leate to arachidonate but so far the animal studies have not conclusively proven this relationship. It may be that the use of an experimental animal in various stages of vitamin B_6 deficiency is too complicated a biological system to unravel the mystery, but work continues in this direction. There is evidence that pyridoxine deficiency is often associated with hypercholesteremia but here again there is very little information concerning the mechanism. Since there is no evidence of a direct effect on synthesis or degradation of cholesterol, pyridoxine may be influencing the transport of cholesterol by its effect on fatty acid metabolism or an alteration in the protein moiety of the lipoprotein required for cholesterol transport. A hypocholesteremic effect of vitamin B_6 in humans appears to be unproved. A human study, however, by Mueller and Iacono appears to have linked pyridoxine with fat metabolism and the results obtained are consistent with those found by the majority of investigators with animals. The site of action, however, still remains unclear.

Toepfer (U.S. Department of Agriculture, Beltsville, Maryland) and Storvick *et al.* (Oregon State University) covered the recent methods for analysis of vitamin B_6 in foods and the methods for determining vitamin B_6 in biological materials. Toepfer described analytical techniques using ion exchange resins for the separation of the three forms of vitamin B_6 followed by microbiological assay of each form separately against the proper standard. It was felt that this technique gave a more reliable estimate of the vitamin B_6 activity of a given foodstuff. Storvick reported her investigations on methodology for determining vitamin B_6 in biological materials. The rather wide variations in literature values for blood and tissue levels of vitamin B_6 in various species were found to be due primarily to difficulties in liberating the phosphorylated and protein-bound vitamin. Available methods involving acid hydrolysis or enzyme digestion require further development before they can be considered adequate. Problems encountered with microbiological, chemical, and enzymatic methods for measuring the liberated vitamin were discussed, as well as the fluorometric method for measuring 4-pyridoxic acid, the main urinary metabolite of vitamin B_6. Further development of methodology is required to permit reliable assessment of vitamin B_6 nutritional status and metabolic patterns.

The occurrence of vitamin B_6 deficiency in the human and the studies which have been conducted to arrive at an estimation of the vitamin B_6 requirement of the human were reviewed by Sauberlich (U.S. Army Medical Research and Nutrition Laboratory, Denver). Although the occurrence of vitamin B_6 deficiency in the human population definitely establishes a requirement for this vitamin, it gives little information concerning the minimum requirements. Recent studies in humans, however, have provided very good estimates of the vitamin B_6 requirement of man. Two recent nutrition surveys, one conducted in Burma and the other in Malaysia, have provided valuable information regarding the minimum requirements for vitamin B_6. In Burma the daily intake of vitamin B_6 averaged 1.70 mg per man per day with the highest being 2.10 mg. A considerable portion of these persons, however, reveal biochemical abnormalities related to the metabolism of vitamin B_6. In Malaysia intakes of vitamin B_6 range between 1.04 and 1.42 mg per man per day, but here again the biochemical abnormalities related to pyridoxine were noted. Recent studies conducted in Sauberlich's laboratory provide the best evidence to date of the human requirement for vitamin B_6. These studies were conducted with young, healthy, adult male subjects, ages 18 to 22 years, on liquid pyridoxine-free diets with high and low protein intakes. The most marked clinical manifestations observed during the deficiency period in the subjects were electroencephalographic abnormalities. In fact, one subject on the low protein intake had a grand mal convulsion during the 7th week of deficiency. As a result of these studies, the optimum daily vitamin B_6 diet for subjects on a high protein diet was found to be 1.75 to 2.0 mg per day and for subjects on a low protein diet 1.25 to 1.5 mg per day. The vitamin B_6 requirement for infants has been generally accepted to be approximately 0.40 mg per day. It is evident that besides the effects of protein intake on the vitamin B_6 requirement other factors such as stresses, sex, and age have an important bearing on vitamin B_6 requirements, but further studies in this area are definitely required.

The vitamin B_6 requirement and the methods for estimating it as well as the relationship of this requirement to actual amounts in the diet were reviewed by Borsook (California Institute of Technology). The literature suggests that the requirement of older people is greater than that of young adults. Estimation of requirements of vitamin B_6 based on energy expenditures is not feasible since pyridoxal phosphate is involved in many enzymatic reactions which release little energy. Individual requirements vary more than that of other vitamins and complicate definition of requirements. The tryptophan load test on young men indicates that 2.76 mg of vitamin B_6 is adequate for 90 percent of the population. It was pointed out that it is diffcult to fullfill the Recommended Dietary Allowance of 1.5 to 2.0 mg per day of vitamin B_6 for women and older men if the calorie intake is restricted to that recommended for their height, weight, and age. In addition, if the object of setting up a Recommended Daily Allowance is to prevent a vitamin B_6 deficiency state in 99.99 percent (10 per 100,000) of the population, then the data indicate that 1.5 to 2.0 mg are not enough. To fulfill this criterion, the requirement would be in the range of 2.5 to 7.0 mg. Borsook concluded that the case is strong for increasing the vitamin B_6 in the food supply. This could easily be done by adding vitamin B_6 to the present flour enrichment formula; all the reasons that led to the original enrichment formula apply to the inclusion of vitamin B_6.

This international symposium on vitamin B_6 was sponsored by Hoffmann-La Roche Inc., and the complete papers will appear in the forthcoming volume of *Vitamins and Hormones.*

R. H. BUNNELL
Hoffmann-La Roche Inc.,
Nutley, New Jersey

Forthcoming Events

November

5–7. **Nutrition Hygiene** Conf., Brno, Czechoslovakia (K. Halacka, Hygiene Section, Czechoslovak Medical Soc., Sokolska 31, Prague 2)

6–7. **Biochemistry**, 7th annual West Central States conf., State Univ. of Iowa, Iowa City. (G. F. Lata, Dept. of Biochemistry, State Univ. of Iowa, Iowa City)

6–7. Experimental Methodology and Applied Immunology in **Allergy Research**, symp., Erfurt, East Germany. (H. D. Faulhaber, Gesellschaft für Experimentelle Medizin der D.D.R., Littenstr. 78, Berlin C.2, East Germany)

6–7. Central Soc. for **Clinical Research**, Chicago, Ill. (J. F. Hammarsten, Ancker Hospital, St. Paul 1, Minn.)

7. International Acad. of **Oral Pathology**, 2nd conf., San Francisco, Calif.

(J. L. Bernier, Dental School, Georgetown Univ., Washington, D.C. 20007)

7–14. International **Dental** Federation, 52nd meeting, San Francisco, Calif. (G. H. Leatherman, 35 Devonshire Pl., London, W.1)

8–14. **Switching Circuit Theory and Logical Design**, 5th annual symp., Princeton Univ., Princeton, N.J. (T. H. Crowley, Bell Telephone Laboratories, Murray Hill, N.J.)

9–11. Flexural Mechanics of **Reinforced Concrete**, intern. symp., Miami, Fla. (H. A. Sawyer, Dept. of Civil Engineering, Univ. of Florida, Gainesville)

9–12. American **Dental** Assoc., San Francisco, Calif. (H. Hillenbrand, 222 E. Superior St., Chicago, Ill.)

9–13. Institute of **Neurosurgery**, 25th anniversary, Santiago, Chile. (C. Villavicencio, Casilla 70-D, Santiago)

9–13. **Mathematical Education**, seminar, Dalat, South Vietnam. (Assoc. of Southeast Asian Insts. of Higher Learning, Ratasastra Bldg., Chulalongkorn Univ., Race Course Rd., Bangkok, Thailand)

10. American College of **Dentists**, San Francisco, Calif. (O. W. Brandhorst, 4236 Lindell Blvd., St. Louis, Mo.)

10–11. **Quality Control**, seminar, Cleveland, Ohio. (R. C. Schultz, American Soc. of Tool and Manufacturing Engineers, 10700 Puritan Ave., Detroit 38, Mich.)

11–12. Use of **Plastics in Machine Construction**, conf., Hungary. (Hungarian Soc. of Mechanical Engineers, Szabadsag ter 17, Budapest 5)

11–13. Eastern **Analytical** symp., New York, N.Y. (M. Margoshes, Room 3, Chemistry Bldg., Natl. Bureau of Standards, Washington, D.C. 20234)

11–13. American Soc. for **Cell Biology**, Cleveland, Ohio. (D. E. Green, Inst. for Enzyme Research, 1710 University Ave., Madison 6, Wis.)

11–13. American **Concrete** Inst., fall meeting, Miami, Fla. (W. T. Eefting, 3332 Pan American Dr., Miami)

11–14. American Acad. of **Neurological Surgery**, Miami, Fla. (E. W. Davis, 806 S.W. Broadway, Portland, Ore.)

11–14. **Models for the Perception of Speech and Visual Forms**, symp., Boston, Mass. (Symp. Committee, Data Sciences Laboratory, Air Force Cambridge Research Laboratory, Bedford, Mass. 01731)

12–13. American Soc. of **Cytology**, 12th annual, Pittsburgh, Pa. (W. R. Lang, 1012 Walnut St., Philadelphia, Pa. 19107)

12–13. **Nerve as a Tissue**, conf., Lankenau Hospital, Philadelphia, Pa. (K. Rodahl, Lankenau Hospital, Philadelphia)

12–13. Netherlands **Nuclear** Forum, intern. congr., Amsterdam. (Nederlands Atoomforum, Scheveningseweg 112, The Hague, Netherlands)

12–14. **Paleomagnetism**, 2nd U.S.–Japan seminar, U.S.–Japan Cooperative Science Program, Univ. of California, Berkeley. (J. Verhoogen, Dept. of Geology and Geophysics, Univ. of California, Berkeley)

13–15. American Inst. of **Professional Geologists**, 1st annual, Denver, Colo. (AIPG, W. A. Newton, Public Information Committee, P.O. Box 836, Golden, Colo. 80402)

13–15. **Clinical Scientists** Assoc., annual, Washington, D.C. (ACS, F. W. Sunderman, Jr., Univ. of Florida, College of Medicine, Gainesville 32603)

14–19. American Acad. of **Ophthalmology and Otolaryngology**, Chicago, Ill. (W. L. Benedict, 15 Second St., SW, Rochester, Minn. 55901)

14–21. Pan American **Medical Women's** Alliance, 9th congr., Los Angeles, Calif. (E. M. Hohl, 1234 N. Vermont Ave., Hollywood, Calif.)

15–17. Water in the **Arid Zones** of the Old World, symp., Halle an der Saale, East Germany. (Deutsche Akademie der Naturforscher Leopoldina, August-Bebel Str. 50 a, Halle an der Saale)

15–19. American Soc. of **Agronomy**, Crop Science Soc. of America, Soil Science Soc. of America, annual, Kansas City, Mo. (L. A. Richards, Amer. Soc. of Agronomy, 677 S. Segoe, Madison, Wis.)

15–19. Society of **Exploration Geophysicists**, Los Angeles, Calif. (C. G. Ferris, E. V. McCollum & Co., 515 Thompson Bldg., Tulsa, Okla.)

16. **Ammonia Metabolism**, symp., Brooklyn, N.Y. (D. M. Kirschenbaum, Dept. of Biochemistry, State Univ. of New York, Downstate Medical Center, 450 Clarkson Ave., Brooklyn 3)

16–17. **Basic Sciences**, 3rd annual conf., New York, N.Y. (A. Gelbart, Yeshiva Univ., Amsterdam Ave. and 186th St., New York)

16–19. Gulf and Caribbean **Fisheries** Inst., conf., Ocho Rios, Jamaica. (Executive Secretary, Gulf and Caribbean Fisheries Inst., 1 Rickenbacker Causeway, Miami, Fla. 33149)

16–19. **Magnetism and Magnetic Materials**, Minneapolis, Minn. (J. B. Goodenough, Lincoln Laboratory C182, Lexington, Mass. 02173)

16–20. Interagency **Chemical Rocket Propulsion** Group, Mechanical Behavior Working Group, 3rd annual, Redstone Arsenal, Ala. (T. H. Duerr, AMSMI-RKP, Redstone Arsenal, Ala. 35809)

16–20. **Soil Science** Soc. of America, annual, Kansas City, Mo. (W. E. Jeske, 7515 N.E. Ankeny Rd., Ankeny, Iowa)

17–18. **Allied Air Force Medical** Conf., 10th annual, Fontainbleau, France. (Officier Administratif, Division Médicale d'Aircent, Camp Guynemer, Fontainbleau)

18–20. **Navy Research and Development**, Philadelphia, Pa. (*clearance*). (H. G. Sparks, Moore School of Electrical Engineering, Univ. of Pennsylvania, Philadelphia 19104)

18–20. Northeastern States **Navy Research and Development** Clinic, Philadelphia, Pa. (N. R. Droulard, Franklin Inst. Laboratories, 20th and Parkway, Philadelphia, Pa. 19103)

18–21. **Neurological Surgeons**, 14th congr., Bal Harbour, Fla. (J. R. Russell, 1815 N. Capitol Ave., Indianapolis, Ind. 46202)

19–21. **Geological** Soc. of America, Miami Beach, Fla. (J. W. Peoples, 10 Wesleyan Place, Middletown, Conn.)

19–21. **Paleontological** Soc., Miami Beach, Fla. (R. L. Langenheim, Jr., Dept. of Geology, Univ. of Illinois, Urbana)

19–21. National Council of **Teachers of Mathematics**, Atlanta, Ga. (J. D. Gates, 1201 16th St., NW, Washington, D.C.)

19–22. American **Anthropological** Assoc., 63rd annual, Detroit, Mich. (E. R. Service, Dept. of Anthropology, Univ. of Michigan, Ann Arbor)

21–22. American **Geological** Inst., Miami Beach, Fla. (L. Hoover, 1444 N St., NW, Washington, D.C. 20005)

21–24. American **Speech and Hearing** Assoc., San Francisco, Calif. (K. O. Johnson, 1001 Connecticut Ave., NW, Washington, D.C.)

23–24. **Water** for Texas, 9th annual, Texas A&M Univ., College Station. (E. T. Smerdon, Water Resources Inst., Texas A&M Univ., College Station)

23–25. American Physical Soc., **Fluid Dynamics** Div., Pasadena, Calif. (R. J. Emrich, Dept. of Physics, Lehigh Univ., Bethlehem, Pa.)

23–27. **Dosimetry of Irradiations from External Sources**, intern. symp., Health Physics Soc., French section, Paris, France. (M. Gras, 5, rue Armand, Gauthier, Paris 18e)

23–27. Use of **Radioisotopes** in Animal Nutrition and Physiology, symp., Intern. Atomic Energy Agency, Food and Agriculture Organization of the UN, Prague, Czechoslovakia. (Symp. Secretariat, Kärntnerring 11, Vienna 1)

23–28. **Internal Medicine**, 8th intern. congr., Buenos Aires, Argentina. (Secretariat, Melo 2081, Buenos Aires)

24. **Manufacturing Chemists'** Assoc., 14th conf., New York, N.Y. (Manufacturing Chemists' Assoc., 1825 Connecticut Ave., NW., Washington, D.C.)

26–28. Central Assoc. of **Science and Mathematics Teachers**, 64th annual, Detroit, Mich. (Sister Mary Ambrosia, Gesu Convent, 17180 Oak Drive, Detroit 48221)

27–28. National Council for **Geographic Education**, Minneapolis, Minn. (L. Kennamer, Univ. of Texas, Austin)

29–1. Association for Research in **Ophthalmology**, Minneapolis, Minn. (H. Kaufman, J. Hillis Miller Health Center, Univ. of Florida, Gainesville)

29–4. American Soc. **Mechanical Engineers**, annual, New York, N.Y. (D. J. Sengstaken, ASME Nuclear Engineering Div., Long Island Lighting Co., 175 Old Country Rd., Hicksville, L.I., N.Y.)

29–4. **Radiological** Soc. of North America, Chicago, Ill. (M. D. Frazer, 1744 S. 58 St., Lincoln, Neb.)

30. **Food and Drug Administration and Law** Inst., 8th annual conf., Washington, D.C. (S. T. Grey, Bureau of Education and Voluntary Compliance, FDA, Washington 25, D.C.)

30–1. Mechanisms of **Dental Caries**, conf., New York, N.Y. (New York Acad. of Sciences, 2 E. 63 St., New York 10021)

30–2. **Pacific Air Force Medical** conf., Fuchu Air Station, Tokyo, Japan. (Lt. Col. R. J. Carter, 14th PACAF Medical Conf., USAF Hospital Tachikawa, APO 323, San Francisco, Calif.)

30–2. **Thalamic Regulation of Sensorimotor Activities**, symp., New York, N.Y. (M. D. Yahr, New York Neurological Inst., 710 W. 168 St., New York 10032)

30–3. **Atomic Industrial Forum**, annual, San Francisco, Calif. (Atomic Industrial Forum, 850 Third Ave., New York, N.Y.)

30–3. **Entomological** Soc. of America, annual Philadelphia, Pa. (ES, 4603 Calvert Rd., College Park, Md.)

30–3. American **Nuclear** Soc., winter meeting, San Francisco, Calif. (W. H. Nutting, Pacific Gas and Electric Co., 245 Market St., San Francisco)