Benjamin Borenstein, Ph.D.

Dr. Borenstein is Director of Product Development and Applications for the Roche Chemical Division, Hoffmann-La Roche Inc., Nutley, NJ. He is also Honorary Professor of Food Science, Rutgers University. He has served on many committees of the Institute of Food Technology and is a member of the American Institute of Nutrition. He has published widely on the stability of nutrients in food processing and the technology of fortification.

He received the B.S. In Chemistry and M.S. and Ph.D. in Food Technology from Rutgers University, New Brunswick, NJ and has held industrial research and development positions since 1954.

The Effect of Food Additives on Health

Despite the high quality, diversity and low cost of the U.S. food supply, both the scientific community at large and consumers are legitimately concerned about food additives and food quality. This discussion isolates specific food additives of current interest relative to possible detrimental effects on health--MSG and sulfites. The history, use and natural occurrence of MSG are detailed. Additives which may be beneficial to health--antioxidants, both synthetic and natural, BHT, BHA and tocopherol are also reviewed. The effects of processing and home cooking on the nutritional quality of foods with respect to vitamins, proteins and fats are briefly reviewed.

Noel W. Solomons, M.D.

Dr. Solomons is an Affiliated Investigator and Visiting Professor in the Division of Nutrition and Health, Institute of Nutrition of Central America and Panama (INCAP). From 1977-1984, he was on the faculty of the Department of Nutrition and Food Science of the Massachusetts Institute of Technology, and a member of the International Food and Nutrition Program of MIT. He has been affiliated with INCAP in Guatemala City since 1974.

Dr. Solomons has been a member of several committees of the National Academy of Sciences and serves on the Geriatric Review Committee of the National Institute on Aging. He is a member of the American Gastroenterological Association, the American Society for Clinical Nutrition, American College of Nutrition, the Latin American Nutrition Society, among others. He is on the Editorial Boards of *Nutrition Reviews*, *Nutrition Research, Manual of Clinical Nutrition* and others. He recently co-edited the textbook: *Absorption and Malabsorption of Mineral Nutrients*. His research interests include intestinal physiology of nutrient absorption, and assessment of human trace metal nutriture.

He received his A.B. degree from Harvard College in 1966, and his M.D. degree from Harvard Medical School in 1970. Between 1970-1973, he carried out internship and residency training in internal medicine at the University of Pennsylvania in Philadelphia. From 1973-1974, he was a fellow in Gastroenterology and Clinical Nutrition at the University of Chicago.

Nutrient-Nutrient Interactions

Much is known and much has been written about the interactions of macronutrients (proteins, carbohydrates and fats) with micronutrients (vitamins and minerals), but there is a lesser appreciation of the importance of nutrient-nutrient interactions between and among *micro*nutrients in human nutrition. This is not for any lack of study of such relationships in laboratory animals. Indeed the literature abounds with information in this regard, but it has been difficult to extrapolate animal results directly to human nutrition. Only recently have direct studies in men and women provided confirmation of the importance of micronutrient interactions in *homo sapiens*.

There are various levels for classification of nutrient-nutrient interactions, firstly by type of interacting species, e.g. vitamin-vitamin, mineral-mineral, or vitamin-mineral. Secondly, the nature of interaction can be either 1) inhibitory or detrimental to the biological availability or metabolic role of one or the other of the interacting micronutrients, or 2) synergistic, complementary or protective. The ratios or proportions of the nutrients are a major determinant of the strength of the interaction, as is often the nutritional status of the host with respect to one or another micronutrient. Thirdly, the locus of the interaction is also of interest; interactions can either occur *pre*-absorption, i.e. in the meal or in the gastrointestinal lumen (a variant of this is pre-*infusion* in the case of nutrients delivered in parenteral alimentation), or in the *post*-absorptive locus, i.e. in the circulation or at the tissue or cellular levels.

The present discussion will center on our recent understanding of specific micronutrient interactions that are likely to have a real and measurable impact on the health or nutritional status of humans.

Vitamin-Vitamin Interactions: Perhaps the best known vitamin-vitamin interaction is the post-absorptive complementation of nuclear maturation in megaloblastic cells of folic acid in vitamin B_{12} deficiency. Folacin, however, has no effect on the nerve lesion. Persistant therapy with folic acid in B_{12} deficiency can thus aggravate the neurological consequence of the latter. Megadoses (gram amounts) of vitamin C have been reported to produce intraluminal destruction of dietary vitamin B_{12}. *Probably* at the level of intestinal passage, and *possibly* in the rods and cones of the human retina, vitamin E acts to protect the highly unsaturated and vulnerable vitamin A molecule from oxidative damage.

Vitamin-Mineral Interactions: The classical example of an important vitamin-mineral interaction is that of vitamin D with calcium. The hormonal form of the vitamin governs the intestinal uptake of the mineral. Based on animal studies (but not yet clearly demonstrable in humans), there is reason to believe that vitamin E and selenium act in a complementary antioxidant fashion to protect somatic cells from oxidative injury. In the context of nutrient solutions for parenteral alimentation, high levels of vitamin C in the presence of copper cause the reduction in the infusate of soluble selenium salts to particulate elemental selenium, which is biologically unavailable to the patient. Ascorbic acid in a meal, however, improves the absorbability of inorganic iron.

Mineral-Mineral Interactions: These interactions are probably the most significant for human nutrition. High (therapeutic) dosages of zinc produce an intestinal blockade that reduces copper absorption. In zinc therapy, this has produced copper deficiency in man, but this interaction is used therapeutically now in treatment of patients with Wilson's disease. Iron deficiency produces not only a more avid uptake of dietary iron, but also of environmental (toxic) lead. Moreover, in the intestine, iron can block the entrance of lead into the body. Since both iron and chromium are transported on transferrin, iron overload conditions reduce the retention of chromium. When simultaneously present in the gut, zinc and iron compete for absorption. Excessive intakes of iron may be responsible for reduced zinc uptake and impaired zinc nutriture in babies on iron-supplemented infant formulas, and in pregnant women taking prenatal iron supplements, among others.

Thursday Morning—July 25

Session A—Optimal Utilization of the Clinical Laboratory for Clinical Decision Making

(Sponsored by a grant from Bayer AG/Miles Laboratories, Ames Division)

Alex A. Pappas, M.D.
Chairman

George Lundberg, M.D.

Doctor Lundberg is Vice President for Scientific Information of the American Medical Association and Editor of JAMA. He holds clinical professorial appointments at Northwestern University and Georgetown University schools of medicine. Doctor Lundberg received his B.S. degree from the University of Alabama, an M.S. from Baylor University and the M.D. from the Medical College of Alabama. He is certified in anatomic and clinical pathology by the American Board of Pathology. Doctor Lundberg has held various administrative, teaching, and research positions at the University of Southern California, and the University of California at Davis prior to taking his current job three years ago. His interests include clinical pathology, toxicology, research in medical education, and guiding physicians to practice appropriately.

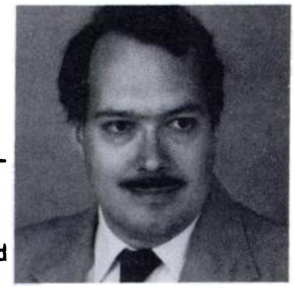
Why Do Physicians Order Laboratory Tests?

The great variety and volume of available clinical tests confronts the modern physician with a major dilemma. What tests should be ordered on what patients? When, how, how often, at what cost, grouped or individually, and in what sequence? What is the interpretation of the results and what steps then should be taken? The frequency with which a laboratory test may be performed varies from never to constant monitoring of all parameters. What constitutes good laboratory medicine practice?

We have found that diagnosis, monitoring, and screening are the most frequent reasons why clinical tests are ordered. However, a wide variety of other reasons also motivate the performance of such tests. These include prognosis, peer pressure, hospital policy, insecurity, and habit, among others.

This presentation will focus upon reasons why physicians order laboratory tests and suggest ways in which such ordering can be guided for patient benefit in the most cost efficient and effective way.

Edward P. Fody, M.D.



Dr. Fody is Chief, Laboratory Service, John L. McClellan Memorial Veterans Hospital, Little Rock, Arkansas and holds academic appointments in the Departments of Pathology and Pharmacology of the University of Arkansas for Medical Sciences. He has been active in the Inspection and Accreditation Programs of the College of American Pathologists and has co-authored the College's Clinical Laboratory Handbook for Patient Preparation and Specimen Handling series.

Dr. Fody holds a B.S. degree from Duke University and an M.S. in analytical chemistry from the University of Wisconsin. He received an M.D. from Vanderbilt University in Nashville. His research interests include clinical pharmacology and toxicology, preanalytical variability in laboratory testing and clinical laboratory systems operations.

The Algorithmic Approach to Diagnosis

An algorithm is a logical, progressive series of steps which may be used to solve a particular problem. Originally developed by mathematicians, algorithms are used extensively in computer programs.

Consciously or unconsciously, physicians use algorithms in diagnosis. In this era of concern about the cost of health care, algorithms provide an approach to diagnosis that ensures the maximal utilization of each laboratory test and that minimizes unnecessary test ordering. Algorithmic diagnosis is also well-suited to plans such as diagnosis-related groups (DRG's).

Algorithms generally take the form of flow charts. Decision points usually require a simple yes no answer and lead to the next decision point. Eventually the correct diagnostic endpoint is reached. Algorithmic decision trees have been devised for a wide variety of clinical problems, including hypertension, anemia, jaundice, fever of unknown origin and hematuria.

This discussion will deal with how physicians use laboratory test results and other data to make a diagnosis. The use of decision tables, flow charts and the construction of algorithms to address real clinical situations will be illustrated.

Alex A. Pappas, M.D.

Dr. Pappas is an Associate Professor of Pathology and Director of Clinical Laboratories at the University of Arkansas for Medical Sciences. He also holds a faculty appointment in the Department of Laboratory Medicine at the Medical University of South Carolina and is consultant to the Veteran's Administration. He is certified by the American Board of Pathology in Clinical Pathology, Anatomic Pathology and Chemical Pathology. He is a member of the American Association for Clinical Chemistry, Association of Clinical Scientists and American Society of Clinical Pathology.

He received his B.S.E.E. degree from the