varying constituents of air on white mice. The balance, $20, went to Bessie Frantz and Christianne Friese of Stevenson Intermediate School for their project on poisonous plant juices and bacterial growth.

Robert L. Fox, Secretary

MEMBERSHIP


In order to expedite the processing of membership applications, these are now circulated to the Council by mail and approval obtained in this way; ratification then follows at the regular Council meetings.

George A. Johannessen, Chairman

AAAS REPRESENTATION AND FELLOWS

In the fall, H.A.S. members who were not already members of the American Association for the Advancement of Science were provided with a booklet describing the Association, and a membership application form. It is not yet known how many new memberships resulted. The AAAS returns to affiliated state academies (such as ours) a certain amount for support of research at the secondary school level, in proportion to membership in the AAAS. In 1964, this amounted to $204.

It was hoped that the Committee would also thus develop a wider base of members from which recommendations as to AAAS Fellows could be proposed.

Shoukuee Goto, Chairman

INDEX

The membership lists of the Academy have been compared with those of nine other societies in Hawaii to see how much overlap occurs. The greatest duplication was found in the rolls of Sigma Xi, with more than 120 persons being Academy members also. The Hawaiian Botanical Society lists showed overlap of 95 names, and the list of the Hawaiian Section of the American Chemical Society contained names of 61 Academy members.

In percentages, approximately 65 per cent of Sigma Xi members, 48 per cent of Botanical Society members, and 40 per cent of Chemical Society members are also members of the Hawaiian Academy. Conversely, only about 16 per cent of Hawaiian Academy members are members of Sigma Xi, 13 per cent are members of the Botanical Society, and 9 per cent are members of the Chemical Society.

There does not seem to be any immediate possibility of maintaining present levels of dissemination of information at reduced cost by combining mailing lists. However, it is clear that joint sponsorship of events by the Academy and affiliated societies, announced through the Academy mailing list, will reach a much larger group than the societies themselves provide. Moreover, it is clear that the affiliated societies represent elements of the scientific community not presently included in Academy membership.

Albert J. Bernatowicz, Chairman

CONSERVATION COUNCIL FOR HAWAII REPRESENTATIVE

Periodic reports on conservation activities in Hawaii have been made to the Academy. The Academy has been asked to act on one conservation matter, relating to future control of the Leeward Hawaiian Islands, and it is anticipated that such action will be taken at the Annual Meeting.

Charles H. Lamoureux, Representative

NOMINATIONS

The Nominating Committee presented the following slate of candidates for Academy offices during the year 1964-65:

President-Elect (one to be elected): Shoukuee Goto, Richard Lee
Secretary: Robert E. Coleman
Treasurer: Eleanor S. Anderson
Councilors (2) (2 years): Nels E. Johnson, John C. Marr, Toshiyuki Nishida, Robert A. Nordyke
Additional officers for the year will be:
President: Roland W. Force
Councilors (1 year): D. Elmo Hardy, Alison Kay, Donald P. Gowing (ex officio)

Doak C. Cox, Chairman

PUBLICATIONS

During the Academy Year 1963-64, the Proceedings for the Thirty-Seventh and Thirty-Eighth Annual Meetings were completed and distributed to the membership.

O. A. Bushnell, Chairman

PUBLICITY

The activities of this committee consisted in obtaining publicity in connection with the Fall and Spring Sessions and the symposia on “Advances in Medicine” and “Controlling the Population Explosion,” and in connection with the Science Fair, sponsored by the Inter-Society Science Education Council of the Academy.

James Bernard, Chairman

PROGRAM

The fall meeting of the Academy was scheduled for the evenings of November 25 and 26 at Agee Auditorium.
The first evening was postponed owing to the national day of mourning, and the second was devoted to five contributed papers.

On January 29 and 30, two symposia were held, one on “Advances in Medicine,” with four speakers, and the second on “Our No. 2 Problem: Controlling the Population Explosion,” with three speakers.

On February 27, the Academy co-sponsored with the Bishop Museum and the Hawaiian Botanical Society a lecture at the Museum by Dr. Kazimierz Wodzicki on “The Status of Some Exotic Vertebrates in the Ecology of New Zealand.”

Both invitational and contributed papers were presented at the final session of the Annual Meeting, on April 23 and 24 at Agee Auditorium. Seven contributed papers made for a full evening on the 23rd, and a symposium on “Oceanographic Research” made the evening of the 24th particularly interesting. Five speakers participated.

At the Annual Banquet, guests of honor were Science Fair winners Stephen Ferreira and Karen Maeda, and five students whose participation in the Westinghouse Science Talent Search was particularly noteworthy. Three of these students, Judith Meyer, Trudy Ann Porter, and Judy Kimura won national honors and were awarded the ISSEC silver medal. Also, Mr. Lloyd Kawahara, winner of the Outstanding Biology Teacher Award of the National Association of Biology Teachers, was the guest of the Academy.

The Annual Banquet was held on April 25 at the Beach Club of the Hilton Hawaiian Village, and retiring President Donald P. Gowing spoke on “Urania and Agora: Scientific Contributions of Industrial Research Organization.”

John M. Digman, Chairman

HAWAII DIVISION

Hawaii Division Officers for the year 1963-64 were as follows: Shuichi Tanaka, chairman; Harry Chuck, secretary-treasurer; Matthew Chow, East Hawaii coordinator; John Iwane, West Hawaii coordinator.

As of April 1, there were 62 members of the Hawaii Division.

FINANCES

Balance April 1, 1963 .......... $ 4,589.07

Receipts:
Dues ................................ $1,119.50

Miscellaneous
For supplies and contingencies re NSF grants .... $408.62
Banquet reservations (1963) .... 380.00
AAAS grantee refund .......... 100.00
Donation .................... 10.00 898.62

NSF Grant Funds .. 13,897.01

ISSEC Grant Supplementary Funds .............................. 1,500.00

First Federal Savings & Loan—interest ........... $ 32.42 17,447.55

Disbursements:
Stationery, Mailing Expense .... 662.61

Printing
1961-62 Proceedings ... 466.39
1962-63 Proceedings ... 347.76

Programs .................... 39.07 853.22

Miscellaneous
Banquet (1963) .............. 389.27
Haskins & Sells—1962-63 audit .................................... 50.00
AAAS grant .............. 70.00
Sen Co.—file cabinet .... 83.63
AAAS Academy Conference ........................................ 15.58
ISSEC—1964 Science Fair Wish Award .... 35.00
Honoraria ............. 10.00
Flowers, gifts .......... 18.26
P. O. Box Rental 9.00
Supplies .............. 26.37
Incidentals .......... 26.40 733.51

NSF Grant Expenditures 15,107.93
ISSEC Supplementary Funds .... 981.07 18,338.34

Balance March 31, 1964 ........ $ 3,698.28

 Distribution of total cash balance:
Bank of Hawaii .................. $ 2,990.43
First Federal Savings & Loan ....... 707.85

$ 3,698.28

Distribution of funds in Bank of Hawaii:
HAS operating funds .......... 1,000.29
NSF grant funds ............ 1,471.21
ISSEC supplementary funds .. 518.93

$ 2,990.43

Status of NSF Grants
G-22636—Teachers Science Seminar Amount of grant ........ $ 2,900.00

Expended 1962-63 ........... 604.51
Balance on hand April 1, 1963 .. $ 2,295.49

Disbursements:
Lecture-Demonstrations .......... $ 351.26
Workshop .................... 1,213.57
NSF refund .................. 730.66 $ 2,295.49

Balance March 31, 1964 .......... 0

G-22477—Students Science Seminar Amount of grant ........ 4,222.00

Expended 1962-63 ........... 3,833.36
Balance on hand April 1, 1963 .. $ 386.64

Receipts:
Refund .................... 25.00 $ 411.64

Disbursements:
Secretarial assistance ........ 149.55
Office supplies ............ 80.00
Postage and telephone ..... 14.09
Instructional materials .... 10.00
Travel and per diem .... 158.00 $ 411.64

Balance March 31, 1964 .......... 0
GE-1609—Students Science Seminar

Amount of grant .................................. 4,220.00
Cash received ..................................... 3,760.00

Disbursements:
Program Director .................................. 415.00
Associate Directors ................................. 900.00
Secretarial Assistance ............................ 270.00
Office supplies ................................... 10.00
Postage and telephone ............................ 25.00
Travel and per diem ................................ 1,753.00 3,373.00

Cash balance on hand March 31, 1964 ........ 387.00
Balance of grant .................................... 847.00

GE-1849—Visiting Scientist Program

Amount of grant .................................. $15,065.00
Cash received ...................................... 10,112.01

Disbursements:
Associate Director ................................ $4,050.00
Secretarial Assistance ............................ 1,264.95
Visiting Scientists & TV........................... 1,045.00
Honaria ............................................. 512.43
Transportation & per diem ........................ 253.34
TV Production costs & Moderator Office supplies .... 617.81
Telephone ......................................... 188.64
Contingencies (overhead, FICA, etc.) .......... 618.98
Transportation to NSF meeting in Washington, D.C. (to be refunded by NSF) ........ 476.65 9,027.80

Cash balance on hand March 31, 1964 ......... 1,084.21
Balance of grant .................................... 6,513.85
ISSEC funds to supplement NSF grants ........ 3,888.65

Disbursements:
NSF refund for film library ...................... 2,388.65*
NSF GE-1849 for secretarial assistance .......... 981.07 3,369.72

Cash balance on hand March 31, 1964 .......... 518.93

Status of Dues Payments
As of March 31, 1963 1964
Advance ........................................... $197.00 129.50
Arrears ............................................ 245.00 318.00

Eleanor S. Anderson, Treasurer

*This amount is recorded in general report as receipt of NSF funds, not as ISSEC supplementary funds.

OFFICERS

1963-64

Daniel P. Gowing .................................. President
Roland Force ........................................ President-Elect
Richard K. C. Lee ................................ President-Elect
Robert E. Coleman ................................ Secretary
Eleanor S. Anderson ................................ Treasurer
D. Elmo Hardy ....................................... Councilor
E. Alison Kay ....................................... Councilor
John C. Marr ....................................... Councilor
Donald P. Gowing .................................. Councilor (ex officio)

1964-65

Roland Force ........................................ President
Richard K. C. Lee ................................ President-Elect
Robert E. Coleman ................................ Secretary
Eleanor S. Anderson ................................ Treasurer
D. Elmo Hardy ....................................... Councilor
E. Alison Kay ....................................... Councilor
John C. Marr ....................................... Councilor
Donald P. Gowing .................................. Councilor (ex officio)

INTER-SOCIETY SCIENCE EDUCATION COUNCIL

The Council has functioned during the year in keeping with its responsibility "... to assure the holding of annual science fairs and to coordinate and actively undertake such other activities in the field of science education as the Academy of Science and its Associated Societies may deem desirable."

The brief reports of the committee chairmen, which follow, do no more than hint at the hours of diligent effort which have made the ISSEC program useful and successful in science education in Hawaii this year. These reports will be allowed to speak for themselves.

We were disappointed not to find leadership for the Junior Academy of Science and Elementary Mathematics areas this year, and the Elementary Science Texts will await the return of Sister Mary St. Lawrence who does such excellent work with them. Moreover, the level of National Science Foundation support will be somewhat less next year, causing the loss of the position of associate director of the Visiting Scientist Program, and restriction of this activity to Oahu. In the future, requests to the NSF for grants for science education programs in the secondary schools will have to compete with similar requests from universities, museums, and the like. The NSF will be discontinuing its State Academies of Science Program, and this function will be diffused to the other divisions of the NSF. We are confident, however, that on the basis of our past accomplishments, our proposals will merit attention.

Dr. Howard Hausman, director of the NSF Program for secondary schools, visited the NSF-supported programs in an on-site inspection from April 2 to 16. He was a luncheon guest with committee chairmen on April 13, visited ISSEC headquarters and the Science Club Camp in session at the time, and was shown other ISSEC activities.

It should be also noted in this annual stock-taking that community support for, and attention to, science education continues at a very creditable level. Evidence for this is the generosity of the donors, the high interest shown by the participating individual scientists and scientific organizations, and by conversations with leaders of two newly interested organizations. One of these was with Col. D. Vanallen, of the Hawaii Council of Engineering Societies, who wished to explore the possibilities of wider engineering participation in the Science Fair. The other was with Dr. George Woollard and Admiral Thomas, both of the Hawaii Institute of Geophysics, who were interested in providing the help of the Institute staff and facilities in stimulating interest of students in the geophysical sciences.

It is also encouraging to report the growing roster of science-oriented individuals, alone and in their associations, who are willing to donate time and effort to the advance-
ment of science education. This year, representatives of the Hawaii Science Teachers Association and the Institute of Electronics and Electrical Engineers have participated in Council meetings. Mr. Theodore Ozawa, president of the former, has taken the chairmanship of two committees and Mr. Roy Oshiro of the HSTA has taken the chairmanship of a third.

Finally, the chairman of the Council wishes to express his personal and official appreciation to the Council members, to the Society representatives and committee chairmen who have accepted and discharged their responsibilities so capably, and to the many scientists who have participated in the ISSEC programs.

Donald P. Gowing, Chairman

ORGANIZATION

Officers
Chairman .................. Dr. Donald P. Gowing, PRI
Vice Chairman .............. Dr. H. Wayne Hilton, HSPA
Secretary .................. Miss Adrienne Kaeppeler, Bishop Museum
Treasurer .................. Mr. Dwight H. Lowrey, Cooke Trust

Committee Chairmen
Community Participation........Dr. John H. Payne, HSPA
Public Relations ........................тельных Dr. Walter Steiger, U of H
Budget ........................................Mr. James W. Bernard, Van Waters & Rogers
Student Science Seminars ...... Dr. Albert B. Carr, U of H
Science Teacher Coordination Mr. Edwin Y. H. Chinn, Dept of Education
Science Talent Search .......... Mr. Edwin Y. H. Chinn, Dept of Education
Science Teacher Workshop ... Mr. Theodore Ozawa, University High School
Science Fair ............ Dr. Bernard J. Winter, Queen's Hospital; Mr. Jules Fine, Plant Quar. Serv.
Visiting Scientists Program...Dr. Wallace G. Sanford, PRI; Mr. Donald Li, ISSEC HQ
Science Clubs Service .......................... Mr. Theodore Ozawa, University High School
Science Clubs Camps ........ Mr. Theodore Ozawa, University High School

REPRESENTATIVES OF ASSOCIATED SOCIETIES

AAUW .............................. Dr. Leonora Bilger
Amer. Chem. Soc. .......... Dr. J. Hylin
Amer. Soc. Agron. .......... Dr. G. Stanford
Amer. Soc. Mech. Eng. ... Mr. Fred Cordes
Am. Stat. Assoc. ......... Mr. Otto Orenstein
Anthrop. Soc. .......... Mr. Robert Bowen
Eng. Assoc. of Hawaii . . Mr. Paul Joy
Hawaii Med. Assoc. .... Dr. Nils Larsen
Geophysical Soc. ........ Dr. Nels Johnson
Hawaii Dietetic Assoc. ... Dr. Boletho Frojen
Haw. St. Dental Assoc. .... Dr. Marilyn Bradshaw
Haw. Astron. Soc. ......... Mr. Robert Britton
Haw. Entom. Soc. .......... Dr. Henry Bess
Haw. Psychol. Assoc. ... Dr. Gilbert Sax
Haw. Bot. Soc. .............. Dr. Robert Coleman

Inst. Food Tech. .................................. Dr. Lyle Allen
Soc. Naval Arch. & Mar. Engrs. .... Mr. Ian Smith
Soc. Sigma Xi .................. Dr. Laurence Snyder
Inst. Electric. & Electron. Eng. .... Mr. H. E. Williamson

FINANCIAL REPORT

As in the past, the ISSEC funds were administered by the Cooke Trust Company.

Contributions (* restricted to Science Fair)

<table>
<thead>
<tr>
<th>Organization</th>
<th>Amount (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harland Bartholomew &amp; Associates</td>
<td>20.00</td>
</tr>
<tr>
<td>City Bank of Honolulu</td>
<td>50.00</td>
</tr>
<tr>
<td>Hawaii Medical Association (* 150.00)</td>
<td>250.00</td>
</tr>
<tr>
<td>First Insurance Company of Hawaii</td>
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Total Receipts $ 9,909.09

Expenditures

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National Science Foundation (repayment) 2,388.65
Science Talent Search (1963 prog. $120.15) 162.65
Film Service to Science Clubs 835.20
Films (1963 obligation) 521.40
6th Annual Science Fair 5,012.50
7th Annual Science Fair 115.75
Total Expenditures $11,375.55
Excess of Expenditures over receipts $1,466.46
Balance March 31, 1964 $14,956.26

SCIENCE FAIR

The Seventh Hawaii Science Fair, which was viewed by approximately 20,000 people, was held in the Hilton Dome from March 20-22, 1964. It was judged to be a highly successful Fair by many viewers, science teachers, judges, and interested scientists.

There were a total of 125 exhibits present, 57 in the senior division and 68 in the intermediate division. Seventy-six of these came from Oahu schools, 15 from Kauai, 13 from Maui, 20 from Hawaii and 1 from Lanai. Seventy-two awards were given to 41 individual projects. Oahu schools received 57 of these awards, Kauai 9, Maui 4 and Hawaii 2.

These awards were given formally to the students at the Annual Awards Banquet in the Long House Saturday evening. Two hundred and eighty people attended the banquet and heard Dr. Andrew Berger of the University of Michigan Medical School deliver the major address. The two major award winners, the recipients of the Sugar award of the Hawaii Sugar Planters' Association and the Pineapple award of the Pineapple Research Institute were Karen M. Maeda of Waianae High School; Waianae, Oahu and Stephen Anthony Ferreira of Kauai High School, Lihue, Kauai. These awards, as before, consist of an expense-paid trip to the National Science Fair. At Baltimore, Stephen won a second place and Karen a fourth place.

Mr. Jules Fine, the associate director and award chairman, accompanied the winners to Baltimore, Maryland, and will be the director of the Eighth Hawaiian Science Fair next year.

B. J. Winter, M.D., Director

SCIENCE TALENT SEARCH

Three Hawaii high school seniors were selected for the Honors Group in the fifth year of participation in the nation's top science competition, the Annual Science Talent Search for Westinghouse Scholarships and Awards. Sixteen high schools in the state requested entry materials which were completed in December. To date, Hawaii's record shows an average of 2,388.65 entries per year since the Geophysical Society of Hawaii will make available films in their library in the near future.

Five students were recognized by ISSEC for meritorious achievement in the Science Talent Search at the Hawaiian Academy of Science Annual Banquet. The students with national honors recognition were Judith L. Meyer and Trudy Ann Porter of Radford High School and Judy T. Kimura of Roosevelt High School. Stephen Ferreira of Kauai High School and Alan Yong of Farrington High School won state honors recognition. Awards of Handbooks of Chemistry and Physics were given and in addition ISSEC awarded medals to the three in the Westinghouse Honors Group.

SCIENCE TEACHERS COORDINATION

Information on various ISSEC-sponsored science education activities was disseminated to public and private schools on Oahu to promote interest and participation. These included the Science Fair, Science Talent Search, Teachers Science Workshop, and Teachers Science Seminars.

SEMINARS FOR SCIENCE TEACHERS

A series of presentations by scientists on six Wednesday evenings in April and May were scheduled. All programs were held at the Hawaii Institute of Geophysics auditorium, and were open to all secondary schools science teachers, grades 7-12.

The topics covered were "The Age of the Hawaiian Islands," by Dr. Lynus Barnes; "Geologic Structure and Geology of the Hawaiian Islands," by Dr. Agatin Abbott; "Basic Ideas of Geochemistry," by Dr. Murli Manghnani; "Recent Advances in Marine Geology," by Dr. Theodore Chamberlain; "Climatology and Weather Forecasting in the Hawaiian Islands," by Mr. Saul Price; "Terrestrial Life in Antarctica," by Dr. Linsley Gressitt.

Edwin Chinn, Chairman

FILM SERVICE TO SCIENCE CLUBS

This program is carried out at the ISSEC headquarters at the Bishop Museum by the part-time secretary, Miss Charmaine Pung, under the general supervision of Mr. Donald Li.

Wide use is made of the service as shown by the statistics compiled as of March 31, 1964. There were 19 private schools and 16 public schools on Oahu that have used the library of films and filmstrips, a total of 35 schools. There were also 13 schools which used the films on the outer islands, including 2 on Maui, 6 on Kauai, and 5 on Hawaii. In addition, 8 additional organizations used the films.

This gave a total number of bookings (films and filmstrips) of 1,203 from September 4, 1963 to March 31, 1964. Since the average number of viewers per film was 139, this gave nearly 157,000 total viewers. It might be added that this total is much higher if we include viewers watching films we show on our "Science in Hawaii" TV program.

We are still receiving free bonus films and filmstrips under the EBF biology film program. It was definitely a bargain to have completed the purchase of the whole series.

A number of additional titles can be listed next year, since the Geophysical Society of Hawaii will make available films in their library for school booking also.

It is recommended that ISSEC continue support of this program by providing funds to purchase additional films in the future.

BUDGET COMMITTEE

The Budget Committee approved budget requests for 1963-64 as follows:

Seventh Annual Science Fair $5,645.00
ISSEC Secretary (½ time) 2,000.00
Office furniture
Films for Hawaiian Science Clubs services
NSF reimbursement for films
Teacher Workshop
Science clubs
Science Club Camp
Science Talent Search Awards

TOTAL $12,989.45

W. R. Steiger, Chairman

VISITING SCIENTISTS PROGRAM

This program is designed to improve the quality of science and mathematics education in private, parochial, and public high schools by making available to them the services of experienced scientists, mathematicians, and engineers to discuss current knowledge in various disciplines. The program was started in July 1963, and is supported by a grant from the National Science Foundation.

More than 100 scientists in the community have indicated their willingness to participate in this program. As of March 31, 1964, 53 scientists visited high schools. It appears at the present time that the 100 visits allotted by the grant will be filled by the end of June 1964. Requests from high schools of the outer islands have been disappointing despite the fact the dentists are provided at no cost to the schools. As of April 1, Maui has had 13 visits, Kauai 3, and Hawaii none.

In addition, the "Science in Hawaii" TV program, which is prepared and put on weekly, has included a number of visiting scientist's lecture-demonstrations. These programs are well received, as indicated by a recent American Research Service Bureau Survey. This survey indicated that one-sixth of the homes in which television was being used were turned to "Science in Hawaii," competing at 10:30 a.m. with a Japanese TV revue on one station and films on another.

The National Science Foundation has approved a grant to continue this program for 1964-65, but the visits will be restricted to Oahu.

W. G. Sanford, Director

SCIENCE TEACHERS WORKSHOP

The Annual Workshop for Science Teachers of grades 7–12 was held at the Empire Room, Hilton Hawaiian Village, with 88 registrants, of which 23 were from the other islands. The Council provided half the plane fare for outer island participants.

The program included comparative judging of Science Fair entries with the help of Dr. Terence Rogers and Dr. Bernard Winter of the Science Fair Committee, and talks by Drs. Nixon Wilson of the Bishop Museum, and Taivo Laevastu, John D. Vaughan, and E. R. Mertz of the University of Hawaii.

Theodore Ozawa, Chairman

SCIENCE CLUBS CAMPS

Two camps are scheduled during April, with the following objectives:

1. To provide valuable learning experiences in science to supplement the students' regular school curricula.
2. To provide a meeting place where science club students from all over Oahu can become better acquainted with each other and to enhance their common interests.
3. To provide pleasant surroundings where students can combine fun with learning.
4. To provide excellent resource people in different scientific fields for science-career information.
5. To provide a meeting place for science club advisors, who can learn while renewing acquaintances with each other and with the students.

The camp for science club members of grades 9–12 is scheduled for April 10–12 at the Kokokahi YWCA Camp in Kaneohe. More than two dozen scientists will participate. The program will include eight hours of talks, demonstrations, and discussions with scientists, telescope-observing with the Hawaii Astronomical Society, and adequate opportunities for recreations.

The camp for members of grades 7 and 8 will be at Camp Homelani in Waialua, with a similar program, but including some science films.

Both programs will run from Friday evening through 3:30 p.m. Sunday afternoon.

Theodore Ozawa, Chairman

PUBLIC RELATIONS

The function of this committee is to bring to the attention of the community the activities and programs of the Academy, those of ISSEC Council being of primary concern.

The activities included the revision of the ISSEC brochure for community circulation, and newspaper coverage of the Seventh Annual Hawaiian Science Fair.

James W. Bernard, Chairman

STUDENT SCIENCE SEMINAR

During 1963-64, the Student Science Seminar program was conducted on four islands—Kauai, Oahu, Maui, and Hawaii. The program was financially supported by a grant of $4,220 from the National Science Foundation (NSF-GE1609). Associate directors were Mr. Barton Nagata (Kauai), Mr. Clifford Kekauoha (Maui), and Mr. Allan Kondo (Hawaii).

The program, in operation since March 1959, is designed to stimulate and encourage the scientific interests of selected groups of secondary school students through evening seminar meetings involving scientists, mathematicians, and engineers.

From all indications, it appears that the program continued to help challenge the talents of "science-prone" students by providing them instruction in scientific concepts, methods, and applications, offered under the regular high school curriculum.

Reactions from parents, teachers, and participating scientists have been very favorable. The highest level of praise has been from the selected student members of the various seminar groups. They receive no stipends, advanced credit, or other inducement to attend the meetings and yet, on the four islands involved, their attendance averaged about 90 per cent.

During 1963-64, about 30 high school students were members of each of the four seminar groups. Twenty-five meeting were held on Oahu and sixteen on each of the other islands.

The program will be continued in 1964-65, again supported by a NSF grant (NSF-GE4239—$6,375.00).

Albert B. Carr, Director
COMMUNITY PARTICIPATION

As of March 5, 1964, a total of $6,540.00 had been received in cash. In addition, the Hawaiian Sugar Planters' Association and the Pineapple Research Institute have agreed to finance expenses up to $1,500.00 each for travel of the two top award winners to the National Fair.

John H. Payne, Chairman

SCIENCE CLUBS COMMITTEE

The Science Clubs Committee was active again, as in previous years. The Hawaiian Science Clubs Service was discontinued because the National Science Foundation cur-tailed funds after June 30 of 1963. However ISSEC continued to support science club activities, relying on Miss Pung for secretarial help.

Science club advisors continued to receive the following support from ISSEC: (1) literature and recommendations for organizing and maintaining an active science club; (2) science films and filmstrips for science club meetings; (3) arrangements for visiting scientists to give presentations at science club meetings; (4) two science club camps; (5) providing science club membership cards to over 2,000 science club members in Hawaii; (6) preparation of a list of field trips available on Oahu.

Roy Oshiro, Chairman
The 39th 
ANNUAL MEETING 1964-65

Program

FIRST SESSION

November 25, 1963, Agee Auditorium, HSPA, Honolulu

(The Symposium scheduled for this evening was postponed because of the National Day of Mourning for President John F. Kennedy.)

November 26, 1963, Agee Auditorium, HSPA, Honolulu

1. Andrew W. Lind: A Theory of the Family in Hawaii Re-examined
4. A. Furumoto, M. Manghnani, L. Marcheski, and W. Strange: Results of Gravity Surveys on Oahu, 1963

SPECIAL SESSIONS

February 27, 1964, Bishop Museum, Honolulu


January 29, 1964, Agee Auditorium, HSPA, Honolulu

Symposium: Advances in Medicine
6. Douglas Bell II: Radioisotopes in Medicine
7. Calvin Sia: Advances in Neonatology
8. Carl Mason: Advances in Cardiovascular Surgery
9. Frederick R. Shepard: Rehabilitation as an Advance in Medicine

January 30, 1964, Agee Auditorium, HSPA, Honolulu

Symposium: Our No. 2 Problem: Controlling the Population Explosion
11. Nils P. Larsen: Does Birth Control Work?
12. Frederick K. F. Lee: Urban Planning for Tomorrow’s City

FINAL SESSION

April 23, 1964, Agee Auditorium, HSPA, Honolulu

14. Martin Vitousek: Geophysical Research in the Leeward Islands
15. Felicitas S. Cabbat and Bluebell R. Standal: The Determination of the Essential Amino Acid Content of Five Hawaiian Fish by Column Chromatography on Ion-Exchange Resins
16. Herbert B. Weaver and Abe Arkoff: Measurement of Attitude Toward Sex
17. Harold E. Dent, John A. Galston, and Arthur A. Dole: Hospitalization as a Component in Social Distance
18. E. H. Bryan, Jr.: Who Knows What About Pacific Science?

April 24, 1964, Agee Auditorium, HSPA, Honolulu

Oceanographic Research: A Series of Invited Papers
20. Lucian M. Sprague: A New Look at an Old Ocean
22. Richard A. Barkley: Studies of Ocean Currents Near the Hawaiian Islands
23. Gunter R. Seckel: Climate Oceanography and Its Applications to the Hawaiian Skipjack Tuna
24. John J. Magnuson: Activity Patterns in Scombrids
26. R. M. Gooding: Observations on Fish from a Floating Observation Raft at Sea

April 25, 1964, The Beach Club, Hawaiian Village Hotel, Honolulu

Banquet
Introduction of New Officers
Presidential Address
Donald P. Gowing: Urania and Agora: Scientific Contributions of a Private Industrial Research Organization
Abstracts and Papers

FIRST SESSION

1. A Theory of Family Structure in Hawaii Re-examined

Romano Adams' analysis of the family structure peculiar to Hawaii, as stated in his *Interracial Marriage*, is still the most comprehensive and authoritative statement available. More than a quarter of a century has elapsed since it was published, and developments in the intervening period suggest the need of re-examination, particularly with regard to family solidarity and morale in certain ethnic groups. Analysis of official records of marriage and divorce over the 5 years 1958–62 tend in general to confirm certain of Adams' conclusions derived from comparable data in 1927. Changes in the social climate of the Islands during the past generation have, however, occasioned new developments deserving attention.

Although Adams qualified his conclusion that divorce rates are highest among the ethnic groups which outmarry the most, subsequent students have been prone to overlook the qualifications and to focus only on the major proposition. The recent data indicate that the two ethnic groups with the highest outmarriage rates—the Hawaiians and the Koreans—also have the highest divorce rates, and the Japanese with the lowest outmarriage rates also have the lowest divorce rates. The other six groups, however, vary quite considerably in the degree of correspondence between their outmarriage rates and their divorce rates. The Chinese, for example, whose record of family solidarity is second only to the Japanese, have an outmarriage rate well above the average, whereas the Caucasians, with outmarriage rates well below the average, have divorce rates considerably above average.

Contrary to the popular impression that interracial marriages always involve greater risks of failure than intraracial marriages, among five of the nine ethnic groups—the Hawaiians, Koreans, Puerto Ricans, Filipinos and the Caucasians, all with divorce rates above the average—the evidence of family breakdown was significantly less among those who had married out than among those who found their marriage mates within the ethnic group. Even among the highly organized Chinese and Japanese groups, divorce rates were slightly lower for marriages between Japanese men and Chinese women than for Japanese in-marrriages, and similarly they were lower for marriage between Chinese men and Japanese women than for Chinese in-marriages. Although the divorce rate is still somewhat higher among the entire group of out-married couples than among the much larger group of in-married couples, the evidence from the present study does not suggest that the anticipated increase in the proportion of interracial marriages will of itself induce an increase in the rate of family breakdown.

ANDREW W. LIND
University of Hawaii


The view is developed that man inherits general energy potential in which genes are the catalysts in the physiological activity that sustains the central nervous system without determining specific patterns of emotional behavior. The personality structure is nurtured through mimicry, identification, learning, and the impact of culture, the most subtle and critical being parental influences. A state of equilibrium is soon established between the personality structure on the one hand, and environmental stress on the other. Excessive pressure would cause disruption in this delicate balance and its physiological processes, creating states of generalized anxiety. The peculiar mechanisms of defense which would be used in dealing with anxiety, whether neurotic or psychotic in nature, would be culturally and socially determined. Partly to support this view and its implications for psychotherapy, a comparison was made between the severity of emotional distress and the degree of traumatic influences during the formative years; highly significant values are reported in a sampling of 300 cases referred to the Psychiatry Service at the U.S. Army Tripler General Hospital. The view is expressed that there is a far greater flexibility to human adjustment than a genetically and deterministically based orientation would theoretically allow. The implication for therapy is that initially and perhaps primarily therapy should be aimed at quickly restoring ego equilibrium through techniques such as support and environmental manipulation. This is especially pertinent to the treatment of emotional problems arising in the early and formative years of life.

SIDNEY L. HALPERIN
PAUL G. YESSLER
U. S. Army Tripler General Hospital

3. Factors in Emotional Choice

The factorial structure of secondary school program preference determinants was studied by means of a questionnaire, "What I Want to Do." Subjects were 300 ninth graders in Dole Intermediate School (45 items in questionnaire) and 300 boys of Japanese ancestry showing a science preference in the ninth grade (35 items).

Six factors were obtained for the Dole School group and five for the science group. These sets of factors were compared and implications for theories of educational choice and of scientific career development were reviewed.

JOHN M. DIGMAN
ARTHUR A. DOLE
University of Hawaii
4. Results of Gravity Surveys on Oahu, 1963

A gravity survey of Oahu consisting of 354 points of observation was done by the staff members of the Hawaii Institute of Geophysics during October and November, 1963. Anomalies of +300 mgs were found in Kailua centering around Kawaiuwi Swamp and in the northern section of Lualualei Valley of the Waianae Range. A ridge of gravity highs followed the shoreline of Kaneohe Bay and extended northwesterly along the crests of the Koolau Range. Anomalies of relative low gravity were found in Waimea Bay area, Pearl Harbor and southern end of Waianae Range.

In general, gravity contour maps corresponded very well with previously published geological evidence. An attempted interpretation of the high anomaly in Kailua resulted in a buried vertical cylinder, 7.4 km in radius, 2.8 km to the top of the cylinder, 20 km to the bottom of the cylinder and density contrast of 0.7 g/cm³.

The gravity survey provided valuable information for the seismic program of crustal investigation, which has just been initiated.

A. FURUMOTO
M. MANGHNANI
L. MACHESKI
W. STRANGE
University of Hawaii

5. Endogenous Respiration in the Fungus, Pythium aphanidermatum

The endogenous \( Q_{O_2} \) of mycelium of \( Pythium aphanidermatum \) varied from 35 to 2. Young mycelium had the highest endogenous \( Q_{O_2} \) values. Starvation of mycelia of different ages reduced the \( Q_{O_2} \) value to an apparent endpoint value of 2 after 5 days of starvation. Maximum \( Q_{O_2} \) values (35) were reached in mycelia grown for short-time periods in water extracts of lima beans. The \( Q_{O_2} \) value of young mycelium grown in chemically defined liquid media containing only essential salts and sucrose and NO₃-N as carbon and nitrogen sources approximated 13.

The addition of glucose or sucrose to mycelium held under starvation conditions for 5 days resulted in a 2.3-fold increase in oxygen consumption after 1 hour. Young mycelium with high endogenous respiration rates had the greatest capacity for sporangia and zoospore production.

R. B. HINE
University of Hawaii

6. Radioisotopes in Medicine

No abstract available.

DOUGLAS BELL, II
Honolulu, Hawaii

7. Advances in Neonatology

The term neonate means literally, newborn, and the phrase neonatal period is used to indicate the first month following birth, but for statistical purposes this period is limited to the first 28 days of life. Neonatology, then, is the study of the newborn, with emphasis on the management of the infant during this critical period of life. To review this subject briefly, it may be interesting to note the leading causes of death in the first 14 days of life in 10,000 deliveries between 1951 though 1954 at the Chicago Lying-In Hospital. These are in the area of malformations, prematurity, and “Hyaline Membrane” disease. In Hawaii during 1962, of the total live births of 17,932, there were 369 deaths, or a death rate of 20.6 per thousand live births. Those infants that died with mention of prematurity numbered 266, or approximately 72 per cent. Again, the leading problems faced by the neonatologist lay in the area of congenital birth defects or malformations, prematurity and immaturity and infectious diseases.

Let us now look into these various areas and consider the problems and advances in them.

In the realm of infectious diseases in the newborn, one has seen many areas of dramatic advances with the advent of antibiotics. Certainly the problem of syphils and its effect on the infant has been well controlled. Ophthalmia neonatorum, the infections of the eyes of the newborn, has been eradicated with the prophylactic use of silver nitrate or antibiotics to the eyes of the infant immediately following birth. In recent years the neonatologist has been faced with the emergence of resistant organisms causing generalized infections as illustrated by the epidemic \( Staphylococcus aureus \) and pathogenic \( E. coli \). The occurrence of pustules or impetigo in the infant in the nursery soon led to community-wide problems of abscess, furunculosis or boils, and overwhelming staph pneumonia that often led to death in early infancy. Various reports have been made correlating family infections, morbidity, and cost based on transmission from the newborn infant on arriving home. In a similar fashion, the gram negative \( E. coli \) has been found to be pathogenic, causing fulminating diarrheas and often death in the small infant. There are instances where the nurseries have had to be closed because of the epidemic diarrheas present in the hospital.

It has been interesting to note that in neonatology there has been a return to basic considerations in bacteriology, its transmission and control. An interesting example in this area relates to the work done by Drs. Shinefield and Eichenwald at Cornell Medical Center. They have found that the infants tend to colonize only one phage type of \( Staph aureus \) once infected. Thus, they have tried to introduce non-virulent \( Staph aureus \) to the infants during an epidemic and thus eradicate the “hit” or virulent strain from the nursery. These investigators have also used the term “cloud baby,” feeling that a small number of infants have a high index of infectivity or contagiousness and are literally surrounded by clouds of bacteria. They felt that the factor responsible for the phenomenon of “cloudiness” is itself infectious and has a distinct epidemiology of its own. This factor consists of a few respiratory viruses occasionally encountered in the nursery. Thus, we find an example of bacterial-viral interaction and the importance of the “cloud baby” in interpreting staph infections in a crowded nursery.

In 1962 in Hawaii the number of infant deaths from congenital malformations was 4.2 per 1,000. The incidence of birth defects is also considerable. With the advance of medicine, the possibility of saving newborns from previously lethal malformations has increased. These trends that characterize the efforts to save life and restore normal function of the neonate are related to (1) completeness of the first physical examination of the newborn, (2) education of nurses to be on the alert for early “give away”
symptoms such as abdominal distention, grunting respirations, excessive salivation or vomiting, cyanosis, jaundice, and other such signs, (3) improved methods for earlier diagnosis of abnormal function and anomalies, and (4) early surgical correction as indicated.

There are many examples here of congenital malformations that have been diagnosed early and treated. Pediatric surgery on the newborn or premature with good pediatric management is often dramatic. Today, many infants with various causes for intestinal obstruction in infancy have been saved with early diagnosis and therapy. In the realm of congenital heart disease, corrective surgery in the infant is dramatic but very seldom successful. Performance of a shunt procedure, for instance, in cases of extreme tetralogy of fallot or tricuspid atresia may prove lifesaving, but the mortality has to be considered at least 50 per cent.

On the medical side, considerable research has been developed in the areas of inborn errors of metabolism. For example, early diagnosis and treatment is mandatory in phenylketonuria or galactosemia, where with proper management the problem of mental retardation may be prevented.

Prematurity is the area of most concern to the neonatologist. In the statistics from Kapiolani Maternity Hospital in 1963, one notes that of the total deaths, prematurity is approximately 5.5 to 7.5 per cent of all deliveries. In Hawaii this incidence may be a little higher because of the Oriental make-up. The Filipinos, for example, have smaller babies by weight. The premature infant faces four major complications: immaturity, hyaline membrane disease, atelectasis, or infection. The problem of hyaline membrane disease has been of major concern to the neonatologist. This is a condition that occurs with higher incidence in the premature infant, in the infant born of a mother with diabetes, and in the infant born of a mother following C-Section. Clinically, the infant in a few hours after delivery develops rapid respiration with marked expiratory grunts and cyanosis. The breathing remains rapid and shallow the next ensuing 24 to 36 hours varying from a rate of 60-80 or more per minute. Many develop respiratory failure and die after 1 or 2 days, while those that pass this critical period improve with no further difficulty. On autopsy on those that expire, the lungs reveal microscopically hyaline membrane lining the alveolus, thus the term hyaline membrane disease. Incidentally, this entity, which has been a baffling problem to the neonatologist for a long time, received recognition during the late President Kennedy's premature infant son's struggle and death. There are many approaches in treating its symptoms but, as yet, there are no basic understanding of its causes.

Brief mention should be made of the "iatrogenic" diseases and problems that develop in this field. We are all well aware of the problem with Thalidomide and its effect on the fetus if taken by the mother in the first trimester. However, we will not dwell on this problem. We are concerned with the development of "iatrogenic" disease in the newborn period. This has been more marked with the advent of drugs and antibiotics used during this early period of life. Jaundice or hyperbilirubinemia in the newborn period has been found to be the factor in many instances in staining of the brain cord, resulting in kernicterus and subsequently death or a brain-damaged infant. It was soon found that Gantrin or Sulfisoxazole and Vitamin K in large doses to the infant produced hyperbilirubinemia or jaundice. Chloromphenicol or chloromycetin in recent years was noted to cause sudden collapse, shock, and death in infants on high doses. This became known as the "Gray Syndrome" and was found to be related to the inability of the infant's liver to breakdown and excrete this drug. Tetracyclines have been another antibiotic that has been correlated with staining of the teeth and bones of infants and also causing some growth retardation during the course of treatment. Streptomycin in the doses used normally on adults was noted to have some ototoxicity in later life. Thus, a new area of concern in the use of drugs developed in the care and management of the newborn. Recognition was made that the infant had physiologic handicaps in the absorption and excretion of drugs.

Briefly, one should also mention the advancement in the early recognition of jaundice in the newborn related to the Rh and ABO incompatibility problem. The introduction of the exchange transfusion has lowered the mortality and morbidity in this area. We in Honolulu are having excellent results with the management of these problems.

And finally, two of the other areas of advancement in neonatology should be mentioned. First, is the development and change in the incubator. There has been considerable work involved in selecting the proper temperature for the care of the premature infant. Concern has also been shown about the proper use of oxygen, the advisability of using humidity, and the like. Secondly, the changing concepts in feeding are illustrated by Mead Johnson's development of the Beneflex feeder. The advantages of the Beneflex are many: the formula is premade, it is sterile with no bacterial growth, there are no errors in making up the formula, there is less chance for the infant to ingest air as the plastic container collapses, and finally the psychological factor.

In summary, when Hawaii's statistics in infant mortality are compared to those of the Mainland, we can see that the care given to the neonates has been good and of a high level. As we look into the future, we find that there are many areas of research and advancement that are necessary. One of the basic problems will be in solving the causes and prevention of prematurity.

8. Advances in Cardiovacular Surgery
CARL MASON
Honolulu, Hawaii

9. Rehabilitation as an Advance in Medicine
FREDERICK R. SHEPARD
Rehabilitation Center of Hawaii

10. The Problem of Feeding a Growing World Population
WORLD POPULATION
d id audacity to deliberately plan his own survival against the most strenuous task master—nature itself.

The title of this discussion is unique to the degree that it suggests a change in man’s attitude, and a shift in his thinking from the problem of a growing world population to the problem of feeding a growing population. Over the last 6,000 years man has developed a vast technology in industry and agriculture; however, it has been the expedient of waging war and conquering thinly populated and rich lands rather than to feed more people from the same land. Historically, war technology has facilitated adjustment through the exploitation of underemployed resources. Usually this form of adjustment has been more rapid than agricultural technology. Yet today man must seriously weigh the possibility that war in itself no longer has this same adjustment capabilities, that in fact war may result in serious maladjustments.

It is these developments which may have been the reason for the shift in thinking that perhaps there are possibilities of feeding the world’s growing population without wars. At the same time man is awakening to the realization that if he does not find the means for controlling run-a-way fertility of the human race he may indeed eat himself into extinction. Considering our present situation and our present knowledge it would certainly seem that this fear has some rationale.

Our prehistoric forebears faced a problem that in their time and place must have been every bit as overwhelming. The difficulty of feeding his family, the competition of the family for food in relation to other families within the tribe, the tribe as related to adjacent tribal development must have sharply established the boundaries of the area within which the primitive culture could develop. Certainly as the limits of the food supply were reached the tribal leaders needed to take stock in order to determine the alternatives open to them. I would suspect that often the best solutions were less than satisfactory as measured in terms of our present day humanitarian concepts. Perhaps the most that can be said for this development was that it involved short term expedients, that the same problems were bound to recoccur as newly acquired hunting areas were exploited. The problem then as now required some sort of means which would provide a more permanent solution. What must have evolved, over time, in our primitive culture was the development of more intensive resource use. This was probably in the form of a primitive agriculture. This example is relevant to the degree that it points out that our primitive forebear adjusted not only in his normal pattern of nomadic migration as a gleaner from nature but that he was forced to recognize that the productivity of nature could be made more bountiful. The alternative of the nomadic tribal structure was to fight other tribes on richer grazing lands. Today the specter of atomic war forces us to consider the feeding of people from existing land resources.

One of the discouraging concepts found in the literature deals with equating food requirements to some sort of minimum standard. Both economists and technical scientists more or less adhere to this idea. The idea probably found its greatest voice in two economists, namely T. R. Malthus and David Ricardo. It is also the fundamental thinking of such world organizations as FAO and WHO. The minimum standard idea is an important concept in that it provides the foundation for quantification. It is based upon the realization that most resources under the existing control of man are scarce.

Malthus conceived that as population increased there would also be more productive power in new hands and minds but at the same time these would demand more food, that ultimately the rate of food demand from the increasing population would outstrip the marginal productivity of the static resource land. From this rather complex concept David Ricardo evolved the “Law of Diminishing Returns.” Ricardo’s concept gave further strength to the fears expounded by Malthus.

The difficulty in dealing with the scarcity models developed by both Malthus and Ricardo is that they do not or cannot allow for the sensitivity to his condition that man as a rational being must ultimately possess. It is adequate to say that over a very long but finite period any significant and constant population growth will present society with food production problems. The seriousness or degree of complexity of this problem will depend upon the rate of population growth as compared to the rate at which man innovates. To us here, who must deal with the question of food adequacy for a considerably shorter time period—say over the next 100 years—the rate of growth in both population and innovative technology (resource productivity) are critical. To perceive within this time period seems possible; periods much longer than these would require considerations of important variables which are not part of our present topic.

In Future Growth

If we base our future demands upon some preconceived minima, and if we project a constant rate of population growth the problem of feeding future generations lends itself to a very neat mathematical equation which will tell us how much food we will need over time. This could be the basis for determining the urgency with which man must devote himself to the problem of increasing his productivity and controlling his rate of consumption. In reality man has always found it difficult to look very far into the future. He is mostly concerned with today, rather than the seemingly dismal specter which is indicated for the future from today’s knowledge. For indeed most of today’s knowledge is not adequate to meet the dimensions of tomorrow’s demands.

The twofold problem—increasing productivity of available resources and the rate of demands made upon known resources—will probably continue to be the basis from which man must operate in order to equate supply to demand. In terms of increasing productivity, there are advances already made which will continue to add to the demand-satisfying potential of world food users. Others I shall talk about may be in the realm of speculation and perhaps wishful thinking.

Meeting Increasing Food Needs

As an economist I am perhaps naturally inclined to look at our problem from a rather broad cause and effect point of view. I tend to depend upon my discipline to give me the necessary tools to look at existing conditions and from this develop my analysis of what I think the future may look like as well as what conditions may be necessary to solve a particular human problem.

Natural Resources: The real foundation of future food as well as industrial productivity are our natural resources. These along with our scientific technology, arts, capital goods, and, most of all, our people and their in-
stitions will shape the nature of things to come. The presently known natural resources are substantially fixed in quantity and as these are not replenishable and as we use them we are in fact faced with the real dilemma of finding alternatives.

The natural resources difficulty, which is after all related directly to food production in our modern world, will perhaps be solved through the employment of improved extractive technology and through the application of new discoveries. For example, we have yet to explore the seas as a source of minerals and of power. Similarly we have yet to explore fully the real potential of solar energy as a power source. These alternatives probably will not come into play until such time as existing sources for this vital ingredient to food production are depleted to a point where it can be economically practical to develop the presently more marginal sources.

A factor to which a considerable amount of attention has been paid historically is the natural resource land. We know that land is limited to both amount and productivity under prevailing technology. Insofar as productivity is concerned and in relation to world food demands it is obvious that much of this resource is not fully exploited. Agricultural techniques are not sufficiently applied to buy the productivity necessary to catch up with population expansion. Many reasons could probably be cited for this inadequacy; however, it suffices to say here that the race between food supply and population can be overcome for some considerable time by simply farming the available area under conditions of known agricultural technology. In many parts of the world the existing structure of subsistence farming simply is underemployment of food producing resources. Presumably when and if pressures of population become sufficient these would be bid into production of food demanders along with other land resources not fully exploited. In the latter instance are all of those lands upon the face of the earth that could produce food but are not bid into production because of the low purchasing power of the masses in the so-called underdeveloped countries.

The land resources presently underemployed for whatever reason of technology, scale of operation or institutional barriers within the underdeveloped area, are not easily brought into productivity. Often the leadership within these areas see a solution to their plight through some sort of resource mobility from agriculture to industrialization, but too often the cost of this mobility is exceedingly stringent in that it would and does require heavy investment in capital accumulation. Usually, at least in recent history, these countries have depended upon foreign aid from more prosperous countries. The problem has been that although this foreign aid in agriculture has brought considerable advances in some areas more often it is offset by the rate of population growth. In these latter instances the countries so involved have more or less remained at the subsistence or minimal level and possibly regressed even further into poverty. In any case greater intensity of land use will probably remain a major factor in staving off hunger over the relevant time period. It is also probable that there will remain inequities insofar as distribution is concerned from greater (more intensive) use of land. Some of the peoples of presently underdeveloped areas will probably continue to live on the margin of poverty as for that matter perhaps whole nations for the reasons cited above.

Productive Capital Goods: One of the reasons for advances in present food production efficiency must to a large measure be the result of the American farmers' ability to accumulate capital goods by which innovational techniques (new technology) could be employed. Many without proper tools has historically been able to provide bare minimal amounts of food for himself and that only if he had access to the essential ingredient land. Under minimal survival conditions very little potential existed or exists with which future productivity could be enhanced. Savings for future productive potential may need to come from a different direction than from internal capital generation by agriculture in those areas classified as underdeveloped or for that matter any area. The North American farmer's ability to accumulate capital was greatly enhanced by early land policy, when land was given to immigrants at little or no cost. Low capital investment (requirement) in land and large units 160 acres or more encouraged U. S. and Canadian farmers to adopt labor saving technology. Perhaps even more important than the above was that the North American farmer had the drive to do things more efficiently.

At this point we could discuss at length such issues as land reform, incentives to save, as well as a variety of other important contributory factors to increasing the productivity potential within underdeveloped areas. A more productive and perhaps a more essential line of reasoning is if we involve ourselves with some of the other factors. It may be adequate to say that food aid, technical assistance programs, and financial aid can all help in contributing to interim solutions. However, at best these are only temporary measures and will probably be offset by the constant pressure of population which may in itself be generated from the aid given. In the long run (within the framework of our time period) a more realistic means may be through self-help measures which are internally motivated.

Research and Technology: Included as a potential solution to the problem of food productivity must be the continued contribution being made in research and through technological innovation. It seems to me that this whole area we call agriculture has, at least for the more advanced countries, taken on a completely different attitude. The concept of food and fiber production is no longer simply a question of the tiller of the soil and the husbandman of livestock but a whole industrial complex of which these are only an integral part. Technology must be considered not only from the point of view of new farming techniques but also those involving food processing, preservation, transportation, and merchandising, and in recent times in the actual synthesis of essential food elements such as vitamins and certain amino acids. The chemist, physicist, and engineer have provided importantly to the means of increasing productivity. In those areas where actual synthesis has taken place these can and do release land and other resources for the production of food to feed an increasing population. To be practical there is no good reason why the wonders of chemistry should not ultimately yield the techniques to produce a great variety of nutrients more cheaply than now provided through the medium of plant and animal tissues.

In terms of technology and in addition to what I have already said about technology before, there are many areas of food potential in the world, where technological inno-
vations have had little or no impact—not only in backward nations but also with the more advanced nations of the United States, Canada, and countries in Europe. In this latter instance we can point to the sea that surrounds us—here we are still in the stone age of development—only about 1 percent of man’s food supply is harvested from this source. Yet the sea is composed of a greater portion of the earth’s surface. It may perhaps be the greatest source of future food supplies. Here the conditions are similar to those faced by the primitive man and early farmers—it is generally a hostile environment that we have yet to tame. Again, the progress in evolving a food culture from the sea will need science, including its many disciplines to give us suitable development.

The important difficulty in developing these resource potentials it seems to me are not limited in our present and future science but more within the ability of society to cope with the complexity of these changes. Taken all together these concepts are capable of advancing the cause of society’s food requirements only to the degree by which society can accommodate these in practice. For all practical purposes one might suggest that man has built in resistance to change, and that perhaps he would sometimes prefer to starve a little rather than to incorporate new values in place of old traditions. I am not at all sure that people the world over are really equally capable of adjusting to new requirements as dictated for adjusting within his natural and physical environment.

That we have turned to science for solutions under our western culture may in part be the result of some unique motivational force. Perhaps our traditions are more easily bent to new demands and conditions or perhaps our system of incentives are based upon a different system of rewards. We do know that there is a revolution afoot the world over for improvement in all sorts of things from more adequate nutrition to greater expression in political values in place of old traditions. I am not at all sure that transition is just not great enough to bring about the required change or innovational potential from a purely quantity point of view. The growth must somehow take active shape? Will, for example, the holder of land and labor resources be willing or able to make the changes research and technology show to be productivity increasing? These, the important decision making properties, can and often are limited by custom, tradition or simply because of an institutional framework which acts as a drag on change. In the area of credit, for example, the money lenders are often more interested in high interest rates than in higher productivity. This, under existing arrangements is not so important in the USA for example, but significant in underdeveloped areas.

The sluggishness in which these necessary adjustments can be made in certain environments permeate the whole socio-economic structure including both the public and private sectors. This contention could be supported from numerous examples where technical aid programs have been tried with much less than the hoped for success. Many times some of these efforts have been diverted to other purposes rather than to effectuate improvements in the productive efficiency of the region participating in programs specifically organized for improvement.

The sluggishness discussed above had another and perhaps more basic relationship to the nature and potential for change. For example, what if productivity can in effect be changed to where biological gains are realized as against a situation where technology simply displaces labor for which there may be no alternative employment? In some situations the marginal cost for labor may be very low in terms of alternative opportunities, in fact so low that the factor substitutions (technology) cannot effectively displace labor. Even considering that productivity could be increased it does not necessarily mean that producers would be better off to substitute machinery for labor—the increased marginal cost may more than offset gains. The problem then takes on a new dimension. Some way must be developed by which these unemployed resources in areas of very great population such as India, China and Indonesia can be mobilized into a situation, which would bid them away from agriculture. This takes on magnificent proportions. The elasticity for labor outside of agriculture is such that transition is just not great enough to bring about the required change or innovational potential from a purely quantity point of view. The growth must somehow be such that it can be spread over existing populations in the form of greater buying power for better nutrition, more vitality; or to postpone consumption through the medium of greater capital accumulation at the agricultural and alternative industrial sectors of these economies. There must be some sort of arrangement of the factors to where effective demand can bring change into play. Anything short of this is manifested in poverty, the basic cause of hunger, and unfortunately this can continue to exist despite the world’s potential to meet present and probably all future food requirements in our time periods.
I expect that the idea of continued poverty or hunger for a large share of the world population is contrary to most of our humanitarian feelings, and perhaps rightly so. Yet at least to me it seems that the job of the physical and natural sciences to overcome the many and varied difficulties within the world is expecting more than can be done by science alone. It will perhaps require great effort to overcome the educational, economical, traditional, cultural, and political barriers which stand at the doorway of adequate development. These perhaps more than the sciences are the limitations to adequate nutrition, even though the sciences may have the technical solutions now and in the future.

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11. Birth Control in Full

The question to be answered is, can our present knowledge about birth control get into the hands for use by enough humans to stop the alarming upsurge before this rising tide of humanity overwhelms us and destroys all progress in economics, culture, and health. That this is a very important world problem is indicated by the fact that the president of the National Academy of Science recently issued the following statement.

"The problem of uncontrolled population quickly emerges as one of the most critical issues of our time since it influences the welfare and happiness of the world's citizens. It commands the attention of every nation and society: the problem is not less grave for the technically advanced nations than for the less developed.

"If we are to meet this challenge, we must make use of the knowledge that science and technology can bring to bear on the social, cultural and bio-chemical questions involved.

"I hope that this report of the Committee on Science and Public Policy of the National Academy of Science will serve as a stimulus to thought and action. It is addressed not only to the other scientists but to people generally, since all must bear the ultimate responsibility."

A few of the cold facts on the rising population tide might be in order. It took from the dawn of history to the year 1830 before humans reached the 1 billion mark. The next 100 years saw the tide rise to 2 billion, another 31 years brought the count to 3 billion, and by the year 2000 (36 years from now) at our present rate we will have between 6 and 7 billion people living on the globe, and if we continue to 2070, 25 billion people will be scrambling for their crust of bread or killing each other to attain it.

Asia at present has 1.8 billion (56%) of the world's population. The Americas have 441 million (14%), Europe, excluding Russia, 437 million (14%), Africa 272 million (8.5%), Russia 225 million (7%). Only 35% of the nations keep accurate census figures, hence many figures given are estimates by a United Nations formula.

On examining birth rates we find an amazing variation. The world rate is put at 36 babies born per 1000 population per year. The rate in Europe is 19, United States and Canada is 25, Africa 47, South East Asia 48. The fertility rate in the developing countries is twice that of the rates in the economically advanced countries.

A few figures from a United Nations report on the variation of the increase percentage of population gives further emphasis on our present situation. The United Kingdom increase is 0.4% per year, Italy 0.6%, Sweden 0.7%, Japan 1.1%, United States 1.7%, India 2%, Brazil 3.6%. With such rates it is evident that the proportion of the world's population will change dramatically. The United Nations assumption is, Asia's share will increase from 55.2% in 1950 to 61.8% in 2000, Latin America from 6.5% to 9.4%. Europe's share (including Russia) would decline from 23% to 15.1%. North America would drop from 6.7% to 5%. The United Nation's report put this dilemma thus: "The growth of the world population during the next 25 years, therefore, has an importance which transcends economic and social considerations. It is at the very heart of the problem of our existence."

Just a few more statistics to emphasize the urgency of our situation. Central America will increase by the year 2000 by 320%, South America by 252%, Asia by 180%, Russia by 109%, United States and Canada by 86% and Europe by 44%. The South American countries will double their population in 23 years, whereas it will take the United States and Canada 38 years to double theirs. Our next door neighbor, Mexico, during the next 20 years will expand its present 35 million to 70 million.

Since at the present time two thirds of the human family goes to bed hungry each night, how many more will be hungry with a 100% more mouths to feed. The best possible estimates on maximum increase in food production is 15%. Prof. Borgstrom who has made a world wide study of this problem also says, "We must realistically recognize that we are faced with an enormous shortage of soils, water, forests, minerals and other vital resources." The U. S. Soils Conservation Committee wrote, "Food production would have to be doubled to provide adequate diets for the present population." And, "to feed one year's world's increment of people now requires a yield equivalent to that of 47 million acres. The limit on cropland resources of the planet could be reached well before the century ends." Our Ambassador to the United Nations, T. P. Plimpten, summed it up: "Immense progress is being made in the field of production, but it is being wiped out by the velocity of reproduction." At present rates, therefore, "the best that can be promised to the vast majority (if not to all the people) will be more starvation and more poverty." But also, among the growing millions of India, Egypt, Pakistan and the Latin American states, 70 to 80% cannot read or write, "and these billions are not only hungry... they are largely uneducated "masses" of hungry illiterate young men and women who will unthinkingly accept any leadership that promises them improved conditions."

The Catholic Church has also awakened to the seriousness of the problem. Rev. John A. O'Brien writing in Ave Maria (a National Catholic Publication) wrote in August of 1963, "How are we to deal effectively with the problem of population increasing with a speed unprecedented in history. It is especially acute in the underdeveloped countries. ... Contrary to widespread belief, the Catholic Church does not forbid birth regulation. ... Catholics in the United States have been oversold on procreation and under-educated on the responsibilities it entails ... indiscriminate procreation is no moral ideal but mere irresponsibility. ... No country can long make reasonable provision for
its population increase unless a good percent of its couples take some effective steps to regulate family size. Family size is determined by conditions of health and well being for the individual family and for society." Pope Pius XII stated the position of the Roman Catholic Church as: "Regulation of offspring is compatible with the law of God."

Sir Julian Huxley summed it up as, "We need a positive population policy for the world ... such a policy will be in the highest degree moral in stressing the wickedness of allowing future generations to be born in increasing misery." The historian Toynbee has given many warnings about this great danger and a proclamation issued by a group of 25 U.S. leaders and 19 Nobel Laureates declared: "The urgent, indisputable need today is for intensified action to decelerate world population growth." Surely these facts and comments would seem sufficient to motivate us to want to do something to help prevent the approaching cataclysm, and this real threat to world peace.

Do we have evidence that this tide can be held back? Since the world largely mastered "death control," which is the cause of this sudden great upsurge, our aim must be toward birth control, to bring the number of people on earth to a level that allows them to be properly fed and housed.

Japan has cut its birth rate in half since the government stepped in after realizing that its very existence was at stake. Japan pays its 153,000 midwives to teach birth control. Abortions are allowed without restrictions. It is estimated that there is one abortion for each birth. Japan has journals and organizations and 900 clinics teaching the necessity of population limitation. "For the first time in years, there actually were empty seats in the lower grades of schoolrooms in Japan." In Japan birth control did work and the birth rate was lowered by 50%.

India is trying hard to keep its expanding population down to its ability to feed it. The Ambassador from India, M. C. Chagla, reported "We are one of the few countries in the world which has officially at government level adopted the policy of birth control and family planning. ... But the task of spreading the gospel of birth control is a Herculean one and we have only made a beginning. Although the first birth control clinic was opened in India in 1925, today (1960) we have only about 2,500 clinics (by 1965 there will be 8,000) giving family planning advice and giving free contraceptives. We have earmarked the sum of $200,000,000 in our third five year plan. What we want to achieve is to cut down our present birth rate by at least ½. In Oct., 1961, at a government vasectomy camp, 3,000 men were sterilized." Since then one camp reported 7000 vasectomies. The government pays 30 rupees to each indigent parent who has 3 children if he undergoes sterilization operation. India is cutting its birth rate.

The Chinese hordes will be an increasing danger to the stability of the world. At the present time, due to food shortages, lack of consumer goods, falling living standards, excess of city populations and maladministration, China has begun another birth control movement with the slogan, "Reproduction must take second place to production." They have announced that no man should be a father until he is 26 years old and no woman a mother until she is 23. However, China's mainland population is increasing at a rate of 2%, or over 12 million a year.

France, in spite of being a Catholic country and with very stringent laws against birth regulations and abortions, has lowered its rate, dramatically and "French writers saw evidence of France's most advanced civilization and well being in her slow population growth." It is estimated that they have one abortion to each birth.

In Sweden, a government board is appointed to study each case requesting an abortion. Sweden's birth rate is down to 1% with the world rate at 36.

Puerto Rico established one of the most extensive publicly sponsored birth control progress in spite of violent opposition by the church. They proved birth control pills can be effective. The people accepted the small family ideal. Compare this with the Assam (English) tea estates where for each 1,000 people another 30 is added each year, while in England the addition is only 5.

The Population Council recently published a "Study in Family Planning" which adds an encouraging note to our discussion, i.e., "a growing number of countries throughout the world are coming to recognize the impact of population pressures on economic and social development ... between Nov. 1962 and April 1963, The Population Council sponsored three country missions to Korea, Tunisia and Turkey ... to advise with government officers on the appropriate ways to proceed."

In Korea, which shows a 3% increase annually, the government is attacking the problem with vigor. They believe the problem of publicity and education are as important as the other aspects of the family planning program. Korea has given high priority to the program of population control with the objective of halving their annual population increase by 1980.

In Tunisia the proposed family planning program is a joint endeavor of the Ford Foundation, The Population Council, and the Tunisian Government.

Turkey, where the government realized that its 3% annual increase will expand its 30 million people to 60 million by 1986, recognizes that such growth will defeat its efforts toward national development. They recognize that to attain a joint planning policy will involve a coordinating committee of responsible members from the ministries of Health, Education, Agriculture, Interior, Defense, Labor, Broadcasting, Finance and the State Planning Officer. Turkey's goal is to attain a decline of 10% in fertility every five years. They realize they must learn the most appropriate methods of communicating information on family planning to the people as well as the problem of distributing supplies. This is quite remarkable since until recently the giving out of birth control information was illegal in Turkey.

In Ceylon there is a Sweden-Ceylon Family Planning Pilot Project costing Sweden $145,000 a year. Sweden has decided to use practically all funds voted for foreign aid into channels for birth controls. In Ceylon's most intelligent pilot center the birth rate has lowered to 22% by 1966; recognizes that such growth will defeat its efforts toward national development. They recognize that to attain a joint planning policy will involve a coordinating committee of responsible members from the ministries of Health, Education, Agriculture, Interior, Defense, Labor, Broadcasting, Finance and the State Planning Officer. Turkey's goal is to attain a decline of 10% in fertility every five years. They realize they must learn the most appropriate methods of communicating information on family planning to the people as well as the problem of distributing supplies. This is quite remarkable since until recently the giving out of birth control information was illegal in Turkey.
The United States figures are interesting. In 1790, the average family had 5.7 persons. This fell to 4.6 in 1900 and 3.5 in 1950. Since then, there has been a rise in 1960 to 3.7. Hawaii has the dubious distinction of having the fewest families with no children and more families with 3 or more children than any other state in the Union. However, in the United States contraceptives are widely available (except in Conn. and Mass.). Magazines and newspapers have many articles, and there are some 74 publications on the subject. There are 160 family planning clinics and more than 40 doctors from their offices help their mothers to stay solvent. In spite of this, there are an estimated 1,000,000 abortions, with 260 deaths and 200,000 illegitimate babies born each year. However, to indicate we are advancing, the 88th Senate was brought up to date on this subject by Senator J. S. Clark, who said, "Mr. President I now speak on the topic 'The Time has Come to Speak out on the Problem of Population Control.' The time has come to speak out in the Congress of the United States on the controversial subject of population control. The time has come to speak out in the congress to give serious study to the writings and speeches of Dr. John Rock, whose book The Time Has Come is subtitled A Catholic Doctor's Proposals to End the Battle Over Birth Control." Wm. Draper said, "It can be done! Puerto Rico—along with France, Ireland and Italy, in the past—proved that even Catholic countries can curtail their population growth."

Perhaps it is not too late. The methods at present in use, if applied, are effective. Sterilization does work. The birth control pill does work but is expensive and has some disturbing side reactions, mechanical contraceptives and foam powders are quite effective but not acceptable to everyone. The rhythm method is used by all staunch Catholics and of the citizens in these countries in a continuous state of preventive enough to save the world from an unprecedented disaster. The real question must remain, can it be applied extensively to all countries because they continue to breed so fast, that they will almost double their numbers in half the number of years that it will take us to double ours. What can possibly be the outcome but tragedy? Without a world policy, birth control as it is today practiced can well be the path of the destruction of ours and of European civilization. The rising tide of ignorance, poverty and starvation, today is a reality. In a brochure written as a world tribute to Margaret Sanger, entitled "And Now, The Challenge Is Not Just A Better Life, But for Life Itself," is written: "This population explosion then, may be a more dangerous threat to peace and freedom than the nuclear arms and guided missiles stockpiled by nations. It's that simple."

NILS P. LARSEN  
Honolulu, Hawaii

12. URBAN PLANNING FOR TOMORROW'S CITY  
No abstract available.  
FREDERICK K. F. LEE  
City and County of Honolulu

13. FIELD SURVEY OF THE EARTHQUAKE AND TSUNAMI OF MARCH 27, 1964, IN ALASKA  
The tsunami and after effects associated with the Alaskan earthquake were studied in the earthquake region by an international team of investigators with the support of the U.S.-Japan Cooperative Program for scientific investigations of the Pacific.

Two sorts of tsunamis appear to have been generated:
1) Local tsunamis resulting from slumping of deltas, such as tsunamis that washed on shores with high velocities after the quake and caused serious damage at Valdez, Seward, and Chenega;
2) a general tsunami, resulting from widespread tectonic displacements of the sea floor.

The shores of Prince William Sound have been elevated to a maximum estimated at 20 feet at Montague Island. The shores of Kenai Peninsula and Afognak and Kodiak islands have subsided to a maximum of about 6 feet. Directional characteristics of tsunami propagata in the Pacific may be related to the dipolar nature of the initiating displacement.

AUGUSTINE S. FURUMOTO  
University of Hawaii

14. GEOPHYSICAL RESEARCH IN THE LEeward ISLANDS  
A description of the physical features of a number of the Islands (Nehoa, Necker, French Frigate Shoal, Laysan, Kure), illustrated by colored slides, and a brief discussion of past and proposed research projects were presented.

MARTIN VITOUSEK  
University of Hawaii

15. THE DETERMINATION OF THE ESSENTIAL AMINO ACID CONTENT OF FIVE HAWAII FISH BY COLUMN CHROMATOGRAPHY ON ION-EXCHANGE RESIN  
Ahi, aku, mahimahi, ulua, and tako are popular foodfish in the Hawaiian Islands and all the tropical areas. Ahi is the yellow-fin tuna, aku is the ocean bonito or skipjack, mahimahi is the common dolphin or mansaku, ulua is the adult papio, and tako is the octopus. Depending on the nationality, the above mentioned fish are consumed
raw, salted, salted mixed with tomatoes or seaweeds, marinated, smoked, fried, baked, steamed, steamed in cordyline leaves, as fish cakes in soups, as appetizers, and as in-between meal snacks.

Fish constitutes an important part in the diet of the people of Hawaii. The 1963 recorded catch of fish for the State of Hawaii was 658,418 metric tons valued around 3 million dollars and was used mostly for food. A knowledge of the composition of the essential amino acids in the fish is basic to the definition of the quality of protein in the fish for food material.

The data obtained showed that the fish studies are good sources of protein judging from the composition of the amino acids. The pattern of essential amino acids was favorable and comparable to the proportions in the FAO "Provisional Pattern" and in the whole egg. Thus, fish could supply sufficient protein of good quality for human requirement, especially in the underdeveloped areas of the world.

FELICITAO S. CABBAT
BLUEBELL R. STANDAL
University of Hawaii

16. Measurement of Attitude Toward Sex

Approximately 260,000 babies are born each day, with a net world population increase estimated at 100,000 daily. At the beginning of 1960 the world's population stood at 2.8 billion; within 36 years from now, in the year 2000, it will be somewhere between 6 and 7 billion as predicted by U.N. expert, or an increase of much more than two-fold. This so-called population "explosion" is widely regarded as ominous, and there is a clear implication that something must or should be done about it.

Before much of anything can be done, it is necessary to have measuring tools for assessing the attitudes of various social groups and peoples (national, ethnic, religious, community, and others) on such matters as contraception, abortion, and sex. Investigation of the literature showed an almost complete absence of means of measuring attitudes toward these socially significant topics. The authors have therefore undertaken to construct attitude scales of the Likert type, relatively precision instruments, as a first step, to provide the needed tools for further substantive research and possible social action. The scale reported is the basic one concerned with measuring attitude toward sex.

A pool of 142 statements covering a wide range of sexual behavior was administered to 176 subjects. Each of these items was scored on a five-point scale depending on the strength of agreement or disagreement expressed by the individual. A total score on all the items was obtained for each individual, and the highest 10% and lowest 10% of subjects were identified to serve as criterion groups, representing the most liberal and the most conservative subjects respectively. The mean difference between these groups was computed for each item, and the 60 items with the highest mean differences were selected and arranged into two equivalent forms of 30 statements each. No item used had a mean difference of less than 2.06. One or more items dealing with each of the following appear on each form: sex jokes, prostitution, cultural sexual values, abortion, sexual enjoyment, extra-marital intercourse, marital intercourse, pre-marital intercourse, adultery, censorship, pornography, homosexuality, masturbation, sex act freedom, sex parties, virginity, contraception, sexual standards, unusual sex practices, miscellaneous. Inter-form reliability was determined on two independent groups, yielding reliability coefficients of 0.97 and 0.95 respectively, with a combined-form reliability coefficient of 0.98.

HERBERT B. WEAVER
ABE ARKOFF
University of Hawaii

17. Hospitalization as a Component in Social Distance

If attitudes toward others are considered multidimensional, the knowledge that a person has been discharged from a mental hospital can be compared with other determinants of social distance. This pilot study was primarily concerned with the relative influence of mental health status, ethnic origin, competence and understanding of others upon social acceptance among students with diverse ethnic backgrounds living in a highly tolerant American city. Secondary objectives were, for this distinctive population, to investigate the relationship of national origin to social distance and to verify a number of theoretical constructions in respect to prejudice suggested by Triandis and Triandis (1960).

Subjects were 127 male and female students enrolled in an upper-division psychology course at a land-grant university. From this group 29 Caucasian Americans were matched with 29 Japanese Americans.

A nine-step Social Distance Scale similar to Triandis and Triandis' (1960) modification of the Bogardus was constructed. Evidence of internal consistency, scale interval values, and subject cooperation was obtained.

Following Richard, Triandis and Patterson's (1963) study of employer attitudes toward disabilities, two levels of the four components were presented randomly in all possible combinations. S's rated each of the 16 stimulus persons for each social distance step on a five-point scale. Total social distance scores for each stimulus person and for each S yielded data which were analyzed by parametric techniques.

'Compliance, understanding of others, and race contributed more to the total variance, than mental health status. The social distance scores of the American Caucasians were substantially similar to the American Japanese. Rehabilitation specialists might fruitfully emphasize personal traits and cultural characteristics in helping discharged mental hospital patients to gain the acceptance of educated ethnically diverse persons. In general, the theoretical constructions of Triandis and Triandis were confirmed.

HAAROLD E. DENT
JOHN E. GASTON
ARTHUR A. DOLE
University of Hawaii

18. Who Knows What About Pacific Science?

One of the projects of the Pacific Scientific Information Center at B.P. Bishop Museum, now four years old, has been to record the names and addresses of experts and their specialties in various lines of scientific investigation concerning the Pacific area. These include some 500 anthro-
polologists, 1,500 botanists, and 2,000 entomologists. Many of these persons have attended congresses of the Pacific Science Association. An increasing number are employed by the administrations of the Pacific Islands territories, especially in the fields of health, social development, and such phases of economic development as agriculture, forestry, fisheries, and minerals (where the geology warrants). These have been assisted materially by the South Pacific Commission. Meteorology has developed in response to the spread of air traffic. Geophysics has been advanced by the IGY and nuclear tests. Scientific assistance is being furnished by such international organizations as UNESCO, WHO, and FAO.

Some major Pacific countries give considerable scientific assistance to other groups: Australia assists Papua and New Guinea and adjacent Melanesian islands; the Dutch did much for West New Guinea; New Zealand helps the Cook Islands, Niue, Tokelau Islands, and Western Samoa; Fiji is a coordinating and training center for health; research in Micronesia has been coordinated by the Pacific Science Board; Hawaii assists American Samoa, Guam, and the Trust Territory of the Pacific Islands; and has supported research in Polynesia.

Expeditions to Pacific islands and resulting research have been sponsored by institutions in many lands, and the “experts” are scattered around the world.

E. H. BRYAN, JR.
Pacific Scientific Information Center

19. STUDIES ON PLANT STEM ELONGATION

The growth responses of pea stems and excised stem segments to auxin, gibberellins, anti-gibberellins, and light, were analyzed.

R. KENNER
J. A. LOCKHART
University of Hawaii

20. A NEW LOOK AT AN OLD OCEAN

The sea has from very early times been a source of fascination and perhaps despair to those interested in puzzling out its mysteries.

Scientific oceanography dates from the work of Maury, circa 1835, who published the first charts of winds and currents based on compilations of detailed records. His charts of average conditions formed the philosophical basis for modern oceanographic studies.

The study of marine communities began in about 1835 by Forbes, who established the modern discipline of marine biology by making extensive surveys and analyses of systematically collected specimens. The studies of average oceanic properties and the taxonomy and biogeography of marine communities can hardly be said to be complete. For very large parts of the ocean we know little or nothing of its properties, much less its inhabitants.

But important philosophical changes in our approaches to the oceans are taking place, in that there is a growing recognition of the importance placed by cyclical events which repeatedly occur in physical properties and biological communities. Intuitively, we know these events to depend on the influence of our nearest star, whose life-giving light is converted into biological energy and whose heat is moderated and distributed by the thin film of water which covers such a large part of our planet. In order to relate time sequence changes back to the primary energy sources, our attention is turning from descriptions of properties to a descriptive analysis of changes in individual properties and the effects of a change in one part of the system on other parts of the system.

Such an approach has led us to describe our work in general terms as a study of the animal in its environment, and needing to focus on some of the many animal communities, we have chosen the tunas and their associated companions.

LUCIAN M. SPRAGUE
U. S. Bureau of Commercial Fisheries

21. SKIPJACK TUNA OCEANOGRAPHY

The broad concepts of fisheries oceanography are discussed in the context of studies on the skipjack tuna (Katsuwonus pelamis). Fisheries oceanography relates the study of fisheries with features of the oceanic environment.

In essence, fisheries science is an investigation of the harvest or yield of an exploited species. An attempt is made to maximize catch while minimizing the cost of fishing on a sustained basis. In order to regulate maximized catches and minimized costs, the components of yield must be investigated. By some models these components are recruitment, growth, natural mortality, and fishing mortality. An additional factor, availability, is of utmost importance in considering yields of tropical tunas.

Fisheries oceanography attempts to relate the components of yield with features of the oceanic environment. Some of these features are currents, winds, temperature, salinity, and productivity.

Our studies of the skipjack tuna are at a stage where we are defining our units of study. These units are groups of skipjack which differ from one another in life history attributes. For example skipjack spawn mostly in the northern winter in Marquesan waters, but in Hawaiian waters these fish spawn mostly in the northern summer. Some of these groups may be genetically distinct and are called subpopulations.

In order to study these units we have developed a model which for the first time formulates a working hypothesis to evaluate the origin and movements of exploited groups of skipjack in the eastern and central Pacific Ocean.

The principal features of this model follow:

1. Skipjack exploited in the eastern Pacific fishery consist of large numbers of fish which originate in the equatorial central Pacific.
2. The exit of skipjack from the area of the eastern Pacific fishery is associated with a spawning movement toward the central Pacific.
3. Skipjack taken in the Hawaiian fishery include fish of both Hawaiian and equatorial origins.

BRIAN J. ROTHSCCHILD
U. S. Bureau of Commercial Fisheries

22. STUDIES OF OCEAN CURRENTS NEAR THE HAWAIIAN ISLANDS

Currents near the Hawaiian Islands are being studied by several methods, for their intrinsic interest to the physical oceanographer, and also because they are a fundamental influence on the marine ecology.
Since 1961, the currents have been studied by means of drift bottles and cards which were released by the research ship "Charles H. Gilbert." The pattern of reported returns suggests a seasonal change in both the speed and direction of the offshore current system. In the first half of the year, the current carries the drift cards and bottles at speeds of about 6 miles per day or less, and the flow has a pronounced northern component; later in the year the speeds increase to about 10 miles per day or more, and the direction of flow shifts toward the west or southwest.

Direct measurements of currents have been made by means of surface floats attached to parachutes opened some distance below the sea surface. These floats have been used to examine details of eddy flow downstream of the Islands, in an attempt to study the generation, duration, and the dissipation of eddies, which are important elements of the current pattern near the Hawaiian Islands.

Finally, data collected by observations at sea are used to calibrate a scale hydrodynamic model of the Hawaiian Islands, in which patterns of current flow can be studied and photographed in the laboratory, under controlled conditions.

RICHARD A. BARKLEY
U. S. Bureau of Commercial Fisheries

23. Climatic Oceanography and its Application to the Hawaiian Skipjack Fishery

There are changes in the temperature and salinity of the ocean's waters which are analogous to changes in temperature and humidity in the atmosphere. Just as the latter can be explained in terms of movement of air masses, weather fronts, and circulatory systems, so the analogous changes in the ocean can be related to the movements of fronts which separate different water types or water masses. The boundary between the North Pacific Central water and the California Current Extension water moves seasonally through the region of the Hawaiian Islands. The time or northward movement of the boundary in late winter, as reflected in the time of initial warming of the sea near Oahu, and the presence of California Current Extension water around the Islands during the summer months have been shown to be related to the success of the Hawaiian skipjack fishery. Consequently, the time of initial warming early in the spring can be used to predict the relative success of the summer skipjack fishery.

GUNTER R. SECKEL
U. S. Bureau of Commercial Fisheries

24. Activity Patterns of Scombrids

Scombrid fishes are characterized by continuous swimming. This is associated in various degrees with search for food, gill ventilation, and maintenance of hydrostatic equilibrium. These three functional aspects of swimming are being investigated by studies of the activity patterns of scombrids in shoreside tanks (24 feet in diameter, and 3 feet deep) at Kewalo Basin.

Quantitative data on activity, measured as swimming speed, are obtained from an observation window in a tower overlooking the tanks. A Plexiglass board, parallel to the tank's surface, is inserted into the frame of the observation window. Sheets of clear plastic acetate paper are laid over the board and the path of the fish swimming in the tank is traced by an observer onto the acetate sheet with a wax pencil. While tracing, the observer views the tank from a fixed position through the acetate paper and Plexiglass. The length of the path, traced over a known time interval, is measured from the paper with a map measurer and converted to distance traveled by the fish and swimming speed. The distances between the window, the tank, and the observer's eye determine the conversion factor. In the present situation, 1 cm. on the acetate paper equals 24 cm. in the tank.

Wavyback skipjack, Euthynnus yaito Kishinouye, which have been in the tank for a month or so, swim at the same slow speed (about 0.9 m/sec for a 0.4 m. fork-length fish) throughout the day and night in the absence of food stimuli. If deprived of food for several days, speed decreases to about 0.6 m/sec, only to increase again following a meal. The average density of five intact E. yaito was 1.074 gm/cc, their food 1,071 gm/cc, and their sea water environment 1.024 gm/cc. Based on these density measurements, a 1 kg. E. yaito would weigh about 50 gm. in sea water and would tend to sink. Following a meal of 100 gm., its weight in water would increase by about 5 gm., because the food was also more dense than sea water. Since these fish swam faster when their stomachs were full and since they received lift while swimming from the planing action of their pectoral fins, it appears that the increase in speed following a meal results in part from the increase in weight.

Another adaptation to maintain hydrostatic equilibrium is the swim bladder. This organ is absent in E. yaito and in many other scombrids. All scombrids without swim bladders are relatively small species, less than 30 kg., in maximum recorded weight, whereas at least eight of those species with swim bladders attain sizes in excess of 30 kg.; some grow over 100 kg. A 100 kg. tuna without a swim bladder would weigh about 5,000 gm. in water if it had the same density as E. yaito. It can be speculated that the planing action of pectoral fins can be sufficient for the amount of lift required by smaller species, but that additional adaptations such as swim bladders are necessary for species with greater mass and heavier weights in water.

Analyses such as those presented in this abstract are being conducted on the activity patterns of scombrids to determine the effects of the functional components of locomotion on their behavior.

JOHN J. MAGNUSON
U. S. Bureau of Commercial Fisheries

25. A Method of Measuring Visual Acuity of Scombrids

Development of techniques for capturing tunas and maintaining them in captivity has progressed sufficiently to allow subjection of these pelagic scombrids to experimental procedures. Experiments designed to measure the visual acuity of tunas have been developed recently at the U. S. Bureau of Commercial Fisheries Biological Laboratory in Honolulu.

The method involves training a fish to respond in a desired manner when a visual stimulus is presented. The visual stimulus is an image of either vertical or horizontal stripes which is projected onto an opal glass plate placed against a window of the tank. When the stripes are vertical, the fish is trained to swim down the tank to a food-drop area where it is rewarded. When the stripes are horizontal,
the fish is trained to turn before it reaches the food-drop area and return to the far end of the tank. If it fails to turn around when horizontal stripes are presented, the fish receives an electric shock. The image is projected onto the opal glass plate when the fish is at the far end of the tank. The projector is turned off when the fish reaches a marked distance from the window. Filters are used to reduce the illumination of the striped image until the fish is no longer able to discriminate between vertical and horizontal stripes.

Visual angles are computed from measurements of the width of the stripes and of the distance between the fish’s eyes and the striped image. Visual acuity is calculated by taking the reciprocal of the visual angle and is then plotted against the logarithm of the luminance of the image.

The experimental tank is enclosed in a Quonset hut so that lighting can be controlled. The observer, conducting the experiment from a booth so that he cannot be seen by the fish, uses remote control buttons to operate the projector, slide changer, and electric shocker. Food is dropped from a feeding tube attached to the booth.

Preliminary analysis of the data indicates a greater visual acuity for aku, Katsuwonus pelamis, than for kawakawa, Euthynnus yaito, at higher luminances. At lower luminances, the visual acuities of the two species of tunas are similar.

EUGENE L. NAKAMURA
U. S. Bureau of Commercial Fisheries

26. Observations of Fish from a Floating Observation Raft at Sea

Pelagic fishes are frequently seen congregating around floating objects at sea. The ecology and behavior of fish accumulating around a drifting raft with a viewing chamber were observed near the island of Hawaii for a total of 85 daylight hours during five drifts of up to 50 hours’ duration. A modified version of this raft was taken south to the Equator where two drifts of 8 and 9 days were made.

Nineteen identified species of fish and one species of porpoise were seen from the chamber near Hawaii. They were classified into three groups—transients, visitors and residents—on the basis of their reaction to the raft and the length of time they remained. Transients included Decapterus sp., Euthynnus pelamis, and istiophorids; they demonstrated no apparent attraction to the raft. Visitors included Sphyraena barracuda, Pterolamiops longimanus, Manta alfredi, and porpoise. They came to the raft and swam around for a few minutes before leaving. Residents included Canthidermis maculatus, Coryphaena hippurus, Penes cyanophrys, Acanthocybium solandri, Decapterus sp., Seriola sp. and juvenile Abudefduf abdominalis. P. cyanophrys was the first to appear on all drifts and had the highest rate of increase.

Total numbers of residents increased three times faster when the raft was drifting than when it was anchored and ten times faster during daylight than at night. Seriola sp. was the only predator at the raft which successfully preyed on smaller fishes present. C. maculatus, P. cyanophrys, A. abdominalis, and Caranx kalla took shelter near the raft when they were frightened by other fish, approaching boats, or other disturbances. Observations of a C. maculatus picking a parasitic isopod from another and attempting to pick from C. hippurus and Decapterus indicate that apparently C. maculatus is a parasite picker and that floating objects may be pelagic cleaning stations.

On the two drifts near the Equator the following animals were seen from the observation chamber: adult and juvenile E. pelamis, small adult and juvenile Neothunnnus macropterus, A. solandri, adult C. hippurus, adult and juvenile Coryphaena equiselis, Decapterus pinnulatus, Elagatis bipinnulatus, Penes cyanophrys, P. longimanus, Priacanthus bonaci, Rhincodon typus, Manta sp., Naucrates ductor, Remora sp., Exocoetidae, turtle and porpoise.

In general, accumulations at the raft had properties ascribed to a community with species playing different interwoven roles.

REGINALD M. GOODING
U. S. Bureau of Commercial Fisheries
NECROLOGY

The Academy records with sorrow the death of the following members during the year:

Nils P. Larsen        Earl M. Bilger
MEMBERSHIP  JUNE 1964

Abbott, Agatin T.
Abramovitz, Melvin
Ai, Raphael A. C.
Akamine, Ernest K.
Akamine, Ralph N.
Akau, Taina I.
Aldrigh, W. W.
Alexander, William P.
†Alcata, J. E.
†Allison, Samuel D.
Amioka, Shiro
Andersen, Carl J.
Anderson, Earl J.
Anderson, Eleanor S.
Appleton Vivia B.
Apt, Walter J.
Arkoff, Abe
Akamine, Ernest K.
†Arnold, H. L., Jr.
Arnold, H. L., Sr.
Au, Stephen
Aust, Ruth Ann
Babbitt, Howard C.
†Baker, Gladys E.
†Baker, R. J.
*Baldwin, Helen S.
*Baldwin, Robert I.
Ballard, Stanley S.
†Banner, Albert H.
Bartz, Ellwood L.
†Bauer, L. D.
Beardsley, J. W.
Beldow, Ralph M.
Bennett, Thomas S.
Benson, Homer R.
Berk, Morton
Bernard, James W.
Bernatowicz, A. J.
*Bess, Henry A.
*Bianchi, Fred A.
Bilger, Leonora N.
Bishop, Brenda
Bonk, William J.
Bowen, Robert N.
Bowers, Neal M.
Bowers, Rohma L.
Bowles, Herbert E.
*Bowman, Hannah K.
Boyle, Frank P.
Brewbaker, James L.
Britten, E.
†Britton, John R.
Broadbent, Frank W.
Brown, Charles S.
Brown, Donald W.
Bruce, Frank J.
Bryan, Edward C.
Bryan, E. H., Jr.
*Bryan, L. W.
Burgess, C. M.
†Bur, George O.
BUSH, William M.
†Bushnell, D. O.
Butchart, David H.
*Bultes, William W.
Chavez, Betsy
Campbell, R. B.
Campbell, Robert L.
Canty, Daniel J., Jr.
*Carmichael, Donn W.
*Carlson, Norman K.
†Carl, Albert B., Jr.
Carr, Elizabeth B.
†Carter, A. Hartwell
†Carter, Walter
*Castle, Northrup H.
Caver, C. V.
*Chang, Leon M.
Chang, Raymond W.
Chao, T. T.
Chapman, Harold B.
Cheever, Austin W.
Chinn, Edwin
Chiu, Arthur N. L.
Chiu, Wan-cheng
Chock, Alvin K.
Chong, Mabel T.
*Chow, Matthew
Christenon, Leroy D.
†Chu, George W.
*Chuck, Harry C.
*Chuck, Mrs. Harry C.
Chun, Edwin Y.
Chun, Raymond K.
Chun, Wallace K. C.
*Chun, William H.
Chung, Ming, Archie
Civin, Harold W.
†Clegg, Charles F.
Clegg, Harry B.
Clark, H. B., Jr.
*Clements, Harry F.
Cleton, Robert W.
Cloward, Ralph B.
†Cobb, Estel
†Coleman, Robert E.
Contois, David E.
Cool, Bruce J.
Cook, Richard A., Jr.
Cooksey, Lewis C.
Cooper, John W.
Corboy, Philip M.*
*Cornelson, A. H.
†Cox, Doak C.
†Cox, Joel B.
†Cox, Marjorie L.
†Cox, Richard H.
Craig, Robert S.
Crawford, Carolyn
Crowell, David
Curtis, Walter
*Cushing, Robert
Custer, Charles C.
Davis, Clifton J.
†Davis, Dan A.
Davis, Ros.
Davis, Walter E.
Delibbaugh, Betty Lou
†Degener, Otto
†Deibert, Austin V.
†Deluca, Cesar B.
Deison, F. C.
Denison, Harry L.
†Diamond, Aaron L.
†Digman, John
Doi, Asao
Dolittle, S. E.
†Doty, Maxwell S.
†Dull, Gerald G.
Durant, Richard C.
†Edmondson, C. H.
*Ego, Kenji
Ego, Wilfred T.
Eguchi, George
*Ekeren, Paul C.
*Eller, Willard H.
Emery, Byron F.
Emory, Kenneth P.
†Enright, J. R.
Estoque, Mariano A.
Ewart, George Y.
Fankhauser, Adolph
†Farnen, Carl A.
Feiteira, Thomas M.
Feldwisch, W. F.
Felton, George
Fernandez, Leabert R.
†Fine, Julius
Florine, Charlotte M.
†Forbes, Theodore W.
†Force, Roland W.
†Fosberg, F. R.
†Fox, Robert L.
Frazier, Frances
Fringes, Hubert W.
Fujimoto, Giichi
Fujitani, Miharu
†Fukuda, Mitsuno
*Fukui, Hiroshi
*Fukunaga, Edward T.
Fullaway, D. T.
Furumoto, Augustine
Furumoto, Howard H.
Gaines, Henry D.
Gaston, John Zell
Gay, Frank E.
Gebauer, Paul
†Gilbert, Fred L.
Gilbert, James C.
*Glass, Eugene E.
Glick, Clarence E.
Glover, Mary A.
Glover, Myrtle H.
Go, Mateo L.
Golden, Patricia
*Gormley, Willis A.
Gosline, W. A.
Goto, George
*Goto, Shouke
Goto, Y. Boren
*Gowing, Donald P.
Gray, Ross H.
*Greenwell, Alice B.
*Greenwell, Amy
Greenwell, Wilfred A., Jr.
†Gressitt, J. Linsley
Gustuson, Donald I.
Gutmanis, Ivars
Habec, Dale
*Hahn, Dorothy
*Hahn, Henry
*Halperin, Sidney L.
*Halperin, Gilbert M.
Halsted, L. A.
Hamada, Dorothy K. I.
*Hamre, Christopher J.
*Handy, E. S. C.
*Hanot, Violette
Hanson, Noel S.
Harada, Glenn K.
Harada, Masato B.
†Haramoto, Francis H.
†Harbison, John A.
†Hardy, D. Elmo
Hargrave, Vernon E.
*Harry, J. V.
Hart, William E.
*Hart, Constance E.
Hartwell, Alfred S.
Hayashi, Toshiichi
*Heinecke, Ralph M.
*Heinz, Don J.
Heisterkampm, Charles, III
Helfrich, Philip
Henke, Louis A.
Henry, George W.
Herrick, Colin J.
Herrick, Raymond B.
Herschler, L. H.
*Hiatt, Robert W.
Hilker, Doris
*Hilton, H. Wayne
*Hind, Robert L., Jr.
Hine, Richard B.
Hinrichsen, Erik C.
Hiraoka, Edith S.
Hirokawa, Sueko
Hitch, Thomas K.
Hii, Dawes N.
Ho, Richard K. B.
Holladay, Natalie
Holmes, Wilfred J.
Holmes, William J.
Holt, Ernest G.
Holtwick, Chester B.
Holtzmann, Oliver
Honda, Howard H.
Honn, L. A.
*Honnert, Henry
Hood, Ernest L.
Horn, Bernhard L.
Hoskins, Charlotte M.

*Member, Hawaii Division, Hawaii Academy of Science.
†Member, American Association for the Advancement of Science.
‡Fellow, American Association for the Advancement of Science.
MEMBERSHIP

Sandberg, Floyd A.
†Sandberg, Wallace G.
Sanford, Mary C.
Sarles, William B.
Sato, Esther
Sax, Gilbert
Sayer, John T., Jr.
Schlesinger, Myron P.
Spalding, P. E.
†Spalding, Philip E., Jr.
Spencer, Frank C.
†Spiegelberg, Carl H.
Spiller, John H.
Spillner, Erich C.
Spero, Alexander
Spring, Thomas
Standal, Bluebell R.
Stanford, George
Stanley, Richard W.
*Stearns, Alvan C.
Steffee, Elizabeth
Steiger, Walter R.
†Steiner, Loren F.
*Stevens, William H.
Stone, Benjamin C.
Stromberg, John L.
Strasburg, Donald W.
Street, Chan
Street, John M.
Stuhler, Louis G.
Suehiro, Amy
Sunn, Franklin Y. K.
*Sutherland, Alvan C.
*Sutherland, Mark M.
Sutherland, Zelie M.
†Tabraham, Frank L.
Tada, Yoshio D.
Takagi, Yoshie
Takahashi, David
Takasaki, Kiyoshi J.
†Takata, Michio
Takazawa, Putoshi
†Tam, Richard K.
*Tanaka, Shuichi
Tanaka, Tokushi
*Tanaka, Toshi
Tani, Leonora H.
†Tanimoto, Ralph H.
Tanoue, Roy T.
*Taylor, James M.
Terayama, Hajime
*Tester, Albert L.
Theaker, M. L.
Thom, James C.
Thomas, Ernest H.
Thomson, Donald A.
Tilden, I. L.
Titcomb, Margaret
*Togashi, Teruo
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Trous, Albert C., Jr.
Truman, Tary H.
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*Uchida, Richard N.
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Uyehara, George K.
†Van Weel, Pieter
†Van Zwaluwenburg, R. H.
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†Vinacke, W. Edgar
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†Wadsworth, Harold A.
Wagoner, Howard E.
Wainwright, Stephen A.
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Walker, Ronald L.
Wallace, Arthur F.
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Wallrobenstein, Paul P.
Walsh, Wm. M.
†Waring, Gerald A.
Warner, H. H.
*Warner, John N.
*Warner, Robert M.
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*Waters, William A.
Watkins, Charles N.
Watson, Leslie J.
Waugh, John L. T.
Weaver, Herbert
*Weeks, John D.
†Welder, Herbert R., Jr.
Weller, D. M.
Wells, Clinton H.
Wendt, Dorothy
*Wennerlund, Apolline B.
*Wentworth, C. K.
*Wentworth, Juliette
†Withington, Paul D.
Without, Nat
Wiener, Robert D.
Wilcox, Kingston S.
Wiley, Frank
Willett, Edwin D.
Williamson, Elmer
Wilson, Warner
Wimbush, H. Mark H.
Winnick, Theodore
†Wismer, Chester A.
Withington, Paul D.
Witterman, Tamme
Wolbrink, Donald H.
*Wold, Myron L.
Wong, Erwin L. S.
Wong, Ruth E. M.
*Wong, Ruth O. T.
Woodford, Ercell C.
Worth, Robert M.
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†Yamamoto, Tatsuo
†Yamamoto, Thomas I.
†Yamane, Richard N.
†Yamauchi, Hiroshi
†Yamauchi, Shofu
†Yamauchi, Shoyei
†Yamaura, Teruko S.
†Yanagihara, Ichi
Yee, Daniel
† Yoshida, Howard O.
Yoshimato, Carl M.
Yoshimoto, Tad T.
Young, Hong Yip
Young, I. Carson
Yuen, Heeny
†Yuen, Quan Hong
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