DR. SCHAEFER: Dr. Weir, Ladies and Gentlemen. I certainly appreciate this opportunity to talk to a group of people who are vitally interested in feeding people and in making a contribution to the nutritional well-being of our population.

While working in the international field, I was interested, for 15 years, in getting an idea of the nutritional status of population groups in the United States. Following a crusade against hunger and malnutrition by some Senators, Congress in December 1967 directed the Secretary of HEW to conduct a national survey to determine the prevalence and cause of hunger and malnutrition within the United States and to report the findings within six months. Congress did not appropriate any funds for this survey. Nor did we have a staff. Our staff at that time, as far as domestic nutrition was concerned, consisted of one public health officer. The money was reprogrammed by bits and pieces over a period of two years. The survey cost, roughly, $5 million.

We quickly decided we could not measure hunger, as such, since it is a psychological phenomena and it could be measured only by a subjective test. The decision was made to try to assess the nutritional status of population groups and define those at "nutritional risk." This had to be based on some objective assessment. That objective assessment was: one, a measure of tissue nutrient levels, either serum levels or urinary excretion levels, of some of the key nutrients. We have not studied all of the nutrients that we know are essential, due to lack of time, funds and to the usual constraints that are associated with such a large undertaking. Two, a measure of growth and development. Height, weight and other anthropometric measurements, including wrist bone x-ray, were used as an objective assessment of growth retardation. Three, determination of clinical evidence of any kind of malnutrition. We did not expect to find flagrant evidence of overt malnutrition such as we have seen overseas. However, the number of clinical signs of malnutrition we did see, although not large, was surprising in our "advanced" society. Four, collection of dietary intake data. Thus, our assessment is based on clinical, biochemical and dietary findings.

The Survey is a random sample from families living in the lower quartile of income areas. Budget considerations made it possible to select only ten states in which to conduct the survey -- Texas, Louisiana, Kentucky, West Virginia, New York (and New York City), Michigan, South Carolina, California, Massachusetts and Washington.

All we have summarized to date are preliminary data on five states -- Texas, Louisiana, Kentucky, New York and Michigan. The first field work began in May 1968 in Texas and the last person was examined last month in Massachusetts. So, we have just really finished the collection of data, but due to political pressures and other factors, we have attempted to summarize our findings as we have gone along. In the first five states, roughly 34,000 people were surveyed and 17,000 biochemistries were completed.
Sample Characteristics

In the first five states, from 18% to 61% of the survey households were living on incomes below the poverty level which is $3334 for an urban family of four with a man as the head of the household. (Figure 1). Our ethnic distribution on these five states was 46% white, 41% Negro and 13% Spanish-speaking, the latter almost entirely in Texas. The average family size was 4-1/2 to 5-1/2 people per family, and 10% of the adults had no formal education.

Biochemical Findings

Unacceptable hemoglobin levels are major problems in all five states, although state to state variation is considerable. Approximately 20 percent of the entire survey population had unacceptable hemoglobin values. This problem is present in both males and females and is similar in all age groups. (Figure 2). Unacceptable hemoglobin levels were present at higher rates in the individuals from poorer households. (Figure 3). However, the rates of unacceptable hemoglobin levels are high in all segments of the survey population and constitute a public health problem that should be treated and prevented on a national scale. Except in Louisiana, where all segments of the survey group had a high prevalence of unacceptable hemoglobin levels, the Negro and Spanish-speaking groups in the survey states had rates from 1-1/2 to three times those of the White group. (Figure 4). Dietary information indicates that iron intake was marginal to inadequate in virtually all age groups and in all five states surveyed. (Figure 5).

Another key finding was the high prevalence of low plasma vitamin A levels. (Figure 6). Low vitamin A levels are related to specific age groups and the problem is particularly severe in the age group from 0 to sixteen. (Figure 7). The rate of unacceptable values is at least three times greater in children than in adults. The rates of unacceptable vitamin A levels are generally higher for groups under poverty than for those with incomes above the poverty level. In general, the Negro and Spanish-speaking groups had a greater prevalence of unacceptable vitamin A values. (Figure 8). The dietary data indicates that from 20-40 percent of the sample population consumed less than 70 percent of the dietary standard for vitamin A. (Figure 9). A few clinical signs associated with inadequate vitamin A intake were reported from the survey. Bitot spots, a specific eye lesion, was seen in 23 persons and follicular hyperkeratosis was reported in 404 persons among the 15,257 persons examined in the five states.

The variation between states is considerable in regard to unacceptable serum vitamin C levels. (Figure 10). The dietary information provides a partial answer to this regional difference. Approximately 27 percent of the households in the three southern states had vitamin C intakes less than 70 percent of the standard. In Michigan and New York 19 percent and 14 percent, respectively, of the households had vitamin C intakes less than 70 percent of the standard. (Figure 11). The groups showing the highest prevalence of unacceptable serum vitamin C levels also varies from state to state. In some states, the older segment of the population shows the highest prevalence while in others, the group between six and sixteen appears to be most vulnerable. Differences in relation to income are less pronounced with vitamin C.
Serum albumin levels, which give some indication of protein nutrition, have been relatively acceptable in most of the areas studied thus far. (Figure 12). In Kentucky, Michigan and New York the percent with unacceptable serum albumin levels was 4% or less. In Texas and Louisiana approximately 15 percent of the survey population were in the unacceptable range. The rates for unacceptable serum albumin levels in all states were highest in the adults. Dietary information suggests that less than acceptable levels of protein intake did occur, but to a lower degree than for other nutrients. (Figure 13).

Unacceptable thiamine excretion levels were found in from 4% to 11% of the total sample population. (Figure 14). Dietary information suggests that approximately 20% of the survey population consumed less than 70% of the dietary standard for thiamine. (Figure 15).

Riboflavin has a pattern similar to that found with vitamin A. Though the rates of unacceptable urinary riboflavin excretion are lower than for plasma vitamin A, the under sixteen years group generally had higher rates than the adult population. (Figure 16). On a state basis, from four to 21 percent of the sample population had unacceptable riboflavin excretion levels. The dietary information indicates that from 10-30 percent of the survey population appears to be consuming less than 70% of the dietary standard for riboflavin. (Figure 17).

Clinical Findings

Among the children under six years of age examined in the five states from 0.1% to 6.6% showed some sign of rickets which is vitamin D deficiency. In the survey population over six years of age goiter, usually associated with iodine deficiency, was seen in from 1.2% to 4.9% of persons studied. Clinical signs associated with B-complex vitamin deficiency, i.e., angular scars or lesions of the mouth, cheilosis and filiform atrophy and fungiform hypertrophy of the tongue, were seen both in those under six years of age and those over six years of age.

Growth Retardation

One of the key problems noted in the survey relates to the poor growth observed in children in several of the states studied. With regard to height, the percent of children who fell one standard deviation below the mean of the Iowa growth standard in the five states ranged from 20.3% in Louisiana to 46.5% in Michigan. (Figure 18). The weights of children varied from Louisiana boys who equaled the Iowa standard to Texas girls who had 40.5% with weights below the 16th percentile. The evaluation of bone maturation by hand-wrist radiographs suggests that skeletal maturation was delayed among the children surveyed. This delay was present during the first eight years of life. The failure of these children to grow, as measured by their height and weight as well as the evaluation of their bone growth, can be due to numerous factors, one of which is inadequate nutrition.

In summary, we are convinced that we have demonstrated that there are problems of undernutrition in the United States today. These problems offer a real challenge to nutritionists and people in the food industry to make available to the consumer food products that will insure an adequate intake of the necessary nutrients. This will require the updating of present
food standards as well as public education in the basic principles of proper nutrition. I am sure you are equal to that challenge.
HEMOGLOBIN: PERCENT UNACCEPTABLE
BY POVERTY (BY STATE)

Figure 3.

HEMOGLOBIN: PERCENT UNACCEPTABLE
BY ETHNIC GROUP (BY STATE)

Figure 4.
DIETARY INTAKE: PERCENT OF POPULATION GROUPS CONSUMING LESS THAN 70% OF DIETARY STANDARD

1 NEW YORK STATE
2 MICHIGAN
3 KENTUCKY
4 TEXAS
5 LOUISIANA

PLASMA VITAMIN A: PERCENT UNACCEPTABLE
(TOTAL SURVEY POPULATION)
(BY STATE)

NEW YORK STATE
MICHIGAN
KENTUCKY
TEXAS
LOUISIANA

NATIONAL NUTRITION SURVEY
Figure 7. Plasma Vitamin A: Percent Unacceptable by Age Group and State

Figure 8. Plasma Vitamin A: Percent Unacceptable by Ethnic Group (by State)

National Nutrition Survey

BY STATE:
1. New York State
2. Michigan
3. Kentucky
4. Texas
5. Louisiana

BY ETHNIC GROUP:
- White
- Negro
- Spanish Speaking

Percentages for each state and ethnic group are shown in the bar charts.
VITAMIN A
DIETARY INTAKE: PERCENT OF POPULATION GROUPS
CONSUMING LESS THAN 70% OF DIETARY STANDARD

1 NEW YORK STATE
2 MICHIGAN
3 KENTUCKY
4 TEXAS
5 LOUISIANA

* Insufficient Sample for Calculation
NATIONAL NUTRITIONAL SURVEY

VITAMIN C
PERCENT UNACCEPTABLE BY STATES
**Figure 11.**

**VITAMIN C**

Dietary Intake: Percent of Population Group Consuming Less Than 70% of Dietary Standard

1. New York State
2. Michigan
3. Kentucky
4. Texas
5. Louisiana

**Figure 16.**

**SERUM ALBUMIN**

Percent Unacceptable by States

- New York: 10%
- Michigan: 13%
- Kentucky: 6%
- Texas: 13%
- Louisiana: 13%

NATIONAL NUTRITION SURVEY
PROTEIN
DIETARY INTAKE: PERCENT OF POPULATION GROUP
CONSUMING LESS THAN 70% OF DIETARY STANDARD

1 NEW YORK STATE
2 MICHIGAN
3 KENTUCKY
4 TEXAS
5 LOUISIANA.

* Insufficient Sample for Calculation
NATIONAL NUTRITION SURVEY

URINARY THIAMINE: PERCENT UNACCEPTABLE
BY STATE

10

5

3.5% 6.0% 6.0%
NEW YORK MICHIGAN KENTUCKY

10.0% 10.0%
TEXAS LOUISIANA

NATIONAL NUTRITION SURVEY
Thiamine:

Consuming less than 70% of dietary standard

1. New York
2. Michigan
3. Kentucky
4. Texas
5. Louisiana

Urinary Riboflavin

Percent unacceptable by age (by state)

1. New York
2. Michigan
3. Kentucky
4. Texas
5. Louisiana

National Nutrition Survey
DIETARY INTAKE: PERCENT OF POPULATION GROUPS CONSUMING LESS THAN 70% OF DIETARY STANDARD

Figure 17.

HEIGHT: PERCENT OF CHILDREN UNDER SIX YEARS OF AGE ONE STANDARD DEVIATION (SD) BELOW OR ABOVE THE MEAN OF THE IOWA GROWTH CHART

NEW YORK
MALE
FEMALE

MICHIGAN
MALE
FEMALE

KENTUCKY
MALE
FEMALE

TEXAS
MALE
FEMALE

LOUISIANA
MALE
FEMALE

EXPECTED PERCENT BELOW 1 S.D.

EXPECTED PERCENT ABOVE 1 S.D.

NATIONAL NUTRITION SURVEY
C. E. WEIR: One of the most astonishing things is how little we know about the human needs for nutrients, and human nutrition. The third speaker this morning is Dr. Isabel Irwin who is the head of the human nutrition metabolism investigations in the Food and Nutrition Research Division in the Department of Agriculture at Beltsville. Dr. Irwin is a fellow countryman of mine, she is a native of Saskatchewan Canada and a graduate of the University of Saskatchewan at Saskatoon. She received her MS and PhD degrees under Dr. E. W. Crampton at McGill University and since then has taught and done research in human nutrition at the Agricultural College in Guelph and at the Univ. of Arkansas. She has been with our Human Nutrition Division since 1961.

For the past 3 years Dr. Irwin has been leading a team of scientists engaged in evaluating what progress has been made in the state of our knowledge of the requirements for nutrients. Part of this time or 2 yrs. of this time she worked at Harvard University in Boston. This morning she will report on the State of our Knowledge of Protein Requirements.

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