NIH-PHS Staff Participate in AMS Meeting

Thirty-four representatives of the Public Health Service, including staff members of NIH, were active participants in the 68th Annual Meeting of the Association of Military Surgeons of the United States at the Mayflower Hotel in Washington, November 6-8.

The 3-day meeting included lectures and panel discussions, with special section meetings for nurses and pharmacists. It was attended by more than 1,800 physicians, dentists, veterinarians, nurses, and medical specialists from the United States and 34 foreign countries.

Fifty-nine technical and 15 scientific exhibits were displayed at the meeting.

Chairmen Awarded Medal

Chairman of the scientific program was Dr. Thomas J. Kennedy, Jr., Assistant to the Director of Laboratories and Clinics, NIH. Dr. James K. Shafer, Health Adviser, Office of Emergency Planning, PHS, was General Chairman of the meeting.

The Founder's Medal, awarded annually for outstanding contributions to military medicine and for meritorious service to the Association, was awarded to Dr. Kennedy and Dr. Shafer. The medal was first awarded in 1941 to commemorate the 50th anniversary of the founding of the Association.

Gen. Cooney New President

The new president of the Association is Maj. Gen. James P. Cooney, USMC (Ret.). He succeeds Surgeon General Leroy E. Burney, USPHS, (Ret.).

The Sustaining Membership Lecture, established in 1958 by the sustaining members of the Association, was delivered by Dr. Vannevar Bush of the Massachusetts Institute of Technology. He spoke on "The Trend Toward Socialism."

Women members and wives of members of the Association visited

(Continued on Page 3)
PERSONNEL TO PERSON

SINCE some NIH employees are being called to active military duty, the Employee Relations and Services Section offers the following timely information on the subject.

The DHEW policy is to place employees on emergency furlough or separation for all accumulated and accrued annual leave up to the limit prescribed by law, or they may elect to have the entire leave account remain to their credit until their return.

Employees with temporary appointments are separated. Although temporary employees do not have restoration rights, Department policy is to re-employ when feasible.

Two Choices Available

In general, persons inducted into the military service may elect to receive a lump sum payment upon separation for all accumulated and accrued annual leave up to the limit prescribed by law, or they may elect to have the entire leave account remain to their credit until their return.

Furlough Benefits Explained

If furloughed, the employee retains rights under the Civil Service Retirement Act and his retirement fund contributions will continue. The employee is entitled to all accrued annual leave for the period during which he was on furlough.

The refund is made to the employee in addition to the lump sum payment received upon separation. The refund makes his separation from the civilian service absolute for retirement purposes, thereby depriving him and his survivors of retirement coverage.

MEDICAL ECOLOGY

(Continued from Page 1)

in Moscow on November 15 and visit several medical institutes and the health services of a number of centers in the Soviet Union for a period of about four weeks.

Members of the mission are:

Dr. William J. Zakut, Office of the Director, National Heart Institute, Chairman of the Mission.

Dr. Victor Bronfenbrenner, Professor of Psychology, Department of Child Development and Family Relationships, Cornell University.

Dr. Paul H. Densen, Deputy Commissioner of Health, New York City.

Dr. Robert Dyrar, Chief, Division of Preventive Medical Services, State Department of Public Health, Berkeley, Calif.

Dr. Philip Lee, Department of Internal Medicine, Palo Alto Medical Clinic, and Clinical Instructor in Medicine, Stanford University School of Medicine.

Dr. John D. Turner, Chief of Preventive Medicine, State Department of Public Health, Berkeley, Calif.

Dr. Philip Lee, Department of Internal Medicine, Palo Alto Medical Clinic, and Clinical Instructor in Medicine, Stanford University School of Medicine.

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To exercise his reemployment rights, he must again register for Health Benefits.

Additional information may be obtained from the Employee Relations and Services Section, Ext. 4581.

PHS Corps Exams

Regular Corps examinations for the appointment of physicians, dentists, nurses, sanitary engineers, veterinarians, and sanitarians to the Commissioned Corps of the Public Health Service will be held throughout the country on Friday, January 4, 1962.

Applications and additional information concerning the examinations may be obtained by contacting the Commissioned Officer Section, Ext. 4212. Applications must be submitted by January 5, 1962.
**NIH-PHS Staff Participate in AMS Meeting**

(Continued from Page 23)

NHI the afternoon of November 8 for a guided tour of the Clinical Center. Arrangements for the tour were made by a committee of wives of PHS officers, headed by Mrs. Stuart Sessions.

Seven NIH scientists presented papers during the 3-day sessions. A brief summary of each follows:

- Dr. Donald S. Fredrickson, Clinical Director of Intramural Research, National Heart Institute, read a paper, "From Genes to Molecular Disease—Emerging Concepts," which emphasized the recent surge of interest in genetic determination of molecular disease.
- Dr. Bert N. La Du, Arthritis and Rheumatism Branch, NIAMD, reviewed inborn errors of metabolism in his paper, "From Genes to Molecular Disease—Outstanding Examples of Inborn Errors in Metabolism of Aromatic Amino Acids." Several metabolic diseases, such as albinism, phenylketonuria, aceruloplasminemia, and tyrosinemia, result from defective metabolism at particular steps in the oxidation of the aromatic amino acids, phenylalanine and tyrosine, he said. Dr. La Du also discussed the study of human hereditary diseases.
- Dr. Alexis Shelokov, Chief of the Laboratory of Tropical Virology, National Institute of Allergy and Infectious Diseases, and Dr. Henry K. Beye, Director of the Middle America Research Unit, reported on "Middle America Research Unit—An Interservice Laboratory Devoted to Medical Research in the American Tropics."" The Society for Tropical Medicine and Hygiene.
- Dr. Richard A. Tjalma, Chief, Epizootology Section, Epidemiology Section, National Cancer Institute, reported on the epidemiology of viral and mycotic diseases occurring in the American tropics.
- Dr. Thomas J. Kennedy, Jr., Assistant to the Director of Laboratories and Clinics, NHI, receives the Founder's Medal citation for research on the etiology, epidemiology, and ecology of viral and mycotic diseases occurring in the American tropics.
- Dr. Arnold E. Schaefer, Executive Director, Interdepartmental Committee on Nutrition for National Defense, NIH, reported on ICNND cooperative nutrition projects with 20 countries. He said that the determination of the nutritional status of population groups is accomplished by a combined survey involving medical, biochemical, and dietary assessment, and a measurement of agricultural productivity and food processing, distribution, habits, and customs.
- Dr. Richard A. Tjalma, Chief, Epizootology Section, Epidemiology Section, National Cancer Institute, reported on the epidemiology of leptospirosis. He reported that the organism has been successfully isolated from both man and contact animals in several instances.

**Clinical Malaria Strain Proven Drug-Resistant in Recent Lab Tests**

For the first time a strain of one of the clinical malaria's has been proven resistant to the two drugs considered most effective against the disease. Resistance of Plasmodium falciparum to chloroquine and amodiaquine has been demonstrated in laboratory studies reported by Dr. Martin D. Young to the Tenth Annual meeting of the American Society of Tropical Medicine and Hygiene.

Dr. Young, Assistant Chief of the Laboratory of Parasite Chemotherapy, National Institute of Allergy and Infectious Diseases, undertook to find out if persons taking regular suppressive doses of these drugs would develop malaria after being bitten by infected mosquitoes. His studies were begun following the initial discovery that an American who had contracted malaria in Colombia, South America, failed to respond normally to treatment with chloroquine.

**Dr. Schaefer Elected to Royal Medical Society**

Dr. Arnold E. Schaefer, Executive Director, Interdepartmental Committee on Nutrition for National Defense, which operates through the National Institute of Arthritis and Metabolic Diseases, has been elected to membership as an Affiliate of The Royal Society of Medicine of London. The membership of this Society, which is dedicated to medical research, includes outstanding authorities in the principal fields of medicine.

Internationally recognized for his work on nutrition in the developing countries, Dr. Schaefer became associated with NIH in 1953. Since 1965 he has been Executive Director of the Committee's program. In this capacity he has been active in directing nutrition surveys in 19 foreign countries, and a survey currently under way in Burma.
Role of Bacteria In Mineralization Studied by NIDR

The process of mineralization is of particular interest to dental and medical scientists, but the underlyng factors that regulate normal and pathological calcification in body tissues are still not clearly understood.

Recent experiments by National Institute of Dental Research investigators, using a technique of intraperitoneal transplants, have opened the way for studying the mechanism of calcification under highly controlled conditions.

In earlier studies of the calcification phenomenon, Drs. Anthony A. Rizzo, David B. Scott, and Stephen E. Mergenhagen of NIDR, and Dr. George R. Martin, American Dental Association Research Associate at the Dental Institute, implanted specimens of normally noncalcifying tissues into the peritoneal cavity of young rats. They found that these tissues, removed after several months, had undergone mineralization. This was confirmed by X-ray diffraction analysis.

Further Studies Made

These findings served as a basis for further in vivo studies of mineralization using tissue preparations implanted in dialysis bags, and in combination with certain agents thought to influence calcification.

When various collagenous tissues were implanted in rats in sealed dialysis bags, it was found that some specimens became calcified, while other samples of the same material did not. Further investigation revealed that the implants which mineralized had been contaminated with bacteria during preparation, whereas those that failed to mineralize had remained sterile.

As a result of the latter findings, NIDR scientists turned their attention to studies of individual microorganisms to determine the extent of bacterial implication in the calcification process, and whether such bacteria would calcify when implanted alone.

In a current study, a number of bacterial species were used including cocci, filamentous forms isolated from human dental calculus. One-day-old cultures were washed, suspended in saline, and transferred to sterile dialysis bags.

The sealed bags were then implanted through an abdominal incision into the peritoneal cavities of young rats. Similar implantations were also made of other non-viable organisms. Following sacrifice of the animals at various intervals over a 90-day period, the contents of the dialysis bags were examined by standard bacteriological technique, X-ray diffraction and electron microscopy.

Results showed that all of the viable implants had undergone calcification in a period of 14 to 26 days, whereas specimens containing killed cultures calcified in an appreciably shorter time. In both instances, the presence of hydroxyapatite was confirmed by X-ray diffraction. Control dialysis bags containing 4% saline or distilled water showed no calcification.

It is of significance that electron microscopy revealed striking similarities between the mineral deposits formed in the intraperitoneal transplants and those obtained from developing human oral calculus.

Although these findings do not implicate any specific organism, they do support the contention that bacteria play a role in the mineralization of dental deposits. Continuing studies, utilizing similar techniques to test the calcifying potential of saliva, may add further to understanding of the mechanism of ectopic oral calcification.

Causative Agent of Toxoplasmosis Seen Related to Sporozoa Parasite Group

Toxoplasma gondii, the causative agent of the sometimes fatal disease, toxoplasmosis, has been unclassified since it was first discovered in 1908. On the basis of new findings by National Institutes of Health investigators, it can now be related to a large group of parasites called the Sporozoa.

The findings, by Mary Ann Gavrin, formerly of the National Institute of Neurological and Blindness; Dr. Theodor Wanko of the same Institute, and Leon Jacobs of the National Institute of Allergy and Infectious Diseases, were reported to the Tenth Annual Meeting of the American Society of Tropical Medicine and Hygiene by Dr. Wanko.

He said that Toxoplasma gondii has been known since 1908 when Nicielle and Manceaux found it in a small African rodent and Spen- dor found it in a rabbit.

Considered A Curiosity

Despite very careful observation by excellent microscopists, the light microscope has not been adequate to discern features of its structure that could aid in deciding its classification. It has remained a parasitological curiosity usually included in text books in a category called "Protozoa of Uncertain Position."

In 1957 Goldman and his co-workers at the Public Health Service's Communicable Disease Center in Atlanta, Ga., stained Toxoplasma with silver stains and noted a strange phenomenon, the reproduction of an organism by the formation of two filial organisms within it.

Because silver stains can give false appearances, or artifacts, unaided microscopy did not receive acceptance. However, it stimulated further work on attempts to discern the reproductive mechanisms of Toxoplasma.

Causative Agent of Toxoplasmosis Seen Related to Sporozoa Parasite Group

The Ophthalmology Branch, NINDB, and the Laboratory of Parasitic Diseases, NIAID, pursued this work by using the electron microscope.

The results of the studies have been very revealing, according to Dr. Wanko. Not only has the process of endodyogeny, or internal budding, been seen and confirmed in detail, but evidence for another division process, schizogony, has been obtained.

Form Within Parent

Schizogony is a process in which a number of individuals are formed within a parent organism. Actually, Dr. Wanko said, endodyogenesis can be looked upon as a special form of schizogony in which only two filial organisms are produced instead of many.

With the light microscope it was not possible to establish clearly the mode of reproduction of Toxoplasma, but the use of the electron microscope has aided in providing a new appraisal of its relationships.

On the basis of the new findings this parasite can be related to a large group called the Sporozoa, in which are located the agents causing malaria and certain intestinal infections of human beings and many animal diseases. While Toxoplasma is not closely related to these, Dr. Wanko said it seems to fit in the same large group.

In the future the number of other findings in the electron micrographs will be important when they are evaluated later in relation to other organisms and to the mechanisms by which Toxoplasma invades and grows in the host cells.

Study Relates Monkey Age to Recovery Rate after Hemidecortication

National Institute of Neurological Diseases and Blindness studies of young monkeys subjected to hemidecortication (removal of the cortex of one brain hemisphere) show that the rate and degree of recovery from resulting neurological deficits is directly related to the age of the animal.

A marked degree of early recovery has been observed in infant monkeys subjected to hemidecortication, while older monkeys retained persistent and severe deficits.

In studies conducted by Dr. Max Ramirez de Arellano of the NINDB Laboratory of Perinatal Physiology, Puerto Rico—reported at the Seventh International Neurological Congress in Rome, Italy—the neurological status of two groups of monkeys subjected to hemidecortication was determined. One group was made up of animals from six to 22 days old. In the other group were animals over 19 months of age.

Early and complete recovery from paralysis occurred in the younger group, whereas asymmetry in the older group was marked and persistent in all older animals.

In the younger animals, voluntary group reflexes, normalized in between 40 minutes and nine days after surgery. Return of volun-

tary group did not occur in the older group.

The younger animals began to vocalize soon after surgery, while the older ones were practically aphasic. The young animals also had earlier recovery of muscle tone than the older animals.

In electroencephalographic recordings of the monkeys, no electrical activity was noted on the side of operation, yet activity on the other side remained normal in the records made from the intact brain hemisphere.

Veterans make up some 54 percent of the Federal work force in the United States.
Inferior Mother-Child Relationships Found Among Dissatisfied Mothers

A mother's employment has little relation to her childrearing characteristics. Few differences seen in the childrearing practices of mothers who worked and those who stayed home. However, when mothers' motivations to work were considered, those who preferred to work but not out of a sense of duty did not, appeared to have the greatest problems in dealing with their children.

Child control was a continuing issue for 61 percent of the mothers, compared with 32 percent of the mothers who preferred not to work, 18 percent of the dissatisfied working mothers, and 42 percent of the satisfied working mothers. The study also revealed that mothers with high school and college training. Within the high school group, maternal employment was associated with fewer child control, assignment of greater responsibility to children, and delegation of a stricter disciplinary role to the father. This difference between the working and nonworking mothers did not appear within the college group.

On the other hand, the college working parents revealed a tendency to compensate for time away from their children by more planning of future childrearing and familial adaptations, depending on mothers' motivations, attitudes, and cultural backgrounds.

Three Named to NCI's Grants, Training Staff

The National Cancer Institute recently announced the appointments of three new members to its Grants and Training Staff. They are Dr. Willis Robert Boss, Chief of the Training Branch; Dr. North Duerston Tapley, Special Assistant to the Associate Director, NCI, for Grants and Training; and Dr. Silvio Stephen Schiaffino, Research Grants Branch.

In his new post, Dr. Tapley will facilitate the expanding grant program of training and research in the areas of radiation therapy, radiobiology, and radiation physics. He received her M.D. degree from Columbia University. Before coming to NIH, Dr. Schiaffino was Chief of the Chemistry Laboratories of the Hadley Laboratories in Falls Church, Va., and was previously Assistant Chief of the Microbiology Branch, Division of Nutrition, Food and Drug Administration. He will be responsible for research grant applications in the related fields.

To Coordinate Programs

In addition, he will coordinate the public information programs of the various NIH components. From 1942 to 1946 he served with the Aerial Photographic Intelligence Section of the U.S. Army. Before World War II, he was Assistant to the Director of the New England Radio News Service in Boston.

In his new post, Mr. Goldthorpe will serve as staff assistant to Mr. Johnson with primary responsibility for NIH activities designed to bring about better public and professional understanding of the total medical and allied research, training, and related programs of NIH.
Governors Hear

PHS Views on Mental Illness

Public Health Service views on the major recommendations of the Final Report of the Joint Commission on Mental Illness and Health were disclosed at the National Governors’ Conference, November 9-10, in Chicago.

Spokesman for the Service was Dr. Robert H. Felix, an Assistant Surgeon General, PHS, and Director of the National Institute of Mental Health. Boisfeuil Jones, Special Assistant for Health and Medical Affairs of the Department of Health, Education, and Welfare, delivered the opening address.

Dr. Felix complimented the Joint Commission on its “bold and brilliant” recommendations and cited the need for attacking mental illness at all levels.

Suggests Considerations

Regarding the Commission’s recommendation that Federal financial assistance be made available to the States to improve the quality of inpatient treatment for the mentally ill, Dr. Felix told the Governors that if a decision is made to draft new legislation providing for such Federal assistance, consideration should be given to:

1. Providing for appropriate amounts of money to implement the program;
2. Concurrently evaluating the impact of these funds upon the States and upon the care of the population;
3. Appraising the new program at the end of the first five years; and
4. Letting experience during the first five years set the pace for future Federal appropriations.

He pledged the Public Health Service’s continued interest in, and emphasis on, long-term research, basic research, adequate support for career researchers, the training of many types of personnel for work in the mental health field, and the extramural aspects of State mental health programs.

He emphasized his agency’s interest in three mental health problems in which the Commission showed little concern. These areas included the needs of mentally retarded persons, the prevention of mental disorders, and the need for area-wide planning for health facilities and services.

Referring to other Joint Commission recommendations, Dr. Felix suggested that some provisions be considered.

These included a recommendation concerning a suggested daily expenditure to meet the costs of caring for hospitalized psychiatric patients. Such expenditures cannot be determined in an “across-the-board” fashion, Dr. Felix said, as they depend on the patient’s medical needs.

While pointing out that “evidence is accumulating which indicates that the smaller hospital is more desirable,” he called for joint consideration of the Joint Commission proposal recommending the maximum size of mental hospitals to be set at 1,000 beds.

Dr. Felix also revealed his professional reservations concerning the Commission’s recommendation that long-term patients be segregated from acute patients into hospitals caring only for chronic patients.

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Dr. Kuvin Reports Research Findings On Simian-Man Malaria Transmission

Dr. Sanford F. Kuvin of the National Institute of Allergy and Infectious Diseases’ Laboratory of Clinical Investigations reported recent findings on the transmission of simian malaria to man, at the Tenth Annual Meeting of the American Society of Tropical Medicine and Hygiene, held early this month in Washington.

A series of laboratory accidents last year triggered the discovery by Dr. Don E. Eyles and Dr. G. Robert Coatney of the Laboratory of Parasite Chemotherapy, NIAID, that at least one strain of malaria normally found only in monkeys is transmissible to man.

Mishaps Described

The mishaps involved four laboratory workers who were accidently infected with Plasmodium cynomolgi bastianelli, a new strain of malaria isolated from Malayan monkeys, and recently imported into this country for study.

The victims subsequently exhibited symptoms similar to those following infection with Plasmodium vivax, the most common of the four species of malaria which infect human beings. Studies related to the clinical and pathological aspects of infection with this simian malaria in man have been carried out at the United States Federal Penitentiary in Atlanta, Ga., by Dr. Henry Deye of the NIAID and his associates.

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Anemia Is Present

Significant laboratory findings in both groups of patients were anemia, a fall in the white blood cell count and platelet count, a rise in the sedimentation rate and alterations in the serum proteins.

In general, the illness produced in man by this strain of monkey malaria appears less severe than that produced by vivax malaria; although its severity is out of proportion to the numbers of parasites found in the blood.

Whether this and other simian malarias will be significant in terms of world-wide malaria eradication can only be determined by future investigations now in progress.

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Good Nutrition Is Seen Beneficial in Treatment Of Schistosomiasis

Results of a 15-month clinical study conducted in Puerto Rico have conclusively demonstrated the marked benefits of good nutrition in combating the disease processes associated with schistosomiasis. A report on the findings to date was presented by Dr. William B. DeWitt of the Laboratory of Parasitic Diseases, National Institute of Allergy and Infectious Diseases, at the Tenth Annual Meeting of the Academy of Tropical Medicine and Hygiene held in Washington this month.

The study was conducted by Dr. DeWitt with the collaboration of Dr. Jose Oliver-Gonzales of the University of Puerto Rico and Dr. Eduardo Medina of the Rio Piedras Municipal Hospital.

34 Patients Studied

Prior to initiation of the study, 34 patients infected with Schistosoma mansoni who had subsisted on a diet low in protein and deficient in vitamins—mainly rice and beans—were hospitalized and given complete physical and laboratory examinations. Dr. DeWitt emphasized on evaluation of nutritional state and the disease processes associated with the schistosome infection. Similar examinations were made at 3-month intervals during the course of the study. Frequent stool examinations were made to determine egg production and viability of the parasites.

Following the initial examination the patients were given a high-protein, high-calorie diet containing large amounts of red meat, cheese, milk, butter, and eggs. The effects of the improved diet on their general health and on the parasite infections were evaluated for the next 15 months. In every case, the results of both physical and laboratory examinations showed improvement due to the good diet.

A group of patients under detention by the Department of State were served under similar conditions. Their diet throughout the study consisted mainly of rice and beans.

NIH Staff Conference Open to D.C. Doctors

Several hundred Washington area physicians in addition to NIH staff are expected to attend the Combined Clinical Staff Conference on "The Syndrome of sarcoidosis, psoriasis, and Gout," to be held Tuesday, November 28, at 8:30 p.m., in the CC auditorium.

Sponsored by the National Institute of Arthritis and Metabolic Diseases, the conference will be moderated by Dr. Joseph J. Bu
MEN OF SCIENCE ASSEMBLE TO DISCUSS RESEARCH FINDINGS

Conferring at the International Conference on Measles Immunization are Dr. A. M. M. Payne of the Department of Epidemiology and Public Health, Yale University School of Medicine (left), and Dr. James A. Shannon, Director of NIH.

Dr. Joseph E. Smadel, Chief of the Laboratory of Virology and Rickettsiology, DBS (right), emphasizes a point in discussion with (left to right): Dr. Philip B. Stones of Pfizer, Ltd., Sandwich, England; Dr. Maurice Hilleman of the Merck Institute for Therapeutic Research, and Dr. John R. Paul of the Department of Epidemiology and Public Health, Yale University School of Medicine.

Participants in two of the several important medical research meetings held here and in the Nation’s Capital recently are pictured in these candid photos taken at the International Conference on Measles Immunization at NIH, November 7-9 (top row), and the 10th Annual Meeting of the American Society of Tropical Medicine and Hygiene in Washington, November 1-3.—Photos by Bob Pumphrey and Sam Silverman.

Between Conference sessions, Dr. John F. Enders, Chief of the Research Division of Infectious Diseases, the Children’s Hospital, Boston, Mass. (left), talks things over with Dr. Rodgerick Murray, Chief of the Division of Biological Standards.

Conducting a council meeting of the Society are (left to right): Dr. Geoffrey M. Jeffery, Head of the Section on Epidemiology of the Laboratory of Parasite Chemotherapy, NIAID, and Secretary of the Society; Dr. Frye, and Dr. John E. Larsh, Jr., of the University of North Carolina School of Public Health.

GENETIC CODE

(Continued from Page 1)

"language," each letter being represented by one of the four chemical bases that are attached to the long-chain RNA molecule. It is the particular sequence of these bases—adenine, guanine, cytosine, and uracil—that determines the code, and this sequence is believed to reflect the sequence of similar bases which occur in DNA.

Serves as Template

Since messenger RNA serves as a template against which 20 or more kinds of amino acids may be aligned in the making of protein molecules, the problem of the code is to translate the four letter language of RNA into the 20 letter language of protein.

In the first part of their work the NIAMD scientists found that trace amounts of the DNA-destoying enzyme, DNAase, could inhibit amino acid incorporation into protein, suggesting that DNA functions all the way down to amino acid linkage. The work on the action of RNA was made possible in large part by their development of a cell-free protein synthesizing system that remained stable.

Add Reducing Agent

The one they used, derived from the microorganism Esherichia coli, has hitherto been extremely unstable, but they found that the addition of the reducing agent, mercaptoethanol, could stabilize it remarkably. The system was provided with a full complement of amino acids and a source of chemical energy (adenosine triphosphate continuously regenerated by secondary reactions), and then various types of RNA were added. The NIAMD investigators found that the incorporation of individual amino acids into protein was dependent upon the addition of particular RNA templates. These could be either naturally occurring RNA or synthetic preparations of polynucleotides of known structure.

Reactions Described

When polyuridylic acid, a synthetic RNA containing only the base uracil was added, one and only one amino acid, phenylalanine was incorporated. Similarly, when another synthetic RNA, polyethylidyllic acid containing only the base cytosine, was added, the sole amino acid incorporated was proline. Only “single stranded” RNA fibers were found to be active in the system.

Many authorities in the past have held that a minimum of three bases is needed to impart the necessary information for the use of any one amino acid.

If this theory is correct, and if one were to extend the analogy of the coded language to the present work, the “word” in RNA that contains information for using phenylalanine would become uracil-uracil-uracil, and the word which contains the corresponding information for proline would be cytosine-cytosine-cytosine. With this cell-free system it now seems likely that any type of protein can be made corresponding to a meaningful informational RNA.

Findings Vested Important

These NIAMD findings provide information of considerable importance to biochemical research, and they represent the first experimental evidence which permits direct translation of the RNA code of protein synthesis. They are reported in the Proceedings of the National Academy of Sciences.