Secretary to undertake feasibility studies of large-scale commercial production of the concentrate and to construct and maintain the experimental plants during a 5-year program. Similar measures have been introduced in the House and referred to the Committee on Merchant Marine and Fisheries, which has not yet scheduled hearings. The Interior Department, whose Bureau of Commercial Fisheries has conducted research on fish protein concentrate and submitted a product to challenge FDA's 1962 negative ruling on a commercial product, still awaits approval of its product. FDA has until the last of August to hand down a decision on the Interior product.

• **REUSS SUBCOMMITTEE:** The publication of an annual Science and Technology Report by the Executive Office of the President is among a series of proposals in a report issued by the Research and Technical Programs Subcommittee of the House Government Operations Committee. The Committee report, "Federal research and development programs: The decision-making process," stems from hearings presided over in recent months by chairman Henry S. Reuss (D–Wis.) (*Science*, 14 January). Other recommendations include the use of cost-benefit analysis for major research and development proposals. Copies of the Reuss report may be obtained without charge from the Research and Technical Programs Subcommittee, U.S. House of Representatives, Washington, D.C.

• **THE WASHINGTON OFFICE:** An outpost in the Nation's capital is coming to be standard equipment for organizations or disciplines that have achieved or aspire to significant federal financial support. A few months ago, the Social Science Research Council announced that it would reactivate a Washington office (*Science*, 20 May). Last week the opening of an office in the capital was announced by Associated Universities, Inc., the 9-university consortium that operates the Brookhaven National Laboratory and the National Radio Astronomy Observatory. AUI's Washington staff consists of T. Keith Glennan, AUI president; Lloyd E. Slater, his assistant, and a secretary. Other members of the staff will stay at the Brookhaven offices where financial administration is centered. A Washington office also has been established by the newly organized National Oceanography Association, among whose aims it is to "mobilize public support" of oceanography. The 18-member board of directors is headed by John H. Clotworthy, vice president, Defense and Space Center and general manager, Underseas Division, Westinghouse Electric Corporation in Baltimore.

REPORT FROM EUROPE

Total Synthesis of Insulin in Red China

London. Western attention is focusing, belatedly, on a major scientific project in mainland China: total synthesis of bovine insulin which possesses the full biological activity of natural insulin.

The existence of the project, which some Western scientists have visited recently, indicates that China is making a modest but significant effort in fundamental biochemistry.

The synthesis of the two chains of which insulin is composed, and their successful assembly into a complete and fully active molecule, was briefly reported in English last November [*Scientia Sinica* **14**, 1710 (1965)]. The announcement was signed by Kung Yueh-ting and 20 other research workers at the institutes of Biochemistry and Organic Chemistry, Academia Sinica, Shanghai, and the department of chemistry, Peking University.

Among the participants in the research were two scientists listed in a directory printed at the back of the recent National Science Foundation publication *Scientific and Engineering Manpower in Communist China, 1949–1963* (NSF publication 65-14). The scientists were Wang Yu, director of the Institute of Organic Chemistry, who received his doctorate from the University of Munich in the 1930's, and Niu Ching-i, a research associate in the Institute of Biochemistry, who received his doctorate from the University of Texas as recently as 1953.

Among those whose supervisory help is acknowledged are a number of scientists trained in the West: Wang Ying-lai, director of the Institute of Biochemistry, who received his doctorate from the University of Cambridge in 1941; Tsao T'ien-chin (Ph.D. Cambridge, 1951) and Shen Chao-wen (Ph.D. Toronto, 1943), both of the Institute of Biochemistry.

An article reviewing the achievement and, most importantly, giving the methods for purifying samples and for reliably linking the two chains to obtain full activity did not appear, however, until April [*Scientia Sinica* **15**, 544 (1966)]. This article, the latest of 18 which have appeared over the past 6 years in this English-language journal of the Academia Sinica (the Chinese equivalent of the Soviet Academy of Sciences), is only now reaching Western libraries.

It is already arousing considerable interest and comment among the many groups of scientists interested in the structure and function of proteins. The article was referred to briefly, for example, on 2 June at a Royal Society meeting on the structure and activity of immunoglobulins.

The first notice of this important project to appear in the popular press was an article in *Le Monde*, Paris, for 9 June. Although *Le Monde* did not say so, the appearance of the article was inspired by the presence in France of a delegation of scientists from mainland China. France and China have an agreement for the exchange of scientists. One of the scientists in the Chinese delegation was a member of the insulin-synthesis group.

The Chinese work on insulin is likely to arouse controversy because Western groups working on the problem—such as those of P. G. Katsoyannis, now of Brookhaven National Laboratory, and H. Zahn of the Technical University of Aachen in West Germany—have had difficulty in restoring the activity of even natural insulin after chemical treatment has destroyed the disulfide bridges between the two chains (one, the so-called alpha chain, is a sequence of 21 amino acids; the other, the beta chain, is a sequence of 30).

Both groups have reported success in synthesizing alpha and beta chains (of sheep insulin, in the case of Katsoyannis' group), but Katsoyannis reports only slight activity when, using a method developed by G. H. Dixon (now of the University of British Columbia) and others, he joins the two synthetic chains.

This method, involving reoxidation to join the two chains separated by reduction, is apparently broadly similar to a method developed at about the same time in China by Du Yu-cang of the Academia Sinica's Institute of Biochemistry in Shanghai [Dixon and A. C. Wardlaw announced their method in *Nature* (**188**, 72) in 1960, and Du announced his method, in English, in *Scientia Sinica* (**10**, 84) in 1961].

The Chinese claim to have refined these techniques considerably. In the November announcement, Kung and his coauthors summarized what they do after the chains are joined by reoxidation as follows.

> Taking advantage of the unique partition property of insulin in the *sec*-butanol-aqueous acetic acid system, we have succeeded in proving that the oxidation mixture can easily be purified by repeated extraction with the upper layer and by re-extraction into the aqueous layer with the lower layer.
>
> A 10–50 fold increase in specific activity can thus be achieved.
>
> By taking up the lyophilized sample of the purified preparation in acetone-citrate buffer in the presence of Zn^{++}, and clarifying it by centrifugation after successive adjustment to *p*H 8.5 and 6.2, we have succeeded in obtaining on standing the synthetic protein in crystalline form possessing an insulin activity greater than 20 I.U. per mg by the mouse convulsion method.

These and other refinements made in the 7 years of concentrated work on insulin synthesis by the Chinese groups are described in the April review article. This and several previous publications lay great stress on the original reconstitution method of Du, who worked first, of course, with separated chains of the natural molecule. Du's success in regaining some of the normal insulin activity made the Chinese follow the same path as Western groups: synthesis of the whole alpha and beta chains first, and then an attempt to combine the chains to obtain full activity.

While there will doubtless be controversy over questions of method, the April review of the Chinese work on insulin is also likely to arouse intense feeling because of its tone. The article not only contains frankly political statements but also directly attacks Katsoyannis.

The opening paragraphs read as follows:

> The first successful total synthesis of a protein was accomplished in 1965 in the People's Republic of China. Holding aloft the great red banner of Chairman Mao Tse-tung's thinking and manifesting the superiority of the socialist system, we have achieved, under the correct leadership of our party, the total synthesis of bovine insulin.
>
> The synthetic product was identical with natural insulin in respect of crystalline form, hormonal activity, immunochemical characteristics and chemical properties.
>
> Since F. Engels predicted about ninety years ago: "As soon as the composition of the protein bodies becomes known, chemistry will be able to set about the preparation of living protein," it has been man's fervent wish to realize this difficult task.
>
> Now that the first synthetic protein has become a reality, it is an important step forward in the long pursuit to synthesize life from organic compounds.

Before these paragraphs are dismissed as adolescent moonshine, it should be remembered that their wording commits the prestige of the Peking regime. It seems a fair speculation that, in the months between the first announcement in November and the contentious review article in April, the Shanghai and Peking biochemists must have made very sure their results were reproducible.

This conclusion is reinforced by the polemical tone of the Chinese scientists' remarks about Katsoyannis.

> Since 1963, Katsoyannis and his coworkers in the United States of America have announced on several occasions the total synthesis of insulin, but have so far not supplied the necessary data for their claims. Their published notes and preliminary communications provide neither information about the experimental conditions chosen nor quantitative data of the activity of their final products.

The paper goes on to quote remarks Katsoyannis made about the dangers posed by impure samples and states firmly that Katsoyannis has not produced any evidence that the traces of activity he has found in his complete synthetic molecules are really due to insulin.

This is confident language, and the embarrassment of the Peking regime will be great if the Shanghai and Peking groups turn out to be wrong.

In the rest of the paper there is evidence that the groups have a sober understanding of the significance of their work, if it proves to be valid. Since the distribution of *Scientia Sinica* is limited, it is worth while to quote a portion of the general discussion from the April article.

> The successful synthesis of insulin has paved the way for the synthesis of larger proteins and of proteins with multiple polypeptide chains linked through disulphide bonds.
>
> Until now the application of structural variations to structure-function studies has been restricted solely within the realm of peptide hormones and antibodies.
>
> For proteins, the most one could do, short of cleaving the peptide chains, was to modify the side chains and observe the changes in the properties of the protein. The successful synthesis of insulin signals that the era of structural variation studies of proteins has now begun. This type of synthetic approach will undoubtedly be of great help in the elucidation of the structure-function relationship of proteins and in the search for imitation enzymes.
>
> The synthesis of ^{14}C-labeled insulin provides a useful tool for the study of the mechanism by which insulin regulates metabolism. It seems also possible to synthesize the crystalline preparations of insulin containing amino acids labeled with suitable heavy atoms, so as to facilitate the x-ray analysis of the complete stereostructure of insulin.
>
> In this study, we effected for the first time the successful reconstitution of a protein consisting of two peptide chains through reoxidation of the reductively cleaved chains and put an end to the hitherto prevailing notion that insulin could not be reactivated after complete inactivation by reduction.
>
> We demonstrated, for the first time with synthetic means, that under favorable conditions, the mode of joining of the disulphide linkage is selective, rather than random.
>
> The successes achieved in the synthesis of crystalline insulin, first from its natural chains and subsequently from its synthetic chains, prove that once the amino acids are in correct sequence, the formation of the alpha helix and its coiling or folding into the proper conformation will follow if suitable conditions are provided. In other words, the primary structure of a protein is able to determine, to a large extent, its higher-ordered structure.

The last paragraph of the foregoing passage echoes remarks made by John Kendrew, the English student of the structure of whale myoglobin, when he accepted the Nobel prize in Stockholm in 1962.

This is only one of many pieces of evidence in the papers of the Shanghai and Peking groups that they are fully aware of Western thinking on protein structure and function—that is, of the broader significance of a technical feat of basic research such as the synthesis of insulin.

Thus, the Chinese work on insulin may be an important indication that the Chinese scientific effort, which was judged to be mostly one of quantity when it was reviewed at a AAAS symposium in New York in 1960, is achieving quality in a growing number of fields. —VICTOR K. MCELHENY

Bibliographical Note

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Too Much Silence on the Potentials of Biology?

London. Two leaders in the popularization of science, one British and the other American, agreed here, on 22 May, that they are having difficulty getting biologists to speak out about dangers inherent in several important lines of current biological research.

Nigel Calder, editor of the London weekly *New Scientist,* and Denis Flanagan, editor of the *Scientific American*, spoke on the British Broadcasting Corporation television program "Horizon."

Calder mentioned research in which mammalian eggs are "manipulated," and the possibility that this work will lead to medical intervention to correct congenital malformations or even to enhance intelligence. He also noted the extensive studies that are being made on the chemistry of behavior. Flanagan, on the other hand, emphasized the potential of research on the chemistry of the gene, which could open up individual choice in such matters as the skin color or the intelligence of offspring (see V. R. Potter, *Science*, 20 November 1964, for a discussion of this question).

The editors agreed that these issues were as important as those raised by the development of nuclear weapons. "I hope it doesn't take a biological Hiroshima to get biologists talking," Calder said.

According to Calder, the scientific community in particular, and the man in the street as well, has a right to factual expositions which give "reasonable extrapolations" of the social and political effect of biological discoveries that are likely to be made. This is different from asking biologists to give advice or to make the actual choices, Calder emphasized.

Calder added that modern societies would have to get out of the habit of proceeding automatically with technical developments as they became feasible, but that such an attitude did not imply foreclosing lines of research. Both Calder and Flanagan said they felt all new knowledge, of itself, was good. "The question is what do you do with it," Calder said. "There is a rather hazy line between intervention to forestall obvious congenital malformations" and more general intervention to enhance the intelligence of all children, which could produce a dangerous imbalance in society between intelligence and emotion.

Flanagan said that the reluctance of biologists to go into cold print about the potentials of their work was partly explained by a healthy mistrust, in the scientific community, of too much speculation. But he agreed when interviewer Gordon Rattray Taylor remarked that biologists might someday face the kind of criticism now being leveled at nuclear physicists for not having resisted employment of their discoveries by the military.

Rattray Taylor had launched the discussion of social issues raised by biology by asking Calder, whose training was in science, and Flanagan, who studied the humanities, how their educations affected their work as science journalists.

Calder said that scientific training could be a disadvantage. A man could know too much to explain a subject well to people who know little about it. He and Flanagan said that the career of scientific journalist is so new that there is as yet no fixed educational pathway. Calder noted that about half the science journalists in Britain came from science, the other half from completely different fields. Editing a popular scientific journal, said Flanagan, involves standing at a gateway between scientific and literary educations, and "it doesn't matter much whether a scientist or nonscientist is the gatekeeper."

A popularizer of science today must move beyond the simple task of clear exposition, Calder asserted. He must pick out of the immense "background noise" of scientific publication "clear signals" that indicate important work.

Flanagan put it more confidently. He said there are a number of well-defined currents in the ocean of contemporary discoveries; the "hot topics" are pretty well defined, and that, according to Flanagan, is just the trouble. Too much attention can be given to particle physics or to nucleic acids.

A more pressing matter for the scientific journalist today, said Flanagan, is to be warned about subjects that have not yet given a clear signal, and to get scientists to discuss them. This problem is acute in biology.—V.K.McE.