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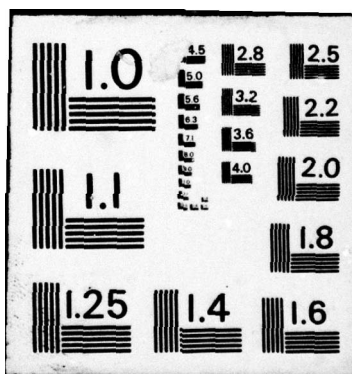
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CONCLUDING COMMENTS AND SUMMARY

ARMY MEDICAL RESEARCH INSTITUTE OF
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Impact of infection on nutritional status:

Concluding comments and summary

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This Workshop has been quite effective in keeping a close focus upon its major objectives and in accomplishing many of them. The very fact that the organizing Subcommittee has been able to conduct this Workshop is, in itself, an important indicator in terms of how far the field has progressed. Early literature and clinical experience did suggest that some aspects of infectious illness could be influenced favorably by nutritional therapy or prophylaxis. Ten or fifteen years ago, however, there were very few individuals who had any real interest in these interrelationships. Since then, many new data have been acquired, many well-trained investigators and clinicians have begun to work in this field, new techniques and advanced methodologies have been introduced, and experimental designs have progressed from merely descriptive approaches to basic and mechanistic ones.

The Workshop has also been especially worthwhile in that, for the first time, we have been able to establish a full and open dialogue among basic and clinical nutritionists, microbiologists and infectious disease specialists, as well as molecular biologists and biochemists. I am sure the viewpoint of all participants has been broadened by the vigorous discussions, fresh interpretations, and teaching points made throughout the different sessions. It has become clear that infection must be considered as a unique and important problem for nutritionists, and one that differs qualitatively as well as quantitatively in its effects from other forms of stress.

Dr. Mata's detailed review of the long-term cooperative study conducted prospectively in a Guatemalan village and his recent

observations in Costa Rica provide new insights that should be of special value to the international health agencies. The relationship between infection and malnutrition is indeed an interaction, and planners must give equal weight to both sides of the problem in establishing their priorities.

Two of Dr. Mata's points deserve much future attention: 1) the need to emphasize health care training and prophylaxis, especially aimed at the control of infantile diarrheas, and 2) the need for an adequate intake of calories. This need should not be neglected during priority planning sessions that tend to focus primarily on protein and amino acid supplementation. Dr. Whitehead's comments on a proper protein-calorie ratio also emphasized this latter point as did his observations about the needs for non-bulky, high calorie kinds of food for use during illness and convalescence.

The Workshop has succeeded fairly well in reviewing available knowledge about the impact of acute infection on various nutritional responses of the host. The current perceptions of infection-induced alterations in amino acid and protein metabolism have become reasonably clear, and the knowledge of changes in host carbohydrate metabolism has been strengthened by revised evaluations of the respective roles of molecular pathways, hormone influences, and substrate availability. These advances in basic knowledge are already being applied directly to problems of patient care.

A key new observation, a defect in hepatic ketogenic capabilities has been identified during infection. This new information must now be

used to help clarify the still uncertain role of lipid metabolism in meeting host energy needs and in other aspects of the host response to infections. We do not yet know why fatty metamorphosis occurs in liver cells during infection or why hyperlipidemia occurs during some, but not all, infections.

A panoply of changes in trace element metabolism and in the concentration of trace glycoproteins in plasma has been recognized, but we do not know why these changes occur or whether or not they have a truly beneficial role to play in host defense. The same uncertainties must be admitted with regard to two other consistent features of all kinds of infection, i.e., fever, and anorexia. Our knowledge of vitamin nutriture during infection is also embarrassingly meager.

Very little has yet been done to clarify host metabolic and nutritional responses during subacute or chronic infections or a series of recurring infections. Although nutritional details are now known about an infection in a well-nourished person, there is still a knowledge gap about whether metabolic responses will be similar or different when infection occurs in persons with pre-existing nutritional deficiency states. A series of important unanswered questions about these problems were listed and evaluated by Dr. Scrimshaw.

The importance of infection-induced anorexia has been emphasized again and again during this Workshop. While a self-imposed avoidance of food is of only transient significance during a brief illness, such a deprivation can have a major effect if it persists for many days. This problem is of special concern during infantile diarrheas,

especially if traditional customs and medical mis-information serve to worsen and prolong the period of starvation.

As summarized by Dr. Teigin, we are now at a point where our new knowledge can be used to design better studies at the laboratory bench, as well as in clinical research wards and in the field. These latter studies must include more comprehensive control observations. We must consider the prior nutritional status of our patients and their age differences. The conditions of a study must be standardized in order to minimize the variables, so that control and experimental groups can be compared more objectively. More data is certainly needed on the longitudinal aspects of a progressive illness in our patients. We also need to develop and utilize appropriate animal models whenever possible.

Recommendations for a clearly defined set of specific minimal nutritional requirements during infection were not established during the Workshop. Realizing how little is known about the unique effects of infection on nutritional status, there was some reluctance about the establishment of rigid guidelines at this time. On the one hand, surgical nutritionists point with pride at the success of aggressive nutritional management in reversing the downhill course of severely septic patients and at newly acquired capabilities to meet the nutritional needs of hypercatabolic patients. Others, however, express concern that harm may come from a too-vigorous attempt to counteract the transient losses of body nutrients caused by the

combination of anorexia and febrile increases in metabolic expenditures. Additional experience should resolve these questions. For immediate therapeutic application, however, a consensus viewpoint does hold that every effort should be made to replace depleted nutrient stores as rapidly as possible during the convalescent period.

Despite the lack of broadly based or extensive research data, certain approximations can be made about nutritional requirements. Dr. Scrimshaw's calculations indicated an estimated excess protein loss of 0.6 to 1.2 g/kg/day during acute infection. Dr. Whitehead suggested that protein intake be increased to 200% of minimal normal requirements during convalescence; Dr. Scrimshaw suggested an increase of dietary protein of 0.3 g/kg/day above minimum needs throughout a convalescent period lasting at least three times the duration of the illness. Dr. Feigin elicited consensus values of 1.5 g/kg/day for children to meet protein needs during illness.

In addition, Dr. Whitehead recommended a convalescent period increase in caloric intake to 125% of normal. His recommendations would increase the dietary protein-energy ratio from 0.05 to 0.08 during convalescence. Dr. Scrimshaw recommended a 10-30% increase in caloric intake during convalescence. The consensus values for illness period requirements were 30-40 kcal/kg/day for adults, 100-150 kcal/kg/day for children and 200 kcal/kg/day for infants.

It should be possible to test these various recommendations under controlled clinical conditions before establishing finite minimal values for broad application in the field.