donor of the material does not specify them himself.

Those present at the conference agreed on the importance of urging leaders in biochemistry and molecular biology to preserve such material from their own files. It was recommended that a statement emphasizing the importance of preservation be sent out in the near future to a selected list of leading scientists in the field. Also, it would be highly desirable to issue a newsletter, perhaps once or twice a year, reporting on the location of such material and on other information useful for scholars. Both the American Institute of Physics and the American Philosophical Society publish such a newsletter. Saul Benison urged the compilation of lists of biographical and autobiographical articles that have already appeared. Everett Mendelsohn pointed out that the *Journal of the History of Biology* could publish at least some of the information for a newsletter among its "Notes." J. S. Fruton spoke of the possible role of the American Society of Biological Chemists in promoting these developments. It was agreed that action should be taken on several of these proposals in the near future and that the American Academy and its Committee should endeavor to implement them.

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Nucleic Acid Structure Function Relations

At a United States–Japan Science Cooperation Seminar in Tokyo, 20–24 April 1970, 7 American scientists and 14 Japanese scientists exchanged details of recent progress in their experiments to determine structure and function relations in nucleic acids. Some 15 additional Japanese research workers attended the discussions as observers. The National Science Foundation of the United States and the Japan Society for Promotion of Science cosponsored this conference at which both new knowledge and elegant research techniques were exchanged.

T. Tsuboi and K. Imahori of Tokyo described how infrared spectroscopy and circular dichroism can be calibrated with model polynucleotides and pure natural ribonucleic acids. The techniques are complementary in revealing

base pair content and helix content of transfer RNA (tRNA), purified fragments of tRNA, and native and denatured RNA's. R. Bock reported the progress in x-ray diffraction studies of six tRNA species crystallized at the University of Wisconsin. Three-dimensional Patterson projections are availfor two species of tRNA, and unit cell dimensions were reported for several other species. Tsuboi reported the crystallization of formylmethionine (fMet) acceptor tRNA from *Escherichia coli*.

Two of the world's leading groups for purification of tRNA were represented by D. Novelli of Oak Ridge and S. Nishimura of Tokyo. Novelli described the strategy and procedures that have made possible the isolation of gram quantities of five species of *E. coli* tRNA. Nishimura described a program that has produced pure samples of *E. coli* tRNA for 11 different amino acid acceptor activities. He reported a series of discoveries of minor bases made possible by this purification.

Ukita presented evidence that one of these newly discovered bases, a 2-thiouridine derivative, causes a codon-reading pattern different from those predicted by the "wobble" hypothesis. It causes glutamyl-$tRNA_{III}$ to recognize only the code word GAA, whereas the only previous report of a tRNA able to read only a single code word was restricted to certain code words ending in the base G. Another new codon recognition pattern was reported by S. Nishimura for tRNA's containing uridine-5-oxyacetic acid in their anticodon. Serine tRNA containing this nucleoside reads the three code words: UCU, UCG, and UCA. Thus, depending on the state of modification of uridine in the anticodon, a given tRNA may read one, two, or three different code words.

H. Ishikura presented a preliminary model for the sequence of this *E. coli* serine acceptor tRNA and pointed out that, in spite of many differences elsewhere, the dihydrouracil-containing loop of serine tRNA is common to samples isolated from yeast, *E. coli*, and rat liver. However, T. Seno presented strong evidence that the dihydrouracil-containing loop was not essential for recognition of $tRNA^{Met}$ by methionyl tRNA synthetase or by methionyl tRNA formylase. He was able to remove the dihydrouracil loop by carefully controlled nuclease digestion with only slight reduction of amino acid acceptor function in the tRNA.

D. Söll of Yale elaborated details on the specificity of the aminoacyl-tRNA synthetases. It is known that a single synthetase is capable of recognizing the several tRNA species in *E. coli* which accept that particular amino acid. He showed that K_m (Michaelis constant) was identical for four different separable serine tRNA species even though they read different codons and have substantial composition differences. Six separable leucine tRNA's are all charged by one single enzyme.

An assembly of experts on tRNA genetics and RNA sequencing had much that was new to discuss and share with those attending the meeting. M. L. Gefter (Columbia), J. E. Dahlberg (Wisconsin), and J. Abelson (San Diego) demonstrated the technique of oligonucleotide mapping, as pioneered in Sanger's laboratory. The experiments were both instructive and successful, even though begun the day after the group arrived in the Japanese laboratory. In addition to teaching the mapping technique, they each described important new concepts of RNA sequence related to RNA function. Gefter showed how the tRNA gene introduced into phage ø80 was a useful tool for obtaining tRNA defective in the modifications that convert adenosine to methylthioisopentenyladenosine. He summarized evidence relating mutant changes to function in the ø80-Su^{+III}–induced tyrosine tRNA. Abelson discussed the leucine tRNA induced by phage T4 and reported on efforts to develop this system into a tool for the study of tRNA structure and function as related to both protein synthesis and metabolic regulation in the phage-infected cell. Dahlberg outlined the strategy and results of sequencing large RNA molecules. The results suggest special structures at the beginnings of RNA messages not unlike the loops found in tRNA.

H. Ozeki and K. Shimura (Kyoto) had good reason to note the experimental details of tRNA sequencing methodology. They have used elegant genetic strategies to obtain a set of interesting mutants of tyrosine suppressor tRNA. One of these mutants gives evidence that the tRNA has mutated so that it is enzymically recognized as a glutamate acceptor instead of a tyrosine acceptor. We are now anxiously awaiting news that will relate a structural change in tRNA to this dramatic functional change.

The great utility of pure tRNA species to serve as substrates for nucleotide methylases was illustrated by Y. Kuchino of Kyushu University. He

purified from animal tissue a G-specific methylase which methylates only one unique locus in *E. coli* $tRNA^{fMet}$.

High-molecular-weight RNA received much attention at the conference. Ando and Takagi brought the audience up to date on the function and specificity of nucleases they have isolated. One nuclease in T4 phage–infected *E. coli* was shown to be essential for repair of photochemical damage. K. Miura summarized his work on the organization of RNA in viruses from the silkworm, human respiratory tissue, and the rice plant. These double-stranded RNA viruses contain, respectively, 10, 10, and 12 discrete pieces of RNA. The 5′ termini of these chains were masked from phosphomonoesterase digestion until the RNA double strands were denatured. Some progress on the separation and characterization of these discrete RNA pieces was described.

J. Krakow of Berkeley and M. Takanami of Kyoto presented new findings on the nature and role of protein factors which influence the initiation and termination of RNA synthesis from DNA templates. Krakow's use of acrylamide-gel electrophoretic separations of RNA polymerase and its control factors made possible a description of the cyclic process of initiation, propagation, and termination of synthesis as influenced by "sigma" factor. Because he was able to subdivide the cycle, he could pinpoint the action of antibiotics such as rifampicin and streptolydigin. Sigma factor is not released upon formation of the first internucleotide bond. However, synthesis of a nascent RNA chain of less than 40 nucleotides was sufficient to displace the sigma factor from a complex of deoxyadenylate-thymidylate and enzyme. Takanami's experiments demonstrated that "rho" factor causes guanosine triphosphate–initiated messages from ø80 DNA to terminate at characteristic places, whereas in the absence of rho the messages synthesized terminate at other places and are severalfold larger. *Escherichia coli* RNA polymerase is stable until sigma factor is separated from the enzyme. In the presence of sigma factor, 90 percent of the new chains started with pppApPyr while only 50 percent had this initiation sequence when sigma factor was withheld.

After the conference, the U.S. participants arranged individual visits to the universities of Chiba, Sendai, Nagoya, Kyoto, and Osaka. At these we learned of detailed progress and aspirations in research and graduate training.

The Japanese workers share our concern for finding balanced solutions to academic evolution and reform. The ability to conduct meaningful basic science research in a well-planned and painstakingly equipped facility may be sacrificed by oversights in hastily adopted solutions in the name of reform. Some Japanese "reformed" universities are now learning of problems that were unforeseen or ignored and are seeking ways that a liberated, equalized student-faculty community can attack nontrivial scientific problems which depend on multiyear development of skills and facilities by a group dedicated to a common goal.

The conference was an efficient and productive mechanism for exchange of current research concepts and techniques. It also produced or strengthened at least four United States–Japan collaborative research efforts. Our information channels are now quite adequate in the literature because of the use of European and U.S. journals by Japanese scientists and the continued improvement of the *Japanese Journal of Biochemistry*. The exchange of professional scientists for extended periods of study needs much better balance. Any well-qualified U.S. scientist who trains himself in the language and arranges to study in one of the several excellent research centers in Japan deserves encouragement and support by our foundations and professional societies. The U.S. science community and our whole society have much to learn from such an exchange.

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Bioresources of Shallow Water Environments

A national symposium on hydrobiology was conducted under the sponsorship of the American Water Resources Association in Miami Beach, Florida, during 24–27 June 1970. The theme of the symposium was directed to shallow waters that supply vast amounts of harvestable materials. The objectives of the meeting were especially pertinent inasmuch as the biological aspects of water resources are becoming increasingly important as greater demands are placed on total water resources by national and international economies.

The first day of technical sessions emphasized the use and potential of bio-